# Periodic Review Report

Gowanus Village I
322 3rd Avenue
(a.k.a. 153 2nd Street)
Brooklyn, New York

March 31, 2025

Prepared for:

**BRT Powerhouse, LLC**
540 President Street, #2K
Brooklyn, New York 11215

Prepared by:

**Roux Environmental Engineering and Geology, D.P.C.**
209 Shafter Street
Islandia, New York 11749

2705.0001Y009.324/CV

Environmental Consulting
& Management
+1.800.322.ROUX
rouxinc.com

# Table of Contents


Executive Summary ..... 1

1. Introduction ..... 3
   1.1 Summary of NYSDEC Submittals ..... 4

2. Site Overview ..... 5
   2.1 Site Description and History ..... 5
   2.2 Summary of Remedial Action ..... 5
   2.3 Remaining Contamination ..... 6
      2.3.1 Soil ..... 6
      2.3.2 Groundwater ..... 7
      2.3.3 Soil Vapor ..... 8
   2.4 Engineering and Institutional Controls ..... 8
      2.4.1 Engineering Controls ..... 8
      2.4.2 Institutional Controls ..... 9

3. Redevelopment Activity ..... 10

4. SMP Requirements and Compliance Monitoring ..... 11
   4.1 IC/EC Inspection and Monitoring Plan Compliance Report ..... 12
      4.1.1 Site Composite Cover System Inspection ..... 12
      4.1.2 Groundwater Monitoring and Sampling ..... 14
      4.1.3 LNAPL in Monitoring Wells and Recovery ..... 15
      4.1.4 Soil Vapor Intrusion Assessment ..... 15

5. Overall Conclusions and Recommendations ..... 17


# Tables


1. Summary of Volatile Organic Compounds in Groundwater
2. Summary of Semivolatile Organic Compounds in Groundwater
3. Summary of Metals in Groundwater
4. Summary of Polychlorinated Biphenyls in Groundwater
5. Summary of First Quarter 2024 through Fourth Quarter 2024 Groundwater Gauging Data


# Figures


1. Site Location Map
2. Groundwater Exceedances 2024 Quarterly Sampling
3. Site Composite Cover System


# Appendices


A. USEPA and NYSDEC Approvals Communications and Approvals
B. IC/EC Certification Form
C. NYSDEC-Approved SMP and Approval Letter
D. Quarterly Groundwater Sampling Results Letters
E. Site Inspection Checklist and Photo Log

# Executive Summary

This Periodic Review Report (PRR) has been prepared by Roux Environmental Engineering and Geology, D.P.C. (Roux) on behalf of BRT Powerhouse, LLC (current site owner) and serves as a required element of the remedial program for the Gowanus Village I site located at 153 2nd Street AKA 322 3rd Avenue, Brooklyn, New York 11215 (hereinafter referred to as the Site). A summary is provided of all inspections, monitoring, maintenance, and reporting activities completed in accordance with the New York State Department of Environmental Conservation (NYSDEC)-approved Site Management Plan (SMP) Revision No. 1, approved on July 29, 2020. This PRR documents onsite activities completed at the Site from March 1, 2024 through March 1, 2025. All onsite monitoring and inspections completed during this reporting period have been performed in accordance with the United States Environmental Protection Agency (USEPA) Consent Order No. CERCLA-02-2017-2021, the NYSDEC-approved SMP, and the USEPA-approved Amendment to the Remedial Action Work Plan for PCB Cleanup (USEPA RAWP), dated March 23, 2020.

The Site received a NYSDEC Certificate of Completion (COC) in December 2017. Onsite redevelopment was completed in 2022 and the Site received a temporary certificate of occupancy (TCO) in February 2022. The Site composite cover system installation was completed in May 2022. The Site has been redeveloped into an industrial arts workshop facility that houses fabrication and production facilities for wood, metal, ceramics, textile, and print. No redevelopment work was completed during this reporting period. There have been no modifications to the Site Cover System during this reporting period. Groundwater sampling reports were submitted to the NYSDEC on a quarterly basis during the reporting period which documented the quarterly groundwater gauging data, groundwater sampling methodology, and groundwater sampling results. Based on analytical data of groundwater samples collected during this reporting period, remaining groundwater contamination at the Site consists of Site-wide exceedances of the AWQSGVs for VOCs and localized exceedances of the AWQSGVs for SVOCs, and metals (total and dissolved) and polychlorinated biphenyls (PCBs).

Roux prepared and submitted the USEPA Final Report to USEPA in May 2022, as required by the Powerhouse Administrative Settlement Agreement and Order on Consent (Index Number CERCLA-02-2017-2021), issued by the USEPA on June 19, 2017. On August 21, 2024, Roux received approval (Appendix A) via email from the USEPA with respect to the work required by the Order, as amended, which confirms no additional sampling is required by the USEPA.

The following sections provide a summary of the controls implemented for the Site, as well as the inspections, monitoring, and reporting activities completed in accordance with the NYSDEC-approved SMP. The components, data, and rationale included in this PRR demonstrate that the IC/ECs are performing as designed, are effective, and are compliant with specifications described in the NYSDEC-approved SMP. The prior PRR, dated May 31, 2024, was submitted to the NYSDEC for the reporting period of January 1, 2023, through March 1, 2024. Roux has not yet received confirmation of approval for the prior PRR. The Institutional Control (IC)/Engineering Control (EC) certification form associated with this PRR was received from the NYSDEC via e-mail on January 21, 2025, and is included in Appendix B. This is the seventh PRR submitted for the Site, which captures the 12 months of activity from March 1, 2024, through March 1, 2025. Redevelopment work at the Site was complete in May 2022, therefore, the reporting frequency for future PRRs can be reduced to once every three years with NYSDEC-approval. If approved, inspections of the ICs and ECs will continue to be completed on an annual basis and inspection forms will be included in each PRR. This request was provided to the NYSDEC under a separate cover, titled Request for Reduction of Frequency

of Groundwater Monitoring and Sampling Plan dated August 12, 2024 and a revised version was submitted dated December 9, 2024. Roux has not yet received confirmation of the proposed changes. These PRRs will identify and assess all of the ICs/ECs required by the remedy for the Site, any environmental monitoring data and/or information generated during the reporting period, and a complete Site evaluation that discusses the overall performance and effectiveness of the remedy.

# 1. Introduction

This Periodic Review Report (PRR) was prepared by Roux Environmental Engineering and Geology, D.P.C. (Roux) on behalf of BRT Powerhouse, LLC (current site owner) and serves as a required element of the remedial program for the Gowanus Village I site located at 153 2nd Street AKA 322 3rd Avenue, Brooklyn, New York 11215 (hereinafter referred to as the Site). A Site Location Map is attached as Figure 1. The Site is currently enrolled in the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP), as Site No. C224099. All work completed at this Site is to be performed in accordance with the United States Environmental Protection Agency (USEPA) Consent Order No. CERCLA-02-2017-2021, the NYSDEC-approved Site Management Plan (SMP) Revision No. 1, approved July 29, 2020, and the USEPA-approved Amendment to the Remedial Action Work Plan for PCB Cleanup (USEPA RAWP), dated March 23, 2020.

Gowanus Village I, LLC (GVI) was the original Volunteer that entered into a Brownfield Cleanup Agreement (BCA) on July 25, 2005, with the NYSDEC to remediate the Site. Subsequent key dates related to the Volunteer's application to the BCA are listed below:

- The Department amended the BCA on March 21, 2011, wherein AI Gowanus Village, LLC (AIGV) and Gowanus Village IV, LLC (GVIV) became the Volunteers and GVI was removed.
- The BCA was amended on August 21, 2012, wherein AIGV consented to a change of party BCA amendment, submitted on July 29, 2012, such that BRT Powerhouse, LLC (BRTP) became the new listed Volunteer.
- The BCA was amended on May 24, 2013, wherein the NYSDEC approved the BCA amendment application submitted by BRTP requesting that Gemini Arts Initiative, Inc. (GAII) be added as the Volunteer.
- BRTP and GAII are listed as the current BCP Volunteers as per the NYSDEC approval letter for Change in Party, which was issued on June 6, 2013.
- The BCA was amended on August 24, 2017, wherein the NYSDEC approved the July 10, 2017 BCA amendment application submitted by BRTP and GAII, such that Gemini Arts Subsidiary, LLC (GAS) became the newly added Volunteer.

As part of being in the BCP, a Site investigation was performed that identified the following contaminants of concern at the Site, to be remediated during implementation of the RAWP prepared by LBG Engineering Services, P.C., dated June 2014:

- Chlorobenzene
- 1,2,4-Trimethylbenzene
- Copper
- Benzo(a)pyrene
- Benzo(a)anthracene
- Polychlorinated biphenyls (PCBs)
- Barium
- Arsenic
- Lead
- Tetrachloroethylene (PCE)
- 1,4-Dichlorobenzene
- Mercury

A Track 4 cleanup was proposed and implemented in accordance with the RAWP.

The Institutional Control (IC)/Engineering Control (EC) certification form was received from the NYSDEC via e-mail on January 21, 2025, and is included in Appendix B. This is the seventh PRR submitted for the Site, which captures the 12 months of activity from March 1, 2024, through March 1, 2025. Redevelopment work

at the Site is complete, therefore, the reporting frequency for future PRRs can be reduced to once every three years with NYSDEC-approval. If approved, inspections of the ICs and ECs will continue to be completed on an annual basis and inspection forms will be included in each PRR. This request was provided to the NYSDEC in a memorandum dated August 12, 2024, as discussed further in Section 1.1. These PRRs will identify and assess all of the ICs/ECs required by the remedy for the Site, any environmental monitoring data and/or information generated during the reporting period, and a complete Site evaluation that discusses the overall performance and effectiveness of the remedy.

## 1.1 Summary of NYSDEC Submittals

Groundwater sampling reports were submitted to the NYSDEC on a quarterly basis during this reporting period which documented groundwater gauging data, groundwater sampling methodology, and groundwater sampling results. All quarterly groundwater sampling reports submitted during this reporting period are included in Appendix D.

A Request for Reduction of Frequency of Groundwater Monitoring and Sampling Plan was submitted to the NYSDEC on August 12, 2024. Based on comments provided by the NYSDEC in an email dated September 30, 2024, Roux prepared a revised requested dated December 9, 2024 which was submitted to the NYSDEC on December 20, 2024. Roux has not yet received a response to the proposed reductions.

# 2. Site Overview

## 2.1 Site Description and History

The Site is located at 153 2nd Street AKA 322 3rd Avenue in Brooklyn, Kings County, New York 11215 and is identified as Block 967 and Lot 1 on the Brooklyn County Tax Map. The Site is approximately 2.4959 acres and is bounded by the historical First Street Basin (Former Lateral Canal) to the north; 2nd Street to the south; 3rd Avenue to the east; and the Gowanus Canal to the west.

The Site currently consists of the historical turbine hall building (turbine hall) with a footprint of approximately 24,200 square feet (SF). Directly north of the turbine hall is the boiler house building (boiler house) that is built atop the historical boiler house mat slab, which is approximately 5-ft thick. The western portion of the Site has been redeveloped as a paved forecourt and loading/unloading area which includes a vegetated and landscaped slope that leads down to the newly installed bulkhead along the Gowanus Canal. The Site has a history of industrial use, historically utilized for: sulfur-works, a power station, a paper mill, a lumber yard, a coal-fired electric powerhouse, an electrical sub-station and switching yards, and a warehouse. The Site is zoned as a manufacturing district (M2-1) and prior to the most recent redevelopment had been vacant for a decade. The Site has been redeveloped to create an industrial arts workshop facility that houses fabrication and production facilities for wood, metal, ceramics, textile, and print.

## 2.2 Summary of Remedial Action

Following NYSDEC-approval of the RAWP and issuance of the Decision Document (DD) (February 2014), Leggette, Brashears and Graham, Inc. (LBG) began remediation at the Site in June 2014. Since then, the Volunteer has fully implemented and completed the approved remedial program. All remedial work was done with oversight, understanding, and direction from the NYSDEC.

In accordance with the DD, the Site-specific remedy included the excavation and offsite disposal of onsite contamination source areas meeting any of the following specifications:

- Grossly contaminated soil, as defined in 6 NYCRR Part 375-1.2(u);
- Soil exceeding the Site-specific Soil Cleanup Objective (SCO) of 10 parts per million (ppm) PCBs, to the extent feasible based on existing structures; and
- Areas of concentrated solid or semi-solid hazardous substances.

The Remedial Action Objectives (RAOs) for the Site, as listed in the DD, dated February 2014, are as follows:

***Groundwater RAOs***

RAOs for Public Health Protection

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.

RAOs for Environmental Protection

- Remove the source of ground or surface water contamination.

***Soil RAOs***

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater or surface water contamination.

***Soil Vapor RAOs***

RAOs for Public Health Protection

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at the Site.

The RAOs were achieved via the following scopes of work:

- Excavation and offsite disposal of grossly contaminated soil in the light non-aqueous phase liquid (LNAPL) source area in the western portion of the Site, including:
  - Grossly contaminated soil as defined in 6NYCRR Part 375-1.2(u);
  - Soil containing LNAPL;
  - Soil containing total semivolatile organic compounds (SVOCs) exceeding 500 ppm; and
  - Soils which exceeded PCB concentrations of 10 ppm.
- Air monitoring of potential airborne volatile organic compounds (VOCs) and particulates during all ground intrusive and soil handling activities.
- Implementation of erosion and sediment controls.
- Monthly groundwater monitoring and LNAPL recovery, as needed.
- Quarterly groundwater sampling to evaluate the performance of LNAPL recovery, the effectiveness of source area removal, and to evaluate if remaining contamination continues to impact groundwater.
- Installation of a Site composite cover system.

Following completion of onsite remediation, the Site received a NYSDEC Certificate of Completion (COC) in December 2017.

## 2.3 Remaining Contamination

The Remedial Action (RA) was designed to reduce the concentration of Site contaminants through excavation of source material identified as PCB areas of concern (AOCs) and removal of LNAPL from the subsurface beneath the turbine hall building mat slab. As per the DD, it was determined that a limited volume of contaminated soil underneath the turbine hall building, which contains PCB concentrations greater than 50 ppm, will remain onsite since removal of this soil is not feasible. During implementation of the RAWP, soils outside the turbine hall building footprint exceeding PCB concentrations of 10 ppm were removed. The Track 4 cleanup permits the remedial program to include the use of long-term ICs and ECs to address all residually contaminated media left in place following implementation of the RA.

### 2.3.1 Soil

The RA addressed PCB contaminated soil in the source areas west of the turbine hall building and at various identified AOCs through excavation. Former onsite AOCs and endpoint sampling results are provided in the NYSDEC-approved SMP included in Appendix C. The remaining onsite soil has been fully characterized and PCB exceedances were delineated during the coal tunnel investigation and delineation/endpoint sampling completed in accordance with the NYSDEC's DER-10 Technical Guidance for Site Investigation and Remediation (DER-10) during the RA. Hot Spots were identified during the characterization of the remaining soil and designated for offsite disposal after PCB exceedances had been delineated.

Upon completion of Site-wide grading and Hot Spot/AOC removal, and prior to installing the Site composite cover system, surficial soil samples were collected to characterize the Residual Management Zone (RMZ). RMZ samples were collected from 0-1 feet below land surface (ft bls), at a frequency of one sample per 5,000 SF in accordance with the RAWP. RMZ sample locations are provided in the NYSDEC-approved SMP included in Appendix C. RMZ samples were not collected from existing Hot Spot/AOC excavations due to the significant number of endpoint samples collected following completion of Hot Spot/AOC excavations. The results of soil sampling data, following completion of the RA excavation and backfilling activities, are provided in the NYSDEC-approved SMP included in Appendix C.

Future contact with contaminated soil containing PCB concentrations less than 10 ppm was addressed by installing a Site composite cover system across the Site. The Site composite cover system consists of Site paving (3-inches of RCA. 4-inches of asphalt binder course, and 3-inches of final asphalt), Site sidewalks and pathways (3-inches of RCA and 4-inch-thick concrete), turbine hall and boiler house foundations (existing buildings slab and TSCA compliant cap), gatehouse foundation (gatehouse concrete slab and waterproofing/vapor barrier), vegetated landscape slope (minimum 2-feet of clean imported planting soil underlain by a demarcation), gravel maintenance path (6-inches of stone and 18-inches of soil underlain by a demarcation layer), stone/RCA (minimum of 24-inches of stone or RCA underlain by a demarcation layer), final landscaping (concrete yard blocks underlain by 8-inches of stone/RCA subbase), drainage structures (1.5-feet wide stone French drain), and bulkhead backfill (3.5-feet of stone, 2.8-feet of RCA blend, and 3-inches of stone). Figure 3 shows the as-built Site composite cover system.

### 2.3.2 Groundwater

The RA addressed groundwater contamination through source area removal of soils with LNAPL impacts or PCB concentrations above the Site-specific SCOs. A component of the RAWP included the dewatering and treatment of groundwater as needed to enable excavation below the groundwater table. The dewatering efforts facilitated the removal of LNAPL present on the groundwater surface within the former cooling water intake tunnel and associated former gate well structures located west of the turbine hall.

Prior to the issuance of the COC, seven monitoring wells were present in the turbine hall cellar. Of these seven monitoring wells, only one monitoring well (MW-3) exhibited consistent recoverable LNAPL thickness (located beneath the turbine hall building). High Viscosity Magnum Spill Buster vacuum extraction methods were attempted at MW-3. Due to the extremely viscous nature of the LNAPL beneath the turbine hall mat slab, vacuum extraction at MW-3 was unsuccessful. To delineate the LNAPL underneath the turbine hall building, additional exterior monitoring wells were installed. Based on consistently observed thicknesses/absence of LNAPL in the exterior monitoring wells, it is believed LNAPL has been properly delineated.

Based on analytical data of groundwater samples collected during this reporting period, remaining groundwater contamination at the Site consists of Site-wide exceedances of the NYSDEC's Ambient Water Quality Standards and Guidance Values (AWQSGVs) for VOCs and localized exceedances of the AWQSGVs for SVOCs, and metals (total and dissolved) and PCBs. All 2024 Groundwater Sampling Results Summary letters are included in Appendix D, and Section 4.1.2 below include additional details regarding remaining groundwater contamination at the Site. The locations and current status of all monitoring wells installed as part of the RA and/or under the NYSDEC-approved SMP are included in Figure 2.

### 2.3.3 Soil Vapor

A summary of the results of historical soil vapor samples with exceedances of the New York State Department of Health (NYSDOH) Soil Vapor/Indoor Air Guidance Values is provided in the NYSDEC-approved SMP included in Appendix C. While exterior excavation and LNAPL recovery activities completed during the RA may have reduced the soil vapor concentrations, source excavation activities could not be completed beneath the turbine hall building due to the thickness of the existing reinforced-concrete mat slab. Therefore, residual contamination could be attributed to SVI for the planned development.

Due to the thickness of the turbine hall and former boiler house's reinforced-concrete mat slab, which extends into the groundwater table, a sub-slab depressurization system (SSDS) is not feasible at the Site. While it is expected the thickness of the reinforced-concrete mat slab will provide a barrier to prevent SVI, a vapor barrier capable of preventing SVI of VOCs has been installed within the subsurface portions of the turbine hall, boiler house and gatehouse buildings prior to occupancy to ensure the protection of indoor air quality. A ventilation system was installed for the lower level of the turbine hall and boiler house which is used as a parking garage. The garage ventilation system was designed to meet the New York City Department of Buildings (NYCDOB) codes for air exchanges suitable for vehicular exhaust and will circulate fresh air into the lower levels of the building. Additionally, open window grilles installed along the south wall of the turbine hall cellar, and open vehicle entrances to the boiler house on the east side of the building allows open air exchange of the cellar areas. The vehicle entrances are constructed with perforated doors and remain open during hours of operation.

Indoor air sampling was conducted in February 2022 prior to building occupancy, and second indoor air sampling event was conducted in April 2023, in accordance with the NYSDEC-approved SMP included in Appendix C. One indoor air sample was collected from each of the cellar levels, utilized as a parking garage, and first floors of both the turbine hall and boiler house buildings. A total of five indoor air samples, including one duplicate sample for QA/QC purposes were collected and one ambient air sample was collected. See section 4.1.4 for more information regarding air sampling.

## 2.4 Engineering and Institutional Controls

Since residual contamination remains beneath the Site, ICs/ECs have been incorporated into the Site remedy as part of the NYSDEC-approved SMP, to provide proper management of residual contamination in the future and ensure protection of public health and the environment. The IC/EC certification form is included in Appendix B.

### 2.4.1 Engineering Controls

The Site has ECs consisting of:

- Site Composite Cover System (refer to Figure 3);
- LNAPL Recovery Program; and
- Vapor Barrier.

The purpose of each EC is described below:

- The Site Composite Cover System prevents exposure to remaining contamination in soil/fill at the Site.
- The LNAPL Recovery Program removes any residual LNAPL that may be present at the groundwater table.

- The Vapor Barrier is capable of preventing SVI of VOCs within the subsurface portions of the onsite buildings, ensuring protection of indoor air quality. A ventilation system was installed for the lower level of the turbine hall and boiler house which will be used as a parking garage. The garage ventilation system was designed to meet NYCDOB codes for air exchanges suitable for vehicular exhaust and will circulate fresh air into the lower levels of the building.

### 2.4.2 Institutional Controls

A Site-specific Environmental Easement has been recorded with the Kings County Clerk that provides an enforceable means to manage the remaining contamination at the Site until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36. The ICs presented in the NYSDEC-approved SMP consist of the following:

- The property may be used for: restricted residential, commercial, or industrial use;
- All ECs must be operated and maintained as specified in the NYSDEC-approved SMP;
- All ECs must be inspected at a frequency and in a manner defined in the NYSDEC-approved SMP;
- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the New York City Department of Health and Mental Hygiene to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;
- Groundwater and other environmental or public health monitoring must be performed as defined in the NYSDEC-approved SMP;
- Data and information pertinent to Site management must be reported at the frequency and in a manner as defined in the NYSDEC-approved SMP;
- All future activities that will disturb remaining contaminated material must be conducted in accordance with the NYSDEC-approved SMP;
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in the NYSDEC-approved SMP;
- Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in the NYSDEC-approved SMP;
- Access to the Site must be provided to agents, employees, or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Easement;
- The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries, and any potential impacts that are identified must be monitored or mitigated; and
- Vegetable gardens and farming on the Site are prohibited.

# 3. Redevelopment Activity

The turbine hall, boiler house, gatehouse, and Site-wide redevelopment work was completed in 2022.

There was no redevelopment work completed at the Site during this reporting period that required oversight as according to the NYSDEC-approved SMP or the Excavation Work Plan (EWP), which is included in Appendix C of the NYSDEC-approved SMP (Appendix C of the PRR). There was no import of material, or offsite disposal of materials or waste to support the redevelopment during this reporting period. There were no modifications to the Site Cover System during this reporting period.

# 4. SMP Requirements and Compliance Monitoring

Since remaining contaminated soil and groundwater exists beneath the Site, ICs and ECs are required to protect human health and the environment. This section details the Operations and Maintenance (O&M) monitoring plan activities currently implemented and an evaluation of the performance and effectiveness of the ECs in reducing or mitigating contamination at the Site. A summary of the requirements as stated in the NYSDEC-approved SMP and as modified during this reporting period is provided in the table below.

| **Site Identification:** | **BCP Site No. C224099<br>Gowanus Village I, LLC (BRT Powerhouse)<br>322 3rd Avenue (a.k.a. 153 2nd Street), Brooklyn, New York** |
|---|---|
| **Institutional Controls** | 1. The property may be used for restricted residential, commercial and/or industrial use only. |
| | 2. Environmental Easement |
| | 3. Performance of soil vapor intrusion evaluation in event of redevelopment. |
| | 4. All ECs must be inspected at a frequency and in a manner defined in the NYSDEC-approved SMP. |
| **Engineering Controls** | 1. Site Composite Cover system |
| | 2. LNAPL Recovery Program |
| | 3. Vapor Barrier |

| **Inspections** | **Frequency** |
|---|---|
| 1. Site Composite Cover System inspection | Annually |
| 2. Vapor Barrier | Upon Installation |
| 3. LNAPL recovery system inspection | As Needed |
| 4. Site-wide Inspection | Annually |
| **Monitoring** | **Frequency** |
| 1. LNAPL recovery wells | Quarterly gauging |
| 2. Monitoring wells - Groundwater sampling | Quarterly for first 2 years. Any change in frequency after 2 years will need to be approved by the NYSDEC. |
| 3. Indoor Vapor Sampling | Upon completion of redevelopment, prior to occupancy of the building (not applicable – sampling completed in February 2022 and April 2023 pertinent to building occupancy) |
| **Maintenance** | **Frequency** |
| 1. LNAPL pump maintenance | As Needed (not applicable) |
| 2. LNAPL recovery drum change-out | As Needed (not applicable) |
| **Reporting** | **Frequency** |
| 1. Monthly Progress Report (Ongoing, as necessary) | Monthly through issuance of COC (not applicable) |
| 2. Groundwater Monitoring Report | Quarterly, corresponding with groundwater monitoring frequency. |
| 3. Periodic Review Report | Annually |

## 4.1 IC/EC Inspection and Monitoring Plan Compliance Report

The monitoring plan describes the measures for evaluating the performance and effectiveness of the remedy to reduce or mitigate contamination at the Site, the Site composite cover system, and all affected Site media identified below. Components of the O&M Plan are:

- Sampling and analysis of all appropriate media (e.g., groundwater).
- Assessing compliance with applicable NYSDEC standards, criteria and guidance, particularly ambient groundwater standards and Part 375 SCOs for soil.
- Assessing achievement of the remedial performance criteria.
- Evaluating Site information periodically to confirm the remedy continues to be effective in protecting public health and the environment.
- Preparing the necessary reports for the various monitoring activities.

Monitoring of the performance of the remedy and overall reduction in contamination onsite will be conducted for the periods specified for each matrix listed in the table below. The frequency is subject to change in consultation with the NYSDEC and based on reports submitted showing contaminant trends. The following components of the monitoring program were completed during this reporting period.

| Monitoring Plan Requirements | | | |
|---|---|---|---|
| **Monitoring Program** | **Frequency** | **Matrix** | **Analysis** |
| Site Composite Cover System and Site-Wide Inspection | Annually. First inspection no more than 16 months after issuance of the COC. | Soil, Asphalt, and/or Concrete Slab | Visual inspection of all composite cover system components. |
| Groundwater in Monitoring Wells | Quarterly gauging and sampling | Groundwater | Target Compound List (TCL) VOCs, TCL SVOCs, Resource Conservation and Recovery Act (RCRA) Metals, PCBs, and Total Cyanide |
| LNAPL in Monitoring Wells | Quarterly gauging | LNAPL | Check for presence of LNAPL and confirm thickness, if applicable. Manual recovery of LNAPL where present and practical. |

### 4.1.1 Site Composite Cover System Inspection

Exposure to remaining contamination at the Site is prevented by an engineered Site composite cover system.

The location and details of the Site composite cover system are shown in Figure 3. Monitoring consisted of a visual inspection, which evaluated the structural integrity of the slab, pavement, and asphalt; and exposure of the demarcation layer and direction of drainage for the soil cover.

Roux performed the annual Site composite cover system and Site-wide inspections on March 12, 2025. The completed Site inspection checklist and associated photo log are provided in Appendix E. Figure 3 shows the as-built Site composite cover system. This inspection determined that all Site Cover System elements described herein were observed to be performing as designed during the reporting period of the PRR and

are protective of human health and the environment. Additional details regarding the current status of the Site composite system are summarized in the table below.

| Site Composite Cover System Existing Conditions | |
|---|---|
| **Engineering Control – Site Composite Cover System** | **Existing Site Conditions** |
| Site paving - 3 inches of recycled concrete aggregate, 4 inches of asphalt binder course, and 3-inches of final asphalt. | This component of the Site composite cover system is performing as designed. This aspect of the cover system includes 3-inches of RCA overlain by 4-inches of binder course asphalt. |
| Site sidewalks and pathways - 3 inches of recycled concrete aggregate and 4-inch-thick concrete | This component of the Site composite cover system is intact and performing as designed and includes concrete sidewalk and curb installation along the north, south and east roadways of the Site and along the northern and eastern exterior of the boiler house for the raised concrete sidewalk as part of the redevelopment. This component of the Site composite cover system consists of 3-inches of RCA overlain by a 4-inch-thick layer of concrete. |
| Turbine hall and boiler house foundations – existing buildings' slab and TSCA compliant cap | The final Site composite cover system in the turbine hall and boiler house consists of the former building mat slab overlain by the TSCA-compliant cap, including a waterproofing/vapor barrier, constructed in accordance with the USEPA RAWP and is performing as designed. |
| Gatehouse foundation – gatehouse concrete slab and waterproofing/vapor barrier | The final site composite cover system in the gatehouse building, located at the northeast site entrance, consists of a 3-inch-thick mud-slab, a sub-slab waterproofing/vapor barrier layer, and a 6-inch-thick concrete topping slab. This component of the Site composite cover system is intact and performing as designed. |
| Vegetated landscape slope – minimum 2 ft of clean imported planting soil underlain by a demarcation layer. | This component of the Site composite cover system is intact and performing as designed on the vegetated landscaped slope in the western portion of the site. This component of the Site composite cover system consists of a demarcation layer overlain by a minimum of 2 ft of clean imported planting soil placed along the western site slope. |
| Gravel maintenance path – 6 inches of stone and 18 inches of soil underlain by a demarcation layer | This component was installed as a 3-ft wide maintenance path at the top of the vegetated landscaped slope and is performing as designed. This component of the Site composite cover system consists of a demarcation layer, overlain by a minimum of 18-inches of soil, and a minimum of 6-inches of stone. |
| Stone/RCA – a minimum of 24-inches of stone or RCA underlain by a demarcation layer | The Site composite cover system in the southwest portion of the Site between the western extent of the south roadway and the previously backfilled south end of the bulkhead area is intact and performing as designed. The composite cover system in this area consists of a demarcation layer overlain by a minimum of 24-inches of stone or RCA. |
| Final landscaping – concrete yard blocks underlain by 8 inches of stone/RCA subbase | This component of the Site composite cover system is intact and performing as designed in the western portion of the site between the bulkhead walkway area and the vegetated landscaped slope. This component of the composite cover system consists of a subbase of 8 inches of stone overlain by a series of 2 ft by 2 ft by 4 ft concrete yard blocks installed along the western portion of the site. |

| Site Composite Cover System Existing Conditions | |
|---|---|
| **Engineering Control – Site Composite Cover System** | **Existing Site Conditions** |
| Drainage structures – 1.5 ft wide stone French drain | This component of the Site composite cover system is intact and performing as designed in the western portion of the Site between the concrete yard block wall and the vegetated landscaped slope. This component of the composite cover system consists of a 1.5 ft wide French drain constructed of a subbase of 8-inches of stone and an 8-inch diameter perforated pipe, ultimately overlain by approximately 5 ft of stone. |
| Bulkhead backfill – 3.5 ft of stone, 2.8 ft of RCA blend, and 3-inches of stone. | This component of the Site composite cover system is intact and performing as designed. This component was installed following the installation of the steel pile bulkhead in the western portion of the site and represents the limited area between the installed steel pile bulkhead to the west and the installed landscaping concrete yard block wall to the east. |

Photographs taken during the Site-wide inspection are also provided in Appendix E.

### 4.1.2 Groundwater Monitoring and Sampling

Quarterly groundwater sampling events were completed in March 2024, June 2024, September 2024, and December 2024/January 2025.

Samples collected were analyzed for TCL VOCs, TCL SVOCs, RCRA 8 total and dissolved metals, PCBs, and total cyanide in accordance with the NYSDEC-approved SMP. All groundwater samples were collected in appropriate laboratory-provided containers and were transported to TestAmerica Laboratories in Edison, New Jersey, a NYSDOH Environmental Laboratory Approval Program (ELAP)-approved laboratory, in ice-filled coolers under chain of custody procedures. Analytical results for the groundwater samples collected during the 2024 groundwater sampling events are included in Tables 1 through 4 and summarized in Figure 2.

During this reporting period, all onsite monitoring wells were gauged on a quarterly basis to monitor groundwater elevations and document the presence of any LNAPL, if present. No LNAPL was observed in any wells during the 2024 quarterly groundwater sampling. No LNAPL has been detected in any wells in the on-Site monitoring well network since 2022. A summary of the 2024 groundwater gauging data for the monitoring wells required under the NYSDEC-approved SMP is included in Table 5.

Purged groundwater generated during the groundwater sampling events was containerized in labeled 55-gallon drums and stored onsite. Groundwater laboratory analytical reports from March through December 2024/January 2025 are provided as attachment to each of the quarterly groundwater sampling results summary reports, included within Appendix D. The sample collection, sample handling, decontamination, and field instrument calibration procedures were performed in accordance with procedures detailed in the NYSDEC-approved SMP.

A summary of the groundwater analytical results for samples collected during this reporting period is included below.

- VOCs were detected at seven out of ten monitoring wells sampled during 2024. Concentrations of VOCs at MW-9, MW-10R, MW-13, MW-14, MW-15, MW-16R, and MW-17R exceeded the AWQSGVs. VOCs that exceeded the AWQSGVs include 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,4-dioxane (p-dioxane), benzene,

chlorobenzene, ethylbenzene, isopropylbenzene (cumene), m,p-xlyene, and o-xylene (1,2-dimethylbenzene). Concentrations of VOCs at these seven monitoring wells are generally consistent with prior data. Throughout the quarterly sampling for 2024, VOC concentrations generally remained static or decreased, excluding chlorobenzene. Chlorobenzene concentrations have remained static at MW-9 and MW-13, with marginally increasing concentrations at MW-13, MW-15, MW-16R, and MW-17R.

- Concentrations of SVOCs at MW-10R and MW-15 exceeded the AWQSGVs during 2024. SVOCs that exceeded the AWQSGVs include acenaphthene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, biphenyl (diphenyl), chrysene, fluorene, indeno(1,2,3-C, D)pyrene, naphthalene, and phenanthrene. Naphthalene was the only SVOC exceedance at MW-15. MW-10R and MW-15 contained static or decreasing trends in SVOC exceedances through 2024.
- Metals, both total and dissolved, were detected in all monitoring wells sampled during 2024. A majority of the metals detected (e.g., sodium, magnesium, manganese, etc.) are associated with brackish water due to the Site's proximity to the Gowanus Canal and are not indicative of Site contamination. Concentrations of metals at MW-11, MW-13, and MW-17R exceeded the AWQSGVs. Metals that exceeded the AWQSGVs include total lead, and total and dissolved arsenic. MW-11, MW-13, and MW-17R contained static or decreasing trends in metals exceedances through 2024.
- PCBs were detected at MW-14, MW-16R, and MW-17R exceeding AWQSGVs in 2024. PCBs were only detected at MW-14 during the first quarter 2024 sampling event. Throughout the first three quarters of 2024, PCB concentrations generally remained static or decreasing, and in the fourth quarter of 2024 PCBs were detected at MW-16R and MW-17R with a concentration of 15 ug/L and 4.7 ug/L, respectively, representing an increase in comparison to the previous three quarters.

### 4.1.3 LNAPL in Monitoring Wells and Recovery

Monitoring wells were gauged on a quarterly basis. No LNAPL was observed in any monitoring wells. Since the removal of the absorbent socks on November 8, 2022, there has not been detectable product observed in MW-16R, MW-17R, and MW-18R. A summary of the gauging data for 2024 is provided in Table 6.

### 4.1.4 Soil Vapor Intrusion Assessment

All waterproofing/vapor barrier installation has been completed prior to this reporting period and are summarized in previously approved PRRs.

The SVI assessment, dated March 24, 2023 was completed prior to occupancy of the onsite buildings and evaluated the potential for SVI for the turbine hall and boiler house buildings and was submitted to the USEPA and NYSDEC. The previously installed waterproofing/vapor barrier at the boiler house and turbine hall superstructures is a component of the TSCA-compliant cap of the buildings to limit the potential for SVI.

Based on the indoor air sampling results present in this SVI assessment, the vapor barrier/TSCA-compliant cap which serves as a long-term EC is capable of preventing any potential SVI into the buildings. Additionally, the installed NYCDOB ventilation system, open window grilles installed along the south wall of the turbine hall cellar, and open vehicle entrances to the boiler house on the east side of the building allows open air exchange of the cellar areas utilized as a parking garage. The vehicle entrances are constructed with perforated doors and remain open during hours of operation. At the gatehouse building, the distance from the residual contamination source area, lack of historical soil vapor exceedances, slab on grade construction, and the installation a vapor barrier during foundation construction are elements that will contribute to the prevention of SVI into the gatehouse building.

Roux prepared and submitted the USEPA Final Report to USEPA in May 2022, as required by the Powerhouse Administrative Settlement Agreement and Order on Consent (Index Number CERCLA-02-2017-

2021), issued by the USEPA on June 19, 2017. On August 21, 2024, Roux received approval (Appendix A) via email from the USEPA with respect to the work required by the Order, as amended, which confirms no additional sampling is required.

# 5. Overall Conclusions and Recommendations

The following section presents conclusions from inspections and monitoring activities as well as recommendations:

- The ICs and ECs are performing as designed, are effective, and are generally compliant with the specifications described in the NYSDEC-approved SMP and/or described in the PRR. Redevelopment work at the Site is complete, therefore, the reporting frequency for future PRRs can be reduced to once every three years with NYSDEC-approval. If approved, inspections of the ICs and ECs will continue to be completed on an annual basis and inspection forms will be included in each PRR. This request was provided to the NYSDEC under a separate cover, titled Request for Reduction of Frequency of Groundwater monitoring and Sampling Plan dated August 12, 2024 and a revised version was submitted dated December 9, 2024.
- Based on analytical data of groundwater samples collected during this reporting period, remaining groundwater contamination at the Site consists of Site-wide exceedances of the AWQSGVs for VOCs and localized exceedances of the AWQSGVs for SVOCs, and metals (total and dissolved), and PCBs. No LNAPL has been detected in any monitoring wells since 2022.
- Roux prepared and submitted the USEPA Final Report to USEPA in May 2022, as required by the Powerhouse Administrative Settlement Agreement and Order on Consent (Index Number CERCLA-02-2017-2021), issued by the USEPA on June 19, 2017. On August 21, 2024, Roux received approval (Appendix A) via email from the USEPA with respect to the work required by the Order, as amended, which confirms no additional sampling is required.

# TABLES

1. Summary of Volatile Organic Compounds in Groundwater
2. Summary of Semivolatile Organic Compounds in Groundwater
3. Summary of Metals in Groundwater
4. Summary of Polychlorinated Biphenyls in Groundwater
5. Summary of First Quarter 2024 through Fourth Quarter 2024 Groundwater Gauging Data

| Notes Utilized Throughout Tables | |
|---|---|
| **Groundwater Tables** | |
| J - | Estimated Value |
| U - | Compound was analyzed for but not detected |
| T - | Indicates that a quality control parameter has exceeded laboratory limits |
| FD - | Duplicate |
| NA - | Compound was not analyzed for by laboratory |
| µg/L - | Micrograms per liter |
| NYSDEC - | New York State Department of Environmental Conservation |
| AWQSGVs - | Ambient Water-Quality Standards and Guidance Values |
| -- | No NYSDEC AWQSGV available |
| Bold data indicates that parameter was detected above the NYSDEC AWQSGVs | |

**Table 1. Summary of Volatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | | | Sample Designation: | MW-9 | MW-9 | MW-9 | MW-9 | MW-9 | MW-9 | MW-10R | MW-10R |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 03/19/2024 | 06/17/2024 | 06/17/2024 | 10/03/2024 | 12/31/2024 | 12/31/2024 | 03/19/2024 | 06/18/2024 |
| | | | Normal or Field Duplicate: | N | N | FD | N | N | FD | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | | |
| 1,1,1-Trichloroethane (TCA) | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| 1,1,2,2-Tetrachloroethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| 1,1,2-Trichloroethane | 1 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| 1,1-Dichloroethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| 1,1-Dichloroethene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| 1,2,3-Trichlorobenzene | 5 | UG/L | 0.8 J | 0.42 J | 0.45 J | 1.3 | 1.1 J | 1.2 J | 1 U | 1 U |
| 1,2,4-Trichlorobenzene | **5** | UG/L | 3.5 | 2.7 | 3 | **5.4** | 4.5 | 4 | 1 U | 1 U |
| 1,2-Dibromo-3-Chloropropane | 0.04 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| 1,2-Dibromoethane (Ethylene Dibromide) | 0.0006 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| 1,2-Dichlorobenzene | 3 | UG/L | 1.4 | 1.3 | 1.3 | 1.7 | 2.4 | 1.9 J | 1 U | 1 U |
| 1,2-Dichloroethane | 0.6 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| 1,2-Dichloropropane | 1 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| 1,3-Dichlorobenzene | **3** | UG/L | **26** | **19** | **20** | **29** | **32** | **29** | 1 U | 1 U |
| 1,4-Dichlorobenzene | **3** | UG/L | **90** | **65** | **66** | **92** | **110** | **100** | 1 U | 1 U |
| 1,4-Dioxane (P-Dioxane) | **0.35** | UG/L | 50 U | 50 U | 50 U | 50 U | 100 U | 100 U | 50 U | 50 U |
| 2-Hexanone | 50 | UG/L | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U | 5 U | 5 U |
| Acetone | 50 | UG/L | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U | 5 U | 5 U |
| Benzene | **1** | UG/L | **4.4** | **4.9** | **5** | **8.2** | **9.5** | **8.7** | **3.4** | **6.5** |
| Bromochloromethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| Bromodichloromethane | 50 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| Bromoform | 50 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| Bromomethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| Carbon Disulfide | 60 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| Carbon Tetrachloride | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| Chlorobenzene | **5** | UG/L | **360** | **290** | **290** | **420** | **540** | **490** | 1 U | 1 U |
| Chloroethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| Chloroform | 7 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| Chloromethane | 5 | UG/L | 1 U | 1 U | 1 U | 0.63 J | 2 U | 2 U | 1 U | 1 U |
| Cis-1,2-Dichloroethylene | 5 | UG/L | 1 U | 1 U | 1 U | 0.25 J | 2 U | 2 U | 1 U | 1 U |
| Cis-1,3-Dichloropropene | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| Cyclohexane | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| Dibromochloromethane | 50 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| Dichlorodifluoromethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |

**Table 1. Summary of Volatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sample Designation: | | MW-9 | MW-9 | MW-9 | MW-9 | MW-9 | MW-9 | MW-10R | MW-10R |
| | Sample Date: | | 03/19/2024 | 06/17/2024 | 06/17/2024 | 10/03/2024 | 12/31/2024 | 12/31/2024 | 03/19/2024 | 06/18/2024 |
| | Normal or Field Duplicate: | | N | N | FD | N | N | FD | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | |
| Ethylbenzene | **5** | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | **6.3** | 4.9 |
| Isopropylbenzene (Cumene) | **5** | UG/L | 1 U | 1 U | 1 U | 0.35 J | 2 U | 2 U | **6.1** | **5.4** |
| m,p-Xylene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 3.3 | 3.6 |
| Methyl Acetate | -- | UG/L | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U | 5 U | 5 U |
| Methyl Ethyl Ketone (2-Butanone) | 50 | UG/L | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U | 5 U | 5 U |
| Methyl Isobutyl Ketone (4-Methyl-2-Pentanone) | -- | UG/L | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U | 5 U | 5 U |
| Methylcyclohexane | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| Methylene Chloride | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| O-Xylene (1,2-Dimethylbenzene) | **5** | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | **5.4** | 4.1 |
| Styrene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| Tert-Butyl Methyl Ether | 10 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 0.34 J | 0.42 J |
| Tetrachloroethylene (PCE) | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| Toluene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1.1 | 1.2 |
| Trans-1,2-Dichloroethene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| Trans-1,3-Dichloropropene | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| Trichloroethylene (TCE) | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| Trichlorofluoromethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |
| Vinyl Chloride | 2 | UG/L | 1 U | 1 U | 1 U | 1 U | 2 U | 2 U | 1 U | 1 U |

**Table 1. Summary of Volatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | Sample Designation: | | MW-10R | MW-10R | MW-11 | MW-11 | MW-11 | MW-11 | MW-12 | MW-12 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sample Date: | | 10/03/2024 | 01/02/2025 | 03/19/2024 | 06/17/2024 | 10/02/2024 | 01/02/2025 | 03/18/2024 | 06/18/2024 |
| | Normal or Field Duplicate: | | N | N | N | N | N | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | |
| 1,1,1-Trichloroethane (TCA) | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 UT | 1 U | 1 U |
| 1,1,2,2-Tetrachloroethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1,2-Trichloroethane | 1 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1-Dichloroethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1-Dichloroethene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2,3-Trichlorobenzene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2,4-Trichlorobenzene | **5** | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dibromo-3-Chloropropane | 0.04 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dibromoethane (Ethylene Dibromide) | 0.0006 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dichlorobenzene | 3 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dichloroethane | 0.6 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dichloropropane | 1 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,3-Dichlorobenzene | **3** | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,4-Dichlorobenzene | **3** | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,4-Dioxane (P-Dioxane) | **0.35** | UG/L | 50 U | 50 U | 50 U | 50 U | 50 U | 50 U | 50 UT | 50 U |
| 2-Hexanone | 50 | UG/L | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Acetone | 50 | UG/L | 29 | 13 | 5 U | 20 | 8 | 5.6 | 5 U | 5 U |
| Benzene | **1** | UG/L | **6.6** | **8.4** | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Bromochloromethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Bromodichloromethane | 50 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Bromoform | 50 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Bromomethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Carbon Disulfide | 60 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Carbon Tetrachloride | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Chlorobenzene | **5** | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Chloroethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Chloroform | 7 | UG/L | 1 U | 1 UT | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Chloromethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Cis-1,2-Dichloroethylene | 5 | UG/L | 1 U | 1 UT | 1 U | 1 U | 1 U | 1 UT | 1 U | 1 U |
| Cis-1,3-Dichloropropene | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Cyclohexane | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Dibromochloromethane | 50 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Dichlorodifluoromethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 UT |

**Table 1. Summary of Volatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sample Designation: | | MW-10R | MW-10R | MW-11 | MW-11 | MW-11 | MW-11 | MW-12 | MW-12 |
| | Sample Date: | | 10/03/2024 | 01/02/2025 | 03/19/2024 | 06/17/2024 | 10/02/2024 | 01/02/2025 | 03/18/2024 | 06/18/2024 |
| | Normal or Field Duplicate: | | N | N | N | N | N | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | |
| Ethylbenzene | **5** | UG/L | **5.9** | 4.2 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Isopropylbenzene (Cumene) | **5** | UG/L | **7.9** | **6.5** | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| m,p-Xylene | 5 | UG/L | 4.6 | 3.2 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Methyl Acetate | -- | UG/L | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Methyl Ethyl Ketone (2-Butanone) | 50 | UG/L | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Methyl Isobutyl Ketone (4-Methyl-2-Pentanone) | -- | UG/L | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Methylcyclohexane | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Methylene Chloride | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| O-Xylene (1,2-Dimethylbenzene) | **5** | UG/L | 5 | 3.5 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Styrene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Tert-Butyl Methyl Ether | 10 | UG/L | 0.38 J | 0.36 J | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Tetrachloroethylene (PCE) | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Toluene | 5 | UG/L | 1.3 | 1.1 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Trans-1,2-Dichloroethene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Trans-1,3-Dichloropropene | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Trichloroethylene (TCE) | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Trichlorofluoromethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Vinyl Chloride | 2 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |

**Table 1. Summary of Volatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | Sample Designation: | | MW-12 | MW-12 | MW-13 | MW-13 | MW-13 | MW-13 | MW-14 | MW-14 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sample Date: | | 10/04/2024 | 12/31/2024 | 03/20/2024 | 06/18/2024 | 10/02/2024 | 12/31/2024 | 03/19/2024 | 06/18/2024 |
| | Normal or Field Duplicate: | | N | N | N | N | N | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | |
| 1,1,1-Trichloroethane (TCA) | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1,2,2-Tetrachloroethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1,2-Trichloroethane | 1 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1-Dichloroethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1-Dichloroethene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2,3-Trichlorobenzene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2,4-Trichlorobenzene | **5** | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dibromo-3-Chloropropane | 0.04 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dibromoethane (Ethylene Dibromide) | 0.0006 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dichlorobenzene | 3 | UG/L | 1 U | 1 U | 1 U | 0.22 J | 0.31 J | 0.24 J | 1 U | 1 U |
| 1,2-Dichloroethane | 0.6 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dichloropropane | 1 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,3-Dichlorobenzene | **3** | UG/L | 1 U | 1 U | 0.45 J | 0.61 J | 0.46 J | 0.81 J | 1 U | 1 U |
| 1,4-Dichlorobenzene | **3** | UG/L | 1 U | 1 U | 0.77 J | 0.97 J | 0.91 J | 1.3 | 0.33 J | 0.5 J |
| 1,4-Dioxane (P-Dioxane) | **0.35** | UG/L | 50 U | 50 U | 50 UT | 50 U | 50 U | 50 U | 50 U | **43 J** |
| 2-Hexanone | 50 | UG/L | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Acetone | 50 | UG/L | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Benzene | **1** | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Bromochloromethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Bromodichloromethane | 50 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Bromoform | 50 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Bromomethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Carbon Disulfide | 60 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Carbon Tetrachloride | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Chlorobenzene | **5** | UG/L | 1 U | 1 U | **11** | **13** | **10** | **14** | 1.7 | 0.67 J |
| Chloroethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Chloroform | 7 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Chloromethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Cis-1,2-Dichloroethylene | 5 | UG/L | 1 U | 1 U | 0.72 J | 0.61 J | 0.6 J | 0.49 J | 0.86 J | 0.9 J |
| Cis-1,3-Dichloropropene | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Cyclohexane | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Dibromochloromethane | 50 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Dichlorodifluoromethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 UT | 1 U | 1 U | 1 U | 1 UT |

**Table 1. Summary of Volatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sample Designation: | | MW-12 | MW-12 | MW-13 | MW-13 | MW-13 | MW-13 | MW-14 | MW-14 |
| | Sample Date: | | 10/04/2024 | 12/31/2024 | 03/20/2024 | 06/18/2024 | 10/02/2024 | 12/31/2024 | 03/19/2024 | 06/18/2024 |
| | Normal or Field Duplicate: | | N | N | N | N | N | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | |
| Ethylbenzene | **5** | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Isopropylbenzene (Cumene) | **5** | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| m,p-Xylene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Methyl Acetate | -- | UG/L | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Methyl Ethyl Ketone (2-Butanone) | 50 | UG/L | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Methyl Isobutyl Ketone (4-Methyl-2-Pentanone) | -- | UG/L | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Methylcyclohexane | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Methylene Chloride | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| O-Xylene (1,2-Dimethylbenzene) | **5** | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Styrene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Tert-Butyl Methyl Ether | 10 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Tetrachloroethylene (PCE) | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 0.69 J | 1 U |
| Toluene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Trans-1,2-Dichloroethene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Trans-1,3-Dichloropropene | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Trichloroethylene (TCE) | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 0.8 J | 0.57 J |
| Trichlorofluoromethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Vinyl Chloride | 2 | UG/L | 1 U | 1 U | 1 U | 0.2 J | 0.26 J | 0.44 J | 0.57 J | 0.48 J |

**Table 1. Summary of Volatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sample Designation: | | MW-14 | MW-14 | MW-15 | MW-15 | MW-15 | MW-15 | MW-16R | MW-16R |
| | Sample Date: | | 10/04/2024 | 01/02/2025 | 03/20/2024 | 06/17/2024 | 10/03/2024 | 12/31/2024 | 03/18/2024 | 06/19/2024 |
| | Normal or Field Duplicate: | | N | N | N | N | N | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | |
| 1,1,1-Trichloroethane (TCA) | 5 | UG/L | 1 U | 1 UT | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| 1,1,2,2-Tetrachloroethane | 5 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 5 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| 1,1,2-Trichloroethane | 1 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| 1,1-Dichloroethane | 5 | UG/L | 0.27 J | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| 1,1-Dichloroethene | 5 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| 1,2,3-Trichlorobenzene | 5 | UG/L | 1 U | 1 U | 0.42 J | 5 U | 2 U | 2 U | 2 U | 2 U |
| 1,2,4-Trichlorobenzene | **5** | UG/L | 1 U | 1 U | 1.6 | 5 U | 1.4 J | 2.6 | 2 U | 2 U |
| 1,2-Dibromo-3-Chloropropane | 0.04 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| 1,2-Dibromoethane (Ethylene Dibromide) | 0.0006 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| 1,2-Dichlorobenzene | 3 | UG/L | 1 U | 1 U | 1.6 | 1.7 J | 1.3 J | 2.1 | 2 U | 2 U |
| 1,2-Dichloroethane | 0.6 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| 1,2-Dichloropropane | 1 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| 1,3-Dichlorobenzene | **3** | UG/L | 1 U | 0.62 J | **29** | **39** | **25** | **36** | **10** | **7.8** |
| 1,4-Dichlorobenzene | **3** | UG/L | 1 U | 1.5 | **110** | **150** | **97** | **140** | **290** | **220** |
| 1,4-Dioxane (P-Dioxane) | **0.35** | UG/L | 50 U | 50 U | 50 UT | 250 U | 100 U | 100 U | 100 UT | 100 U |
| 2-Hexanone | 50 | UG/L | 5 U | 5 U | 5 U | 25 U | 10 U | 10 U | 10 U | 10 U |
| Acetone | 50 | UG/L | 5 U | 5 U | 5 U | 25 U | 10 U | 10 U | 10 U | 10 U |
| Benzene | **1** | UG/L | 1 U | 1 U | **4.9** | **7.9** | **5.6** | **17** | **11** | **12** |
| Bromochloromethane | 5 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| Bromodichloromethane | 50 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| Bromoform | 50 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| Bromomethane | 5 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| Carbon Disulfide | 60 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| Carbon Tetrachloride | 5 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| Chlorobenzene | **5** | UG/L | 1 | **5.5** | **390** | **900** | **410** | **810** | **760** | **730** |
| Chloroethane | 5 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| Chloroform | 7 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| Chloromethane | 5 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| Cis-1,2-Dichloroethylene | 5 | UG/L | 1.6 | 0.66 JT | 0.74 J | 5 U | 0.71 J | 0.72 J | 2 U | 2 U |
| Cis-1,3-Dichloropropene | -- | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| Cyclohexane | -- | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| Dibromochloromethane | 50 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| Dichlorodifluoromethane | 5 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |

**Table 1. Summary of Volatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sample Designation: | | MW-14 | MW-14 | MW-15 | MW-15 | MW-15 | MW-15 | MW-16R | MW-16R |
| | Sample Date: | | 10/04/2024 | 01/02/2025 | 03/20/2024 | 06/17/2024 | 10/03/2024 | 12/31/2024 | 03/18/2024 | 06/19/2024 |
| | Normal or Field Duplicate: | | N | N | N | N | N | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | |
| Ethylbenzene | **5** | UG/L | 1 U | 1 U | 0.7 J | 5 U | 2 U | 0.8 J | 2 U | 2 U |
| Isopropylbenzene (Cumene) | **5** | UG/L | 1 U | 1 U | 0.37 J | 5 U | 2 U | 2 U | 2 U | 2 U |
| m,p-Xylene | 5 | UG/L | 1 U | 1 U | 0.59 J | 5 U | 2 U | 2 U | 2 U | 2 U |
| Methyl Acetate | -- | UG/L | 5 U | 5 U | 5 U | 25 U | 10 U | 10 U | 10 U | 10 U |
| Methyl Ethyl Ketone (2-Butanone) | 50 | UG/L | 5 U | 5 U | 5 U | 25 U | 10 U | 10 U | 10 U | 10 U |
| Methyl Isobutyl Ketone (4-Methyl-2-Pentanone) | -- | UG/L | 5 U | 5 U | 5 U | 25 U | 10 U | 10 U | 10 U | 10 U |
| Methylcyclohexane | -- | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| Methylene Chloride | 5 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| O-Xylene (1,2-Dimethylbenzene) | **5** | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| Styrene | 5 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| Tert-Butyl Methyl Ether | 10 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| Tetrachloroethylene (PCE) | 5 | UG/L | 1 U | 1 U | 1.7 | 5 U | 2 U | 2 U | 2 U | 2 U |
| Toluene | 5 | UG/L | 1 U | 1 U | 0.54 J | 5 U | 2 U | 2 U | 2 U | 2 U |
| Trans-1,2-Dichloroethene | 5 | UG/L | 1 U | 1 U | 0.28 J | 5 U | 2 U | 2 U | 2 U | 2 U |
| Trans-1,3-Dichloropropene | -- | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| Trichloroethylene (TCE) | 5 | UG/L | 0.92 J | 0.42 J | 1.9 | 5 U | 1.3 J | 1.1 J | 2 U | 2 U |
| Trichlorofluoromethane | 5 | UG/L | 1 U | 1 U | 1 U | 5 U | 2 U | 2 U | 2 U | 2 U |
| Vinyl Chloride | 2 | UG/L | 0.73 J | 1 U | 0.36 J | 5 U | 2 U | 0.59 J | 2 U | 2 U |

**Table 1. Summary of Volatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | Sample Designation: | MW-16R | MW-16R | MW-17R | MW-17R | MW-17R | MW-17R | MW-17R | MW-18R |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 10/03/2024 | 01/03/2025 | 03/18/2024 | 03/18/2024 | 06/19/2024 | 10/03/2024 | 01/03/2025 | 03/20/2024 |
| | | | Normal or Field Duplicate: | N | N | N | FD | N | N | N | N |
| 1,1,1-Trichloroethane (TCA) | 5 | UG/L | | 2 U | 2 UT | 1 U | 1 U | 1 U | 1 U | 1 UT | 1 U |
| 1,1,2,2-Tetrachloroethane | 5 | UG/L | | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 5 | UG/L | | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1,2-Trichloroethane | 1 | UG/L | | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1-Dichloroethane | 5 | UG/L | | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1-Dichloroethene | 5 | UG/L | | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2,3-Trichlorobenzene | 5 | UG/L | | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2,4-Trichlorobenzene | **5** | UG/L | | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dibromo-3-Chloropropane | 0.04 | UG/L | | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dibromoethane (Ethylene Dibromide) | 0.0006 | UG/L | | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dichlorobenzene | 3 | UG/L | | 2 U | 2 U | 0.29 J | 0.3 J | 0.38 J | 0.35 J | 0.33 J | 1 U |
| 1,2-Dichloroethane | 0.6 | UG/L | | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dichloropropane | 1 | UG/L | | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,3-Dichlorobenzene | **3** | UG/L | | **7.3** | **7.3** | **5.2** | **5** | **7.4** | **5** | **7.2** | 1 U |
| 1,4-Dichlorobenzene | **3** | UG/L | | **140** | **130** | **12** | **12** | **18** | **10** | **15** | 1 U |
| 1,4-Dioxane (P-Dioxane) | **0.35** | UG/L | | 100 U | 100 U | 50 UT | 50 UT | 50 U | 50 U | 50 U | 50 UT |
| 2-Hexanone | 50 | UG/L | | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Acetone | 50 | UG/L | | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Benzene | **1** | UG/L | | **12** | **15** | **1.4** | **1.6** | **4.4** | **2** | **4.5** | 0.4 J |
| Bromochloromethane | 5 | UG/L | | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Bromodichloromethane | 50 | UG/L | | 2 U | 2 U | 0.38 J | 0.38 J | 1 U | 1 U | 1 U | 1 U |
| Bromoform | 50 | UG/L | | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Bromomethane | 5 | UG/L | | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Carbon Disulfide | 60 | UG/L | | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Carbon Tetrachloride | 5 | UG/L | | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Chlorobenzene | **5** | UG/L | | **620** | **980** | **41** | **43** | **180** | **55** | **160** | 1 U |
| Chloroethane | 5 | UG/L | | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Chloroform | 7 | UG/L | | 2 U | 2 U | 5.3 | 5.3 | 1 U | 0.81 J | 1 U | 1 U |
| Chloromethane | 5 | UG/L | | 2 U | 2 U | 1 U | 1 U | 1 U | 0.48 J | 1 U | 1 U |
| Cis-1,2-Dichloroethylene | 5 | UG/L | | 2 U | 2 UT | 0.26 J | 0.31 J | 0.41 J | 0.39 J | 0.38 JT | 0.23 J |
| Cis-1,3-Dichloropropene | -- | UG/L | | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Cyclohexane | -- | UG/L | | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Dibromochloromethane | 50 | UG/L | | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Dichlorodifluoromethane | 5 | UG/L | | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |

**Table 1. Summary of Volatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | Sample Designation: | | MW-16R | MW-16R | MW-17R | MW-17R | MW-17R | MW-17R | MW-17R | MW-18R |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sample Date: | | 10/03/2024 | 01/03/2025 | 03/18/2024 | 03/18/2024 | 06/19/2024 | 10/03/2024 | 01/03/2025 | 03/20/2024 |
| | Normal or Field Duplicate: | | N | N | N | FD | N | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | |
| Ethylbenzene | **5** | UG/L | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Isopropylbenzene (Cumene) | **5** | UG/L | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| m,p-Xylene | 5 | UG/L | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Methyl Acetate | -- | UG/L | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Methyl Ethyl Ketone (2-Butanone) | 50 | UG/L | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Methyl Isobutyl Ketone (4-Methyl-2-Pentanone) | -- | UG/L | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Methylcyclohexane | -- | UG/L | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Methylene Chloride | 5 | UG/L | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| O-Xylene (1,2-Dimethylbenzene) | **5** | UG/L | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Styrene | 5 | UG/L | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Tert-Butyl Methyl Ether | 10 | UG/L | 2 U | 2 U | 0.6 J | 0.8 J | 1.1 | 0.68 J | 0.81 J | 0.35 J |
| Tetrachloroethylene (PCE) | 5 | UG/L | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Toluene | 5 | UG/L | 2 U | 2 U | 1 U | 0.41 J | 0.52 J | 1 U | 0.38 J | 1 U |
| Trans-1,2-Dichloroethene | 5 | UG/L | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Trans-1,3-Dichloropropene | -- | UG/L | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Trichloroethylene (TCE) | 5 | UG/L | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Trichlorofluoromethane | 5 | UG/L | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Vinyl Chloride | 2 | UG/L | 2 U | 2 U | 1 U | 1 U | 1 U | 0.2 J | 1 U | 1 U |

**Table 1. Summary of Volatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | Sample Designation: | | MW-18R | MW-18R | MW-18R | MW-18R |
|---|---|---|---|---|---|---|
| | Sample Date: | | 06/19/2024 | 10/02/2024 | 10/02/2024 | 01/02/2025 |
| | Normal or Field Duplicate: | | N | N | FD | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | |
| 1,1,1-Trichloroethane (TCA) | 5 | UG/L | 1 U | 1 U | 1 U | 1 UT |
| 1,1,2,2-Tetrachloroethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U |
| 1,1,2-Trichloroethane | 1 | UG/L | 1 U | 1 U | 1 U | 1 U |
| 1,1-Dichloroethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U |
| 1,1-Dichloroethene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U |
| 1,2,3-Trichlorobenzene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U |
| 1,2,4-Trichlorobenzene | **5** | UG/L | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dibromo-3-Chloropropane | 0.04 | UG/L | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dibromoethane (Ethylene Dibromide) | 0.0006 | UG/L | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dichlorobenzene | 3 | UG/L | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dichloroethane | 0.6 | UG/L | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dichloropropane | 1 | UG/L | 1 U | 1 U | 1 U | 1 U |
| 1,3-Dichlorobenzene | **3** | UG/L | 1 U | 1 U | 1 U | 1 U |
| 1,4-Dichlorobenzene | **3** | UG/L | 1 U | 1 U | 1 U | 1 U |
| 1,4-Dioxane (P-Dioxane) | **0.35** | UG/L | 50 U | 50 U | 50 U | 50 U |
| 2-Hexanone | 50 | UG/L | 5 U | 5 U | 5 U | 5 U |
| Acetone | 50 | UG/L | 5 U | 5 U | 5 U | 7.5 |
| Benzene | **1** | UG/L | 0.42 J | 1 U | 1 U | 0.38 J |
| Bromochloromethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U |
| Bromodichloromethane | 50 | UG/L | 1 U | 1 U | 1 U | 1 U |
| Bromoform | 50 | UG/L | 1 U | 1 U | 1 U | 1 U |
| Bromomethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U |
| Carbon Disulfide | 60 | UG/L | 1 U | 1 U | 1 U | 1 U |
| Carbon Tetrachloride | 5 | UG/L | 1 U | 1 U | 1 U | 1 U |
| Chlorobenzene | **5** | UG/L | 1 U | 1 U | 1 U | 1 U |
| Chloroethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U |
| Chloroform | 7 | UG/L | 1 U | 1 U | 1 U | 1 U |
| Chloromethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U |
| Cis-1,2-Dichloroethylene | 5 | UG/L | 1 U | 1 U | 1 U | 1 UT |
| Cis-1,3-Dichloropropene | -- | UG/L | 1 U | 1 U | 1 U | 1 U |
| Cyclohexane | -- | UG/L | 1 U | 1 U | 1 U | 1 U |
| Dibromochloromethane | 50 | UG/L | 1 U | 1 U | 1 U | 1 U |
| Dichlorodifluoromethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U |

**Table 1. Summary of Volatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | Sample Designation: | | MW-18R | MW-18R | MW-18R | MW-18R |
|---|---|---|---|---|---|---|
| | Sample Date: | | 06/19/2024 | 10/02/2024 | 10/02/2024 | 01/02/2025 |
| | Normal or Field Duplicate: | | N | N | FD | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | |
| Ethylbenzene | **5** | UG/L | 1 U | 1 U | 1 U | 1 U |
| Isopropylbenzene (Cumene) | **5** | UG/L | 1 U | 1 U | 1 U | 1 U |
| m,p-Xylene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U |
| Methyl Acetate | -- | UG/L | 5 U | 5 U | 5 U | 5 U |
| Methyl Ethyl Ketone (2-Butanone) | 50 | UG/L | 5 U | 5 U | 5 U | 5 U |
| Methyl Isobutyl Ketone (4-Methyl-2-Pentanone) | -- | UG/L | 5 U | 5 U | 5 U | 5 U |
| Methylcyclohexane | -- | UG/L | 1 U | 1 U | 1 U | 1 U |
| Methylene Chloride | 5 | UG/L | 1 U | 1 U | 1 U | 1 U |
| O-Xylene (1,2-Dimethylbenzene) | **5** | UG/L | 1 U | 1 U | 1 U | 1 U |
| Styrene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U |
| Tert-Butyl Methyl Ether | 10 | UG/L | 0.38 J | 1 U | 1 U | 0.4 J |
| Tetrachloroethylene (PCE) | 5 | UG/L | 1 U | 1 U | 1 U | 1 U |
| Toluene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U |
| Trans-1,2-Dichloroethene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U |
| Trans-1,3-Dichloropropene | -- | UG/L | 1 U | 1 U | 1 U | 1 U |
| Trichloroethylene (TCE) | 5 | UG/L | 1 U | 1 U | 1 U | 1 U |
| Trichlorofluoromethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U |
| Vinyl Chloride | 2 | UG/L | 1 U | 1 U | 1 U | 1 U |

**Table 2. Summary of Semivolatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | Sample Designation: | | MW-9 | MW-9 | MW-9 | MW-9 | MW-9 | MW-9 | MW-10R | MW-10R |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sample Date: | | 03/19/2024 | 06/17/2024 | 06/17/2024 | 10/03/2024 | 12/31/2024 | 12/31/2024 | 03/19/2024 | 06/18/2024 |
| | Normal or Field Duplicate: | | N | N | FD | N | N | FD | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | |
| 1,2,4,5-Tetrachlorobenzene | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,3,4,6-Tetrachlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4,5-Trichlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4,6-Trichlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dichlorophenol | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dimethylphenol | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dinitrophenol | 10 | UG/L | 40 U | 40 U | 40 U | 40 U | 40 U | 40 U | 40 U | 40 U |
| 2,4-Dinitrotoluene | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,6-Dinitrotoluene | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| 2-Chloronaphthalene | 10 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Chlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Methylnaphthalene | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 47 | 10 U |
| 2-Methylphenol (O-Cresol) | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Nitroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Nitrophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 3,3'-Dichlorobenzidine | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 3-Nitroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4,6-Dinitro-2-Methylphenol | -- | UG/L | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U |
| 4-Bromophenyl Phenyl Ether | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chloro-3-Methylphenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chloroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chlorophenyl Phenyl Ether | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Methylphenol (P-Cresol) | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Nitroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Nitrophenol | -- | UG/L | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U |
| Acenaphthene | **20** | UG/L | 3.3 J | 5.1 J | 6.2 J | 6.5 J | 5.8 J | 5.8 J | **310** | **23** |
| Acenaphthylene | 20 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 0.93 J |
| Acetophenone | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Anthracene | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 11 | 10 U |
| Atrazine | 7.5 | UG/L | 2 UT | 2 U | 2 U | 2 U | 2 U | 2 U | 2 UT | 2 UT |
| Benzaldehyde | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 UT |
| Benzo(A)Anthracene | **0.002** | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | **1.3** | **0.75 J** |
| Benzo(A)Pyrene | **0** | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | **0.87 J** | **0.63 J** |
| Benzo(B)Fluoranthene | **0.002** | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | **0.82 J** | 2 U |

**Table 2. Summary of Semivolatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | Sample Designation: | | MW-9 | MW-9 | MW-9 | MW-9 | MW-9 | MW-9 | MW-10R | MW-10R |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sample Date: | | 03/19/2024 | 06/17/2024 | 06/17/2024 | 10/03/2024 | 12/31/2024 | 12/31/2024 | 03/19/2024 | 06/18/2024 |
| | Normal or Field Duplicate: | | N | N | FD | N | N | FD | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | |
| Benzo(G,H,I)Perylene | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Benzo(K)Fluoranthene | 0.002 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Benzyl Butyl Phthalate | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Biphenyl (Diphenyl) | **5** | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | **18** | 10 U |
| Bis(2-Chloroethoxy) Methane | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | 1 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Bis(2-Chloroisopropyl) Ether | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Ethylhexyl) Phthalate | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Caprolactam | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Carbazole | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 2.8 J | 10 U |
| Chrysene | **0.002** | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | **1 J** | 2 U |
| Dibenz(A,H)Anthracene | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Dibenzofuran | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 2.1 J | 10 U |
| Diethyl Phthalate | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Dimethyl Phthalate | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Di-N-Butyl Phthalate | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Di-N-Octylphthalate | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Fluoranthene | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 16 | 2.8 J |
| Fluorene | **50** | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | **140** | 4.9 J |
| Hexachlorobenzene | 0.04 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Hexachlorobutadiene | 0.5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Hexachlorocyclopentadiene | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Hexachloroethane | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Indeno(1,2,3-C,D)Pyrene | **0.002** | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Isophorone | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Naphthalene | **10** | UG/L | 1.5 J | 2 U | 2 U | 2 U | 0.96 J | 1 J | **680** | 2 U |
| Nitrobenzene | 0.4 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| N-Nitrosodi-N-Propylamine | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| N-Nitrosodiphenylamine | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Pentachlorophenol | 1 | UG/L | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U |
| Phenanthrene | **50** | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | **140** | 2 J |
| Phenol | 1 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Pyrene | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 22 | 7.1 J |

**Table 2. Summary of Semivolatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sample Designation: | | MW-10R | MW-10R | MW-11 | MW-11 | MW-11 | MW-11 | MW-12 | MW-12 |
| | Sample Date: | | 10/03/2024 | 01/02/2025 | 03/19/2024 | 06/17/2024 | 10/02/2024 | 01/02/2025 | 03/18/2024 | 06/18/2024 |
| | Normal or Field Duplicate: | | N | N | N | N | N | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | |
| 1,2,4,5-Tetrachlorobenzene | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,3,4,6-Tetrachlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4,5-Trichlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4,6-Trichlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dichlorophenol | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dimethylphenol | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dinitrophenol | 10 | UG/L | 40 U | 40 UT | 40 U | 40 U | 40 U | 40 UT | 40 U | 40 U |
| 2,4-Dinitrotoluene | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,6-Dinitrotoluene | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| 2-Chloronaphthalene | 10 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Chlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Methylnaphthalene | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Methylphenol (O-Cresol) | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Nitroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Nitrophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 3,3'-Dichlorobenzidine | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 3-Nitroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4,6-Dinitro-2-Methylphenol | -- | UG/L | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U |
| 4-Bromophenyl Phenyl Ether | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chloro-3-Methylphenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chloroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chlorophenyl Phenyl Ether | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Methylphenol (P-Cresol) | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Nitroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Nitrophenol | -- | UG/L | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U |
| Acenaphthene | **20** | UG/L | **210** | **130** | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Acenaphthylene | 20 | UG/L | 10 U | 3.3 J | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Acetophenone | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Anthracene | 50 | UG/L | 7.6 J | 1.5 J | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Atrazine | 7.5 | UG/L | 2 U | 2 UT | 2 UT | 2 U | 2 U | 2 UT | 2 U | 2 UT |
| Benzaldehyde | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 UT |
| Benzo(A)Anthracene | **0.002** | UG/L | **1.7** | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Benzo(A)Pyrene | **0** | UG/L | **2** | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Benzo(B)Fluoranthene | **0.002** | UG/L | **1.5 J** | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |

**Table 2. Summary of Semivolatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | Sample Designation: | | MW-10R | MW-10R | MW-11 | MW-11 | MW-11 | MW-11 | MW-12 | MW-12 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sample Date: | | 10/03/2024 | 01/02/2025 | 03/19/2024 | 06/17/2024 | 10/02/2024 | 01/02/2025 | 03/18/2024 | 06/18/2024 |
| | Normal or Field Duplicate: | | N | N | N | N | N | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | |
| Benzo(G,H,I)Perylene | -- | UG/L | 1.5 J | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Benzo(K)Fluoranthene | 0.002 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Benzyl Butyl Phthalate | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Biphenyl (Diphenyl) | **5** | UG/L | **10** | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Chloroethoxy) Methane | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | 1 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Bis(2-Chloroisopropyl) Ether | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Ethylhexyl) Phthalate | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Caprolactam | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Carbazole | -- | UG/L | 2.2 J | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chrysene | **0.002** | UG/L | **1.6 J** | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Dibenz(A,H)Anthracene | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Dibenzofuran | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Diethyl Phthalate | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Dimethyl Phthalate | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Di-N-Butyl Phthalate | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Di-N-Octylphthalate | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Fluoranthene | 50 | UG/L | 11 | 4.5 J | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Fluorene | **50** | UG/L | **77** | 18 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Hexachlorobenzene | 0.04 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Hexachlorobutadiene | 0.5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Hexachlorocyclopentadiene | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Hexachloroethane | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Indeno(1,2,3-C,D)Pyrene | **0.002** | UG/L | **1 J** | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Isophorone | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Naphthalene | **10** | UG/L | 0.57 J | 2 U | 2 U | 2 U | 1 J | 2 U | 2 U | 2 U |
| Nitrobenzene | 0.4 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| N-Nitrosodi-N-Propylamine | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| N-Nitrosodiphenylamine | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Pentachlorophenol | 1 | UG/L | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U |
| Phenanthrene | **50** | UG/L | **58** | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Phenol | 1 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Pyrene | 50 | UG/L | 17 | 7.5 J | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |

**Table 2. Summary of Semivolatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sample Designation: | | MW-12 | MW-12 | MW-13 | MW-13 | MW-13 | MW-13 | MW-14 | MW-14 |
| | Sample Date: | | 10/04/2024 | 12/31/2024 | 03/20/2024 | 06/18/2024 | 10/02/2024 | 12/31/2024 | 03/19/2024 | 06/18/2024 |
| | Normal or Field Duplicate: | | N | N | N | N | N | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | |
| 1,2,4,5-Tetrachlorobenzene | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,3,4,6-Tetrachlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4,5-Trichlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4,6-Trichlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dichlorophenol | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dimethylphenol | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dinitrophenol | 10 | UG/L | 40 U | 40 U | 40 U | 40 U | 40 U | 40 U | 40 U | 40 U |
| 2,4-Dinitrotoluene | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,6-Dinitrotoluene | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| 2-Chloronaphthalene | 10 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Chlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Methylnaphthalene | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Methylphenol (O-Cresol) | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Nitroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Nitrophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 3,3'-Dichlorobenzidine | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 3-Nitroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4,6-Dinitro-2-Methylphenol | -- | UG/L | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U |
| 4-Bromophenyl Phenyl Ether | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chloro-3-Methylphenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chloroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chlorophenyl Phenyl Ether | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Methylphenol (P-Cresol) | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Nitroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Nitrophenol | -- | UG/L | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U |
| Acenaphthene | **20** | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Acenaphthylene | 20 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Acetophenone | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Anthracene | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Atrazine | 7.5 | UG/L | 2 UT | 2 U | 2 U | 2 UT | 2 U | 2 U | 2 UT | 2 UT |
| Benzaldehyde | -- | UG/L | 10 U | 10 U | 10 U | 10 UT | 10 U | 10 U | 10 U | 10 UT |
| Benzo(A)Anthracene | **0.002** | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Benzo(A)Pyrene | **0** | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Benzo(B)Fluoranthene | **0.002** | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |

**Table 2. Summary of Semivolatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | Sample Designation: | | MW-12 | MW-12 | MW-13 | MW-13 | MW-13 | MW-13 | MW-14 | MW-14 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sample Date: | | 10/04/2024 | 12/31/2024 | 03/20/2024 | 06/18/2024 | 10/02/2024 | 12/31/2024 | 03/19/2024 | 06/18/2024 |
| | Normal or Field Duplicate: | | N | N | N | N | N | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | |
| Benzo(G,H,I)Perylene | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Benzo(K)Fluoranthene | 0.002 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Benzyl Butyl Phthalate | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Biphenyl (Diphenyl) | **5** | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Chloroethoxy) Methane | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | 1 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Bis(2-Chloroisopropyl) Ether | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Ethylhexyl) Phthalate | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Caprolactam | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Carbazole | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chrysene | **0.002** | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Dibenz(A,H)Anthracene | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Dibenzofuran | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Diethyl Phthalate | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Dimethyl Phthalate | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Di-N-Butyl Phthalate | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Di-N-Octylphthalate | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Fluoranthene | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Fluorene | **50** | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Hexachlorobenzene | 0.04 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Hexachlorobutadiene | 0.5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Hexachlorocyclopentadiene | 5 | UG/L | 10 UT | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Hexachloroethane | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Indeno(1,2,3-C,D)Pyrene | **0.002** | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Isophorone | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Naphthalene | **10** | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Nitrobenzene | 0.4 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| N-Nitrosodi-N-Propylamine | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| N-Nitrosodiphenylamine | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Pentachlorophenol | 1 | UG/L | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U |
| Phenanthrene | **50** | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Phenol | 1 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Pyrene | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |

**Table 2. Summary of Semivolatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | Sample Designation: | | MW-14 | MW-14 | MW-15 | MW-15 | MW-15 | MW-15 | MW-16R | MW-16R |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sample Date: | | 10/04/2024 | 01/02/2025 | 03/20/2024 | 06/17/2024 | 10/03/2024 | 12/31/2024 | 03/18/2024 | 06/19/2024 |
| | Normal or Field Duplicate: | | N | N | N | N | N | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | |
| 1,2,4,5-Tetrachlorobenzene | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,3,4,6-Tetrachlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4,5-Trichlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4,6-Trichlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dichlorophenol | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 1.2 J | 10 U |
| 2,4-Dimethylphenol | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dinitrophenol | 10 | UG/L | 40 U | 40 U | 40 U | 40 U | 40 U | 40 U | 40 U | 40 U |
| 2,4-Dinitrotoluene | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,6-Dinitrotoluene | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| 2-Chloronaphthalene | 10 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Chlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 0.9 J | 10 U | 10 U | 9.4 J | 2 J |
| 2-Methylnaphthalene | -- | UG/L | 10 U | 10 U | 3.3 J | 4.3 J | 2.3 J | 3.2 J | 10 U | 10 U |
| 2-Methylphenol (O-Cresol) | -- | UG/L | 10 U | 10 U | 0.78 J | 10 U | 10 U | 0.87 J | 10 U | 10 U |
| 2-Nitroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Nitrophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 3,3'-Dichlorobenzidine | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 3-Nitroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4,6-Dinitro-2-Methylphenol | -- | UG/L | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U |
| 4-Bromophenyl Phenyl Ether | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chloro-3-Methylphenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chloroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chlorophenyl Phenyl Ether | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Methylphenol (P-Cresol) | -- | UG/L | 10 U | 10 U | 2 J | 0.7 J | 10 U | 2.1 J | 10 U | 10 U |
| 4-Nitroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Nitrophenol | -- | UG/L | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U |
| Acenaphthene | **20** | UG/L | 10 U | 10 U | 5.1 J | 9.2 J | 4.8 J | 5.6 J | 10 U | 10 U |
| Acenaphthylene | 20 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Acetophenone | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Anthracene | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Atrazine | 7.5 | UG/L | 2 UT | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Benzaldehyde | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Benzo(A)Anthracene | **0.002** | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Benzo(A)Pyrene | **0** | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Benzo(B)Fluoranthene | **0.002** | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |

**Table 2. Summary of Semivolatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | Sample Designation: | MW-14 | MW-15 | MW-15 | MW-15 | MW-15 | MW-16R | MW-16R |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 10/04/2024 | 01/02/2025 | 03/20/2024 | 06/17/2024 | 10/03/2024 | 12/31/2024 | 03/18/2024 | 06/19/2024 |
| | | | Normal or Field Duplicate: | N | N | N | N | N | N | N | N |
| Benzo(G,H,I)Perylene | -- | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Benzo(K)Fluoranthene | 0.002 | UG/L | | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Benzyl Butyl Phthalate | 50 | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Biphenyl (Diphenyl) | **5** | UG/L | | 10 U | 10 U | 10 U | 1.3 J | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Chloroethoxy) Methane | 5 | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | 1 | UG/L | | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Bis(2-Chloroisopropyl) Ether | 5 | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Ethylhexyl) Phthalate | 5 | UG/L | | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Caprolactam | -- | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Carbazole | -- | UG/L | | 10 U | 10 U | 1.8 J | 2.1 J | 1 J | 1 J | 10 U | 10 U |
| Chrysene | **0.002** | UG/L | | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Dibenz(A,H)Anthracene | -- | UG/L | | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Dibenzofuran | -- | UG/L | | 10 U | 10 U | 1.8 J | 2.4 J | 1.2 J | 1.7 J | 10 U | 10 U |
| Diethyl Phthalate | 50 | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Dimethyl Phthalate | 50 | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 UT |
| Di-N-Butyl Phthalate | 50 | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Di-N-Octylphthalate | -- | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Fluoranthene | 50 | UG/L | | 10 U | 10 U | 0.88 J | 1.3 J | 10 U | 10 U | 10 U | 10 U |
| Fluorene | **50** | UG/L | | 10 U | 10 U | 2.5 J | 3.6 J | 1.8 J | 2.4 J | 10 U | 10 U |
| Hexachlorobenzene | 0.04 | UG/L | | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Hexachlorobutadiene | 0.5 | UG/L | | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Hexachlorocyclopentadiene | 5 | UG/L | | 10 UT | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Hexachloroethane | 5 | UG/L | | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Indeno(1,2,3-C,D)Pyrene | **0.002** | UG/L | | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Isophorone | 50 | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Naphthalene | **10** | UG/L | | 2 U | 2 U | **26** | **33** | **14** | **26** | 8 | 2 U |
| Nitrobenzene | 0.4 | UG/L | | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| N-Nitrosodi-N-Propylamine | -- | UG/L | | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| N-Nitrosodiphenylamine | 50 | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Pentachlorophenol | 1 | UG/L | | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U |
| Phenanthrene | **50** | UG/L | | 10 U | 10 U | 4.7 J | 7.3 J | 4.2 J | 4.2 J | 10 U | 10 U |
| Phenol | 1 | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Pyrene | 50 | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |

**Table 2. Summary of Semivolatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | Sample Designation: | | MW-16R | MW-16R | MW-17R | MW-17R | MW-17R | MW-17R | MW-17R | MW-18R |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sample Date: | | 10/03/2024 | 01/03/2025 | 03/18/2024 | 03/18/2024 | 06/19/2024 | 10/03/2024 | 01/03/2025 | 03/20/2024 |
| | Normal or Field Duplicate: | | N | N | N | FD | N | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | |
| 1,2,4,5-Tetrachlorobenzene | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,3,4,6-Tetrachlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4,5-Trichlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4,6-Trichlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dichlorophenol | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dimethylphenol | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 UT |
| 2,4-Dinitrophenol | 10 | UG/L | 40 U | 40 U | 40 U | 40 U | 40 U | 40 U | 40 U | 40 U |
| 2,4-Dinitrotoluene | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,6-Dinitrotoluene | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| 2-Chloronaphthalene | 10 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Chlorophenol | -- | UG/L | 2 J | 2.2 J | 10 U | 10 U | 0.61 J | 10 U | 10 U | 10 U |
| 2-Methylnaphthalene | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Methylphenol (O-Cresol) | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Nitroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Nitrophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 3,3'-Dichlorobenzidine | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 3-Nitroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4,6-Dinitro-2-Methylphenol | -- | UG/L | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U |
| 4-Bromophenyl Phenyl Ether | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chloro-3-Methylphenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chloroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chlorophenyl Phenyl Ether | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Methylphenol (P-Cresol) | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Nitroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Nitrophenol | -- | UG/L | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U |
| Acenaphthene | **20** | UG/L | 1.1 J | 10 U | 10 U | 10 U | 1.5 J | 1.4 J | 10 U | 10 U |
| Acenaphthylene | 20 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Acetophenone | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Anthracene | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Atrazine | 7.5 | UG/L | 2 U | 2 UT | 2 U | 2 U | 2 U | 2 U | 2 UT | 2 U |
| Benzaldehyde | -- | UG/L | 10 U | 10 UT | 10 U | 10 U | 10 U | 10 U | 10 UT | 10 U |
| Benzo(A)Anthracene | **0.002** | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Benzo(A)Pyrene | **0** | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Benzo(B)Fluoranthene | **0.002** | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |

**Table 2. Summary of Semivolatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | Sample Designation: | MW-16R | MW-16R | MW-17R | MW-17R | MW-17R | MW-17R | MW-17R | MW-18R |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 10/03/2024 | 01/03/2025 | 03/18/2024 | 03/18/2024 | 06/19/2024 | 10/03/2024 | 01/03/2025 | 03/20/2024 |
| | | | Normal or Field Duplicate: | N | N | N | FD | N | N | N | N |
| Benzo(G,H,I)Perylene | -- | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Benzo(K)Fluoranthene | 0.002 | UG/L | | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Benzyl Butyl Phthalate | 50 | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Biphenyl (Diphenyl) | **5** | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Chloroethoxy) Methane | 5 | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | 1 | UG/L | | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Bis(2-Chloroisopropyl) Ether | 5 | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Ethylhexyl) Phthalate | 5 | UG/L | | 2 U | 2 U | 2 U | 2 U | 2.6 | 2 U | 2 U | 2 U |
| Caprolactam | -- | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Carbazole | -- | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chrysene | **0.002** | UG/L | | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Dibenz(A,H)Anthracene | -- | UG/L | | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Dibenzofuran | -- | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Diethyl Phthalate | 50 | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Dimethyl Phthalate | 50 | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 UT | 10 U | 10 U | 10 U |
| Di-N-Butyl Phthalate | 50 | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Di-N-Octylphthalate | -- | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Fluoranthene | 50 | UG/L | | 10 U | 10 U | 10 U | 10 U | 1 J | 10 U | 10 U | 10 U |
| Fluorene | **50** | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Hexachlorobenzene | 0.04 | UG/L | | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Hexachlorobutadiene | 0.5 | UG/L | | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Hexachlorocyclopentadiene | 5 | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Hexachloroethane | 5 | UG/L | | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Indeno(1,2,3-C,D)Pyrene | **0.002** | UG/L | | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Isophorone | 50 | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Naphthalene | **10** | UG/L | | 1.5 J | 0.98 J | 2 U | 2 U | 2 U | 0.61 J | 2 U | 2 U |
| Nitrobenzene | 0.4 | UG/L | | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| N-Nitrosodi-N-Propylamine | -- | UG/L | | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| N-Nitrosodiphenylamine | 50 | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Pentachlorophenol | 1 | UG/L | | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U |
| Phenanthrene | **50** | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Phenol | 1 | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Pyrene | 50 | UG/L | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |

**Table 2. Summary of Semivolatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | Sample Designation: | | MW-18R | MW-18R | MW-18R | MW-18R |
|---|---|---|---|---|---|---|
| | Sample Date: | | 06/19/2024 | 10/02/2024 | 10/02/2024 | 01/02/2025 |
| | Normal or Field Duplicate: | | N | N | FD | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | |
| 1,2,4,5-Tetrachlorobenzene | 5 | UG/L | 10 U | 10 U | 10 U | 10 U |
| 2,3,4,6-Tetrachlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U |
| 2,4,5-Trichlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U |
| 2,4,6-Trichlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dichlorophenol | 5 | UG/L | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dimethylphenol | 50 | UG/L | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dinitrophenol | 10 | UG/L | 40 U | 40 U | 40 U | 40 U |
| 2,4-Dinitrotoluene | 5 | UG/L | 10 U | 10 U | 10 U | 10 U |
| 2,6-Dinitrotoluene | 5 | UG/L | 2 U | 2 U | 2 U | 2 U |
| 2-Chloronaphthalene | 10 | UG/L | 10 U | 10 U | 10 U | 10 U |
| 2-Chlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U |
| 2-Methylnaphthalene | -- | UG/L | 10 U | 10 U | 10 U | 10 U |
| 2-Methylphenol (O-Cresol) | -- | UG/L | 10 U | 10 U | 10 U | 10 U |
| 2-Nitroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U |
| 2-Nitrophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U |
| 3,3'-Dichlorobenzidine | 5 | UG/L | 10 U | 10 U | 10 U | 10 U |
| 3-Nitroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U |
| 4,6-Dinitro-2-Methylphenol | -- | UG/L | 20 U | 20 U | 20 U | 20 U |
| 4-Bromophenyl Phenyl Ether | -- | UG/L | 10 U | 10 U | 10 U | 10 U |
| 4-Chloro-3-Methylphenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U |
| 4-Chloroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U |
| 4-Chlorophenyl Phenyl Ether | -- | UG/L | 10 U | 10 U | 10 U | 10 U |
| 4-Methylphenol (P-Cresol) | -- | UG/L | 10 U | 10 U | 10 U | 10 U |
| 4-Nitroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U |
| 4-Nitrophenol | -- | UG/L | 20 U | 20 U | 20 U | 20 U |
| Acenaphthene | **20** | UG/L | 10 U | 10 U | 10 U | 10 U |
| Acenaphthylene | 20 | UG/L | 10 U | 10 U | 10 U | 10 U |
| Acetophenone | -- | UG/L | 10 U | 10 U | 10 U | 10 U |
| Anthracene | 50 | UG/L | 10 U | 10 U | 10 U | 10 U |
| Atrazine | 7.5 | UG/L | 2 U | 2 U | 2 U | 2 U |
| Benzaldehyde | -- | UG/L | 10 U | 10 U | 10 U | 10 U |
| Benzo(A)Anthracene | **0.002** | UG/L | 1 U | 1 U | 1 U | 1 U |
| Benzo(A)Pyrene | **0** | UG/L | 1 U | 1 U | 1 U | 1 U |
| Benzo(B)Fluoranthene | **0.002** | UG/L | 2 U | 2 U | 2 U | 2 U |

**Table 2. Summary of Semivolatile Organic Compounds in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | Sample Designation: | | MW-18R | MW-18R | MW-18R | MW-18R |
|---|---|---|---|---|---|---|
| | Sample Date: | | 06/19/2024 | 10/02/2024 | 10/02/2024 | 01/02/2025 |
| | Normal or Field Duplicate: | | N | N | FD | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | |
| Benzo(G,H,I)Perylene | -- | UG/L | 10 U | 10 U | 10 U | 10 U |
| Benzo(K)Fluoranthene | 0.002 | UG/L | 1 U | 1 U | 1 U | 1 U |
| Benzyl Butyl Phthalate | 50 | UG/L | 10 U | 10 U | 10 U | 10 U |
| Biphenyl (Diphenyl) | **5** | UG/L | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Chloroethoxy) Methane | 5 | UG/L | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | 1 | UG/L | 1 U | 1 U | 1 U | 1 U |
| Bis(2-Chloroisopropyl) Ether | 5 | UG/L | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Ethylhexyl) Phthalate | 5 | UG/L | 2 U | 2 U | 2 U | 2 U |
| Caprolactam | -- | UG/L | 10 U | 10 U | 10 U | 10 U |
| Carbazole | -- | UG/L | 10 U | 10 U | 10 U | 10 U |
| Chrysene | **0.002** | UG/L | 2 U | 2 U | 2 U | 2 U |
| Dibenz(A,H)Anthracene | -- | UG/L | 1 U | 1 U | 1 U | 1 U |
| Dibenzofuran | -- | UG/L | 10 U | 10 U | 10 U | 10 U |
| Diethyl Phthalate | 50 | UG/L | 10 U | 10 U | 10 U | 10 U |
| Dimethyl Phthalate | 50 | UG/L | 10 UT | 10 U | 10 U | 10 U |
| Di-N-Butyl Phthalate | 50 | UG/L | 10 U | 10 U | 10 U | 10 U |
| Di-N-Octylphthalate | -- | UG/L | 10 U | 10 U | 10 U | 10 U |
| Fluoranthene | 50 | UG/L | 10 U | 10 U | 10 U | 10 U |
| Fluorene | **50** | UG/L | 10 U | 10 U | 10 U | 10 U |
| Hexachlorobenzene | 0.04 | UG/L | 1 U | 1 U | 1 U | 1 U |
| Hexachlorobutadiene | 0.5 | UG/L | 1 U | 1 U | 1 U | 1 U |
| Hexachlorocyclopentadiene | 5 | UG/L | 10 U | 10 U | 10 U | 10 U |
| Hexachloroethane | 5 | UG/L | 2 U | 2 U | 2 U | 2 U |
| Indeno(1,2,3-C,D)Pyrene | **0.002** | UG/L | 2 U | 2 U | 2 U | 2 U |
| Isophorone | 50 | UG/L | 10 U | 10 U | 10 U | 10 U |
| Naphthalene | **10** | UG/L | 2 U | 2 U | 2 U | 2 U |
| Nitrobenzene | 0.4 | UG/L | 1 U | 1 U | 1 U | 1 U |
| N-Nitrosodi-N-Propylamine | -- | UG/L | 1 U | 1 U | 1 U | 1 U |
| N-Nitrosodiphenylamine | 50 | UG/L | 10 U | 10 U | 10 U | 10 U |
| Pentachlorophenol | 1 | UG/L | 20 U | 20 U | 20 U | 20 U |
| Phenanthrene | **50** | UG/L | 10 U | 10 U | 10 U | 10 U |
| Phenol | 1 | UG/L | 10 U | 10 U | 10 U | 10 U |
| Pyrene | 50 | UG/L | 10 U | 10 U | 10 U | 10 U |

**Table 3. Summary of Metals in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Designation: | | | MW-9 | MW-9 | MW-9 | MW-9 | MW-9 | MW-9 | MW-9 | MW-9 | MW-9 | MW-9 |
| Sample Date: | | | 03/19/2024 | 03/19/2024 | 06/17/2024 | 06/17/2024 | 06/17/2024 | 06/17/2024 | 10/03/2024 | 10/03/2024 | 12/31/2024 | 12/31/2024 |
| Normal or Field Duplicate: | | | N | N | N | N | FD | FD | N | N | N | N |
| Total or Dissolved: | | | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | | | |
| Arsenic | **25** | UG/L | 2 | 2.1 | 2.3 | 2.2 | 2.4 | 2 | 5 | 4.7 | 4.9 | 3.7 |
| Barium | 1000 | UG/L | 124 | 134 | 125 | 74.5 | 113 | 76.4 | 91.1 | 75.6 | 93.6 | 55.2 |
| Cadmium | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Chromium, Total | 50 | UG/L | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4.8 | 3.2 J |
| Cyanide | **200** | UG/L | 10 U | NA | 10 U | NA | 10 U | NA | 10 U | NA | 10 U | NA |
| Lead | **25** | UG/L | 1.2 U | 1.2 U | 0.63 J | 1.2 U | 0.62 J | 1.2 U | 1.2 U | 1.2 U | 1.3 | 1.2 U |
| Mercury | 0.7 | UG/L | 0.38 | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U |
| Selenium | 10 | UG/L | 2.5 U | 2.5 U | 2.5 U | 0.83 J | 2.5 U | 0.96 J | 2.5 U | 1.3 J | 1.8 J | 0.84 J |
| Silver | 50 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |

**Table 3. Summary of Metals in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Designation: | | | MW-9 | MW-9 | MW-10R | MW-10R | MW-10R | MW-10R | MW-10R | MW-10R | MW-10R | MW-10R |
| Sample Date: | | | 12/31/2024 | 12/31/2024 | 03/19/2024 | 03/19/2024 | 06/18/2024 | 06/18/2024 | 10/03/2024 | 10/03/2024 | 01/02/2025 | 01/02/2025 |
| Normal or Field Duplicate: | | | FD | FD | N | N | N | N | N | N | N | N |
| Total or Dissolved: | | | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | | | |
| Arsenic | **25** | UG/L | 4.4 | 4 | 2 U | 2 U | 1.7 J | 2 U | 1.4 J | 2 U | 2 U | 2 U |
| Barium | 1000 | UG/L | 92.7 | 53.6 | 79.3 | 69.1 | 130 | 113 | 124 | 121 | 125 | 115 |
| Cadmium | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Chromium, Total | 50 | UG/L | 3.9 J | 3.9 J | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| Cyanide | **200** | UG/L | 10 U | NA | 14 | NA | **12400** | NA | 10 U | NA | 14 | NA |
| Lead | **25** | UG/L | 1.2 | 1.2 U | 2.4 | 1.2 U | 5.2 | 1.2 U | 14.2 | 1.2 U | 6 | 1.2 U |
| Mercury | 0.7 | UG/L | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U |
| Selenium | 10 | UG/L | 0.46 J | 1.4 J | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U |
| Silver | 50 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |

**Table 3. Summary of Metals in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Designation: | | | MW-11 | MW-11 | MW-11 | MW-11 | MW-11 | MW-11 | MW-11 | MW-11 | MW-12 | MW-12 |
| Sample Date: | | | 03/19/2024 | 03/19/2024 | 06/17/2024 | 06/17/2024 | 10/02/2024 | 10/02/2024 | 01/02/2025 | 01/02/2025 | 03/18/2024 | 03/18/2024 |
| Normal or Field Duplicate: | | | N | N | N | N | N | N | N | N | N | N |
| Total or Dissolved: | | | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | | | |
| Arsenic | **25** | UG/L | 14.9 | 1.3 J | 22.1 | 2.3 | **29.9** | 7 | 18.7 | 1.8 J | 1.6 J | 2 U |
| Barium | 1000 | UG/L | 173 | 135 | 189 | 132 | 238 | 185 | 189 | 146 | 16.6 | 15.9 |
| Cadmium | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Chromium, Total | 50 | UG/L | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| Cyanide | **200** | UG/L | 10 U | NA | 10 U | NA | 10 U | NA | 10 U | NA | 10 U | NA |
| Lead | **25** | UG/L | 1.7 | 1.2 U | 1.6 | 1.2 U | 2.7 | 1.2 U | 2.9 | 1.2 U | 1.2 U | 1.2 U |
| Mercury | 0.7 | UG/L | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U |
| Selenium | 10 | UG/L | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U |
| Silver | 50 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |

**Table 3. Summary of Metals in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Designation: | | | MW-12 | MW-12 | MW-12 | MW-12 | MW-12 | MW-12 | MW-13 | MW-13 | MW-13 | MW-13 |
| Sample Date: | | | 06/18/2024 | 06/18/2024 | 10/04/2024 | 10/04/2024 | 12/31/2024 | 12/31/2024 | 03/20/2024 | 03/20/2024 | 06/18/2024 | 06/18/2024 |
| Normal or Field Duplicate: | | | N | N | N | N | N | N | N | N | N | N |
| Total or Dissolved: | | | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | | | |
| Arsenic | **25** | UG/L | 1.4 J | 2 U | 1.7 J | 1.9 J | 2 | 2 U | **52.1** | 13 | **56.3** | **48.8** |
| Barium | 1000 | UG/L | 13.9 | 13.3 | 18.1 | 16.1 | 20 | 13.4 | 11.6 | 7.5 | 6 | 1.4 J |
| Cadmium | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Chromium, Total | 50 | UG/L | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| Cyanide | **200** | UG/L | 10 U | NA | 10 U | NA | 10 U | NA | 10 U | NA | 10 U | NA |
| Lead | **25** | UG/L | 0.47 J | 1.2 U | 1.2 U | 1.2 U | 3.1 | 1.2 U | 1.3 | 1.2 U | 0.76 J | 1.2 U |
| Mercury | 0.7 | UG/L | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U |
| Selenium | 10 | UG/L | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U |
| Silver | 50 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |

**Table 3. Summary of Metals in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Designation: | | | MW-13 | MW-13 | MW-13 | MW-13 | MW-14 | MW-14 | MW-14 | MW-14 | MW-14 | MW-14 |
| Sample Date: | | | 10/02/2024 | 10/02/2024 | 12/31/2024 | 12/31/2024 | 03/19/2024 | 03/19/2024 | 06/18/2024 | 06/18/2024 | 10/04/2024 | 10/04/2024 |
| Normal or Field Duplicate: | | | N | N | N | N | N | N | N | N | N | N |
| Total or Dissolved: | | | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | | | |
| Arsenic | **25** | UG/L | **125** | **124** | **93.7** | 3.8 | 3.5 | 1.3 J | 5.5 | 1.5 J | 7.9 | 3.4 |
| Barium | 1000 | UG/L | 9.5 | 2 J | 15.7 | 10 | 57.7 | 58 | 79.3 | 78.4 | 80 | 68 |
| Cadmium | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Chromium, Total | 50 | UG/L | 4 | 4 U | 1.9 J | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| Cyanide | **200** | UG/L | 10 U | NA | 10 U | NA | 10 U | NA | 10 U | NA | 10 U | NA |
| Lead | **25** | UG/L | 4.2 | 1.2 U | 4.8 | 1.2 U | 2.8 | 1.2 U | 1.8 | 1.2 U | 3.4 | 1.2 U |
| Mercury | 0.7 | UG/L | 0.64 | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U |
| Selenium | 10 | UG/L | 2.5 U | 2.5 U | 0.67 J | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U |
| Silver | 50 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |

**Table 3. Summary of Metals in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Designation: | | | MW-14 | MW-14 | MW-15 | MW-15 | MW-15 | MW-15 | MW-15 | MW-15 | MW-15 | MW-15 |
| Sample Date: | | | 01/02/2025 | 01/02/2025 | 03/20/2024 | 03/20/2024 | 06/17/2024 | 06/17/2024 | 10/03/2024 | 10/03/2024 | 12/31/2024 | 12/31/2024 |
| Normal or Field Duplicate: | | | N | N | N | N | N | N | N | N | N | N |
| Total or Dissolved: | | | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | | | |
| Arsenic | **25** | UG/L | 14.1 | 2.5 | 2 U | 2 U | 1.3 J | 1.4 J | 4.8 | 4.9 | 2.9 | 2.5 |
| Barium | 1000 | UG/L | 76.5 | 72.7 | 71.7 | 77.9 | 24 | 22.5 | 18.3 | 18 | 33.4 | 22.2 |
| Cadmium | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Chromium, Total | 50 | UG/L | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| Cyanide | **200** | UG/L | 10 U | NA | 10 U | NA | 10 U | NA | 10 U | NA | 10 U | NA |
| Lead | **25** | UG/L | 3 | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.1 J | 1.2 U | 1.3 | 1.2 U |
| Mercury | 0.7 | UG/L | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U |
| Selenium | 10 | UG/L | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 0.45 J |
| Silver | 50 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |

**Table 3. Summary of Metals in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Designation: | | | MW-16R | MW-16R | MW-16R | MW-16R | MW-16R | MW-16R | MW-16R | MW-16R | MW-17R | MW-17R |
| Sample Date: | | | 03/18/2024 | 03/18/2024 | 06/19/2024 | 06/19/2024 | 10/03/2024 | 10/03/2024 | 01/03/2025 | 01/03/2025 | 03/18/2024 | 03/18/2024 |
| Normal or Field Duplicate: | | | N | N | N | N | N | N | N | N | N | N |
| Total or Dissolved: | | | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | | | |
| Arsenic | **25** | UG/L | 3.9 | 2 U | 3.7 | 2 U | 7.6 | 3.9 | 4.9 | 1.4 J | 2.8 | 2 U |
| Barium | 1000 | UG/L | 97.8 | 71.1 | 109 | 75 | 169 | 191 | 171 | 145 | 308 | 250 |
| Cadmium | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Chromium, Total | 50 | UG/L | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| Cyanide | **200** | UG/L | 10 U | NA | 10 U | NA | 10 U | NA | 4.9 J | NA | 4.1 J | NA |
| Lead | **25** | UG/L | 2.8 | 1.2 U | 1.5 | 1.2 U | 1.5 | 1.2 U | 4.6 | 1.2 U | 8.4 | 1.2 U |
| Mercury | 0.7 | UG/L | 0.42 | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U |
| Selenium | 10 | UG/L | 0.81 J | 0.67 J | 0.73 J | 0.54 J | 2.5 U | 0.95 J | 0.69 J | 0.64 J | 2.5 U | 2.5 U |
| Silver | 50 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |

**Table 3. Summary of Metals in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| Sample Designation: | | | MW-17R | MW-17R | MW-17R | MW-17R | MW-17R | MW-17R | MW-17R | MW-17R | MW-18R | MW-18R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | | | 03/18/2024 | 03/18/2024 | 06/19/2024 | 06/19/2024 | 10/03/2024 | 10/03/2024 | 01/03/2025 | 01/03/2025 | 03/20/2024 | 03/20/2024 |
| Normal or Field Duplicate: | | | FD | FD | N | N | N | N | N | N | N | N |
| Total or Dissolved: | | | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | | | |
| Arsenic | **25** | UG/L | 3 | 2 U | 1.7 J | 2 U | 3.3 | 2 U | 1.3 J | 2 U | 9.6 | 2 U |
| Barium | 1000 | UG/L | 267 | 248 | 583 | 368 | 417 | 313 | 446 | 371 | 477 | 352 |
| Cadmium | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Chromium, Total | 50 | UG/L | 4 U | 4 U | 3.1 J | 4 U | 3 J | 4 U | 1.7 J | 4 U | 4 U | 4 U |
| Cyanide | **200** | UG/L | 10 U | NA | 10 U | NA | 10 U | NA | 6.4 J | NA | 7.1 J | NA |
| Lead | **25** | UG/L | 4.6 | 1.2 U | **27.6** | 1.2 U | **28.4** | 1.2 U | 10.5 | 1.2 U | 1.2 U | 1.2 U |
| Mercury | 0.7 | UG/L | 0.2 U | 0.2 U | 0.28 | 0.2 U | 0.3 | 0.2 U | 0.11 J | 0.2 U | 0.2 U | 0.2 U |
| Selenium | 10 | UG/L | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U |
| Silver | 50 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |

**Table 3. Summary of Metals in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sample Designation: | | MW-18R | MW-18R | MW-18R | MW-18R | MW-18R | MW-18R | MW-18R | MW-18R |
| | Sample Date: | | 06/19/2024 | 06/19/2024 | 10/02/2024 | 10/02/2024 | 10/02/2024 | 10/02/2024 | 01/02/2025 | 01/02/2025 |
| | Normal or Field Duplicate: | | N | N | N | N | FD | FD | N | N |
| | Total or Dissolved: | | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | |
| Arsenic | **25** | UG/L | 8.2 | 2 U | 7.6 | 1.8 J | 7.9 | 3.7 | 6.8 | 2 U |
| Barium | 1000 | UG/L | 437 | 310 | 605 | 432 | 595 | 415 | 583 | 369 |
| Cadmium | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Chromium, Total | 50 | UG/L | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| Cyanide | **200** | UG/L | 10 U | NA | 10 U | NA | 10 U | NA | 6.6 J | NA |
| Lead | **25** | UG/L | 1.2 U | 1.2 U | 0.7 J | 1.2 U | 0.6 J | 1.2 U | 1.2 U | 1.2 U |
| Mercury | 0.7 | UG/L | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U |
| Selenium | 10 | UG/L | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U |
| Silver | 50 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |

**Table 4. Summary of Polychlorinated Biphenyls in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample Designation: | MW-9 | MW-9 | MW-9 | MW-9 | MW-9 | MW-9 | MW-10R | MW-10R | MW-10R |
| | | Sample Date: | 03/19/2024 | 06/17/2024 | 06/17/2024 | 10/03/2024 | 12/31/2024 | 12/31/2024 | 03/19/2024 | 06/18/2024 | 10/03/2024 |
| | | Normal or Field Duplicate: | N | N | FD | N | N | FD | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | | |
| PCB-1016 (Aroclor 1016) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1221 (Aroclor 1221) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1232 (Aroclor 1232) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1242 (Aroclor 1242) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1248 (Aroclor 1248) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1254 (Aroclor 1254) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1260 (Aroclor 1260) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1262 (Aroclor 1262) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1268 (Aroclor 1268) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| Polychlorinated Biphenyl (PCBs) | **0.09** | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |

**Table 4. Summary of Polychlorinated Biphenyls in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample Designation: | MW-10R | MW-11 | MW-11 | MW-11 | MW-11 | MW-12 | MW-12 | MW-12 | MW-12 |
| | | Sample Date: | 01/02/2025 | 03/19/2024 | 06/17/2024 | 10/02/2024 | 01/02/2025 | 03/18/2024 | 06/18/2024 | 10/04/2024 | 12/31/2024 |
| | | Normal or Field Duplicate: | N | N | N | N | N | N | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | | |
| PCB-1016 (Aroclor 1016) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1221 (Aroclor 1221) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1232 (Aroclor 1232) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1242 (Aroclor 1242) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1248 (Aroclor 1248) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1254 (Aroclor 1254) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1260 (Aroclor 1260) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1262 (Aroclor 1262) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1268 (Aroclor 1268) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| Polychlorinated Biphenyl (PCBs) | **0.09** | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |

**Table 4. Summary of Polychlorinated Biphenyls in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample Designation: | MW-13 | MW-13 | MW-13 | MW-13 | MW-14 | MW-14 | MW-14 | MW-14 | MW-15 |
| | | Sample Date: | 03/20/2024 | 06/18/2024 | 10/02/2024 | 12/31/2024 | 03/19/2024 | 06/18/2024 | 10/04/2024 | 01/02/2025 | 03/20/2024 |
| | | Normal or Field Duplicate: | N | N | N | N | N | N | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | | |
| PCB-1016 (Aroclor 1016) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1221 (Aroclor 1221) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1232 (Aroclor 1232) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1242 (Aroclor 1242) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1248 (Aroclor 1248) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1254 (Aroclor 1254) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1260 (Aroclor 1260) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.62 | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1262 (Aroclor 1262) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1268 (Aroclor 1268) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| Polychlorinated Biphenyl (PCBs) | **0.09** | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | **0.62** | 0.4 U | 0.4 U | 0.4 U | 0.4 U |

**Table 4. Summary of Polychlorinated Biphenyls in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample Designation: | MW-15 | MW-15 | MW-15 | MW-16R | MW-16R | MW-16R | MW-16R | MW-17R | MW-17R |
| | | Sample Date: | 06/17/2024 | 10/03/2024 | 12/31/2024 | 03/18/2024 | 06/19/2024 | 10/03/2024 | 01/03/2025 | 03/18/2024 | 03/18/2024 |
| | | Normal or Field Duplicate: | N | N | N | N | N | N | N | N | FD |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | | |
| PCB-1016 (Aroclor 1016) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.8 U | 0.4 U | 0.4 U |
| PCB-1221 (Aroclor 1221) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.8 U | 0.4 U | 0.4 U |
| PCB-1232 (Aroclor 1232) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.8 U | 0.4 U | 0.4 U |
| PCB-1242 (Aroclor 1242) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.8 U | 0.4 U | 0.4 U |
| PCB-1248 (Aroclor 1248) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.8 U | 0.4 U | 0.4 U |
| PCB-1254 (Aroclor 1254) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.8 U | 0.4 U | 0.4 U |
| PCB-1260 (Aroclor 1260) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.84 | 0.4 U | 0.4 U | 15 | 1.5 | 0.49 |
| PCB-1262 (Aroclor 1262) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.8 U | 0.4 U | 0.4 U |
| PCB-1268 (Aroclor 1268) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.8 U | 0.4 U | 0.4 U |
| Polychlorinated Biphenyl (PCBs) | **0.09** | UG/L | 0.4 U | 0.4 U | 0.4 U | **0.84** | 0.4 U | 0.4 U | **15** | **1.5** | **0.49** |

**Table 4. Summary of Polychlorinated Biphenyls in Groundwater, 322 3rd Avenue, Brooklyn, New York**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample Designation: | MW-17R | MW-17R | MW-17R | MW-18R | MW-18R | MW-18R | MW-18R | MW-18R |
| | | Sample Date: | 06/19/2024 | 10/03/2024 | 01/03/2025 | 03/20/2024 | 06/19/2024 | 10/02/2024 | 10/02/2024 | 01/02/2025 |
| | | Normal or Field Duplicate: | N | N | N | N | N | N | FD | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance | Units | | | | | | | | |
| PCB-1016 (Aroclor 1016) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 2 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1221 (Aroclor 1221) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 2 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1232 (Aroclor 1232) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 2 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1242 (Aroclor 1242) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 2 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1248 (Aroclor 1248) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 2 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1254 (Aroclor 1254) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 2 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1260 (Aroclor 1260) | -- | UG/L | 0.4 U | 1.5 | 4.7 | 0.4 U | 2 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1262 (Aroclor 1262) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 2 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1268 (Aroclor 1268) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 2 U | 0.4 U | 0.4 U | 0.4 U |
| Polychlorinated Biphenyl (PCBs) | **0.09** | UG/L | 0.4 U | **1.5** | **4.7** | 0.4 U | 2 U | 0.4 U | 0.4 U | 0.4 U |

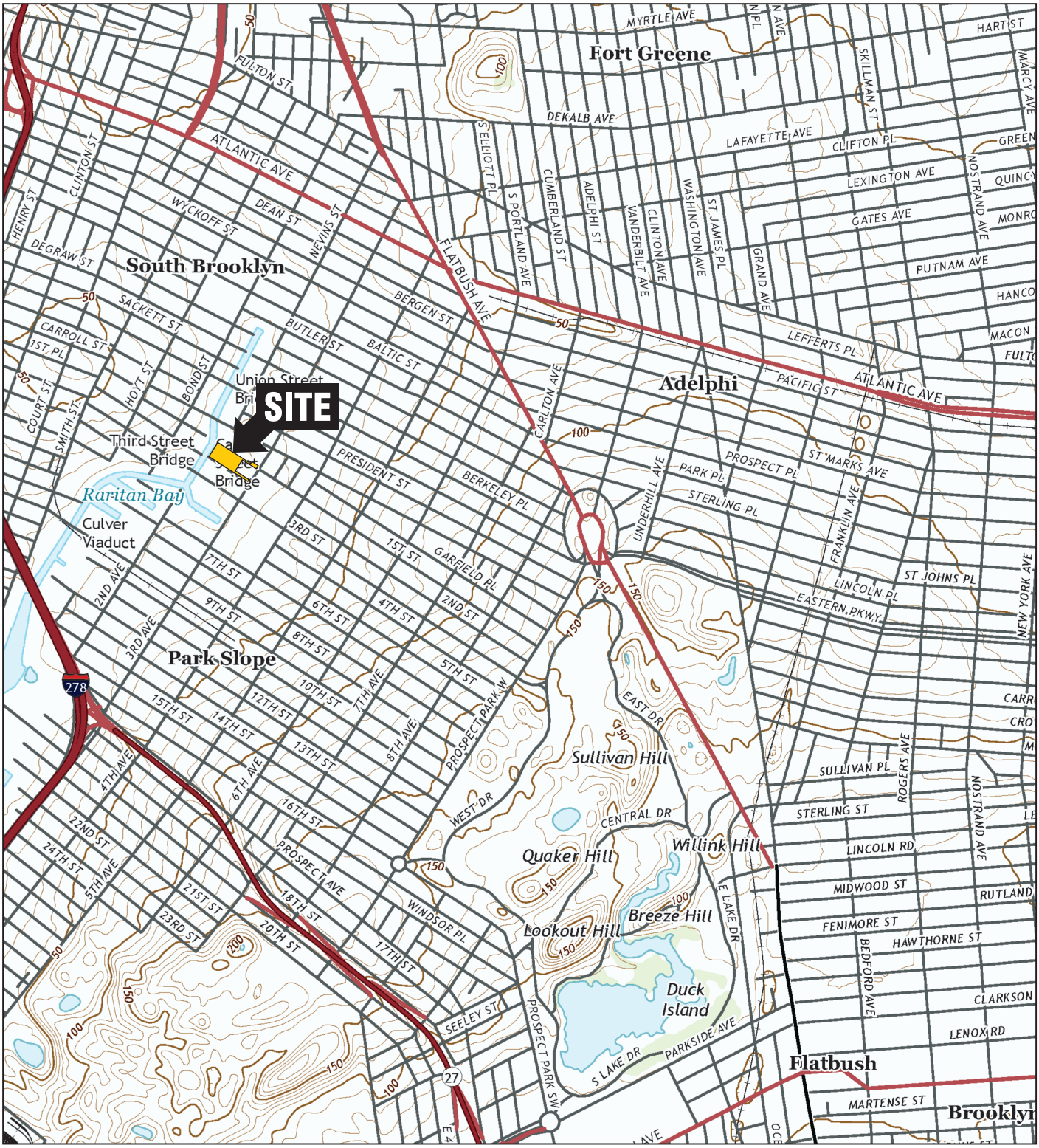
**Table 5. Summary of First Quarter 2024 through Fourth Quarter 2024 Groundwater Gauging Data**

| Well ID | Date | Well Elevation (ft) | DTW (ft) | DTP (ft) | DTB (ft) | Corrected Groundwater Elevation | Product Thickness (ft) |
|---|---|---|---|---|---|---|---|
| MW-9 | 3/18/2024 | 18.87 | 14.86 | ND | 20.19 | 4.01 | -- |
| MW-9 | 6/17/2024 | 18.87 | 14.71 | ND | 20.52 | 4.16 | -- |
| MW-9 | 10/4/2024 | 18.87 | 14.95 | ND | 20.45 | 3.92 | -- |
| MW-9 | 12/31/2024 | 18.87 | 14.48 | ND | 20.23 | 4.39 | -- |
| MW-10R | 3/18/2024 | 13.30 | 4.38 | ND | 20.32 | 8.92 | -- |
| MW-10R | 6/17/2024 | 13.30 | 4.37 | ND | 20.31 | 8.93 | -- |
| MW-10R | 10/4/2024 | 13.30 | 5.21 | ND | 20.38 | 8.09 | -- |
| MW-10R | 12/31/2024 | 13.30 | 4.51 | ND | 20.72 | 8.79 | -- |
| MW-11 | 3/18/2024 | 12.10 | 3.94 | ND | 13.87 | 8.16 | -- |
| MW-11 | 6/17/2024 | 12.10 | 4.01 | ND | 13.94 | 8.09 | -- |
| MW-11 | 10/4/2024 | 12.10 | 4.64 | ND | 13.96 | 7.46 | -- |
| MW-11 | 12/31/2024 | 12.10 | 4.08 | ND | 14.89 | 8.02 | -- |
| MW-12 | 3/18/2024 | 18.71 | 15.94 | ND | 23.63 | 2.77 | -- |
| MW-12 | 6/17/2024 | 18.71 | 15.74 | ND | 22.65 | 2.97 | -- |
| MW-12 | 10/4/2024 | 18.71 | 15.99 | ND | 22.74 | 2.72 | -- |
| MW-12 | 12/31/2024 | 18.71 | 15.75 | ND | 22.60 | 2.96 | -- |
| MW-13 | 3/18/2024 | 18.57 | 15.58 | ND | 24.51 | 2.99 | -- |
| MW-13 | 6/17/2024 | 18.57 | 15.36 | ND | 25.07 | 3.21 | -- |
| MW-13 | 10/4/2024 | 18.57 | 15.62 | ND | 24.50 | 2.95 | -- |
| MW-13 | 12/13/2024 | 18.57 | 15.27 | ND | 24.51 | 3.30 | -- |
| MW-14 | 3/18/2024 | 18.27 | 14.39 | ND | 24.93 | 3.88 | -- |
| MW-14 | 6/17/2024 | 18.27 | 15.17 | ND | 29.01 | 3.10 | -- |
| MW-14 | 10/4/2024 | 18.27 | 15.56 | ND | 28.96 | 2.71 | -- |
| MW-14 | 12/31/2024 | 18.27 | 15.07 | ND | 29.88 | 3.20 | -- |
| MW-15 | 3/18/2024 | 19.34 | 16.17 | ND | 21.26 | 3.17 | -- |
| MW-15 | 6/17/2024 | 19.34 | 16.01 | ND | 21.27 | 3.33 | -- |
| MW-15 | 10/4/2024 | 19.34 | 16.26 | ND | 21.43 | 3.08 | -- |
| MW-15 | 12/31/2024 | 19.34 | 15.42 | ND | 21.28 | 3.92 | -- |
| MW-16R | 3/18/2024 | 17.88 | 14.87 | ND | 24.65 | 3.01 | -- |
| MW-16R | 6/17/2024 | 17.88 | 14.63 | ND | 24.56 | 3.25 | -- |
| MW-16R | 10/4/2024 | 17.88 | 15.16 | ND | 24.75 | 2.72 | -- |
| MW-16R | 12/31/2024 | 17.88 | 14.55 | ND | 24.40 | 3.33 | -- |
| MW-17R | 3/18/2024 | 16.23 | 13.24 | ND | 25.08 | 2.99 | -- |
| MW-17R | 6/17/2024 | 16.23 | 13.03 | ND | 25.19 | 3.20 | -- |
| MW-17R | 10/4/2024 | 16.23 | 13.52 | ND | 24.95 | 2.71 | -- |
| MW-17R | 12/31/2024 | 16.23 | 12.92 | ND | 24.86 | 3.31 | -- |
| MW-18R | 3/18/2024 | 15.44 | 11.98 | ND | 24.55 | 3.46 | -- |
| MW-18R | 6/17/2024 | 15.44 | 11.82 | ND | 24.63 | 3.62 | -- |
| MW-18R | 10/4/2024 | 15.44 | 12.13 | ND | 24.62 | 3.31 | -- |
| MW-18R | 12/31/2024 | 15.44 | 11.86 | ND | 24.51 | 3.58 | -- |

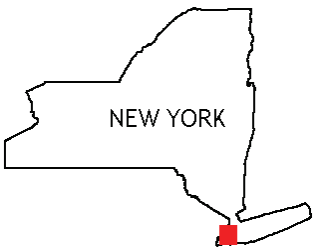
**Notes:**
DTW - Depth to Water
DTP - Depth to Product
DTB - Depth to Bottom
ND - No Detection

# FIGURES

1. Site Location Map
2. Groundwater Exceedances 2024 Quarterly Sampling
3. Site Composite Cover System




QUADRANGLE LOCATION




SOURCE:
USGS; 2019, Brooklyn, NY
7.5 Minute Topographic Quadrangle

N

0 2000'

Title:

# SITE LOCATION MAP

PERIODIC REVIEW REPORT
GOWANUS VILLAGE I, LLC - BROOKLYN, NEW YORK

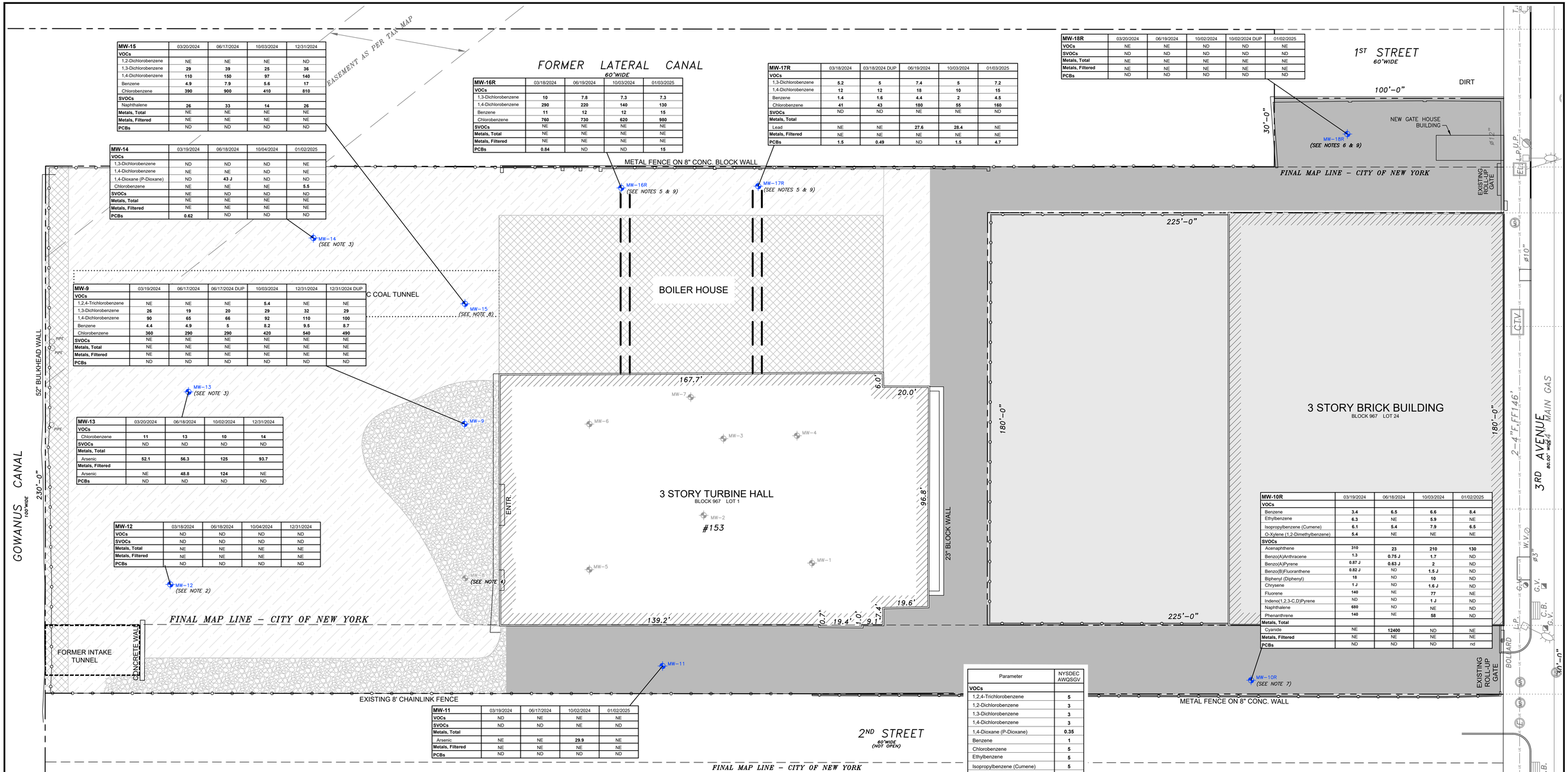
Prepared for:

BRT POWERHOUSE LLC

ROUX

| | | |
|---|---|---|
| Compiled by: M.O. | Date: 12MAR25 | FIGURE |
| Prepared by: G.M. | Scale: AS SHOWN | 1 |
| Project Mgr: L.D. | Project: 2705.0001Y009 | |
| File: 2705.0001Y324.01.CDR | | |

\2705\0001Y324\2705.0001Y324.01.CDR




| MW-15 | 03/20/2024 | 06/17/2024 | 10/03/2024 | 12/31/2024 |
|---|---|---|---|---|
| **VOCs** | | | | |
| 1,2-Dichlorobenzene | NE | NE | NE | ND |
| 1,3-Dichlorobenzene | **29** | **39** | **25** | **36** |
| 1,4-Dichlorobenzene | **110** | **150** | **97** | **140** |
| Benzene | **4.9** | **7.9** | **5.6** | **17** |
| Chlorobenzene | **390** | **900** | **410** | **810** |
| **SVOCs** | | | | |
| Naphthalene | **26** | **33** | **14** | **26** |
| **Metals, Total** | NE | NE | NE | NE |
| **Metals, Filtered** | NE | NE | NE | NE |
| **PCBs** | ND | ND | ND | ND |

| MW-14 | 03/19/2024 | 06/18/2024 | 10/04/2024 | 01/02/2025 |
|---|---|---|---|---|
| **VOCs** | | | | |
| 1,3-Dichlorobenzene | ND | ND | ND | NE |
| 1,4-Dichlorobenzene | NE | NE | ND | NE |
| 1,4-Dioxane (P-Dioxane) | ND | **43 J** | ND | ND |
| Chlorobenzene | NE | NE | NE | **5.5** |
| **SVOCs** | NE | ND | ND | ND |
| **Metals, Total** | NE | NE | NE | NE |
| **Metals, Filtered** | NE | NE | NE | NE |
| **PCBs** | **0.62** | ND | ND | ND |

| MW-9 | 03/19/2024 | 06/17/2024 | 06/17/2024 DUP | 10/03/2024 | 12/31/2024 | 12/31/2024 DUP |
|---|---|---|---|---|---|---|
| **VOCs** | | | | | | |
| 1,2,4-Trichlorobenzene | NE | NE | NE | **5.4** | NE | NE |
| 1,3-Dichlorobenzene | **26** | **19** | **20** | **29** | **32** | **29** |
| 1,4-Dichlorobenzene | **90** | **65** | **66** | **92** | **110** | **100** |
| Benzene | **4.4** | **4.9** | **5** | **8.2** | **9.5** | **8.7** |
| Chlorobenzene | **360** | **290** | **290** | **420** | **540** | **490** |
| **SVOCs** | NE | NE | NE | NE | NE | NE |
| **Metals, Total** | NE | NE | NE | NE | NE | NE |
| **Metals, Filtered** | NE | NE | NE | NE | NE | NE |
| **PCBs** | ND | ND | ND | ND | ND | ND |

| MW-13 | 03/20/2024 | 06/18/2024 | 10/02/2024 | 12/31/2024 |
|---|---|---|---|---|
| **VOCs** | | | | |
| Chlorobenzene | **11** | **13** | **10** | **14** |
| **SVOCs** | ND | ND | ND | ND |
| **Metals, Total** | | | | |
| Arsenic | **52.1** | **56.3** | **125** | **93.7** |
| **Metals, Filtered** | | | | |
| Arsenic | NE | **48.8** | **124** | NE |
| **PCBs** | ND | ND | ND | ND |

| MW-12 | 03/18/2024 | 06/18/2024 | 10/04/2024 | 12/31/2024 |
|---|---|---|---|---|
| **VOCs** | ND | ND | ND | ND |
| **SVOCs** | ND | ND | ND | ND |
| **Metals, Total** | NE | NE | NE | NE |
| **Metals, Filtered** | NE | NE | NE | NE |
| **PCBs** | ND | ND | ND | ND |

| MW-16R | 03/18/2024 | 06/19/2024 | 10/03/2024 | 01/03/2025 |
|---|---|---|---|---|
| **VOCs** | | | | |
| 1,3-Dichlorobenzene | **10** | **7.8** | **7.3** | **7.3** |
| 1,4-Dichlorobenzene | **290** | **220** | **140** | **130** |
| Benzene | **11** | **12** | **12** | **15** |
| Chlorobenzene | **760** | **730** | **620** | **980** |
| **SVOCs** | NE | NE | NE | NE |
| **Metals, Total** | NE | NE | NE | NE |
| **Metals, Filtered** | NE | NE | NE | NE |
| **PCBs** | **0.84** | ND | ND | **15** |

| MW-17R | 03/18/2024 | 03/18/2024 DUP | 06/19/2024 | 10/03/2024 | 01/03/2025 |
|---|---|---|---|---|---|
| **VOCs** | | | | | |
| 1,3-Dichlorobenzene | **5.2** | **5** | **7.4** | **5** | **7.2** |
| 1,4-Dichlorobenzene | **12** | **12** | **18** | **10** | **15** |
| Benzene | **1.4** | **1.6** | **4.4** | **2** | **4.5** |
| Chlorobenzene | **41** | **43** | **180** | **55** | **160** |
| **SVOCs** | ND | ND | NE | NE | ND |
| **Metals, Total** | | | | | |
| Lead | NE | NE | **27.6** | **28.4** | NE |
| **Metals, Filtered** | NE | NE | NE | NE | NE |
| **PCBs** | **1.5** | **0.49** | ND | **1.5** | **4.7** |

| MW-18R | 03/20/2024 | 06/19/2024 | 10/02/2024 | 10/02/2024 DUP | 01/02/2025 |
|---|---|---|---|---|---|
| **VOCs** | NE | NE | ND | ND | NE |
| **SVOCs** | ND | ND | ND | ND | ND |
| **Metals, Total** | NE | NE | NE | NE | NE |
| **Metals, Filtered** | NE | NE | NE | NE | NE |
| **PCBs** | ND | ND | ND | ND | ND |

| MW-10R | 03/19/2024 | 06/18/2024 | 10/03/2024 | 01/02/2025 |
|---|---|---|---|---|
| **VOCs** | | | | |
| Benzene | **3.4** | **6.5** | **6.6** | **8.4** |
| Ethylbenzene | **6.3** | NE | **5.9** | NE |
| Isopropylbenzene (Cumene) | **6.1** | **5.4** | **7.9** | **6.5** |
| O-Xylene (1,2-Dimethylbenzene) | **5.4** | NE | NE | NE |
| **SVOCs** | | | | |
| Acenaphthene | **310** | **23** | **210** | **130** |
| Benzo(A)Anthracene | **1.3** | **0.75 J** | **1.7** | ND |
| Benzo(A)Pyrene | **0.87 J** | **0.63 J** | **2** | ND |
| Benzo(B)Fluoranthene | **0.82 J** | ND | **1.5 J** | ND |
| Biphenyl (Diphenyl) | **18** | ND | **10** | ND |
| Chrysene | **1 J** | ND | **1.6 J** | ND |
| Fluorene | **140** | NE | **77** | NE |
| Indeno(1,2,3-C,D)Pyrene | ND | ND | **1 J** | ND |
| Naphthalene | **680** | ND | NE | ND |
| Phenanthrene | **140** | NE | **58** | ND |
| **Metals, Total** | | | | |
| Cyanide | NE | **12400** | ND | NE |
| **Metals, Filtered** | NE | NE | NE | NE |
| **PCBs** | ND | ND | ND | nd |

| MW-11 | 03/19/2024 | 06/17/2024 | 10/02/2024 | 01/02/2025 |
|---|---|---|---|---|
| **VOCs** | ND | NE | NE | NE |
| **SVOCs** | ND | ND | NE | ND |
| **Metals, Total** | | | | |
| Arsenic | NE | NE | **29.9** | NE |
| **Metals, Filtered** | NE | NE | NE | NE |
| **PCBs** | ND | ND | ND | ND |

| Parameter | NYSDEC AWQSGV |
|---|---|
| **VOCs** | |
| 1,2,4-Trichlorobenzene | **5** |
| 1,2-Dichlorobenzene | **3** |
| 1,3-Dichlorobenzene | **3** |
| 1,4-Dichlorobenzene | **3** |
| 1,4-Dioxane (P-Dioxane) | **0.35** |
| Benzene | **1** |
| Chlorobenzene | **5** |
| Ethylbenzene | **5** |
| Isopropylbenzene (Cumene) | **5** |
| m,p-Xylene | **5** |
| O-Xylene (1,2-Dimethylbenzene) | **5** |
| **SVOCs** | |
| Acenaphthene | **20** |
| Benzo(A)Anthracene | **0.002** |
| Benzo(A)Pyrene | **0** |
| Benzo(B)Fluoranthene | **0.002** |
| Biphenyl (Diphenyl) | **5** |
| Chrysene | **0.002** |
| Fluorene | **50** |
| Indeno(1,2,3-C,D)Pyrene | **0.002** |
| Naphthalene | **10** |
| Phenanthrene | **50** |
| **Metals, Total** | |
| Arsenic | **25** |
| Cyanide | **200** |
| Lead | **25** |
| **Metals, Filtered** | |
| Arsenic | **25** |
| **PCBs** | |
| Polychlorinated Biphenyl (PCBs) | **0.09** |

## LEGEND

- EXISTING BUILDING OR STRUCTURE
- PROPERTY LINE
- FENCE LINE
- UE — UE — EXISTING UNDERGROUND ELECTRIC
- SS — SS — EXISTING STORM WATER SEWER
- MH EXISTING MANHOLE
- DR. EXISTING STORM WATER DRYWELL
- APPROXIMATE LOCATION OF FORMER LATERAL DISCHARGE TUNNELS
- MW–10 LOCATION AND DESIGNATION OF MONITORING WELL
- MW–8 LOCATION AND DESIGNATION OF DESTROYED MONITORING WELL
- ASPHALT CAP
- CLEAN STONE
- EXISTING CONCRETE SLAB
- RECYCLED CONCRETE AGGREGATE

## NOTES

1. BASE MAP PREPARED FROM SURVEY PERFORMED BY GARDEN STATE ENGINEERING SURVEYING & PLANNING IN JUNE 2022.
2. MW–12 INSTALLED ON DECEMBER 18, 2019.
3. MW–13 AND MW–14 INSTALLED ON FEBRUARY 20, 2020 AND FEBRUARY 21, 2020, RESPECTIVELY.
4. MW–8 WAS DESTROYED DURING REDEVELOPMENT ACTIVITIES IN JUNE 2019.
5. MW–16 AND MW–17 WERE DESTROYED DURING REDEVELOPMENT ACTIVITIES IN FEBRUARY 2020 AND WERE REINSTALLED AS MW–16R AND MW–17R, RESPECTIVELY, IN JUNE 2022 .
6. MW–18 WAS DESTROYED DURING REDEVELOPMENT ACTIVITIES IN MARCH 2021 AND WAS REINSTALLED AS MW–18R IN JUNE 2022.
7. MW–10 WAS DESTROYED DURING REDEVELOPMENT ACTIVITIES IN NOVEMBER 2021 AND WAS REINSTALLED AS MW–10R IN JUNE 2022.
8. MW–15 WAS INSTALLED IN MAY 2022.
9. ABSORBENT SOCKS WERE REMOVED FROM MW–16R, MW–17R, AND MW–18R DURING FOURTH QUARTER 2022 SAMPLING EVENT. LNAPL HAS NOT BEEN DETECTED DURING SUBSEQUENT GAUGING AND SAMPLING EVENTS.

## DATA BOX KEY

SAMPLE DESIGNATION → | ← SAMPLE DATE

| MW-13 | 03/20/2024 | 06/18/2024 | 10/02/2024 | 12/31/2024 |
|---|---|---|---|---|
| **VOCs** | | | | |
| Chlorobenzene | **11** | **13** | **10** | **14** |
| **SVOCs** | ND | ND | ND | ND |
| **Metals, Total** | | | | |
| Arsenic | **52.1** | **56.3** | **125** | **93.7** |
| **Metals, Filtered** | | | | |
| Arsenic | NE | **48.8** | **124** | NE |
| **PCBs** | ND | ND | ND | ND |

PARAMETER → | ← CONCENTRATION

CONCENTRATIONS IN µg/L

µg/L – MICROGRAMS PER LITER

NYSDEC – NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

AWQSGVs – AMBIENT WATER–QUALITY STANDARDS AND GUIDANCE VALUES

VOCs – VOLATILE ORGANIC COMPOUNDS

SVOCs – SEMIVOLATILE ORGANIC COMPOUNDS

PCBs – POLYCHLORINATED BIPHENYLS

B – COMPOUND WAS FOUND IN BLANK AND SAMPLE

J – ESTIMATED VALUE

DUP – DUPLICATE SAMPLE

ND – NO DETECTION

NE – NO EXCEEDANCES

NS – NOT SAMPLED

20' 0 20'

| NO. | DATE | REVISION DESCRIPTION | INT. |
|---|---|---|---|

*UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF STATE LAW.*

*THESE DOCUMENTS (OR COPIES OF ANY THEREOF) PREPARED BY OR BEARING THE SEAL OF THE ENGINEER, SHALL NOT BE REUSED FOR ANY EXTENSIONS OF THE PROJECT OR ANY OTHER PROJECT WITHOUT THE WRITTEN CONSENT OF THE ENGINEER.*

| | | | |
|---|---|---|---|
| PROJ. ENGINEER: | C.M. | DRAWN BY: | G.M. |
| DESIGNED BY: | M.O. | CHECKED BY: | M.O. |
| DRAWING SCALE: | AS SHOWN | PLOT SCALE: | 1:1 |
| DRAWING DATE: | 12MAR25 | PRINT TYPE: | COLOR |
| OFFICE: | NY | PAPER SIZE: | ARCH D |
| PROJECT NO.: | 2705.0001Y009 | | |
| DRAWING FILE: | 2705.0001Y324.02.DWG | | |

ROUX
Roux Environmental Engineering & Geology, D.P.C.
209 SHAFTER STREET, ISLANDIA, NEW YORK 11749
(631) 232-2600

PROJECT NAME:
GOWANUS VILLAGE I, LLC - BROOKLYN, NEW YORK

PROJECT FOR:
BRT POWERHOUSE LLC

TITLE:
FIRST QUARTER 2024 - FOURTH QUARTER 2024 GROUNDWATER SAMPLING RESULTS

FIGURE
2

V:\CAD\PROJECTS\2705\V0001Y\324\2705.0001Y324.02.DWG

FORMER LATERAL CANAL
60'WIDE
(FILLED IN)

EASEMENT AS PER TAX MAP

1ST STREET
60'WIDE

DIRT

100'–0"

30'–0"

GATEHOUSE

FINAL MAP LINE – CITY OF NEW YORK

INSTALLED STEEL PILE BULKHEAD

2'-0" ±

2'X2'X4" CONCRETE YARD BLOCK

SPECIALTY ASPHALT ENTRY PAVING

PLAIN ASPHALT

225'–0"

BOILER HOUSE

TURBINE HALL

3 STORY BRICK BUILDING
BLOCK 967 LOT 24

180'–0"

3RD AVENUE
80.00' WIDE

GOWANUS CANAL
BULKHEAD

FRENCH DRAIN, SEE CIVIL DWGS

LIGHT POLE SEE ARCH DWGS

CATCH BASIN , SEE CIVIL DWGS

FLUSH MOUNT FREEBOARD HOSE BIBS, SEE ARCH DWG

SLIDING GATE, SEE ARCH DWG

ROLLED IN AGGREGATE ASPHALT

FIRE LANE NO PARKING

2'-0" STANDARD SIDEWALK SCORING

METAL FENCE ON 8" CONC. WALL

EDGE OF SIDEWALK · EDGE OF WALL · DRIVE FLARE · EDGE OF BLOCK · CL OF PILASTER

## LEGEND

- PROPERTY LINE
- SITE COMPOSITE COVER SYSTEM CONSISTING OF THE EXISTING 5–FT THICK CONCRETE MAT SLAB OVERLAIN BY A TSCA–COMPLIANT CAP, CONSISTING OF A 1.5–2 FT OF CLEAN IMPORTED SOIL, A 12–MIL DURA–SKIM LAYER, A 3–INCH THICK CONCRETE MUD–SLAB, A WATERPROOFING/VAPOR BARRIER LAYER (SEE NOTE 1), AND A 6–INCH THICK CONCRETE TOPPING SLAB.
- SITE COMPOSITE COVER SYSTEM CONSISTS OF APPROXIMATELY 3.5 FT OF 3/4" VIRGIN CRUSHED STONE, 2.8 FT OF RCA BLEND AND 3–INCHES OF 3/4" VIRGIN CRUSHED STONE.
- SITE COMPOSITE COVER SYSTEM CONSISTING OF THE EXISTING 5–FT THICK CONCRETE MAT SLAB OVERLAIN BY A TSCA–COMPLIANT CAP, CONSISTING OF A 1–2 FT OF CLEAN IMPORTED SOIL, A 3–INCH THICK CONCRETE MUD–SLAB, A WATERPROOFING/VAPOR BARRIER LAYER (SEE NOTE 1), AND A 6–INCH THICK CONCRETE TOPPING SLAB.
- THE COMPOSITE COVER SYSTEM CONSISTING OF A DEMARCATION LAYER OVERLAIN BY A MINIMUM OF 24–INCHES OF STONE OR RCA.
- SITE COMPOSITE COVER SYSTEM CONSISTS OF MINIMUM 3–INCH OF RCA AND 4–INCH OF ASPHALT BINDER COURSE AND 3–INCHES OF FINAL ASPHALT.
- SITE COMPOSITE COVER SYSTEM CONSISTS OF MINIMUM 3–INCH OF RCA AND 4–INCH OF CONCRETE SIDEWALKS AND CURBS.
- SITE COMPOSITE COVER SYSTEM CONSISTS OF 2 FT X 2 FT X 4 FT CONCRETE YARD BLOCKS UNDERLAIN BY 8–INCHES OF STONE/RCA SUBBASE.
- SITE COMPOSITE COVER SYSTEM CONSISTS OF A 3–INCH THICK MUD–SLAB, A WATERPROOFING/VAPOR BARRIER LAYER (SEE NOTE 1), AND A 6–INCH THICK CONCRETE TOPPING SLAB.
- SITE COMPOSITE COVER SYSTEM CONSISTS OF 2 FT OF CLEAN IMPORTED PLATING SOIL UNDERLAIN BY A DEMARCATION LAYER.
- SITE COMPOSITE COVER SYSTEM (DRAINAGE STRUCTURES) CONSISTS OF A SUBBASE OF 8 INCHES OF STONE AND AN 8–INCH DIAMETER PERFORATED PIPE, ULTIMATELY OVERLAIN BY APPROXIMATELY 5 FT OF STONE.
- SITE COMPOSITE COVER SYSTEM CONSISTS OF 18–INCH OF SOIL AND 6–INCH OF STONE UNDERLAIN BY A DEMARCATION LAYER.

## NOTES

1. SUB–SLAB WATERPROOFING/VAPOR BARRIER CONSISTS OF A LAYER OF PREPRUFE 300R SEALED WITH A LIQUID MEMBRANE AS NECESSARY
2. RCA – RECYCLED CONCRETE AGGREGATE

N

20' 0 20'

| NO. | DATE | REVISION DESCRIPTION | INT. |
|---|---|---|---|

*UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF STATE LAW.*

*THESE DOCUMENTS (OR COPIES OF ANY THEREOF) PREPARED BY OR BEARING THE SEAL OF THE ENGINEER, SHALL NOT BE REUSED FOR ANY EXTENSIONS OF THE PROJECT OR ANY OTHER PROJECT WITHOUT THE WRITTEN CONSENT OF THE ENGINEER.*

| | | | |
|---|---|---|---|
| PROJ. ENGINEER: C.M. | | DRAWN BY: G.M. | |
| DESIGNED BY: M.O. | | CHECKED BY: L.D. | |
| DRAWING SCALE: AS SHOWN | | PLOT SCALE: 1:1 | |
| DRAWING DATE: 12MAR25 | | PRINT TYPE: COLOR | |
| OFFICE: NY | | PAPER SIZE: ARCH D | |
| PROJECT NO.: 2705.0001Y009 | | | |
| DRAWING FILE: 2705.0001Y324.03.DWG | | | |

ROUX
Roux Environmental Engineering & Geology, D.P.C.
209 SHAFTER STREET, ISLANDIA, NEW YORK 11746
(631) 232-2600

PROJECT NAME:
PERIODIC REVIEW REPORT
GOWANUS VILLAGE I, LLC - BROOKLYN, NEW YORK

PROJECT FOR:
BRT POWERHOUSE LLC

TITLE:
SITE COMPOSITE COVER SYSTEM

FIGURE
3

V:\CAD\PROJECTS\2705\Y\0001\Y324\2705.0001Y324.03.DWG

# APPENDICES

A. USEPA and NYSDEC Approvals Communications and Approvals
B. IC/EC Certification Form
C. NYSDEC-Approved SMP and Approval Letter
D. Quarterly Groundwater Sampling Results Letters
E. Site Inspection Checklist and Photo Log

# APPENDIX A

USEPA and NYSDEC Approvals Communications and Approvals

**From:** Granger, Mark
**To:** Lauren Dolginko
**Cc:** Carr, Brian
**Subject:** FW: BRT Powerhouse (Site No. C224099) - Final Report
**Date:** Wednesday, August 21, 2024 6:51:14 PM

**This message originated outside your organization. Please use caution!**

Lauren –

EPA has reviewed the Final Report for the Powerhouse Administrative Settlement Agreement and Order on Consent, Index NumberCERCLA-02-2017-2021 ("Order"), issued by EPA on June 19, 2017.

EPA approves the Final Report with respect to the work required by the Order, as amended. Please feel free to reach out if there are any questions, all the best.

-- Mark

| | |
|---|---|
| **From:** | Lauren Dolginko |
| **To:** | Mustico, Richard P (DEC); Michelle Okvist |
| **Cc:** | Frank Cherena; Charlie McGuckin; Bennett, William B (DEC) |
| **Subject:** | RE: Gowanus Village I (C224099) - BRT Powerhouse Second Quarter 2024 Groundwater Sampling Results Summary & 2024 O&M Request |
| **Date:** | Thursday, March 6, 2025 5:11:20 PM |
| **Attachments:** | image001.png<br>image002.png<br>image003.png<br>image004.png<br>image005.png<br>image006.png<br>image007.png<br>image008.png<br>image009.png<br>image010.png |

---

Hi Richard,

Thank you for getting back to me. To clarify, we have been providing you with the quarterly groundwater analytical results and submitted an O&M Modification request in August 2024. You reviewed and provided comments which we addressed in the revised O&M Modification Request which was submitted in December 2024. In the O&M Modification request, we included a groundwater trend analysis of the analytical data that has been collected at the site for several years. Since redevelopment has now been complete for a few years (TCO was received in 2022), we also included a request to reduce the PRR frequency to once every 3 years. Additionally, we have not yet received any feedback or an approval letter for the PRR dated May 2024.

The O&M Modification request, dated December 2024, can be accessed via link below, for your convenience. If you could please review and advise, we would appreciate it.

Gowanus Village I - O&M Modification Request

Please feel free to call me (631-697-2773) if you'd like to discuss.

Thanks,
Lauren

---

**From:** Mustico, Richard P (DEC) <richard.mustico1@dec.ny.gov>
**Sent:** Thursday, February 27, 2025 8:05 AM
**To:** Lauren Dolginko <ldolginko@rouxinc.com>; Michelle Okvist <mokvist@rouxinc.com>
**Cc:** Frank Cherena <fcherena@rouxinc.com>; Charlie McGuckin <cmcguckin@rouxinc.com>; Bennett, William B (DEC) <william.bennett@dec.ny.gov>
**Subject:** RE: Gowanus Village I (C224099) - BRT Powerhouse Second Quarter 2024 Groundwater Sampling Results Summary & 2024 O&M Request

**This message originated outside your organization. Please use caution!**

---

Hi Lauren,

DEC will require a PRR to be submitted this year and will return to the request of submitting PRRs every 3 years after this year's PRR is submitted. As required in site management all available monitoring wells need to be sampled. Once DEC receives this sampling data, we can then determine which monitoring wells are able to be excluded from groundwater sampling events.

Please let me know if you have any questions, Richard.

**Richard P. Mustico, P.E.**
he/him/his
Professional Engineer 1 (Environmental), Division of Environmental Remediation

**New York State Department of Environmental Conservation**
625 Broadway, Albany, NY 12233-7016
P: 518-402-9647| F: 518-402-9627| richard.mustico1@dec.ny.gov

www.dec.ny.gov | | |

---

**From:** Lauren Dolginko <ldolginko@rouxinc.com>
**Sent:** Wednesday, February 26, 2025 10:47 AM
**To:** Mustico, Richard P (DEC) <richard.mustico1@dec.ny.gov>; Michelle Okvist <mokvist@rouxinc.com>
**Cc:** Frank Cherena <fcherena@rouxinc.com>; cmcguckin@rouxinc.com; Bennett, William B (DEC) <william.bennett@dec.ny.gov>
**Subject:** RE: Gowanus Village I (C224099) - BRT Powerhouse Second Quarter 2024 Groundwater Sampling Results Summary & 2024 O&M Request

*ATTENTION: This email came from an external source. Do not open attachments or click on links from unknown senders or unexpected emails.*

Hi Richard,

Just left you another voicemail. If you could please advise on your review of the May 2024 PRR and O&M Modification Request, I would appreciate it. We need direction from you since the next PRR is due on March 31, 2025, however redevelopment is complete and it would be appropriate to reduce the PRR frequency to once every three years.

Additionally, we are preparing for the first quarter 2025 groundwater sampling event and need to know if the requested O&M modifications are acceptable.

Thanks,
Lauren

---

**From:** Lauren Dolginko
**Sent:** Wednesday, February 5, 2025 9:59 AM
**To:** 'Mustico, Richard P (DEC)' <richard.mustico1@dec.ny.gov>; Michelle Okvist <mokvist@rouxinc.com>
**Cc:** Frank Cherena <fcherena@rouxinc.com>; Charlie McGuckin <cmcguckin@rouxinc.com>; 'Bennett, William B (DEC)' <william.bennett@dec.ny.gov>
**Subject:** RE: Gowanus Village I (C224099) - BRT Powerhouse Second Quarter 2024 Groundwater Sampling Results Summary & 2024 O&M Request

Hi Richard, good morning.

Just following-up on our phone call from last week. Please provide me with an update on your review of the May 2024 PRR and O&M Modification Request. Since redevelopment is complete, submittal of the PRR should be reduced to once every three years. We need confirmation from you since we have received the attached PRR reminder notice with a due date of March 31, 2025.

Thanks,
Lauren

---

**From:** Lauren Dolginko
**Sent:** Tuesday, January 21, 2025 3:23 PM
**To:** 'Mustico, Richard P (DEC)' <richard.mustico1@dec.ny.gov>; Michelle Okvist <mokvist@rouxinc.com>
**Cc:** Frank Cherena <fcherena@rouxinc.com>; Charlie McGuckin <cmcguckin@rouxinc.com>; 'Bennett, William B (DEC)' <william.bennett@dec.ny.gov>
**Subject:** RE: Gowanus Village I (C224099) - BRT Powerhouse Second Quarter 2024 Groundwater Sampling Results Summary & 2024 O&M Request

Hi Richard,

I just left you a voicemail. We received the attached PRR reminder notice. Can you please provide an update on when we will receive any comments or approval for the May 2024 PRR? Additionally, if there's an update on the O&M Modification Request review? We included a request to reduce the PRR frequency from every year to every three years now that redevelopment has been completed.

Please give me a call (631-697-2773) or respond back to this email with an update.

Thanks,
Lauren

---

**From:** Lauren Dolginko
**Sent:** Thursday, January 16, 2025 9:38 AM
**To:** Mustico, Richard P (DEC) <richard.mustico1@dec.ny.gov>; Michelle Okvist <mokvist@rouxinc.com>
**Cc:** Frank Cherena <fcherena@rouxinc.com>; Charlie McGuckin <cmcguckin@rouxinc.com>; Bennett, William B (DEC) <william.bennett@dec.ny.gov>
**Subject:** RE: Gowanus Village I (C224099) - BRT Powerhouse Second Quarter 2024 Groundwater Sampling Results Summary & 2024 O&M Request

Hi Richard,

Would you be able to please provide an update on your review of the O&M Modification request and your review and approval of the PRR submitted in May 2024? Please give me a call (631-697-2773) if there's anything you'd like to discuss.

Thanks,
Lauren

---

**From:** Lauren Dolginko
**Sent:** Monday, January 6, 2025 8:38 AM
**To:** Mustico, Richard P (DEC) <richard.mustico1@dec.ny.gov>; Michelle Okvist <mokvist@rouxinc.com>
**Cc:** Frank Cherena <fcherena@rouxinc.com>; Charlie McGuckin <cmcguckin@rouxinc.com>; Bennett, William B (DEC) <william.bennett@dec.ny.gov>
**Subject:** RE: Gowanus Village I (C224099) - BRT Powerhouse Second Quarter 2024 Groundwater Sampling Results Summary & 2024 O&M Request

Hi Richard,

Good morning. I am following-up to confirm you received the O&M Modification request and to see if you have an update on your review and approval of the PRR submitted in May 2024.

Thanks,
Lauren

---

**From:** Lauren Dolginko
**Sent:** Friday, December 20, 2024 3:39 PM

**To:** Mustico, Richard P (DEC) <richard.mustico1@dec.ny.gov>; Michelle Okvist <mokvist@rouxinc.com>
**Cc:** Frank Cherena <fcherena@rouxinc.com>; Charlie McGuckin <cmcguckin@rouxinc.com>; Bennett, William B (DEC) <william.bennett@dec.ny.gov>
**Subject:** RE: Gowanus Village I (C224099) - BRT Powerhouse Second Quarter 2024 Groundwater Sampling Results Summary & 2024 O&M Request

Hi Richard,

I have just uploaded the revised O&M Modification Request, which addresses your comments, via NYSDEC file transfer service. Please confirm receipt when you can. We will be completing the fourth quarter sampling event in accordance with the current monitoring plan, however are hoping to receive your concurrence to our modified plan for 2025 sampling.

Additionally, I wanted to follow-up on the Periodic Review Report submitted for this Site, which was submitted in May 2024. See attached email – we established a onedrive link for your convenience back in October. We have not yet received an approval letter for this Periodic Review Report. Can you provide an update?

Thanks,
Lauren

---

**From:** Mustico, Richard P (DEC) <richard.mustico1@dec.ny.gov>
**Sent:** Monday, September 30, 2024 8:53 AM
**To:** Lauren Dolginko <ldolginko@rouxinc.com>; Michelle Okvist <mokvist@rouxinc.com>
**Cc:** Frank Cherena <fcherena@rouxinc.com>; Charlie McGuckin <cmcguckin@rouxinc.com>; Bennett, William B (DEC) <william.bennett@dec.ny.gov>
**Subject:** RE: Gowanus Village I (C224099) - BRT Powerhouse Second Quarter 2024 Groundwater Sampling Results Summary & 2024 O&M Request

**This message originated outside your organization. Please use caution!**

---

Hi Lauren,

Please re-submit the request for O&M Modification with the following modifications incorporated:

1. Trend analysis should be included in the revised O&M Modification request to support this proposal. Data clearly showing stagnating and decreasing concentrations in the monitoring well network is not included, but is referenced in the request. Please revise and resubmit with supporting information.
2. Include in the revised O&M Modification request original rational for why each well was included in the program and how the revised program still adheres to these original goals proposed.

3. Removal of monitoring wells strictly due to them being in the way of site activities is not an appropriate rationale for removal. This language should be replaced and instead the request should be reinforced with the required supporting documentation above.

Let me know if you wish to discuss, Richard.

**Richard P. Mustico**
he/him/his
Assistant Engineer (Environmental), Division of Environmental Remediation

**New York State Department of Environmental Conservation**
625 Broadway, Albany, NY 12233-7016
P: 518-402-9647| F: 518-402-9627| richard.mustico1@dec.ny.gov

www.dec.ny.gov | | | |

---

**From:** Lauren Dolginko <ldolginko@rouxinc.com>
**Sent:** Monday, September 23, 2024 12:00 PM
**To:** Mustico, Richard P (DEC) <richard.mustico1@dec.ny.gov>; Michelle Okvist <mokvist@rouxinc.com>
**Cc:** Frank Cherena <fcherena@rouxinc.com>; cmcguckin@rouxinc.com; Bennett, William B (DEC) <william.bennett@dec.ny.gov>
**Subject:** RE: Gowanus Village I (C224099) - BRT Powerhouse Second Quarter 2024 Groundwater Sampling Results Summary & 2024 O&M Request

*ATTENTION: This email came from an external source. Do not open attachments or click on links from unknown senders or unexpected emails.*

Hi Richard,

Good morning, I just left you a voicemail. I am checking in on your review of the attached O&M Modification request. I am trying to coordinate our third quarter sampling event and your feedback/approval of the attached would be appreciated. Please feel free to give me a call to discuss (631-697-2773).

Thanks,
Lauren

---

**From:** Lauren Dolginko

**Sent:** Monday, September 16, 2024 3:57 PM
**To:** Mustico, Richard P (DEC) <richard.mustico1@dec.ny.gov>; Michelle Okvist <mokvist@rouxinc.com>
**Cc:** Frank Cherena <fcherena@rouxinc.com>; Charlie McGuckin <cmcguckin@rouxinc.com>; Bennett, William B (DEC) <william.bennett@dec.ny.gov>
**Subject:** RE: Gowanus Village I (C224099) - BRT Powerhouse Second Quarter 2024 Groundwater Sampling Results Summary & 2024 O&M Request

Hi Richard,

I am following up on the attached O&M Modification request. Have you had a chance to review? Please provide me with an update when you can, your feedback is appreciated as we are currently finalizing our sampling schedule.

Thanks,
Lauren

---

**From:** Lauren Dolginko
**Sent:** Wednesday, September 4, 2024 1:36 PM
**To:** Mustico, Richard P (DEC) <richard.mustico1@dec.ny.gov>; Michelle Okvist <mokvist@rouxinc.com>
**Cc:** Frank Cherena <fcherena@rouxinc.com>; Charlie McGuckin <cmcguckin@rouxinc.com>; Bennett, William B (DEC) <william.bennett@dec.ny.gov>
**Subject:** RE: Gowanus Village I (C224099) - BRT Powerhouse Second Quarter 2024 Groundwater Sampling Results Summary & 2024 O&M Request

Hi Richard,

Do you have an update on your review of the groundwater results summary and our request to modify the monitoring and sampling plan? We are getting ready to schedule the third quarter groundwater sampling event and are looking for feedback on our request.

Thanks,
Lauren

---

**From:** Mustico, Richard P (DEC) <richard.mustico1@dec.ny.gov>
**Sent:** Tuesday, August 20, 2024 8:59 AM
**To:** Michelle Okvist <mokvist@rouxinc.com>
**Cc:** Lauren Dolginko <ldolginko@rouxinc.com>; Frank Cherena <fcherena@rouxinc.com>; Charlie McGuckin <cmcguckin@rouxinc.com>; Bennett, William B (DEC) <william.bennett@dec.ny.gov>
**Subject:** RE: Gowanus Village I (C224099) - BRT Powerhouse Second Quarter 2024 Groundwater Sampling Results Summary & 2024 O&M Request

**This message originated outside your organization. Please use caution!**

Hi Michelle,

DEC will need more time to review. Once reviewed I will need to coordinate with my supervisor who is out this week.

Thank you, Richard.

**Richard P. Mustico**
he/him/his
Assistant Engineer (Environmental), Division of Environmental Remediation

**New York State Department of Environmental Conservation**
625 Broadway, Albany, NY 12233-7016
P: 518-402-9647| F: 518-402-9627| richard.mustico1@dec.ny.gov

www.dec.ny.gov | | | |

---

**From:** Michelle Okvist <mokvist@rouxinc.com>
**Sent:** Monday, August 19, 2024 1:48 PM
**To:** Mustico, Richard P (DEC) <richard.mustico1@dec.ny.gov>
**Cc:** Lauren Dolginko <ldolginko@rouxinc.com>; Frank Cherena <fcherena@rouxinc.com>; cmcguckin@rouxinc.com
**Subject:** RE: Gowanus Village I (C224099) - BRT Powerhouse Second Quarter 2024 Groundwater Sampling Results Summary & 2024 O&M Request

*ATTENTION: This email came from an external source. Do not open attachments or click on links from unknown senders or unexpected emails.*

Hi Richard,

We would like to check in on the status of your review of the attached Request for Reduction of Frequency of Groundwater Monitoring and Sampling Plan. We are currently working to coordinate the Third Quarter Sampling event, and due to the specifics of the request, we want to be sure we come to a decision before moving forward with the field sampling process.

Please let us know if you have any questions, comments, or concerns.

Thanks,
Michelle

**Michelle E. Okvist | Staff Scientist II**
209 Shafter Street, Islandia, New York 11749
Main: (631) 232-2600 | Direct: (631) 630-2380 | Mobile: (631) 831-8490
Email: mokvist@rouxinc.com | Website: www.rouxinc.com

---

**From:** Michelle Okvist
**Sent:** Sunday, August 11, 2024 9:59 PM
**To:** richard.mustico1@dec.ny.gov
**Cc:** Lauren Dolginko <ldolginko@rouxinc.com>; Frank Cherena <fcherena@rouxinc.com>; Charlie McGuckin <cmcguckin@rouxinc.com>
**Subject:** Gowanus Village I (C224099) - BRT Powerhouse Second Quarter 2024 Groundwater Sampling Results Summary & 2024 O&M Request

Hi Richard,

I have just uploaded the Second Quarter 2024 Groundwater Sampling Results Summary for the Gowanus Village I (BRT Powerhouse) Site located at 322 3rd Avenue, Brooklyn, New York (C224099) to the NYSDEC file transfer service. Please let me know if you have any issues downloading the report.

Under a separate cover, I have attached above a Request for Reduction of Frequency of Groundwater Monitoring and Sampling Plan. Please review, and let us know if you have any questions, comments, or concerns.

Thanks,
**Michelle E Okvist | Staff Scientist II**
209 Shafter Street, Islandia, NY 11749
Main: 631-232-2600 | Direct: 631-630-2380 | Mobile: 631-831-8490
Email: mokvist@rouxinc.com | Website: www.rouxinc.com



**California | Illinois | Massachusetts | New Jersey | New York | Texas | Virginia**



Please consider the environment before printing this email.
NOTICE: This electronic communication, including any authorized attachments, contains information that may be legally privileged, protected, confidential and/or exempt from disclosure or certain types of use under applicable law. This information is for the sole use of the intended recipient(s). If you are not the intended recipient(s) or the employee or agent responsible for delivery of this message to the intended recipient(s), you are hereby notified that any review, use, disclosure, copying, distribution or the taking of any action in reliance on the contents of this e-mail or any attachments is strictly prohibited. You are further advised that review by an individual other than the intended recipient(s) shall not constitute a waiver of any attorney-client privilege which may apply to this communication. If you have received this communication in error, please notify the

sender immediately by return e-mail, permanently delete this e-mail and any attachments from all computers on which they may be stored and destroy any print-outs of this email and any attachments.

# APPENDIX B

IC/EC Certification Form

**Enclosure 2**
**NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION**
**Site Management Periodic Review Report Notice**
**Institutional and Engineering Controls Certification Form**

**Site Details** **Box 1**

**Site No.** **C224099**

**Site Name Gowanus Village I**

Site Address: 153 2nd St a/k/a 322 3rd Avenue Zip Code: 11215
City/Town: Brooklyn
County: Kings
Site Acreage: 2.496

Reporting Period: March 01, 2024 to March 01, 2025

| | YES | NO |
|---|---|---|
| 1. Is the information above correct? | ☑ | ☐ |
| If NO, include handwritten above or on a separate sheet. | | |
| 2. Has some or all of the site property been sold, subdivided, merged, or undergone a tax map amendment during this Reporting Period? | ☐ | ☑ |
| 3. Has there been any change of use at the site during this Reporting Period (see 6NYCRR 375-1.11(d))? | ☐ | ☑ |
| 4. Have any federal, state, and/or local permits (e.g., building, discharge) been issued for or at the property during this Reporting Period? | ☐ | ☑ |
| **If you answered YES to questions 2 thru 4, include documentation or evidence that documentation has been previously submitted with this certification form.** | | |
| 5. Is the site currently undergoing development? | ☐ | ☑ |

**Box 2**

| | YES | NO |
|---|---|---|
| 6. Is the current site use consistent with the use(s) listed below? Restricted-Residential, Commercial, and Industrial | ☑ | ☐ |
| 7. Are all ICs in place and functioning as designed? | ☑ | ☐ |

**IF THE ANSWER TO EITHER QUESTION 6 OR 7 IS NO, sign and date below and DO NOT COMPLETE THE REST OF THIS FORM. Otherwise continue.**

**A Corrective Measures Work Plan must be submitted along with this form to address these issues.**

Signature of Owner, Remedial Party or Designated Representative Date

**Box 2A**

| | YES | NO |
|---|---|---|
| 8. Has any new information revealed that assumptions made in the Qualitative Exposure Assessment regarding offsite contamination are no longer valid? | ☐ | ☑ |

**If you answered YES to question 8, include documentation or evidence that documentation has been previously submitted with this certification form.**

| | | |
|---|---|---|
| 9. Are the assumptions in the Qualitative Exposure Assessment still valid? (The Qualitative Exposure Assessment must be certified every five years) | ☑ | ☐ |

**If you answered NO to question 9, the Periodic Review Report must include an updated Qualitative Exposure Assessment based on the new assumptions.**

**SITE NO. C224099** **Box 3**

**Description of Institutional Controls**

| Parcel | Owner | Institutional Control |
|---|---|---|
| **3-967-1** | BRT Powerhouse LLC | Ground Water Use Restriction<br>Soil Management Plan<br>Monitoring Plan<br>Site Management Plan<br>O&M Plan<br>IC/EC Plan |

Environmental Easement which entails the property may be used for: restricted residential, commercial, or industrial use. All ECs must be operated and maintained as specified in the SMP. All ECs must be inspected at a frequency and in a manner defined in the SMP. The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the New York City Department of Health and Mental Hygiene to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department. Groundwater and other environmental or public health monitoring must be performed as defined in the SMP. Data and information pertinent to Site management must be reported at the frequency and in a manner as defined in the SMP. All future activities that will disturb remaining contaminated material must be conducted in accordance with the SMP. Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in the SMP. Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in the SMP. Access to the Site must be provided to agents, employees, or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Easement. The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries, and any potential impacts that are identified must be monitored or mitigated, and vegetable gardens and farming on the Site are prohibited.

**Box 4**

**Description of Engineering Controls**

| Parcel | Engineering Control |
|---|---|
| **3-967-1** | Cover System<br>Groundwater Containment<br>Monitoring Wells |

Modified Site Composite Cover System which prevents exposure to remaining contamination in soil/fill at the Site. LNAPL Recovery Program removes any residual LNAPL that may be present at the groundwater table. Vapor Barrier is capable of preventing SVI of VOCs within the subsurface portions of the buildings.

**Box 5**

**Periodic Review Report (PRR) Certification Statements**

1. I certify by checking "YES" below that:

   a) the Periodic Review report and all attachments were prepared under the direction of, and reviewed by, the party making the Engineering Control certification;

   b) to the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program, and generally accepted engineering practices; and the information presented is accurate and compete.

| YES | NO |
|---|---|
| ☑ | ☐ |

2. For each Engineering control listed in Box 4, I certify by checking "YES" below that all of the following statements are true:

   (a) The Engineering Control(s) employed at this site is unchanged since the date that the Control was put in-place, or was last approved by the Department;

   (b) nothing has occurred that would impair the ability of such Control, to protect public health and the environment;

   (c) access to the site will continue to be provided to the Department, to evaluate the remedy, including access to evaluate the continued maintenance of this Control;

   (d) nothing has occurred that would constitute a violation or failure to comply with the Site Management Plan for this Control; and

   (e) if a financial assurance mechanism is required by the oversight document for the site, the mechanism remains valid and sufficient for its intended purpose established in the document.

| YES | NO |
|---|---|
| ☑ | ☐ |

**IF THE ANSWER TO QUESTION 2 IS NO, sign and date below and DO NOT COMPLETE THE REST OF THIS FORM. Otherwise continue.**

**A Corrective Measures Work Plan must be submitted along with this form to address these issues.**

Signature of Owner, Remedial Party or Designated Representative

Date

**IC CERTIFICATIONS**
**SITE NO. C224099**

**Box 6**

**SITE OWNER OR DESIGNATED REPRESENTATIVE SIGNATURE**

I certify that all information and statements in Boxes 1,2, and 3 are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

I Paul Parkhill (print name) at 322 Third Avenue, Brooklyn, NY 11215 (print business address)

am certifying as Remedial Party (Owner or Remedial Party)

for the Site named in the Site Details Section of this form.

Signature of Owner, Remedial Party, or Designated Representative Rendering Certification

3/28/25
Date

## EC CERTIFICATIONS

**Box 7**

### Professional Engineer Signature

I certify that all information in Boxes 4 and 5 are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

I Charles McGuckin at 209 Shafter Street, Islandia, NY 11749,
print name print business address

am certifying as a Professional Engineer for the Remedial Party
(Owner or Remedial Party)




| Signature of Professional Engineer, for the Owner or Remedial Party, Rendering Certification | Stamp (Required for PE) | Date |
|---|---|---|
| | | 03/31/2025 |

# APPENDIX C

NYSDEC-Approved SMP and Approval Letter

**NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION**

**Division of Environmental Remediation, Remedial Bureau B**
625 Broadway, 12th Floor, Albany, NY 12233-7016
P: (518) 402-9767 I F: (518) 402-9773
www.dec.ny.gov

July 29, 2020

Frank Cherena
Roux Associates
209 Shafter St.
Islandia, NY 11749

RE: Site Management Plan (revised)
Gowanus Village I
Brooklyn, New York
BCP #C224099

Dear Mr. Cherena:

The Department has reviewed your revised Site Management Plan (SMP) for the above referenced site dated May 15, 2020. The updated document remains consistent with the 2014 Decision Document and as such the Department has no comments. The May 15, 2020 SMP is hereby approved.

If you have any questions, or wish to discuss, please contact me by e-mail at richard.mustico1@dec.ny.gov.

Sincerely,



Richard P. Mustico, E.I.T.
Project Manager
Remedial Section B

ec: G Burke, NYSDEC
J Grathwol, NYSDEC
J O'Connell, NYSDEC
S McLaughlin, NYSDOH
J. Nealon, NYSDOH
A. Martin, NYSDOH
S. Lawrence, NYSDOH

**GOWANUS VILLAGE I, LLC KINGS COUNTY**

**BROOKLYN, NEW YORK**

# SITE MANAGEMENT PLAN

**NYSDEC Site Number: C224099**

**USEPA ID # 110057070164**

**Prepared for:**

Gemini Arts Initiative, Inc.

153 2nd Street, Brooklyn, New York

**Prepared by:**

Roux Environmental Engineering and Geology, D.P.C. 209 Shafter Street, Islandia, New York 11749 631-232-2600

**Revisions to Final Approved Site Management Plan:**

| Revision No. | Date Submitted | Summary of Revision | NYSDEC Approval Date |
|---|---|---|---|
| 1 | May 15, 2020 | Revisions as requested by NYSDEC in letter dated February 7, 2020 and incorporation of paragraphs 44 a-e of Administrative Settlement Agreement and Order on Consent, dated June 26, 2017. | July 29, 2020 |
| | | | |
| | | | |
| | | | |

**DECEMBER 2017**

# CERTIFICATION STATEMENT

I, Charles McGuckin, certify that I am currently a NYS registered professional engineer and that this Site Management Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).




_____ P.E.

_____ DATE

**GOWANUS VILLAGE I, LLC**

**KINGS COUNTY**

**BROOKLYN, NEW YORK**

# SITE MANAGEMENT PLAN

## TABLE OF CONTENTS

CERTIFICATION STATEMENT ..... 2
TABLE OF CONTENTS ..... 3
EXECUTIVE SUMMARY ..... 8
1.0 INTRODUCTION ..... 10
1.1 General ..... 10
1.2 Revisions ..... 11
1.3 Notifications ..... 12
1.4 USEPA Order on Consent ..... 13
2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS ..... 15
2.1 Site Location and Description ..... 15
2.2 Physical Setting ..... 15
2.2.1 Land Use ..... 15
2.2.2 Geology ..... 16
2.2.3 Hydrogeology ..... 18
2.3 Investigation and Remedial History ..... 18
2.3.1 Environmental Investigation History ..... 18
2.3.2 Interior Buildings Materials Investigations and Remediation ..... 22
2.3.2.1 Boiler House Building Materials Investigation and Remediation ..... 22
2.3.2.2 Turbine Hall Building Materials Investigation and Remediation ..... 23
2.3.2.2.1 Proposed Turbine Hall Sump Structure Remediation ..... 25
2.3.3 Gowanus Canal Bulkhead Design ..... 25
2.4 Remedial Action Objectives ..... 26
2.4.1 Groundwater ..... 26
2.4.2 Soil ..... 26
2.4.3 Soil Vapor ..... 27
2.5 Remaining Contamination ..... 27
2.5.1 Soil ..... 27
2.5.2 Groundwater ..... 29
2.5.3 Soil Vapor ..... 31
3.0 INSTITUTIONAL AND ENGINEERING CONTROL PLAN ..... 33
3.1 General ..... 33
3.2 Institutional Controls ..... 33
3.3 Engineering Controls ..... 34
3.3.1 Cover System ..... 34

3.3.2 Vapor Barrier Installation ....35
3.3.3 Spill Buster Recovery System ....36
3.3.4 Criteria for Completion of Remediation/Termination of Remedial Systems ....37
*3.3.4.1 Cover* ....37
*3.3.4.2 LNAPL Recovery* ....38

4.0 MONITORING AND SAMPLING PLAN ....39
4.1 General ....39
4.2 Site–wide Inspection ....41
4.3 Groundwater and LNAPL Monitoring ....43
4.3.1 Recovery System Monitoring and Groundwater Gauging ....43
4.3.2 Groundwater Sampling ....44
4.4 Soil Vapor Intrusion Sampling ....47

5.0 OPERATION AND MAINTENANCE PLAN ....49
5.1 General ....49
5.2 Remedial System (or other Engineering Control) Performance Criteria ....49
5.3 Operation and Maintenance of Spill Buster Recovery System ....50
5.3.1 System Start-Up and Testing ....50
5.3.2 Routine System Operation and Maintenance ....50
5.3.3 Non-Routine Operation and Maintenance ....51
5.3.4 System Monitoring Devices and Alarms ....51

6.0 PERIODIC ASSESSMENTS/EVALUATIONS ....52
6.1 Climate Change Vulnerability Assessment ....52
6.1.1 Flood Plain ....52
6.1.2 Erosion ....52
6.1.3 Electricity ....52
6.1.4 Spill/Containment Release ....53
6.2 Green Remediation Evaluation ....53
6.2.1 Timing of Green Remediation Evaluations ....54
6.2.2 Remedial Systems ....54
6.2.3 Frequency of System Checks, Sampling and Other Periodic Activities ....54
6.3 Remedial System Optimization ....55

7.0. REPORTING REQUIREMENTS ....56
7.1 Site Management Reports ....56
7.2 Monthly Reports ....58
7.3 Periodic Review Report ....58
7.3.1 Certification of Institutional and Engineering Controls ....60
7.4 Corrective Measures Work Plan ....61
7.5 Remedial Site Optimization Report ....61

8.0 REFERENCES ....62

## List of Tables

1. Notifications *(Embedded in Text in Section 1.3*)
2. Summary of Groundwater Gauging Data
3. Summary of Volatile Organic Compounds Exceedances in Soil
4. Summary of Semi-Volatile Organic Compounds Exceedances in Soil
5. Summary of Metals Exceedances in Soil
6. Summary of Polychlorinated Biphenyls Exceedances in Soil
7. Summary of Volatile Organic Compounds in Groundwater
8. Summary of Semi-volatile Organic Compounds in Groundwater
9. Summary of Metals in Groundwater
10. Summary of Polychlorinated Biphenyls in Groundwater
11. Summary of Pesticides and Herbicides in Groundwater
12. Historical Soil Vapor Sample Exceedances
13. Post Remediation Inspection and Monitoring Schedule *(Embedded in Text in Section 4.1)*
14. Well Construction Details *(Embedded in Text in Section 4.3.2)*
15. Interim Reporting Summary/Schedule *(Embedded in Text in Section 7.1)*

## List of Figures

Figure 1 – Site Map
Figure 2 – Engineering Control Location – Composite Cover System
Figure 3 – Groundwater Contour Map and January and March 2020 Sample Exceedances
Figure 4 – Cross Sections and Details
Figure 5 – SVOCs and PCB Concentrations in Soil Confirmatory Endpoint Samples in Areas of Additional Excavation
Figure 6 – Remaining Total SVOCs and PCB Concentrations in Soil
Figure 7 – Remaining PCB and Total SVOC Soil Exceedances Below Turbine Hall Building Slab
Figure 8 – Historical Soil Vapor Sample Exceedances

## List of Appendices

Appendix A – Environmental Easement
Appendix B – List of Site Contacts
Appendix C – Excavation Work Plan
Appendix D – Site Specific Boring Logs
Appendix E – Monitoring Well Boring and Construction Logs
Appendix F – Site-Specific Health and Safety Plan & Community Air Monitoring Plan
Appendix G – Operation and Maintenance Manual
Appendix H – Quality Assurance Project Plan
Appendix I – Site Management Forms
Appendix J – Field Sampling Plan

## List of Acronyms

| | |
|---|---|
| AIGV | AI Gowanus Village, LLC |
| AOCs | Areas of Concern |
| BCA | Brownfield Cleanup Agreement |
| BCP | Brownfield Cleanup Program |
| BRTP | BRT Powerhouse, LLC |
| CAMP | Community Air Monitoring |
| CERCLA | Comprehensive Environmental Response, Compensation and Liability Act |
| CES | Creative Environmental Solutions Corp. |
| CMWP | Corrective Measures Work Plan |
| COC | Certificate of Completion |
| DER | Division of Environmental Remediation |
| EC | Engineering Control |
| ESA | Environmental Site Assessment |
| EWP | Excavation Work Plan |
| FER | Final Engineering Report |
| ft bls | feet below land surface |
| GAII | Gemini Arts Initiative, Inc. |
| GAS | Gemini Arts Subsidiary LLC |
| GVI | Gowanus Village I, LLC |
| HASP | Health and Safety Plan |
| Hydro Tech | Hydro Tech Environmental Corporation |
| IC | Institutional Control |
| Korner | Korner Environmental, Inc. |
| Langan | Langan Engineering and Environmental Services |
| LNAPL | Light Non-Aqueous Phase Liquid |
| NAVD 88 | North American Vertical Datum of 1988 |
| NYSDEC | New York State Department of Environmental Conservation |
| NYSDOH | New York State Department of Health |
| O&M | Operation and Maintenance |
| PAHs | Polycyclic Aromatic Hydrocarbons |
| PCBs | Polychlorinated Biphenyls |
| PID | Photoionization Detector |
| PoG | Protection of Groundwater |
| PRR | Periodic Review Report |
| PVC | Polyvinyl Chloride |
| QA/QC | Quality Assurance/Quality Control |
| RA | Remedial Action |
| RAO | Remedial Action Objective |
| RAWP | Remedial Action Work Plan |
| RCA | Recycled Concrete Aggregate |
| RI | Remedial Investigation |
| Roux Associates | Roux Associates, Inc. |
| RRSCOs | Restricted Residential Soil Cleanup Standards |

| | |
|---|---|
| SCO | Soil Cleanup Objective |
| SMP | Site Management Plan |
| SRIWP | Supplemental Remedial Investigation Work Plan |
| SSDS | Sub-slab Depressurization System |
| SVI | Soil Vapor Intrusion |
| SVOCs | Semi-Volatile Organic Compounds |
| TCL | Target Compound List |
| USEPA | United States Environmental Protection Agency |
| UUSCO | Unrestricted Use Soil Cleanup Standards |
| VOC | Volatile Organic Compounds |

## EXECUTIVE SUMMARY

The following provides a brief summary of the controls implemented for the Site, as well as the inspections, monitoring, maintenance and reporting activities required by this Site Management Plan (SMP):

Site Identification:

BCP Site No. C224099
Gowanus Village I, LLC
153 2nd Street a/k/a 322 3rd Avenue
Brooklyn, Kings, New York

| | |
|---|---|
| Institutional Controls: | 1. The property may be used for restricted residential, commercial and/or industrial use only. |
| | 2. Environmental Easement. |
| | 3. Performance of soil vapor intrusion evaluation in event of redevelopment. |
| | 4. All Engineering Controls (ECs) must be inspected at a frequency and in a manner defined in the SMP. |
| Engineering Controls: | 1. Cover system |
| | 2. Vapor Barrier |
| | 3. Light Non-Aqueous Phase Liquid (LNAPL) Recovery System |

| Inspections: | Frequency |
|---|---|
| 1. Cover inspection | Annually |
| 2. High Viscosity Magnum Spill Buster (Spill Buster) inspection | As needed |
| 3. Vapor barrier | Upon installation |
| 4. Site-Wide Inspection | Annually; First inspection in 2018 |

Site Identification:

BCP Site No. C224099
Gowanus Village I, LLC
153 2nd Street a/k/a 322 3rd Avenue
Brooklyn, Kings, New York

| Monitoring: | Frequency |
|---|---|
| 1. LNAPL recovery wells | Monthly |
| 2. Monitoring wells - Groundwater | Quarterly for first 2 years. Any change in frequency after two years will need to be approved by the New York State Department of Environmental Conservation (NYSDEC). |
| 3. Indoor Vapor Sampling | Upon completion of redevelopment, prior to occupancy of the building. |
| Maintenance: | |
| 1. Spill Buster pump maintenance | As Needed |
| 2. Spill Buster recovery drum change-out | As Needed |
| Reporting: | |
| 1. Monthly Progress Report (Ongoing, as necessary) | Monthly through issuance of COC |
| 2. | |
| 3. Groundwater and LNAPL Monitoring Report | Quarterly, corresponding with groundwater monitoring frequency |
| 4. Periodic Review Report | Annually |

Further descriptions of the above requirements are provided in detail in the latter sections of this Site Management Plan.

# 1.0 INTRODUCTION

## 1.1 General

This SMP is a required element of the remedial program for the Gowanus Village I, LLC site located in Brooklyn, New York (hereinafter referred to as the "Site"). See Figure 1. The Site (No. C224099 ) received a certificate of completion from the New York State Department of Environmental Conservation (NYSDEC) under the Brownfield Cleanup Program on December 30, 2017.

A three party limited liability company, Gowanus Village I, LLC (GVI), was the original Volunteer that entered into a Brownfield Cleanup Agreement (BCA) on July 25, 2005 with the NYSDEC to remediate the site. Subsequent key dates related to the Volunteer's application to the BCA are listed below:

- The Department amended the BCA on March 21, 2011 wherein AI Gowanus Village, LLC (AIGV) and Gowanus Village IV, LLC (GVIV) became the Volunteers and GVI was removed.
- The BCA was amended on August 21, 2012, wherein AIGV consented to a change of party BCA amendment, submitted on July 29, 2012, such that BRT Powerhouse, LLC (BRTP), became the new listed Volunteer.
- The BCA was amended on May 24, 2013, wherein the NYSDEC approved the BCA amendment application submitted by BRTP requesting that Gemini Arts Initiative, Inc. (GAII) be added as the Volunteer.
- BRTP and GAII are listed as the current BCP Volunteers as per the NYSDEC approval letter for Change in Party, which was issued on June 6, 2013.
- The BCA was amended on August 24, 2017, wherein the NYSDEC approved the July 10, 2017 BCA amendment application submitted by BRTP and GAII, such that Gemini Arts Subsidiary, LLC (GAS) became the newly added Volunteer.

A figure showing the site location and boundaries of this site is provided in Figure 1. The boundaries of the site are more fully described in the metes and bounds site description that is part of the Environmental Easement provided in Appendix A.

After completion of the remedial work, some contamination was left at this site, which is hereafter referred to as "remaining contamination". Institutional and Engineering Controls (ICs and ECs) have been incorporated into the site remedy to control exposure to remaining contamination to ensure protection of public health and the environment. An

Environmental Easement granted to the NYSDEC, and recorded with the Kings County Clerk, requires compliance with this SMP and all ECs and ICs placed on the site. Figure 2 show the location of the ECs for the Site.

This SMP was prepared to manage remaining contamination at the site until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36. This plan has been approved by the NYSDEC, and compliance with this plan is required by the grantor of the Environmental Easement and the grantor's successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

It is important to note that:

- This SMP details the site-specific implementation procedures that are required by the Environmental Easement. Failure to properly implement the SMP is a violation of the Environmental Easement, which is grounds for revocation of the Certificate of Completion (COC);
- Failure to comply with this SMP is also a violation of Environmental Conservation Law, 6NYCRR Part 375 and the BCA (Index #C224099-08-12; Site #C224099) for the site, and thereby subject to applicable penalties.

All reports associated with the site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State. A list of contacts for persons involved with the site is provided in Appendix B of this SMP.

This SMP was prepared by Roux Environmental Engineering and Geology, D.P.C. (Roux), on behalf of GAII, in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated May 2010, and the guidelines provided by the NYSDEC. This SMP addresses the means for implementing the ICs and/or ECs that are required by the Environmental Easement for the site.

### 1.2 Revisions

Revisions to this plan will be proposed in writing to the NYSDEC's project manager. Revisions will be necessary upon, but not limited to, the following occurring: a change in media monitoring requirements, upgrades to or shut-down of a remedial system, post-remedial removal of contaminated sediment or soil, or other significant change to the site conditions. In accordance with the Environmental Easement for the site, the NYSDEC will

provide a notice of any approved changes to the SMP, and append these notices to the SMP that is retained in its files.

### 1.3 Notifications

Notifications will be submitted by the property owner to the NYSDEC, as needed, in accordance with NYSDEC's DER – 10 for the following reasons:

- 60-day advance notice of any proposed changes in site use that are required under the terms of the BCA, 6NYCRR Part 375 and/or Environmental Conservation Law.
- 7-day advance notice of any field activity associated with the remedial program.
- 15-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan (Appendix C).
- Notice within 48-hours of any damage or defect to the foundation, structures or EC that reduces or has the potential to reduce the effectiveness of an EC, and likewise, any action to be taken to mitigate the damage or defect.
- Verbal notice by noon of the following day of any emergency, such as a fire; flood; or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the site, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.
- Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action submitted to the NYSDEC within 45 days describing and documenting actions taken to restore the effectiveness of the ECs.

Any change in the ownership of the site or the responsibility for implementing this SMP will include the following notifications:

- At least 60 days prior to the change, the NYSDEC will be notified in writing of the proposed change. This will include a certification that the prospective purchaser/Remedial Party has been provided with a copy of the BCA, and all approved work plans and reports, including this SMP.
- Within 15 days after the transfer of all or part of the site, the new owner's name, contact representative, and contact information will be confirmed in writing to the NYSDEC.

Table 1 on the following page includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of site-related contact information is provided in Appendix B.

**Table 1: Notifications***

| Name | Contact Information |
|---|---|
| NYSDEC, DER, Bureau of Technical Support<br>Site Control Section | Chief, Site Control Section<br>New York State Department of<br>Environmental Conservation<br>Division of Environmental Remediation<br>625 Broadway<br>Albany NY 12233-7020 |
| Richard Mustico, NYSDEC | 518-402-9647<br>richard.mustico1@dec.ny.gov |
| John Grathwol, NYSDEC | 518-402-9767<br>john.grathwol@dec.gov |
| Steven Lawrence, Project Manager, NYSDOH | 518-402-7860<br>BEEI@health.ny.gov |

* Note: Notifications are subject to change and will be updated as necessary.

### 1.4 USEPA Order on Consent

As discussed further in Section 2.3.2, the United States Environmental Protection Agency (USEPA) entered into an Administrative Settlement Agreement and Order on Consent for a Removal Action pursuant to sections Section 106(a) and 122(a) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) ,Index Number CERCLA-02-2017-2021) dated June 26, 2017 (Settlement Agreement). As stated in the Settlement Agreement, the following will be completed under the SMP:

a) Completion of all actions required by the NYSDEC BCP, as set forth in the BCP RAWP, and as it may be amended, including for purposes of satisfying CERCLA and TSCA requirements, soil excavation, backfill and installation of Site cover, installation of recovery wells, and implementation of any institutional controls;
b) Submission to USEPA and NYSDEC as a component of the SMP, of a design of a new steel pile bulkhead compatible with future dredging and documentation of the existing historic bulkhead, pursuant to a USEPA-approved cultural resource work plan;
c) Following the completion of sampling, submission to USEPA and NYSDEC of a design for addressing PCB-impacted interior building surfaces, including vaults and topping slab;

d) Coordination and cooperation, including for access in accordance with Paragraph 69 of the Settlement Agreement, with the City of New York and/or any other potentially responsible parties with respect to the implementation of the RD/RA for the extraction and restoration of the 1st Street turning basin; and

e) Performance of such other investigations, studies, and response actions of Respondent or USEPA may propose and upon which all agree to include under the Settlement Agreement.

# 2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

## 2.1 Site Location and Description

The site is located in Brooklyn, Kings County, New York and is identified as Block 967 and Lot 1 on the Brooklyn County Tax Map (see Figure 2). The site is an approximately 2.5-acre area and is bounded by the historical 1st Street Basin (Former Lateral Canal) to the north, 2nd Street to the south, 3rd Avenue to the east, and the Gowanus Canal to the west (see Figure 2 – Site Layout Map). The boundaries of the site are more fully described in Appendix A –Environmental Easement. The owner(s) of the site parcel(s) at the time of issuance of this SMP is/are:

BRT Powerhouse, LLC

## 2.2 Physical Setting

### 2.2.1 Land Use

The Site is currently undergoing redevelopment activities, including construction of a superstructure for a new building known as the Boiler House; selective demolition of the interior of the existing three-story building known as the Turbine Hall; and structural steel installation/ repair in the Turbine Hall. The Site is being redeveloped to create an industrial arts workshop facility that will house fabrication and production facilities for wood, metal, ceramics, textile, and print. The Site has a history of industrial use. The Site was historically utilized for: sulfur-works, a power station, a paper mill, a lumber yard, a coal-fired electric powerhouse, an electrical sub-station and switching yards, and a warehouse. The Site is zoned as a manufacturing district (M2-1) and has subsequently been vacant over the past decade.

The properties adjoining the Site and in the neighborhood surrounding the Site primarily include a mixture of small, light manufacturing businesses and residentially-zoned properties. The following is a brief description of the properties surrounding the Site:

North

- The filled-in former 1st Street Turning Basin (Former Lateral Canal), which is approximately 60 feet wide, forms the northern boundary of the Site. On the north side of the Former Lateral Canal is a truck storage and maintenance facility, a construction contractor warehouse and equipment storage area, and a commercial

storage facility.

- Further to the north are residential buildings and various commercial businesses and restaurants.

East

- Residential and commercial facilities are located east of the Site. A commercial building housing a self-storage facility is located adjacent to the Site, with shared borders on the east, north, and south sides.
- A Consolidated Edison, Inc. truck depot is located to the east on the eastern side of 3rd Avenue. The facility occupies the space between the 1st and 3rd Streets along 3rd Avenue. A fueling station is suspected to be present within the facility.

South

- A Verizon truck depot is located adjacent to the subject property's southern boundary. Further south, across 3rd Street is a Whole Foods Market grocery store.

West

- The Gowanus Canal, which is approximately 100 feet (ft) wide, lies directly west of the Site.

### 2.2.2 Geology

The Site is located near the southern end of the Manhattan Prong, which is one of two southwestward extensions of the New England Upland physiographic providence of the Northern Appalachians. The topographical elevation of the Site following the Remedial Action Work Plan (RAWP) implementation ranges from +5.0 to +18.5 ft, with the elevation datum utilized is the North American Vertical Datum of 1988 (NAVD 88). Following redevelopment of the Site, the final elevation will be raised to +19.5 ft at the highest point.

During previous investigations of the Site, three distinct geologic strata were encountered from land surface to a depth of approximately 102 feet below land surface (ft bls). Borings within the Turbine Hall and Former Boiler House structures were completed to determine suitability of the concrete mat slabs for continued use as foundation elements in the proposed redevelopment. The concrete mats encountered consist of the following elements:

- A concrete topping slab approximately 4 to 9-inches thick;

- A layer of sand with trace gravel and wood fragments directly below the topping slab, with a thickness ranging from about 1.5 to 2.3 ft; and
- A reinforced-concrete mat slab below the layer of sand, with a thickness that ranges from about 5.5 to 6.5-ft

The concrete topping slab and the layer of sand (sand leveling course) was removed in October 2018 – January 2019 during the selective demolition of the Turbine Hall interior.

The observed lithology located outside and beneath the Turbine Hall reinforced-concrete mat is as follows:

- A layer of "historical fill", as defined by the NYSDEC in DER-10, with an approximate thickness of 10 to 22 ft. The fill material is primarily compromised of coarse to fine sand with some silt and varying amounts of brick, concrete, steel, wood, and cobbles.
- Estuarine deposits were encountered immediately below the fill. Thickness of this layer ranges from about 4 to 11 ft. The estuarine deposit consists of soft, dark gray clay, peat, and brownish-gray silt.
- Glacial deposits were encountered below the estuarine deposits and consisted of brown to grayish brown medium to fine sand with varying amounts of silt, clay, and gravel underlies the organic silt layer. The glacial deposit ranged from 18 to 28 ft in thickness.

The following are site-specific site grading and cover features that were completed during implementation of the NYSDEC-approved RAWP:

- Prior to Site grading and installation of the composite cover system, the hot spot or areas of concern excavation footprints were backfilled with clean stone to 1 foot above groundwater table, followed by backfilling the excavations to preexisting surrounding sub-grade with clean soil.

- The grading of the Site was completed following the aforementioned backfilling. The grading completed consisted of grading/cutting the entirety of the Site to subgrade elevations (approximately 2 ft below proposed redevelopment grade elevations). Upon reaching subgrade elevations required for future redevelopment, a demarcation layer was installed prior to installation of the composite cover system.
- The composite cover system for the Site consists of the reinforced-concrete building slab of the Turbine Hall, asphalt, or the NYSDEC-approved 2-foot clean soil site cover. The 2-foot clean soil site cover consists of a minimum of a 1.5 ft of clean soil and with a minimum of 6-inches of clean stone. This EC is further discussed in Section 3.3.1.
- A vehicular ramp was installed to the western entrance of the Turbine Hall using

NYSDEC-approved recycled concrete aggregate (RCA). In addition, RCA was used to stabilize the slope located in the area north of and adjacent to the vehicular ramp.

A geologic cross section is shown in Figure 4. Site specific boring logs are provided in Appendix D.

2.2.3 Hydrogeology

Groundwater in the area occurs under water-table (unconfined) conditions in the Upper Glacial Aquifer. Regional groundwater flow in the area is inferred to be in the westerly direction towards the Gowanus Canal. Stabilized groundwater was measured to be approximately elevation -1.0 to -4.0 (NAVD 88). Groundwater levels closer to the Gowanus Canal have been observed to fluctuate with the tide.

A groundwater contour map utilizing groundwater elevations observed on March 12, 2020 is shown in Figure 3. Groundwater elevation data from 2017 to 2020 is provided in Table 2. Groundwater monitoring well construction logs are provided in Appendix E.

## 2.3 Investigation and Remedial History

The following narrative provides a remedial history timeline and a brief summary of the available project records to document key investigative and remedial milestones for the Site. Full titles for each of the reports referenced below are provided in Section 8.0 - References.

2.3.1 Environmental Investigation History

Prior to submittal of the BCP application, and later in support of due diligence for a potential purchase of the Site, two (2) Phase I Environmental Site Assessments (ESAs) were completed for the Site. The Phase I ESAs completed by Korner Environmental, Inc. (Korner) revealed the potential for soil, groundwater, and soil vapor contamination, and was included in the BCP application dated October 2004. The Phase I completed by Langan Engineering and Environmental Services (Langan) in 2012 identified environmental conditions that were consistent with the original Phase I findings.

The environmental conditions described in these documents indicated that the historical industrial uses of the property and surrounding area had the potential to impact soil and

groundwater and constituted as a recognized environmental condition. Potential impacts to soil, soil vapor, and groundwater were identified and included petroleum, solvents, metals, and polychlorinated biphenyls (PCBs). Several Areas of Concern (AOCs) (including preexisting waste such as drums, containers, etc.) were identified across the Site, and it was determined from the Korner Phase I that additional investigation would need to be completed to confirm the above mentioned potential impacts.

A limited Phase II ESA was completed by Hydro Tech Environmental Corporation (Hydro Tech) in 2005. The purpose of the limited Phase II ESA was to determine the presence of hazardous or non-hazardous constituents in soil or groundwater at select locations of the Site, based on specific requirements of the Owner and the Phase I ESA findings. Results of this limited Phase II ESA confirmed the presence of NYSDEC Part 375 Unrestricted Use Soil Cleanup Standards (UUSCOs) exceedances and NYSDEC Ambient Water Quality Standards and Guidance Values (AWQSGVs) in both soil and groundwater, respectively, for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, and PCBs. These exceedances observed at the Site were present beneath the concrete slab and west of the existing Turbine Hall building.

Additional AOCs identified during the completion of the limited Phase II ESA included areas where 55-gallon drums had been stored onsite, the western portion of the Site near the Gowanus Canal where the sulfur-works was historically operated, the northern portion of the Site where a historical coal tunnel ran parallel to the former Lateral Canal, and an area where historical operations were completed within the Turbine Hall. These AOCs would be further investigated during the implementation of the Remedial Investigation (RI).

In 2007 Langan completed an RI to characterize soil, groundwater, and soil vapor on behalf of the prior Owner and to further investigate the AOCs identified in the Hydro Tech Phase II ESA. In addition to the sampling, test pits were utilized to confirm the presence of the historical coal tunnel in the northern portion of the Site. The investigation confirmed the presence of Site-wide polycyclic aromatic hydrocarbons (PAHs) and metal contamination above standards that were typical of historic urban fill, with areas of elevated PAH concentrations coinciding with field evidence of petroleum contamination.

The main compounds of concern identified in the Langan RI, PCBs, were detected within both historic fill and native soil beneath and to the west of the Turbine Hall building and along the northern border of the Site. The presence of LNAPL was observed at the groundwater table underneath the Turbine Hall building footprint and in monitoring wells directly west of the structure. A sheen attributed to LNAPL was observed in monitoring wells east of the Turbine Hall. This investigation confirmed that LNAPL and PCB impacted soil were the primary concerns of the Site.

A Supplemental Remedial Investigation Work Plan (SRIWP) was prepared by Creative Environmental Solutions Corp., (CES) in May 2011 in response to NYSDEC comments on the 2007 Langan RI Report. The findings from the Supplemental RI, completed in March 2012, indicated that the following source areas would need to be addressed via a RAWP:

- PCB impacts to soil and groundwater were observed primarily in the center of the Site, beneath and west of the Turbine Hall building; and
- Petroleum-related impacts (i.e., VOCs and SVOCs) to soil and groundwater in the area immediately adjacent to the west of the Turbine Hall building.

Following NYSDEC-approval of the RAWP and issuance of the Decision Document (February 2014), the following contaminants of concern were identified for the Site to be remediated during implementation of the RAWP:

- Chlorobenzene
- 1,2,4-Trimethylbenzene
- Copper
- Benzo(a)pyrene
- Benzo(a)anthracene
- PCBs
- Barium
- Arsenic
- Lead
- Tetrachloroethylene (PCE)
- 1,4-Dichlorobenzene
- Mercury

The Site-specific remedy detailed by the RAWP and Decision Document also included the provision for the excavation and off-site disposal of on-site contamination source areas meeting any of the following specifications:

- Grossly contaminated soil, as defined in 6 NYCRR Part 375-1.2(u);
- Soil exceeding 10 ppm PCBs, to the extent feasible based on existing structures; and

- Areas of concentrated solid or semi-solid hazardous substances.

In June 2014, Leggette, Brashears and Graham, Inc. (LBG) commenced RAWP field activities at the Site. The following components of the RAWP were completed from the first week of June 2014 to August 2015:

- Excavation of identified AOCs;
- Investigation of gatewell and Intake Tunnel structures;
- Demolition of gatewell structures;
- Removal/management of AOC soils;
- Utilization of a dual phase extraction system within the Turbine Hall; and
- Mobilization and operation of surface dewatering treatment system.

In December 2015, there was a change in consultant. The new consultant on Site was Roux Associates, Inc. (Roux Associates). The following components of the RAWP were completed by Roux Associates from October 2016 to November 2017:

- Consolidation, removal, and management of existing wastes;
- Backfill preexisting remedial excavation;
- Removal/management of "Hot Spot" areas and other remaining identified AOCs;
- Dewatering operations, as needed during removal and backfill activities;
- Dewatering treatment system decontamination and demobilization;
- Installation of a High Viscosity Magnum Spill Buster (Spill Buster); and
- Installation of a Site-wide Cover System.

Due to the previously identified LNAPL and PCB contamination in soil above Toxic Substances Control Act (TSCA) hazardous levels at the Site, and the Site's proximity to the adjacent Gowanus Canal Superfund Site, the United States Environmental Protection Agency (USEPA) determined that the TSCA cleanup approval requirement for the Site will be addressed through compliance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) Settlement Agreement (CERCLA Index Number-02-2017-2021) dated June 26, 2017 (Settlement Agreement). In accordance with the Settlement Agreement, the draft BRT Powerhouse Sampling Plan (Sampling Plan), dated June 23, 2017 and the Response to USEPA BRT Powerhouse Sampling Plan Comments, dated August 29, 2017 was reviewed by both USEPA and NYSDEC. The

Sampling Plan proposed additional subsurface investigation to be conducted during the site-wide grading plan activities. Findings of that investigation were incorporated into the remedy or will be completed under the SMP. as appropriate. The Sampling Plan also includes additional Turbine Hall interior building investigation activities that will be completed after completion of the remedy and prior to completion of redevelopment.

Additional details of the RAWP implementation and completion are documented fully in the Final Engineering Report (FER). The interior building investigation and remediation which were not completed during this phase of work and deemed necessary by the USEPA and/or NYSDEC will be completed under this SMP.

### 2.3.2 Interior Buildings Materials Investigations and Remediation

The sections below provide a brief summary of the investigations, sampling, and remediation of the interior building materials at the Site. The USEPA Remedial Action Work Plan for PCB Cleanup, dated April 9, 2019 (USEPA RAWP) and the Amendment to the USEPA Remedial Action Work Plan for PCB Cleanup, dated March 23, 2020 (Amendment) have been submitted to NYSDEC and USEPA. The USEPA RAWP and Amendment was approved by USEPA via e-mail on May 11, 2020.

Roux has completed investigations and remediation of the Boiler House mat slab and lateral discharge tunnels and the Turbine Hall topping slab, leveling course, mat slab, interior brick walls, aboveground concrete vaults, and historical sump structures. The findings of these investigations, previously completed removal, and proposed future remediation to be completed under the SMP and in accordance with the USEPA RAWP and Amendment are summarized below.

#### *2.3.2.1 Boiler House Building Materials Investigation and Remediation*

The investigation and remediation at the former Boiler House focused on any residual PCB contamination in the existing mat slab and lateral discharge tunnels. A total of 15 samples were collected using a rotary hammer drill from 2-3” below the surface of the Boiler House mat slab. As previously approved by USEPA, the modified cellar concrete floor surface characterization sampling protocol consisted of collecting one concrete sample to represent

approximately 800 SF. All samples were analyzed for PCBs via USEPA SW-846 Methods. The rotary hammer drill was decontaminated between each sampling location. PCBs were detected in three of the fifteen samples collected from the Boiler House mat slab, ranging from 0.059 ppm (estimated) to 0.42 ppm. Following sample collection, an approximately 2-foot thick layer of clean soil was added to the surface of the Boiler House mat slab to reach the required grade for the lower level of the building. An overlying slab was then constructed that consists of a 3-inch non-structural rat slab, a layer of waterproofing and vapor barrier, and a 6-inch reinforced topping slab. The 2-foot thick layer of clean soil overlain by the new slab surface completely isolates the Boiler House mat slab from the redeveloped area.

The Boiler House lateral discharge tunnels were uncovered during soil/debris removal from the Boiler House mat slab during redevelopment work. All soil, debris, sludge, and oil/water was removed from each tunnel and was properly disposed of offsite. The soil and debris was placed into 55-gallon steel drums, the sludge was removed from the tunnels via Cusco vacuum trailer through multiple openings cut through the slab, and the oil/water was pumped, as needed, into a storage tank. The oil/water was then pumped into a weir tank to separate the oil and the water was pumped to the onsite groundwater treatment system. When material removal was completed from the interior of the tunnels, Roux personnel completed a thorough inspection to ensure that all oil, water, sludge and debris had been removed. When it was determined that the tunnels had been thoroughly cleared of all materials, the entirety of both tunnels were completely filled with a low pressure flowable fill grout mix. The mat slab tunnel openings were then repaired with reinforced concrete. No additional remediation of the Boiler House mat slab or lateral discharge tunnels is required.

*2.3.2.2 Turbine Hall Building Materials Investigation and Remediation*

In 2015, LBG completed sampling of the concrete floor surfaces in the Turbine Hall. Concrete samples were collected from the concrete floor in the basement (referred to as the topping slab), the 1st floor mezzanine, 2nd floor, 3rd floor, and 4th floor in accordance with the USEPA Standard Operating Procedure for Sampling Porous Surfaces for PCBs (SOP) dated May 2011. The concrete floor characterization analytical results for samples collected

from all of the floor levels (above the basement level) indicate that all PCB concentrations are below the USEPA High Occupancy Cleanup Level of 1 ppm. The concrete floor in the basement that was thought to have been the top of the building's mat slab was a 4 to 9-inch thick topping slab overlaying a sand leveling course. The actual top of the building mat slab (and the original's Turbine Hall's basement) was situated below these materials. The onsite contractor completed demolition and offsite disposal of the Topping Slab and two aboveground concrete vaults, and excavation and offsite disposal of the underlying sand leveling course.

As discussed in the USEPA RAWP, demolition of the two aboveground vaults and topping slab and excavation of the former sand leveling course exposed sections of the Turbine Hall's brick walls and mat slab that were previously inaccessible and therefore not sampled. To supplement data previously collected by LBG, Roux collected eighteen brick wall samples and eighteen concrete mat slab samples using a rotary hammer drill from the surface to 2-3" below the surface to identify any potential residual PCB contamination. Twelve of the brick wall samples were completed along the newly exposed walls that were originally obstructed by the aboveground vaults. Six wall samples were collected from the lower two feet of the brick walls that were previously covered by the former sand leveling course and topping slab. All samples were biased towards areas exhibiting visual contamination. All samples were analyzed for PCBs via USEPA SW-846 Methods.

PCBs were detected in six of the 18 samples collected from the previously inaccessible areas of the Turbine Hall cellar walls. PCB detections ranged from 0.053 ppm (estimated) to 2.3 ppm. PCB detections in previous wall samples collected by LBG in the Turbine Hall cellar during the Remedial Action (RA) ranged from non-detect to 3.7 ppm. No additional sampling or remediation of the Turbine Hall interior brick walls is required.

PCBs were detected in all 18 of the samples collected from the Turbine Hall mat slab, ranging from 0.061 ppm (estimated) to one sample of 460 ppm. In accordance with the USEPA RAWP and Amendment, the Turbine Hall mat slab remediation will consist of a TSCA-compliant cap which will consist of 1 to 2 feet of clean imported soil and RCA to act as a level course, an additional 1.5 to 2 feet of clean imported soil to reach the required

grade for the lower level of the building, a 3-inch mud slab, waterproofing/vapor barrier membrane (i.e., Grave Preprufe 300R Membrane), and a 6-inch reinforced concrete slab. The cap will meet the requirements of 40 CFR §761.61 (a)(4)(7) and the Site will have a deed restriction in accordance with 40 CFR §761.61 (a)(4)(8).

*2.3.2.2.1 Proposed Turbine Hall Sump Structure Remediation*

During remediation and redevelopment activities inside the Turbine Hall cellar, eight sump structures and two smaller auxiliary sump structures were uncovered. Sludge and oily water were previously removed and disposed from the sumps using a small excavator bucket and drum vacuum. As discussed in the Amendment, the proposed remediation of the Turbine Hall sump structures is to seal each sump with a concrete plug. Concrete will be placed into each sump starting uniformly working from bottom to top. Any remaining groundwater displaced by the concrete will be captured via drum vacuum and disposed of offsite. The concrete plug at each sump structure will be a minimum of 2 feet thick. Since the concrete used to fill the Turbine Hall sumps will not have a structural purpose, the upper 18-inches of the sump will be completed to the top of the mat slab with a reinforced structural concrete slab that will be tied into the existing mat slab as required by the final structural design.

2.3.3 Gowanus Canal Bulkhead Design

In accordance with the Settlement Agreement, a new steel pile bulkhead design was submitted to USEPA on April 8, 2019, revised with dimension clarifications and resubmitted on August 16, 2019, and was approved on August 23, 2019. On April 16, 2020, a redesign of the bulkhead, including the new location of the stormwater outfall and additional water quality unit information was submitted to USEPA, approval pending. The new steel pile bulkhead will be compatible with future dredging and documentation of the existing historic bulkhead, pursuant to a USEPA-approved cultural resource work plan. Installation of the steel pile bulkhead will be completed in accordance with the SMP.

## 2.4 Remedial Action Objectives

In accordance with the Decision Document, the Site-specific remedy included the excavation and off-site disposal of on-site contamination source areas meeting any of the following specifications:

- Grossly contaminated soil, as defined in 6 NYCRR Part 375-1.2(u);
- Soil exceeding 10 ppm PCBs, to the extent feasible based on existing structures; and
- Areas of concentrated solid or semi-solid hazardous substances.

Groundwater impacts beneath the Site were addressed through the excavation and disposal of PCB and LNAPL impacted soil and source removal and treatment completed via dewatering activities. The dewatering efforts during the excavation activities facilitated the removal of the majority of LNAPL present on the groundwater surface within the former gatewell structures and excavation footprints, while vacuum extraction methods were used to remove LNAPL present below the Turbine Hall footprint using four monitoring wells (MW-1 through MW-4) located within in the Turbine Hall (Figure 3). Consistent with 6 NYCRR Part 375 requirements, the proposed remedies for the Site were fully protective of public health and the environment, taking into account the current, intended and potential future land use. To address remaining recoverable LNAPL present at the water table a LNAPL recovery EC will be implemented, further discussed in Section 3.3.3.

The Remedial Action Objectives (RAOs) for the Site as listed in the Decision Document dated February 2014 are as follows:

### 2.4.1 Groundwater

RAOs for Public Health Protection

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.

RAOs for Environmental Protection

- Remove the source of ground or surface water contamination.

### 2.4.2 Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater or surface water contamination.

2.4.3 Soil Vapor

RAOs for Public Health Protection

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at a site.

## 2.5 Remaining Contamination

The RA was designed to reduce the concentration of Site contaminants through excavation of source material identified as PCB AOCs and removal of LNAPL from the subsurface beneath the Turbine Hall building reinforced-concrete slab. As per the Decision Document, it was determined that a limited volume of contaminated soil underneath the Turbine Hall building, which contains PCBs greater than 50 ppm, will remain on-site since removal of this soil is not feasible. During completion of the RAWP, soils outside the Turbine Hall building footprint exceeding PCB concentrations of 10 ppm were removed. The Track 4 cleanup track permits the remedial program to include the use of long-term IC or ECs to address all residually contaminated media left in place (i.e., contaminated soil with PCB levels less than 10 ppm) following implementation of the RA.

2.5.1 Soil

The RA addressed PCB contaminated soil in the source areas west of the Turbine Hall building and at various identified AOCs through excavation (Figure 5). The remaining onsite soil has been fully characterized and PCB exceedances delineated between the 59 soil samples collected during the coal tunnel investigation and 71 delineation and endpoint samples collected from existing excavations during remediation. A current summary of PCB detections in soil is shown in Figures 5 and 6. At locations where a known PCB exceedance were removed via Site-wide grading (e.g., Hot Spot 3), and no additional excavation was necessary, a bottom sample was collected. Following additional excavation of Hot Spots and AOCs (e.g., TP-2-S, TP-2, TP-3, and Hot Spot 4, etc.), confirmation endpoint samples were collected in accordance with NYSDEC's DER-10 Technical Guidance for Site Investigation and Remediation (DER-10). Approximately 78 confirmation endpoint samples were collected and analyzed for PCBs via USEPA Method

8082A. Once confirmation sample results indicated all exceedances had been removed, the excavation was backfilled with clean fill.

Upon completion of Site-wide grading and Hot Spot/AOC removal and prior to installing the composite cover system, surficial soil samples were collected to characterize the Residual Management Zone (RMZ). RMZ samples were collected from 0-1 ft bls, at a frequency of 1 sample per 5,000 SF. A total of 19 soil samples were collected and analyzed for:

- Part 375 VOCs;
- Part 375 SVOCs;
- Part 375 Metals;
- Part 375 Pesticides;
- PCBs;
- Total Cyanide;
- Silvex; and
- Hex/Tri Chromium.

RMZ sample locations are shown on Figure 6. RMZ samples were not collected from existing Hot Spot/AOC excavations due to the high frequency of endpoint samples collected during remediation. The results of soil sampling data, following completion of the RA excavation and backfilling activities, are presented in Tables 3 through 6. Analytical reports for all soil data is provided as a separate CD.

Future contact with contaminated soil with PCB levels less than 10 ppm was addressed by installing a composite cover across the Site. Details about the composite cover construction are discussed below in Section 3.3.

*2.5.1.1 Lateral Discharge Tunnels*

Two Lateral Discharge Tunnels beneath the historical Boiler House building slab were investigated. Test pits were completed along the northern edge of the Boiler House building slab to a depth of 15 feet below land surface (bls) and approximately 5 feet below the top

of the slab (elevation +0.5 ft NAVD 88). Based on historical drawings, the two lateral discharge tunnel locations were approximately 53 ft in from the edge of both the western and eastern edges of the Boiler House building slab, respectively. The two lateral tunnels were found to be in place during the investigation. Both lateral tunnels were constructed out of concrete and ended within the concrete footing approximately 10.5 feet south of the northern property line. The vertical extent of the lateral discharge tunnels is embedded within the top and bottom bounds of the mat slab with the top of the tunnel structures approximately 2.5 feet below the slab, as depicted in the historical drawings.

Additional excavation was performed to address the impacted soil at Lateral Tunnel 2 (Figure 5). After the soil was removed, the tunnel opening was then plugged with concrete. Additional remediation was completed from August through October 2019 and is summarized in Section 2.3.2.1.

### 2.5.2 Groundwater

Historical groundwater sampling data collected during the Limited Phase II, RI, and SRIWP (Section 2.3.1) indicated VOC, SVOC, metals and PCBs detections in monitoring wells installed across the Site, with more recent sampling data confirming these observations. Groundwater results from the fourth quarter 2019 and first quarter 2020 quarterly groundwater sampling, compared to the NYSDEC AWQSGVs, are shown on Tables 7 through 11 and Figure 3. The SVOC groundwater exceedances are likely attributed to concentrations of SVOCs present in the historic fill, and the metal exceedances in groundwater are likely attributed to the brackish water conditions. The VOC and PCBs exceedances observed in the groundwater are localized and consistent with source soil that was removed during the RA.

The RA addressed groundwater through source area removal of soils with LNAPL impacts or PCB concentrations above the Site-specific Soil Cleanup Objectives (SCOs). A component of the RAWP included the dewatering and treatment of groundwater as needed to enable excavation below the groundwater table. The dewatering efforts facilitated the removal of the majority of LNAPL present on the groundwater surface within the former gatewell structures and excavation footprints. Additionally, vacuum extraction methods

were used to remove LNAPL present below the Turbine Hall footprint using four monitoring wells in the Turbine Hall (MW-1 through MW-4).

Semi-weekly gauging and LNAPL bailing (when necessary) was completed at the four (4) preexisting monitoring wells in Turbine Hall basement (MW-1 to MW-4) during completion of the RA activities. LNAPL remained present at monitoring well MW-3 located within the Turbine Hall. To delineate the LNAPL underneath the Turbine Hall building, five monitoring wells were installed in October 2017, with the capability to be used as recovery wells, if product is observed. Locations of the monitoring wells are shown on Figure 3. Two of the interior wells were installed in the western (downgradient) side of the building within the footprint of each of the two intake tunnels that reportedly ran within the building mat slab (MW-5 and MW-6). Based on consistently observed LNAPL in MW-3 during gauging and bailing, a monitoring well was installed on the north side of building to delineate LNAPL in a northern direction (MW-7). Monitoring wells MW-1, MW-2, and MW-4 continue to no show signs of LNAPL, therefore, it is believed that LNAPL has been properly delineated in an eastern and southern direction. Exterior to the Turbine Hall, two monitoring wells (MW-8 and MW-9) were installed on the western side of the building, each adjacent to location of former gate well structure, to mitigate any potential residual contamination in the gate well area or migration from under the building.

The monitoring wells were installed in such a way that they may be converted into recovery wells, pending field observation. Each well was installed with 4-inch PVC with 20-slot screen to straddle the water table. A 2 ft sump was installed at the bottom of each well to draw groundwater in for recovery.

Upon completion of monitoring well installation and development, the five new monitoring wells were gauged using an electronic interface probe capable of detecting LNAPL with an accuracy of +/- 0.01 feet. Groundwater samples were collected from monitoring wells that do not exhibit any LNAPL. Samples were analyzed for:

- TCL VOCs;
- TCL SVOCs;

- RCRA Metals;
- PCBs;
- TCL Pesticides;
- Herbicides; and
- Total Cyanide.

Gauging data from 2017 to 2020 is summarized in Table 2 and groundwater sampling results are shown on Figure 3. All future groundwater sampling results conducted under this SMP will be submitted to the NYSDEC in EDD format as well as the raw data in the annual Periodic Review Reports.

The residual contamination present in groundwater will be addressed by operation of the Spill Buster, discussed further in Sections 4.3 and 5.0.

2.5.3 Soil Vapor

Table 12 and Figure 8 summarize the results of historical soil vapor samples with exceedances of the New York State Department of Health (NYSDOH) Soil Vapor/Indoor Air Guidance Values. While exterior excavation and LNAPL recovery activities completed during the RA may have reduced the soil vapor concentrations, source excavation activities could not be completed beneath the Turbine Hall building due to the thickness of the reinforced-concrete mat slab. Therefore, residual contamination could attribute to soil vapor intrusion (SVI) for the planned development.

Due to the thickness of the Turbine Hall building's reinforced-concrete mat slab, which extends into the groundwater table, a sub-slab depressurization (SSDS) is not feasible at the Site. While it is expected that the thickness of the reinforced-concrete mat slab will provide a barrier to prevent SVI, a vapor barrier capable of preventing SVI of VOCs will be installed within the subsurface portions of the building prior to occupancy to ensure the protection of indoor air quality.

Details pertaining to the installation of the vapor barrier are discussed in Section 3.3.2. The potential for soil vapor intrusion in any new development structures will be evaluated with

the collection and analysis of a single round of indoor air sampling prior to occupation. Details regarding indoor air sampling procedures are discussed further in Section 4.6 below.

# 3.0 INSTITUTIONAL AND ENGINEERING CONTROL PLAN

## 3.1 General

Since remaining contamination exists at the site, ICs and ECs are required to protect human health and the environment including following procedures during implementation of all actions required by the NYSDEC, as set forth in the BCP Decision Document, and as it may be amended, including for purposes of satisfying CERCLA and TSCA requirements, soil excavation, backfill and installation of a Site cover, installation of recovery wells.

This IC/EC Plan describes the procedures for the implementation and management of all IC/ECs at the site. The IC/EC Plan is one component of the SMP and is subject to revision by the NYSDEC.

This plan provides:

- A description of all IC/ECs on the site;
- The basic implementation and intended role of each IC/EC;
- A description of the key components of the ICs set forth in the Environmental Easement;
- A description of the controls to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of IC/ECs, such as the implementation of the Excavation Work Plan (EWP) (as provided in Appendix C) for the proper handling of remaining contamination that may be disturbed during maintenance or redevelopment work on the site; and
- Any other provisions necessary to identify or establish methods for implementing the IC/ECs required by the site remedy, as determined by the NYSDEC.

## 3.2 Institutional Controls

- A series of ICs is required by the Decision Document to: (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining contamination; and (3) limit the use and development of the site to Restricted Residential, Commercial and/or Industrial uses only. Adherence to these ICs on the site is required by the Environmental Easement and will be implemented under this SMP. ICs identified in the Environmental Easement may not be discontinued without an amendment to or extinguishment of the Environmental Easement. The IC boundaries are shown on Figure 2 and are described in Appendix A-Environmental Easement. These ICs are: The property may be used for: restricted residential or industrial use;

- All ECs must be operated and maintained as specified in this SMP;
- All ECs must be inspected at a frequency and in a manner defined in the SMP;
- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the New York City Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;
- Groundwater and other environmental or public health monitoring must be performed as defined in this SMP;
- Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP;
- All future activities that will disturb remaining contaminated material must be conducted in accordance with this SMP;
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP;
- Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in this SMP;
- Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Easement;
- The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted on Figure 2, and any potential impacts that are identified must be monitored or mitigated; and
- Vegetable gardens and farming on the site are prohibited.

## 3.3 Engineering Controls

### 3.3.1 Cover System

Exposure to remaining contamination at the site is prevented by a cover system placed over the site. This cover system consists of the reinforced-concrete building slab of the Turbine Hall, asphalt pavement, or a soil cover consisting of a minimum of 1.5 feet of NYSDEC-approved clean soil and a minimum of 6 inches of NYSDEC-approved clean stone. The clean soil cover is underlain by a demarcation layer of orange construction fencing. The asphalt cover system was installed in the driveways of the Site and consists of a 3-inch RCA subgrade and a minimum of 3 inches of asphalt.

Figure 2 presents the location of the cover system and applicable demarcation layers. The Excavation Work Plan (EWP) provided in Appendix C outlines the procedures required to

be implemented in the event the cover system is breached, penetrated or temporarily removed, and any underlying remaining contamination is disturbed. Procedures for the inspection of this cover are provided in the Monitoring and Sampling Plan included in Section 4.0 of this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and Safety Plan (HASP) and associated Community Air Monitoring Plan (CAMP) prepared for the site and provided in Appendix F.

3.3.2 Vapor Barrier Installation

Due to the thickness of the Turbine Hall building's reinforced-concrete mat slab, which extends into the groundwater table, a SSDS is not feasible at the Site. While it is assumed that the thickness of the reinforced-concrete mat slab will provide a barrier to prevent SVI, to ensure protectiveness of the indoor air quality a vapor barrier capable of preventing SVI of VOCs will be installed within the subsurface portions of the building prior to occupancy.

The vapor barrier will consist of a sheet membrane or fluid applied coating that will cover the basement floor area and subsurface portion of the walls. The vapor barrier may require multiple products due to the unique conditions of the existing structure and final redevelopment design plans. For subsurface walls, installation of a combined water proofing and vapor barrier product will be considered. All proposed vapor barrier products will be submitted to NYSDEC for approval prior to use. A summary of the preparation and installation activities are presented below.

Prior to application of the vapor barrier, all application concrete surfaces shall have a roughness of a light broom finish, or smoother, and shall be free of any dirt, debris, loose material, release agents or curing compounds. All joints and voids will be patched in accordance with manufacturer's instructions. All penetrations will be cleaned via pressure washing and all metal penetrations will be sanded. All surface preparation activities will be performed to ensure there is a competent application surface for the installation of the vapor barrier.

All vapor barrier joints and penetrations will be sealed with approved materials including grout, tape and/or mastic. These penetrations will include form tie holes as applicable.

Throughout the application of the vapor barrier, the membrane will be kept free of dirt, debris, and traffic.

Following the installation and QA/QC inspection activities, the existing Turbine Hall basement mat slab and vapor barrier will be overlain with protective concrete slab.

Details pertaining to SVI monitoring are summarized in Section 4.4.

### 3.3.3 Spill Buster Recovery System

To address remaining recoverable LNAPL present at the water table, a Spill Buster was installed at recovery well MW-3 in September 2017 (see Figures 3 and 4). The Spill Buster is comprised of an automated compressor-powered pump (Magnum Spill Buster™), control panel, and a 55-gallon LNAPL storage drum. The Spill Buster ran from November 2017 through February 2018 but was unsuccessful at recovering LNAPL at MW-3 due to the extremely high viscosity of the observed LNAPL. No additional Spill Busters were installed since LNAPL was not observed in any other interior monitoring well with a measurable thickness of 0.3 ft or greater. When the partial demolition work began in the Turbine Hall during the second quarter of 2018, the High Viscosity Magnum Spill Buster was removed. All detectable LNAPL was recovered via bailing and/or absorbent socks, until all interior monitoring wells were destroyed during demolition work in 2018.

Based on the extremely viscous characteristic of the LNAPL present at the Site and the poor recovery performance of the Spill Buster, Roux does not recommend the reinstallation of the High Viscosity Magnum Spill Buster for future LNAPL recovery. The use of absorbent socks and bailing from monitoring wells, and the use of drum vacuum methods within the Turbine Hall sumps have proven to be significantly more successful at LNAPL recovery. Use of the Spill Buster for LNAPL recovery, however, is included as part of this SMP as an alternative recovery method for future operation, if conditions change. The Site-wide exterior monitoring well network will continue to be gauged on a monthly basis. No LNAPL migration has been observed in the exterior wells MW-8 and MW-9 immediately downgradient from the Turbine Hall.

The Magnum Spill Buster™ recovers LNAPL from recovery wells using an AC powered pressure/vacuum pump. The Magnum Spill Buster™ features a product intake assembly that incorporates both a density float and an oleophilic/hydrophobic filter that differentiates between floating hydrocarbons and water. The auto-seeking device allows the pump intake to automatically follow the elevation of the oil/water interface as it fluctuates throughout the entire length of the well. Once the pump canister is filled via the vacuum cycle, the pump reverses, pressurizes the system, and pumps the recovered fluid to the surface and into a storage vessel. The Magnum Spill Buster™ will not pump water.

The density float assembly mounted above the skimmer attachment is designed to adjust the pump intake depth as LNAPL is recovered from the well. The controller can be used to adjust the pump cycle duration to set the average pump flow rate at a recovery rate that is less than the observed recharge rate of LNAPL into the well.

Procedures for operating and maintaining the LNAPL system are documented in the Operation and Maintenance Plan (Section 5.0 of this SMP and in Appendix G).

3.3.4 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when monitoring indicates that the remedy has achieved the RAOs identified by the decision document. The framework for determining when remedial processes are complete is provided in Section 6.4 of NYSDEC DER-10.

*3.3.4.1 Cover*

The composite cover system is a permanent control and the quality and integrity of this system will be inspected at defined, regular intervals in accordance with this SMP in perpetuity. The current cover system is comprised of the concrete building slab of the Turbine Hall, asphalt pavement, or the clean soil cover consisting of 1.5 feet of clean soil and 6-inches of clean stone. Future development plans modifying the cover system will be submitted to NYSDEC prior to start of construction.

#### *3.3.4.2 LNAPL Recovery*

LNAPL recovery will continue onsite via the passive recovery method. This method includes the continuation of monthly gauging and the use of absorbent socks and/or bailing of product from monitoring wells with detectable product. LNAPL recovery will not be discontinued unless prior written approval is granted by the NYSDEC. In the event that monitoring data indicates that LNAPL recovery may no longer be required, a proposal to discontinue the system, including the results of an impact study, will be submitted by the remedial party. Conditions that may warrant discontinuing the LNAPL recovery include stabilized LNAPL thicknesses less than 0.3 ft and/or the NYSDEC has determined that LNAPL recovery has reached the limit of its effectiveness. This assessment will be based in part on post-remediation gauging data from monitoring wells located throughout the Site. The system will remain in place and operational until permission to discontinue use is granted in writing by the NYSDEC.

# 4.0 MONITORING AND SAMPLING PLAN

## 4.1 General

This Monitoring and Sampling Plan describes the measures for evaluating the overall performance and effectiveness of the remedy. This Monitoring and Sampling Plan may only be revised with the approval of the NYSDEC. Details regarding the sampling procedures, data quality usability objectives, analytical methods, etc. for all samples collected as part of site management for the site are included in the Quality Assurance Project Plan provided in Appendix H.

This Monitoring and Sampling Plan describes the methods to be used for:

- Sampling and analysis of all appropriate media (e.g., groundwater and indoor air);
- Assessing compliance with applicable NYSDEC SCGs, particularly groundwater standards and Part 375 SCOs for soil;
- Assessing achievement of the remedial performance criteria;
- Evaluating site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment; and
- Preparing the necessary reports for the various monitoring and sampling activities.

To adequately address these issues, this Monitoring and Sampling Plan provides information on:

- Monitoring and sampling locations, protocol and frequency;
- Information on all designed monitoring systems (e.g., wells logs);
- Analytical sampling program requirements;
- Reporting requirements;
- Quality Assurance/Quality Control (QA/QC);
- Inspection and maintenance requirements for monitoring and recovery wells;
- Monitoring and recovery well decommissioning procedures; and
- Annual inspection and periodic certification.

Monitoring of the performance of the remedy and overall reduction in contamination on-site will be conducted for the periods specified for Table 13, below. The frequency thereafter will be determined in consultation with NYSDEC and based on reports submitted showing contaminant trends. Trends in contaminant levels in groundwater will be

evaluated to determine if the remedy continues to be effective in achieving remedial goals. Reporting requirements are provided in Section 7.0 of this SMP.

**Table 13: Post-Remediation Inspection and Monitoring Schedule**

| Inspection/ Monitoring Task | Goal of Inspection/Monitoring Task | Frequency of Inspection/ Monitoring Task[1] |
|---|---|---|
| Inspection | | |
| Site-wide Cover System | Confirm Site-Wide Cover System has not been compromised | Annually, First inspection to occur no more than 15 months after issuance of COC or upon completion of redevelopment, whichever occurs first |
| Site-wide Inspection | Confirm compliance with all ICs and effectiveness of ECs. | Annually, First inspection no more than 15 months after issuance of the COC |
| Spill Buster | Confirm Proper Operation of System | As needed |
| Monitoring | | |
| Groundwater (MW-8, MW-9, MW-10, MW-11, MW-12, MW-13, MW-14. MW-15, MW-16, MW-17, MW-18 etc.) | Collect samples and analyze for Target Compound List (TCL) VOCs; TCL SVOCs; Resource Conservation and Recovery Act (RCRA) Metals; PCBs; TCL Pesticides; Herbicides; and Total Cyanide to Assess effectiveness of remedy[2]. | Quarterly for one year following installation of all required exterior monitoring wells |
| Free-Product/ LNAPL (MW-8, MW-9, MW-10, MW-11, MW-12, MW-13, MW-14 MW-15, MW-16, MW-17, MW-18 etc.) | Check for presence of LNAPL and confirm thickness of LNAPL, if applicable[2]; Recovery of free-product where present and practical | Monthly |
| Indoor Air Locations to be confirmed as requested by NYSDEC | Obtain indoor air quality samples to determine the potential of vapor intrusion into the Site buildings. For all structures, both new development and preexisting. Sub-slab soil vapor will be evaluated for any future buildings constructed above the water table. | To be completed prior to building occupation |

1. The frequency of events will be conducted as specified above until otherwise approved by NYSDEC and NYSDOH.
2. Monitoring wells that have LNAPL present will not be sampled.

A record of the findings of each monitoring/ inspection event and resulting maintenance activity performed, where applicable, will be kept in a dedicated log book and documented on the Site Management Forms (Appendix I). If at any time during the reporting period the Volunteer identifies a failure of one or more of the engineering controls or non-compliance with one or more of the institutional controls, the remedial party must notify the Department and implement corrective measures in accordance with a Corrective Measures Work Plan (CMWP) that will be submitted to and approved by NYSDEC and provide a periodic certification of the IC/ECs. Confirmation of the completion of maintenance activities will be documented in the subsequent Periodic Review Report (PRR).

### 4.2 Site–wide Inspection

Site-wide inspections will be performed at a minimum of once per year. Modification to the frequency or duration of the inspections will require approval from the NYSDEC. Site-wide inspections will also be performed after all severe weather conditions that may affect ECs or monitoring devices. During these inspections, an inspection form will be completed as provided in Appendix I – Site Management Forms. The form will compile sufficient information to assess the following:

- Compliance with all ICs, including site usage;
- An evaluation of the condition and continued effectiveness of ECs;
- General site conditions at the time of the inspection;
- The site management activities being conducted including, where appropriate, confirmation sampling and a health and safety inspection; and
- Confirm that site records are up to date.

Inspections of all remedial components installed at the site will be conducted. A comprehensive site-wide inspection will be conducted and documented according to the SMP schedule, regardless of the frequency of the Periodic Review Report. The inspections will determine and document the following:

- Whether ECs continue to perform as designed;
- If these controls continue to be protective of human health and the environment;

- Compliance with requirements of this SMP and the Environmental Easement;
- Achievement of remedial performance criteria; and
- If site records are complete and up to date.

Monitoring of the site cover system will occur during completion of the Site-wide inspection for as long as the Environmental Easement is in effect to ensure the system's integrity. The engineered site cover system is comprised of the reinforced-concrete building slab of the Turbine Hall, asphalt pavement, or the clean soil cover. The location and details of the site cover system are shown on Figure 2.

Monitoring will consist of visual inspection, which shall evaluate the structural integrity of the concrete floor slab, support columns into the floors and the wall joints. If any penetrating cracks or openings are identified, they shall be screened for organic vapors with a photo-ionization detector (PID) and any readings shall be noted. In addition, any penetrating cracks or openings in the floor shall then be properly sealed. The results of the inspection will be included in the PRR. In addition, the site cover system must be inspected and recertified any time a disturbance in the system occurs. The inspection frequency is subject to change with the approval of the NYSDEC. Unscheduled inspections and/or sampling may take place when a suspected failure of the site cover system has been reported or an emergency occurs that is deemed likely to affect the operation of the system.

Disturbance of the concrete floor slab and/or any of the underlying demarcation layers or EC components is governed by the Environmental Easement. In the unlikely event of an unanticipated accidental or required disturbance of the site cover system, the response procedure is outlined in Appendix C.

Reporting requirements are outlined in Section 7.0 of this plan.

Inspections will also be performed in the event of an emergency. If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs that reduces or has the potential to reduce the effectiveness of ECs in place at the site, verbal notice to the NYSDEC must be given by noon of the following day. In addition, an inspection of the site will be conducted within 5 days of the event to verify the effectiveness of the IC/ECs

implemented at the site by a qualified environmental professional, as determined by the NYSDEC. Written confirmation must be provided to the NYSDEC within 7 days of the event that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.

## 4.3 Groundwater and LNAPL Monitoring

Samples shall be collected from groundwater monitoring wells to evaluate performance of LNAPL recovery, the effectiveness of source area soil removal, and to evaluate if remaining contamination continues to impact groundwater. Sampling locations, the required analytical parameters and schedule are provided in Section 4.3.2 and on Figure 3. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

Detailed sample collection and analytical procedures and protocols are provided in Appendix J – Field Sampling Plan .

### 4.3.1 Recovery System Monitoring and Groundwater Gauging

Monitoring wells and recovery wells that have previously had observations of LNAPL, or are suspect of containing LNAPL, will be gauged monthly. During these monitoring events, and prior to groundwater sample collection discussed below, an electronic oil/water interface-probe indicator will be utilized to gauge the water level and to determine the presence of free-product within the monitoring and recovery wells. The depth to free-product and depth to water will be measured from the top of the well casing at each monitoring well or recovery well to an accuracy of 0.01 feet. The free-product and water levels, where applicable, will be recorded in a field book and on the groundwater well sampling log (Appendix I).

Monitoring of the Spill Buster will be performed during these visits, with a visual inspection of the complete system conducted. Modification to the frequency or sampling requirements will require approval from the NYSDEC. Unscheduled inspections and/or sampling may take place when a suspected failure of the Spill Buster has been reported or an emergency occurs that is deemed likely to affect the operation of the system. If any equipment readings are not within their specified operation range, any equipment is

observed to be malfunctioning or the system is not performing within specifications; maintenance and repair, as per the O&M Plan, is required immediately.

4.3.2 Groundwater Sampling

Groundwater monitoring will be performed quarterly for two years following issuance of the COC to assess the performance of the remedy. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

Samples will be collected from monitoring wells that are within the specified monitoring well network (as identified in Table 14 below). The monitoring wells will be sampled for the following analytical:

- Target Compound List (TCL) VOCs;
- TCL SVOCs;
- RCRA Metals;
- PCBs;
- TCL Pesticides;
- Herbicides; and
- Total Cyanide.

Purge water and decontamination waste water generated during groundwater sampling will be containerized, properly labeled, and disposed of. The sampling, sample handling, decontamination, and field instrument calibration procedures will be performed in accordance with established procedures for the Site (Appendix J).

Table 14 shown below summarizes the wells identification number, as well as the purpose, location, depths, diameter and screened intervals of the wells within the monitoring network. The existing on-site wells consist of seven (7) exterior groundwater monitoring wells (MW-8 through MW-14 and MW-18). All monitoring well without the presence of LNAPL will be sampled as part of the groundwater monitoring to evaluate the effectiveness of the remedial system.

**Table 14 – Monitoring Well Construction Details**

| Monitoring /Recovery Well ID | Well Location | | Well Diameter (inches) | Elevation (NAVD 88) | | | |
|---|---|---|---|---|---|---|---|
| | Coordinates (longitude) | Coordinates (latitude) | | Casing | Surface | Screen Top | Screen Bottom |
| MW-5* | N/A | N/A | 4 | 7.15 | 7.15 | 3.2 | -8.9 |
| MW-6* | N/A | N/A | 4 | 7.15 | 7.15 | 2.7 | -9.4 |
| MW-7* | N/A | N/A | 4 | 7.15 | 7.15 | 3.2 | -6.9 |
| MW-8* | N/A | N/A | 4 | 8.50 | 6.00 | 5.0 | -4.5 |
| MW-9 | N/A | N/A | 4 | 12.56 | 9.00 | 6.5 | -3.5 |
| MW-10 | N/A | N/A | 2 | 13.21 | 13.8 | 5.8 | -4.2 |
| MW-11 | N/A | N/A | 2 | 9.88 | 10.25 | 6.3 | -3.8 |
| MW-12 | N/A | N/A | 2 | 14.39 | 14.69 | 10.89 | -4.11 |
| MW-13 | N/A | N/A | 2 | NS | NS | NS | NS |
| MW-14 | N/A | N/A | 2 | NS | NS | NS | NS |
| MW-16* | N/A | N/A | 2 | 15.87 | 16.06 | 4.1 | -5.9 |
| MW-17* | N/A | N/A | 2 | 15.78 | 16.03 | 4.0 | -6.0 |
| MW-18 | N/A | N/A | 2 | 16.28 | 16.9 | 3.9 | -6.1 |

*Monitoring well has been destroyed during redevelopment activities
NS – Not yet surveyed

Monitoring well construction logs are included in Appendix E of this document.

In July 2018, December 2019, and February 2020, additional exterior monitoring wells were installed, as required under the SMP, to further evaluate groundwater quality throughout the Site. Under the SMP, monitoring wells MW-10, MW-11, MW-12, MW-16, MW-17, and MW-18 were installed as shown in Figure 3. All monitoring wells that are required by the SMP have been installed with the exception of MW-15. This monitoring well, shown as proposed in Figure 3, has not been installed due to Site access issues during redevelopment activities. Previously installed interior monitoring wells (MW-5, MW-6, MW-7, MW-8, MW-16 and MW-17) were destroyed during redevelopment activities in 2018 - 2019. Interior wells MW-5, 6, and 7 are not intended to be replaced inside the renovated Powerhouse building. New exterior wells MW-8, 16, and

17 were destroyed inadvertently during construction and their locations are expected to remain inaccessible throughout the construction period. Roux will continue quarterly groundwater sampling for one (1) year following installation of the remaining required exterior monitoring well. The monitoring well will be constructed of 2-inch diameter, schedule 40, flush-joint internally-threaded polyvinyl chloride (PVC) well casing and well screen. The well screen will be 0.020-inch slot size, set at a depth that straddles the water table and allows adequate monitoring. The annular space between the well screen and the borehole will be backfilled with No. 2 sand from the bottom of the well to approximately two (2) feet above the well screen. A one to two feet thick bentonite pellet seal will be placed on top of the sand pack, and the balance of the annular space will be backfilled with cement grout to ground surface. The monitoring well will be completed with a J-plug and an 8-inch, bolt down flush mount protective casing, and developed to ensure hydraulic connectivity with the aquifer. Monitoring well development will consist of using a submersible pump to surge periodically until the well yield is consistent and turbidity is below 50 nephelometric turbidity units (NTUs), or the equivalent of 10 well casing volumes are purged.

Locations of all existing monitoring and recovery wells, and proposed monitoring wells, are shown on Figure 2.

If biofouling or silt accumulation occurs in the on-site and/or off-site monitoring wells, the wells will be physically agitated/surged and redeveloped. Additionally, monitoring wells will be properly decommissioned and replaced, if an event renders the wells unusable.

Repairs and/or replacement of wells in the monitoring well network will be performed based on assessments of structural integrity and overall performance.

The NYSDEC will be notified prior to any repair or decommissioning of any monitoring well for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent Periodic Review Report. Well decommissioning without replacement will be done only with the prior approval of the NYSDEC. Well abandonment will be performed in accordance with NYSDEC's guidance entitled "CP-43: Groundwater Monitoring Well Decommissioning Procedures." Monitoring

wells that are decommissioned because they have been rendered unusable will be replaced in kind in the nearest available location, unless otherwise approved by the NYSDEC.

The sampling frequency may only be modified with the approval of the NYSDEC. This SMP will be modified to reflect changes in sampling plans approved by the NYSDEC.

Deliverables for the groundwater monitoring program are specified in Section 7.0 – Reporting Requirements.

### 4.4 Soil Vapor Intrusion Sampling

The planned Boiler House building will be an alteration of the preexisting reinforced concrete mat slab foundation, which is related to a former Boiler House building that was previously demolished and covered with soil by others. This foundation mat slab is the same foundation mat slab of the Turbine Hall building, which extends north of the existing Turbine Hall building and is where the previous Boiler House building once existed. As stated previously, this mat slab extends into the groundwater table, and thus a SSDS will not be feasible below either of these buildings.

The planned Gate House Building will be a smaller slab on grade structure. An SSDS system would be feasible for this building. This building, as well as the existing Turbine Hall building and the proposed Boiler House building, will have the potential for SVI and will be evaluated with the collection and analysis of indoor air samples prior to occupation.

Indoor air quality samples will be collected within the basement and first floor levels at the breathing zone to determine the potential of vapor intrusion into the Site building (one per floor). Samples will be collected using batch-certified, vacuum canisters equipped with laboratory-supplied regulators calibrated to collect a sample over a 24-hour interval. Indoor air quality samples will be submitted for VOCs via USEPA Method TO-15.

In conjunction with the indoor air sampling, one (1) ambient air quality sample will be collected at the breathing zone to characterize Site-specific background outdoor air conditions. Ambient air samples will accompany each of the indoor air samples in tandem to utilize the NYSDOH matrix to determine the course of action, if warranted. A separate

soil vapor intrusion sampling plan will be submitted for NYSDEC and NYSDOH approval for each building where a soil vapor intrusion evaluation is proposed, if any.

Samples will be collected using batch-certified, vacuum canisters equipped with laboratory-supplied regulators calibrated to collect a sample over an 8-hour interval. Indoor air quality samples will be submitted for VOCs via USEPA Method TO 15.

# 5.0 OPERATION AND MAINTENANCE PLAN

## 5.1 General

This Operation and Maintenance Plan provides a brief description of the measures necessary to operate, monitor and maintain the mechanical components of the remedy selected for the site. This Operation and Maintenance Plan:

- Includes the procedures necessary to allow individuals unfamiliar with the site to operate and maintain the Spill Buster;
- Will be updated periodically to reflect changes in site conditions or the manner in which the Spill Buster is operated and maintained.

The current LNAPL recovery method uses absorbent socks, bailing, and/or vacuum extraction. LNAPL recovery was unsuccessful via Spill Buster due to the extremely high viscosity of the observed LNAPL. Additional detail regarding the operation and maintenance of the Spill Buster is included in this Section for future operation, if onsite conditions change.

Further detail regarding the Operation and Maintenance of the Spill Buster is provided in Appendix G - Operation and Maintenance Manual. A copy of this Operation and Maintenance Manual, along with the complete SMP, is to be maintained at the site. This Operation and Maintenance Plan is not to be used as a stand-alone document, but as a component document of this SMP.

## 5.2 Remedial System (or other Engineering Control) Performance Criteria

This section describes the performance criteria for the engineering controls at the Site. The Spill Buster has been shut down, as discussed in Section 3.3.3 and will be operated only if conditions change and as required by NYSDEC. The following procedures have been provided as contingency.

Minimum operating requirements for each system are outlined below:

- Spill Buster
    - Product of sufficient thickness (i.e., 0.3 ft) is present within recovery well to allow for recovery.

## 5.3 Operation and Maintenance of Spill Buster Recovery System

The following sections provide a description of the operations and maintenance of the Spill Buster. The cut-sheets and as-built drawings for the Spill Buster are provided in Appendix G - Operations and Maintenance Manual. A complete list of components to be inspected is provided in the Inspection Checklist, provided in Appendix I- Site Management Forms.

### 5.3.1 System Start-Up and Testing

The system was inspected prior to system start-up to ensure all piping is in place and secure. Startup included:

- Inspection of the system to ensure system is connected to power source, including the control box, probe and autoseeker;
- Turning the power on and allowing the system to cycle (typically within 5 seconds of power on);
- Using the "test system" button to cause the pump to run for 5 seconds prior to lowering the probe into the well. After testing, pressing STOP to prevent the system from beginning to cycle or AUTO to leave the system operating; and
- Testing all high level alarms for functionality.

The system testing described above was conducted during startup of the system on October 10, 2017 and should be conducted if, in the course of the Spill Buster lifetime, the system goes down or significant changes are made to the system and the system must be restarted.

### 5.3.2 Routine System Operation and Maintenance

All mechanical aspects of the product recovery system will be visibly inspected monthly to ensure proper function. Inspection activities include making sure that power supply is functioning, verifying no leaks are present in any of the recovery tubing, hoses or connections. The 55-gallon product storage tank should also be checked during each visit in order to determine if disposal arrangements need to be made. The in-well probe/product pump will be cleaned on a monthly basis during the system inspections, as needed. The tank level sensor probes will be inspected every visit to ensure that they are functioning correctly.

Free product levels within the wells located in the area should be monitored and recorded to determine if the system is operating at optimal conditions. As noted in Section 3.3.3, any LNAPL that is observed in monitoring wells at the Site during routine gauging events

that is below the 0.3ft LNAPL thickness requirement for active Spill Buster and/or are not within the capture zone of these existing recovery well will be manually recovered, to the extent practical, on a monthly basis. Modification and/or expansion of the Spill Buster can and will be performed, if necessary, to address LNAPL thickness above 0.3ft.

### 5.3.3 Non-Routine Operation and Maintenance

Non-routine equipment maintenance consists of maintenance activities that will be performed with less frequency than the routine (i.e., annually) on system components on an as-needed basis. Non-routine equipment maintenance will be performed in accordance with manufacturer's instructions. Specific non-routine maintenance tasks could potentially include the following:

- Cleaning the well screen (primarily to clear bio growth and keep thick degraded product from impeding conductivity to the well at the product layer);
- Placing the float assembly in water to verify the screen stays out of the water at the top of the traverse range. If it does not, replacing the coiled tubing and/or the float assembly;
- Opening the pump and cleaning interior and parts with soapy water;
- Degreasing the check disk and checking the ball seats; and
- Cleaning and priming the intake screen.

### 5.3.4 System Monitoring Devices and Alarms

The Spill Buster has warning devices to indicate that the system is not operating properly. A description of the Spill Buster monitoring devices and alarms are outlined in the Operations and Maintenance Plan. In the event that warning device is activated, applicable maintenance and repairs will be conducted, as specified in the Operation and Maintenance Plan, and the Spill Buster will be restarted. Operational problems will be noted in the Periodic Review Report to be prepared for that reporting period.

# 6.0 PERIODIC ASSESSMENTS/EVALUATIONS

## 6.1 Climate Change Vulnerability Assessment

Increases in both the severity and frequency of storms/weather events, an increase in sea level elevations along with accompanying flooding impacts, shifting precipitation patterns and wide temperature fluctuation, resulting from global climactic change and instability, have the potential to significantly impact the performance, effectiveness and protectiveness of a given site and associated remedial systems. Vulnerability assessments provide information so that the site and associated remedial systems are prepared for the impacts of the increasing frequency and intensity of severe storms/weather events and associated flooding.

This section provides a summary of vulnerability assessments that will be conducted for the site during periodic assessments, and briefly summarizes the vulnerability of the site and/or engineering controls to severe storms/weather events and associated flooding.

### 6.1.1 Flood Plain

The west perimeter of the Site is bounded by the bulkhead of the Gowanus Canal. The Site is currently within the 100-year flood zone. The Site's current development plan shows an elevated berm will be maintained along the Canal and Site grade will be raised to approximate +19.5 ft (NAVD 88). The Spill Buster is unlikely to be affected by typical flood events, due to the elevated berm protecting the Site from the Gowanus Canal, however, the 100-year flood could cause temporary shutdown of equipment if power is affected.

### 6.1.2 Erosion

The Site will be primarily covered by buildings and pavement. Stabilized landscaping will be present for the slope along the Canal. This vegetated slope will be stabilized to prevent erosion.

### 6.1.3 Electricity

In the event of an electricity outage, the Spill Buster will not function. The Spill Buster is not considered critical for short term emergency periods and will remain inactive until power comes back on.

6.1.4 Spill/Containment Release

The Spill Buster drum inside the Turbine Hall building has been equipped with an overflow float valve that will trigger the system to turn off if the drum is at capacity. Due to the drum(s) being located inside a building, the drum(s) should not be affected by the 100-year flood.

## 6.2 Green Remediation Evaluation

NYSDEC's DER-31 Green Remediation requires that green remediation concepts and techniques be considered during all stages of the remedial program including site management, with the goal of improving the sustainability of the cleanup and summarizing the net environmental benefit of any implemented green technology. This section of the SMP provides a summary of any green remediation evaluations to be completed for the site during site management, and as reported in the PRR.

The assessment will include a discussion of several components of sustainability, including waste generation, energy usage, emissions, water usage, and land and/or ecosystems. A preliminary summary of each component as it relates to the Site is provided below:

- Waste Generation
  - The Spill Buster and passive product recovery will generate drums of LNAPL as a waste product. To minimize the amount of drums disposed of, product may be transferred between drums (i.e. if two drums are half full and combined into one drum – only one drum needs to be disposed of and replaced).
- Energy Usage
  - Remedial system energy usage is primarily for the Spill Buster product recovery pumps. These pumps operated only periodically and do not represent a significant demand.
- Emissions
  - Emissions from the Spill Buster cannot be quantified at this time. Drums will be maintained covered to limit emissions.
- Water Usage
  - No water is expected to be used by the remedial system.
- Land/Ecosystems

- Prior to the RA, the Site was covered by buildings and a concrete courtyard. Current plans include new landscaping along the Canal front.

Methods proposed to reduce energy consumption, resource usage, waste generation, and water usage etc. will be included in the PRR.

### 6.2.1 Timing of Green Remediation Evaluations

For major remedial system components, green remediation evaluations and corresponding modifications will be undertaken as part of a formal Remedial System Optimization (RSO), or at any time that the Project Manager feels appropriate, e.g. during significant maintenance events or in conjunction with storm recovery activities.

Modifications resulting from green remediation evaluations will be routinely implemented and scheduled to occur during planned/routine operation and maintenance activities. Reporting of these modifications will be presented in the PRR.

### 6.2.2 Remedial Systems

Remedial systems will be operated properly considering the current site conditions to conserve materials and resources to the greatest extent possible. Consideration will be given to operating rates and use of reagents and consumables. Spent materials will be sent for recycling, as appropriate.

Components of the remedial system to be evaluated the Spill Buster.

### 6.2.3 Frequency of System Checks, Sampling and Other Periodic Activities

Transportation to and from the Site and use of consumables in relation to visiting the Site in order to conduct system checks and or collect samples and shipping samples to a laboratory for analyses have direct and/or inherent energy costs. The schedule and/or means of these periodic activities have been prepared so that these tasks can be accomplished in a manner that does not impact remedy protectiveness but reduces expenditure of energy or resources.

Consideration shall be given to:

- Reduced sampling frequencies;

- Reduced Site visits and system checks;
- Installation of remote sensing/operations and telemetry;
- Coordination/consolidation of activities to maximize foreman/labor time; and
- Use of mass transit for Site visits, when feasible.

### 6.3 Remedial System Optimization

A Remedial Site Optimization (RSO) study will be conducted any time that the NYSDEC or the remedial party requests in writing that an in-depth evaluation of the remedy is needed. An RSO may be appropriate if any of the following occur:

- The remedial actions have not met or are not expected to meet RAOs in the time frame estimated in the Decision Document;
- The management and operation of the remedial system is exceeding the estimated costs;
- The remedial system is not performing as expected or as designed;
- Previously unidentified source material may be suspected;
- Plume shift has potentially occurred;
- Site conditions change due to development, change of use, change in groundwater use, etc.;
- There is an anticipated transfer of the site management to another remedial party or agency; and
- A new and applicable remedial technology becomes available.

An RSO will provide a critique of a site's conceptual model, give a summary of past performance, document current cleanup practices, summarize progress made toward the site's cleanup goals, gather additional performance or media specific data and information and provide recommendations for improvements to enhance the ability of the present system to reach RAOs or to provide a basis for changing the remedial strategy.

The RSO study will focuses on overall site cleanup strategy, process optimization and management with the intent of identifying impediments to cleanup and improvements to site operations to increase efficiency, cost effectiveness and remedial time frames. Green remediation technology and principals are to be considered when performing the RSO.

## 7.0. REPORTING REQUIREMENTS

### 7.1 Site Management Reports

All site management inspection, maintenance and monitoring events will be recorded on the appropriate site management forms provided in Appendix I. These forms are subject to NYSDEC revision.

All applicable inspection forms and other records, including media sampling data and system maintenance reports, generated for the site during the reporting period will be provided in electronic format to the NYSDEC in accordance with the requirements of Table 15 and summarized in the PRR.

**Table 15: Schedule of Interim Monitoring/Inspection Reports**

| Task/Report | Reporting Frequency* |
|---|---|
| Monthly Progress Report (Ongoing, as necessary) | Monthly through issuance of COC |
| | |
| Groundwater and LNAPL Monitoring Report | Quarterly, corresponding with groundwater monitoring frequency |
| Periodic Review Report | Annually, or as otherwise determined by the Department |

* The frequency of events will be conducted as specified until otherwise approved by the NYSDEC.

All interim monitoring/inspections reports will include, at a minimum:

- Date of event or reporting period;
- Name, company, and position of person(s) conducting monitoring/inspection activities;
- Description of the activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet);
- Type of samples collected (e.g., sub-slab vapor, indoor air, outdoor air, etc.);

- Copies of all field forms completed (e.g., well sampling logs, chain-of-custody documentation, etc.);
- Sampling results in comparison to appropriate standards/criteria;
- A figure illustrating sample type and sampling locations;
- Copies of all laboratory data sheets and the required laboratory data deliverables required for all points sampled (to be submitted electronically in the NYSDEC-identified format);
- Any observations, conclusions, or recommendations; and
- A determination as to whether contaminant conditions have changed since the last reporting event.

Routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting maintenance activities;
- Description of maintenance activities performed;
- Any modifications to the system;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet); and
- Other documentation such as copies of invoices for maintenance work, receipts for replacement equipment, etc., (attached to the checklist/form).

Non-routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting non-routine maintenance/repair activities;
- Description of non-routine activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents (included either on the form or on an attached sheet); and
- Other documentation such as copies of invoices for repair work, receipts for replacement equipment, etc. (attached to the checklist/form).

Data will be reported in digital format as determined by the NYSDEC. Currently, data is to be supplied electronically and submitted to the NYSDEC EQuIS™ database in accordance with the requirements found at this link http://www.dec.ny.gov/chemical/62440.html.

## 7.2 Monthly Reports

Monthly reports will be submitted to NYSDEC and NYSDOH Project Managers within one week following the end of the month of the reporting period, as necessary during active implementation of remediation activities. Upon issuance of the COC, progress reports will be submitted on an as-needed basis. The progress reports will include:

- Activities relative to the Site during the previous reporting period and those anticipated for the next reporting period, including a quantitative presentation of work performed (i.e., tons of material exported and imported, etc.);
- Description of approved activity modifications, including changes of work scope and/or schedule;
- Sampling results received following internal data review and validation, as applicable; and
- An update of the remedial schedule including the percentage of project completion, unresolved delays encountered or anticipated that may affect the future schedule, and efforts made to mitigate such delays.

## 7.3 Periodic Review Report

A PRR will be submitted to the Department beginning sixteen (16) months after the Certificate of Completion is issued. After submittal of the initial PRR, the next PRR shall be submitted annually to the Department or at another frequency as may be required by the Department. In the event that the site is subdivided into separate parcels with different ownership, a single PRR will be prepared that addresses the site described in Appendix A -Environmental Easement. The report will be prepared in accordance with NYSDEC's DER-10 and submitted within 30 days of the end of each certification period. Media sampling results will also be incorporated into the PRR. The report will include:

- Identification, assessment and certification of all ECs/ICs required by the remedy for the site.
- Results of the required annual site inspections and severe condition inspections, if applicable.
- All applicable site management forms and other records generated for the site during the reporting period in the NYSDEC-approved electronic format, if not previously submitted.
- A summary of any discharge monitoring data and/or information generated during the reporting period, with comments and conclusions.

- Data summary tables and graphical representations of contaminants of concern by media (groundwater, soil vapor, etc.), which include a listing of all compounds analyzed, along with the applicable standards, with all exceedances highlighted. These will include a presentation of past data as part of an evaluation of contaminant concentration trends.
- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted in digital format as determined by the NYSDEC. Currently, data is supplied electronically and submitted to the NYSDEC EQuIS™ database in accordance with the requirements found at this link: http://www.dec.ny.gov/chemical/62440.html.
- A site evaluation, which includes the following:
  - The compliance of the remedy with the requirements of the site-specific RAWP, ROD or Decision Document;
  - The operation and the effectiveness of all treatment units, etc., including identification of any needed repairs or modifications;
  - Any new conclusions or observations regarding site contamination based on inspections or data generated by the Monitoring and Sampling Plan for the media being monitored;
  - Recommendations regarding any necessary changes to the remedy and/or Monitoring and Sampling Plan; and
  - Trends in contaminant levels in the affected media will be evaluated to determine if the remedy continues to be effective in achieving remedial goals as specified by the Decision Document.
  - The overall performance and effectiveness of the remedy.
- A performance summary for all treatment systems at the site during the calendar year, including information such as:
  - The number of days the system operated for the reporting period;
  - The average, high, and low flows per day;
  - The contaminant mass removed;
  - A description of breakdowns and/or repairs along with an explanation for any significant downtime;
  - A description of the resolution of performance problems;
  - Alarm conditions;
  - Trends in equipment failure;
  - A summary of the performance, effluent and/or effectiveness monitoring; and
  - Comments, conclusions, and recommendations based on data evaluation.

7.3.1 Certification of Institutional and Engineering Controls

Following the last inspection of the reporting period, a Professional Engineer licensed to practice in New York State will prepare, and include in the Periodic Review Report, the following certification as per the requirements of NYSDEC DER-10:

"*For each institutional or engineering control identified for the site, I certify that all of the following statements are true:*

- *The inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;*
- *The institutional control and/or engineering control employed at this site is unchanged from the date the control was put in place, or last approved by the Department;*
- *Nothing has occurred that would impair the ability of the control to protect the public health and environment;*
- *Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;*
- *Access to the site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control;*
- *If a financial assurance mechanism is required under the oversight document for the site, the mechanism remains valid and sufficient for the intended purpose under the document;*
- *Use of the site is compliant with the environmental easement;*
- *The engineering control systems are performing as designed and are effective;*
- *To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program and generally accepted engineering practices; and*
- *The information presented in this report is accurate and complete.*
- *The assumptions made in the qualitative exposure assessment remain valid.*

*I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, Charles McGuckin, of Roux Environmental Engineering and Geology, D.P.C., 209 Shafter St. Islandia, NY 11749, am certifying as Gemini Arts Initiative, Inc.'s Designated Site Representative for the site."*

The signed certification will be included in the Periodic Review Report.

The Periodic Review Report will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the site is located and the NYSDOH Bureau of Environmental Exposure Investigation. The Periodic Review Report may need to be submitted in hard-copy format, as requested by the NYSDEC project manager.

### 7.4 Corrective Measures Work Plan

If any component of the remedy is found to have failed, or if the periodic certification cannot be provided due to the failure of an institutional or engineering control, a Corrective Measures Work Plan will be submitted to the NYSDEC for approval. This plan will explain the failure and provide the details and schedule for performing work necessary to correct the failure. Unless an emergency condition exists, no work will be performed pursuant to the Corrective Measures Work Plan until it has been approved by the NYSDEC.

### 7.5 Remedial Site Optimization Report

In the event that an RSO is to be performed (see Section 6.3), upon completion of an RSO, an RSO report must be submitted to the Department for approval. The RSO report will document the research/ investigation and data gathering that was conducted, evaluate the results and facts obtained, present a revised conceptual site model and present recommendations. RSO recommendations are to be implemented upon approval from the NYSDEC. Additional work plans, design documents, HASPs etc., may still be required to implement the recommendations, based upon the actions that need to be taken. A final engineering report and update to the SMP may also be required.

The RSO report will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the site is located, Site Control and the NYSDOH Bureau of Environmental Exposure Investigation.

## 8.0 REFERENCES

Creative Environmental Solutions Corp. (2012, March 22). Final Remedial Investigation Report.

Hydro Tech Environmental, Corp. (2005, March 1). Limited Phase II Environmental Site Assessment Report.

Korner Environmental, Inc. (2004, August). Phase I Environmental Site Assessment.

Langan Engineering & Environmental Services, P.C. (2007, June). Remedial Investigation Report for Gowanus Village I - Parcel B.

Langan Engineering & Environmental Services, P.C. (2012, April 3). Phase I Environmental Site Asessment.

Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C. (2016, December 12). Geotechnical Engineering Report. New York.

Leggette, Brashears & Graham, Inc. (2015, January 22). Remedial Action Implementation Summary.

6NYCRR Part 375, Environmental Remediation Programs. December 14, 2006.

NYSDEC DER-10 – "Technical Guidance for Site Investigation and Remediation".

NYSDEC, 1998. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1. June 1998 (April 2000 addendum).

Roux Environmental Engineering and Geology, D.P.C. (2019, April 9). Remedial Action Work Plan for PCB Cleanup.

Roux Environmental Engineering and Geology, D.P.C. (2020, March 23). Amendment to the USEPA Remedial Action Work Plan for PCB Cleanup.

# TABLES

1. Notifications (Embedded in Text in Section 1.3)
2. Summary of Groundwater Gauging Data
3. Summary of Volatile Organic Compounds Exceedances in Soil
4. Summary of Semi-Volatile Organic Compounds Exceedances in Soil
5. Summary of Metals Exceedances in Soil
6. Summary of Polychlorinated Biphenyls Exceedances in Soil
7. Summary of Volatile Organic Compounds in Groundwater
8. Summary of Semi-volatile Organic Compounds in Groundwater
9. Summary of Metals in Groundwater
10. Summary of Polychlorinated Biphenyls in Groundwater
11. Summary of Pesticides and Herbicides in Groundwater
12. Historical Soil Vapor Sample Exceedances
13. Post Remediation Inspection and Monitoring Schedule (Embedded in Text in Section 4.1)
14. Well Construction Details (Embedded in Text in Section 4.3.2)
15. Interim Reporting Summary/Schedule (Embedded in Text in Section 7.1)

**Table 2a. Summary of 2017 Groundwater Gauging Data, Gowanus Village I LLC, Brooklyn, New York**

| Date | Well ID | Well Elevation (ft) | DTW (ft) | DTP (ft) | Product Thickness (ft) | Corrected Groundwater Elevation | Gallons of Product Removed | Notes | Technician |
|---|---|---|---|---|---|---|---|---|---|
| 6/16/2016 | MW-1 | 6.77 | 4.93 | -- | -- | 1.84 | NA | Bailer sent down to confirm, no product | M.Sarni |
| 6/16/2016 | MW-2 | 6.85 | 6.05 | 5.91 | 0.14 | 0.8 | 0.25 | Bailed .25 gallons | M.Sarni |
| 6/16/2016 | MW-3 | 6.9 | 7.49 | 2.37 | 5.12 | -0.59 | 0.03 | Bailed 1 bailer full (1inch bailer= 1/32 gallon) , product very thick | M.Sarni |
| 6/16/2016 | MW-4 | 7.17 | -- | -- | | -- | NA | Did not have time to measure | M.Sarni |
| 6/30/2016 | MW-1 | 6.77 | 4.88 | 14.85 | -- | 1.89 | NA | 1 inch dimater well | M.Sarni |
| 6/30/2016 | MW-2 | 6.85 | 6.91 | 6.49 | 0.42 | -0.06 | 0.25 | 2 inch diameter, Product very thick | M.Sarni |
| 6/30/2016 | MW-3 | 6.9 | 7.21 | 4.97 | 2.24 | -0.31 | 1 | 2 inch diamer, product very thick | M.Sarni |
| 6/30/2016 | MW-4 | 7.17 | 5.13 | -- | -- | 2.04 | NA | 1 inch dimater well | M.Sarni |
| 7/12/2016 | MW-1 | 6.77 | 4.84 | -- | | 1.93 | NA | | Sarni/Alfredo |
| 7/12/2016 | MW-2 | 6.85 | 7.11 | 6.41 | 0.7 | -0.26 | trace | trace bailed | Sarni/Alfredo |
| 7/12/2016 | MW-3 | 6.9 | 9.43 | 6.62 | 2.81 | -2.53 | 0.25 | 0.25 gallons bailed | Sarni/Alfredo |
| 7/12/2016 | MW-4 | 7.17 | 4.85 | -- | | 2.32 | NA | | Sarni/Alfredo |
| 12/20/2016 | MW-1 | 6.77 | 5.81 | -- | -- | 0.96 | NA | Prior to dewatering | L. Dolginko |
| 12/20/2016 | MW-2 | 6.85 | 6.53 | 6.49 | 0.04 | 0.32 | NA | Prior to dewatering | L. Dolginko |
| 12/20/2016 | MW-3 | 6.9 | 9.0 | 6.8 | 2.2 | -2.1 | NA | Prior to dewatering | L. Dolginko |
| 12/20/2016 | MW-4 | 7.17 | 5.3 | -- | -- | 1.88 | NA | Prior to dewatering | L. Dolginko |
| 12/20/2016 | MW-1 | 6.77 | 7.52 | -- | -- | -0.75 | NA | During dewatering | L. Dolginko |
| 12/20/2016 | MW-2 | 6.85 | 5.98 | -- | -- | 0.87 | NA | During dewatering | L. Dolginko |
| 12/20/2016 | MW-3 | 6.9 | 7.4 | 5.5 | 1.9 | -0.5 | NA | During dewatering | L. Dolginko |
| 12/20/2016 | MW-4 | 7.17 | 4.94 | -- | -- | 2.23 | NA | During dewatering | L. Dolginko |
| 12/20/2016 | MW-1 | 6.77 | 8.09 | 8.05 | 0.04 | -1.32 | NA | After dewatering | L. Dolginko |
| 12/20/2016 | MW-2 | 6.85 | 6.38 | -- | -- | 0.47 | NA | After dewatering | L. Dolginko |
| 12/20/2016 | MW-3 | 6.9 | 7.9 | 5.9 | 2 | -1 | NA | After dewatering | L. Dolginko |
| 12/20/2016 | MW-4 | 7.17 | 4.97 | -- | -- | 2.2 | NA | After dewatering | L. Dolginko |
| 12/21/2016 | MW-1 | 6.77 | 6.98 | -- | -- | -0.21 | NA | Prior to dewatering | L. Dolginko |
| 12/21/2016 | MW-2 | 6.85 | 6.91 | 6.9 | 0.01 | -0.06 | NA | Prior to dewatering | L. Dolginko |
| 12/21/2016 | MW-3 | 6.9 | 9.15 | 7 | 2.15 | -2.25 | NA | Prior to dewatering | L. Dolginko |
| 12/21/2016 | MW-4 | 7.17 | 5.19 | -- | -- | 1.98 | NA | Prior to dewatering | L. Dolginko |
| 12/21/2016 | MW-1 | 6.77 | 9.75 | 9.7 | 0.05 | -2.98 | NA | After dewatering | L. Dolginko |
| 12/21/2016 | MW-2 | 6.85 | 6.65 | 6.64 | 0.01 | 0.2 | NA | After dewatering | L. Dolginko |
| 12/21/2016 | MW-3 | 6.9 | 7.58 | 6.2 | 1.38 | -0.68 | NA | After dewatering | L. Dolginko |
| 12/21/2016 | MW-4 | 7.17 | 4.95 | -- | -- | 2.22 | NA | After dewatering | L. Dolginko |
| 12/22/2016 | MW-1 | 6.77 | 7.4 | -- | -- | -0.63 | NA | Prior to dewatering | L. Dolginko |
| 12/22/2016 | MW-2 | 6.85 | 7.15 | -- | -- | -0.3 | NA | Prior to dewatering | L. Dolginko |
| 12/22/2016 | MW-3 | 6.9 | 8.96 | 7.18 | 1.78 | -2.06 | NA | Prior to dewatering | L. Dolginko |
| 12/22/2016 | MW-4 | 7.17 | 5.15 | -- | -- | 2.02 | NA | Prior to dewatering | L. Dolginko |
| 12/22/2016 | MW-1 | 6.77 | 9.37 | 9.35 | 0.02 | -2.6 | NA | After dewatering | L. Dolginko |
| 12/22/2016 | MW-2 | 6.85 | 7.32 | -- | -- | -0.47 | NA | After dewatering | L. Dolginko |
| 12/22/2016 | MW-3 | 6.9 | 8.52 | 6.5 | 2.02 | -1.62 | NA | After dewatering | L. Dolginko |
| 12/22/2016 | MW-4 | 7.17 | 5.5 | -- | -- | 1.67 | NA | After dewatering | L. Dolginko |
| 12/22/2016 | MW-1 | 6.77 | 8.93 | 8.9 | 0.03 | -2.16 | NA | After dewatering | L. Dolginko |
| 12/22/2016 | MW-2 | 6.85 | 6.9 | -- | -- | -0.05 | NA | After dewatering | L. Dolginko |
| 12/22/2016 | MW-3 | 6.9 | 8.4 | 6.4 | 2 | -1.5 | NA | After dewatering | L. Dolginko |
| 12/22/2016 | MW-4 | 7.17 | 4.98 | -- | -- | 2.19 | NA | After dewatering | L. Dolginko |
| 12/28/2016 | MW-1 | 6.77 | 5.78 | -- | -- | 0.99 | NA | Prior to dewatering | L. Dolginko |
| 12/28/2016 | MW-2 | 6.85 | 5.35 | -- | -- | 1.5 | NA | Prior to dewatering | L. Dolginko |
| 12/28/2016 | MW-3 | 6.9 | 7.2 | 5.38 | 1.82 | -0.3 | NA | Prior to dewatering | L. Dolginko |
| 12/28/2016 | MW-4 | 7.17 | 4.95 | -- | -- | 2.22 | NA | Prior to dewatering | L. Dolginko |
| 12/28/2016 | MW-1 | 6.77 | 7.7 | -- | -- | -0.93 | NA | During dewatering | L. Dolginko |
| 12/28/2016 | MW-2 | 6.85 | 6.68 | -- | -- | 0.17 | NA | During dewatering | L. Dolginko |
| 12/28/2016 | MW-3 | 6.9 | 7.95 | 6.58 | 1.37 | -1.05 | NA | During dewatering | L. Dolginko |
| 12/28/2016 | MW-4 | 7.17 | 5.2 | -- | -- | 1.97 | NA | During dewatering | L. Dolginko |
| 12/28/2016 | MW-1 | 6.77 | 8.91 | -- | -- | -2.14 | NA | After dewatering | L. Dolginko |
| 12/28/2016 | MW-2 | 6.85 | 7.41 | -- | -- | -0.56 | NA | After dewatering | L. Dolginko |
| 12/28/2016 | MW-3 | 6.9 | 9.4 | 7.22 | | -2.5 | NA | After dewatering | L. Dolginko |
| 12/28/2016 | MW-4 | 7.17 | 5.46 | -- | -- | 1.71 | NA | After dewatering | L. Dolginko |
| 12/29/2016 | MW-1 | 6.77 | 7.19 | 7.18 | 0.01 | -0.42 | NA | Prior to dewatering | L. Dolginko |

**Table 2a. Summary of 2017 Groundwater Gauging Data, Gowanus Village I LLC, Brooklyn, New York**

| Date | Well ID | Well Elevation (ft) | DTW (ft) | DTP (ft) | Product Thickness (ft) | Corrected Groundwater Elevation | Gallons of Product Removed | Notes | Technician |
|---|---|---|---|---|---|---|---|---|---|
| 12/29/2016 | MW-2 | 6.85 | 5.45 | -- | -- | 1.4 | NA | Prior to dewatering | L. Dolginko |
| 12/29/2016 | MW-3 | 6.9 | 7.4 | 5.19 | | -0.5 | NA | Prior to dewatering | L. Dolginko |
| 12/29/2016 | MW-4 | 7.17 | 4.83 | -- | -- | 2.34 | NA | Prior to dewatering | L. Dolginko |
| 12/29/2016 | MW-1 | 6.77 | 9.43 | -- | -- | -2.66 | NA | During dewatering | L. Dolginko |
| 12/29/2016 | MW-2 | 6.85 | 6.22 | -- | -- | 0.63 | NA | During dewatering | L. Dolginko |
| 12/29/2016 | MW-3 | 6.9 | 7.86 | 5.8 | 2.06 | -0.96 | NA | During dewatering | L. Dolginko |
| 12/29/2016 | MW-4 | 7.17 | 4.9 | -- | -- | 2.27 | NA | During dewatering | L. Dolginko |
| 12/30/2016 | MW-1 | 6.77 | 7.18 | -- | -- | -0.41 | NA | Prior to dewatering | L. Dolginko |
| 12/30/2016 | MW-2 | 6.85 | 6.08 | -- | -- | 0.77 | NA | Prior to dewatering | L. Dolginko |
| 12/30/2016 | MW-3 | 6.9 | 7.81 | 5.77 | 2.04 | -0.91 | NA | Prior to dewatering | L. Dolginko |
| 12/30/2016 | MW-4 | 7.17 | 4.91 | -- | -- | 2.26 | NA | Prior to dewatering | L. Dolginko |
| 12/30/2016 | MW-1 | 6.77 | 8.7 | 8.68 | 0.02 | -1.93 | NA | After dewatering | L. Dolginko |
| 12/30/2016 | MW-2 | 6.85 | 6.6 | -- | -- | 0.25 | NA | After dewatering | L. Dolginko |
| 12/30/2016 | MW-3 | 6.9 | 7.95 | 6.18 | 1.77 | -1.05 | NA | After dewatering | L. Dolginko |
| 12/30/2016 | MW-4 | 7.17 | 4.96 | -- | -- | 2.21 | NA | After dewatering | L. Dolginko |
| 1/10/2017 | MW-1 | 6.77 | 6.04 | -- | -- | 0.73 | NA | | Alfredo |
| 1/10/2017 | MW-2 | 6.85 | 5.16 | -- | -- | 1.69 | NA | | Alfredo |
| 1/10/2017 | MW-3 | 6.9 | 7.63 | 4.42 | 3.21 | -0.73 | 0.25 | Bailed .25 gallons, product very thick | Alfredo |
| 1/10/2017 | MW-4 | 7.17 | 5.03 | -- | -- | 2.14 | NA | | Alfredo |
| 1/10/2017 | MW-3 | 6.9 | 5.27 | 5.28 | 0.01 | 1.63 | NA | After bailing 0.25 gallons | Alfredo |
| 1/19/2017 | MW-1 | 6.77 | 7.74 | -- | -- | -0.97 | NA | | Alfredo |
| 1/19/2017 | MW-2 | 6.85 | 7.09 | -- | -- | -0.24 | NA | | Alfredo |
| 1/19/2017 | MW-3 | 6.9 | 9.65 | 6.88 | 2.77 | -2.75 | 1 | | Alfredo |
| 1/19/2017 | MW-4 | 7.17 | 4.98 | -- | -- | 2.19 | NA | | Alfredo |
| 1/19/2017 | MW-3 | 6.9 | 6.93 | 6.88 | 0.05 | -0.03 | NA | After bailing 1.0 gallons, product very thick | Alfredo |
| 1/20/2017 | MW-1 | 6.77 | 6.75 | -- | -- | 0.02 | NA | | L. Dolginko |
| 1/20/2017 | MW-2 | 6.85 | 6.79 | -- | -- | 0.06 | NA | | L. Dolginko |
| 1/20/2017 | MW-3 | 6.9 | 7.28 | 6.97 | 0.31 | -0.38 | 0.125 | | L. Dolginko |
| 1/20/2017 | MW-4 | 7.17 | 5.08 | -- | -- | 2.09 | NA | | L. Dolginko |
| 1/20/2017 | MW-3 | 6.9 | 7.16 | 7.03 | 0.13 | -0.26 | NA | After bailing 1/8 gallon - absorbent sock put in well | L. Dolginko |
| 1/24/2017 | MW-1 | 6.77 | 3.73 | -- | -- | 3.04 | NA | | Alfredo |
| 1/24/2017 | MW-2 | 6.85 | 3.02 | -- | -- | 3.83 | NA | | Alfredo |
| 1/24/2017 | MW-3 | 6.9 | 3.13 | 2.92 | 0.21 | 3.77 | Trace | Sock removed from well- 100% saturation | Alfredo |
| 1/24/2017 | MW-4 | 7.17 | 4.14 | -- | -- | 3.03 | NA | | Alfredo |
| 1/24/2017 | MW-3 | 6.9 | 3 | 2.99 | 0.01 | 3.9 | Trace | After bailing trace product | Alfredo |
| 2/2/2017 | MW-1 | 6.77 | 5.23 | -- | -- | 1.54 | NA | | Alfredo |
| 2/2/2017 | MW-2 | 6.85 | 6.29 | -- | -- | 0.56 | NA | | Alfredo |
| 2/2/2017 | MW-3 | 6.9 | 8.06 | 6.12 | 1.94 | -1.16 | 0.38 | | Alfredo |
| 2/2/2017 | MW-4 | 7.17 | 5.02 | -- | -- | 2.15 | NA | | Alfredo |
| 2/2/2017 | MW-3 | 6.9 | 5.99 | 5.89 | 0.1 | 0.91 | trace | After bailing 0.38 gallons with peri pump | Alfredo |
| 2/7/2017 | MW-1 | 6.77 | 5.77 | -- | -- | 1 | NA | | M.Sarni |
| 2/7/2017 | MW-2 | 6.85 | 5.79 | -- | -- | 1.06 | NA | | M.Sarni |
| 2/7/2017 | MW-3 | 6.9 | 6.61 | 5.98 | 0.63 | 0.29 | 1 | | M.Sarni |
| 2/7/2017 | MW-4 | 7.17 | 5.01 | -- | -- | 2.16 | NA | | M.Sarni |
| 2/7/2017 | MW-3 | 6.9 | 6.81 | 6.79 | 0.02 | 0.09 | NA | After bailing 1 gallon | M.Sarni |
| 2/14/2017 | MW-1 | 6.77 | 5.97 | -- | -- | 0.8 | NA | | L. Dolginko |
| 2/14/2017 | MW-2 | 6.85 | 5.79 | -- | -- | 1.06 | NA | | L. Dolginko |
| 2/14/2017 | MW-3 | 6.9 | 6.53 | 5.74 | 0.79 | 0.37 | 0.25 | | L. Dolginko |
| 2/14/2017 | MW-4 | 7.17 | 5.01 | -- | -- | 2.16 | NA | | L. Dolginko |
| 2/14/2017 | MW-3 | 6.9 | 5.6 | 5.59 | 0.01 | 1.3 | NA | After bailing 0.25 gallons | L. Dolginko |
| 2/22/2017 | MW-1 | 6.77 | 5.63 | -- | | 1.14 | NA | | L. Dolginko |
| 2/22/2017 | MW-2 | 6.85 | 5.63 | -- | | 1.22 | NA | | L. Dolginko |
| 2/22/2017 | MW-3 | 6.9 | 6.5 | 5.82 | 0.68 | 0.4 | 0.25 | | L. Dolginko |
| 2/22/2017 | MW-4 | 7.17 | 4.86 | -- | | 2.31 | NA | | L. Dolginko |
| 2/22/2017 | MW-3 | 6.9 | 5.99 | 5.89 | 0.1 | 0.91 | NA | After bailing 0.25 gallons | L. Dolginko |
| 3/1/2017 | MW-1 | 6.77 | 5.43 | -- | | 1.34 | NA | | L. Dolginko |
| 3/1/2017 | MW-2 | 6.85 | 4.74 | -- | | 2.11 | NA | | L. Dolginko |

**Table 2a. Summary of 2017 Groundwater Gauging Data, Gowanus Village I LLC, Brooklyn, New York**

| Date | Well ID | Well Elevation (ft) | DTW (ft) | DTP (ft) | Product Thickness (ft) | Corrected Groundwater Elevation | Gallons of Product Removed | Notes | Technician |
|---|---|---|---|---|---|---|---|---|---|
| 3/1/2017 | MW-3 | 6.9 | 4.9 | 4.59 | 0.31 | 2 | 0.25 | | L. Dolginko |
| 3/1/2017 | MW-4 | 7.17 | 4.78 | -- | | 2.39 | NA | | L. Dolginko |
| 3/1/2017 | MW-3 | 6.9 | 4.77 | 4.75 | 0.02 | 2.13 | NA | After bailing 0.25 gallons | L. Dolginko |
| 4/7/2017 | MW-1 | 6.77 | 4.27 | -- | | 2.5 | NA | | L. Dolginko |
| 4/7/2017 | MW-2 | 6.85 | 5.31 | -- | | 1.54 | NA | | L. Dolginko |
| 4/7/2017 | MW-3 | 6.9 | 5.98 | 5.88 | 0.1 | 0.92 | NA | | L. Dolginko |
| 4/7/2017 | MW-4 | 7.17 | 4.63 | -- | | 2.54 | NA | | L. Dolginko |
| 5/2/2017 | MW-1 | 6.77 | 5.12 | -- | | 1.65 | NA | | L. Dolginko |
| 5/2/2017 | MW-2 | 6.85 | 6.11 | -- | | 0.74 | NA | | L. Dolginko |
| 5/2/2017 | MW-3 | 6.9 | 7.55 | 6.51 | 1.04 | -0.65 | 0.25 | | L. Dolginko |
| 5/2/2017 | MW-4 | 7.17 | 4.92 | -- | | 2.25 | NA | | L. Dolginko |
| 5/2/2017 | MW-3 | 6.9 | 7.56 | 7.53 | 0.03 | -0.66 | NA | After bailing 0.25 gallons | L. Dolginko |
| 5/24/2017 | MW-26D | 20.86 | 16.2 | -- | | 4.66 | NA | Depth measurement in feet below land surface | L. Dolginko |
| 5/24/2017 | MW-26S | 20.86 | -- | -- | | NM | NA | Depth measurement in feet below land surface | L. Dolginko |
| 5/24/2017 | MW-25 | 15.7 | 11.09 | -- | | 4.61 | NA | Depth measurement in feet below land surface | L. Dolginko |
| 5/24/2017 | B-14 | 15.91 | 13.48 | -- | | 2.43 | NA | Depth measurement in feet below land surface | L. Dolginko |
| 5/24/2017 | MW-1 | 6.77 | 4.58 | -- | | 2.19 | NA | | L. Dolginko |
| 5/24/2017 | MW-2 | 6.85 | 4.39 | -- | | 2.46 | NA | | L. Dolginko |
| 5/24/2017 | MW-3 | 6.9 | 5.2 | 4.36 | 0.84 | 1.7 | 0.25 | | L. Dolginko |
| 5/24/2017 | MW-4 | 7.17 | 4.47 | -- | | 2.7 | NA | | L. Dolginko |
| 5/24/2017 | MW-3 | 6.9 | 5.56 | 5.55 | 0.01 | 1.34 | NA | After bailing 0.25 gallons | L. Dolginko |
| 6/16/2017 | MW-1 | 6.77 | 5.3 | -- | | 1.47 | NA | | L. Dolginko |
| 6/16/2017 | MW-2 | 6.85 | 6.2 | -- | | 0.65 | NA | | L. Dolginko |
| 6/16/2017 | MW-3 | 6.9 | 7.63 | 6.58 | 1.05 | -0.73 | 0.25 | | L. Dolginko |
| 6/16/2017 | MW-4 | 7.17 | 4.91 | -- | | 2.26 | NA | | L. Dolginko |
| 6/16/2017 | MW-3 | 6.9 | 6.67 | -- | TRACE | 0.23 | NA | After bailing 0.25 gallons | L. Dolginko |
| 6/27/2017 | MW-1 | 6.77 | 5 | -- | | 1.77 | NA | | L. Dolginko |
| 6/27/2017 | MW-2 | 6.85 | 6.18 | -- | | 0.67 | NA | | L. Dolginko |
| 6/27/2017 | MW-3 | 6.9 | 6.94 | 6.6 | 0.34 | -0.04 | 0.125 | | L. Dolginko |
| 6/27/2017 | MW-4 | 7.17 | 4.83 | -- | | 2.34 | NA | | L. Dolginko |
| 6/27/2017 | MW-3 | 6.9 | 6.65 | 6.64 | 0.01 | 0.25 | NA | After bailing 0.125 gallons | L. Dolginko |
| 6/27/2017 | B-14 | 15.91 | 13.22 | | | 2.69 | | Depth Measurement in feet below top of casing | L. Dolginko |
| 6/27/2017 | MW-26D | 20.86 | 18.22 | | | 2.64 | | Depth Measurement in feet below top of casing | L. Dolginko |
| 6/27/2017 | MW-26S | 20.86 | 18.31 | | | 2.55 | | Depth Measurement in feet below top of casing | L. Dolginko |
| 6/27/2017 | B-1 | 20.16 | 17.43 | | | 2.73 | | Depth Measurement in feet below top of casing | L. Dolginko |
| 6/27/2017 | MW-25 | 15.7 | 13.69 | | | 2.01 | | Depth Measurement in feet below top of casing | L. Dolginko |
| 7/5/2017 | MW-1 | 6.77 | 5.32 | -- | | 1.45 | NA | | L. Dolginko |
| 7/5/2017 | MW-2 | 6.85 | 6.11 | -- | | 0.74 | NA | | L. Dolginko |
| 7/5/2017 | MW-3 | 6.9 | 7.21 | 6.47 | 0.74 | -0.31 | 0.125 | | L. Dolginko |
| 7/5/2017 | MW-4 | 7.17 | 4.85 | -- | | 2.32 | NA | | L. Dolginko |
| 7/5/2017 | MW-3 | 6.9 | 6.64 | 6.64 | TRACE | 0.26 | NA | After bailing 0.125 gallons | L. Dolginko |
| 7/10/2017 | MW-1 | 6.77 | 5 | -- | | 1.77 | NA | | L. Dolginko |
| 7/10/2017 | MW-2 | 6.85 | 5.02 | -- | | 1.83 | NA | | L. Dolginko |
| 7/10/2017 | MW-3 | 6.9 | 5.58 | 5.09 | 0.49 | 1.32 | 0.125 | | L. Dolginko |
| 7/10/2017 | MW-4 | 7.17 | 4.55 | -- | | 2.62 | NA | | L. Dolginko |
| 7/10/2017 | MW-3 | 6.9 | 5.2 | -- | TRACE | 1.7 | NA | After bailing 0.125 gallons | L. Dolginko |
| 7/20/2017 | MW-1 | 6.77 | 5.25 | -- | | 1.52 | NA | | L. Dolginko |
| 7/20/2017 | MW-2 | 6.85 | 6.15 | -- | | 0.7 | NA | | L. Dolginko |
| 7/20/2017 | MW-3 | 6.9 | 6.52 | 6.24 | 0.28 | 0.38 | 0.25 | | L. Dolginko |
| 7/20/2017 | MW-4 | 7.17 | 5.03 | -- | | 2.14 | NA | | L. Dolginko |
| 7/20/2017 | MW-3 | 6.9 | 6.69 | 6.6 | 0.09 | 0.21 | NA | After bailing 0.25 gallons | L. Dolginko |
| 7/27/2017 | MW-1 | 6.77 | 4.83 | -- | | 1.94 | NA | | L. Dolginko |
| 7/27/2017 | MW-2 | 6.85 | 4.88 | -- | | 1.97 | NA | | L. Dolginko |
| 7/27/2017 | MW-3 | 6.9 | 5.11 | 4.89 | 0.22 | 1.79 | 0.125 | | L. Dolginko |
| 7/27/2017 | MW-4 | 7.17 | 4.5 | -- | | 2.67 | NA | | L. Dolginko |
| 7/27/2017 | MW-3 | 6.9 | 4.89 | 4.88 | 0.01 | 2.01 | NA | After bailing 0.125 gallons | L. Dolginko |
| 8/11/2017 | MW-1 | 6.77 | 4.99 | -- | | 1.78 | NA | | L. Dolginko |

**Table 2a. Summary of 2017 Groundwater Gauging Data, Gowanus Village I LLC, Brooklyn, New York**

| Date | Well ID | Well Elevation (ft) | DTW (ft) | DTP (ft) | Product Thickness (ft) | Corrected Groundwater Elevation | Gallons of Product Removed | Notes | Technician |
|---|---|---|---|---|---|---|---|---|---|
| 8/11/2017 | MW-2 | 6.85 | 4.94 | -- | | 1.91 | NA | | L. Dolginko |
| 8/11/2017 | MW-3 | 6.9 | 6.24 | 5 | 1.24 | 0.66 | 0.25 | | L. Dolginko |
| 8/11/2017 | MW-4 | 7.17 | 4.6 | -- | | 2.57 | NA | | L. Dolginko |
| 8/11/2017 | MW-3 | 6.9 | 4.98 | 4.79 | #REF! | 1.92 | NA | After bailing 0.25 gallons | L. Dolginko |
| 8/16/2017 | MW-1 | 6.77 | 5.08 | -- | | 1.69 | NA | | L. Dolginko |
| 8/16/2017 | MW-2 | 6.85 | 6.1 | -- | | 0.75 | NA | | L. Dolginko |
| 8/16/2017 | MW-3 | 6.9 | 7.33 | 6.5 | 0.83 | -0.43 | 0.125 | | L. Dolginko |
| 8/16/2017 | MW-4 | 7.17 | 4.9 | -- | | 2.27 | NA | | L. Dolginko |
| 8/16/2017 | MW-3 | 6.9 | 6.66 | 6.61 | #REF! | 0.24 | NA | After bailing 0.125 gallons | L. Dolginko |
| 9/6/2017 | MW-1 | 6.77 | 4.69 | -- | | 2.08 | NA | | L. Dolginko |
| 9/6/2017 | MW-2 | 6.85 | 5.39 | -- | | 1.46 | NA | | L. Dolginko |
| 9/6/2017 | MW-3 | 6.9 | -- | -- | | NM | 0.25 | Interface probe malfunction - no reading | L. Dolginko |
| 9/6/2017 | MW-4 | 7.17 | 4.69 | -- | | 2.48 | NA | | L. Dolginko |
| 9/25/2017 | MW-1 | 6.77 | 4.72 | -- | | 2.05 | NA | | B. Copeland |
| 9/25/2017 | MW-2 | 6.85 | 4.48 | -- | | 2.37 | NA | | B. Copeland |
| 9/25/2017 | MW-3 | 6.9 | 5.77 | 4.29 | 1.48 | 1.13 | 0.25 | | B. Copeland |
| 9/25/2017 | MW-4 | 7.17 | 4.53 | -- | | 2.64 | NA | | B. Copeland |
| 9/29/2017 | MW-5 | NS | 5.14 | -- | | NS | NA | | L. Dolginko |
| 9/29/2017 | MW-6 | NS | 5.2 | -- | | NS | NA | | L. Dolginko |
| 10/2/2017 | MW-8 | NS | 4.2 | -- | | NS | NA | | L. Dolginko |
| 10/2/2017 | MW-9 | NS | 7.69 | -- | | NS | NA | | L. Dolginko |
| 10/2/2017 | MW-5 | NS | 4.98 | -- | | NS | NA | | L. Dolginko |
| 10/2/2017 | MW-6 | NS | 5.2 | -- | | NS | NA | | L. Dolginko |
| 10/2/2017 | MW-5 | NS | 5.1 | -- | | NS | NA | | L. Dolginko |
| 10/2/2017 | MW-6 | NS | 5.24 | -- | | NS | NA | | L. Dolginko |
| 10/2/2017 | MW-6 | NS | 5.25 | -- | | NS | NA | | L. Dolginko |
| 10/2/2017 | MW-5 | NS | 5.14 | -- | | NS | NA | | L. Dolginko |
| 10/2/2017 | MW-8 | NS | 4.21 | -- | | NS | NA | | L. Dolginko |
| 10/2/2017 | MW-9 | NS | 7.72 | -- | | NS | NA | | L. Dolginko |
| 10/2/2017 | MW-5 | NS | 5.19 | -- | | NS | NA | | L. Dolginko |
| 10/2/2017 | MW-6 | NS | 5.28 | -- | | NS | NA | | L. Dolginko |
| 10/2/2017 | MW-8 | NS | 4.24 | -- | | NS | NA | | L. Dolginko |
| 10/2/2017 | MW-9 | NS | 7.68 | -- | | NS | NA | | L. Dolginko |
| 10/2/2017 | MW-2 | 6.85 | 6.16 | -- | | 0.69 | NA | | L. Dolginko |
| 10/2/2017 | MW-1 | 6.77 | 5.25 | -- | | 1.52 | NA | | L. Dolginko |
| 10/2/2017 | MW-4 | 7.17 | 5 | -- | | 2.17 | NA | | L. Dolginko |
| 10/6/2017 | MW-5 | NS | 4.93 | -- | | NS | NA | | B. Copeland |
| 10/6/2017 | MW-6 | NS | 5.15 | -- | | NS | NA | | B. Copeland |
| 10/6/2017 | MW-7 | NS | 4.98 | -- | | NS | NA | | B. Copeland |
| 10/6/2017 | MW-8 | NS | 7.81 | -- | | NS | NA | | B. Copeland |
| 10/6/2017 | MW-9 | NS | 4.33 | -- | | NS | NA | | B. Copeland |
| 10/10/2017 | MW-1 | 6.77 | 4.96 | -- | | 1.81 | NA | | L. Dolginko |
| 10/10/2017 | MW-2 | 6.85 | 6.13 | -- | | 0.72 | NA | | L. Dolginko |
| 10/10/2017 | MW-3 | 6.9 | 7.5 | 6.56 | 0.94 | -0.6 | NA | | L. Dolginko |
| 10/10/2017 | MW-4 | 7.17 | 5.14 | -- | | 2.03 | NA | | L. Dolginko |
| 10/10/2017 | MW-5 | NS | 4.82 | -- | | NS | NA | | L. Dolginko |
| 10/10/2017 | MW-6 | NS | 4.93 | 4.89 | 0.04 | NS | NA | | L. Dolginko |
| 10/10/2017 | MW-7 | NS | 5.51 | -- | | NS | NA | | L. Dolginko |
| 10/10/2017 | MW-8 | NS | 4.12 | -- | | NS | NA | | L. Dolginko |
| 10/10/2017 | MW-9 | NS | 7.67 | -- | | NS | NA | | L. Dolginko |

**Table 2b. Summary of 2018 Groundwater Gauging Data, Gowanus Village I LLC, Brooklyn, New York**

| Well ID | Date | Well Elevation (ft NAVD 88) | Depth to Water (ft) | Depth to Product (ft) | Corrected Groundwater Elevation | Product Thickness (ft) |
|---|---|---|---|---|---|---|
| MW-1 | 1/30/2018 | 6.77 | 4.69 | ND | 2.08 | -- |
| MW-1 | 2/14/2018 | 6.77 | 5.03 | ND | 1.74 | -- |
| MW-1 | 3/2/2018 | 6.77 | -- | -- | -- | -- |
| MW-1 | 3/13/2018 | 6.77 | 4.58 | ND | 2.19 | -- |
| MW-1 | 3/23/2018 | 6.77 | 5.05 | ND | 1.72 | -- |
| MW-1 | 4/6/2018 | 6.77 | 5.68 | ND | 1.09 | -- |
| MW-1 | 4/12/2018 | 6.77 | 5.4 | ND | 1.37 | -- |
| MW-1 | 5/1/2018 | 6.77 | 5.56 | ND | 1.21 | -- |
| MW-1 | 5/10/2018 | 6.77 | 5.42 | ND | 1.35 | -- |
| MW-1 | 5/22/2018 | 6.77 | 5.22 | ND | 1.55 | -- |
| MW-1 | 7/16/2018 | 6.77 | 4.39 | ND | 2.38 | -- |
| MW-1 | 10/2/2018 | 6.77 | 4.02 | ND | 2.75 | -- |
| MW-2 | 1/30/2018 | 6.85 | 4.19 | ND | 2.66 | -- |
| MW-2 | 2/14/2018 | 6.85 | 4.81 | ND | 2.04 | -- |
| MW-2 | 3/2/2018 | 6.85 | 2.9 | ND | 3.95 | -- |
| MW-2 | 3/13/2018 | 6.85 | 4.11 | ND | 2.74 | -- |
| MW-2 | 3/23/2018 | 6.85 | 5.9 | ND | 0.95 | -- |
| MW-2 | 4/6/2018 | 6.85 | 5.8 | ND | 1.05 | -- |
| MW-2 | 4/12/2018 | 6.85 | 5.61 | ND | 1.24 | -- |
| MW-2 | 5/1/2018 | 6.85 | 5.5 | ND | 1.35 | -- |
| MW-2 | 5/10/2018 | 6.85 | 5.68 | ND | 1.17 | -- |
| MW-2 | 5/22/2018 | 6.85 | 6.16 | ND | 0.69 | -- |
| MW-2 | 7/16/2018 | 6.85 | 4.94 | ND | 1.91 | -- |
| MW-3 | 1/30/2018 | 6.9 | 6.32 | 4.48 | 0.58 | 1.84 |
| MW-3 | 2/14/2018 | 6.9 | 7.61 | 5.95 | -0.71 | 1.66 |
| MW-3 | 3/2/2018 | 6.9 | 2.81 | 2.74 | 4.09 | 0.07 |
| MW-3 | 3/13/2018 | 6.9 | 4.7 | 3.98 | 2.20 | 0.72 |
| MW-3 | 3/23/2018 | 6.9 | 5.9 | 5.6 | 1.00 | 0.30 |
| MW-3 | 4/6/2018 | 6.9 | 6.2 | 5.68 | 0.70 | 0.52 |
| MW-3 | 4/12/2018 | 6.9 | 6.29 | 5.89 | 0.61 | 0.40 |
| MW-3 | 5/1/2018 | 6.9 | 5.61 | 5.22 | 1.29 | 0.39 |
| MW-3 | 5/10/2018 | 6.9 | 5.96 | 5.71 | 0.94 | 0.25 |
| MW-3 | 5/22/2018 | 6.9 | 6.41 | 6.24 | 0.49 | 0.17 |
| MW-4 | 1/30/2018 | 7.17 | 4.8 | ND | 2.37 | -- |
| MW-4 | 2/14/2018 | 7.17 | 5.31 | ND | 1.86 | -- |
| MW-4 | 3/2/2018 | 7.17 | 4.27 | ND | 2.90 | -- |
| MW-4 | 3/13/2018 | 7.17 | 4.32 | ND | 2.85 | -- |
| MW-4 | 3/23/2018 | 7.17 | 4.7 | ND | 2.47 | -- |
| MW-4 | 4/6/2018 | 7.17 | 4.8 | ND | 2.37 | -- |
| MW-4 | 4/12/2018 | 7.17 | 4.93 | ND | 2.24 | -- |
| MW-4 | 5/1/2018 | 7.17 | 4.79 | ND | 2.38 | -- |
| MW-4 | 5/10/2018 | 7.17 | 4.85 | ND | 2.32 | -- |
| MW-4 | 5/22/2018 | 7.17 | 5.04 | ND | 2.13 | -- |
| MW-5 | 1/30/2018 | -- | 4.7 | ND | -- | -- |
| MW-5 | 2/14/2018 | -- | 4.69 | ND | -- | -- |
| MW-5 | 3/2/2018 | -- | -- | -- | -- | -- |

**Table 2b. Summary of 2018 Groundwater Gauging Data, Gowanus Village I LLC, Brooklyn, New York**

| Well ID | Date | Well Elevation (ft NAVD 88) | Depth to Water (ft) | Depth to Product (ft) | Corrected Groundwater Elevation | Product Thickness (ft) |
|---|---|---|---|---|---|---|
| MW-5 | 3/13/2018 | -- | 4.49 | ND | -- | -- |
| MW-5 | 3/23/2018 | -- | 4.9 | ND | -- | -- |
| MW-5 | 4/6/2018 | -- | 5.6 | ND | -- | -- |
| MW-5 | 4/12/2018 | -- | 5.32 | ND | -- | -- |
| MW-5 | 5/1/2018 | -- | 5.37 | ND | -- | -- |
| MW-5 | 5/10/2018 | -- | 5.29 | ND | -- | -- |
| MW-5 | 5/22/2018 | -- | 5.05 | ND | -- | -- |
| MW-6 | 1/30/2018 | -- | 5.68 | 4.94 | -- | 0.74 |
| MW-6 | 2/14/2018 | -- | 4.81 | 4.75 | -- | 0.06 |
| MW-6 | 3/2/2018 | -- | 4.13 | 4.1 | -- | 0.03 |
| MW-6 | 3/13/2018 | -- | 4.62 | Trace | -- | Trace |
| MW-6 | 3/23/2018 | -- | 5.02 | 4.72 | -- | 0.30 |
| MW-6 | 4/6/2018 | -- | 5.1 | Trace | -- | Trace |
| MW-6 | 4/12/2018 | -- | 5.11 | ND | -- | -- |
| MW-6 | 5/1/2018 | -- | 4.78 | ND | -- | -- |
| MW-6 | 5/10/2018 | -- | 5.02 | ND | -- | -- |
| MW-6 | 5/22/2018 | -- | 4.46 | ND | -- | -- |
| MW-7 | 1/30/2018 | -- | 4.14 | ND | -- | -- |
| MW-7 | 2/14/2018 | -- | 5.26 | 5.25 | -- | 0.01 |
| MW-7 | 3/2/2018 | -- | 3.99 | ND | -- | -- |
| MW-7 | 3/13/2018 | -- | 4.52 | Trace | -- | Trace |
| MW-7 | 3/23/2018 | -- | 5.6 | 5.5 | -- | 0.10 |
| MW-7 | 4/6/2018 | -- | 5.5 | Trace | -- | Trace |
| MW-7 | 4/12/2018 | -- | 5.25 | Trace | -- | Trace |
| MW-7 | 5/1/2018 | -- | 5.67 | 5.24 | -- | 0.43 |
| MW-7 | 5/10/2018 | -- | 5.09 | 5.07 | -- | 0.02 |
| MW-7 | 5/22/2018 | -- | 5.23 | Trace | -- | Trace |
| MW-7 | 7/16/2018 | -- | 4.6 | 4.51 | -- | 0.09 |
| MW-7 | 10/2/2018 | -- | 4.85 | 4.79 | -- | 0.06 |
| MW-8 | 1/30/2018 | 9.41 | 7.51 | ND | 1.90 | -- |
| MW-8 | 2/14/2018 | 9.41 | 7.2 | ND | 2.21 | -- |
| MW-8 | 3/2/2018 | 9.41 | 5.98 | ND | 3.43 | -- |
| MW-8 | 3/13/2018 | 9.41 | 6.99 | ND | 2.42 | -- |
| MW-8 | 3/23/2018 | 9.41 | 3.66 | ND | 5.75 | -- |
| MW-8 | 4/6/2018 | 9.41 | 3.92 | ND | 5.49 | -- |
| MW-8 | 4/12/2018 | 9.41 | 4.11 | ND | 5.30 | -- |
| MW-8 | 5/1/2018 | 9.41 | 3.83 | ND | 5.58 | -- |
| MW-8 | 5/10/2018 | 9.41 | 4.0 | ND | 5.41 | -- |
| MW-8 | 5/22/2018 | 9.41 | 3.78 | ND | 5.63 | -- |
| MW-8 | 7/26/2018 | 9.41 | 3.11 | ND | 6.30 | -- |

**Table 2b. Summary of 2018 Groundwater Gauging Data, Gowanus Village I LLC, Brooklyn, New York**

| Well ID | Date | Well Elevation (ft NAVD 88) | Depth to Water (ft) | Depth to Product (ft) | Corrected Groundwater Elevation | Product Thickness (ft) |
|---|---|---|---|---|---|---|
| MW-8 | 8/6/2018 | 9.41 | 6.93 | ND | 2.48 | -- |
| MW-8 | 11/14/2018 | 9.41 | 6.63 | ND | 2.78 | -- |
| MW-8 | 10/2/2018 | 9.41 | 6.85 | ND | 2.56 | -- |
| MW-8 | 12/20/2018 | 9.41 | 6.74 | ND | 2.67 | -- |
| MW-9 | 1/30/2018 | 12.48 | 10.61 | ND | 1.87 | -- |
| MW-9 | 2/14/2018 | 12.48 | 10.3 | ND | 2.18 | -- |
| MW-9 | 3/2/2018 | 12.48 | 9.11 | ND | 3.37 | -- |
| MW-9 | 3/13/2018 | 12.48 | 10.16 | ND | 2.32 | -- |
| MW-9 | 3/23/2018 | 12.48 | 7.06 | ND | 5.42 | -- |
| MW-9 | 4/6/2018 | 12.48 | 7.39 | ND | 5.09 | -- |
| MW-9 | 4/12/2018 | 12.48 | 7.68 | ND | 4.80 | -- |
| MW-9 | 5/1/2018 | 12.48 | 7.4 | ND | 5.08 | -- |
| MW-9 | 5/10/2018 | 12.48 | 7.59 | ND | 4.89 | -- |
| MW-9 | 5/22/2018 | 12.48 | 7.38 | ND | 5.10 | -- |
| MW-9 | 7/26/2018 | 12.48 | 6.71 | ND | 5.77 | -- |
| MW-9 | 8/6/2018 | 12.48 | 10.07 | ND | 2.41 | -- |
| MW-9 | 10/2/2018 | 12.48 | 10.00 | ND | 2.48 | -- |
| MW-9 | 11/14/2018 | 12.48 | 9.61 | ND | 2.87 | -- |
| MW-9 | 12/20/2018 | 12.48 | 9.86 | ND | 2.62 | -- |
| MW-10 | 8/6/2018 | 13.22 | 6.46 | ND | 6.76 | -- |
| MW-10 | 10/2/2018 | 13.22 | 6.27 | ND | 6.95 | -- |
| MW-10 | 11/14/2018 | 13.22 | 6.14 | ND | 7.08 | -- |
| MW-10 | 12/20/2018 | 13.22 | 6.36 | ND | 6.86 | -- |
| MW-11 | 8/6/2018 | 9.85 | 4.54 | ND | 5.31 | -- |
| MW-11 | 10/2/2018 | 9.85 | 4.19 | ND | 5.66 | -- |
| MW-11 | 11/14/2018 | 9.85 | 5.36 | ND | 4.49 | -- |
| MW-11 | 12/20/2018 | 9.85 | 4.49 | ND | 5.36 | -- |
| MW-16 | 7/26/2018 | 15.87 | 15.17 | ND | 0.70 | -- |
| MW-16 | 8/6/2018 | 15.87 | 16.00 | ND | -0.13 | -- |
| MW-16 | 10/2/2018 | 15.87 | 16.42 | ND | -0.55 | -- |
| MW-16 | 11/14/2018 | 15.87 | 15.11 | ND | 0.76 | -- |
| MW-16 | 12/20/2018 | 15.87 | 14.8 | ND | 1.07 | -- |
| MW-16 | 12/26/2018 | 15.87 | 14.91 | Trace | 0.96 | Trace |
| MW-17 | 7/26/2018 | 15.78 | 14.95 | ND | 0.83 | -- |
| MW-17 | 8/6/2018 | 15.78 | 15.99 | ND | -0.21 | -- |
| MW-17 | 10/2/2018 | 15.78 | 16.19 | ND | -0.41 | -- |
| MW-17 | 11/14/2018 | 15.78 | 15.21 | 15.00 | 0.57 | 0.21 |
| MW-17 | 12/20/2018 | 15.78 | 15.42 | Trace | 0.36 | Trace |
| MW-17 | 12/26/2018 | 15.78 | 14.72 | Trace | 1.06 | Trace |
| MW-18 | 8/6/2018 | 16.35 | 13.39 | ND | 2.96 | -- |
| MW-18 | 10/2/2018 | 16.35 | 13.35 | ND | 3.00 | -- |
| MW-18 | 11/14/2018 | 16.35 | 13.49 | ND | 2.86 | -- |
| MW-18 | 12/20/2018 | 16.35 | 13.35 | ND | 3.00 | -- |

**Notes:**

DTW - Depth to Water DTP - Depth to Product

**Table 2c. Summary of 2019 Groundwater Gauging Data, Gowanus Village I LLC, Brooklyn, New York**

| Well ID | Date | Well Elevation (ft NAVD 88) | Depth to Water (ft) | Depth to Product (ft) | Corrected Groundwater Elevation | Product Thickness (ft) |
|---|---|---|---|---|---|---|
| MW-8 | 1/23/2019 | 9.41 | 6.61 | ND | 2.80 | -- |
| MW-8 | 1/24/2019 | 9.41 | 6.39 | ND | 3.02 | -- |
| MW-8 | 1/25/2019 | 9.41 | 5.45 | ND | 3.96 | -- |
| MW-8 | 1/28/2019 | 9.41 | 6.39 | ND | 3.02 | -- |
| MW-8 | 1/29/2019 | 9.41 | 6.43 | ND | 2.98 | -- |
| MW-8 | 1/30/2019 | 9.41 | 6.25 | ND | 3.16 | -- |
| MW-8 | 1/31/2019 | 9.41 | 6.49 | ND | 2.92 | -- |
| MW-8 | 2/1/2019 | 9.41 | 6.54 | ND | 2.87 | -- |
| MW-8 | 2/4/2019 | 9.41 | 6.54 | ND | 2.87 | -- |
| MW-8 | 2/5/2019 | 9.41 | 6.57 | ND | 2.84 | -- |
| MW-8 | 2/6/2019 | 9.41 | 6.75 | ND | 2.66 | -- |
| MW-8 | 2/7/2019 | 9.41 | 6.02 | ND | 3.39 | -- |
| MW-8 | 2/8/2019 | 9.41 | 5.88 | ND | 3.53 | -- |
| MW-8 | 2/11/2019 | 9.41 | 6.47 | ND | 2.94 | -- |
| MW-8 | 2/12/2019 | 9.41 | 6.49 | ND | 2.92 | -- |
| MW-8 | 2/13/2019 | 9.41 | 6.08 | ND | 3.33 | -- |
| MW-8 | 2/14/2019 | 9.41 | 6 | ND | 3.41 | -- |
| MW-8 | 2/15/2019 | 9.41 | 6.15 | ND | 3.26 | -- |
| MW-8 | 2/18/2019 | 9.41 | 6.33 | ND | 3.08 | -- |
| MW-8 | 2/19/2019 | 9.41 | 6.43 | ND | 2.98 | -- |
| MW-8 | 2/20/2019 | 9.41 | 6.42 | ND | 2.99 | -- |
| MW-8 | 2/21/2019 | 9.41 | 6.13 | ND | 3.28 | -- |
| MW-8 | 2/22/2019 | 9.41 | 5.79 | ND | 3.62 | -- |
| MW-8 | 2/28/2019 | 9.41 | 6.55 | ND | 2.86 | -- |
| MW-8 | 3/20/2019 | 9.41 | 8.99 | ND | 0.42 | -- |
| MW-8 | 3/21/2019 | 9.41 | 5.89 | ND | 3.52 | -- |
| MW-8 | 4/1/2019 | 9.41 | 5.97 | ND | 3.44 | -- |
| MW-8 | 4/30/2019 | 9.41 | 6.06 | ND | 3.35 | -- |
| MW-8 | 5/24/2019 | 9.41 | 5.98 | ND | 3.43 | -- |
| MW-8 | 5/29/2019 | 9.41 | 5.90 | ND | 3.51 | -- |
| MW-9 | 1/23/2019 | 12.56 | 9.61 | ND | 2.95 | -- |
| MW-9 | 1/24/2019 | 12.56 | 9.54 | ND | 3.02 | -- |
| MW-9 | 1/25/2019 | 12.56 | 8.69 | ND | 3.87 | -- |
| MW-9 | 1/28/2019 | 12.56 | 9.55 | ND | 3.01 | -- |
| MW-9 | 1/29/2019 | 12.56 | 9.65 | ND | 2.91 | -- |
| MW-9 | 1/30/2019 | 12.56 | 9.6 | ND | 2.96 | -- |
| MW-9 | 1/31/2019 | 12.56 | 9.84 | ND | 2.72 | -- |
| MW-9 | 2/1/2019 | 12.56 | 9.7 | ND | 2.86 | -- |
| MW-9 | 2/4/2019 | 12.56 | 9.78 | ND | 2.78 | -- |
| MW-9 | 2/5/2019 | 12.56 | 9.77 | ND | 2.79 | -- |
| MW-9 | 2/6/2019 | 12.56 | 9.75 | ND | 2.81 | -- |
| MW-9 | 2/7/2019 | 12.56 | 9.23 | ND | 3.33 | -- |
| MW-9 | 2/8/2019 | 12.56 | 9.17 | ND | 3.39 | -- |
| MW-9 | 2/11/2019 | 12.56 | 9.8 | ND | 2.76 | -- |
| MW-9 | 2/12/2019 | 12.56 | 9.68 | ND | 2.88 | -- |
| MW-9 | 2/13/2019 | 12.56 | 9.36 | ND | 3.20 | -- |
| MW-9 | 2/14/2019 | 12.56 | 9.13 | ND | 3.43 | -- |
| MW-9 | 2/15/2019 | 12.56 | 9.35 | ND | 3.21 | -- |
| MW-9 | 2/18/2019 | 12.56 | 9.47 | ND | 3.09 | -- |
| MW-9 | 2/19/2019 | 12.56 | 9.59 | ND | 2.97 | -- |
| MW-9 | 2/20/2019 | 12.56 | 9.69 | ND | 2.87 | -- |
| MW-9 | 2/21/2019 | 12.56 | 9.31 | ND | 3.25 | -- |

**Table 2c. Summary of 2019 Groundwater Gauging Data, Gowanus Village I LLC, Brooklyn, New York**

| Well ID | Date | Well Elevation (ft NAVD 88) | Depth to Water (ft) | Depth to Product (ft) | Corrected Groundwater Elevation | Product Thickness (ft) |
|---|---|---|---|---|---|---|
| MW-9 | 2/22/2019 | 12.56 | 9.08 | ND | 3.48 | -- |
| MW-9 | 2/28/2019 | 12.56 | 9.59 | ND | 2.97 | -- |
| MW-9 | 3/20/2019 | 12.56 | 9.17 | ND | 3.39 | -- |
| MW-9 | 3/21/2019 | 12.56 | 9.01 | ND | 3.55 | -- |
| MW-9 | 4/1/2019 | 12.56 | 9.14 | ND | 3.42 | -- |
| MW-9 | 4/30/2019 | 12.56 | 9.2 | ND | 3.36 | -- |
| MW-9 | 5/24/2019 | 12.56 | 9.12 | ND | 3.44 | -- |
| MW-9 | 5/29/2019 | 12.56 | 9.08 | ND | 3.48 | -- |
| MW-9 | 6/24/2019 | 12.56 | 8.76 | ND | 3.80 | -- |
| MW-9 | 7/18/2019 | 12.56 | 9.05 | ND | 3.51 | -- |
| MW-9 | 8/12/2019 | 12.56 | 9.17 | ND | 3.39 | -- |
| MW-9 | 8/14/2019 | 12.56 | 9.03 | ND | 3.53 | -- |
| MW-9 | 9/12/2019 | 12.56 | 8.81 | ND | 3.75 | -- |
| MW-9 | 10/10/2019 | 12.56 | 8.96 | ND | 3.60 | -- |
| MW-9 | 10/25/2019 | 12.56 | 8.6 | ND | 3.96 | -- |
| MW-9 | 11/12/2019 | 12.56 | 8.85 | ND | 3.71 | -- |
| MW-10 | 1/30/2019 | 13.21 | 6.33 | ND | 6.88 | -- |
| MW-10 | 1/31/2019 | 13.21 | 6.41 | ND | 6.80 | -- |
| MW-10 | 2/28/2019 | 13.21 | 6.35 | ND | 6.86 | -- |
| MW-10 | 3/20/2019 | 13.21 | 6.49 | ND | 6.72 | -- |
| MW-10 | 3/21/2019 | 13.21 | -- | NA | -- | -- |
| MW-10 | 4/1/2019 | 13.21 | 6.53 | ND | 6.68 | -- |
| MW-10 | 4/30/2019 | 13.21 | 6.45 | ND | 6.76 | -- |
| MW-10 | 5/24/2019 | 13.21 | 6.35 | ND | 6.86 | -- |
| MW-10 | 5/28/2019 | 13.21 | 6.48 | ND | 6.73 | -- |
| MW-10 | 6/24/2019 | 13.21 | 6.06 | ND | 7.15 | -- |
| MW-10 | 7/18/2019 | 13.21 | 6.41 | ND | 6.80 | -- |
| MW-10 | 8/12/2019 | 13.21 | 6.32 | ND | 6.89 | -- |
| MW-10 | 8/14/2019 | 13.21 | 6.45 | ND | 6.76 | -- |
| MW-10 | 9/12/2019 | 13.21 | 6.56 | ND | 6.65 | -- |
| MW-10 | 10/10/2019 | 13.21 | 6.83 | ND | 6.38 | -- |
| MW-10 | 10/25/2019 | 13.21 | 6.45 | ND | 6.76 | -- |
| MW-10 | 11/12/2019 | 13.21 | 6.25 | ND | 6.96 | -- |
| MW-11 | 1/24/2019 | 9.88 | 4.29 | ND | 5.59 | -- |
| MW-11 | 1/25/2019 | 9.88 | 3.98 | ND | 5.90 | -- |
| MW-11 | 1/28/2019 | 9.88 | 4.23 | ND | 5.65 | -- |
| MW-11 | 1/29/2019 | 9.88 | 4.28 | ND | 5.60 | -- |
| MW-11 | 1/30/2019 | 9.88 | 4.26 | ND | 5.62 | -- |
| MW-11 | 1/31/2019 | 9.88 | 4.33 | ND | 5.55 | -- |
| MW-11 | 2/1/2019 | 9.88 | 4.39 | ND | 5.49 | -- |
| MW-11 | 2/4/2019 | 9.88 | 4.49 | ND | 5.39 | -- |
| MW-11 | 2/5/2019 | 9.88 | 4.52 | ND | 5.36 | -- |
| MW-11 | 2/6/2019 | 9.88 | 4.59 | ND | 5.29 | -- |
| MW-11 | 2/7/2019 | 9.88 | 4.37 | ND | 5.51 | -- |
| MW-11 | 2/8/2019 | 9.88 | 4.29 | ND | 5.59 | -- |
| MW-11 | 2/11/2019 | 9.88 | 4.37 | ND | 5.51 | -- |
| MW-11 | 2/12/2019 | 9.88 | 4.41 | ND | 5.47 | -- |
| MW-11 | 2/13/2019 | 9.88 | 4.21 | ND | 5.67 | -- |
| MW-11 | 2/14/2019 | 9.88 | 4.19 | ND | 5.69 | -- |
| MW-11 | 2/15/2019 | 9.88 | 4.25 | ND | 5.63 | -- |
| MW-11 | 2/18/2019 | 9.88 | 4.39 | ND | 5.49 | -- |
| MW-11 | 2/19/2019 | 9.88 | 4.49 | ND | 5.39 | -- |

**Table 2c. Summary of 2019 Groundwater Gauging Data, Gowanus Village I LLC, Brooklyn, New York**

| Well ID | Date | Well Elevation (ft NAVD 88) | Depth to Water (ft) | Depth to Product (ft) | Corrected Groundwater Elevation | Product Thickness (ft) |
|---|---|---|---|---|---|---|
| MW-11 | 2/20/2019 | 9.88 | 4.47 | ND | 5.41 | -- |
| MW-11 | 2/21/2019 | 9.88 | 3.15 | ND | 6.73 | -- |
| MW-11 | 2/22/2019 | 9.88 | 4.15 | ND | 5.73 | -- |
| MW-11 | 2/28/2019 | 9.88 | 4.25 | ND | 5.63 | -- |
| MW-11 | 3/20/2019 | 9.88 | 4.23 | ND | 5.65 | -- |
| MW-11 | 3/21/2019 | 9.88 | 4.2 | ND | 5.68 | -- |
| MW-11 | 4/1/2019 | 9.88 | 4.24 | ND | 5.64 | -- |
| MW-11 | 4/30/2019 | 9.88 | 4.12 | ND | 5.76 | -- |
| MW-11 | 5/24/2019 | 9.88 | 3.94 | ND | 5.94 | -- |
| MW-11 | 5/28/2019 | 9.88 | 4.05 | ND | 5.83 | -- |
| MW-11 | 6/24/2019 | 9.88 | 3.61 | ND | 6.27 | -- |
| MW-11 | 7/18/2019 | 9.88 | 3.75 | ND | 6.13 | -- |
| MW-11 | 8/12/2019 | 9.88 | 3.99 | ND | 5.89 | -- |
| MW-11 | 8/14/2019 | 9.88 | 4.15 | ND | 5.73 | -- |
| MW-11 | 9/12/2019 | 9.88 | 4.07 | ND | 5.81 | -- |
| MW-11 | 10/10/2019 | 9.88 | 4.30 | ND | 5.58 | -- |
| MW-11 | 10/25/2019 | 9.88 | 4.60 | ND | 5.28 | -- |
| MW-11 | 11/12/2019 | 9.88 | 4.40 | ND | 5.48 | -- |
| MW-12 | 12/20/2019 | 14.39 | 12.91 | ND | 1.48 | -- |
| MW-12 | 12/23/2019 | 14.39 | 12.90 | ND | 1.49 | -- |
| MW-12 | 12/23/2019 | 14.39 | 12.95 | ND | 1.44 | -- |
| MW-12 | 12/26/2019 | 14.39 | 12.48 | ND | 1.91 | -- |
| MW-16 | 1/4/2019 | 15.87 | 13.65 | ND | 2.22 | -- |
| MW-16 | 1/8/2019 | 15.87 | 16.00 | ND | -0.13 | -- |
| MW-16 | 1/10/2019 | 15.87 | 15.04 | ND | 0.83 | -- |
| MW-16 | 1/18/2019 | 15.87 | 15.69 | ND | 0.18 | -- |
| MW-16 | 1/23/2019 | 15.87 | 13.24 | ND | 2.63 | -- |
| MW-16 | 1/23/2019 | 15.87 | 15.54 | ND | 0.33 | -- |
| MW-16 | 1/23/2019 | 15.87 | 16.01 | ND | -0.14 | -- |
| MW-16 | 1/24/2019 | 15.87 | 13.95 | ND | 1.92 | -- |
| MW-16 | 1/31/2019 | 15.87 | 16.68 | ND | -0.81 | -- |
| MW-16 | 2/1/2019 | 15.87 | 16.25 | ND | -0.38 | -- |
| MW-16 | 2/15/2019 | 15.87 | 16.19 | ND | -0.32 | -- |
| MW-16 | 2/18/2019 | 15.87 | 12.29 | ND | 3.58 | -- |
| MW-16 | 2/19/2019 | 15.87 | 13.59 | ND | 2.28 | -- |
| MW-16 | 2/20/2019 | 15.87 | 13.45 | ND | 2.42 | -- |
| MW-16 | 2/21/2019 | 15.87 | 12.79 | ND | 3.08 | -- |
| MW-16 | 2/22/2019 | 15.87 | 15.11 | ND | 0.76 | -- |
| MW-16 | 2/28/2019 | 15.87 | 16.49 | ND | -0.62 | -- |
| MW-16 | 3/8/2019 | 15.87 | 14.06 | ND | 1.81 | -- |
| MW-16 | 3/15/2019 | 15.87 | 16.46 | ND | -0.59 | -- |
| MW-16 | 3/8/2019 | 15.87 | 14.06 | ND | 1.81 | -- |
| MW-16 | 3/15/2019 | 15.87 | 16.46 | ND | -0.59 | -- |
| MW-16 | 3/20/2019 | 15.87 | 16.75 | ND | -0.88 | -- |
| MW-16 | 3/21/2019 | 15.87 | 16.83 | ND | -0.96 | -- |
| MW-16 | 4/1/2019 | 15.87 | 16.60 | ND | -0.73 | -- |
| MW-16 | 4/30/2019 | 15.87 | 14.79 | ND | 1.08 | -- |
| MW-16 | 5/24/2019 | 15.87 | 14.17 | Trace | 1.70 | Trace |
| MW-16 | 6/24/2019 | 15.87 | 16.23 | ND | -0.36 | -- |
| MW-16 | 7/18/2019 | 15.87 | 13.87 | ND | 2.00 | -- |
| MW-16 | 8/12/2019 | 15.87 | 16.33 | Trace | -0.46 | Trace |
| MW-16 | 8/14/2019 | 15.87 | 15.95 | ND | -0.08 | -- |

**Table 2c. Summary of 2019 Groundwater Gauging Data, Gowanus Village I LLC, Brooklyn, New York**

| Well ID | Date | Well Elevation (ft NAVD 88) | Depth to Water (ft) | Depth to Product (ft) | Corrected Groundwater Elevation | Product Thickness (ft) |
|---|---|---|---|---|---|---|
| MW-16 | 9/12/2019 | 15.87 | 15.23 | ND | 0.64 | -- |
| MW-16 | 10/10/2019 | 15.81 | 12.99 | ND | 2.82 | -- |
| MW-16 | 10/25/2019 | 15.81 | 15.41 | ND | 0.40 | -- |
| MW-16 | 11/12/2019 | 15.81 | 13.60 | ND | 2.21 | -- |
| MW-17 | 1/4/2019 | 15.78 | 13.61 | ND | 2.17 | -- |
| MW-17 | 1/8/2019 | 15.78 | 16.05 | ND | -0.27 | -- |
| MW-17 | 1/10/2019 | 15.78 | 14.92 | ND | 0.86 | -- |
| MW-17 | 1/14/2019 | 15.78 | 15.22 | ND | 0.56 | -- |
| MW-17 | 1/18/2019 | 15.78 | 15.3 | ND | 0.48 | -- |
| MW-17 | 1/23/2019 | 15.78 | 13.09 | ND | 2.69 | -- |
| MW-17 | 1/24/2019 | 15.78 | 14.05 | ND | 1.73 | -- |
| MW-17 | 1/31/2019 | 15.78 | 16.52 | ND | -0.74 | -- |
| MW-17 | 2/1/2019 | 15.78 | 16.22 | ND | -0.44 | -- |
| MW-17 | 2/15/2019 | 15.78 | 16.19 | Trace | -0.41 | Trace |
| MW-17 | 2/18/2019 | 15.78 | 12.19 | ND | 3.59 | -- |
| MW-17 | 2/19/2019 | 15.78 | 13.53 | ND | 2.25 | -- |
| MW-17 | 2/20/2019 | 15.78 | 13.35 | ND | 2.43 | -- |
| MW-17 | 2/21/2019 | 15.78 | 12.69 | ND | 3.09 | -- |
| MW-17 | 2/22/2019 | 15.78 | 15.29 | ND | 0.49 | -- |
| MW-17 | 2/28/2019 | 15.78 | 16.34 | Trace | -0.56 | -- |
| MW-17 | 3/8/2019 | 15.78 | 14.02 | Trace | 1.76 | -- |
| MW-17 | 3/15/2019 | 15.78 | 16.29 | ND | -0.51 | -- |
| MW-17 | 3/8/2019 | 15.78 | 14.02 | Trace | 1.76 | -- |
| MW-17 | 3/15/2019 | 15.78 | 16.29 | ND | -0.51 | -- |
| MW-17 | 3/20/2019 | 15.78 | 16.34 | ND | -0.56 | -- |
| MW-17 | 3/21/2019 | 15.78 | 16.69 | ND | -0.91 | -- |
| MW-17 | 4/1/2019 | 15.78 | 16.33 | Trace | -0.55 | Trace |
| MW-17 | 4/30/2019 | 15.78 | 14.7 | ND | 1.08 | -- |
| MW-17 | 5/24/2019 | 15.78 | 15.9 | Trace | -0.12 | Trace |
| MW-17 | 6/24/2019 | 15.78 | 16.08 | ND | -0.30 | -- |
| MW-17 | 7/18/2019 | 15.78 | 13.81 | Trace | 1.97 | Trace |
| MW-17 | 8/12/2019 | 15.78 | 16.29 | Trace | -0.51 | Trace |
| MW-17 | 8/14/2019 | 15.78 | 15.8 | ND | -0.02 | -- |
| MW-17 | 9/12/2019 | 15.78 | 15.11 | ND | 0.67 | -- |
| MW-17 | 10/10/2019 | 15.69 | 12.46 | ND | 3.23 | -- |
| MW-17 | 10/25/2019 | 15.69 | 15.53 | ND | 0.16 | -- |
| MW-17 | 11/12/2019 | 15.69 | 15.81 | ND | -0.12 | -- |
| MW-18 | 1/30/2019 | 16.28 | 13.44 | ND | 2.84 | -- |
| MW-18 | 1/31/2019 | 16.28 | 13.39 | ND | 2.89 | -- |
| MW-18 | 2/28/2019 | 16.28 | 13.29 | ND | 2.99 | -- |
| MW-18 | 3/20/2019 | 16.28 | 13.29 | ND | 2.99 | -- |
| MW-18 | 3/21/2019 | 16.28 | 13.45 | ND | 2.83 | -- |
| MW-18 | 4/1/2019 | 16.28 | 13.29 | ND | 2.99 | -- |
| MW-18 | 4/30/2019 | 16.28 | 13.23 | ND | 3.05 | -- |
| MW-18 | 5/24/2019 | 16.28 | 13.25 | ND | 3.03 | -- |
| MW-18 | 5/28/2019 | 16.28 | 13.3 | ND | 2.98 | -- |
| MW-18 | 6/25/2019 | 16.28 | 13.2 | ND | 3.08 | -- |
| MW-18 | 7/18/2019 | 16.28 | 12.84 | ND | 3.44 | -- |
| MW-18 | 8/12/2019 | 16.28 | 13.33 | ND | 2.95 | -- |
| MW-18 | 8/14/2019 | 16.28 | 13.35 | ND | 2.93 | -- |
| MW-18 | 9/12/2019 | 16.28 | 13.4 | ND | 2.88 | -- |
| MW-18 | 10/10/2019 | 16.28 | 13.48 | ND | 2.80 | -- |

**Table 2c. Summary of 2019 Groundwater Gauging Data, Gowanus Village I LLC, Brooklyn, New York**

| Well ID | Date | Well Elevation (ft NAVD 88) | Depth to Water (ft) | Depth to Product (ft) | Corrected Groundwater Elevation | Product Thickness (ft) |
|---|---|---|---|---|---|---|
| MW-18 | 10/25/2019 | 16.28 | 13.36 | ND | 2.92 | -- |
| MW-18 | 11/12/2019 | 16.28 | 13.56 | ND | 2.72 | -- |

**Notes:**
DTW - Depth to Water DTP - Depth to Product

**Table 2d. Summary of 2020 Groundwater Gauging Data, Gowanus Village I LLC, Brooklyn, New York**

| Well ID | Date | Well Elevation (ft) | DTW (ft) | DTP (ft) | Corrected Groundwater Elevation | Product Thickness (ft) |
|---|---|---|---|---|---|---|
| MW-9 | 1/6/2020 | 12.56 | 9.1 | ND | 3.46 | -- |
| MW-9 | 1/30/2020 | 12.56 | 9.2 | ND | 3.36 | -- |
| MW-9 | 1/31/2020 | 12.56 | 8.95 | ND | 3.61 | -- |
| MW-9 | 2/18/2020 | 12.56 | 8.79 | ND | 3.77 | -- |
| MW-9 | 2/21/2020 | 12.56 | 8.95 | ND | 3.61 | -- |
| MW-9 | 2/28/2020 | 12.56 | 8.81 | ND | 3.75 | -- |
| MW-9 | 3/4/2020 | 12.56 | 8.27 | ND | 4.29 | -- |
| MW-9 | 3/12/2020 | 12.56 | 9.2 | ND | 3.36 | -- |
| MW-9 | 3/16/2020 | 12.56 | 9.29 | ND | 3.27 | -- |
| MW-9 | 3/16/2020 | 12.56 | 9.29 | ND | 3.27 | -- |
| MW-9 | 4/6/2020 | 12.56 | 8.92 | ND | 3.64 | -- |
| MW-9 | 4/22/2020 | 12.56 | 8.88 | ND | 3.68 | -- |
| MW-10 | 1/6/2020 | 13.21 | 6.45 | ND | 6.76 | -- |
| MW-10 | 2/21/2020 | 13.21 | 6.6 | ND | 6.61 | -- |
| MW-10 | 2/28/2020 | 13.21 | 7.2 | ND | 6.01 | -- |
| MW-10 | 3/4/2020 | 13.21 | 6.59 | ND | 6.62 | -- |
| MW-10 | 3/12/2020 | 13.21 | 6.75 | ND | 6.46 | -- |
| MW-10 | 3/16/2020 | 13.21 | 6.81 | ND | 6.40 | -- |
| MW-10 | 3/16/2020 | 13.21 | 6.82 | ND | 6.39 | -- |
| MW-10 | 4/6/2020 | 13.21 | 6.39 | ND | 6.82 | -- |
| MW-10 | 4/22/2020 | 13.21 | 6.14 | ND | 7.07 | -- |
| MW-11 | 1/6/2020 | 9.88 | 4 | ND | 5.88 | -- |
| MW-11 | 1/30/2020 | 9.88 | 4.4 | ND | 5.48 | -- |
| MW-11 | 1/31/2020 | 9.88 | 4.46 | ND | 5.42 | -- |
| MW-11 | 2/18/2020 | 9.88 | 4.14 | ND | 5.74 | -- |
| MW-11 | 2/21/2020 | 9.88 | 4.25 | ND | 5.63 | -- |
| MW-11 | 2/28/2020 | 9.88 | 5.35 | ND | 4.53 | -- |
| MW-11 | 3/4/2020 | 9.88 | 5.56 | ND | 4.32 | -- |
| MW-11 | 3/12/2020 | 9.88 | 4.4 | ND | 5.48 | -- |
| MW-11 | 3/16/2020 | 9.88 | 4.39 | ND | 5.49 | -- |
| MW-11 | 3/16/2020 | 9.88 | 4.39 | ND | 5.49 | -- |
| MW-11 | 4/6/2020 | 9.88 | 4.73 | ND | 5.15 | -- |
| MW-11 | 4/22/2020 | 9.88 | 3.32 | ND | 6.56 | -- |
| MW-12 | 1/2/2020 | 14.39 | 12.72 | ND | 1.67 | -- |
| MW-12 | 1/6/2020 | 14.39 | 12.99 | ND | 1.40 | -- |
| MW-12 | 1/16/2020 | 14.39 | 13.55 | ND | 0.84 | -- |
| MW-12 | 1/21/2020 | 14.39 | 13.24 | ND | 1.15 | -- |
| MW-12 | 1/30/2020 | 14.39 | 12.69 | ND | 1.70 | -- |
| MW-12 | 1/31/2020 | 14.39 | 13.02 | ND | 1.37 | -- |
| MW-12 | 2/18/2020 | 14.39 | 12.93 | ND | 1.46 | -- |
| MW-12 | 2/21/2020 | 14.39 | 13.23 | ND | 1.16 | -- |
| MW-12 | 2/28/2020 | 14.39 | 12.5 | ND | 1.89 | -- |
| MW-12 | 3/4/2020 | 14.39 | 12.91 | ND | 1.48 | -- |
| MW-12 | 3/12/2020 | 14.39 | 12.42 | ND | 1.97 | -- |
| MW-12 | 3/16/2020 | 14.39 | 13.5 | ND | 0.89 | -- |
| MW-12 | 3/16/2020 | 14.39 | 13.5 | ND | 0.89 | -- |

**Table 2d. Summary of 2020 Groundwater Gauging Data, Gowanus Village I LLC, Brooklyn, New York**

| Well ID | Date | Well Elevation (ft) | DTW (ft) | DTP (ft) | Corrected Groundwater Elevation | Product Thickness (ft) |
|---|---|---|---|---|---|---|
| MW-12 | 4/6/2020 | 14.39 | 12.07 | ND | 2.32 | -- |
| MW-12 | 4/22/2020 | 14.39 | 13 | ND | 1.39 | -- |
| MW-13 | 2/28/2020 | NM | 11.75 | ND | NM | -- |
| MW-13 | 3/4/2020 | NM | 12.89 | ND | NM | -- |
| MW-13 | 3/12/2020 | NM | 13.21 | ND | NM | -- |
| MW-13 | 3/16/2020 | NM | 13.4 | ND | NM | -- |
| MW-13 | 3/17/2020 | NM | 13.5 | ND | NM | -- |
| MW-13 | 4/6/2020 | NM | 13.06 | ND | NM | -- |
| MW-13 | 4/22/2020 | NM | 13.23 | ND | NM | -- |
| MW-14 | 2/28/2020 | NM | 12.57 | ND | NM | -- |
| MW-14 | 3/4/2020 | NM | 11.03 | ND | NM | -- |
| MW-14 | 3/16/2020 | NM | 15.45 | ND | NM | -- |
| MW-14 | 3/16/2020 | NM | 15.42 | ND | NM | -- |
| MW-14 | 3/17/2020 | NM | 15.45 | ND | NM | -- |
| MW-14 | 4/6/2020 | NM | 14.73 | ND | NM | -- |
| MW-14 | 4/22/2020 | NM | 14.95 | ND | NM | -- |
| MW-16 | 1/6/2020 | 15.87 | 14.48 | ND | 1.39 | -- |
| MW-16 | 1/28/2020 | 15.87 | NM | ND | NM | -- |
| MW-16 | 2/21/2020 | 15.87 | NM | ND | NM | -- |
| MW-17 | 1/6/2020 | 15.78 | 14.75 | ND | 1.03 | -- |
| MW-17 | 2/21/2020 | 15.78 | NM | ND | NM | -- |
| MW-17 | 1/28/2020 | 15.78 | NM | ND | NM | -- |
| MW-18 | 1/6/2020 | 16.28 | 13.37 | ND | 2.91 | -- |
| MW-18 | 1/30/2020 | 16.28 | 13.37 | ND | 2.91 | -- |
| MW-18 | 1/31/2020 | 16.28 | 13.07 | ND | 3.21 | -- |
| MW-18 | 2/18/2020 | 16.28 | 13.25 | ND | 3.03 | -- |
| MW-18 | 2/21/2020 | 16.28 | 13.39 | ND | 2.89 | -- |
| MW-18 | 2/28/2020 | 16.28 | 14.01 | ND | 2.27 | -- |
| MW-18 | 3/4/2020 | 16.28 | 13.74 | ND | 2.54 | -- |
| MW-18 | 3/12/2020 | 16.28 | 13.41 | ND | 2.87 | -- |
| MW-18 | 3/16/2020 | 16.28 | 13.5 | ND | 2.78 | -- |
| MW-18 | 3/17/2020 | 16.28 | 13.5 | ND | 2.78 | -- |
| MW-18 | 4/6/2020 | 16.28 | 13.28 | ND | 3.00 | -- |
| MW-18 | 4/22/2020 | 16.28 | 13.34 | ND | 2.94 | -- |

**Notes:**
DTW - Depth to Water  DTP - Depth to Product

**Table 3. Summary of Remaining VOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**

**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | | |
|---|---|---|---|---|
| | | | Sample Designation: | TP-2-N2 |
| | | | Sample Date: | 10/24/2016 |
| | | | Elevation (ft): | 19.5 to 17.5 |
| | | | Normal or Field Duplicate: | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | |
| 1,1,1-Trichloroethane | 100 | 500 | MG/KG | 0.73 J |
| 1,1,2,2-Tetrachloroethane | -- | -- | MG/KG | 0.78 U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | -- | -- | MG/KG | 0.78 U |
| 1,1,2-Trichloroethane | -- | -- | MG/KG | 0.78 U |
| 1,1-Dichloroethane | 26 | 240 | MG/KG | 5.6 |
| 1,1-Dichloroethene | 100 | 500 | MG/KG | 0.78 U |
| 1,2,3-Trichlorobenzene | -- | -- | MG/KG | 1.1 |
| 1,2,4-Trichlorobenzene | -- | -- | MG/KG | 5 |
| 1,2,4-Trimethylbenzene | 52 | 190 | MG/KG | NA |
| 1,2-Dibromo-3-Chloropropane | -- | -- | MG/KG | 0.78 U |
| 1,2-Dibromoethane (Ethylene Dibromide) | -- | -- | MG/KG | 0.78 U |
| 1,2-Dichlorobenzene | 100 | 500 | MG/KG | 15 |
| 1,2-Dichloroethane | 3.1 | 30 | MG/KG | 0.78 U |
| 1,2-Dichloropropane | -- | -- | MG/KG | 0.78 UV |
| 1,3,5-Trimethylbenzene (Mesitylene) | 52 | 190 | MG/KG | NA |
| 1,3-Dichlorobenzene | 49 | 280 | MG/KG | 0.47 J |
| 1,4-Dichlorobenzene | 13 | 130 | MG/KG | 3.1 |
| 1,4-Dioxane (P-Dioxane) | 13 | 130 | MG/KG | **17 J** |
| 2-Hexanone | -- | -- | MG/KG | 0.6 J |
| Acetone | 100 | 500 | MG/KG | 6.3 JV |
| Benzene | 4.8 | 44 | MG/KG | **18** |
| Bromochloromethane | -- | -- | MG/KG | 0.78 U |
| Bromodichloromethane | -- | -- | MG/KG | 0.78 U |
| Bromoform | -- | -- | MG/KG | 0.78 UJV |
| Bromomethane | -- | -- | MG/KG | 0.78 UT |
| Carbon Disulfide | -- | -- | MG/KG | 0.78 U |
| Carbon Tetrachloride | 2.4 | 22 | MG/KG | 0.78 U |
| Chlorobenzene | 100 | 500 | MG/KG | 0.59 J |
| Chloroethane | -- | -- | MG/KG | 0.78 U |
| Chloroform | 49 | 350 | MG/KG | 0.79 |
| Chloromethane | -- | -- | MG/KG | 0.78 U |
| Cis-1,2-Dichloroethylene | 100 | 500 | MG/KG | 3.3 |
| Cis-1,3-Dichloropropene | -- | -- | MG/KG | 0.78 U |
| Cyclohexane | -- | -- | MG/KG | 0.93 |
| Dibromochloromethane | -- | -- | MG/KG | 0.78 U |
| Dichlorodifluoromethane | -- | -- | MG/KG | 0.78 U |
| Ethylbenzene | 41 | 390 | MG/KG | **59** |
| Isopropylbenzene (Cumene) | -- | -- | MG/KG | 2.8 |
| m,p-Xylene | -- | -- | MG/KG | 130 |
| Methyl Acetate | -- | -- | MG/KG | 0.71 J |
| Methyl Ethyl Ketone (2-Butanone) | 100 | 500 | MG/KG | 41 |
| Methyl Isobutyl Ketone (4-Methyl-2-Pentanor | -- | -- | MG/KG | 77 |

**Table 3. Summary of Remaining VOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**

**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | | |
|---|---|---|---|---|
| | | | Sample Designation: | TP-2-N2 |
| | | | Sample Date: | 10/24/2016 |
| | | | Elevation (ft): | 19.5 to 17.5 |
| | | | Normal or Field Duplicate: | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | |
| Methylcyclohexane | -- | -- | MG/KG | 2.1 |
| Methylene Chloride | 100 | 500 | MG/KG | 0.78 U |
| N-Butylbenzene | 100 | 500 | MG/KG | NA |
| N-Propylbenzene | 100 | 500 | MG/KG | NA |
| O-Xylene (1,2-Dimethylbenzene) | -- | -- | MG/KG | 30 |
| Sec-Butylbenzene | 100 | 500 | MG/KG | NA |
| Styrene | -- | -- | MG/KG | 0.78 U |
| T-Butylbenzene | 100 | 500 | MG/KG | NA |
| Tert-Butyl Methyl Ether | 100 | 500 | MG/KG | 0.78 U |
| Tetrachloroethylene (PCE) | 19 | 150 | MG/KG | 6.6 |
| Toluene | 100 | 500 | MG/KG | **230** |
| Trans-1,2-Dichloroethene | 100 | 500 | MG/KG | 0.74 J |
| Trans-1,3-Dichloropropene | -- | -- | MG/KG | 0.78 U |
| Trichloroethylene (TCE) | 21 | 200 | MG/KG | 1.4 |
| Trichlorofluoromethane | -- | -- | MG/KG | 0.16 J |
| Vinyl Chloride | 0.9 | 13 | MG/KG | 0.39 J |
| Xylenes, Total | 100 | 500 | MG/KG | NA |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
V - Value altered or qualifier added during data validation
T - LCS or LCSD is outside acceptance limits
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | B-013117 | RMZ-1 | RMZ-10 | RMZ-11 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 1/31/2017 | 7/25/2017 | 8/14/2017 | 8/17/2017 |
| | | | Elevation (ft): | 14 | 6 | 15 | 15 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| 1,2,4,5-Tetrachlorobenzene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,3,4,6-Tetrachlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4,5-Trichlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4,6-Trichlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dichlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dimethylphenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dinitrophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dinitrotoluene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,6-Dinitrotoluene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Chloronaphthalene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Chlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Methylnaphthalene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Methylphenol (O-Cresol) | 100 | 500 | MG/KG | NA | 0.4 U | 0.36 U | 1.8 U |
| 2-Nitroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Nitrophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 3,3'-Dichlorobenzidine | -- | -- | MG/KG | NA | NA | NA | NA |
| 3-Nitroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 4,6-Dinitro-2-Methylphenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Bromophenyl Phenyl Ether | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Chloro-3-Methylphenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Chloroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Chlorophenyl Phenyl Ether | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Methylphenol (P-Cresol) | 100 | 500 | MG/KG | NA | NA | NA | NA |
| 4-Nitroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Nitrophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| Acenaphthene | 100 | 500 | MG/KG | 0.33 J | 0.28 J | 0.13 J | 0.15 J |
| Acenaphthylene | 100 | 500 | MG/KG | 0.24 J | 0.14 J | 0.36 | 0.079 J |
| Acetophenone | -- | -- | MG/KG | NA | NA | NA | NA |
| Anthracene | 100 | 500 | MG/KG | 0.84 | 0.84 | 0.53 | 0.5 J |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | B-013117 | RMZ-1 | RMZ-10 | RMZ-11 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 1/31/2017 | 7/25/2017 | 8/14/2017 | 8/17/2017 |
| | | | Elevation (ft): | 14 | 6 | 15 | 15 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Atrazine | -- | -- | MG/KG | NA | NA | NA | NA |
| Benzaldehyde | -- | -- | MG/KG | NA | NA | NA | NA |
| Benzo(A)Anthracene | 1 | 5.6 | MG/KG | **2.2** | **1.5** | **2** | **1.3** |
| Benzo(A)Pyrene | 1 | 1 | MG/KG | **2** | **1.5** | **2.2** | **1.3** |
| Benzo(B)Fluoranthene | 1 | 5.6 | MG/KG | **2.5** | **1.8** | **3** | **1.5** |
| Benzo(G,H,I)Perylene | 100 | 500 | MG/KG | 1.1 | 1.9 | 0.88 | 1.1 J |
| Benzo(K)Fluoranthene | 3.9 | 56 | MG/KG | 1.1 | 0.6 | 1.1 | 0.18 U |
| Benzyl Butyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Biphenyl (Diphenyl) | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Chloroethoxy) Methane | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Chloroisopropyl) Ether | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Ethylhexyl) Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Caprolactam | -- | -- | MG/KG | NA | NA | NA | NA |
| Carbazole | -- | -- | MG/KG | NA | NA | NA | NA |
| Chrysene | 3.9 | 56 | MG/KG | 2.3 | 1.7 | 2 | 1.4 J |
| Cresols, M & P | 100 | 500 | MG/KG | NA | 0.023 J | 0.047 J | 1.8 U |
| Dibenz(A,H)Anthracene | 0.33 | 0.56 | MG/KG | 0.31 | **0.38** | 0.27 | 0.26 |
| Dibenzofuran | 59 | 350 | MG/KG | NA | 0.16 J | 0.15 J | 0.15 J |
| Diethyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Dimethyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Di-N-Butyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Di-N-Octylphthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Fluoranthene | 100 | 500 | MG/KG | 4.6 | 3.4 | 3.8 | 2.7 |
| Fluorene | 100 | 500 | MG/KG | 0.33 J | 0.3 J | 0.18 J | 0.2 J |
| Hexachlorobenzene | 1.2 | 6 | MG/KG | NA | 0.04 U | 0.036 U | 0.18 U |
| Hexachlorobutadiene | -- | -- | MG/KG | NA | NA | NA | NA |
| Hexachlorocyclopentadiene | -- | -- | MG/KG | NA | NA | NA | NA |
| Hexachloroethane | -- | -- | MG/KG | NA | NA | NA | NA |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | B-013117 | RMZ-1 | RMZ-10 | RMZ-11 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 1/31/2017 | 7/25/2017 | 8/14/2017 | 8/17/2017 |
| | | | Elevation (ft): | 14 | 6 | 15 | 15 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Indeno(1,2,3-C,D)Pyrene | 0.5 | 5.6 | MG/KG | **1.3** | **1.9** | **1.1** | **1.1** |
| Isophorone | -- | -- | MG/KG | NA | NA | NA | NA |
| Naphthalene | 100 | 500 | MG/KG | 0.29 J | 0.23 J | 0.35 J | 0.21 J |
| Nitrobenzene | -- | -- | MG/KG | NA | NA | NA | NA |
| N-Nitrosodi-N-Propylamine | -- | -- | MG/KG | NA | NA | NA | NA |
| N-Nitrosodiphenylamine | -- | -- | MG/KG | NA | NA | NA | NA |
| Pentachlorophenol | 6.7 | 6.7 | MG/KG | NA | 0.32 U | 0.29 U | 1.5 U |
| Phenanthrene | 100 | 500 | MG/KG | 3.3 | 4.5 | 2.1 | 1.8 |
| Phenol | 100 | 500 | MG/KG | NA | 0.017 J | 0.36 U | 1.8 U |
| Pyrene | 100 | 500 | MG/KG | 3.1 | 2.9 | 2.9 | 1.8 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
T - LCS or LCSD is outside acceptance limits
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
V - Value altered or qualifier added during data validation
R - Sample results rejected by validator
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RMZ-11 | RMZ-12 | RMZ-13 | RMZ-14 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 8/17/2017 | 8/29/2017 | 8/29/2017 | 8/29/2017 |
| | | | Elevation (ft): | 15 | 15 | 15 | 15 |
| | | | Normal or Field Duplicate: | FD | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| 1,2,4,5-Tetrachlorobenzene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,3,4,6-Tetrachlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4,5-Trichlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4,6-Trichlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dichlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dimethylphenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dinitrophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dinitrotoluene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,6-Dinitrotoluene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Chloronaphthalene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Chlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Methylnaphthalene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Methylphenol (O-Cresol) | 100 | 500 | MG/KG | 1.8 U | 0.36 U | 0.39 U | 0.74 U |
| 2-Nitroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Nitrophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 3,3'-Dichlorobenzidine | -- | -- | MG/KG | NA | NA | NA | NA |
| 3-Nitroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 4,6-Dinitro-2-Methylphenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Bromophenyl Phenyl Ether | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Chloro-3-Methylphenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Chloroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Chlorophenyl Phenyl Ether | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Methylphenol (P-Cresol) | 100 | 500 | MG/KG | NA | NA | NA | NA |
| 4-Nitroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Nitrophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| Acenaphthene | 100 | 500 | MG/KG | 0.12 J | 0.086 J | 0.14 J | 0.72 J |
| Acenaphthylene | 100 | 500 | MG/KG | 0.1 J | 0.021 J | 0.078 J | 0.14 J |
| Acetophenone | -- | -- | MG/KG | NA | NA | NA | NA |
| Anthracene | 100 | 500 | MG/KG | 0.41 J | 0.25 J | 0.49 | 1.9 |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RMZ-11 | RMZ-12 | RMZ-13 | RMZ-14 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 8/17/2017 | 8/29/2017 | 8/29/2017 | 8/29/2017 |
| | | | Elevation (ft): | 15 | 15 | 15 | 15 |
| | | | Normal or Field Duplicate: | FD | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Atrazine | -- | -- | MG/KG | NA | NA | NA | NA |
| Benzaldehyde | -- | -- | MG/KG | NA | NA | NA | NA |
| Benzo(A)Anthracene | 1 | 5.6 | MG/KG | 0.93 | 0.71 | **1.5** | **3.9** |
| Benzo(A)Pyrene | 1 | 1 | MG/KG | 0.89 | 0.76 | **1.6** | **3.5** |
| Benzo(B)Fluoranthene | 1 | 5.6 | MG/KG | 1 | 0.92 | **1.8** | **4** |
| Benzo(G,H,I)Perylene | 100 | 500 | MG/KG | 0.96 J | 0.74 | 1.6 | 2.6 |
| Benzo(K)Fluoranthene | 3.9 | 56 | MG/KG | 0.18 U | 0.39 | 0.65 | 1.3 |
| Benzyl Butyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Biphenyl (Diphenyl) | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Chloroethoxy) Methane | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Chloroisopropyl) Ether | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Ethylhexyl) Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Caprolactam | -- | -- | MG/KG | NA | NA | NA | NA |
| Carbazole | -- | -- | MG/KG | NA | NA | NA | NA |
| Chrysene | 3.9 | 56 | MG/KG | 1 J | 0.69 | 1.5 | 3.8 |
| Cresols, M & P | 100 | 500 | MG/KG | 1.8 U | 0.36 U | 0.39 U | 0.042 J |
| Dibenz(A,H)Anthracene | 0.33 | 0.56 | MG/KG | 0.21 | 0.23 | **0.47** | **1** |
| Dibenzofuran | 59 | 350 | MG/KG | 0.12 J | 0.071 J | 0.093 J | 0.66 J |
| Diethyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Dimethyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Di-N-Butyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Di-N-Octylphthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Fluoranthene | 100 | 500 | MG/KG | 2 | 1.4 | 3.3 | 8.5 |
| Fluorene | 100 | 500 | MG/KG | 0.19 J | 0.081 J | 0.14 J | 0.87 |
| Hexachlorobenzene | 1.2 | 6 | MG/KG | 0.18 U | 0.036 U | 0.039 U | 0.074 U |
| Hexachlorobutadiene | -- | -- | MG/KG | NA | NA | NA | NA |
| Hexachlorocyclopentadiene | -- | -- | MG/KG | NA | NA | NA | NA |
| Hexachloroethane | -- | -- | MG/KG | NA | NA | NA | NA |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RMZ-11 | RMZ-12 | RMZ-13 | RMZ-14 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 8/17/2017 | 8/29/2017 | 8/29/2017 | 8/29/2017 |
| | | | Elevation (ft): | 15 | 15 | 15 | 15 |
| | | | Normal or Field Duplicate: | FD | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Indeno(1,2,3-C,D)Pyrene | 0.5 | 5.6 | MG/KG | **0.88** | **0.83** | **1.8** | **3.5** |
| Isophorone | -- | -- | MG/KG | NA | NA | NA | NA |
| Naphthalene | 100 | 500 | MG/KG | 0.11 J | 0.085 J | 0.098 J | 1.1 |
| Nitrobenzene | -- | -- | MG/KG | NA | NA | NA | NA |
| N-Nitrosodi-N-Propylamine | -- | -- | MG/KG | NA | NA | NA | NA |
| N-Nitrosodiphenylamine | -- | -- | MG/KG | NA | NA | NA | NA |
| Pentachlorophenol | 6.7 | 6.7 | MG/KG | 1.5 U | 0.29 U | 0.32 U | 0.6 U |
| Phenanthrene | 100 | 500 | MG/KG | 1.5 J | 1 | 1.9 | 8 |
| Phenol | 100 | 500 | MG/KG | 1.8 U | 0.36 U | 0.39 U | 0.035 J |
| Pyrene | 100 | 500 | MG/KG | 1.3 J | 1.3 | 2.2 | 5.5 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
T - LCS or LCSD is outside acceptance limits
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
V - Value altered or qualifier added during data validation
R - Sample results rejected by validator
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RMZ-15 | RMZ-16 | RMZ-17 | RMZ-18 | RMZ-19 |
|---|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 9/6/2017 | 9/6/2017 | 9/7/2017 | 9/12/2017 | 9/11/2017 |
| | | | Elevation (ft): | 15 | 15 | 15 | 15 | 15 |
| | | | Normal or Field Duplicate: | N | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | | |
| 1,2,4,5-Tetrachlorobenzene | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| 2,3,4,6-Tetrachlorophenol | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| 2,4,5-Trichlorophenol | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| 2,4,6-Trichlorophenol | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| 2,4-Dichlorophenol | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| 2,4-Dimethylphenol | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| 2,4-Dinitrophenol | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| 2,4-Dinitrotoluene | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| 2,6-Dinitrotoluene | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| 2-Chloronaphthalene | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| 2-Chlorophenol | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| 2-Methylnaphthalene | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| 2-Methylphenol (O-Cresol) | 100 | 500 | MG/KG | 1.9 U | 0.36 U | 0.36 | 0.38 | 0.38 |
| 2-Nitroaniline | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| 2-Nitrophenol | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| 3,3'-Dichlorobenzidine | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| 3-Nitroaniline | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| 4,6-Dinitro-2-Methylphenol | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| 4-Bromophenyl Phenyl Ether | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| 4-Chloro-3-Methylphenol | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| 4-Chloroaniline | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| 4-Chlorophenyl Phenyl Ether | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| 4-Methylphenol (P-Cresol) | 100 | 500 | MG/KG | NA | NA | NA | NA | NA |
| 4-Nitroaniline | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| 4-Nitrophenol | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| Acenaphthene | 100 | 500 | MG/KG | 0.41 J | 0.07 J | 0.15 | 0.13 | 0.022 |
| Acenaphthylene | 100 | 500 | MG/KG | 0.84 J | 0.18 J | 0.27 | 0.13 | 0.022 |
| Acetophenone | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| Anthracene | 100 | 500 | MG/KG | 1.5 J | 0.24 J | 0.34 | 0.42 | 0.07 |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RMZ-15 | RMZ-16 | RMZ-17 | RMZ-18 | RMZ-19 |
|---|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 9/6/2017 | 9/6/2017 | 9/7/2017 | 9/12/2017 | 9/11/2017 |
| | | | Elevation (ft): | 15 | 15 | 15 | 15 | 15 |
| | | | Normal or Field Duplicate: | N | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | | |
| Atrazine | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| Benzaldehyde | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| Benzo(A)Anthracene | 1 | 5.6 | MG/KG | **5.7** | **1.1** | **2** | **1.5** | 0.43 |
| Benzo(A)Pyrene | 1 | 1 | MG/KG | **5.9** | **1.2** | **2.8** | **1.6** | 0.55 |
| Benzo(B)Fluoranthene | 1 | 5.6 | MG/KG | **9.1** | **1.8** | **2.7** | **2.2** | 0.74 |
| Benzo(G,H,I)Perylene | 100 | 500 | MG/KG | 1.9 | 0.47 | 3.2 | 0.76 | 0.7 |
| Benzo(K)Fluoranthene | 3.9 | 56 | MG/KG | 3.6 | 0.64 | 1.2 | 0.76 | 0.3 |
| Benzyl Butyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| Biphenyl (Diphenyl) | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| Bis(2-Chloroethoxy) Methane | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| Bis(2-Chloroisopropyl) Ether | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| Bis(2-Ethylhexyl) Phthalate | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| Caprolactam | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| Carbazole | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| Chrysene | 3.9 | 56 | MG/KG | **5.8** | 1.2 | 2.2 | 1.6 | 0.46 |
| Cresols, M & P | 100 | 500 | MG/KG | 1.9 U | 0.36 U | 0.36 | 0.01 | 0.38 |
| Dibenz(A,H)Anthracene | 0.33 | 0.56 | MG/KG | **0.56** | 0.14 | **0.45** | 0.2 | 0.12 |
| Dibenzofuran | 59 | 350 | MG/KG | 0.28 J | 0.043 J | 0.084 | 0.089 | 0.015 |
| Diethyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| Dimethyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| Di-N-Butyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| Di-N-Octylphthalate | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| Fluoranthene | 100 | 500 | MG/KG | 14 | 2.1 | 2.8 | 2.9 | 0.68 |
| Fluorene | 100 | 500 | MG/KG | 0.47 J | 0.066 J | 0.14 | 0.12 | 0.021 |
| Hexachlorobenzene | 1.2 | 6 | MG/KG | 0.19 U | 0.036 U | 0.036 | 0.038 | 0.038 |
| Hexachlorobutadiene | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| Hexachlorocyclopentadiene | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| Hexachloroethane | -- | -- | MG/KG | NA | NA | NA | NA | NA |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RMZ-15 | RMZ-16 | RMZ-17 | RMZ-18 | RMZ-19 |
|---|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 9/6/2017 | 9/6/2017 | 9/7/2017 | 9/12/2017 | 9/11/2017 |
| | | | Elevation (ft): | 15 | 15 | 15 | 15 | 15 |
| | | | Normal or Field Duplicate: | N | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | | |
| Indeno(1,2,3-C,D)Pyrene | 0.5 | 5.6 | MG/KG | **2.4** | **0.58** | **2.9** | **0.86** | **0.66** |
| Isophorone | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| Naphthalene | 100 | 500 | MG/KG | 0.34 J | 0.044 J | 0.14 | 0.19 | 0.021 |
| Nitrobenzene | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| N-Nitrosodi-N-Propylamine | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| N-Nitrosodiphenylamine | -- | -- | MG/KG | NA | NA | NA | NA | NA |
| Pentachlorophenol | 6.7 | 6.7 | MG/KG | 1.5 U | 0.29 U | 0.29 | 0.3 | 0.31 |
| Phenanthrene | 100 | 500 | MG/KG | 6.2 | 0.94 | 2 | 1.9 | 0.36 |
| Phenol | 100 | 500 | MG/KG | 1.9 U | 0.36 U | 0.36 | 0.38 | 0.38 |
| Pyrene | 100 | 500 | MG/KG | 7.8 | 1.2 | 4 | 2.3 | 0.76 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
T - LCS or LCSD is outside acceptance limits
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
V - Value altered or qualifier added during data validation
R - Sample results rejected by validator
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RMZ-2 | RMZ-3 | RMZ-4 | RMZ-4-E |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 7/25/2017 | 7/25/2017 | 7/25/2017 | 8/3/2017 |
| | | | Elevation (ft): | 6 | 6 | 6 | 7 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| 1,2,4,5-Tetrachlorobenzene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,3,4,6-Tetrachlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4,5-Trichlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4,6-Trichlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dichlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dimethylphenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dinitrophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dinitrotoluene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,6-Dinitrotoluene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Chloronaphthalene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Chlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Methylnaphthalene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Methylphenol (O-Cresol) | 100 | 500 | MG/KG | 2 U | 0.4 U | 0.41 U | 0.36 U |
| 2-Nitroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Nitrophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 3,3'-Dichlorobenzidine | -- | -- | MG/KG | NA | NA | NA | NA |
| 3-Nitroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 4,6-Dinitro-2-Methylphenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Bromophenyl Phenyl Ether | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Chloro-3-Methylphenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Chloroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Chlorophenyl Phenyl Ether | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Methylphenol (P-Cresol) | 100 | 500 | MG/KG | NA | NA | NA | NA |
| 4-Nitroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Nitrophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| Acenaphthene | 100 | 500 | MG/KG | 1.3 J | 1.1 | 0.11 J | 0.13 J |
| Acenaphthylene | 100 | 500 | MG/KG | 0.56 J | 0.28 J | 0.13 J | 0.14 J |
| Acetophenone | -- | -- | MG/KG | NA | NA | NA | NA |
| Anthracene | 100 | 500 | MG/KG | 5.3 | 2.2 | 0.38 J | 0.5 |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RMZ-2 | RMZ-3 | RMZ-4 | RMZ-4-E |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 7/25/2017 | 7/25/2017 | 7/25/2017 | 8/3/2017 |
| | | | Elevation (ft): | 6 | 6 | 6 | 7 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Atrazine | -- | -- | MG/KG | NA | NA | NA | NA |
| Benzaldehyde | -- | -- | MG/KG | NA | NA | NA | NA |
| Benzo(A)Anthracene | 1 | 5.6 | MG/KG | **12** | **3.3** | **1.1** | **1.6** |
| Benzo(A)Pyrene | 1 | 1 | MG/KG | **11** | **3.3** | **1.2** | **1.8** |
| Benzo(B)Fluoranthene | 1 | 5.6 | MG/KG | **15** | **3.6** | **1.5** | 0.024 J |
| Benzo(G,H,I)Perylene | 100 | 500 | MG/KG | 11 | 2.2 | 0.88 | 0.53 |
| Benzo(K)Fluoranthene | 3.9 | 56 | MG/KG | **6** | 1.6 | 0.62 | 2.4 |
| Benzyl Butyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Biphenyl (Diphenyl) | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Chloroethoxy) Methane | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Chloroisopropyl) Ether | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Ethylhexyl) Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Caprolactam | -- | -- | MG/KG | NA | NA | NA | NA |
| Carbazole | -- | -- | MG/KG | NA | NA | NA | NA |
| Chrysene | 3.9 | 56 | MG/KG | **12** | 3.6 | 1.2 | 1.7 |
| Cresols, M & P | 100 | 500 | MG/KG | 2 U | 0.024 J | 0.039 J | 0.011 J |
| Dibenz(A,H)Anthracene | 0.33 | 0.56 | MG/KG | **3** | **0.63** | 0.26 | 0.2 |
| Dibenzofuran | 59 | 350 | MG/KG | 1.5 J | 0.68 | 0.084 J | 0.11 J |
| Diethyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Dimethyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Di-N-Butyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Di-N-Octylphthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Fluoranthene | 100 | 500 | MG/KG | 29 | 7.7 | 2.2 | 3.1 |
| Fluorene | 100 | 500 | MG/KG | 1.2 J | 1.1 | 0.1 J | 0.17 J |
| Hexachlorobenzene | 1.2 | 6 | MG/KG | 0.2 U | 0.04 U | 0.041 U | 0.036 U |
| Hexachlorobutadiene | -- | -- | MG/KG | NA | NA | NA | NA |
| Hexachlorocyclopentadiene | -- | -- | MG/KG | NA | NA | NA | NA |
| Hexachloroethane | -- | -- | MG/KG | NA | NA | NA | NA |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | Sample Designation: | RMZ-2 | RMZ-3 | RMZ-4 | RMZ-4-E |
| | | | Sample Date: | 7/25/2017 | 7/25/2017 | 7/25/2017 | 8/3/2017 |
| | | | Elevation (ft): | 6 | 6 | 6 | 7 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Indeno(1,2,3-C,D)Pyrene | 0.5 | 5.6 | MG/KG | **13** | **2.4** | **1** | **0.86** |
| Isophorone | -- | -- | MG/KG | NA | NA | NA | NA |
| Naphthalene | 100 | 500 | MG/KG | 1.2 J | 0.76 | 0.15 J | 0.1 J |
| Nitrobenzene | -- | -- | MG/KG | NA | NA | NA | NA |
| N-Nitrosodi-N-Propylamine | -- | -- | MG/KG | NA | NA | NA | NA |
| N-Nitrosodiphenylamine | -- | -- | MG/KG | NA | NA | NA | NA |
| Pentachlorophenol | 6.7 | 6.7 | MG/KG | 1.6 U | 0.32 U | 0.33 U | 0.29 U |
| Phenanthrene | 100 | 500 | MG/KG | 27 | 8.1 | 1.4 | 2.2 |
| Phenol | 100 | 500 | MG/KG | 2 U | 0.4 U | 0.02 J | 0.36 U |
| Pyrene | 100 | 500 | MG/KG | 19 | 4.9 | 1.3 | 2.5 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
T - LCS or LCSD is outside acceptance limits
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
V - Value altered or qualifier added during data validation
R - Sample results rejected by validator
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RMZ-5 | RMZ-6 | RMZ-6 | RMZ-7 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 7/25/2017 | 7/25/2017 | 7/25/2017 | 7/25/2017 |
| | | | Elevation (ft): | 6 | 6 | 6 | 6 |
| | | | Normal or Field Duplicate: | N | N | FD | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| 1,2,4,5-Tetrachlorobenzene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,3,4,6-Tetrachlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4,5-Trichlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4,6-Trichlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dichlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dimethylphenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dinitrophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dinitrotoluene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,6-Dinitrotoluene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Chloronaphthalene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Chlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Methylnaphthalene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Methylphenol (O-Cresol) | 100 | 500 | MG/KG | 0.38 U | 0.79 U | 0.8 U | 0.4 U |
| 2-Nitroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Nitrophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 3,3'-Dichlorobenzidine | -- | -- | MG/KG | NA | NA | NA | NA |
| 3-Nitroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 4,6-Dinitro-2-Methylphenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Bromophenyl Phenyl Ether | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Chloro-3-Methylphenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Chloroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Chlorophenyl Phenyl Ether | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Methylphenol (P-Cresol) | 100 | 500 | MG/KG | NA | NA | NA | NA |
| 4-Nitroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Nitrophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| Acenaphthene | 100 | 500 | MG/KG | 0.059 J | 0.089 J | 0.12 J | 0.15 J |
| Acenaphthylene | 100 | 500 | MG/KG | 0.081 J | 0.47 J | 0.64 J | 0.12 J |
| Acetophenone | -- | -- | MG/KG | NA | NA | NA | NA |
| Anthracene | 100 | 500 | MG/KG | 0.22 J | 0.45 J | 0.66 J | 0.38 J |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RMZ-5 | RMZ-6 | RMZ-6 | RMZ-7 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 7/25/2017 | 7/25/2017 | 7/25/2017 | 7/25/2017 |
| | | | Elevation (ft): | 6 | 6 | 6 | 6 |
| | | | Normal or Field Duplicate: | N | N | FD | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Atrazine | -- | -- | MG/KG | NA | NA | NA | NA |
| Benzaldehyde | -- | -- | MG/KG | NA | NA | NA | NA |
| Benzo(A)Anthracene | 1 | 5.6 | MG/KG | 0.8 | 0.74 | **2.1** | **1.2** |
| Benzo(A)Pyrene | 1 | 1 | MG/KG | 0.88 | 1 | **2.7** | **1.3** |
| Benzo(B)Fluoranthene | 1 | 5.6 | MG/KG | **1.1** | **1.2** | **2.9** | **1.6** |
| Benzo(G,H,I)Perylene | 100 | 500 | MG/KG | 0.71 | 1 | 3.8 | 0.96 |
| Benzo(K)Fluoranthene | 3.9 | 56 | MG/KG | 0.37 | 0.33 | 1 | 0.54 |
| Benzyl Butyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Biphenyl (Diphenyl) | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Chloroethoxy) Methane | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Chloroisopropyl) Ether | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Ethylhexyl) Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Caprolactam | -- | -- | MG/KG | NA | NA | NA | NA |
| Carbazole | -- | -- | MG/KG | NA | NA | NA | NA |
| Chrysene | 3.9 | 56 | MG/KG | 0.88 | 0.92 | 2.5 | 1.3 |
| Cresols, M & P | 100 | 500 | MG/KG | 0.38 U | 0.79 U | 0.026 J | 0.4 U |
| Dibenz(A,H)Anthracene | 0.33 | 0.56 | MG/KG | 0.16 | 0.21 | **0.72** | 0.23 |
| Dibenzofuran | 59 | 350 | MG/KG | 0.05 J | 0.098 J | 0.13 J | 0.09 J |
| Diethyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Dimethyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Di-N-Butyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Di-N-Octylphthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Fluoranthene | 100 | 500 | MG/KG | 1.5 | 1.4 | 3.5 | 2.3 |
| Fluorene | 100 | 500 | MG/KG | 0.063 J | 0.15 J | 0.17 J | 0.13 J |
| Hexachlorobenzene | 1.2 | 6 | MG/KG | 0.038 U | 0.079 U | 0.08 U | 0.04 U |
| Hexachlorobutadiene | -- | -- | MG/KG | NA | NA | NA | NA |
| Hexachlorocyclopentadiene | -- | -- | MG/KG | NA | NA | NA | NA |
| Hexachloroethane | -- | -- | MG/KG | NA | NA | NA | NA |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RMZ-5 | RMZ-6 | RMZ-6 | RMZ-7 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 7/25/2017 | 7/25/2017 | 7/25/2017 | 7/25/2017 |
| | | | Elevation (ft): | 6 | 6 | 6 | 6 |
| | | | Normal or Field Duplicate: | N | N | FD | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Indeno(1,2,3-C,D)Pyrene | 0.5 | 5.6 | MG/KG | **0.78** | **0.94** | **3.6** | **1.1** |
| Isophorone | -- | -- | MG/KG | NA | NA | NA | NA |
| Naphthalene | 100 | 500 | MG/KG | 0.12 J | 0.47 J | 0.62 J | 0.16 J |
| Nitrobenzene | -- | -- | MG/KG | NA | NA | NA | NA |
| N-Nitrosodi-N-Propylamine | -- | -- | MG/KG | NA | NA | NA | NA |
| N-Nitrosodiphenylamine | -- | -- | MG/KG | NA | NA | NA | NA |
| Pentachlorophenol | 6.7 | 6.7 | MG/KG | 0.31 U | 0.64 U | 0.64 U | 0.32 U |
| Phenanthrene | 100 | 500 | MG/KG | 0.99 | 1.2 | 2.2 | 1.7 |
| Phenol | 100 | 500 | MG/KG | 0.014 J | 0.79 U | 0.8 U | 0.4 U |
| Pyrene | 100 | 500 | MG/KG | 1.1 | 0.94 | 3 | 1.7 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
T - LCS or LCSD is outside acceptance limits
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
V - Value altered or qualifier added during data validation
R - Sample results rejected by validator
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RMZ-8 | RMZ-9 | RX-1 | RX-3 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 8/3/2017 | 8/3/2017 | 5/12/2016 | 5/12/2016 |
| | | | Elevation (ft): | 13 to 13.5 | 15.5 to 16 | 6.5 | 6.5 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| 1,2,4,5-Tetrachlorobenzene | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| 2,3,4,6-Tetrachlorophenol | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| 2,4,5-Trichlorophenol | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| 2,4,6-Trichlorophenol | -- | -- | MG/KG | NA | NA | 0.15 U | 0.74 U |
| 2,4-Dichlorophenol | -- | -- | MG/KG | NA | NA | 0.15 U | 0.74 U |
| 2,4-Dimethylphenol | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| 2,4-Dinitrophenol | -- | -- | MG/KG | NA | NA | 0.3 U | 1.5 U |
| 2,4-Dinitrotoluene | -- | -- | MG/KG | NA | NA | 0.076 U | 0.37 U |
| 2,6-Dinitrotoluene | -- | -- | MG/KG | NA | NA | 0.076 U | 0.37 U |
| 2-Chloronaphthalene | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| 2-Chlorophenol | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| 2-Methylnaphthalene | -- | -- | MG/KG | NA | NA | 0.13 J | 0.44 J |
| 2-Methylphenol (O-Cresol) | 100 | 500 | MG/KG | 0.36 U | 0.36 U | 0.37 U | 1.8 U |
| 2-Nitroaniline | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| 2-Nitrophenol | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| 3,3'-Dichlorobenzidine | -- | -- | MG/KG | NA | NA | 0.15 U | 0.74 U |
| 3-Nitroaniline | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| 4,6-Dinitro-2-Methylphenol | -- | -- | MG/KG | NA | NA | 0.3 U | 1.5 U |
| 4-Bromophenyl Phenyl Ether | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| 4-Chloro-3-Methylphenol | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| 4-Chloroaniline | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| 4-Chlorophenyl Phenyl Ether | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| 4-Methylphenol (P-Cresol) | 100 | 500 | MG/KG | NA | NA | 0.015 J | 1.8 U |
| 4-Nitroaniline | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| 4-Nitrophenol | -- | -- | MG/KG | NA | NA | 0.76 U | 3.7 U |
| Acenaphthene | 100 | 500 | MG/KG | 0.089 J | 0.17 J | 0.15 J | 0.93 J |
| Acenaphthylene | 100 | 500 | MG/KG | 0.11 J | 0.48 | 0.18 J | 0.28 J |
| Acetophenone | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| Anthracene | 100 | 500 | MG/KG | 0.32 J | 0.73 | 0.53 | 1.8 |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RMZ-8 | RMZ-9 | RX-1 | RX-3 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 8/3/2017 | 8/3/2017 | 5/12/2016 | 5/12/2016 |
| | | | Elevation (ft): | 13 to 13.5 | 15.5 to 16 | 6.5 | 6.5 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Atrazine | -- | -- | MG/KG | NA | NA | 0.15 U | 0.74 U |
| Benzaldehyde | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| Benzo(A)Anthracene | 1 | 5.6 | MG/KG | **1.3** | **2.7** | **1.4** | **3.6** |
| Benzo(A)Pyrene | 1 | 1 | MG/KG | **1.5** | **3.2** | **1.6** | **3.4** |
| Benzo(B)Fluoranthene | 1 | 5.6 | MG/KG | **2.3** | **5.2** | **2** | **4.4** |
| Benzo(G,H,I)Perylene | 100 | 500 | MG/KG | 0.43 | 0.96 | 0.97 | 0.95 J |
| Benzo(K)Fluoranthene | 3.9 | 56 | MG/KG | 0.89 | 1.8 | 0.74 | 0.18 U |
| Benzyl Butyl Phthalate | -- | -- | MG/KG | NA | NA | 0.077 J | 1.8 U |
| Biphenyl (Diphenyl) | -- | -- | MG/KG | NA | NA | 0.038 J | 1.8 U |
| Bis(2-Chloroethoxy) Methane | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | -- | -- | MG/KG | NA | NA | 0.037 U | 0.18 U |
| Bis(2-Chloroisopropyl) Ether | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| Bis(2-Ethylhexyl) Phthalate | -- | -- | MG/KG | NA | NA | 0.37 UV | 1.1 J |
| Caprolactam | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| Carbazole | -- | -- | MG/KG | NA | NA | 0.23 J | 1.1 J |
| Chrysene | 3.9 | 56 | MG/KG | 1.4 | 2.8 | 1.6 | **4** |
| Cresols, M & P | 100 | 500 | MG/KG | 0.36 U | 0.043 J | NA | NA |
| Dibenz(A,H)Anthracene | 0.33 | 0.56 | MG/KG | 0.17 | 0.32 | 0.24 | **0.36** |
| Dibenzofuran | 59 | 350 | MG/KG | 0.062 J | 0.15 J | 0.16 J | 1 J |
| Diethyl Phthalate | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| Dimethyl Phthalate | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| Di-N-Butyl Phthalate | -- | -- | MG/KG | NA | NA | 0.37 UV | 1.8 U |
| Di-N-Octylphthalate | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| Fluoranthene | 100 | 500 | MG/KG | 2.3 | 4.9 | 3.1 | 9.7 |
| Fluorene | 100 | 500 | MG/KG | 0.098 J | 0.21 J | 0.2 J | 0.97 J |
| Hexachlorobenzene | 1.2 | 6 | MG/KG | 0.036 U | 0.036 U | 0.037 U | 0.18 U |
| Hexachlorobutadiene | -- | -- | MG/KG | NA | NA | 0.076 U | 0.37 U |
| Hexachlorocyclopentadiene | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| Hexachloroethane | -- | -- | MG/KG | NA | NA | 0.037 U | 0.18 U |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RMZ-8 | RMZ-9 | RX-1 | RX-3 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 8/3/2017 | 8/3/2017 | 5/12/2016 | 5/12/2016 |
| | | | Elevation (ft): | 13 to 13.5 | 15.5 to 16 | 6.5 | 6.5 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Indeno(1,2,3-C,D)Pyrene | 0.5 | 5.6 | MG/KG | **0.73** | **1.5** | **1.1** | **1.3** |
| Isophorone | -- | -- | MG/KG | NA | NA | 0.15 U | 0.74 U |
| Naphthalene | 100 | 500 | MG/KG | 0.064 J | 0.25 J | 0.25 J | 0.62 J |
| Nitrobenzene | -- | -- | MG/KG | NA | NA | 0.037 U | 0.18 U |
| N-Nitrosodi-N-Propylamine | -- | -- | MG/KG | NA | NA | 0.037 U | 0.18 U |
| N-Nitrosodiphenylamine | -- | -- | MG/KG | NA | NA | 0.37 U | 1.8 U |
| Pentachlorophenol | 6.7 | 6.7 | MG/KG | 0.29 U | 0.29 U | 0.3 U | 1.5 U |
| Phenanthrene | 100 | 500 | MG/KG | 1.5 | 2.7 | 2.2 | 9.5 |
| Phenol | 100 | 500 | MG/KG | 0.36 U | 0.36 U | 0.37 U | 1.8 U |
| Pyrene | 100 | 500 | MG/KG | 2.1 | 3.9 | 2 | 4.5 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
T - LCS or LCSD is outside acceptance limits
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
V - Value altered or qualifier added during data validation
R - Sample results rejected by validator
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RX-6 | RX-6 | RX-8B | RX-B-1 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 5/12/2016 | 5/12/2016 | 5/12/2016 | 10/3/2016 |
| | | | Elevation (ft): | 8.5 | 8.5 | 4 | 12 |
| | | | Normal or Field Duplicate: | N | FD | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| 1,2,4,5-Tetrachlorobenzene | -- | -- | MG/KG | 0.37 U | 0.38 U | 0.38 UJV | 1.8 U |
| 2,3,4,6-Tetrachlorophenol | -- | -- | MG/KG | 0.37 U | 0.38 U | 0.38 UJV | 1.8 U |
| 2,4,5-Trichlorophenol | -- | -- | MG/KG | 0.37 U | 0.38 U | 0.38 UJV | 1.8 U |
| 2,4,6-Trichlorophenol | -- | -- | MG/KG | 0.15 U | 0.15 U | 0.15 UJV | 0.72 U |
| 2,4-Dichlorophenol | -- | -- | MG/KG | 0.15 U | 0.15 U | 0.15 UJV | 0.72 U |
| 2,4-Dimethylphenol | -- | -- | MG/KG | 0.37 U | 0.38 U | 0.38 UJV | 1.8 U |
| 2,4-Dinitrophenol | -- | -- | MG/KG | 0.3 U | 0.3 U | 0.3 UJV | 1.4 U |
| 2,4-Dinitrotoluene | -- | -- | MG/KG | 0.075 U | 0.077 U | 0.076 UJV | 0.36 U |
| 2,6-Dinitrotoluene | -- | -- | MG/KG | 0.075 U | 0.077 U | 0.076 UJV | 0.36 U |
| 2-Chloronaphthalene | -- | -- | MG/KG | 0.37 U | 0.38 U | 0.026 JV | 1.8 U |
| 2-Chlorophenol | -- | -- | MG/KG | 0.37 U | 0.38 U | 0.38 UJV | 1.8 U |
| 2-Methylnaphthalene | -- | -- | MG/KG | 0.33 J | 0.27 J | 2.6 JV | 0.3 J |
| 2-Methylphenol (O-Cresol) | 100 | 500 | MG/KG | 0.37 U | 0.38 U | 0.018 JV | 1.8 U |
| 2-Nitroaniline | -- | -- | MG/KG | 0.37 U | 0.38 U | 0.38 UJV | 1.8 U |
| 2-Nitrophenol | -- | -- | MG/KG | 0.37 U | 0.38 U | 0.38 UJV | 1.8 U |
| 3,3'-Dichlorobenzidine | -- | -- | MG/KG | 0.15 U | 0.15 U | 0.15 UJV | 0.72 U |
| 3-Nitroaniline | -- | -- | MG/KG | 0.37 U | 0.38 U | 0.38 UJV | 1.8 U |
| 4,6-Dinitro-2-Methylphenol | -- | -- | MG/KG | 0.3 U | 0.3 U | 0.3 UJV | 1.4 U |
| 4-Bromophenyl Phenyl Ether | -- | -- | MG/KG | 0.37 U | 0.38 U | 0.38 UJV | 1.8 U |
| 4-Chloro-3-Methylphenol | -- | -- | MG/KG | 0.37 U | 0.38 U | 0.38 UJV | 1.8 U |
| 4-Chloroaniline | -- | -- | MG/KG | 0.37 U | 0.38 U | 0.38 UJV | 1.8 U |
| 4-Chlorophenyl Phenyl Ether | -- | -- | MG/KG | 0.37 U | 0.38 U | 0.38 UJV | 1.8 U |
| 4-Methylphenol (P-Cresol) | 100 | 500 | MG/KG | 0.03 J | 0.025 J | 0.066 JV | 1.8 U |
| 4-Nitroaniline | -- | -- | MG/KG | 0.37 U | 0.38 U | 0.38 UJV | 1.8 U |
| 4-Nitrophenol | -- | -- | MG/KG | 0.75 U | 0.77 U | 0.76 UJV | 3.6 U |
| Acenaphthene | 100 | 500 | MG/KG | 0.28 J | 0.24 J | 0.27 JV | 1.1 J |
| Acenaphthylene | 100 | 500 | MG/KG | 0.36 J | 0.33 J | 0.52 JV | 0.21 J |
| Acetophenone | -- | -- | MG/KG | 0.37 UV | 0.035 J | 0.38 UJV | 1.8 U |
| Anthracene | 100 | 500 | MG/KG | 0.8 | 0.83 | 0.8 JV | 3.1 |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RX-6 | RX-6 | RX-8B | RX-B-1 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 5/12/2016 | 5/12/2016 | 5/12/2016 | 10/3/2016 |
| | | | Elevation (ft): | 8.5 | 8.5 | 4 | 12 |
| | | | Normal or Field Duplicate: | N | FD | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Atrazine | -- | -- | MG/KG | 0.15 U | 0.15 U | 0.15 UJV | 0.72 U |
| Benzaldehyde | -- | -- | MG/KG | 0.06 J | 0.072 J | 0.38 UJV | 1.8 U |
| Benzo(A)Anthracene | 1 | 5.6 | MG/KG | **2.6** | **2.8** | **2.6 JV** | **7.8** |
| Benzo(A)Pyrene | 1 | 1 | MG/KG | **2.9** | **3** | **3.1 JV** | **6.3** |
| Benzo(B)Fluoranthene | 1 | 5.6 | MG/KG | **4** | **4.1** | **4.8 JV** | **8.8** |
| Benzo(G,H,I)Perylene | 100 | 500 | MG/KG | 1.1 | 1.2 | 0.87 JV | 5.1 |
| Benzo(K)Fluoranthene | 3.9 | 56 | MG/KG | 1.5 | 1.6 | 1.5 JV | 2.9 |
| Benzyl Butyl Phthalate | -- | -- | MG/KG | 0.24 J | 35 | 0.25 JV | 0.53 J |
| Biphenyl (Diphenyl) | -- | -- | MG/KG | 0.1 J | 0.083 J | 0.48 JV | 1.8 U |
| Bis(2-Chloroethoxy) Methane | -- | -- | MG/KG | 0.37 U | 0.38 U | 0.38 UJV | 1.8 U |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | -- | -- | MG/KG | 0.037 U | 0.038 U | 0.038 UJV | 0.18 U |
| Bis(2-Chloroisopropyl) Ether | -- | -- | MG/KG | 0.37 U | 0.38 U | 0.38 UJV | 1.8 U |
| Bis(2-Ethylhexyl) Phthalate | -- | -- | MG/KG | 0.92 | 0.86 | 0.67 JV | 0.45 J |
| Caprolactam | -- | -- | MG/KG | 0.37 U | 0.38 U | 0.38 UJV | 1.8 U |
| Carbazole | -- | -- | MG/KG | 0.35 J | 0.38 | 0.42 JV | 1.4 J |
| Chrysene | 3.9 | 56 | MG/KG | 3.1 | 3.1 | 3 JV | **8** |
| Cresols, M & P | 100 | 500 | MG/KG | NA | NA | NA | NA |
| Dibenz(A,H)Anthracene | 0.33 | 0.56 | MG/KG | **0.35** | **0.4** | 0.29 JV | **0.9** |
| Dibenzofuran | 59 | 350 | MG/KG | 0.34 J | 0.23 J | 0.42 JV | 0.87 J |
| Diethyl Phthalate | -- | -- | MG/KG | 0.37 U | 0.38 U | 0.38 UJV | 1.8 U |
| Dimethyl Phthalate | -- | -- | MG/KG | 0.37 U | 0.38 U | 0.38 UJV | 1.8 U |
| Di-N-Butyl Phthalate | -- | -- | MG/KG | 0.37 UV | 0.38 UV | 0.38 UJV | 1.8 U |
| Di-N-Octylphthalate | -- | -- | MG/KG | 0.37 U | 0.38 U | 0.38 UJV | 1.8 U |
| Fluoranthene | 100 | 500 | MG/KG | 6.4 | 6.4 | 6.7 JV | 14 |
| Fluorene | 100 | 500 | MG/KG | 0.29 J | 0.3 J | 0.37 JV | 1.4 J |
| Hexachlorobenzene | 1.2 | 6 | MG/KG | 0.037 U | 0.038 U | 0.038 UJV | 0.18 U |
| Hexachlorobutadiene | -- | -- | MG/KG | 0.075 U | 0.077 U | 0.076 UJV | 0.36 U |
| Hexachlorocyclopentadiene | -- | -- | MG/KG | 0.37 U | 0.38 U | 0.38 UJV | 1.8 U |
| Hexachloroethane | -- | -- | MG/KG | 0.037 U | 0.038 U | 0.038 UJV | 0.18 U |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RX-6 | RX-6 | RX-8B | RX-B-1 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 5/12/2016 | 5/12/2016 | 5/12/2016 | 10/3/2016 |
| | | | Elevation (ft): | 8.5 | 8.5 | 4 | 12 |
| | | | Normal or Field Duplicate: | N | FD | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Indeno(1,2,3-C,D)Pyrene | 0.5 | 5.6 | MG/KG | **1.4** | **1.5** | **1.2 JV** | **4.3** |
| Isophorone | -- | -- | MG/KG | 0.2 | 0.15 U | 0.11 JV | 0.72 U |
| Naphthalene | 100 | 500 | MG/KG | 0.58 | 0.4 | 1.4 JV | 0.61 J |
| Nitrobenzene | -- | -- | MG/KG | 0.037 U | 0.038 U | 0.038 UJV | 0.18 U |
| N-Nitrosodi-N-Propylamine | -- | -- | MG/KG | 0.037 U | 0.038 U | 0.038 UJV | 0.18 U |
| N-Nitrosodiphenylamine | -- | -- | MG/KG | 0.37 U | 0.38 U | 0.38 UJV | 1.8 U |
| Pentachlorophenol | 6.7 | 6.7 | MG/KG | 0.3 U | 0.3 U | 0.3 UJV | 1.4 U |
| Phenanthrene | 100 | 500 | MG/KG | 3.8 | 3.5 | 3.8 JV | 14 |
| Phenol | 100 | 500 | MG/KG | 0.019 J | 0.38 U | 0.043 JV | 1.8 U |
| Pyrene | 100 | 500 | MG/KG | 3.5 | 3.5 | 3 JV | 14 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
T - LCS or LCSD is outside acceptance limits
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
V - Value altered or qualifier added during data validation
R - Sample results rejected by validator
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RX-B-4 | RX-B-6 | RX-B-7 | RX-B-8 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 10/3/2016 | 9/30/2016 | 10/3/2016 | 11/11/2016 |
| | | | Elevation (ft): | 11 | 12 | 11 | 11 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| 1,2,4,5-Tetrachlorobenzene | -- | -- | MG/KG | 0.36 U | 0.87 U | 0.36 U | NA |
| 2,3,4,6-Tetrachlorophenol | -- | -- | MG/KG | 0.36 U | 0.87 U | 0.36 U | NA |
| 2,4,5-Trichlorophenol | -- | -- | MG/KG | 0.36 U | 0.87 U | 0.36 U | NA |
| 2,4,6-Trichlorophenol | -- | -- | MG/KG | 0.15 U | 0.35 U | 0.15 U | NA |
| 2,4-Dichlorophenol | -- | -- | MG/KG | 0.15 U | 0.35 U | 0.15 U | NA |
| 2,4-Dimethylphenol | -- | -- | MG/KG | 0.36 U | 0.87 U | 0.36 U | NA |
| 2,4-Dinitrophenol | -- | -- | MG/KG | 0.29 U | 0.7 U | 0.29 RV | NA |
| 2,4-Dinitrotoluene | -- | -- | MG/KG | 0.073 U | 0.18 U | 0.073 U | NA |
| 2,6-Dinitrotoluene | -- | -- | MG/KG | 0.073 U | 0.18 U | 0.073 U | NA |
| 2-Chloronaphthalene | -- | -- | MG/KG | 0.36 U | 0.87 U | 0.36 U | NA |
| 2-Chlorophenol | -- | -- | MG/KG | 0.36 U | 0.87 U | 0.36 U | NA |
| 2-Methylnaphthalene | -- | -- | MG/KG | 0.1 J | 0.18 J | 0.056 J | NA |
| 2-Methylphenol (O-Cresol) | 100 | 500 | MG/KG | 0.36 U | 0.87 U | 0.36 U | 0.74 U |
| 2-Nitroaniline | -- | -- | MG/KG | 0.36 U | 0.87 U | 0.36 U | NA |
| 2-Nitrophenol | -- | -- | MG/KG | 0.36 U | 0.87 U | 0.36 U | NA |
| 3,3'-Dichlorobenzidine | -- | -- | MG/KG | 0.15 U | 0.35 U | 0.15 RV | NA |
| 3-Nitroaniline | -- | -- | MG/KG | 0.36 U | 0.87 U | 0.36 U | NA |
| 4,6-Dinitro-2-Methylphenol | -- | -- | MG/KG | 0.29 U | 0.7 U | 0.29 UJV | NA |
| 4-Bromophenyl Phenyl Ether | -- | -- | MG/KG | 0.36 U | 0.87 U | 0.36 U | NA |
| 4-Chloro-3-Methylphenol | -- | -- | MG/KG | 0.36 U | 0.87 U | 0.36 U | NA |
| 4-Chloroaniline | -- | -- | MG/KG | 0.36 U | 0.87 U | 0.36 U | NA |
| 4-Chlorophenyl Phenyl Ether | -- | -- | MG/KG | 0.36 U | 0.87 U | 0.36 U | NA |
| 4-Methylphenol (P-Cresol) | 100 | 500 | MG/KG | 0.0099 J | 0.024 J | 0.36 U | NA |
| 4-Nitroaniline | -- | -- | MG/KG | 0.36 U | 0.87 U | 0.36 U | NA |
| 4-Nitrophenol | -- | -- | MG/KG | 0.73 U | 1.8 U | 0.73 U | NA |
| Acenaphthene | 100 | 500 | MG/KG | 0.17 J | 0.26 J | 0.24 J | 0.6 J |
| Acenaphthylene | 100 | 500 | MG/KG | 0.24 J | 0.27 J | 0.039 JV | 0.085 J |
| Acetophenone | -- | -- | MG/KG | 0.36 U | 0.029 J | 0.36 U | NA |
| Anthracene | 100 | 500 | MG/KG | 0.49 | 0.56 J | 0.5 | 1.4 |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RX-B-4 | RX-B-6 | RX-B-7 | RX-B-8 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 10/3/2016 | 9/30/2016 | 10/3/2016 | 11/11/2016 |
| | | | Elevation (ft): | 11 | 12 | 11 | 11 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Atrazine | -- | -- | MG/KG | 0.15 U | 0.35 U | 0.15 U | NA |
| Benzaldehyde | -- | -- | MG/KG | 0.039 J | 0.87 U | 0.36 U | NA |
| Benzo(A)Anthracene | 1 | 5.6 | MG/KG | **1.4** | **2.3** | **1.3 JV** | **2.8** |
| Benzo(A)Pyrene | 1 | 1 | MG/KG | **1.6** | **2.2** | **1.1 JV** | **2.5** |
| Benzo(B)Fluoranthene | 1 | 5.6 | MG/KG | **1.8** | **2.8** | **1.4** | **3** |
| Benzo(G,H,I)Perylene | 100 | 500 | MG/KG | 1.8 | 2.4 | 0.96 | 2.4 |
| Benzo(K)Fluoranthene | 3.9 | 56 | MG/KG | 0.72 | 1.2 | 0.59 | 1.1 |
| Benzyl Butyl Phthalate | -- | -- | MG/KG | 0.38 | 3.9 | 0.028 JV | NA |
| Biphenyl (Diphenyl) | -- | -- | MG/KG | 0.033 J | 0.87 U | 0.36 U | NA |
| Bis(2-Chloroethoxy) Methane | -- | -- | MG/KG | 0.36 U | 0.87 U | 0.36 U | NA |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | -- | -- | MG/KG | 0.036 U | 0.087 U | 0.036 U | NA |
| Bis(2-Chloroisopropyl) Ether | -- | -- | MG/KG | 0.36 U | 0.87 U | 0.36 U | NA |
| Bis(2-Ethylhexyl) Phthalate | -- | -- | MG/KG | 0.4 | 4.1 | 0.037 J | NA |
| Caprolactam | -- | -- | MG/KG | 0.36 U | 0.87 U | 0.36 U | NA |
| Carbazole | -- | -- | MG/KG | 0.22 J | 0.24 J | 0.24 J | NA |
| Chrysene | 3.9 | 56 | MG/KG | 1.5 | 2.4 | 1.3 JV | 2.9 |
| Cresols, M & P | 100 | 500 | MG/KG | NA | NA | NA | 0.74 U |
| Dibenz(A,H)Anthracene | 0.33 | 0.56 | MG/KG | **0.49** | **0.45** | 0.22 | **0.69** |
| Dibenzofuran | 59 | 350 | MG/KG | 0.11 J | 0.24 J | 0.13 J | 0.39 J |
| Diethyl Phthalate | -- | -- | MG/KG | 0.36 U | 0.87 U | 0.36 U | NA |
| Dimethyl Phthalate | -- | -- | MG/KG | 0.36 U | 0.87 U | 0.36 U | NA |
| Di-N-Butyl Phthalate | -- | -- | MG/KG | 0.092 J | 0.091 J | 0.36 U | NA |
| Di-N-Octylphthalate | -- | -- | MG/KG | 0.36 U | 0.08 J | 0.36 U | NA |
| Fluoranthene | 100 | 500 | MG/KG | 3 | 4.1 | 2.6 | 5.8 |
| Fluorene | 100 | 500 | MG/KG | 0.17 J | 0.29 J | 0.26 J | 0.66 J |
| Hexachlorobenzene | 1.2 | 6 | MG/KG | 0.036 U | 0.087 U | 0.036 U | 0.074 U |
| Hexachlorobutadiene | -- | -- | MG/KG | 0.073 U | 0.18 U | 0.073 U | NA |
| Hexachlorocyclopentadiene | -- | -- | MG/KG | 0.36 U | 0.87 U | 0.36 RV | NA |
| Hexachloroethane | -- | -- | MG/KG | 0.036 U | 0.087 U | 0.036 U | NA |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RX-B-4 | RX-B-6 | RX-B-7 | RX-B-8 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 10/3/2016 | 9/30/2016 | 10/3/2016 | 11/11/2016 |
| | | | Elevation (ft): | 11 | 12 | 11 | 11 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Indeno(1,2,3-C,D)Pyrene | 0.5 | 5.6 | MG/KG | **1.7** | **2.3** | **0.83** | **2.4** |
| Isophorone | -- | -- | MG/KG | 0.15 U | 0.35 U | 0.15 U | NA |
| Naphthalene | 100 | 500 | MG/KG | 0.19 J | 0.37 J | 0.079 J | 0.24 J |
| Nitrobenzene | -- | -- | MG/KG | 0.036 U | 0.087 U | 0.036 U | NA |
| N-Nitrosodi-N-Propylamine | -- | -- | MG/KG | 0.036 U | 0.087 U | 0.036 U | NA |
| N-Nitrosodiphenylamine | -- | -- | MG/KG | 0.36 U | 0.87 U | 0.36 U | NA |
| Pentachlorophenol | 6.7 | 6.7 | MG/KG | 0.29 U | 0.7 U | 0.29 UJV | 0.59 U |
| Phenanthrene | 100 | 500 | MG/KG | 1.9 | 2.7 | 2.4 | 6 |
| Phenol | 100 | 500 | MG/KG | 0.36 U | 0.87 U | 0.36 U | 0.74 U |
| Pyrene | 100 | 500 | MG/KG | 2.4 | 3.8 | 2.3 | 5.3 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
T - LCS or LCSD is outside acceptance limits
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
V - Value altered or qualifier added during data validation
R - Sample results rejected by validator
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | Sample Designation: | RX-B-9 | RX-SW-1 | RX-SW-10 | RX-SW-11 |
| | | | Sample Date: | 10/3/2016 | 9/30/2016 | 9/30/2016 | 9/30/2016 |
| | | | Elevation (ft): | 9 | 4 | 12 | 12 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| 1,2,4,5-Tetrachlorobenzene | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.36 U |
| 2,3,4,6-Tetrachlorophenol | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.36 U |
| 2,4,5-Trichlorophenol | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.36 U |
| 2,4,6-Trichlorophenol | -- | -- | MG/KG | 0.15 U | 0.17 U | 0.14 U | 0.14 U |
| 2,4-Dichlorophenol | -- | -- | MG/KG | 0.15 U | 0.17 U | 0.14 U | 0.14 U |
| 2,4-Dimethylphenol | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.36 U |
| 2,4-Dinitrophenol | -- | -- | MG/KG | 0.29 U | 0.34 U | 0.29 U | 0.29 U |
| 2,4-Dinitrotoluene | -- | -- | MG/KG | 0.074 U | 0.086 U | 0.072 U | 0.073 U |
| 2,6-Dinitrotoluene | -- | -- | MG/KG | 0.074 U | 0.086 U | 0.072 U | 0.073 U |
| 2-Chloronaphthalene | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.36 U |
| 2-Chlorophenol | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.36 U |
| 2-Methylnaphthalene | -- | -- | MG/KG | 0.089 J | 0.19 J | 0.048 J | 0.15 J |
| 2-Methylphenol (O-Cresol) | 100 | 500 | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.36 U |
| 2-Nitroaniline | -- | -- | MG/KG | 0.37 U | 0.42 UT | 0.36 UT | 0.36 UT |
| 2-Nitrophenol | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.36 U |
| 3,3'-Dichlorobenzidine | -- | -- | MG/KG | 0.15 U | 0.17 U | 0.14 U | 0.14 U |
| 3-Nitroaniline | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.36 U |
| 4,6-Dinitro-2-Methylphenol | -- | -- | MG/KG | 0.29 U | 0.34 U | 0.29 U | 0.29 U |
| 4-Bromophenyl Phenyl Ether | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.36 U |
| 4-Chloro-3-Methylphenol | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.36 U |
| 4-Chloroaniline | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.36 U |
| 4-Chlorophenyl Phenyl Ether | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.36 U |
| 4-Methylphenol (P-Cresol) | 100 | 500 | MG/KG | 0.37 U | 0.016 J | 0.36 U | 0.36 U |
| 4-Nitroaniline | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.36 U |
| 4-Nitrophenol | -- | -- | MG/KG | 0.74 U | 0.86 U | 0.72 U | 0.73 U |
| Acenaphthene | 100 | 500 | MG/KG | 0.2 J | 0.39 J | 0.067 J | 0.31 J |
| Acenaphthylene | 100 | 500 | MG/KG | 0.21 J | 0.32 J | 0.12 J | 0.28 J |
| Acetophenone | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.027 J | 0.031 J |
| Anthracene | 100 | 500 | MG/KG | 0.55 | 1 | 0.23 J | 0.92 |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RX-B-9 | RX-SW-1 | RX-SW-10 | RX-SW-11 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 10/3/2016 | 9/30/2016 | 9/30/2016 | 9/30/2016 |
| | | | Elevation (ft): | 9 | 4 | 12 | 12 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Atrazine | -- | -- | MG/KG | 0.15 U | 0.17 U | 0.14 U | 0.14 U |
| Benzaldehyde | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.054 J |
| Benzo(A)Anthracene | 1 | 5.6 | MG/KG | **2** | **2.1** | 1 | **2.4** |
| Benzo(A)Pyrene | 1 | 1 | MG/KG | **2.2** | **2.3** | **1.1** | **2.5** |
| Benzo(B)Fluoranthene | 1 | 5.6 | MG/KG | **2.5** | **2.5** | **1.4** | **3.1** |
| Benzo(G,H,I)Perylene | 100 | 500 | MG/KG | 2.2 | 1.2 | 1 | 1.6 |
| Benzo(K)Fluoranthene | 3.9 | 56 | MG/KG | 0.98 | 1 | 0.55 | 1.4 |
| Benzyl Butyl Phthalate | -- | -- | MG/KG | 0.23 J | 0.42 U | 2.7 | 5.7 |
| Biphenyl (Diphenyl) | -- | -- | MG/KG | 0.032 J | 0.18 J | 0.36 U | 0.062 J |
| Bis(2-Chloroethoxy) Methane | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.36 U |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | -- | -- | MG/KG | 0.037 U | 0.042 U | 0.036 U | 0.036 U |
| Bis(2-Chloroisopropyl) Ether | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.36 U |
| Bis(2-Ethylhexyl) Phthalate | -- | -- | MG/KG | 1 | 0.42 UV | 6.6 | 0.63 |
| Caprolactam | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.36 U |
| Carbazole | -- | -- | MG/KG | 0.22 J | 0.22 J | 0.089 J | 0.4 |
| Chrysene | 3.9 | 56 | MG/KG | 2.3 | 2.2 | 1.1 | 2.6 |
| Cresols, M & P | 100 | 500 | MG/KG | NA | NA | NA | NA |
| Dibenz(A,H)Anthracene | 0.33 | 0.56 | MG/KG | **0.61** | 0.28 | 0.26 | **0.44** |
| Dibenzofuran | 59 | 350 | MG/KG | 0.11 J | 0.24 J | 0.055 J | 0.25 J |
| Diethyl Phthalate | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.36 U |
| Dimethyl Phthalate | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.051 J |
| Di-N-Butyl Phthalate | -- | -- | MG/KG | 0.09 J | 0.42 U | 0.074 J | 0.056 J |
| Di-N-Octylphthalate | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.36 U |
| Fluoranthene | 100 | 500 | MG/KG | 4.2 | 4.3 | 1.7 | 4.8 |
| Fluorene | 100 | 500 | MG/KG | 0.18 J | 0.41 J | 0.07 J | 0.36 |
| Hexachlorobenzene | 1.2 | 6 | MG/KG | 0.037 U | 0.042 U | 0.036 U | 0.036 U |
| Hexachlorobutadiene | -- | -- | MG/KG | 0.074 U | 0.086 U | 0.072 U | 0.073 U |
| Hexachlorocyclopentadiene | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.36 U |
| Hexachloroethane | -- | -- | MG/KG | 0.037 U | 0.042 U | 0.036 U | 0.036 U |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RX-B-9 | RX-SW-1 | RX-SW-10 | RX-SW-11 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 10/3/2016 | 9/30/2016 | 9/30/2016 | 9/30/2016 |
| | | | Elevation (ft): | 9 | 4 | 12 | 12 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Indeno(1,2,3-C,D)Pyrene | 0.5 | 5.6 | MG/KG | **2** | **1.2** | **1.1** | **1.7** |
| Isophorone | -- | -- | MG/KG | 0.15 U | 0.17 U | 0.14 U | 0.015 J |
| Naphthalene | 100 | 500 | MG/KG | 0.13 J | 0.5 | 0.1 J | 0.42 |
| Nitrobenzene | -- | -- | MG/KG | 0.037 U | 0.042 U | 0.036 U | 0.036 U |
| N-Nitrosodi-N-Propylamine | -- | -- | MG/KG | 0.037 U | 0.042 U | 0.036 U | 0.036 U |
| N-Nitrosodiphenylamine | -- | -- | MG/KG | 0.37 U | 0.42 U | 0.36 U | 0.36 U |
| Pentachlorophenol | 6.7 | 6.7 | MG/KG | 0.29 U | 0.34 U | 0.29 U | 0.29 U |
| Phenanthrene | 100 | 500 | MG/KG | 2.4 | 3.5 | 1 | 3.6 |
| Phenol | 100 | 500 | MG/KG | 0.37 U | 0.42 U | 0.026 J | 0.36 U |
| Pyrene | 100 | 500 | MG/KG | 3.3 | 3.6 | 1.8 | 4.1 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
T - LCS or LCSD is outside acceptance limits
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
V - Value altered or qualifier added during data validation
R - Sample results rejected by validator
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RX-SW-2 | RX-SW-3 | RX-SW-4 | RX-SW-5 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 9/30/2016 | 9/30/2016 | 9/30/2016 | 9/30/2016 |
| | | | Elevation (ft): | 4 | 3 | 4 | 3 |
| | | | Normal or Field Duplicate: | N | FD | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| 1,2,4,5-Tetrachlorobenzene | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| 2,3,4,6-Tetrachlorophenol | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| 2,4,5-Trichlorophenol | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| 2,4,6-Trichlorophenol | -- | -- | MG/KG | 0.17 U | 0.37 U | 0.25 U | 0.93 U |
| 2,4-Dichlorophenol | -- | -- | MG/KG | 0.17 U | 0.37 U | 0.25 U | 0.93 U |
| 2,4-Dimethylphenol | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| 2,4-Dinitrophenol | -- | -- | MG/KG | 0.35 U | 0.75 U | 0.51 U | 1.9 U |
| 2,4-Dinitrotoluene | -- | -- | MG/KG | 0.088 U | 0.19 U | 0.13 U | 0.47 U |
| 2,6-Dinitrotoluene | -- | -- | MG/KG | 0.088 U | 0.19 U | 0.13 U | 0.47 U |
| 2-Chloronaphthalene | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| 2-Chlorophenol | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| 2-Methylnaphthalene | -- | -- | MG/KG | 0.51 | 0.13 J | 0.28 J | 0.31 J |
| 2-Methylphenol (O-Cresol) | 100 | 500 | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| 2-Nitroaniline | -- | -- | MG/KG | 0.43 UT | 0.93 UT | 0.63 UT | 2.3 UT |
| 2-Nitrophenol | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| 3,3'-Dichlorobenzidine | -- | -- | MG/KG | 0.17 U | 0.37 U | 0.25 U | 0.93 U |
| 3-Nitroaniline | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| 4,6-Dinitro-2-Methylphenol | -- | -- | MG/KG | 0.35 U | 0.75 U | 0.51 U | 1.9 U |
| 4-Bromophenyl Phenyl Ether | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| 4-Chloro-3-Methylphenol | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| 4-Chloroaniline | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| 4-Chlorophenyl Phenyl Ether | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| 4-Methylphenol (P-Cresol) | 100 | 500 | MG/KG | 0.43 U | 0.93 U | 0.078 J | 2.3 U |
| 4-Nitroaniline | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| 4-Nitrophenol | -- | -- | MG/KG | 0.88 U | 1.9 U | 1.3 U | 4.7 U |
| Acenaphthene | 100 | 500 | MG/KG | 0.32 J | 0.27 J | 0.43 J | 1.8 J |
| Acenaphthylene | 100 | 500 | MG/KG | 0.5 | 0.1 J | 2.5 | 3.6 |
| Acetophenone | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.051 J | 2.3 U |
| Anthracene | 100 | 500 | MG/KG | 0.37 J | 0.65 J | 1.6 | 1.9 J |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RX-SW-2 | RX-SW-3 | RX-SW-4 | RX-SW-5 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 9/30/2016 | 9/30/2016 | 9/30/2016 | 9/30/2016 |
| | | | Elevation (ft): | 4 | 3 | 4 | 3 |
| | | | Normal or Field Duplicate: | N | FD | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Atrazine | -- | -- | MG/KG | 0.17 U | 0.37 U | 0.25 U | 0.93 U |
| Benzaldehyde | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.15 J | 2.3 U |
| Benzo(A)Anthracene | 1 | 5.6 | MG/KG | **1.6** | **1.9 JV** | **6.5** | **7.4** |
| Benzo(A)Pyrene | 1 | 1 | MG/KG | **2.4** | **2.1 JV** | **13** | **23** |
| Benzo(B)Fluoranthene | 1 | 5.6 | MG/KG | **2.6** | **2.5 JV** | **10** | **14** |
| Benzo(G,H,I)Perylene | 100 | 500 | MG/KG | 1.6 | 1.3 JV | 6.9 | 14 |
| Benzo(K)Fluoranthene | 3.9 | 56 | MG/KG | 0.93 | 0.95 JV | 3.5 | **5.7** |
| Benzyl Butyl Phthalate | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| Biphenyl (Diphenyl) | -- | -- | MG/KG | 0.13 J | 0.93 U | 0.21 J | 0.45 J |
| Bis(2-Chloroethoxy) Methane | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | -- | -- | MG/KG | 0.043 U | 0.093 U | 0.063 U | 0.23 U |
| Bis(2-Chloroisopropyl) Ether | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| Bis(2-Ethylhexyl) Phthalate | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| Caprolactam | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| Carbazole | -- | -- | MG/KG | 0.059 J | 0.18 J | 0.076 J | 2.3 U |
| Chrysene | 3.9 | 56 | MG/KG | 1.6 | 2 | **5.7** | **7.7** |
| Cresols, M & P | 100 | 500 | MG/KG | NA | NA | NA | NA |
| Dibenz(A,H)Anthracene | 0.33 | 0.56 | MG/KG | 0.27 | **0.43** | **1.1** | **2.3** |
| Dibenzofuran | 59 | 350 | MG/KG | 0.15 J | 0.2 J | 0.1 J | 2.3 U |
| Diethyl Phthalate | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| Dimethyl Phthalate | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| Di-N-Butyl Phthalate | -- | -- | MG/KG | 0.014 J | 0.93 U | 0.63 U | 2.3 U |
| Di-N-Octylphthalate | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| Fluoranthene | 100 | 500 | MG/KG | 2.1 | 4.9 JV | 4.2 | 7.9 |
| Fluorene | 100 | 500 | MG/KG | 0.21 J | 0.25 J | 0.45 J | 0.52 J |
| Hexachlorobenzene | 1.2 | 6 | MG/KG | 0.043 U | 0.093 U | 0.063 U | 0.23 U |
| Hexachlorobutadiene | -- | -- | MG/KG | 0.088 U | 0.19 U | 0.13 U | 0.47 U |
| Hexachlorocyclopentadiene | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| Hexachloroethane | -- | -- | MG/KG | 0.043 U | 0.093 U | 0.063 U | 0.23 U |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RX-SW-2 | RX-SW-3 | RX-SW-4 | RX-SW-5 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 9/30/2016 | 9/30/2016 | 9/30/2016 | 9/30/2016 |
| | | | Elevation (ft): | 4 | 3 | 4 | 3 |
| | | | Normal or Field Duplicate: | N | FD | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Indeno(1,2,3-C,D)Pyrene | 0.5 | 5.6 | MG/KG | **1.4** | **1.5** | **5** | **10** |
| Isophorone | -- | -- | MG/KG | 0.17 U | 0.37 U | 0.02 J | 0.93 U |
| Naphthalene | 100 | 500 | MG/KG | 0.76 | 0.28 J | 1 | 1.6 J |
| Nitrobenzene | -- | -- | MG/KG | 0.043 U | 0.093 U | 0.063 U | 0.23 U |
| N-Nitrosodi-N-Propylamine | -- | -- | MG/KG | 0.043 U | 0.093 U | 0.063 U | 0.23 U |
| N-Nitrosodiphenylamine | -- | -- | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| Pentachlorophenol | 6.7 | 6.7 | MG/KG | 0.35 U | 0.75 U | 0.51 U | 1.9 U |
| Phenanthrene | 100 | 500 | MG/KG | 0.81 | 2.7 JV | 2.2 | 2.2 J |
| Phenol | 100 | 500 | MG/KG | 0.43 U | 0.93 U | 0.63 U | 2.3 U |
| Pyrene | 100 | 500 | MG/KG | 3.4 | 2.5 JV | 11 | 6.6 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
T - LCS or LCSD is outside acceptance limits
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
V - Value altered or qualifier added during data validation
R - Sample results rejected by validator
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | Sample Designation: | RX-SW-9 | SW-013117-E | SW-013117-N |
| | | | Sample Date: | 9/30/2016 | 1/31/2017 | 1/31/2017 |
| | | | Elevation (ft): | 11 | 15 | 15 |
| | | | Normal or Field Duplicate: | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | |
| 1,2,4,5-Tetrachlorobenzene | -- | -- | MG/KG | 0.36 U | NA | NA |
| 2,3,4,6-Tetrachlorophenol | -- | -- | MG/KG | 0.36 U | NA | NA |
| 2,4,5-Trichlorophenol | -- | -- | MG/KG | 0.36 U | NA | NA |
| 2,4,6-Trichlorophenol | -- | -- | MG/KG | 0.14 U | NA | NA |
| 2,4-Dichlorophenol | -- | -- | MG/KG | 0.14 U | NA | NA |
| 2,4-Dimethylphenol | -- | -- | MG/KG | 0.36 U | NA | NA |
| 2,4-Dinitrophenol | -- | -- | MG/KG | 0.29 U | NA | NA |
| 2,4-Dinitrotoluene | -- | -- | MG/KG | 0.073 U | NA | NA |
| 2,6-Dinitrotoluene | -- | -- | MG/KG | 0.073 U | NA | NA |
| 2-Chloronaphthalene | -- | -- | MG/KG | 0.36 U | NA | NA |
| 2-Chlorophenol | -- | -- | MG/KG | 0.36 U | NA | NA |
| 2-Methylnaphthalene | -- | -- | MG/KG | 0.053 J | NA | NA |
| 2-Methylphenol (O-Cresol) | 100 | 500 | MG/KG | 0.36 U | NA | NA |
| 2-Nitroaniline | -- | -- | MG/KG | 0.36 UT | NA | NA |
| 2-Nitrophenol | -- | -- | MG/KG | 0.36 U | NA | NA |
| 3,3'-Dichlorobenzidine | -- | -- | MG/KG | 0.14 U | NA | NA |
| 3-Nitroaniline | -- | -- | MG/KG | 0.36 U | NA | NA |
| 4,6-Dinitro-2-Methylphenol | -- | -- | MG/KG | 0.29 U | NA | NA |
| 4-Bromophenyl Phenyl Ether | -- | -- | MG/KG | 0.36 U | NA | NA |
| 4-Chloro-3-Methylphenol | -- | -- | MG/KG | 0.36 U | NA | NA |
| 4-Chloroaniline | -- | -- | MG/KG | 0.36 U | NA | NA |
| 4-Chlorophenyl Phenyl Ether | -- | -- | MG/KG | 0.36 U | NA | NA |
| 4-Methylphenol (P-Cresol) | 100 | 500 | MG/KG | 0.36 U | NA | NA |
| 4-Nitroaniline | -- | -- | MG/KG | 0.36 U | NA | NA |
| 4-Nitrophenol | -- | -- | MG/KG | 0.73 U | NA | NA |
| Acenaphthene | 100 | 500 | MG/KG | 0.11 J | 0.82 | 0.083 J |
| Acenaphthylene | 100 | 500 | MG/KG | 0.088 J | 0.25 J | 0.13 J |
| Acetophenone | -- | -- | MG/KG | 0.013 J | NA | NA |
| Anthracene | 100 | 500 | MG/KG | 0.26 J | 2.2 | 0.26 J |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | Sample Designation: | RX-SW-9 | SW-013117-E | SW-013117-N |
| | | | Sample Date: | 9/30/2016 | 1/31/2017 | 1/31/2017 |
| | | | Elevation (ft): | 11 | 15 | 15 |
| | | | Normal or Field Duplicate: | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | |
| Atrazine | -- | -- | MG/KG | 0.14 U | NA | NA |
| Benzaldehyde | -- | -- | MG/KG | 0.36 U | NA | NA |
| Benzo(A)Anthracene | 1 | 5.6 | MG/KG | 0.89 | **5.9** | **1.1** |
| Benzo(A)Pyrene | 1 | 1 | MG/KG | 0.9 | **5.2** | 0.92 |
| Benzo(B)Fluoranthene | 1 | 5.6 | MG/KG | **1.3** | **6.1** | **1.2** |
| Benzo(G,H,I)Perylene | 100 | 500 | MG/KG | 0.54 | 3.3 | 0.76 J |
| Benzo(K)Fluoranthene | 3.9 | 56 | MG/KG | 0.41 | 2.5 | 0.48 |
| Benzyl Butyl Phthalate | -- | -- | MG/KG | 0.84 | NA | NA |
| Biphenyl (Diphenyl) | -- | -- | MG/KG | 0.36 U | NA | NA |
| Bis(2-Chloroethoxy) Methane | -- | -- | MG/KG | 0.36 U | NA | NA |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | -- | -- | MG/KG | 0.036 U | NA | NA |
| Bis(2-Chloroisopropyl) Ether | -- | -- | MG/KG | 0.36 U | NA | NA |
| Bis(2-Ethylhexyl) Phthalate | -- | -- | MG/KG | 0.19 J | NA | NA |
| Caprolactam | -- | -- | MG/KG | 0.36 U | NA | NA |
| Carbazole | -- | -- | MG/KG | 0.12 J | NA | NA |
| Chrysene | 3.9 | 56 | MG/KG | 0.94 | **5.7** | 1.1 |
| Cresols, M & P | 100 | 500 | MG/KG | NA | NA | NA |
| Dibenz(A,H)Anthracene | 0.33 | 0.56 | MG/KG | 0.15 | **0.84** | 0.18 |
| Dibenzofuran | 59 | 350 | MG/KG | 0.084 J | NA | NA |
| Diethyl Phthalate | -- | -- | MG/KG | 0.36 U | NA | NA |
| Dimethyl Phthalate | -- | -- | MG/KG | 0.36 U | NA | NA |
| Di-N-Butyl Phthalate | -- | -- | MG/KG | 0.017 J | NA | NA |
| Di-N-Octylphthalate | -- | -- | MG/KG | 0.36 U | NA | NA |
| Fluoranthene | 100 | 500 | MG/KG | 1.7 | 13 | 1.8 |
| Fluorene | 100 | 500 | MG/KG | 0.13 J | 0.69 J | 0.084 J |
| Hexachlorobenzene | 1.2 | 6 | MG/KG | 0.036 U | NA | NA |
| Hexachlorobutadiene | -- | -- | MG/KG | 0.073 U | NA | NA |
| Hexachlorocyclopentadiene | -- | -- | MG/KG | 0.36 U | NA | NA |
| Hexachloroethane | -- | -- | MG/KG | 0.036 U | NA | NA |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | Sample Designation: | RX-SW-9 | SW-013117-E | SW-013117-N |
| | | | Sample Date: | 9/30/2016 | 1/31/2017 | 1/31/2017 |
| | | | Elevation (ft): | 11 | 15 | 15 |
| | | | Normal or Field Duplicate: | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | |
| Indeno(1,2,3-C,D)Pyrene | 0.5 | 5.6 | MG/KG | **0.63** | **3.6** | **0.79** |
| Isophorone | -- | -- | MG/KG | 0.14 U | NA | NA |
| Naphthalene | 100 | 500 | MG/KG | 0.093 J | 0.49 J | 0.096 J |
| Nitrobenzene | -- | -- | MG/KG | 0.036 U | NA | NA |
| N-Nitrosodi-N-Propylamine | -- | -- | MG/KG | 0.036 U | NA | NA |
| N-Nitrosodiphenylamine | -- | -- | MG/KG | 0.36 U | NA | NA |
| Pentachlorophenol | 6.7 | 6.7 | MG/KG | 0.29 U | NA | NA |
| Phenanthrene | 100 | 500 | MG/KG | 1.1 | 10 | 1.1 |
| Phenol | 100 | 500 | MG/KG | 0.36 U | NA | NA |
| Pyrene | 100 | 500 | MG/KG | 1.4 | 10 | 1.9 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
T - LCS or LCSD is outside acceptance limits
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
V - Value altered or qualifier added during data validation
R - Sample results rejected by validator
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | SW-013117-S | SW-013117-W | HS-4-BOTTOM |
|---|---|---|---|---|---|---|
| | | | Sample Date: | 1/31/2017 | 1/31/2017 | 8/4/2017 |
| | | | Elevation (ft): | 15 | 15 | 1.5 |
| | | | Normal or Field Duplicate: | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | |
| 1,2,4,5-Tetrachlorobenzene | -- | -- | MG/KG | NA | NA | NA |
| 2,3,4,6-Tetrachlorophenol | -- | -- | MG/KG | NA | NA | NA |
| 2,4,5-Trichlorophenol | -- | -- | MG/KG | NA | NA | NA |
| 2,4,6-Trichlorophenol | -- | -- | MG/KG | NA | NA | NA |
| 2,4-Dichlorophenol | -- | -- | MG/KG | NA | NA | NA |
| 2,4-Dimethylphenol | -- | -- | MG/KG | NA | NA | NA |
| 2,4-Dinitrophenol | -- | -- | MG/KG | NA | NA | NA |
| 2,4-Dinitrotoluene | -- | -- | MG/KG | NA | NA | NA |
| 2,6-Dinitrotoluene | -- | -- | MG/KG | NA | NA | NA |
| 2-Chloronaphthalene | -- | -- | MG/KG | NA | NA | NA |
| 2-Chlorophenol | -- | -- | MG/KG | NA | NA | NA |
| 2-Methylnaphthalene | -- | -- | MG/KG | NA | NA | NA |
| 2-Methylphenol (O-Cresol) | 100 | 500 | MG/KG | NA | NA | 0.78 U |
| 2-Nitroaniline | -- | -- | MG/KG | NA | NA | NA |
| 2-Nitrophenol | -- | -- | MG/KG | NA | NA | NA |
| 3,3'-Dichlorobenzidine | -- | -- | MG/KG | NA | NA | NA |
| 3-Nitroaniline | -- | -- | MG/KG | NA | NA | NA |
| 4,6-Dinitro-2-Methylphenol | -- | -- | MG/KG | NA | NA | NA |
| 4-Bromophenyl Phenyl Ether | -- | -- | MG/KG | NA | NA | NA |
| 4-Chloro-3-Methylphenol | -- | -- | MG/KG | NA | NA | NA |
| 4-Chloroaniline | -- | -- | MG/KG | NA | NA | NA |
| 4-Chlorophenyl Phenyl Ether | -- | -- | MG/KG | NA | NA | NA |
| 4-Methylphenol (P-Cresol) | 100 | 500 | MG/KG | NA | NA | NA |
| 4-Nitroaniline | -- | -- | MG/KG | NA | NA | NA |
| 4-Nitrophenol | -- | -- | MG/KG | NA | NA | NA |
| Acenaphthene | 100 | 500 | MG/KG | 0.16 J | 0.22 J | 0.39 J |
| Acenaphthylene | 100 | 500 | MG/KG | 0.28 J | 0.18 J | 0.69 J |
| Acetophenone | -- | -- | MG/KG | NA | NA | NA |
| Anthracene | 100 | 500 | MG/KG | 0.6 J | 0.63 J | 2.1 |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | SW-013117-S | SW-013117-W | HS-4-BOTTOM |
|---|---|---|---|---|---|---|
| | | | Sample Date: | 1/31/2017 | 1/31/2017 | 8/4/2017 |
| | | | Elevation (ft): | 15 | 15 | 1.5 |
| | | | Normal or Field Duplicate: | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | |
| Atrazine | -- | -- | MG/KG | NA | NA | NA |
| Benzaldehyde | -- | -- | MG/KG | NA | NA | NA |
| Benzo(A)Anthracene | 1 | 5.6 | MG/KG | **2.1** | **2.2** | **6.4** |
| Benzo(A)Pyrene | 1 | 1 | MG/KG | **1.9** | **2** | **6** |
| Benzo(B)Fluoranthene | 1 | 5.6 | MG/KG | **2.6** | **2.4** | **8.3** |
| Benzo(G,H,I)Perylene | 100 | 500 | MG/KG | 0.89 | 1.5 | 2.1 |
| Benzo(K)Fluoranthene | 3.9 | 56 | MG/KG | 0.97 | 1 | 3.3 |
| Benzyl Butyl Phthalate | -- | -- | MG/KG | NA | NA | NA |
| Biphenyl (Diphenyl) | -- | -- | MG/KG | NA | NA | NA |
| Bis(2-Chloroethoxy) Methane | -- | -- | MG/KG | NA | NA | NA |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | -- | -- | MG/KG | NA | NA | NA |
| Bis(2-Chloroisopropyl) Ether | -- | -- | MG/KG | NA | NA | NA |
| Bis(2-Ethylhexyl) Phthalate | -- | -- | MG/KG | NA | NA | NA |
| Caprolactam | -- | -- | MG/KG | NA | NA | NA |
| Carbazole | -- | -- | MG/KG | NA | NA | NA |
| Chrysene | 3.9 | 56 | MG/KG | 2.2 | 2.2 | **6.3** |
| Cresols, M & P | 100 | 500 | MG/KG | NA | NA | 0.78 U |
| Dibenz(A,H)Anthracene | 0.33 | 0.56 | MG/KG | 0.26 | **0.36** | **0.74** |
| Dibenzofuran | 59 | 350 | MG/KG | NA | NA | 0.38 J |
| Diethyl Phthalate | -- | -- | MG/KG | NA | NA | NA |
| Dimethyl Phthalate | -- | -- | MG/KG | NA | NA | NA |
| Di-N-Butyl Phthalate | -- | -- | MG/KG | NA | NA | NA |
| Di-N-Octylphthalate | -- | -- | MG/KG | NA | NA | NA |
| Fluoranthene | 100 | 500 | MG/KG | 4.2 | 4.2 | 13 |
| Fluorene | 100 | 500 | MG/KG | 0.16 J | 0.24 J | 0.61 J |
| Hexachlorobenzene | 1.2 | 6 | MG/KG | NA | NA | 0.078 U |
| Hexachlorobutadiene | -- | -- | MG/KG | NA | NA | NA |
| Hexachlorocyclopentadiene | -- | -- | MG/KG | NA | NA | NA |
| Hexachloroethane | -- | -- | MG/KG | NA | NA | NA |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | SW-013117-S | SW-013117-W | HS-4-BOTTOM |
|---|---|---|---|---|---|---|
| | | | Sample Date: | 1/31/2017 | 1/31/2017 | 8/4/2017 |
| | | | Elevation (ft): | 15 | 15 | 1.5 |
| | | | Normal or Field Duplicate: | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | |
| Indeno(1,2,3-C,D)Pyrene | 0.5 | 5.6 | MG/KG | **1.1** | **1.6** | **3.4** |
| Isophorone | -- | -- | MG/KG | NA | NA | NA |
| Naphthalene | 100 | 500 | MG/KG | 0.16 J | 0.24 J | 0.51 J |
| Nitrobenzene | -- | -- | MG/KG | NA | NA | NA |
| N-Nitrosodi-N-Propylamine | -- | -- | MG/KG | NA | NA | NA |
| N-Nitrosodiphenylamine | -- | -- | MG/KG | NA | NA | NA |
| Pentachlorophenol | 6.7 | 6.7 | MG/KG | NA | NA | 0.63 U |
| Phenanthrene | 100 | 500 | MG/KG | 2.3 | 2.8 | 9.2 |
| Phenol | 100 | 500 | MG/KG | NA | NA | 0.78 U |
| Pyrene | 100 | 500 | MG/KG | 2.8 | 3.7 | 11 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
T - LCS or LCSD is outside acceptance limits
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
V - Value altered or qualifier added during data validation
R - Sample results rejected by validator
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | IS-EAST | IS-WEST | IS-WEST | IS-WEST |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 8/14/2017 | 7/19/2017 | 7/19/2017 | 7/19/2017 |
| | | | Elevation (ft): | 2.5 to 3 | 0 to -1 | -1 to -2 | -2 to -4 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| 1,2,4,5-Tetrachlorobenzene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,3,4,6-Tetrachlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4,5-Trichlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4,6-Trichlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dichlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dimethylphenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dinitrophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dinitrotoluene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,6-Dinitrotoluene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Chloronaphthalene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Chlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Methylnaphthalene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Methylphenol (O-Cresol) | 100 | 500 | MG/KG | 0.47 U | 0.4 U | 0.42 U | 0.44 U |
| 2-Nitroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Nitrophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 3,3'-Dichlorobenzidine | -- | -- | MG/KG | NA | NA | NA | NA |
| 3-Nitroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 4,6-Dinitro-2-Methylphenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Bromophenyl Phenyl Ether | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Chloro-3-Methylphenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Chloroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Chlorophenyl Phenyl Ether | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Methylphenol (P-Cresol) | 100 | 500 | MG/KG | NA | NA | NA | NA |
| 4-Nitroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Nitrophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| Acenaphthene | 100 | 500 | MG/KG | 0.15 J | 0.13 J | 0.096 J | 0.075 J |
| Acenaphthylene | 100 | 500 | MG/KG | 0.4 J | 0.25 JT | 0.078 JT | 1.5 T |
| Acetophenone | -- | -- | MG/KG | NA | NA | NA | NA |
| Anthracene | 100 | 500 | MG/KG | 0.42 J | 0.45 | 0.35 J | 1 |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | IS-EAST | IS-WEST | IS-WEST | IS-WEST |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 8/14/2017 | 7/19/2017 | 7/19/2017 | 7/19/2017 |
| | | | Elevation (ft): | 2.5 to 3 | 0 to -1 | -1 to -2 | -2 to -4 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Atrazine | -- | -- | MG/KG | NA | NA | NA | NA |
| Benzaldehyde | -- | -- | MG/KG | NA | NA | NA | NA |
| Benzo(A)Anthracene | 1 | 5.6 | MG/KG | 0.83 | **1.3** | 1 | **5.5** |
| Benzo(A)Pyrene | 1 | 1 | MG/KG | **1.3** | **1.8** | **1.2** | **7.6** |
| Benzo(B)Fluoranthene | 1 | 5.6 | MG/KG | **1.1** | **1.8** | **1.3** | **8.4** |
| Benzo(G,H,I)Perylene | 100 | 500 | MG/KG | 1 | 1.5 | 1.3 | 5.2 |
| Benzo(K)Fluoranthene | 3.9 | 56 | MG/KG | 0.24 | 0.76 | 0.61 | 2.8 |
| Benzyl Butyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Biphenyl (Diphenyl) | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Chloroethoxy) Methane | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Chloroisopropyl) Ether | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Ethylhexyl) Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Caprolactam | -- | -- | MG/KG | NA | NA | NA | NA |
| Carbazole | -- | -- | MG/KG | NA | NA | NA | NA |
| Chrysene | 3.9 | 56 | MG/KG | 0.77 | 1.5 | 1.2 | **6.8** |
| Cresols, M & P | 100 | 500 | MG/KG | 0.47 U | 0.11 J | 0.12 J | 0.047 J |
| Dibenz(A,H)Anthracene | 0.33 | 0.56 | MG/KG | 0.3 | **0.35** | 0.3 | **1.5** |
| Dibenzofuran | 59 | 350 | MG/KG | 0.26 J | 0.1 J | 0.095 J | 0.22 J |
| Diethyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Dimethyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Di-N-Butyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Di-N-Octylphthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Fluoranthene | 100 | 500 | MG/KG | 1.4 | 2.1 | 1.6 | 6.9 |
| Fluorene | 100 | 500 | MG/KG | 0.17 J | 0.14 J | 0.12 J | 0.22 J |
| Hexachlorobenzene | 1.2 | 6 | MG/KG | 0.047 U | 0.04 U | 0.042 U | 0.044 U |
| Hexachlorobutadiene | -- | -- | MG/KG | NA | NA | NA | NA |
| Hexachlorocyclopentadiene | -- | -- | MG/KG | NA | NA | NA | NA |
| Hexachloroethane | -- | -- | MG/KG | NA | NA | NA | NA |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | IS-EAST | IS-WEST | IS-WEST | IS-WEST |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 8/14/2017 | 7/19/2017 | 7/19/2017 | 7/19/2017 |
| | | | Elevation (ft): | 2.5 to 3 | 0 to -1 | -1 to -2 | -2 to -4 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Indeno(1,2,3-C,D)Pyrene | 0.5 | 5.6 | MG/KG | **1.1** | **1.5** | **1.3** | **5.3** |
| Isophorone | -- | -- | MG/KG | NA | NA | NA | NA |
| Naphthalene | 100 | 500 | MG/KG | 0.85 | 0.22 J | 0.21 J | 0.99 |
| Nitrobenzene | -- | -- | MG/KG | NA | NA | NA | NA |
| N-Nitrosodi-N-Propylamine | -- | -- | MG/KG | NA | NA | NA | NA |
| N-Nitrosodiphenylamine | -- | -- | MG/KG | NA | NA | NA | NA |
| Pentachlorophenol | 6.7 | 6.7 | MG/KG | 0.38 U | 0.32 U | 0.34 U | 0.36 U |
| Phenanthrene | 100 | 500 | MG/KG | 1.1 | 1.3 | 1 | 2.3 |
| Phenol | 100 | 500 | MG/KG | 0.47 U | 0.4 U | 0.42 U | 0.44 U |
| Pyrene | 100 | 500 | MG/KG | 2.2 | 2 | 1.9 | 6.2 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
T - LCS or LCSD is outside acceptance limits
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
V - Value altered or qualifier added during data validation
R - Sample results rejected by validator
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | LAT-CAN-1 | RX-B-18 | RX-B-5 | RX-SW-12 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 9/15/2017 | ######## | 10/3/2016 | 9/30/2016 |
| | | | Elevation (ft): | 15 | 0.5 | 11 | 12 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| 1,2,4,5-Tetrachlorobenzene | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 U |
| 2,3,4,6-Tetrachlorophenol | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 U |
| 2,4,5-Trichlorophenol | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 U |
| 2,4,6-Trichlorophenol | -- | -- | MG/KG | NA | NA | 0.31 U | 0.17 U |
| 2,4-Dichlorophenol | -- | -- | MG/KG | NA | NA | 0.31 U | 0.17 U |
| 2,4-Dimethylphenol | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 U |
| 2,4-Dinitrophenol | -- | -- | MG/KG | NA | NA | 0.62 U | 0.33 U |
| 2,4-Dinitrotoluene | -- | -- | MG/KG | NA | NA | 0.15 U | 0.083 U |
| 2,6-Dinitrotoluene | -- | -- | MG/KG | NA | NA | 0.15 U | 0.083 U |
| 2-Chloronaphthalene | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 U |
| 2-Chlorophenol | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 U |
| 2-Methylnaphthalene | -- | -- | MG/KG | NA | NA | 0.24 J | 0.12 J |
| 2-Methylphenol (O-Cresol) | 100 | 500 | MG/KG | 0.77 | 0.43 U | 0.76 U | 0.41 U |
| 2-Nitroaniline | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 UT |
| 2-Nitrophenol | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 U |
| 3,3'-Dichlorobenzidine | -- | -- | MG/KG | NA | NA | 0.31 U | 0.17 U |
| 3-Nitroaniline | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 U |
| 4,6-Dinitro-2-Methylphenol | -- | -- | MG/KG | NA | NA | 0.62 U | 0.33 U |
| 4-Bromophenyl Phenyl Ether | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 U |
| 4-Chloro-3-Methylphenol | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 U |
| 4-Chloroaniline | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 U |
| 4-Chlorophenyl Phenyl Ether | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 U |
| 4-Methylphenol (P-Cresol) | 100 | 500 | MG/KG | NA | NA | 0.033 J | 0.028 J |
| 4-Nitroaniline | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 U |
| 4-Nitrophenol | -- | -- | MG/KG | NA | NA | 1.5 U | 0.83 U |
| Acenaphthene | 100 | 500 | MG/KG | 0.16 | 0.62 | 0.22 J | 0.21 J |
| Acenaphthylene | 100 | 500 | MG/KG | 1.2 | 0.35 J | 0.26 J | 0.33 J |
| Acetophenone | -- | -- | MG/KG | NA | NA | 0.017 J | 0.016 J |
| Anthracene | 100 | 500 | MG/KG | 0.62 | 1.7 JV | 0.58 J | 0.75 |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | LAT-CAN-1 | RX-B-18 | RX-B-5 | RX-SW-12 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 9/15/2017 | ######## | 10/3/2016 | 9/30/2016 |
| | | | Elevation (ft): | 15 | 0.5 | 11 | 12 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Atrazine | -- | -- | MG/KG | NA | NA | 0.31 U | 0.17 U |
| Benzaldehyde | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 U |
| Benzo(A)Anthracene | 1 | 5.6 | MG/KG | **1.9** | **5.8** | **2.1** | **2.6** |
| Benzo(A)Pyrene | 1 | 1 | MG/KG | **2.8** | **6.6** | **2.3** | **2.7** |
| Benzo(B)Fluoranthene | 1 | 5.6 | MG/KG | **3** | **7.4** | **2.6** | **3.5** |
| Benzo(G,H,I)Perylene | 100 | 500 | MG/KG | 1.9 | 7.4 | 3.1 | 1.6 |
| Benzo(K)Fluoranthene | 3.9 | 56 | MG/KG | 1 | 3.2 | 1.1 | 1.4 |
| Benzyl Butyl Phthalate | -- | -- | MG/KG | NA | NA | 5.9 | 2 |
| Biphenyl (Diphenyl) | -- | -- | MG/KG | NA | NA | 0.091 J | 0.051 J |
| Bis(2-Chloroethoxy) Methane | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 U |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | -- | -- | MG/KG | NA | NA | 0.076 U | 0.041 U |
| Bis(2-Chloroisopropyl) Ether | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 U |
| Bis(2-Ethylhexyl) Phthalate | -- | -- | MG/KG | NA | NA | 0.5 J | 0.31 J |
| Caprolactam | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 U |
| Carbazole | -- | -- | MG/KG | NA | NA | 0.2 J | 0.35 J |
| Chrysene | 3.9 | 56 | MG/KG | 2.1 | **6.5** | 2.2 | 2.9 |
| Cresols, M & P | 100 | 500 | MG/KG | 0.053 | 0.047 J | NA | NA |
| Dibenz(A,H)Anthracene | 0.33 | 0.56 | MG/KG | **0.37** | **1.9** | **0.7** | **0.41** |
| Dibenzofuran | 59 | 350 | MG/KG | 0.13 | 0.53 | 0.17 J | 0.22 J |
| Diethyl Phthalate | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 U |
| Dimethyl Phthalate | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 U |
| Di-N-Butyl Phthalate | -- | -- | MG/KG | NA | NA | 0.048 J | 0.02 J |
| Di-N-Octylphthalate | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 U |
| Fluoranthene | 100 | 500 | MG/KG | 3.1 | 10 JV | 3.6 | 5.1 |
| Fluorene | 100 | 500 | MG/KG | 0.25 | 0.57 | 0.21 J | 0.25 J |
| Hexachlorobenzene | 1.2 | 6 | MG/KG | 0.077 | 0.043 U | 0.076 U | 0.041 U |
| Hexachlorobutadiene | -- | -- | MG/KG | NA | NA | 0.15 U | 0.083 U |
| Hexachlorocyclopentadiene | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 U |
| Hexachloroethane | -- | -- | MG/KG | NA | NA | 0.076 U | 0.041 U |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | Sample Designation: | LAT-CAN-1 | RX-B-18 | RX-B-5 | RX-SW-12 |
| | | | Sample Date: | 9/15/2017 | ######## | 10/3/2016 | 9/30/2016 |
| | | | Elevation (ft): | 15 | 0.5 | 11 | 12 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Indeno(1,2,3-C,D)Pyrene | 0.5 | 5.6 | MG/KG | **1.7** | **7.5** | **2.3** | **1.8** |
| Isophorone | -- | -- | MG/KG | NA | NA | 0.31 U | 0.17 U |
| Naphthalene | 100 | 500 | MG/KG | 0.72 | 1.1 | 0.37 J | 0.29 J |
| Nitrobenzene | -- | -- | MG/KG | NA | NA | 0.076 U | 0.041 U |
| N-Nitrosodi-N-Propylamine | -- | -- | MG/KG | NA | NA | 0.076 U | 0.041 U |
| N-Nitrosodiphenylamine | -- | -- | MG/KG | NA | NA | 0.76 U | 0.41 U |
| Pentachlorophenol | 6.7 | 6.7 | MG/KG | 0.62 | 0.35 UJV | 0.62 U | 0.33 U |
| Phenanthrene | 100 | 500 | MG/KG | 1.6 | 8 JV | 2.2 | 3.3 |
| Phenol | 100 | 500 | MG/KG | 0.77 | 0.43 U | 0.76 U | 0.41 U |
| Pyrene | 100 | 500 | MG/KG | 3.6 | 10 JV | 3.3 | 4 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
T - LCS or LCSD is outside acceptance limits
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
V - Value altered or qualifier added during data validation
R - Sample results rejected by validator
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RX-SW-14 | RX-SW-15 | RX-SW-16 | RX-SW2-6 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 1/30/2017 | 11/9/2016 | 12/6/2016 | 11/21/2016 |
| | | | Elevation (ft): | 13.5 | 4.5 | 4.5 | 1 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| 1,2,4,5-Tetrachlorobenzene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,3,4,6-Tetrachlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4,5-Trichlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4,6-Trichlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dichlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dimethylphenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dinitrophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,4-Dinitrotoluene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2,6-Dinitrotoluene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Chloronaphthalene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Chlorophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Methylnaphthalene | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Methylphenol (O-Cresol) | 100 | 500 | MG/KG | 0.75 U | 2 U | 2.1 U | 0.51 U |
| 2-Nitroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 2-Nitrophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 3,3'-Dichlorobenzidine | -- | -- | MG/KG | NA | NA | NA | NA |
| 3-Nitroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 4,6-Dinitro-2-Methylphenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Bromophenyl Phenyl Ether | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Chloro-3-Methylphenol | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Chloroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Chlorophenyl Phenyl Ether | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Methylphenol (P-Cresol) | 100 | 500 | MG/KG | NA | NA | NA | NA |
| 4-Nitroaniline | -- | -- | MG/KG | NA | NA | NA | NA |
| 4-Nitrophenol | -- | -- | MG/KG | NA | NA | NA | NA |
| Acenaphthene | 100 | 500 | MG/KG | 0.21 J | 1.6 J | 0.73 J | 0.097 J |
| Acenaphthylene | 100 | 500 | MG/KG | 0.39 J | 0.95 J | 0.78 J | 0.1 J |
| Acetophenone | -- | -- | MG/KG | NA | NA | NA | NA |
| Anthracene | 100 | 500 | MG/KG | 0.94 | 4.3 | 2 J | 0.2 J |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RX-SW-14 | RX-SW-15 | RX-SW-16 | RX-SW2-6 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 1/30/2017 | 11/9/2016 | 12/6/2016 | 11/21/2016 |
| | | | Elevation (ft): | 13.5 | 4.5 | 4.5 | 1 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Atrazine | -- | -- | MG/KG | NA | NA | NA | NA |
| Benzaldehyde | -- | -- | MG/KG | NA | NA | NA | NA |
| Benzo(A)Anthracene | 1 | 5.6 | MG/KG | **4.4** | **11** | **4.9** | **1.4** |
| Benzo(A)Pyrene | 1 | 1 | MG/KG | **4.4** | **9.7** | **4.3** | **1.4** |
| Benzo(B)Fluoranthene | 1 | 5.6 | MG/KG | **5.3** | **11** | **6** | **2.7** |
| Benzo(G,H,I)Perylene | 100 | 500 | MG/KG | 4.2 | 7.3 | 2.1 | 1.7 |
| Benzo(K)Fluoranthene | 3.9 | 56 | MG/KG | 1.8 | **4.5** | 2.2 | 1.4 |
| Benzyl Butyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Biphenyl (Diphenyl) | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Chloroethoxy) Methane | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Chloroisopropyl) Ether | -- | -- | MG/KG | NA | NA | NA | NA |
| Bis(2-Ethylhexyl) Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Caprolactam | -- | -- | MG/KG | NA | NA | NA | NA |
| Carbazole | -- | -- | MG/KG | NA | NA | NA | NA |
| Chrysene | 3.9 | 56 | MG/KG | **4.8** | **11** | **5.1** | 1.7 |
| Cresols, M & P | 100 | 500 | MG/KG | 0.079 J | 0.11 J | 0.099 J | 0.051 J |
| Dibenz(A,H)Anthracene | 0.33 | 0.56 | MG/KG | **1.2** | **0.76** | **0.64** | **0.41** |
| Dibenzofuran | 59 | 350 | MG/KG | 0.34 J | 1.4 J | 0.51 J | 0.11 J |
| Diethyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Dimethyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Di-N-Butyl Phthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Di-N-Octylphthalate | -- | -- | MG/KG | NA | NA | NA | NA |
| Fluoranthene | 100 | 500 | MG/KG | 7.6 | 20 | 14 | 1.7 |
| Fluorene | 100 | 500 | MG/KG | 0.25 J | 1.8 J | 0.83 J | 0.067 J |
| Hexachlorobenzene | 1.2 | 6 | MG/KG | 0.075 U | 0.2 U | 0.21 U | 0.051 U |
| Hexachlorobutadiene | -- | -- | MG/KG | NA | NA | NA | NA |
| Hexachlorocyclopentadiene | -- | -- | MG/KG | NA | NA | NA | NA |
| Hexachloroethane | -- | -- | MG/KG | NA | NA | NA | NA |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RX-SW-14 | RX-SW-15 | RX-SW-16 | RX-SW2-6 |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 1/30/2017 | 11/9/2016 | 12/6/2016 | 11/21/2016 |
| | | | Elevation (ft): | 13.5 | 4.5 | 4.5 | 1 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Indeno(1,2,3-C,D)Pyrene | 0.5 | 5.6 | MG/KG | **5.2** | **8** | **2.2** | **2.1** |
| Isophorone | -- | -- | MG/KG | NA | NA | NA | NA |
| Naphthalene | 100 | 500 | MG/KG | 0.81 | 2 | 0.53 J | 1.5 |
| Nitrobenzene | -- | -- | MG/KG | NA | NA | NA | NA |
| N-Nitrosodi-N-Propylamine | -- | -- | MG/KG | NA | NA | NA | NA |
| N-Nitrosodiphenylamine | -- | -- | MG/KG | NA | NA | NA | NA |
| Pentachlorophenol | 6.7 | 6.7 | MG/KG | 0.61 U | 1.6 U | 1.7 U | 0.41 U |
| Phenanthrene | 100 | 500 | MG/KG | 3.9 | 18 | 6.1 | 0.75 |
| Phenol | 100 | 500 | MG/KG | 0.043 J | 2 U | 2.1 U | 0.51 U |
| Pyrene | 100 | 500 | MG/KG | 6.4 | 19 | 6.1 JV | 1.6 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
T - LCS or LCSD is outside acceptance limits
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
V - Value altered or qualifier added during data validation
R - Sample results rejected by validator
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RX-SW2-7 | RX-SW-8 | TP-1-E-BOTTOM | TP-2-SW-E |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 11/21/2016 | 9/30/2016 | 7/31/2017 | 8/10/2017 |
| | | | Elevation (ft): | 1 | 3 | 12.5 to 10.5 | 11 to 11.5 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| 1,2,4,5-Tetrachlorobenzene | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| 2,3,4,6-Tetrachlorophenol | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| 2,4,5-Trichlorophenol | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| 2,4,6-Trichlorophenol | -- | -- | MG/KG | NA | 0.32 U | NA | NA |
| 2,4-Dichlorophenol | -- | -- | MG/KG | NA | 0.32 U | NA | NA |
| 2,4-Dimethylphenol | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| 2,4-Dinitrophenol | -- | -- | MG/KG | NA | 0.64 U | NA | NA |
| 2,4-Dinitrotoluene | -- | -- | MG/KG | NA | 0.16 U | NA | NA |
| 2,6-Dinitrotoluene | -- | -- | MG/KG | NA | 0.16 U | NA | NA |
| 2-Chloronaphthalene | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| 2-Chlorophenol | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| 2-Methylnaphthalene | -- | -- | MG/KG | NA | 0.37 J | NA | NA |
| 2-Methylphenol (O-Cresol) | 100 | 500 | MG/KG | 0.41 U | 0.8 U | 0.77 U | 0.36 U |
| 2-Nitroaniline | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| 2-Nitrophenol | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| 3,3'-Dichlorobenzidine | -- | -- | MG/KG | NA | 0.32 U | NA | NA |
| 3-Nitroaniline | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| 4,6-Dinitro-2-Methylphenol | -- | -- | MG/KG | NA | 0.64 U | NA | NA |
| 4-Bromophenyl Phenyl Ether | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| 4-Chloro-3-Methylphenol | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| 4-Chloroaniline | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| 4-Chlorophenyl Phenyl Ether | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| 4-Methylphenol (P-Cresol) | 100 | 500 | MG/KG | NA | 0.034 J | NA | NA |
| 4-Nitroaniline | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| 4-Nitrophenol | -- | -- | MG/KG | NA | 1.6 U | NA | NA |
| Acenaphthene | 100 | 500 | MG/KG | 0.16 J | 1.2 | 0.14 J | 0.069 J |
| Acenaphthylene | 100 | 500 | MG/KG | 0.15 J | 0.28 J | 0.11 J | 0.082 J |
| Acetophenone | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| Anthracene | 100 | 500 | MG/KG | 0.41 | 2.2 | 0.42 J | 0.25 J |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | Sample Designation: | RX-SW2-7 | RX-SW-8 | TP-1-E-BOTTOM | TP-2-SW-E |
| | | | Sample Date: | 11/21/2016 | 9/30/2016 | 7/31/2017 | 8/10/2017 |
| | | | Elevation (ft): | 1 | 3 | 12.5 to 10.5 | 11 to 11.5 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Atrazine | -- | -- | MG/KG | NA | 0.32 U | NA | NA |
| Benzaldehyde | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| Benzo(A)Anthracene | 1 | 5.6 | MG/KG | **1.5** | **5.8** | **1.7** | 0.92 |
| Benzo(A)Pyrene | 1 | 1 | MG/KG | **1.6** | **5.5** | **1.7** | 0.98 |
| Benzo(B)Fluoranthene | 1 | 5.6 | MG/KG | **2.2** | **6.5** | **1.9** | **1.4** |
| Benzo(G,H,I)Perylene | 100 | 500 | MG/KG | 1.6 | 5.4 | 1.8 | 0.41 |
| Benzo(K)Fluoranthene | 3.9 | 56 | MG/KG | 0.77 | 2.4 | 0.81 | 0.48 |
| Benzyl Butyl Phthalate | -- | -- | MG/KG | NA | 0.12 J | NA | NA |
| Biphenyl (Diphenyl) | -- | -- | MG/KG | NA | 0.14 J | NA | NA |
| Bis(2-Chloroethoxy) Methane | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | -- | -- | MG/KG | NA | 0.08 U | NA | NA |
| Bis(2-Chloroisopropyl) Ether | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| Bis(2-Ethylhexyl) Phthalate | -- | -- | MG/KG | NA | 0.15 J | NA | NA |
| Caprolactam | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| Carbazole | -- | -- | MG/KG | NA | 0.78 J | NA | NA |
| Chrysene | 3.9 | 56 | MG/KG | 1.6 | **5.7** | 1.8 | 0.91 |
| Cresols, M & P | 100 | 500 | MG/KG | 0.31 J | NA | 0.77 U | 0.36 U |
| Dibenz(A,H)Anthracene | 0.33 | 0.56 | MG/KG | **0.37** | **1** | **0.37** | 0.14 |
| Dibenzofuran | 59 | 350 | MG/KG | 0.15 J | 0.61 J | 0.094 J | 0.06 J |
| Diethyl Phthalate | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| Dimethyl Phthalate | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| Di-N-Butyl Phthalate | -- | -- | MG/KG | NA | 0.043 J | NA | NA |
| Di-N-Octylphthalate | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| Fluoranthene | 100 | 500 | MG/KG | 3 | 11 | 2.6 | 1.8 |
| Fluorene | 100 | 500 | MG/KG | 0.17 J | 0.98 | 0.12 J | 0.071 J |
| Hexachlorobenzene | 1.2 | 6 | MG/KG | 0.041 U | 0.08 U | 0.077 U | 0.036 U |
| Hexachlorobutadiene | -- | -- | MG/KG | NA | 0.16 U | NA | NA |
| Hexachlorocyclopentadiene | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| Hexachloroethane | -- | -- | MG/KG | NA | 0.08 U | NA | NA |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RX-SW2-7 | RX-SW-8 | TP-1-E-BOTTOM | TP-2-SW-E |
|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 11/21/2016 | 9/30/2016 | 7/31/2017 | 8/10/2017 |
| | | | Elevation (ft): | 1 | 3 | 12.5 to 10.5 | 11 to 11.5 |
| | | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | |
| Indeno(1,2,3-C,D)Pyrene | 0.5 | 5.6 | MG/KG | **1.6** | **4.9** | **1.6** | **0.69** |
| Isophorone | -- | -- | MG/KG | NA | 0.32 U | NA | NA |
| Naphthalene | 100 | 500 | MG/KG | 0.37 J | 0.63 J | 0.17 J | 0.093 J |
| Nitrobenzene | -- | -- | MG/KG | NA | 0.08 U | NA | NA |
| N-Nitrosodi-N-Propylamine | -- | -- | MG/KG | NA | 0.08 U | NA | NA |
| N-Nitrosodiphenylamine | -- | -- | MG/KG | NA | 0.8 U | NA | NA |
| Pentachlorophenol | 6.7 | 6.7 | MG/KG | 0.33 U | 0.64 U | 0.62 U | 0.29 U |
| Phenanthrene | 100 | 500 | MG/KG | 1.8 | 9.3 | 1.9 | 1.1 |
| Phenol | 100 | 500 | MG/KG | 0.021 J | 0.8 U | 0.77 U | 0.36 U |
| Pyrene | 100 | 500 | MG/KG | 2.6 | 11 | 2.7 | 1.3 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
T - LCS or LCSD is outside acceptance limits
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
V - Value altered or qualifier added during data validation
R - Sample results rejected by validator
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | TP-3-SW-W | WC-11-BOTTOM | ZEB-SB-3-BOTTOM |
|---|---|---|---|---|---|---|
| | | | Sample Date: | 8/11/2017 | 8/10/2017 | 7/31/2017 |
| | | | Elevation (ft): | 9 | 13 | 16 to 14 |
| | | | Normal or Field Duplicate: | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | |
| 1,2,4,5-Tetrachlorobenzene | -- | -- | MG/KG | NA | NA | NA |
| 2,3,4,6-Tetrachlorophenol | -- | -- | MG/KG | NA | NA | NA |
| 2,4,5-Trichlorophenol | -- | -- | MG/KG | NA | NA | NA |
| 2,4,6-Trichlorophenol | -- | -- | MG/KG | NA | NA | NA |
| 2,4-Dichlorophenol | -- | -- | MG/KG | NA | NA | NA |
| 2,4-Dimethylphenol | -- | -- | MG/KG | NA | NA | NA |
| 2,4-Dinitrophenol | -- | -- | MG/KG | NA | NA | NA |
| 2,4-Dinitrotoluene | -- | -- | MG/KG | NA | NA | NA |
| 2,6-Dinitrotoluene | -- | -- | MG/KG | NA | NA | NA |
| 2-Chloronaphthalene | -- | -- | MG/KG | NA | NA | NA |
| 2-Chlorophenol | -- | -- | MG/KG | NA | NA | NA |
| 2-Methylnaphthalene | -- | -- | MG/KG | NA | NA | NA |
| 2-Methylphenol (O-Cresol) | 100 | 500 | MG/KG | 0.39 U | 1.9 U | 0.77 U |
| 2-Nitroaniline | -- | -- | MG/KG | NA | NA | NA |
| 2-Nitrophenol | -- | -- | MG/KG | NA | NA | NA |
| 3,3'-Dichlorobenzidine | -- | -- | MG/KG | NA | NA | NA |
| 3-Nitroaniline | -- | -- | MG/KG | NA | NA | NA |
| 4,6-Dinitro-2-Methylphenol | -- | -- | MG/KG | NA | NA | NA |
| 4-Bromophenyl Phenyl Ether | -- | -- | MG/KG | NA | NA | NA |
| 4-Chloro-3-Methylphenol | -- | -- | MG/KG | NA | NA | NA |
| 4-Chloroaniline | -- | -- | MG/KG | NA | NA | NA |
| 4-Chlorophenyl Phenyl Ether | -- | -- | MG/KG | NA | NA | NA |
| 4-Methylphenol (P-Cresol) | 100 | 500 | MG/KG | NA | NA | NA |
| 4-Nitroaniline | -- | -- | MG/KG | NA | NA | NA |
| 4-Nitrophenol | -- | -- | MG/KG | NA | NA | NA |
| Acenaphthene | 100 | 500 | MG/KG | 0.12 J | 0.18 J | 0.18 J |
| Acenaphthylene | 100 | 500 | MG/KG | 0.25 J | 0.33 J | 0.34 J |
| Acetophenone | -- | -- | MG/KG | NA | NA | NA |
| Anthracene | 100 | 500 | MG/KG | 0.41 | 0.37 J | 0.66 J |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | TP-3-SW-W | WC-11-BOTTOM | ZEB-SB-3-BOTTOM |
|---|---|---|---|---|---|---|
| | | | Sample Date: | 8/11/2017 | 8/10/2017 | 7/31/2017 |
| | | | Elevation (ft): | 9 | 13 | 16 to 14 |
| | | | Normal or Field Duplicate: | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | |
| Atrazine | -- | -- | MG/KG | NA | NA | NA |
| Benzaldehyde | -- | -- | MG/KG | NA | NA | NA |
| Benzo(A)Anthracene | 1 | 5.6 | MG/KG | **1.5** | 0.94 | **2.5** |
| Benzo(A)Pyrene | 1 | 1 | MG/KG | **1.5** | **1.1** | **2.7** |
| Benzo(B)Fluoranthene | 1 | 5.6 | MG/KG | **2.1** | **1.3** | **3.2** |
| Benzo(G,H,I)Perylene | 100 | 500 | MG/KG | 0.86 | 2 | 3.5 |
| Benzo(K)Fluoranthene | 3.9 | 56 | MG/KG | 0.77 | 0.53 | 1.3 |
| Benzyl Butyl Phthalate | -- | -- | MG/KG | NA | NA | NA |
| Biphenyl (Diphenyl) | -- | -- | MG/KG | NA | NA | NA |
| Bis(2-Chloroethoxy) Methane | -- | -- | MG/KG | NA | NA | NA |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | -- | -- | MG/KG | NA | NA | NA |
| Bis(2-Chloroisopropyl) Ether | -- | -- | MG/KG | NA | NA | NA |
| Bis(2-Ethylhexyl) Phthalate | -- | -- | MG/KG | NA | NA | NA |
| Caprolactam | -- | -- | MG/KG | NA | NA | NA |
| Carbazole | -- | -- | MG/KG | NA | NA | NA |
| Chrysene | 3.9 | 56 | MG/KG | 1.5 | 1.1 J | 2.8 |
| Cresols, M & P | 100 | 500 | MG/KG | 0.029 J | 1.9 U | 0.77 U |
| Dibenz(A,H)Anthracene | 0.33 | 0.56 | MG/KG | 0.25 | 0.25 | **0.79** |
| Dibenzofuran | 59 | 350 | MG/KG | 0.14 J | 0.19 J | 0.17 J |
| Diethyl Phthalate | -- | -- | MG/KG | NA | NA | NA |
| Dimethyl Phthalate | -- | -- | MG/KG | NA | NA | NA |
| Di-N-Butyl Phthalate | -- | -- | MG/KG | NA | NA | NA |
| Di-N-Octylphthalate | -- | -- | MG/KG | NA | NA | NA |
| Fluoranthene | 100 | 500 | MG/KG | 2.8 | 2 | 3.5 |
| Fluorene | 100 | 500 | MG/KG | 0.15 J | 0.18 J | 0.2 J |
| Hexachlorobenzene | 1.2 | 6 | MG/KG | 0.039 U | 0.19 U | 0.077 U |
| Hexachlorobutadiene | -- | -- | MG/KG | NA | NA | NA |
| Hexachlorocyclopentadiene | -- | -- | MG/KG | NA | NA | NA |
| Hexachloroethane | -- | -- | MG/KG | NA | NA | NA |

**Table 4. Summary of Remaining SVOCs in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | TP-3-SW-W | WC-11-BOTTOM | ZEB-SB-3-BOTTOM |
|---|---|---|---|---|---|---|
| | | | Sample Date: | 8/11/2017 | 8/10/2017 | 7/31/2017 |
| | | | Elevation (ft): | 9 | 13 | 16 to 14 |
| | | | Normal or Field Duplicate: | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | |
| Indeno(1,2,3-C,D)Pyrene | 0.5 | 5.6 | MG/KG | **1** | **1.3** | **3.1** |
| Isophorone | -- | -- | MG/KG | NA | NA | NA |
| Naphthalene | 100 | 500 | MG/KG | 0.26 J | 0.52 J | 0.44 J |
| Nitrobenzene | -- | -- | MG/KG | NA | NA | NA |
| N-Nitrosodi-N-Propylamine | -- | -- | MG/KG | NA | NA | NA |
| N-Nitrosodiphenylamine | -- | -- | MG/KG | NA | NA | NA |
| Pentachlorophenol | 6.7 | 6.7 | MG/KG | 0.31 U | 1.6 U | 0.62 U |
| Phenanthrene | 100 | 500 | MG/KG | 1.8 | 1.4 J | 2.7 |
| Phenol | 100 | 500 | MG/KG | 0.39 U | 1.9 U | 0.77 U |
| Pyrene | 100 | 500 | MG/KG | 2.2 | 1.7 J | 4 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
T - LCS or LCSD is outside acceptance limits
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
V - Value altered or qualifier added during data validation
R - Sample results rejected by validator
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 5. Summary of Remaining Metals in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RMZ-10 | RMZ-15 | RMZ-18 | RMZ-1-E | RMZ-2 | RMZ-3 | RMZ-4-E | RMZ-5 | RMZ-6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 8/14/2017 | 9/6/2017 | 9/12/2017 | 8/3/2017 | 7/25/2017 | 7/25/2017 | 8/3/2017 | 7/25/2017 | 7/25/2017 |
| | | | Elevation (ft) | 15 | 15 | 15 | 7 | 6 | 6 | 7 | 6 | 6 |
| | | | Normal or Field Duplicate: | N | N | N | N | N | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | | | | | | |
| Aluminum | -- | -- | MG/KG | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Antimony | -- | -- | MG/KG | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Arsenic | 16 | 16 | MG/KG | 9.2 | 14.8 | 9.8 | **21.5** | 11.9 | **27** | 9.4 | **22.7** | **22.7** |
| Barium | 400 | 400 | MG/KG | 376 | **589** | 264 | 347 | **662** | **728** | 356 | 366 | **1190** |
| Beryllium | 72 | 590 | MG/KG | 0.32 J | 0.27 J | 0.42 | 0.34 J | 0.38 J | 1 | 0.24 J | 0.32 J | 0.42 J |
| Cadmium | 4.3 | 9.3 | MG/KG | 2.9 | **12.3** | 2 | 3.7 | 3.9 | **4.6** | 2.1 | 1.8 | **4.5** |
| Calcium | -- | -- | MG/KG | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chromium III | 180 | 1500 | MG/KG | 51.5 | 64.9 | 33.4 | 33.2 | 60.9 | 126 | 44.7 | 68.7 | 113 |
| Chromium, Hexavalent | 110 | 400 | MG/KG | 2.2 U | 2.3 U | 2.3 | 0.53 J | 2.3 U | 2.5 U | 2.3 U | 2.2 U | 2.4 U |
| Chromium, Total | 180 | 1500 | MG/KG | 51.5 | 64.9 | 33.4 | 33.7 | 60.9 | 126 | 44.7 | 68.7 | 113 |
| Cobalt | -- | -- | MG/KG | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Copper | 270 | 270 | MG/KG | **666** | 215 | 132 | 211 | 186 | 200 | 162 | 166 | **1400** |
| Cyanide | 27 | 27 | MG/KG | 1 J | 1.6 | 0.84 | 1 J | 1.1 J | 0.6 J | 1 | 1.2 U | 1.2 U |
| Iron | -- | -- | MG/KG | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Lead | 400 | 1000 | MG/KG | **476** | **904** | **423** | **1440** | **734** | **737** | **505** | **609** | **3730** |
| Magnesium | -- | -- | MG/KG | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Manganese | 2000 | 10000 | MG/KG | 284 | 345 | 360 | 432 | 874 | 473 | 326 | 405 | 345 |
| Mercury | 0.81 | 2.8 | MG/KG | 0.68 | **1** | **0.86** | 0.24 | 0.73 | **1** | **0.95** | **0.83** | **3.3** |
| Nickel | 310 | 310 | MG/KG | 56.1 | 36.3 | 93.5 | 67.7 | 81 | 102 | 38.7 | 56.7 | 62 |
| Potassium | -- | -- | MG/KG | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Selenium | 180 | 1500 | MG/KG | 3.3 U | 1.8 J | 1.2 | 7 | 4.5 U | 4.6 U | 2.8 J | 4.7 U | 4.6 U |
| Silver | 180 | 1500 | MG/KG | 1.7 | 4.3 | 0.35 | 0.79 J | 4.6 | 8.4 | 2.5 | 1.8 J | 3.9 |
| Sodium | -- | -- | MG/KG | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Thallium | -- | -- | MG/KG | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Vanadium | -- | -- | MG/KG | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Zinc | 10000 | 10000 | MG/KG | 511 | 867 | 513 | 953 | 893 | 898 | 894 | 953 | 2150 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
V - Value altered or qualifier added during data validation
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 5. Summary of Remaining Metals in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RMZ-6 | RMZ-7 | RMZ-8 | RMZ-9 | RX-1 | RX-3 | RX-6 | RX-6 | RX-8B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 7/25/2017 | 7/25/2017 | 8/3/2017 | 8/3/2017 | 5/12/2016 | 5/12/2016 | 5/12/2016 | 5/12/2016 | 5/12/2016 |
| | | | Elevation (ft) | 6 | 6 | 13 to 13.5 | 15.5 to 16 | 6.5 | 6.5 | 8.5 | 8.5 | 4 |
| | | | Normal or Field Duplicate: | FD | N | N | N | N | N | N | FD | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | | | | | | |
| Aluminum | -- | -- | MG/KG | NA | NA | NA | NA | 7800 | 9350 | 6610 | 6520 | 5640 |
| Antimony | -- | -- | MG/KG | NA | NA | NA | NA | 2.3 J | 4.1 U | 16.2 | 17.6 | 6.1 |
| Arsenic | 16 | 16 | MG/KG | **22.4** | **16.9** | 8.8 | 12.2 | 9.5 | 9.5 | 14.9 | 11.6 | **19.6** |
| Barium | 400 | 400 | MG/KG | **606** | **2290** | **453** | **742** | 189 | 393 | **570** | **525** | **482** |
| Beryllium | 72 | 590 | MG/KG | 0.39 J | 0.59 | 0.37 J | 0.24 J | 0.44 U | 0.41 U | 1 U | 0.63 | 0.44 U |
| Cadmium | 4.3 | 9.3 | MG/KG | **5** | 4.2 | 2.7 | 3.6 | 1.4 | 1.1 | 1.6 J | 1.5 | 1.3 |
| Calcium | -- | -- | MG/KG | NA | NA | NA | NA | 14900 | 13600 | 26000 | 28300 | 16700 JV |
| Chromium III | 180 | 1500 | MG/KG | 97 | 113 | 145 | 66.6 | NA | NA | NA | NA | NA |
| Chromium, Hexavalent | 110 | 400 | MG/KG | 2.4 U | 2.4 U | 2.2 U | 2.2 U | NA | NA | NA | NA | NA |
| Chromium, Total | 180 | 1500 | MG/KG | 97 | 113 | 145 | 66.6 | 27.8 | 29.7 | 51.4 | 38.7 | 37.6 JV |
| Cobalt | -- | -- | MG/KG | NA | NA | NA | NA | 8 J | 9.2 J | 8.3 J | 6 J | 9.6 J |
| Copper | 270 | 270 | MG/KG | **567** | 226 | 137 | 251 | 104 | 138 | 184 | 156 | 191 |
| Cyanide | 27 | 27 | MG/KG | 1.2 U | 1.4 | 0.65 J | 2 | NA | NA | NA | NA | NA |
| Iron | -- | -- | MG/KG | NA | NA | NA | NA | 28500 | 23900 | 71000 JV | 22800 JV | 26900 |
| Lead | 400 | 1000 | MG/KG | **1950** | **3990** | **498** | **943** | **499** | **543** | **951** | **875** | **2020** |
| Magnesium | -- | -- | MG/KG | NA | NA | NA | NA | 5710 | 3360 | 3450 | 3630 | 2580 |
| Manganese | 2000 | 10000 | MG/KG | 339 | 395 | 351 | 357 | 243 | 714 | 477 JV | 279 JV | 290 |
| Mercury | 0.81 | 2.8 | MG/KG | **4.4** | **1.2** | 0.56 | **0.93** | **0.84** | 0.67 | **1.2** | **1.2** | **0.93** |
| Nickel | 310 | 310 | MG/KG | 58.1 | 64 | 68.4 | 55.4 | 46.1 | 35.3 | 42.2 | 28.4 | 30.2 |
| Potassium | -- | -- | MG/KG | NA | NA | NA | NA | 1350 | 1140 | 987 J | 1010 | 877 J |
| Selenium | 180 | 1500 | MG/KG | 4.8 U | 4.6 U | 1.9 J | 2 J | 4.4 U | 4.1 U | 10.3 U | 3.4 U | 4.4 U |
| Silver | 180 | 1500 | MG/KG | 3.5 | 1.9 J | 1.3 J | 7.2 | 0.84 J | 1.3 J | 5.7 | 4.8 | 1.5 J |
| Sodium | -- | -- | MG/KG | NA | NA | NA | NA | 248 J | 130 J | 2570 U | 225 J | 176 J |
| Thallium | -- | -- | MG/KG | NA | NA | NA | NA | 4.4 U | 4.1 U | 10.3 U | 3.4 U | 4.4 U |
| Vanadium | -- | -- | MG/KG | NA | NA | NA | NA | 32.2 | 35.3 | 27.1 | 28.3 | 28.6 |
| Zinc | 10000 | 10000 | MG/KG | 2000 | 1190 | 530 | 828 | 546 | 773 | 829 | 616 | 636 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
V - Value altered or qualifier added during data validation
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential S
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 5. Summary of Remaining Metals in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RX-B-1 | RX-B-13 | RX-B-6 | RX-B-9 | RX-SW-1 | RX-SW-10 | RX-SW-11 | RX-SW-2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 10/3/2016 | 11/15/2016 | 9/30/2016 | 10/3/2016 | 9/30/2016 | 9/30/2016 | 9/30/2016 | 9/30/2016 |
| | | | Elevation (ft) | 12 | -5 | 12 | 9 | 4 | 12 | 12 | 4 |
| | | | Normal or Field Duplicate: | N | N | N | N | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | | | | | |
| Aluminum | -- | -- | MG/KG | 8240 | NA | 7640 | 7850 | 6080 | 7320 | 6360 | 2710 |
| Antimony | -- | -- | MG/KG | 3.3 U | NA | 3.1 J | 5.4 | 4 U | 3.3 U | 3.9 U | 1.6 J |
| Arsenic | 16 | 16 | MG/KG | 9.1 | 8.3 | 6.9 | **16.1** | 6.9 | 8.7 | 9.4 | 5.1 |
| Barium | 400 | 400 | MG/KG | **597** | 41.7 J | 239 | **429** | 69.8 | 310 | 400 | 89.6 |
| Beryllium | 72 | 590 | MG/KG | 0.51 | 0.83 | 0.48 U | 0.52 | 0.51 | 0.45 | 0.41 | 0.45 |
| Cadmium | 4.3 | 9.3 | MG/KG | 1 | 1.1 U | 0.97 | 4.3 | 0.79 U | 1.6 | **10.3** | 0.53 J |
| Calcium | -- | -- | MG/KG | 13600 | NA | 15700 | 18000 | 4260 | 22300 | 14600 | 18800 |
| Chromium III | 180 | 1500 | MG/KG | NA | 30.1 | NA | NA | NA | NA | NA | NA |
| Chromium, Hexavalent | 110 | 400 | MG/KG | NA | 1.8 J | NA | NA | NA | NA | NA | NA |
| Chromium, Total | 180 | 1500 | MG/KG | 29.3 | 31.9 | 31.7 | 32.6 | 15.9 | 48.4 | 80.2 | 19.1 |
| Cobalt | -- | -- | MG/KG | 6 J | NA | 10.2 J | 8.4 J | 7.2 J | 8.9 | 9.5 J | 5.9 J |
| Copper | 270 | 270 | MG/KG | 74.9 | 14.8 | 132 | 93.3 | 138 | 136 | **601** | 109 |
| Cyanide | 27 | 27 | MG/KG | 0.13 | 0.072 J | 0.42 | 0.19 | 0.063 J | 0.39 | 0.48 | 0.25 |
| Iron | -- | -- | MG/KG | 25000 | NA | 23200 | 41400 | 15200 | 62400 | 99100 | 20600 |
| Lead | 400 | 1000 | MG/KG | **1170** | 25.8 | **416** | **615** | 190 | **541** | **750** | 261 |
| Magnesium | -- | -- | MG/KG | 3400 | NA | 4770 | 3180 | 2080 | 3810 | 3930 | 1790 |
| Manganese | 2000 | 10000 | MG/KG | 281 | 344 | 272 | 413 | 185 | 462 | 1180 | 164 |
| Mercury | 0.81 | 2.8 | MG/KG | 0.78 | **1.1** | 0.57 | 0.79 | **1.2** | 0.64 | **1.1** | **0.98** |
| Nickel | 310 | 310 | MG/KG | 22.5 | 26 | 35.8 | 55.2 | 22.4 | 46.8 | 58.4 | 33 |
| Potassium | -- | -- | MG/KG | 1440 | NA | 919 J | 1130 | 848 J | 964 | 746 J | 488 J |
| Selenium | 180 | 1500 | MG/KG | 3.3 U | 5.3 U | 4.8 U | 3.4 U | 1.4 J | 3.3 U | 3.9 U | 3.7 U |
| Silver | 180 | 1500 | MG/KG | 0.99 J | 2.6 U | 1.5 J | 1.5 J | 2 U | 1.2 J | 4 | 1.8 U |
| Sodium | -- | -- | MG/KG | 125 J | NA | 600 J | 229 J | 124 J | 166 J | 117 J | 136 J |
| Thallium | -- | -- | MG/KG | 3.3 U | NA | 4.8 U | 3.4 U | 4 U | 3.3 U | 3.9 U | 3.7 U |
| Vanadium | -- | -- | MG/KG | 26.2 | NA | 33 | 27.2 | 20.5 | 42.5 | 28.9 | 12.7 |
| Zinc | 10000 | 10000 | MG/KG | 477 | 69 | 636 | 756 | 157 | **10200** | 3080 | 352 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
V - Value altered or qualifier added during data validation
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential S
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 5. Summary of Remaining Metals in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RX-SW-3 | RX-SW-4 | RX-SW-5 | HS-4-BOTTOM | IS-WEST | IS-WEST | LAT-CAN-1 | RX-B-18 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 9/30/2016 | 9/30/2016 | 9/30/2016 | 8/4/2017 | 7/19/2017 | 7/19/2017 | 9/15/2017 | 11/21/2016 |
| | | | Elevation (ft) | 3 | 4 | 3 | 1.5 | -1 to -2 | -2 to -4 | 15 | 0.5 |
| | | | Normal or Field Duplicate: | FD | N | N | N | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | | | | | |
| Aluminum | -- | -- | MG/KG | 5140 | 7370 | 10800 | NA | NA | NA | NA | NA |
| Antimony | -- | -- | MG/KG | 4.4 U | 6.6 U | 4.4 U | NA | NA | NA | NA | NA |
| Arsenic | 16 | 16 | MG/KG | 7.4 | **16.2** | 10.3 | 14.1 | **17.8** | **16.3** | 6.5 | **27.7** |
| Barium | 400 | 400 | MG/KG | 113 | 231 | 68.3 | 345 | 53.8 | 57.1 | 265 | 154 |
| Beryllium | 72 | 590 | MG/KG | 0.42 J | 0.61 J | 0.89 | 0.39 J | 0.61 | 0.41 J | 0.28 | 0.44 |
| Cadmium | 4.3 | 9.3 | MG/KG | 0.89 U | 1.3 U | 1.1 | **7** | 1 U | 1.2 | 0.53 | 0.87 U |
| Calcium | -- | -- | MG/KG | 15100 JV | 134000 | 2240 | NA | NA | NA | NA | NA |
| Chromium III | 180 | 1500 | MG/KG | NA | NA | NA | 38.9 | 20.8 | 24.8 | 24.7 | 20.1 JV |
| Chromium, Hexavalent | 110 | 400 | MG/KG | NA | NA | NA | 0.62 J | 2.6 U | 2.7 U | 2.4 | 2.6 UJV |
| Chromium, Total | 180 | 1500 | MG/KG | 18.1 | 17.5 | 21.2 | 39.5 | 20.8 | 24.8 | 24.7 | 20.1 |
| Cobalt | -- | -- | MG/KG | 6.1 J | 5.9 J | 16 | NA | NA | NA | NA | NA |
| Copper | 270 | 270 | MG/KG | 59.1 | **794** | **541** | 136 | 29.8 | 81.9 | 106 | 64.1 |
| Cyanide | 27 | 27 | MG/KG | 0.38 JV | 0.42 JV | 0.28 | 0.99 | 1.2 U | 1.2 J | 0.66 | 0.31 |
| Iron | -- | -- | MG/KG | 20100 | 32300 | 17600 | NA | NA | NA | NA | NA |
| Lead | 400 | 1000 | MG/KG | 352 | **672** | 241 | **515** | 108 | 251 | **513** | 371 |
| Magnesium | -- | -- | MG/KG | 1420 | 2280 | 2690 | NA | NA | NA | NA | NA |
| Manganese | 2000 | 10000 | MG/KG | 350 | 570 | 129 | 294 | 347 | 140 | 293 | 117 |
| Mercury | 0.81 | 2.8 | MG/KG | **0.9 JV** | **65.6** | **17.8** | 0.77 | 0.63 | **0.89** | **1.4** | **1.2** |
| Nickel | 310 | 310 | MG/KG | 19.1 | 21.9 | 44.1 | 32.4 | 21.3 | 31.7 | 27.2 | 21.3 |
| Potassium | -- | -- | MG/KG | 601 J | 1090 J | 1070 J | NA | NA | NA | NA | NA |
| Selenium | 180 | 1500 | MG/KG | 4.4 UJV | 6.6 U | 7.8 | 4.4 U | 5 U | 2.4 J | 4.5 | 4.9 |
| Silver | 180 | 1500 | MG/KG | 2.2 U | 3.3 U | 2.2 U | 2.8 | 2.5 U | 0.55 J | 2.3 | 2.2 U |
| Sodium | -- | -- | MG/KG | 238 J | 1380 J | 352 J | NA | NA | NA | NA | NA |
| Thallium | -- | -- | MG/KG | 4.4 U | 6.6 U | 4.4 U | NA | NA | NA | NA | NA |
| Vanadium | -- | -- | MG/KG | 15.4 | 18.2 | 25.1 | NA | NA | NA | NA | NA |
| Zinc | 10000 | 10000 | MG/KG | 224 | 473 | 610 | 558 | 80.6 | 267 | 314 | 283 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
V - Value altered or qualifier added during data validation
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential S
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 5. Summary of Remaining Metals in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | Sample Designation: | RX-B-5 | RX-SW-12 | RX-SW-14 | RX-SW-15 | RX-SW-16 | RX-SW2-7 | RX-SW-8 | TP-1-E-BOTTOM | TP-3-SW-W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample Date: | 10/3/2016 | 9/30/2016 | 1/30/2017 | 11/9/2016 | 12/6/2016 | 11/21/2016 | 9/30/2016 | 7/31/2017 | 8/11/2017 |
| | | | Elevation (ft) | 11 | 12 | 13.5 | 4.5 | 4.5 | 1 | 3 | 12.5 to 10.5 | 9 |
| | | | Normal or Field Duplicate: | N | N | N | N | N | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | | | | | | | | |
| Aluminum | -- | -- | MG/KG | 6970 | 9880 | NA | NA | NA | NA | 7650 | NA | NA |
| Antimony | -- | -- | MG/KG | 3.5 U | 4 U | NA | NA | NA | NA | 4.5 U | NA | NA |
| Arsenic | 16 | 16 | MG/KG | 13.1 | 8 | **21.6** | **18** | 14 | 12 | 12.8 | 8.5 | 9.9 |
| Barium | 400 | 400 | MG/KG | **607** | 226 | 382 | 243 | 232 | 161 | 230 | **540** | 382 |
| Beryllium | 72 | 590 | MG/KG | 0.44 | 0.73 | 0.42 | 0.36 J | 0.39 J | 0.63 | 0.56 | 0.25 J | 0.52 |
| Cadmium | 4.3 | 9.3 | MG/KG | 1.9 | 0.97 | 2.4 | 0.76 U | 1.1 | 0.97 | 1.6 | **8.9** | 2.3 |
| Calcium | -- | -- | MG/KG | 26700 | 13500 | NA | NA | NA | NA | 15200 | NA | NA |
| Chromium III | 180 | 1500 | MG/KG | NA | NA | 53.4 | 20 | 35.6 | 23.4 | NA | 161 | 40.8 |
| Chromium, Hexavalent | 110 | 400 | MG/KG | NA | NA | 2.3 U | 2.4 U | 2.5 U | 2.5 U | NA | 2.3 U | 2.4 U |
| Chromium, Total | 180 | 1500 | MG/KG | 59.9 | 27.4 | 53.4 | 20 | 35.6 | 23.4 | 24.1 | 161 | 63.2 |
| Cobalt | -- | -- | MG/KG | 6.8 J | 8.1 J | NA | NA | NA | NA | 7.5 J | NA | NA |
| Copper | 270 | 270 | MG/KG | 142 | 111 | 164 | 92.1 | 198 | 105 | 125 | 260 | 159 |
| Cyanide | 27 | 27 | MG/KG | 0.39 | 0.17 | 0.11 U | 0.2 | 0.17 | 0.3 | 0.36 | 1 J | 1.1 U |
| Iron | -- | -- | MG/KG | 30100 | 21500 | NA | NA | NA | NA | 24300 | NA | NA |
| Lead | 400 | 1000 | MG/KG | **672** | **671** | **600** | **573** | **582** | **415** | **678** | **735** | **822** |
| Magnesium | -- | -- | MG/KG | 3420 | 3840 | NA | NA | NA | NA | 3030 | NA | NA |
| Manganese | 2000 | 10000 | MG/KG | 317 | 349 | 305 | 251 | 205 | 236 | 279 | 300 | 383 |
| Mercury | 0.81 | 2.8 | MG/KG | **0.92** | 0.65 | **1** | 0.66 | **1.2** | **1.3** | **1.3** | **0.99** | 0.56 |
| Nickel | 310 | 310 | MG/KG | 29.5 | 57.8 | 33.3 | 20.9 | 33 | 25.9 | 25.2 | 57.5 | 50.2 |
| Potassium | -- | -- | MG/KG | 1020 | 1360 | NA | NA | NA | NA | 1340 | NA | NA |
| Selenium | 180 | 1500 | MG/KG | 3.5 U | 4 U | 3.6 U | 1.4 J | 4 U | 4.2 U | 1.5 J | 2.3 J | 4.6 U |
| Silver | 180 | 1500 | MG/KG | 4.6 | 2 U | 3.5 | 1.9 U | 0.72 J | 0.61 J | 2.2 U | 3.4 | 0.78 J |
| Sodium | -- | -- | MG/KG | 219 J | 209 J | NA | NA | NA | NA | 2640 | NA | NA |
| Thallium | -- | -- | MG/KG | 3.5 U | 4 U | NA | NA | NA | NA | 4.5 U | NA | NA |
| Vanadium | -- | -- | MG/KG | 25 | 31.2 | NA | NA | NA | NA | 27.4 | NA | NA |
| Zinc | 10000 | 10000 | MG/KG | 617 | 376 | 666 | 254 | 470 | 414 | 786 | 910 | 702 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
V - Value altered or qualifier added during data validation
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential S
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 5. Summary of Remaining Metals in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | | | | |
|---|---|---|---|---|---|
| | | | Sample Designation: | WC-11-BOTTOM | ZEB-SB-3-BOTTOM |
| | | | Sample Date: | 8/10/2017 | 7/31/2017 |
| | | | Elevation (ft) | 13 | 16 to 14 |
| | | | Normal or Field Duplicate: | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | NYSDEC Part 375 Commercial SCO | Units | | |
| Aluminum | -- | -- | MG/KG | NA | NA |
| Antimony | -- | -- | MG/KG | NA | NA |
| Arsenic | 16 | 16 | MG/KG | 6 | 10.5 |
| Barium | 400 | 400 | MG/KG | **694** | **1010** |
| Beryllium | 72 | 590 | MG/KG | 0.35 J | 0.3 J |
| Cadmium | 4.3 | 9.3 | MG/KG | **15.9** | 2.5 |
| Calcium | -- | -- | MG/KG | NA | NA |
| Chromium III | 180 | 1500 | MG/KG | **306** | 52.3 |
| Chromium, Hexavalent | 110 | 400 | MG/KG | 2.4 U | 2.3 U |
| Chromium, Total | 180 | 1500 | MG/KG | **306** | 52.3 |
| Cobalt | -- | -- | MG/KG | NA | NA |
| Copper | 270 | 270 | MG/KG | 177 | 171 |
| Cyanide | 27 | 27 | MG/KG | 9.7 | 1.8 |
| Iron | -- | -- | MG/KG | NA | NA |
| Lead | 400 | 1000 | MG/KG | **584** | **546** |
| Magnesium | -- | -- | MG/KG | NA | NA |
| Manganese | 2000 | 10000 | MG/KG | 174 | 410 |
| Mercury | 0.81 | 2.8 | MG/KG | 0.59 | **1.1** |
| Nickel | 310 | 310 | MG/KG | 118 | 50.6 |
| Potassium | -- | -- | MG/KG | NA | NA |
| Selenium | 180 | 1500 | MG/KG | 4.5 U | 2.4 J |
| Silver | 180 | 1500 | MG/KG | 0.94 J | 5.5 |
| Sodium | -- | -- | MG/KG | NA | NA |
| Thallium | -- | -- | MG/KG | NA | NA |
| Vanadium | -- | -- | MG/KG | NA | NA |
| Zinc | 10000 | 10000 | MG/KG | 714 | 786 |

J - Estimated value
U - Indicates that the compound was analyzed for but not detected
V - Value altered or qualifier added during data validation
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
FD - Duplicate sample
mg/kg - Milligrams per kilogram
Elevation (ft) in NAVD 88
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential S
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO

**Table 6. Summary of Remaining Polychlorinated Biphenyl in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | Sample Designation: | IS-EAST | RMZ-10 | RMZ-13 | RMZ-15 | RMZ-1-E | RMZ-1-N | RMZ-2 |
|---|---|---|---|---|---|---|---|---|---|
| | | Sample Date: | 8/14/2017 | 8/14/2017 | 8/29/2017 | 9/6/2017 | 7/31/2017 | 7/31/2017 | 7/25/2017 |
| | | Elevation (ft) | 2.5 to 3 | 15 | 15 | 15 | 7 | 6 | 6 |
| | | Normal or Field Duplicate: | N | N | N | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | Units | | | | | | | |
| PCB-1016 (Aroclor 1016) | -- | MG/KG | 0.48 U | 0.37 U | 0.08 U | 0.38 U | 0.077 U | 0.37 U | 0.4 U |
| PCB-1221 (Aroclor 1221) | -- | MG/KG | 0.48 U | 0.37 U | 0.08 U | 0.38 U | 0.077 U | 0.37 U | 0.4 U |
| PCB-1232 (Aroclor 1232) | -- | MG/KG | 0.48 U | 0.37 U | 0.08 U | 0.38 U | 0.077 U | 0.37 U | 0.4 U |
| PCB-1242 (Aroclor 1242) | -- | MG/KG | 0.48 U | 0.37 U | 0.08 U | 0.38 U | 0.077 U | 0.37 U | 0.4 U |
| PCB-1248 (Aroclor 1248) | -- | MG/KG | 0.48 U | 0.37 U | 0.08 U | 0.38 U | 0.54 | 0.37 U | 0.4 U |
| PCB-1254 (Aroclor 1254) | -- | MG/KG | 0.48 U | 0.37 U | 0.08 U | 0.38 U | 0.077 U | 0.37 U | 0.4 U |
| PCB-1260 (Aroclor 1260) | -- | MG/KG | 6.7 | 4.1 | 1.1 | 4.8 | 1.3 | 3.5 | 6 |
| PCB-1262 (Aroclor 1262) | -- | MG/KG | 0.48 U | 0.37 U | 0.08 U | 0.38 U | 0.077 U | 0.37 U | 0.4 U |
| PCB-1268 (Aroclor 1268) | -- | MG/KG | 0.48 U | 0.37 U | 0.08 U | 0.38 U | 0.077 U | 0.37 U | 0.4 U |
| Polychlorinated Biphenyl (PCBs) | 1 | MG/KG | **6.7** | **4.1** | **1.1** | **4.8** | **1.8** | **3.5** | **6** |

J - Estimated value

U - Indicates that the compound was analyzed for but not detected

P - The %RPD between the primary and confirmation column/detector is >40%. The lower value has been removed

FD - Duplicate sample

mg/kg - Milligrams per kilogram

Elevation (ft) in NAVD 88

NYSDEC - New York State Department of Environmental Conservation

Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO

Shaded data indicates that parameter was detected above the USEPA TSCA Low Occupancy Area Cleanup Level

**Table 6. Summary of Remaining Polychlorinated Biphenyl in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | Sample Designation: | RMZ-3 | RMZ-4-E | RMZ-4-S | RMZ-5 | RMZ-7 | RMZ-8 | RMZ-9 |
|---|---|---|---|---|---|---|---|---|---|
| | | Sample Date: | 7/25/2017 | 7/31/2017 | 7/31/2017 | 7/25/2017 | 7/25/2017 | 8/3/2017 | 8/3/2017 |
| | | Elevation (ft) | 6 | 7 | 6 | 6 | 6 | 13 to 13.5 | 15.5 to 16 |
| | | Normal or Field Duplicate: | N | N | N | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | Units | | | | | | | |
| PCB-1016 (Aroclor 1016) | -- | MG/KG | 0.41 U | 0.38 U | 0.15 U | 0.39 U | 0.4 U | 0.37 U | 0.74 U |
| PCB-1221 (Aroclor 1221) | -- | MG/KG | 0.41 U | 0.38 U | 0.15 U | 0.39 U | 0.4 U | 0.37 U | 0.74 U |
| PCB-1232 (Aroclor 1232) | -- | MG/KG | 0.41 U | 0.38 U | 0.15 U | 0.39 U | 0.4 U | 0.37 U | 0.74 U |
| PCB-1242 (Aroclor 1242) | -- | MG/KG | 0.41 U | 0.38 U | 0.15 U | 0.39 U | 0.4 U | 0.37 U | 0.74 U |
| PCB-1248 (Aroclor 1248) | -- | MG/KG | 0.41 U | 0.38 U | 0.15 U | 0.39 U | 0.4 U | 0.37 U | 0.74 U |
| PCB-1254 (Aroclor 1254) | -- | MG/KG | 0.41 U | 0.38 U | 0.15 U | 0.39 U | 0.4 U | 0.37 U | 0.74 U |
| PCB-1260 (Aroclor 1260) | -- | MG/KG | 4.7 | 3.9 | 2.4 | 5 | 3.3 | 4.6 | 9 |
| PCB-1262 (Aroclor 1262) | -- | MG/KG | 0.41 U | 0.38 U | 0.15 U | 0.39 U | 0.4 U | 0.37 U | 0.74 U |
| PCB-1268 (Aroclor 1268) | -- | MG/KG | 0.41 U | 0.38 U | 0.15 U | 0.39 U | 0.4 U | 0.37 U | 0.74 U |
| Polychlorinated Biphenyl (PCBs) | 1 | MG/KG | **4.7** | **3.9** | **2.4** | **5** | **3.3** | **4.6** | **9** |

J - Estimated value

U - Indicates that the compound was analyzed for but not detected

P - The %RPD between the primary and confirmation column/detector is >40%. The lower value has been removed

FD - Duplicate sample

mg/kg - Milligrams per kilogram

Elevation (ft) in NAVD 88

NYSDEC - New York State Department of Environmental Conservation

Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO

Shaded data indicates that parameter was detected above the USEPA TSCA Low Occupancy Area Cleanup Level

**Table 6. Summary of Remaining Polychlorinated Biphenyl in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | Sample Designation: | RX-6B | RX-7 | RX-B-12 | RX-B-13 | RX-SW-11 | HS-4-BOTTOM |
|---|---|---|---|---|---|---|---|---|
| | | Sample Date: | 5/12/2016 | 5/12/2016 | 11/15/2016 | 11/15/2016 | 9/30/2016 | 8/4/2017 |
| | | Elevation (ft) | 4.5 | 6 | -5 | -5 | 12 | 1.5 |
| | | Normal or Field Duplicate: | N | N | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | Units | | | | | | |
| PCB-1016 (Aroclor 1016) | -- | MG/KG | 0.38 U | 0.15 U | 0.62 U | 0.22 U | 0.073 U | 0.79 U |
| PCB-1221 (Aroclor 1221) | -- | MG/KG | 0.38 U | 0.15 U | 0.62 U | 0.22 U | 0.073 U | 0.79 U |
| PCB-1232 (Aroclor 1232) | -- | MG/KG | 0.38 U | 0.15 U | 0.62 U | 0.22 U | 0.073 U | 0.79 U |
| PCB-1242 (Aroclor 1242) | -- | MG/KG | 0.38 U | 0.15 U | 0.62 U | 0.22 U | 0.073 U | 0.79 U |
| PCB-1248 (Aroclor 1248) | -- | MG/KG | 0.38 U | 0.15 U | 0.62 U | 0.22 U | 0.073 U | 0.79 U |
| PCB-1254 (Aroclor 1254) | -- | MG/KG | 0.38 U | 0.15 U | 0.62 U | 0.22 U | 0.073 U | 0.79 U |
| PCB-1260 (Aroclor 1260) | -- | MG/KG | 3.8 | 2.3 | 8.4 | 2.6 | 1.3 | 6.3 |
| PCB-1262 (Aroclor 1262) | -- | MG/KG | 0.38 U | 0.15 U | 0.62 U | 0.22 U | 0.073 U | 0.79 U |
| PCB-1268 (Aroclor 1268) | -- | MG/KG | 0.38 U | 0.15 U | 0.62 U | 0.22 U | 0.073 U | 0.79 U |
| Polychlorinated Biphenyl (PCBs) | 1 | MG/KG | **3.8** | **2.3** | **8.4** | **2.6** | **1.3** | **6.3** |

J - Estimated value

U - Indicates that the compound was analyzed for but not detected

P - The %RPD between the primary and confirmation column/detector is >40%. The lower value has been removed

FD - Duplicate sample

mg/kg - Milligrams per kilogram

Elevation (ft) in NAVD 88

NYSDEC - New York State Department of Environmental Conservation

Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO

Shaded data indicates that parameter was detected above the USEPA TSCA Low Occupancy Area Cleanup Level

**Table 6. Summary of Remaining Polychlorinated Biphenyl in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | Sample Designation: | HS-4-SW-E | HS-4-SW-N | HS-4-SW-S | HS-4-SW-W | RX-B2-20 | RX-B2-3 | RX-B-5 |
|---|---|---|---|---|---|---|---|---|---|
| | | Sample Date: | 8/4/2017 | 8/4/2017 | 8/4/2017 | 8/4/2017 | 11/17/2016 | 11/16/2016 | 10/3/2016 |
| | | Elevation (ft) | 5 to 3 | 5.5 to 3.5 | 4.5 to 3.5 | 5 to 4 | 1.5 | 8 | 11 |
| | | Normal or Field Duplicate: | N | N | N | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | Units | | | | | | | |
| PCB-1016 (Aroclor 1016) | -- | MG/KG | 0.36 U | 0.78 U | 0.78 U | 0.37 U | 0.08 U | 0.78 U | 0.077 U |
| PCB-1221 (Aroclor 1221) | -- | MG/KG | 0.36 U | 0.78 U | 0.78 U | 0.37 U | 0.08 U | 0.78 U | 0.077 U |
| PCB-1232 (Aroclor 1232) | -- | MG/KG | 0.36 U | 0.78 U | 0.78 U | 0.37 U | 0.08 U | 0.78 U | 0.077 U |
| PCB-1242 (Aroclor 1242) | -- | MG/KG | 0.36 U | 0.78 U | 0.78 U | 0.37 U | 0.08 U | 0.78 U | 0.077 U |
| PCB-1248 (Aroclor 1248) | -- | MG/KG | 0.36 U | 0.78 U | 0.78 U | 0.37 U | 0.08 U | 0.78 U | 0.077 U |
| PCB-1254 (Aroclor 1254) | -- | MG/KG | 0.36 U | 0.78 U | 0.78 U | 0.37 U | 0.08 U | 0.78 U | 0.077 U |
| PCB-1260 (Aroclor 1260) | -- | MG/KG | 4.1 | 6.8 | 9.4 | 4.1 | 1.2 | 9.8 | 1.5 |
| PCB-1262 (Aroclor 1262) | -- | MG/KG | 0.36 U | 0.78 U | 0.78 U | 0.37 U | 0.08 U | 0.78 U | 0.077 U |
| PCB-1268 (Aroclor 1268) | -- | MG/KG | 0.36 U | 0.78 U | 0.78 U | 0.37 U | 0.08 U | 0.78 U | 0.077 U |
| Polychlorinated Biphenyl (PCBs) | 1 | MG/KG | **4.1** | **6.8** | **9.4** | **4.1** | **1.2** | **9.8** | **1.5** |

J - Estimated value

U - Indicates that the compound was analyzed for but not detected

P - The %RPD between the primary and confirmation column/detector is >40%. The lower value has been removed

FD - Duplicate sample

mg/kg - Milligrams per kilogram

Elevation (ft) in NAVD 88

NYSDEC - New York State Department of Environmental Conservation

Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO

Shaded data indicates that parameter was detected above the USEPA TSCA Low Occupancy Area Cleanup Level

**Table 6. Summary of Remaining Polychlorinated Biphenyl in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | Sample Designation: | RX-SW-13-N | RX-SW-14 | RX-SW-15 | RX-SW-16 | RX-SWS1-3 | TP-1-E |
|---|---|---|---|---|---|---|---|---|
| | | Sample Date: | 1/30/2017 | 1/30/2017 | 11/9/2016 | 12/6/2016 | 11/16/2016 | 10/24/2016 |
| | | Elevation (ft) | 11.5 | 13.5 | 4.5 | 4.5 | 10 | 16.5 to 14.5 |
| | | Normal or Field Duplicate: | N | N | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | Units | | | | | | |
| PCB-1016 (Aroclor 1016) | -- | MG/KG | 0.078 U | 0.077 U | 0.08 U | 0.42 U | 0.16 U | 0.4 U |
| PCB-1221 (Aroclor 1221) | -- | MG/KG | 0.078 U | 0.077 U | 0.08 U | 0.42 U | 0.16 U | 0.4 U |
| PCB-1232 (Aroclor 1232) | -- | MG/KG | 0.078 U | 0.077 U | 0.08 U | 0.42 U | 0.16 U | 0.4 U |
| PCB-1242 (Aroclor 1242) | -- | MG/KG | 0.078 U | 0.077 U | 0.08 U | 0.42 U | 0.16 U | 0.4 U |
| PCB-1248 (Aroclor 1248) | -- | MG/KG | 0.078 U | 0.077 U | 0.08 U | 0.42 U | 0.16 U | 0.4 U |
| PCB-1254 (Aroclor 1254) | -- | MG/KG | 0.078 U | 0.077 U | 0.08 U | 0.42 U | 2.3 | 0.4 U |
| PCB-1260 (Aroclor 1260) | -- | MG/KG | 1.3 | 1.7 | 1.3 | 4 | 1 | 4.1 |
| PCB-1262 (Aroclor 1262) | -- | MG/KG | 0.078 U | 0.077 U | 0.08 U | 0.42 U | 0.16 U | 0.4 U |
| PCB-1268 (Aroclor 1268) | -- | MG/KG | 0.078 U | 0.077 U | 0.08 U | 0.42 U | 0.16 U | 0.4 U |
| Polychlorinated Biphenyl (PCBs) | 1 | MG/KG | **1.3** | **1.7** | **1.3** | **4** | **3.3** | **4.1** |

J - Estimated value

U - Indicates that the compound was analyzed for but not detected

P - The %RPD between the primary and confirmation column/detector is >40%. The lower value has been removed

FD - Duplicate sample

mg/kg - Milligrams per kilogram

Elevation (ft) in NAVD 88

NYSDEC - New York State Department of Environmental Conservation

Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO

Shaded data indicates that parameter was detected above the USEPA TSCA Low Occupancy Area Cleanup Level

**Table 6. Summary of Remaining Polychlorinated Biphenyl in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | Sample Designation: | TP-1-E-BOTTOM | TP-1-E-SW-E | TP-1-N | TP-1-S | TP-1-W | TP-2-N |
|---|---|---|---|---|---|---|---|---|
| | | Sample Date: | 7/31/2017 | 7/31/2017 | 10/24/2016 | 10/24/2016 | 10/24/2016 | 10/21/2016 |
| | | Elevation (ft) | 12.5 to 10.5 | 0 - 1 | 16.5 to 14.5 | 16.5 to 14.5 | 16.5 to 14.5 | 9.5 to 7.5 |
| | | Normal or Field Duplicate: | N | N | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | Units | | | | | | |
| PCB-1016 (Aroclor 1016) | -- | MG/KG | 0.39 U | 0.4 U | 0.16 U | 0.36 U | 0.38 U | 0.14 U |
| PCB-1221 (Aroclor 1221) | -- | MG/KG | 0.39 U | 0.4 U | 0.16 U | 0.36 U | 0.38 U | 0.14 U |
| PCB-1232 (Aroclor 1232) | -- | MG/KG | 0.39 U | 0.4 U | 0.16 U | 0.36 U | 0.38 U | 0.14 U |
| PCB-1242 (Aroclor 1242) | -- | MG/KG | 0.39 U | 0.4 U | 0.16 U | 0.36 U | 0.38 U | 0.14 U |
| PCB-1248 (Aroclor 1248) | -- | MG/KG | 0.39 U | 0.4 U | 0.16 U | 0.36 U | 0.38 U | 0.14 U |
| PCB-1254 (Aroclor 1254) | -- | MG/KG | 2.1 | 0.4 U | 0.16 U | 0.36 U | 0.38 U | 0.14 U |
| PCB-1260 (Aroclor 1260) | -- | MG/KG | 1.2 | 4.2 | 2.3 | 3.8 | 5.4 | 2.8 |
| PCB-1262 (Aroclor 1262) | -- | MG/KG | 0.39 U | 0.4 U | 0.16 U | 0.36 U | 0.38 U | 0.14 U |
| PCB-1268 (Aroclor 1268) | -- | MG/KG | 0.39 U | 0.4 U | 0.16 U | 0.36 U | 0.38 U | 0.14 U |
| Polychlorinated Biphenyl (PCBs) | 1 | MG/KG | **3.3** | **4.2** | **2.3** | **3.8** | **5.4** | **2.8** |

J - Estimated value

U - Indicates that the compound was analyzed for but not detected

P - The %RPD between the primary and confirmation column/detector is >40%. The lower value has been removed

FD - Duplicate sample

mg/kg - Milligrams per kilogram

Elevation (ft) in NAVD 88

NYSDEC - New York State Department of Environmental Conservation

Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO

Shaded data indicates that parameter was detected above the USEPA TSCA Low Occupancy Area Cleanup Level

**Table 6. Summary of Remaining Polychlorinated Biphenyl in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | Sample Designation: | TP-2-N2 | TP-2-S | TP-2-S-SW-W2 | TP-2-SW-E | TP-3-N | TP-3-S-BOTTOM |
|---|---|---|---|---|---|---|---|---|
| | | Sample Date: | 10/24/2016 | 10/21/2016 | 8/14/2017 | 8/9/2017 | 10/25/2016 | 8/11/2017 |
| | | Elevation (ft) | 7.5 to 6.5 | 10 to 8 | 7 | 11 to 10.5 | 2 to -1 | 15 to 13 |
| | | Normal or Field Duplicate: | N | N | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | Units | | | | | | |
| PCB-1016 (Aroclor 1016) | -- | MG/KG | 0.15 U | 0.15 U | 0.38 U | 0.4 U | 0.089 U | 0.16 U |
| PCB-1221 (Aroclor 1221) | -- | MG/KG | 0.15 U | 0.15 U | 0.38 U | 0.4 U | 0.089 U | 0.16 U |
| PCB-1232 (Aroclor 1232) | -- | MG/KG | 0.15 U | 0.15 U | 0.38 U | 0.4 U | 0.089 U | 0.16 U |
| PCB-1242 (Aroclor 1242) | -- | MG/KG | 1.4 | 1.5 | 0.38 U | 0.4 U | 0.089 U | 0.16 U |
| PCB-1248 (Aroclor 1248) | -- | MG/KG | 0.15 U | 0.15 U | 0.38 U | 0.4 U | 0.089 U | 0.16 U |
| PCB-1254 (Aroclor 1254) | -- | MG/KG | 2.2 | 0.15 U | 0.38 U | 4.4 | 0.089 U | 1.3 |
| PCB-1260 (Aroclor 1260) | -- | MG/KG | 1.8 | 1.6 | 2.3 | 3.6 | 1.1 | 2.1 |
| PCB-1262 (Aroclor 1262) | -- | MG/KG | 0.15 U | 0.15 U | 0.38 U | 0.4 U | 0.089 U | 0.16 U |
| PCB-1268 (Aroclor 1268) | -- | MG/KG | 0.15 U | 0.15 U | 0.38 U | 0.4 U | 0.089 U | 0.16 U |
| Polychlorinated Biphenyl (PCBs) | 1 | MG/KG | **5.4** | **3.1** | **2.3** | **8** | **1.1** | **3.4** |

J - Estimated value

U - Indicates that the compound was analyzed for but not detected

P - The %RPD between the primary and confirmation column/detector is >40%. The lower value has been removed

FD - Duplicate sample

mg/kg - Milligrams per kilogram

Elevation (ft) in NAVD 88

NYSDEC - New York State Department of Environmental Conservation

Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO

Shaded data indicates that parameter was detected above the USEPA TSCA Low Occupancy Area Cleanup Level

**Table 6. Summary of Remaining Polychlorinated Biphenyl in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | Sample Designation: | TP-3-S-SW-E | TP-3-S-SW-W | TP-3-SW-S | TP-3-SW-W | TP-3-W | TP-3-W |
|---|---|---|---|---|---|---|---|---|
| | | Sample Date: | 8/11/2017 | 8/11/2017 | 8/11/2017 | 8/11/2017 | 10/25/2016 | 10/25/2016 |
| | | Elevation (ft) | 15 to 13 | 15 to 13 | 9 | 9 | 11 to 9 | 11 to 9 |
| | | Normal or Field Duplicate: | N | N | N | N | FD | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | Units | | | | | | |
| PCB-1016 (Aroclor 1016) | -- | MG/KG | 0.38 U | 0.15 U | 0.079 U | 0.16 U | 0.077 U | 0.078 U |
| PCB-1221 (Aroclor 1221) | -- | MG/KG | 0.38 U | 0.15 U | 0.079 U | 0.16 U | 0.077 U | 0.078 U |
| PCB-1232 (Aroclor 1232) | -- | MG/KG | 0.38 U | 0.15 U | 0.079 U | 0.16 U | 0.077 U | 0.078 U |
| PCB-1242 (Aroclor 1242) | -- | MG/KG | 0.38 U | 0.15 U | 0.079 U | 0.16 U | 0.077 U | 0.078 U |
| PCB-1248 (Aroclor 1248) | -- | MG/KG | 0.38 U | 0.15 U | 0.079 U | 0.16 U | 0.077 U | 0.078 U |
| PCB-1254 (Aroclor 1254) | -- | MG/KG | 2.5 | 1.3 | 1.1 | 1.5 | 0.077 U | 0.078 U |
| PCB-1260 (Aroclor 1260) | -- | MG/KG | 3.9 | 2.3 | 0.72 | 2.5 | 1.4 | 1.2 |
| PCB-1262 (Aroclor 1262) | -- | MG/KG | 0.38 U | 0.15 U | 0.079 U | 0.16 U | 0.077 U | 0.078 U |
| PCB-1268 (Aroclor 1268) | -- | MG/KG | 0.38 U | 0.15 U | 0.079 U | 0.16 U | 0.077 U | 0.078 U |
| Polychlorinated Biphenyl (PCBs) | 1 | MG/KG | **6.3** | **3.6** | **1.8** | **4** | **1.4** | **1.2** |

J - Estimated value

U - Indicates that the compound was analyzed for but not detected

P - The %RPD between the primary and confirmation column/detector is >40%. The lower value has been removed

FD - Duplicate sample

mg/kg - Milligrams per kilogram

Elevation (ft) in NAVD 88

NYSDEC - New York State Department of Environmental Conservation

Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO

Shaded data indicates that parameter was detected above the USEPA TSCA Low Occupancy Area Cleanup Level

**Table 6. Summary of Remaining Polychlorinated Biphenyl in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | Sample Designation: | WC-11-N | ZEB-SB-3-BOTTOM | ZEB-SB-3-E2 | ZEB-SB-3-E-BOTTOM | ZEB-SB-3-E-SW-N |
|---|---|---|---|---|---|---|---|
| | | Sample Date: | 8/10/2017 | 7/31/2017 | 10/26/2016 | 7/31/2017 | 7/31/2017 |
| | | Elevation (ft) | 13 | 16 to 14 | 16 to 14 | 14 to 12 | 16 to 14 |
| | | Normal or Field Duplicate: | N | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | Units | | | | | |
| PCB-1016 (Aroclor 1016) | -- | MG/KG | 0.073 U | 0.78 U | 0.079 U | 0.38 U | 0.17 U |
| PCB-1221 (Aroclor 1221) | -- | MG/KG | 0.073 U | 0.78 U | 0.079 U | 0.38 U | 0.17 U |
| PCB-1232 (Aroclor 1232) | -- | MG/KG | 0.073 U | 0.78 U | 0.079 U | 0.38 U | 0.17 U |
| PCB-1242 (Aroclor 1242) | -- | MG/KG | 0.073 U | 0.78 U | 0.079 U | 0.38 U | 0.17 U |
| PCB-1248 (Aroclor 1248) | -- | MG/KG | 0.98 | 0.78 U | 0.079 U | 0.38 U | 0.17 U |
| PCB-1254 (Aroclor 1254) | -- | MG/KG | 0.073 U | 0.78 U | 0.079 U | 0.38 U | 0.17 U |
| PCB-1260 (Aroclor 1260) | -- | MG/KG | 0.31 | 7.4 | 1.4 | 4.3 | 2.6 |
| PCB-1262 (Aroclor 1262) | -- | MG/KG | 0.073 U | 0.78 U | 0.079 U | 0.38 U | 0.17 U |
| PCB-1268 (Aroclor 1268) | -- | MG/KG | 0.073 U | 0.78 U | 0.079 U | 0.38 U | 0.17 U |
| Polychlorinated Biphenyl (PCBs) | 1 | MG/KG | **1.3** | **7.4** | **1.4** | **4.3** | **2.6** |

J - Estimated value

U - Indicates that the compound was analyzed for but not detected

P - The %RPD between the primary and confirmation column/detector is >40%. The lower value has been removed

FD - Duplicate sample

mg/kg - Milligrams per kilogram

Elevation (ft) in NAVD 88

NYSDEC - New York State Department of Environmental Conservation

Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO

Shaded data indicates that parameter was detected above the USEPA TSCA Low Occupancy Area Cleanup Level

**Table 6. Summary of Remaining Polychlorinated Biphenyl in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | Sample Designation: | ZEB-SB-3-N | ZEB-SB-3-N2 | ZEB-SB-3-N-BOTTOM | ZEB-SB-3-N-SW-N | LAT-CAN-1 |
|---|---|---|---|---|---|---|---|
| | | Sample Date: | 10/26/2016 | 10/26/2016 | 8/8/2017 | 8/8/2017 | 9/15/2017 |
| | | Elevation (ft) | 16 to 14 | 12 to 10 | 14 to 13.5 | 16 to 14 | 0.5 to 0 |
| | | Normal or Field Duplicate: | N | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | Units | | | | | |
| PCB-1016 (Aroclor 1016) | -- | MG/KG | 0.15 U | 0.18 U | 0.4 U | 0.83 U | 0.16 |
| PCB-1221 (Aroclor 1221) | -- | MG/KG | 0.15 U | 0.18 U | 0.4 U | 0.83 U | 0.16 |
| PCB-1232 (Aroclor 1232) | -- | MG/KG | 0.15 U | 0.18 U | 0.4 U | 0.83 U | 0.16 |
| PCB-1242 (Aroclor 1242) | -- | MG/KG | 0.15 U | 0.18 U | 0.4 U | 0.83 U | 0.16 |
| PCB-1248 (Aroclor 1248) | -- | MG/KG | 0.15 U | 0.18 U | 0.4 U | 0.83 U | 0.16 |
| PCB-1254 (Aroclor 1254) | -- | MG/KG | 0.15 U | 0.18 U | 0.4 U | 0.83 U | 0.16 |
| PCB-1260 (Aroclor 1260) | -- | MG/KG | 2.9 JV | 2.4 | 5.3 | 7 | 2.2 |
| PCB-1262 (Aroclor 1262) | -- | MG/KG | 0.15 U | 0.18 U | 0.4 U | 0.83 U | 0.16 |
| PCB-1268 (Aroclor 1268) | -- | MG/KG | 0.15 U | 0.18 U | 0.4 U | 0.83 U | 0.16 |
| Polychlorinated Biphenyl (PCBs) | 1 | MG/KG | **2.9** | **2.4** | **5.3** | **7** | **2.2** |

J - Estimated value

U - Indicates that the compound was analyzed for but not detected

P - The %RPD between the primary and confirmation column/detector is >40%. The lower value has been removed

FD - Duplicate sample

mg/kg - Milligrams per kilogram

Elevation (ft) in NAVD 88

NYSDEC - New York State Department of Environmental Conservation

Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO

Shaded data indicates that parameter was detected above the USEPA TSCA Low Occupancy Area Cleanup Level

**Table 6. Summary of Remaining Polychlorinated Biphenyl in Soil Exceeding NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives**
**Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| | | Sample Designation: | LAT-TUN-3-BOT | LAT-TUN-3-N | LAT-TUN-3-T | LAT-TUN-3-W |
|---|---|---|---|---|---|---|
| | | Sample Date: | 11/10/2017 | 11/10/2017 | 11/10/2017 | 11/10/2017 |
| | | Elevation (ft) | -1.5 to -2.5 | -1.5 to -2.5 | 0 - 0 | -1.5 to -2.5 |
| | | Normal or Field Duplicate: | N | N | N | N |
| Parameter | NYSDEC Part 375 Restricted Residential SCO | Units | | | | |
| PCB-1016 (Aroclor 1016) | -- | MG/KG | 4 U | 0.41 U | 1100 U | 0.84 U |
| PCB-1221 (Aroclor 1221) | -- | MG/KG | 4 U | 0.41 U | 1100 U | 0.84 U |
| PCB-1232 (Aroclor 1232) | -- | MG/KG | 4 U | 0.41 U | 1100 U | 0.84 U |
| PCB-1242 (Aroclor 1242) | -- | MG/KG | 4 U | 0.41 U | 1100 U | 0.84 U |
| PCB-1248 (Aroclor 1248) | -- | MG/KG | 4 U | 0.41 U | 1100 U | 0.84 U |
| PCB-1254 (Aroclor 1254) | -- | MG/KG | 4 U | 4.1 J | 1100 U | 0.84 U |
| PCB-1260 (Aroclor 1260) | -- | MG/KG | 48 | 2.7 J | 5300 | 7.9 |
| PCB-1262 (Aroclor 1262) | -- | MG/KG | 4 U | 0.41 U | 1100 U | 0.84 U |
| PCB-1268 (Aroclor 1268) | -- | MG/KG | 4 U | 0.41 U | 1100 U | 0.84 U |
| Polychlorinated Biphenyl (PCBs) | 1 | MG/KG | **44 P** | **6.8 J** | **5300** | **7.9** |

J - Estimated value

U - Indicates that the compound was analyzed for but not detected

P - The %RPD between the primary and confirmation column/detector is >40%. The lower value has been removed

FD - Duplicate sample

mg/kg - Milligrams per kilogram

Elevation (ft) in NAVD 88

NYSDEC - New York State Department of Environmental Conservation

Bold data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO

Shaded data indicates that parameter was detected above the USEPA TSCA Low Occupancy Area Cleanup Level

| Notes Utilized Throughout Tables | |
|---|---|
| **Groundwater Tables** | |
| J - | Estimated Value |
| U - | Compound was analyzed for but not detected |
| P - | The RPD between the results for the two columns exceeds the method-specified criteria |
| RPD - | Relative Percent Difference |
| T - | Indicates that a quality control parameter has exceeded laboratory limits |
| FD - | Duplicate |
| NA - | Compound was not analyzed for by laboratory |
| µg/L - | Micrograms per liter |
| NYSDEC - | New York State Department of Environmental Conservation |
| AWQSGVs - | Ambient Water-Quality Standards and Guidance Values |
| -- | No NYSDEC AWQSGV available |
| Bold data indicates that parameter was detected above the NYSDEC AWQSGVs | |

**Table 7. Summary of Volatile Organic Compounds in Groundwater, Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| Sample Designation: | | | MW-9 | MW-9 | MW-10 | MW-10 | MW-11 | MW-11 | MW-12 |
|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | | | 01/07/2020 | 03/16/2020 | 01/06/2020 | 03/16/2020 | 01/06/2020 | 03/16/2020 | 01/06/2020 |
| Normal Sample or Field Duplicate: | | | N | N | N | N | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance Values | Unit | | | | | | | |
| 1,1,1-Trichloroethane (TCA) | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1,2,2-Tetrachloroethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1,2-Trichloroethane | 1 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1-Dichloroethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1-Dichloroethene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2,3-Trichlorobenzene | 5 | UG/L | 3 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2,4-Trichlorobenzene | **5** | UG/L | **13** | 1.9 | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dibromo-3-Chloropropane | 0.04 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dibromoethane (Ethylene Dibromide) | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dichlorobenzene | **3** | UG/L | **7** | **5.9** | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dichloroethane | 0.6 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dichloropropane | 1 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,3-Dichlorobenzene | **3** | UG/L | **85** | **94** | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,4-Dichlorobenzene | **3** | UG/L | **340** | **390** | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,4-Dioxane (P-Dioxane) | -- | UG/L | 50 U | 50 U | 50 U | 50 U | 50 U | 50 U | 50 U |
| 2-Hexanone | 50 | UG/L | 5 U | 5 U | 5 UT | 5 U | 5 UT | 5 U | 5 UT |
| Acetone | 50 | UG/L | 5 U | 5 U | 8.2 | 5 U | 9.3 | 5.9 | 5 U |
| Benzene | **1** | UG/L | 0.91 J | **1.6** | **2.2** | **2.5** | 1 U | 1 U | 1 U |
| Bromochloromethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Bromodichloromethane | 50 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Bromoform | 50 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Bromomethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Carbon Disulfide | 60 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Carbon Tetrachloride | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Chlorobenzene | **5** | UG/L | **130** | **250** | 1 U | 1 U | 1 U | 1 U | 1 U |
| Chloroethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Chloroform | 7 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Chloromethane | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Cis-1,2-Dichloroethylene | **5** | UG/L | 1 U | 0.22 J | 1 U | 1 U | 1 U | 1 U | 1 U |
| Cis-1,3-Dichloropropene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Cyclohexane | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |

**Table 7. Summary of Volatile Organic Compounds in Groundwater, Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| Sample Designation: | | | MW-9 | MW-9 | MW-10 | MW-10 | MW-11 | MW-11 | MW-12 |
|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | | | 01/07/2020 | 03/16/2020 | 01/06/2020 | 03/16/2020 | 01/06/2020 | 03/16/2020 | 01/06/2020 |
| Normal Sample or Field Duplicate: | | | N | N | N | N | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance Values | Unit | | | | | | | |
| Dibromochloromethane | 50 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Dichlorodifluoromethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Ethylbenzene | 5 | UG/L | 0.46 J | 0.35 J | 0.43 J | 0.74 J | 1 U | 1 U | 1 U |
| Isopropylbenzene (Cumene) | 5 | UG/L | 0.42 J | 0.44 J | 2.9 | 4.4 | 1 U | 1 U | 1 U |
| m,p-Xylene | 5 | UG/L | 0.33 J | 1 U | 0.97 J | 1.3 | 1 U | 1 U | 1 U |
| Methyl Acetate | -- | UG/L | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Methyl Ethyl Ketone (2-Butanone) | 50 | UG/L | 5 U | 5 U | 5 UT | 5 U | 5 UT | 5 U | 5 UT |
| Methyl Isobutyl Ketone (4-Methyl-2-Pentanone) | -- | UG/L | 5 U | 5 U | 5 UT | 5 U | 5 UT | 5 U | 5 UT |
| Methylcyclohexane | -- | UG/L | 1 U | 0.26 J | 1 U | 1 U | 1 U | 1 U | 1 U |
| Methylene Chloride | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| O-Xylene (1,2-Dimethylbenzene) | 5 | UG/L | 1 U | 1 U | 0.86 J | 1.1 | 1 U | 1 U | 1 U |
| Styrene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Tert-Butyl Methyl Ether | 10 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Tetrachloroethylene (PCE) | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Toluene | 5 | UG/L | 1 U | 1 U | 0.4 J | 0.43 J | 1 U | 1 U | 1 U |
| Trans-1,2-Dichloroethene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Trans-1,3-Dichloropropene | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Trichloroethylene (TCE) | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Trichlorofluoromethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Vinyl Chloride | 2 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |

**Table 7. Summary of Volatile Organic Compounds in Groundwater, Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| Sample Designation: | | | MW-12 | MW-12 | MW-13 | MW-13 | MW-14 | MW-16 | MW-17 |
|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | | | 01/06/2020 | 03/16/2020 | 03/17/2020 | 03/17/2020 | 03/18/2020 | 01/07/2020 | 01/07/2020 |
| Normal Sample or Field Duplicate: | | | FD | N | N | FD | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance Values | Unit | | | | | | | |
| 1,1,1-Trichloroethane (TCA) | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1,2,2-Tetrachloroethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1,2-Trichloroethane | 1 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1-Dichloroethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,1-Dichloroethene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2,3-Trichlorobenzene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 UT | 1 UT |
| 1,2,4-Trichlorobenzene | **5** | UG/L | 1 U | 1 U | 1 U | 1 U | 0.96 J | 1 U | 1 U |
| 1,2-Dibromo-3-Chloropropane | 0.04 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dibromoethane (Ethylene Dibromide) | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dichlorobenzene | **3** | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 0.47 J |
| 1,2-Dichloroethane | 0.6 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,2-Dichloropropane | 1 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| 1,3-Dichlorobenzene | **3** | UG/L | 1 U | 1 U | 0.65 J | 0.65 J | 1 U | **8.1** | **7.3** |
| 1,4-Dichlorobenzene | **3** | UG/L | 1 U | 1 U | 1 | 1.1 | 1 U | **46** | **25** |
| 1,4-Dioxane (P-Dioxane) | -- | UG/L | 50 U | 50 U | 50 U | 50 U | 50 U | 50 U | 50 U |
| 2-Hexanone | 50 | UG/L | 5 UT | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Acetone | 50 | UG/L | 9.3 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Benzene | **1** | UG/L | 1 U | 1 U | 0.65 J | 0.67 J | 1 U | 1 U | 1 U |
| Bromochloromethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Bromodichloromethane | 50 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Bromoform | 50 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Bromomethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 UT | 1 UT |
| Carbon Disulfide | 60 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Carbon Tetrachloride | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Chlorobenzene | **5** | UG/L | 1 U | 1 U | **11** | **12** | 0.73 J | **9.9** | **15** |
| Chloroethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 UT | 1 UT |
| Chloroform | 7 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Chloromethane | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 UT | 1 UT |
| Cis-1,2-Dichloroethylene | **5** | UG/L | 1 U | 1 U | 0.87 J | 0.84 J | **6** | 1 U | 1 U |
| Cis-1,3-Dichloropropene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Cyclohexane | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |

**Table 7. Summary of Volatile Organic Compounds in Groundwater, Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| Sample Designation: | | | MW-12 | MW-12 | MW-13 | MW-13 | MW-14 | MW-16 | MW-17 |
|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | | | 01/06/2020 | 03/16/2020 | 03/17/2020 | 03/17/2020 | 03/18/2020 | 01/07/2020 | 01/07/2020 |
| Normal Sample or Field Duplicate: | | | FD | N | N | FD | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance Values | Unit | | | | | | | |
| Dibromochloromethane | 50 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Dichlorodifluoromethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Ethylbenzene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Isopropylbenzene (Cumene) | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 0.48 J |
| m,p-Xylene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Methyl Acetate | -- | UG/L | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Methyl Ethyl Ketone (2-Butanone) | 50 | UG/L | 5 UT | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Methyl Isobutyl Ketone (4-Methyl-2-Pentanone) | -- | UG/L | 5 UT | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Methylcyclohexane | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Methylene Chloride | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| O-Xylene (1,2-Dimethylbenzene) | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Styrene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Tert-Butyl Methyl Ether | 10 | UG/L | 1 U | 1 U | 1 U | 1 U | 0.74 J | 2.5 | 2.7 |
| Tetrachloroethylene (PCE) | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 0.39 J | 1 U | 1 U |
| Toluene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Trans-1,2-Dichloroethene | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Trans-1,3-Dichloropropene | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Trichloroethylene (TCE) | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Trichlorofluoromethane | 5 | UG/L | 1 U | 1 U | 1 U | 1 U | 0.78 J | 1 U | 1 U |
| Vinyl Chloride | 2 | UG/L | 1 U | 1 U | 0.88 J | 0.9 J | 0.24 J | 1 U | 1 U |

**Table 7. Summary of Volatile Organic Compounds in Groundwater, Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| Sample Designation: | | | MW-18 | MW-18 |
|---|---|---|---|---|
| Sample Date: | | | 01/07/2020 | 03/17/2020 |
| Normal Sample or Field Duplicate: | | | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance Values | Unit | | |
| 1,1,1-Trichloroethane (TCA) | 5 | UG/L | 1 U | 1 U |
| 1,1,2,2-Tetrachloroethane | 5 | UG/L | 1 U | 1 U |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | -- | UG/L | 1 U | 1 U |
| 1,1,2-Trichloroethane | 1 | UG/L | 1 U | 1 U |
| 1,1-Dichloroethane | 5 | UG/L | 1 U | 1 U |
| 1,1-Dichloroethene | 5 | UG/L | 1 U | 1 U |
| 1,2,3-Trichlorobenzene | 5 | UG/L | 1 UT | 1 U |
| 1,2,4-Trichlorobenzene | **5** | UG/L | 1 U | 1 U |
| 1,2-Dibromo-3-Chloropropane | 0.04 | UG/L | 1 U | 1 U |
| 1,2-Dibromoethane (Ethylene Dibromide) | -- | UG/L | 1 U | 1 U |
| 1,2-Dichlorobenzene | **3** | UG/L | 1 U | 1 U |
| 1,2-Dichloroethane | 0.6 | UG/L | 1 U | 1 U |
| 1,2-Dichloropropane | 1 | UG/L | 1 U | 1 U |
| 1,3-Dichlorobenzene | **3** | UG/L | 0.59 J | 0.47 J |
| 1,4-Dichlorobenzene | **3** | UG/L | 1.3 | 0.87 J |
| 1,4-Dioxane (P-Dioxane) | -- | UG/L | 50 U | 50 U |
| 2-Hexanone | 50 | UG/L | 5 U | 5 U |
| Acetone | 50 | UG/L | 5 U | 5 U |
| Benzene | **1** | UG/L | 1 U | 0.28 J |
| Bromochloromethane | 5 | UG/L | 1 U | 1 U |
| Bromodichloromethane | 50 | UG/L | 1 U | 1 U |
| Bromoform | 50 | UG/L | 1 U | 1 U |
| Bromomethane | 5 | UG/L | 1 UT | 1 U |
| Carbon Disulfide | 60 | UG/L | 1 U | 1 U |
| Carbon Tetrachloride | 5 | UG/L | 1 U | 1 U |
| Chlorobenzene | **5** | UG/L | **8.8** | **7.9** |
| Chloroethane | 5 | UG/L | 1 UT | 1 U |
| Chloroform | 7 | UG/L | 1 U | 1 U |
| Chloromethane | -- | UG/L | 1 UT | 1 U |
| Cis-1,2-Dichloroethylene | **5** | UG/L | 1 U | 1 U |
| Cis-1,3-Dichloropropene | 5 | UG/L | 1 U | 1 U |
| Cyclohexane | -- | UG/L | 1 U | 1 U |

**Table 7. Summary of Volatile Organic Compounds in Groundwater, Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| Sample Designation: | | | MW-18 | MW-18 |
|---|---|---|---|---|
| Sample Date: | | | 01/07/2020 | 03/17/2020 |
| Normal Sample or Field Duplicate: | | | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance Values | Unit | | |
| Dibromochloromethane | 50 | UG/L | 1 U | 1 U |
| Dichlorodifluoromethane | 5 | UG/L | 1 U | 1 U |
| Ethylbenzene | 5 | UG/L | 1 U | 1 U |
| Isopropylbenzene (Cumene) | 5 | UG/L | 1 U | 1 U |
| m,p-Xylene | 5 | UG/L | 0.31 J | 1 U |
| Methyl Acetate | -- | UG/L | 5 U | 5 U |
| Methyl Ethyl Ketone (2-Butanone) | 50 | UG/L | 5 U | 5 U |
| Methyl Isobutyl Ketone (4-Methyl-2-Pentanone) | -- | UG/L | 5 U | 5 U |
| Methylcyclohexane | -- | UG/L | 1 U | 1 U |
| Methylene Chloride | 5 | UG/L | 1 U | 1 U |
| O-Xylene (1,2-Dimethylbenzene) | 5 | UG/L | 1 U | 1 U |
| Styrene | 5 | UG/L | 1 U | 1 U |
| Tert-Butyl Methyl Ether | 10 | UG/L | 0.65 J | 0.69 J |
| Tetrachloroethylene (PCE) | 5 | UG/L | 1 U | 1 U |
| Toluene | 5 | UG/L | 1 U | 1 U |
| Trans-1,2-Dichloroethene | 5 | UG/L | 1 U | 1 U |
| Trans-1,3-Dichloropropene | -- | UG/L | 1 U | 1 U |
| Trichloroethylene (TCE) | 5 | UG/L | 1 U | 1 U |
| Trichlorofluoromethane | 5 | UG/L | 1 U | 1 U |
| Vinyl Chloride | 2 | UG/L | 1 U | 1 U |

**Table 8. Summary of Semi-volatile Organic Compounds in Groundwater, Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| Sample Designation: | | | MW-9 | MW-9 | MW-10 | MW-10 | MW-11 | MW-11 | MW-12 | MW-12 |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | | | 01/07/2020 | 03/16/2020 | 01/06/2020 | 03/16/2020 | 01/06/2020 | 03/16/2020 | 01/06/2020 | 01/06/2020 |
| Normal Sample or Field Duplicate: | | | N | N | N | N | N | N | N | FD |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance Values | Unit | | | | | | | | |
| 1,2,4,5-Tetrachlorobenzene | -- | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| 2,3,4,6-Tetrachlorophenol | -- | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| 2,4,5-Trichlorophenol | -- | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| 2,4,6-Trichlorophenol | -- | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dichlorophenol | 5 | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dimethylphenol | 50 | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dinitrophenol | 10 | UG/L | 20 U | 20 U | 100 U | 40 U | 20 U | 20 U | 20 U | 20 U |
| 2,4-Dinitrotoluene | 5 | UG/L | 2 U | 2 U | 10 U | 4 U | 2 U | 2 U | 2 U | 2 U |
| 2,6-Dinitrotoluene | 5 | UG/L | 2 U | 2 U | 10 U | 4 U | 2 U | 2 U | 2 U | 2 U |
| 2-Chloronaphthalene | 10 | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| 2-Chlorophenol | -- | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| 2-Methylnaphthalene | -- | UG/L | 10 U | 10 U | 9 J | 8.3 J | 10 U | 10 U | 10 U | 10 U |
| 2-Methylphenol (O-Cresol) | -- | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| 2-Nitroaniline | 5 | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| 2-Nitrophenol | -- | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| 3,3'-Dichlorobenzidine | 5 | UG/L | 10 U | 10 U | 50 UT | 20 U | 10 UT | 10 U | 10 UT | 10 UT |
| 3-Nitroaniline | 5 | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| 4,6-Dinitro-2-Methylphenol | -- | UG/L | 20 U | 20 U | 100 U | 40 U | 20 U | 20 U | 20 U | 20 U |
| 4-Bromophenyl Phenyl Ether | -- | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chloro-3-Methylphenol | -- | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chloroaniline | 5 | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chlorophenyl Phenyl Ether | -- | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| 4-Methylphenol (P-Cresol) | -- | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| 4-Nitroaniline | 5 | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| 4-Nitrophenol | -- | UG/L | 20 U | 20 U | 100 U | 40 U | 20 U | 20 U | 20 U | 20 U |
| Acenaphthene | **20** | UG/L | 2.4 J | 3.6 J | **350** | **330** | 10 U | 10 U | 1.9 J | 1.3 J |
| Acenaphthylene | 20 | UG/L | 10 U | 10 U | 50 U | 2 J | 10 U | 10 U | 10 U | 10 U |
| Acetophenone | -- | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| Anthracene | 50 | UG/L | 10 U | 10 U | 12 J | 11 J | 10 U | 10 U | 10 U | 10 U |
| Atrazine | -- | UG/L | 2 U | 2 U | 10 U | 4 U | 2 U | 2 U | 2 U | 2 U |
| Benzaldehyde | -- | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| Benzo(A)Anthracene | 0.002 | UG/L | 1 U | 1 U | 5 U | 2 U | 1 U | 1 U | 1 U | 1 U |

**Table 8. Summary of Semi-volatile Organic Compounds in Groundwater, Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| Sample Designation: | | | MW-9 | MW-9 | MW-10 | MW-10 | MW-11 | MW-11 | MW-12 | MW-12 |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | | | 01/07/2020 | 03/16/2020 | 01/06/2020 | 03/16/2020 | 01/06/2020 | 03/16/2020 | 01/06/2020 | 01/06/2020 |
| Normal Sample or Field Duplicate: | | | N | N | N | N | N | N | N | FD |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance Values | Unit | | | | | | | | |
| Benzo(A)Pyrene | 0 | UG/L | 1 U | 1 UT | 5 U | 2 UT | 1 U | 1 UT | 1 U | 1 U |
| Benzo(B)Fluoranthene | 0.002 | UG/L | 2 U | 2 UT | 10 U | 4 UT | 2 U | 2 UT | 2 U | 2 U |
| Benzo(G,H,I)Perylene | -- | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| Benzo(K)Fluoranthene | 0.002 | UG/L | 1 U | 1 U | 5 U | 2 U | 1 U | 1 U | 1 U | 1 U |
| Benzyl Butyl Phthalate | 50 | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| Biphenyl (Diphenyl) | -- | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Chloroethoxy) Methane | 5 | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | 1 | UG/L | 1 U | 1 U | 5 U | 2 U | 1 U | 1 U | 1 U | 1 U |
| Bis(2-Chloroisopropyl) Ether | 5 | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Ethylhexyl) Phthalate | 5 | UG/L | 2 U | 2 U | 10 U | 4 U | 2 U | 2 U | 2 U | 2 U |
| Caprolactam | -- | UG/L | 10 UT | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| Carbazole | -- | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| Chrysene | 0.002 | UG/L | 2 U | 2 U | 10 U | 4 U | 2 U | 2 U | 2 U | 2 U |
| Dibenz(A,H)Anthracene | -- | UG/L | 1 U | 1 U | 5 U | 2 U | 1 U | 1 U | 1 U | 1 U |
| Dibenzofuran | -- | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| Diethyl Phthalate | 50 | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| Dimethyl Phthalate | 50 | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| Di-N-Butyl Phthalate | 50 | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| Di-N-Octylphthalate | -- | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| Fluoranthene | 50 | UG/L | 10 U | 10 U | 14 J | 13 J | 10 U | 10 U | 10 U | 10 U |
| Fluorene | **50** | UG/L | 10 U | 10 U | **150** | **160** | 10 U | 10 U | 0.96 J | 10 U |
| Hexachlorobenzene | 0.04 | UG/L | 1 U | 1 U | 5 U | 2 U | 1 U | 1 U | 1 U | 1 U |
| Hexachlorobutadiene | 0.5 | UG/L | 1 U | 1 U | 5 U | 2 U | 1 U | 1 U | 1 U | 1 U |
| Hexachlorocyclopentadiene | 5 | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| Hexachloroethane | 5 | UG/L | 2 U | 2 U | 10 U | 4 U | 2 U | 2 U | 2 U | 2 U |
| Indeno(1,2,3-C,D)Pyrene | 0.002 | UG/L | 2 U | 2 U | 10 U | 4 U | 2 U | 2 U | 2 U | 2 U |
| Isophorone | 50 | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| Naphthalene | **10** | UG/L | 10 U | 2 U | **84** | **86** | 10 U | 2 U | 10 U | 10 U |
| Nitrobenzene | 0.4 | UG/L | 1 U | 1 U | 5 U | 2 U | 1 U | 1 U | 1 U | 1 U |
| N-Nitrosodi-N-Propylamine | -- | UG/L | 1 U | 1 U | 5 U | 2 U | 1 U | 1 U | 1 U | 1 U |
| N-Nitrosodiphenylamine | 50 | UG/L | 10 U | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| Pentachlorophenol | 1 | UG/L | 20 U | 20 U | 100 U | 40 U | 20 U | 20 U | 20 U | 20 U |
| Phenanthrene | **50** | UG/L | 10 U | 10 U | **180** | **140** | 10 U | 10 U | 1.1 J | 0.83 J |
| Phenol | 1 | UG/L | 0.63 JT | 10 U | 50 U | 20 U | 10 U | 10 U | 10 U | 10 U |
| Pyrene | 50 | UG/L | 10 U | 10 UT | 17 J | 15 JT | 10 U | 10 UT | 10 U | 10 U |

**Table 8. Summary of Semi-volatile Organic Compounds in Groundwater, Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| Sample Designation: | | | MW-12 | MW-13 | MW-13 | MW-14 | MW-16 | MW-17 | MW-18 | MW-18 |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | | | 03/16/2020 | 03/17/2020 | 03/17/2020 | 03/18/2020 | 01/07/2020 | 01/07/2020 | 01/07/2020 | 03/17/2020 |
| Normal Sample or Field Duplicate: | | | N | N | FD | N | N | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance Values | Unit | | | | | | | | |
| 1,2,4,5-Tetrachlorobenzene | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,3,4,6-Tetrachlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4,5-Trichlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4,6-Trichlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dichlorophenol | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dimethylphenol | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dinitrophenol | 10 | UG/L | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U |
| 2,4-Dinitrotoluene | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| 2,6-Dinitrotoluene | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| 2-Chloronaphthalene | 10 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Chlorophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Methylnaphthalene | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Methylphenol (O-Cresol) | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Nitroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Nitrophenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 3,3'-Dichlorobenzidine | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 3-Nitroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4,6-Dinitro-2-Methylphenol | -- | UG/L | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U |
| 4-Bromophenyl Phenyl Ether | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chloro-3-Methylphenol | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chloroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chlorophenyl Phenyl Ether | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Methylphenol (P-Cresol) | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Nitroaniline | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Nitrophenol | -- | UG/L | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U |
| Acenaphthene | **20** | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 9.4 J | 10 U | 10 U |
| Acenaphthylene | 20 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Acetophenone | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Anthracene | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Atrazine | -- | UG/L | 2 U | 2 U | 2 U | 2 UT | 2 U | 2 U | 2 U | 2 U |
| Benzaldehyde | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Benzo(A)Anthracene | 0.002 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |

**Table 8. Summary of Semi-volatile Organic Compounds in Groundwater, Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| Sample Designation: | | | MW-12 | MW-13 | MW-13 | MW-14 | MW-16 | MW-17 | MW-18 | MW-18 |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | | | 03/16/2020 | 03/17/2020 | 03/17/2020 | 03/18/2020 | 01/07/2020 | 01/07/2020 | 01/07/2020 | 03/17/2020 |
| Normal Sample or Field Duplicate: | | | N | N | FD | N | N | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance Values | Unit | | | | | | | | |
| Benzo(A)Pyrene | 0 | UG/L | 1 UT | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Benzo(B)Fluoranthene | 0.002 | UG/L | 2 UT | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Benzo(G,H,I)Perylene | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Benzo(K)Fluoranthene | 0.002 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Benzyl Butyl Phthalate | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Biphenyl (Diphenyl) | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Chloroethoxy) Methane | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether) | 1 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Bis(2-Chloroisopropyl) Ether | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Ethylhexyl) Phthalate | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Caprolactam | -- | UG/L | 10 U | 10 U | 10 U | 10 UT | 10 UT | 10 UT | 10 UT | 10 U |
| Carbazole | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chrysene | 0.002 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Dibenz(A,H)Anthracene | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Dibenzofuran | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Diethyl Phthalate | 50 | UG/L | 10 U | 10 U | 10 U | 4 J | 10 U | 10 U | 10 U | 10 U |
| Dimethyl Phthalate | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Di-N-Butyl Phthalate | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Di-N-Octylphthalate | -- | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Fluoranthene | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Fluorene | **50** | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Hexachlorobenzene | 0.04 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Hexachlorobutadiene | 0.5 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Hexachlorocyclopentadiene | 5 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Hexachloroethane | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Indeno(1,2,3-C,D)Pyrene | 0.002 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Isophorone | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Naphthalene | **10** | UG/L | 2 U | 2 U | 2 U | 2 U | 10 U | 10 U | 10 U | 2 U |
| Nitrobenzene | 0.4 | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| N-Nitrosodi-N-Propylamine | -- | UG/L | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| N-Nitrosodiphenylamine | 50 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Pentachlorophenol | 1 | UG/L | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U |
| Phenanthrene | **50** | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 0.72 J | 10 U | 0.92 J |
| Phenol | 1 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 UT | 10 UT | 10 UT | 10 U |
| Pyrene | 50 | UG/L | 10 UT | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |

**Table 9. Summary of Metals in Groundwater, Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| Sample Designation: | | | MW-9 | MW-9 | MW-9 | MW-9 | MW-10 | MW-10 | MW-10 | MW-10 | MW-11 | MW-11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | | | 01/07/2020 | 01/07/2020 | 03/16/2020 | 03/16/2020 | 01/06/2020 | 01/06/2020 | 03/16/2020 | 03/16/2020 | 01/06/2020 | 01/06/2020 |
| Normal Sample or Field Duplicate: | | | N | N | N | N | N | N | N | N | N | N |
| Total or Dissolved: | | | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance Values | Unit | | | | | | | | | | |
| Arsenic | **25** | UG/L | 5.3 | 4.6 | 1.9 J | 1.9 J | 2 U | 2 U | 2 U | 2 U | 3.5 | 1 J |
| Barium | 1000 | UG/L | 133 | 120 | 319 | 272 | 106 | 101 | 140 | 125 | 114 | 64.1 |
| Cadmium | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Chromium, Total | 50 | UG/L | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| Cyanide | 200 | UG/L | 4.8 J | NA | 6.8 J | NA | 6.4 J | NA | 9.3 J | NA | 10 U | NA |
| Lead | **25** | UG/L | 2.7 | 1.2 U | 1.2 U | 1.2 U | 0.94 J | 1.2 U | 1.2 U | 1.2 U | 2 | 1.2 U |
| Mercury | 0.7 | UG/L | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U |
| Selenium | 10 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Silver | 50 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |

**Table 9. Summary of Metals in Groundwater, Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| Sample Designation: | | | MW-11 | MW-11 | MW-12 | MW-12 | MW-12 | MW-12 | MW-12 | MW-12 | MW-13 | MW-13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | | | 03/16/2020 | 03/16/2020 | 01/06/2020 | 01/06/2020 | 01/06/2020 | 01/06/2020 | 03/16/2020 | 03/16/2020 | 03/17/2020 | 03/17/2020 |
| Normal Sample or Field Duplicate: | | | N | N | N | N | FD | FD | N | N | N | N |
| Total or Dissolved: | | | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance Values | Unit | | | | | | | | | | |
| Arsenic | **25** | UG/L | 1 J | 2 U | 4.1 | 2.2 | 4.6 | 2.1 | 1.3 J | 0.91 J | **115** | **49.9** |
| Barium | 1000 | UG/L | 89.1 | 84.3 | 87.9 | 69.3 | 87.8 | 68.1 | 58.3 | 50.6 | 6.1 | 2.3 J |
| Cadmium | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Chromium, Total | 50 | UG/L | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U | 4 U |
| Cyanide | 200 | UG/L | 10 U | NA | 4.3 J | NA | 10 U | NA | 19 | NA | 4.3 J | NA |
| Lead | **25** | UG/L | 0.84 J | 1.2 U | **35.9** | 1.2 U | **32** | 1.2 U | 6 | 1.4 | 1.9 | 1.2 U |
| Mercury | 0.7 | UG/L | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U |
| Selenium | 10 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Silver | 50 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |

**Table 9. Summary of Metals in Groundwater, Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| Sample Designation: | | | MW-13 | MW-13 | MW-14 | MW-14 | MW-16 | MW-16 | MW-17 | MW-17 | MW-18 | MW-18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | | | 03/17/2020 | 03/17/2020 | 03/18/2020 | 03/18/2020 | 01/07/2020 | 01/07/2020 | 01/07/2020 | 01/07/2020 | 01/07/2020 | 01/07/2020 |
| Normal Sample or Field Duplicate: | | | FD | FD | N | N | N | N | N | N | N | N |
| Total or Dissolved: | | | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved | Total | Dissolved |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance Values | Unit | | | | | | | | | | |
| Arsenic | **25** | UG/L | **118** | **58.6** | 8.5 | 3.7 | 3.1 | 1.3 J | 2 U | 2 U | 10.2 | 2 |
| Barium | 1000 | UG/L | 4 | 1.3 J | 76.1 | 62.6 | 43.9 | 30.5 | 116 | 105 | 283 | 156 |
| Cadmium | 5 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |
| Chromium, Total | 50 | UG/L | 4 U | 4 U | 4 U | 4 U | 3.3 J | 4 U | 4 U | 4 U | 4 U | 4 U |
| Cyanide | 200 | UG/L | 10 U | NA | 10 U | NA | 4.9 J | NA | 10 U | NA | 5.4 J | NA |
| Lead | **25** | UG/L | 1.2 U | 1.2 U | 2.5 | 1.2 U | 4.8 | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U |
| Mercury | 0.7 | UG/L | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U |
| Selenium | 10 | UG/L | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Silver | 50 | UG/L | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U | 2 U |

**Table 9. Summary of Metals in Groundwater, Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance Values | Unit | MW-18 | MW-18 |
|---|---|---|---|---|
| Sample Designation: | | | MW-18 | MW-18 |
| Sample Date: | | | 03/17/2020 | 03/17/2020 |
| Normal Sample or Field Duplicate: | | | N | N |
| Total or Dissolved: | | | Total | Dissolved |
| Arsenic | **25** | UG/L | 8.8 | 0.74 J |
| Barium | 1000 | UG/L | 327 | 195 |
| Cadmium | 5 | UG/L | 2 U | 2 U |
| Chromium, Total | 50 | UG/L | 4 U | 4 U |
| Cyanide | 200 | UG/L | 7.6 J | NA |
| Lead | **25** | UG/L | 1.3 | 1.2 U |
| Mercury | 0.7 | UG/L | 0.2 U | 0.2 U |
| Selenium | 10 | UG/L | 10 U | 10 U |
| Silver | 50 | UG/L | 2 U | 2 U |

**Table 10. Summary of Polychlorinated Biphenyls in Groundwater, Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| Sample Designation: | | | MW-9 | MW-9 | MW-10 | MW-10 | MW-11 | MW-11 | MW-12 | MW-12 | MW-12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | | | 01/07/2020 | 03/16/2020 | 01/06/2020 | 03/16/2020 | 01/06/2020 | 03/16/2020 | 01/06/2020 | 01/06/2020 | 03/16/2020 |
| Normal Sample or Field Duplicate: | | | N | N | N | N | N | N | N | FD | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance Values | Unit | | | | | | | | | |
| PCB-1016 (Aroclor 1016) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1221 (Aroclor 1221) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1232 (Aroclor 1232) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1242 (Aroclor 1242) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1248 (Aroclor 1248) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1254 (Aroclor 1254) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1260 (Aroclor 1260) | -- | UG/L | 0.29 J | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1262 (Aroclor 1262) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1268 (Aroclor 1268) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| Polychlorinated Biphenyl (PCBs) | **0.09** | UG/L | **0.29 J** | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |

**Table 10. Summary of Polychlorinated Biphenyls in Groundwater, Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| Sample Designation: | | | MW-13 | MW-13 | MW-14 | MW-16 | MW-17 | MW-18 | MW-18 |
|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | | | 03/17/2020 | 03/17/2020 | 03/18/2020 | 01/07/2020 | 01/07/2020 | 01/07/2020 | 03/17/2020 |
| Normal Sample or Field Duplicate: | | | N | FD | N | N | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance Values | Unit | | | | | | | |
| PCB-1016 (Aroclor 1016) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.8 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1221 (Aroclor 1221) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.8 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1232 (Aroclor 1232) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.8 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1242 (Aroclor 1242) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.8 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1248 (Aroclor 1248) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.8 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1254 (Aroclor 1254) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.8 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1260 (Aroclor 1260) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 10 | 4.5 | 0.4 U | 0.4 U |
| PCB-1262 (Aroclor 1262) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.8 U | 0.4 U | 0.4 U | 0.4 U |
| PCB-1268 (Aroclor 1268) | -- | UG/L | 0.4 U | 0.4 U | 0.4 U | 0.8 U | 0.4 U | 0.4 U | 0.4 U |
| Polychlorinated Biphenyl (PCBs) | **0.09** | UG/L | 0.4 U | 0.4 U | 0.4 U | **10** | **4.5** | 0.4 U | 0.4 U |

**Table 11. Summary of Pesticides and Herbicides in Groundwater, Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| Sample Designation: | | | MW-9 | MW-9 | MW-10 | MW-10 | MW-11 | MW-11 | MW-12 | MW-12 |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | | | 01/07/2020 | 03/16/2020 | 01/06/2020 | 03/16/2020 | 01/06/2020 | 03/16/2020 | 01/06/2020 | 01/06/2020 |
| Normal Sample or Field Duplicate: | | | N | N | N | N | N | N | N | FD |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance Values | Unit | | | | | | | | |
| 2,4-D (Dichlorophenoxyacetic Acid) | 50 | UG/L | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U |
| Acetic acid, (2,4,5-trichlorophenoxy)- | -- | UG/L | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U |
| Aldrin | 0 | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Alpha Bhc (Alpha Hexachlorocyclohexane) | -- | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Alpha Endosulfan | -- | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Beta Bhc (Beta Hexachlorocyclohexane) | -- | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Beta Endosulfan | -- | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Delta BHC (Delta Hexachlorocyclohexane) | -- | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Dieldrin | 0.004 | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Endosulfan Sulfate | -- | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Endrin | 0 | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Endrin Aldehyde | 5 | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Endrin Ketone | -- | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Gamma Bhc (Lindane) | -- | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Heptachlor | 0.04 | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Heptachlor Epoxide | 0.03 | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Methoxychlor | 35 | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| P,P'-DDD | 0.3 | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| P,P'-DDE | 0.2 | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| P,P'-DDT | 0.2 | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.057 | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Silvex (2,4,5-TP) | 0.26 | UG/L | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U |
| Toxaphene | 0.06 | UG/L | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U |

**Table 11. Summary of Pesticides and Herbicides in Groundwater, Gowanus Village I LLC, 153 2nd Street, Brooklyn, New York**

| Sample Designation: | | | MW-12 | MW-13 | MW-13 | MW-14 | MW-16 | MW-17 | MW-18 | MW-18 |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date: | | | 03/16/2020 | 03/17/2020 | 03/17/2020 | 03/18/2020 | 01/07/2020 | 01/07/2020 | 01/07/2020 | 03/17/2020 |
| Normal Sample or Field Duplicate: | | | N | N | FD | N | N | N | N | N |
| Parameter | NYSDEC Ambient Water-Quality Standards and Guidance Values | Unit | | | | | | | | |
| 2,4-D (Dichlorophenoxyacetic Acid) | 50 | UG/L | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U |
| Acetic acid, (2,4,5-trichlorophenoxy)- | -- | UG/L | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U |
| Aldrin | 0 | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Alpha Bhc (Alpha Hexachlorocyclohexane) | -- | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Alpha Endosulfan | -- | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Beta Bhc (Beta Hexachlorocyclohexane) | -- | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Beta Endosulfan | -- | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Delta BHC (Delta Hexachlorocyclohexane) | -- | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Dieldrin | 0.004 | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Endosulfan Sulfate | -- | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Endrin | 0 | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Endrin Aldehyde | 5 | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Endrin Ketone | -- | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Gamma Bhc (Lindane) | -- | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Heptachlor | 0.04 | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Heptachlor Epoxide | 0.03 | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Methoxychlor | 35 | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| P,P'-DDD | 0.3 | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.088 | 0.12 |
| P,P'-DDE | 0.2 | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.017 JP |
| P,P'-DDT | 0.2 | UG/L | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Silvex (2,4,5-TP) | 0.26 | UG/L | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U |
| Toxaphene | 0.06 | UG/L | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U |

**Table 12. Historical Soil Vapor Sample Exceedances**
**Gowanus Village I LLC, Brooklyn, New York**

| | **Sample Designation:** | SG-1 | SG-2 | SG-3 | SG-4 | SG-5 | SG-6 | SG-7 | SG-8 |
|---|---|---|---|---|---|---|---|---|---|
| | **Sample Date:** | 3/22/2007 | 3/21/2007 | 3/22/2007 | 3/22/2007 | 3/22/2007 | 3/22/2007 | 3/29/2007 | 3/21/2007 |
| Parameter | NYSDEC DOH Soil Vapor/Indoor Air Guidance Value | | | | | | | | |
| **VOCs (µg/l)** | | | | | | | | | |
| 1,1,1-Trichloroethane | 100 | ND | ND | ND | ND | ND | ND | ND | ND |
| cis-1,2-Dichloroethene | 6 | ND | ND | ND | ND | ND | ND | ND | ND |
| Methylene Chloride | 100 | ND | ND | ND | ND | ND | ND | ND | ND |
| Tetrachloroethene | 100 | 444.8 | 118 | 130.2 | NE | NE | NE | NE | NE |
| Trichloroethene | 6 | 154.8 | 25 | 12.7 | ND | ND | 11.6 | ND | ND |

**Table 12. Historical Soil Vapor Sample Exceedances**
**Gowanus Village I LLC, Brooklyn, New York**

| | **Sample Designation:** | SG-9 | SG-10 | PELM-SV1 | PELM-SV2 | PELM-SV3 | PELM-SV4 | PELM-SV5 |
|---|---|---|---|---|---|---|---|---|
| | **Sample Date:** | 3/29/2007 | 3/22/2007 | 9/22/2011 | 9/22/2011 | 9/22/2011 | 9/22/2011 | 9/22/2011 |
| Parameter | NYSDEC DOH Soil Vapor/Indoor Air Guidance Value | | | | | | | |
| **VOCs (µg/l)** | | | | | | | | |
| 1,1,1-Trichloroethane | 100 | ND | ND | ND | ND | ND | NE | ND |
| cis-1,2-Dichloroethene | 6 | ND | ND | ND | ND | NE | NE | ND |
| Methylene Chloride | 100 | ND | ND | NE | NE | ND | ND | NE |
| Tetrachloroethene | 100 | NE | 254.3 | NE | NE | NE | NE | NE |
| Trichloroethene | 6 | ND | 27.9 | ND | 26.3 | 15.3 | 75.2 | ND |

**Table 12. Historical Soil Vapor Sample Exceedances**
**Gowanus Village I LLC, Brooklyn, New York**

| | **Sample Designation:** | PELM-SV6 | PELM-SV7 | PELM-SV8 | PELM-SV9 | PELM-SV10 | PELM-SV11 | PELM-SV12 |
|---|---|---|---|---|---|---|---|---|
| | **Sample Date:** | 9/22/2011 | 9/22/2011 | 9/22/2011 | 9/22/2011 | 9/22/2011 | 9/22/2011 | 9/22/2011 |
| Parameter | NYSDEC DOH Soil Vapor/Indoor Air Guidance Value | | | | | | | |
| **VOCs (µg/l)** | | | | | | | | |
| 1,1,1-Trichloroethane | 100 | NE | NE | NE | NE | NE | NE | ND |
| cis-1,2-Dichloroethene | 6 | ND | ND | ND | ND | ND | ND | ND |
| Methylene Chloride | 100 | NE | NE | NE | NE | NE | NE | NE |
| Tetrachloroethene | 100 | NE | NE | NE | NE | NE | NE | NE |
| Trichloroethene | 6 | 175 | 20.3 | ND | 54.8 | 10.3 | 61.8 | ND |

**Table 12. Historical Soil Vapor Sample Exceedances**
**Gowanus Village I LLC, Brooklyn, New York**

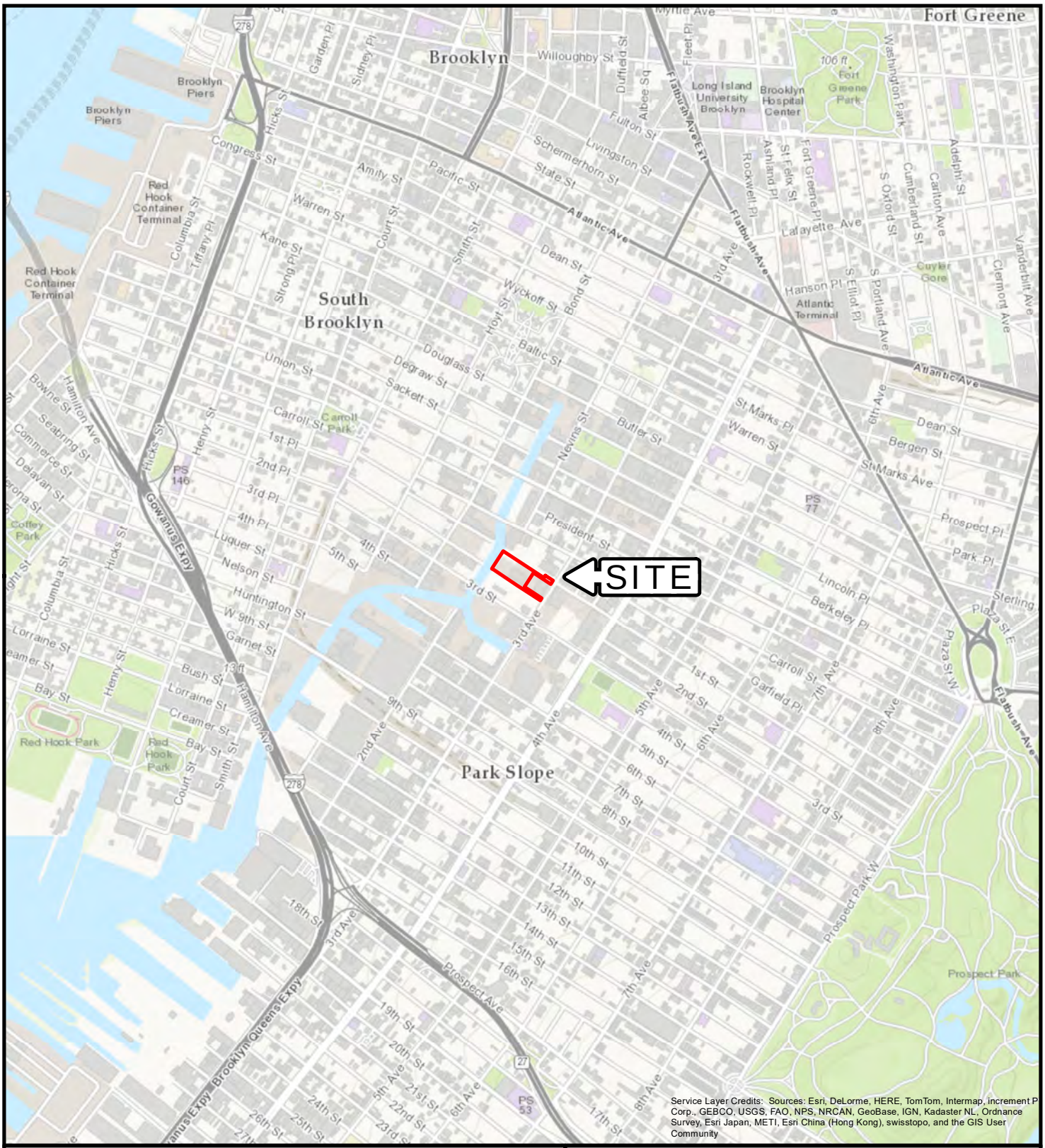
| | **Sample Designation:** | PELM-SV13 | PELM-SV14 | PELM-SV15 | PELM-SV16 | PELM-SV17 | PELM-SV18 | PELM-SV19 |
|---|---|---|---|---|---|---|---|---|
| | **Sample Date:** | 9/22/2011 | 9/22/2011 | 9/22/2011 | 9/22/2011 | 9/22/2011 | 9/22/2011 | 9/22/2011 |
| Parameter | NYSDEC DOH Soil Vapor/Indoor Air Guidance Value | | | | | | | |
| **VOCs (µg/l)** | | | | | | | | |
| 1,1,1-Trichloroethane | 100 | NE | NE | ND | NE | ND | ND | ND |
| cis-1,2-Dichloroethene | 6 | ND | ND | ND | ND | ND | ND | ND |
| Methylene Chloride | 100 | NE | NE | NE | NE | NE | NE | NE |
| Tetrachloroethene | 100 | NE | NE | NE | NE | NE | NE | NE |
| Trichloroethene | 6 | ND | NE | ND | NE | 6.99 | NE | NE |

**Table 12. Historical Soil Vapor Sample Exceedances**
**Gowanus Village I LLC, Brooklyn, New York**

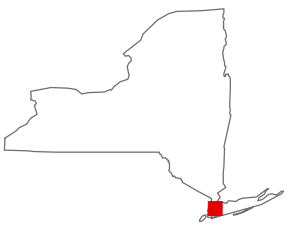
| | **Sample Designation:** | PELM-SV20 | PELM-SV21 | PELM-SV22 | PELM-SV23 | PELM-SV24 | PELM-SV25 |
|---|---|---|---|---|---|---|---|
| | **Sample Date:** | 9/22/2011 | 9/22/2011 | 9/22/2011 | 9/22/2011 | 9/22/2011 | 9/22/2011 |
| Parameter | NYSDEC DOH Soil Vapor/Indoor Air Guidance Value | | | | | | |
| **VOCs (µg/l)** | | | | | | | |
| 1,1,1-Trichloroethane | 100 | ND | ND | ND | ND | ND | ND |
| cis-1,2-Dichloroethene | 6 | ND | ND | ND | ND | ND | 51.9 |
| Methylene Chloride | 100 | NE | NE | NE | NE | NE | NE |
| Tetrachloroethene | 100 | 1,260 | NE | NE | NE | NE | NE |
| Trichloroethene | 6 | ND | ND | 31.3 | ND | 126 | 360 |

# FIGURES

1. Site Map
2. Engineering Control Location – Composite Cover System
3. Groundwater Contour Map and January and March 2020 Sample Exceedances
4. Cross Sections and Details
5. SVOCs and PCB Concentrations in Soil Confirmatory Endpoint Samples in Areas of Additional Excavation
6. Remaining Total SVOCs and PCB Concentrations in Soil
7. Remaining PCB and Total SVOC Soil Exceedances Below Turbine Hall Building Slab
8. Historical Soil Vapor Sample Exceedances




QUADRANGLE LOCATION



N

750 0 750 1,500

Feet

Title:

## SITE LOCATION MAP

SITE MANAGEMENT PLAN
GOWANUS VILLAGE 1, LLC
BROOKLYN, NEW YORK

Prepared For:

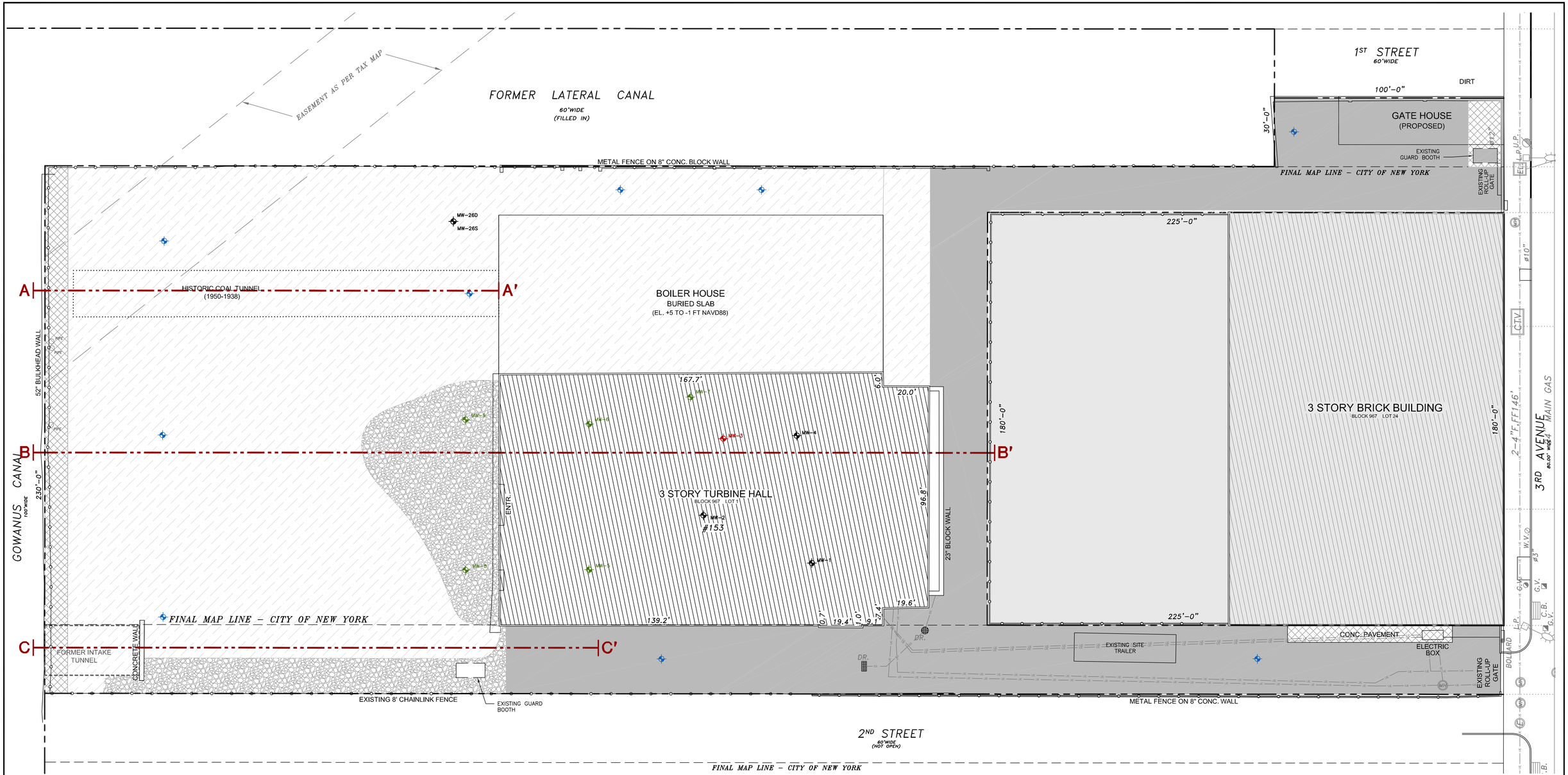
BRT POWERHOUSE LLC

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

| | |
|---|---|
| Compiled by: L.D. | Date: 20JUL17 |
| Prepared by: M.R. | Scale: AS SHOWN |
| Project Mgr: M.A. | Project: 2705.0001Y000 |
| File: 2705.0001Y181.2.mxd | |

FIGURE 1

V:\GIS\Projects\2705Y\0001Y\181\2705.0001Y181.2.mxd




LEGEND

- EXISTING BUILDING OR STRUCTURE
- PROPERTY LINE
- FENCE LINE
- EXISTING UNDERGROUND ELECTRIC
- EXISTING STORM WATER SEWER
- EXISTING MANHOLE
- EXISTING STORM WATER DRYWELL
- MW-3 LOCATION & DESIGNATION OF RECOVERY/ MONITORING WELLS
- MW-1 LOCATION AND DESIGNATION OF MONITORING WELL INSTALLED BY LBG
- APPROXIMATE LOCATION OF PROPOSED MONITORING WELLS
- MW-5 LOCATION AND DESIGNATION OF MONITORING WELL INSTALLED BY ROUX 2017
- A LINE OF GEOLOGIC SECTION
- ASPHALT CAP
- CLEAN STONE
- EXISTING CONCRETE SLAB
- RECYCLED CONCRETE AGGREGATE

NOTE

BASE MAP PREPARED FROM SURVEY PERFORMED BY PERFECT POINT LAND SURVEYING, RT, JANUARY 2017.

20' 0 20'

| NO. | DATE | REVISION DESCRIPTION | INT. |
|---|---|---|---|
| | | | |

UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF STATE LAW.

THESE DOCUMENTS (OR COPIES OF ANY THEREOF) PREPARED BY OR BEARING THE SEAL OF THE ENGINEER, SHALL NOT BE REUSED FOR ANY EXTENSIONS OF THE PROJECT OR ANY OTHER PROJECT WITHOUT THE WRITTEN CONSENT OF THE ENGINEER.

| | | | |
|---|---|---|---|
| PROJ. ENGINEER: C.M. | | DRAWN BY: J.A.D. | |
| DESIGNED BY: J.K. | | CHECKED BY: C.P. | |
| DRAWING SCALE: AS SHOWN | | PLOT SCALE: 1:1 | |
| DRAWING DATE: 06NOV17 | | PRINT TYPE: COLOR | |
| OFFICE: NY | | PAPER SIZE: ARCH D | |
| PROJECT NO.: | 2705.0001Y000 | | |
| DRAWING FILE: | 2705.0001Y181.04.DWG | | |

Remedial
REMEDIAL ENGINEERING, P.C.
209 Shafter Street
Islandia, New York 11749 (631) 232-2600

PROJECT NAME:
SITE MANAGEMENT PLAN
GOWANUS VILLAGE I, LLC - BROOKLYN, NEW YORK

PROJECT FOR:
BRT POWERHOUSE LLC

TITLE:
ENGINEERING CONTROL LOCATION - COMPOSITE COVER SYSTEM

FIGURE
2
FIGURE 2 OF 8

V:\CAD\PROJECTS\2705\Y\0001Y\181\2705.0001Y181.04.DWG

FORMER LATERAL CANAL
60'WIDE
(FILLED IN)

EASEMENT AS PER TAX MAP

1ST STREET
60'WIDE

DIRT

100'–0"

GATE HOUSE
(PROPOSED)

EXISTING
GUARD BOOTH

EXISTING
ROLL-UP
GATE

30'–0"

FINAL MAP LINE – CITY OF NEW YORK

METAL FENCE ON 8" CONC. BLOCK WALL

225'–0"

| MW-16 | 01/07/2020 | 03/17/2020 |
|---|---|---|
| VOCs | | |
| 1,3-Dichlorobenzene | 8.1 | NS |
| 1,4-Dichlorobenzene | 46 | NS |
| Chlorobenzene | 9.9 | NS |
| PCBs | 10 | NS |

MW-16
(SEE NOTE 5)

| MW-17 | 01/07/2020 | 03/17/2020 |
|---|---|---|
| VOCs | | |
| 1,3-Dichlorobenzene | 7.3 | NS |
| 1,4-Dichlorobenzene | 25 | NS |
| Chlorobenzene | 15 | NS |
| PCBs | 4.5 | NS |

MW-17
(SEE NOTE 5)

| MW-18 | 01/07/2020 | 03/17/2020 |
|---|---|---|
| VOCs | | |
| Chlorobenzene | 8.8 | 7.9 |

MW-18*
2.87

| MW-14 | 01/07/2020 | 03/18/2020 |
|---|---|---|
| VOCs | | |
| Cis-1,2-Dichloroethylene | NS | 6 |

MW-14
(SEE NOTE 4)

HISTORIC COAL TUNNEL
(1950-1938)

FORMER
BOILER HOUSE SLAB
(EL. +5 TO -1 FT NAVD88)

MW-15

| MW-9 | 01/07/2020 | 03/16/2020 |
|---|---|---|
| VOCs | | |
| 1,2,4-Trichlorobenzene | 13 | NE |
| 1,2-Dichlorobenzene | 7 | 5.9 |
| 1,3-Dichlorobenzene | 85 | 94 |
| 1,4-Dichlorobenzene | 340 | 390 |
| Benzene | NE | 1.6 |
| Chlorobenzene | 130 | 250 |
| PCBs | 0.29 J | ND |

MW-9*
3.36

MW-13
(SEE NOTE 4)

| MW-13 | 01/07/2020 | 3/17/20 | 03/17/2020 DUP |
|---|---|---|---|
| VOCs | | | |
| Chlorobenzene | NS | 11 | 12 |
| Metals, Total | | | |
| Arsenic | NS | 115 | 118 |
| Metals, Filtered | | | |
| Arsenic | NS | 49.9 | 58.6 |

52" BULKHEAD WALL

GOWANUS CANAL
100'WIDE

230'–0"

167.7'

20.0'

96.8'

180'–0"

3 STORY BRICK BUILDING
BLOCK 967 LOT 24

3 STORY TURBINE HALL
BLOCK 967 LOT 1

#153

ENTR.

23" BLOCK WALL

| MW-10 | 01/06/2020 | 03/16/2020 |
|---|---|---|
| VOCs | | |
| Benzene | 2.2 | 2.5 |
| SVOCs | | |
| Acenaphthene | 350 | 330 |
| Fluorene | 150 | 160 |
| Naphthalene | 84 | 86 |
| Phenanthrene | 180 | 140 |

| MW-8 | 01/07/2020 | 03/16/2020 |
|---|---|---|
| VOCs | NS | NS |
| SVOCs | NS | NS |
| Metals, Total | NS | NS |
| Metals, Filtered | NS | NS |
| PCBs | NS | NS |
| Pesticides | NS | NS |

| MW-12 | 01/06/2020 | 01/06/2020 DUP | 03/16/2020 |
|---|---|---|---|
| Metals, Total | | | |
| Lead | 35.9 | 32 | NE |

MW-12*
1.97
(SEE NOTE 3)

FINAL MAP LINE – CITY OF NEW YORK

CONCRETE WALL

FORMER INTAKE
TUNNEL

EXISTING 8' CHAINLINK FENCE

EXISTING
BOOTH

MW-11*
5.48

| MW-11 | 01/06/2020 | 03/16/2020 |
|---|---|---|
| VOCs | ND | ND |
| SVOCs | ND | ND |
| Metals, Total | NE | NE |
| Metals, Filtered | NE | NE |
| PCBs | ND | ND |
| Pesticides | ND | ND |

139.2'

19.4'

9.0'

7.4'

19.6'

0.7'

EXISTING SITE
TRAILER

MW-10*
6.46

CONC. PAVEMENT

ELECTRIC
BOX

BOLLARD

EXISTING
ROLL-UP
GATE

METAL FENCE ON 8" CONC. WALL

2ND STREET
60'WIDE
(NOT OPEN)

FINAL MAP LINE – CITY OF NEW YORK

3RD AVENUE
66.00' WIDE
MAIN GAS

2–4"F.F.146'

CTV

W.V.

G.V.

C.B.

L.P.

E.L.P.U.P.

1 2 3 4 5 6 7

## LEGEND

- EXISTING BUILDING OR STRUCTURE
- PROPERTY LINE
- FENCE LINE
- UE — UE — EXISTING UNDERGROUND ELECTRIC
- SS — SS — EXISTING STORM WATER SEWER
- MH — EXISTING MANHOLE
- DR. — EXISTING STORM WATER DRYWELL
- APPROXIMATE LOCATION OF FORMER LATERAL DISCHARGE TUNNELS
- MW-10 — LOCATION AND DESIGNATION OF MONITORING WELL
- MW-1 — LOCATION AND DESIGNATION OF DESTROYED MONITORING WELL
- MW-15 — PROPOSED LOCATION AND DESIGNATION OF MONITORING WELL
- ASPHALT CAP
- CLEAN STONE
- EXISTING CONCRETE SLAB
- RECYCLED CONCRETE AGGREGATE
- 2 — GROUNDWATER ELEVATION CONTOUR
- 1.97 — ELEVATION OF WATER TABLE ON MARCH 12, 2020
- * — MONITORING WELL ELEVATION USED FOR GROUNDWATER CONTOURS ON MARCH 12, 2020

## DATA BOX KEY

SAMPLE DESIGNATION → MW-18 | 01/07/2020 | 03/17/2020 | ← SAMPLE DATE

| VOCs | | |
|---|---|---|
| Chlorobenzene | 8.8 | 7.9 |

PARAMETER → CONCENTRATION

| Parameter | NYSDEC AWQSGV |
|---|---|
| VOCs | |
| 1,2,4-Trichlorobenzene | 5 |
| 1,2-Dichlorobenzene | 3 |
| 1,3-Dichlorobenzene | 3 |
| 1,4-Dichlorobenzene | 3 |
| Benzene | 1 |
| Chlorobenzene | 5 |
| Cis-1,2-Dichloroethylene | 5 |
| SVOCs | |
| Acenaphthene | 20 |
| Fluorene | 50 |
| Naphthalene | 10 |
| Phenanthrene | 50 |
| Metals, Total | |
| Arsenic | 25 |
| Lead | 25 |
| Metals, Filtered | |
| Arsenic | 25 |
| Lead | 25 |
| PCBs | 0.09 |

CONCENTRATIONS IN ug/L

ug/L – MICROGRAMS PER LITER

* – NYSDEC AWQSGVs

NYSDEC – NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

AWQSGVs – AMBIENT WATER-QUALITY STANDARDS AND GUIDANCE VALUES

VOCs – VOLATILE ORGANIC COMPOUNDS

SVOCs – SEMIVOLATILE ORGANIC COMPOUNDS

PCBs – POLYCHLORINATED BIPHENYLS

– – NOT DETECTED ABOVE NYSDEC AWQSGV

J – ESTIMATED VALUE

DUP – DUPLICATE SAMPLE

ND – NO DETECTION

NE – NO EXCEEDANCE

NS – NOT SAMPLED

## NOTES

1. BASE MAP PREPARED FROM SURVEY PERFORMED BY PERFECT POINT LAND SURVEYING, RT, JANUARY 2017.
2. LOCATIONS OF MONITORING WELL MW-12, MW-13 AND MW-14 ARE APPROXIMATE AND WILL BE FINALIZED AFTER A SURVEY.
3. MW-12 INSTALLED ON DECEMBER 18, 2019.
4. MW-13 AND MW-14 INSTALLED ON FEBRUARY 20, 2020 AND FEBRUARY 21, 2020, RESPECTIVELY.
5. MW-16 AND MW-17 WERE DESTROYED DURING REDEVELOPMENT ACTIVITIES IN FEBRUARY 2020.
6. ALL ELEVATION DATA IS IN FEET RELATIVE TO THE NEW YORK STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN VERTICAL DATUM OF 1980 (NAVD88).

20' 0 20'

| NO. | DATE | REVISION DESCRIPTION | INT. |
|---|---|---|---|

UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF STATE LAW.

THESE DOCUMENTS (OR COPIES OF ANY THEREOF) PREPARED BY OR BEARING THE SEAL OF THE ENGINEER, SHALL NOT BE REUSED FOR ANY EXTENSIONS OF THE PROJECT OR ANY OTHER PROJECT WITHOUT THE WRITTEN CONSENT OF THE ENGINEER.

| | | | |
|---|---|---|---|
| PROJ. ENGINEER: | C.M. | DRAWN BY: | G.M. |
| DESIGNED BY: | P.R. | CHECKED BY: | C.P. |
| DRAWING SCALE: | AS SHOWN | PLOT SCALE: | 1:1 |
| DRAWING DATE: | 13MAY20 | PRINT TYPE: | COLOR |
| OFFICE: | NY | PAPER SIZE: | ARCH D |
| PROJECT NO.: | 2705.0001Y005 | | |
| DRAWING FILE: | 2705.0001Y181.01.DWG | | |

ROUX
Roux Environmental Engineering & Geology, D.P.C.
209 SHAFTER STREET, ISLANDIA, NEW YORK 11746
(631) 232-2600

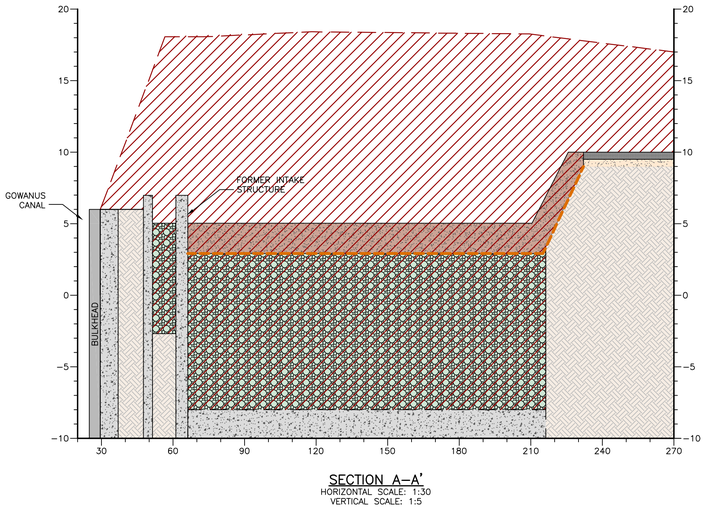
PROJECT NAME:
SITE MANAGEMENT PLAN
GOWANUS VILLAGE I, LLC - BROOKLYN, NEW YORK

PROJECT FOR:
BRT POWERHOUSE LLC

TITLE:
GROUNDWATER CONTOUR MAP AND JANUARY AND MARCH 2020 SAMPLE EXCEEDANCES

FIGURE
3
FIGURE 3 OF 8

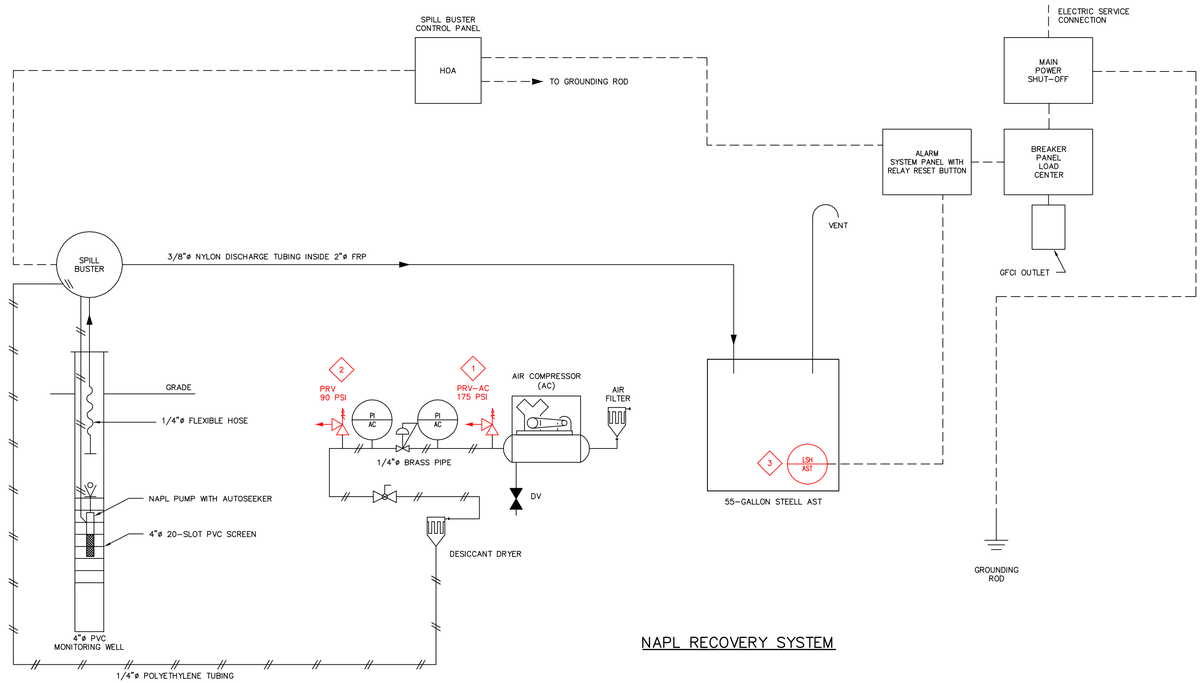
C:\USERS\USER\DESKTOP\ROUX WORK\2705.0001Y181.01.DWG




## SECTION A–A'
HORIZONTAL SCALE: 1:30
VERTICAL SCALE: 1:5

KEY

- DEMARCATION LAYER
- EXTENT OF EXCAVATION
- TYPICAL COVER SYSTEM
- RCA BACKFILL
- EXISTING UNDISTURBED MATERIAL
- SAND LEVELING COARSE
- 3/4 INCH CLEAN STONE
- CONCRETE TOPPING SLAB
- ASPHALT
- EXISTING BRICK WALL OF TURBINE HALL
- TENCATE MIRAFI® 140N FILTER FABRIC




## NAPL RECOVERY SYSTEM

LEGEND

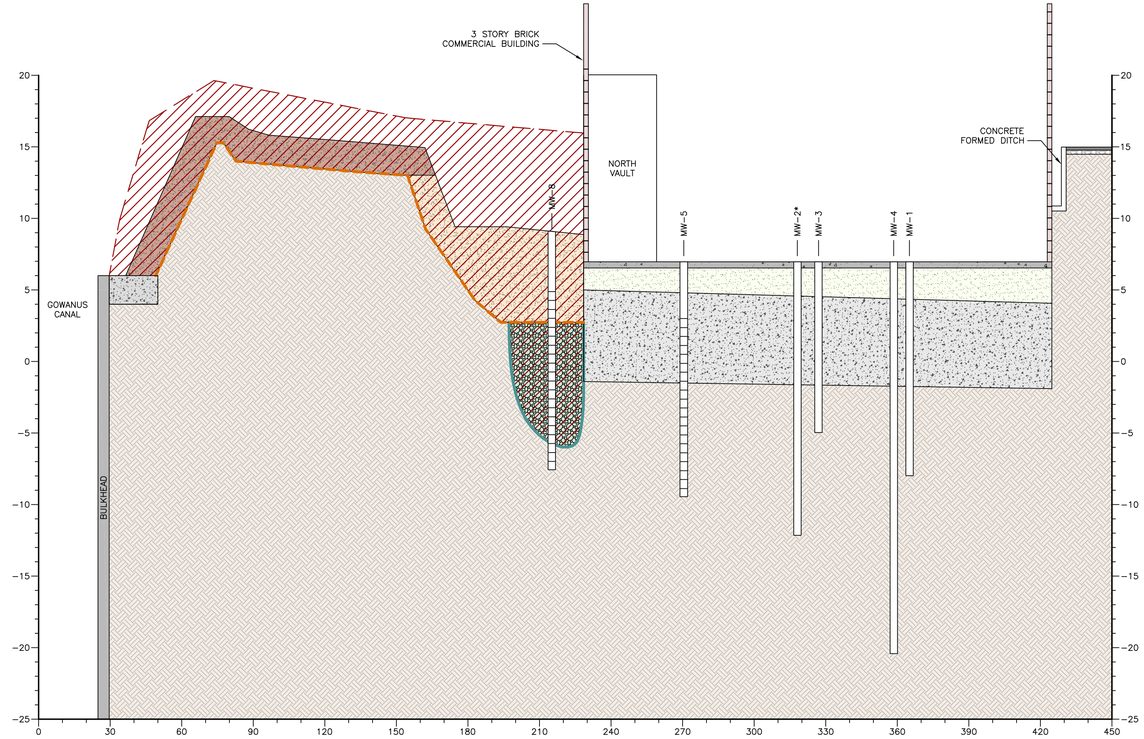
- RECOVERED LNAPL STREAM
- ELECTRICAL/SIGNAL CONDUITS
- PNEUMATIC LINE
- FLEXIBLE HOSE
- REGULATOR
- BALL VALVE
- BALL CHECK VALVE
- AST ABOVEGROUND STORAGE TANK
- FRP FIBRE–REINFORCED PLASTIC
- HOA SELECTOR SWITCH HAND–OFF–AUTO
- GM GALVANIZED
- PSI POUND PER SQUARE INCH
- AC AIR COMPRESSOR
- PVC POLYVINYL CHLORIDE
- LSH HIGH LEVEL SWITCH
- ERW ELECTRIC RECOVERY WELL AND PUMP
- PRV PRESSURE RELIEF VALVE
- NAPL NON–AQUEOUS PHASE LIQUID
- GFCI GROUND–FAULT CIRCUIT INTERRUPTER
- DV DRAIN VALVE
- MW MONITORING WELL

CRITICAL EQUIPMENT SCHEDULE

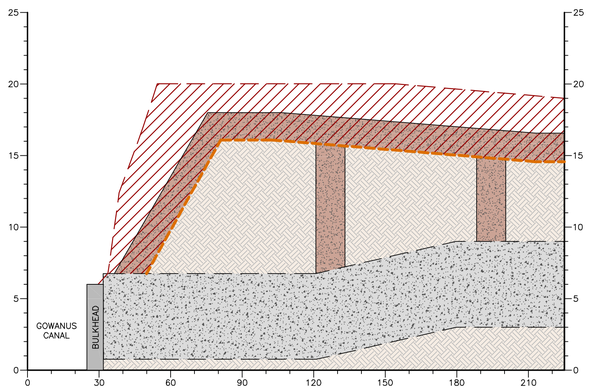
1. AIR COMPRESSOR PRESSURE RELIEF VALVE
2. IN–LINE PRESSURE RELIEF VALVE
3. AST HIGH LEVEL SWITCH

NOTE

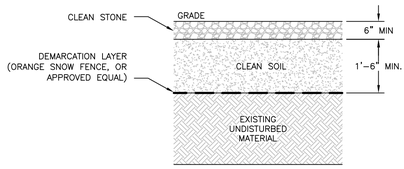
CRITICAL EQUIPMENT SHOWN IN RED.



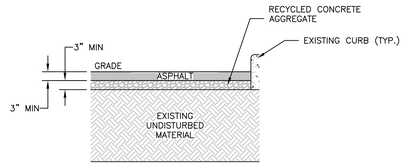

## SECTION B–B'
HORIZONTAL SCALE: 1:30
VERTICAL SCALE: 1:5




## SECTION C–C'
HORIZONTAL SCALE: 1:30
VERTICAL SCALE: 1:5




## 1/4 TYPICAL CLEAN SOIL COVER SYSTEM DETAIL
SCALE: 1"=2'




## 1A/4 TYPICAL ASPHALT COVER SYSTEM DETAIL
SCALE: 1"=2'

| NO. | DATE | REVISION DESCRIPTION | INT. |
|---|---|---|---|
| | | | |

UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF STATE LAW.

THESE DOCUMENTS (OR COPIES OF ANY THEREOF) PREPARED BY OR BEARING THE SEAL OF THE ENGINEER, SHALL NOT BE REUSED FOR ANY EXTENSIONS OF THE PROJECT OR ANY OTHER PROJECT WITHOUT THE WRITTEN CONSENT OF THE ENGINEER.

| | | | |
|---|---|---|---|
| PROJ. ENGINEER: C.M. | | DRAWN BY: J.A.D. | |
| DESIGNED BY: J.K. | | CHECKED BY: C.P. | |
| DRAWING SCALE: AS SHOWN | | PLOT SCALE: 1:1 | |
| DRAWING DATE: 06NOV17 | | PRINT TYPE: COLOR | |
| OFFICE: NY | | PAPER SIZE: ARCH D | |
| PROJECT NO.: 2705.0001Y000 | | | |
| DRAWING FILE: 2705.0001Y181.01.DWG | | | |

Remedial
REMEDIAL ENGINEERING, P.C.
209 Shafter Street
Islandia, New York 11749 (631) 232–2600

PROJECT NAME:
SITE MANAGEMENT PLAN
GOWANUS VILLAGE I, LLC - BROOKLYN, NEW YORK

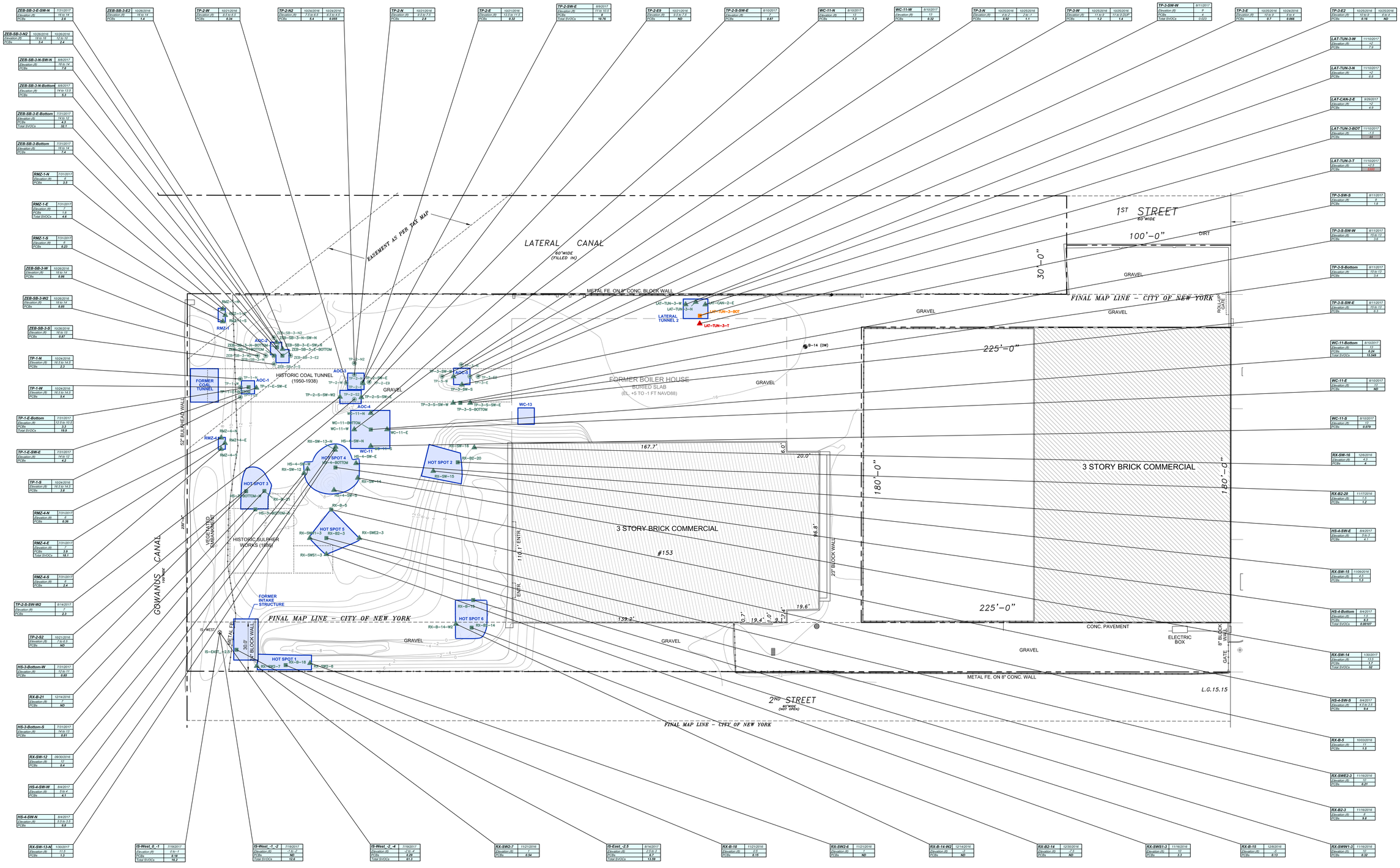
PROJECT FOR:
BRT POWERHOUSE LLC

TITLE:
CROSS SECTIONS AND DETAILS

FIGURE
4

FIGURE 4 OF 8

V:\CAD\PROJECTS\2705\0001Y\181\2705.0001Y181.01.DWG




| NO. | DATE | REVISION DESCRIPTION | INT. |
|---|---|---|---|

UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF STATE LAW.

THESE DOCUMENTS (OR COPIES OF ANY THEREOF) PREPARED BY OR BEARING THE SEAL OF THE ENGINEER, SHALL NOT BE REUSED FOR ANY EXTENSIONS OF THE PROJECT OR ANY OTHER PROJECT WITHOUT THE WRITTEN CONSENT OF THE ENGINEER.

| | |
|---|---|
| PROJ. ENGINEER: C.M. | DRAWN BY: J.A.D. |
| DESIGNED BY: L.D. | CHECKED BY: M.A. |
| DRAWING SCALE: AS SHOWN | PLOT SCALE: 1:1 |
| DRAWING DATE: 15DEC17 | PRINT TYPE: COLOR |
| OFFICE: NY | PAPER SIZE: ARCH D |
| PROJECT NO.: 2705.0001Y000 | |
| DRAWING FILE: 2705.0001Y181.08.DWG | |

Remedial
REMEDIAL ENGINEERING, P.C.
209 Shafter Street
Islandia, New York 11749 (631) 232-2600

PROJECT NAME:
SITE MANAGEMENT PLAN
GOWANUS VILLAGE I, LLC - BROOKLYN, NEW YORK
PROJECT FOR:
BRT POWERHOUSE LLC

TITLE:
SOIL CONFIRMATORY ENDPOINT SAMPLES PCB & TOTAL SVOC CONCENTRATIONS IN AREAS OF ADDITIONAL EXCAVATION

FIGURE
5
FIGURE 5 OF 8

V:\CAD\PROJECTS\2705\V001\Y181\2705.0001Y181.08.DWG

| RMZ-8 | 8/3/2017 |
|---|---|
| Elevation (ft) | 17.5 to 13.5 |
| PCBs | 4.1 |
| Total SVOCs | 13.3 |

| RMZ-10 | 8/29/2017 |
|---|---|
| Elevation (ft) | 15 |
| PCBs | 4.1 |
| Total SVOCs | 23.097 |

| TP-2/TP-3 | 10/26/2017 |
|---|---|
| Elevation (ft) | 9.5 to 8.5 |
| PCBs | 0.23 |

| RX-8 | 5/12/2016 |
|---|---|
| Elevation (ft) | 8.5 |
| PCBs | 0.66 |

| RMZ-11 | 8/17/2017 |
|---|---|
| Elevation (ft) | 15 |
| PCBs | 0.42 |
| Total SVOCs | 15.549 |

| RX-9B | 5/12/2016 |
|---|---|
| Elevation (ft) | 4 |
| PCBs | 0.64 |

| LAT-CAN-1 | 9/15/2017 |
|---|---|
| Elevation (ft) | 8.5 |
| PCBs | 2.2 |
| Total SVOCs | 29.2 |

| RMZ-12 | 8/29/2017 |
|---|---|
| Elevation (ft) | 15 |
| PCBs | 0.29 |
| Total SVOCs | 9.56 |

| RX-B-11 | 2/6/2016 |
|---|---|
| Elevation (ft) | -5 |
| PCBs | ND |
| Total SVOCs | 0.5 |

| RMZ-13 | 8/29/2017 |
|---|---|
| Elevation (ft) | 15 |
| PCBs | 1.1 |
| Total SVOCs | 19.36 |

| RMZ-14 | 8/29/2017 |
|---|---|
| Elevation (ft) | 15 |
| PCBs | 0.46 |
| Total SVOCs | 51.07 |

| RMZ-18 | 9/12/2017 |
|---|---|
| Elevation (ft) | 15 |
| PCBs | 0.78 |
| Total SVOCs | 17.07 |

| TP-1/TP-2 | 10/26/2017 |
|---|---|
| Elevation (ft) | 9.5 to 7.5 |
| PCBs | 0.23 |

| RX-B-6 | 9/30/2016 |
|---|---|
| Elevation (ft) | 12 |
| PCBs | 0.81 |
| Total SVOCs | 37 |

| RMZ-1-E | 7/31/2017 |
|---|---|
| Elevation (ft) | 7 |
| PCBs | 1.8 |
| Total SVOCs | 4.6 |

| RMZ-19 | 9/11/2017 |
|---|---|
| Elevation (ft) | 15 |
| PCBs | 0.077 |
| Total SVOCs | 5.93 |

| RMZ-2 | 7/25/2017 |
|---|---|
| Elevation (ft) | 7 |
| PCBs | 2.2 |
| Total SVOCs | 161.3 |

| RX-8B | 5/12/2016 |
|---|---|
| Elevation (ft) | 4 |
| PCBs | 0.81 |
| Total SVOCs | 45 |

| RMZ-9 | 8/3/2017 |
|---|---|
| Elevation (ft) | 15.5 to 10 |
| PCBs | 5.6 |
| Total SVOCs | 32.6 |

| RX-7 | 5/12/2016 |
|---|---|
| Elevation (ft) | 8.5 |
| PCBs | 2.3 |

| RMZ-3 | 7/25/2017 |
|---|---|
| Elevation (ft) | 7 |
| PCBs | 1.7 |
| Total SVOCs | 40.3 |

| RX-B-12 | 11/15/2016 |
|---|---|
| Elevation (ft) | -2 |
| PCBs | 0.4 |
| Total SVOCs | 9 |

| RMZ-4-E | 7/31/2017 |
|---|---|
| Elevation (ft) | 7 |
| PCBs | 3.9 |
| Total SVOCs | 18.1 |

| RX-7B | 5/12/2016 |
|---|---|
| Elevation (ft) | 4 |
| PCBs | 0.99 |

| RX-SW-14 | 1/30/2017 |
|---|---|
| Elevation (ft) | 7.5 |
| PCBs | 1.7 |
| Total SVOCs | 52 |

| RMZ-5 | 7/25/2017 |
|---|---|
| Elevation (ft) | 7 |
| PCBs | 0.9 |
| Total SVOCs | 8.8 |

| RX-6 | 5/12/2016 |
|---|---|
| Elevation (ft) | 8.5 |
| PCBs | 0.91 |
| Total SVOCs | 38 |

| RX-B-1 | 10/3/2016 |
|---|---|
| Elevation (ft) | 12 |
| PCBs | 0.98 |
| Total SVOCs | 98 |

| RMZ-16 | 9/6/2017 |
|---|---|
| Elevation (ft) | 15 |
| PCBs | 1.1 |
| Total SVOCs | 12.51 |

| RMZ-6 | 7/25/2017 |
|---|---|
| Elevation (ft) | 7 |
| PCBs | 0.43 |
| Total SVOCs | 8.5 |

| RMZ-17 | 9/7/2017 |
|---|---|
| Elevation (ft) | 15 |
| PCBs | 0.057 |
| Total SVOCs | 27.37 |

| RX-SW-11 | 09/30/2016 |
|---|---|
| Elevation (ft) | 12 |
| PCBs | 1.3 |
| Total SVOCs | 38 |

| RX-B-13 | 11/15/2016 |
|---|---|
| Elevation (ft) | -2 |
| PCBs | 2.6 |
| Total SVOCs | 20 |

| RMZ-7 | 7/25/2017 |
|---|---|
| Elevation (ft) | 7 |
| PCBs | 3.3 |
| Total SVOCs | 13.4 |

| RX-B-9 | 10/3/2016 |
|---|---|
| Elevation (ft) | 9 |
| PCBs | 0.96 |
| Total SVOCs | 28 |

| RX-SW-10 | 9/30/2016 |
|---|---|
| Elevation (ft) | 12 |
| PCBs | 0.65 |
| Total SVOCs | 22 |

| RX-SW-9 | 9/30/2016 |
|---|---|
| Elevation (ft) | 11 |
| PCBs | 0.39 |
| Total SVOCs | 12 |

| RX-1 | 5/12/2016 |
|---|---|
| Elevation (ft) | 8.5 |
| PCBs | ND |
| Total SVOCs | 19 |

| RX-B-4 | 10/3/2016 |
|---|---|
| Elevation (ft) | 11 |
| PCBs | 0.21 |
| Total SVOCs | 19 |

| RX-2 | 5/12/2016 |
|---|---|
| Elevation (ft) | 8.5 |
| PCBs | 0.3 |

| RX-B-7 | 10/3/2016 |
|---|---|
| Elevation (ft) | 11 |
| PCBs | ND |
| Total SVOCs | 17 |

| RX-SW-5 | 9/30/2016 |
|---|---|
| Elevation (ft) | 3 |
| PCBs | ND |
| Total SVOCs | 111 |

| RX-3 | 5/12/2016 |
|---|---|
| Elevation (ft) | 8.5 |
| PCBs | ND |
| Total SVOCs | 50 |

| RX-SW-4 | 9/30/2016 |
|---|---|
| Elevation (ft) | 4 |
| PCBs | ND |
| Total SVOCs | 79 |

| RX-SW-3 | 9/30/2016 |
|---|---|
| Elevation (ft) | 3 |
| PCBs | ND |
| Total SVOCs | 19.2 |

| RX-4 | 5/12/2016 |
|---|---|
| Elevation (ft) | 8.5 |
| PCBs | 0.14 |

| RX-SW-2 | 9/30/2016 |
|---|---|
| Elevation (ft) | 3 |
| PCBs | 0.653 |
| Total SVOCs | 22 |

| RX-B-8 | 11/11/2016 |
|---|---|
| Elevation (ft) | 11 |
| PCBs | 0.28 |
| Total SVOCs | 38 |

| RX-5 | 5/12/2016 |
|---|---|
| Elevation (ft) | 8.5 |
| PCBs | 0.47 |

| RX-SW-1 | 9/30/2016 |
|---|---|
| Elevation (ft) | 4 |
| PCBs | ND |
| Total SVOCs | 28 |

| RMZ-15 | 9/6/2017 |
|---|---|
| Elevation (ft) | 15 |
| PCBs | 4.8 |
| Total SVOCs | 66.99 |

| RX-6B | 5/12/2016 |
|---|---|
| Elevation (ft) | 4.5 |
| PCBs | 3.8 |

LEGEND

- EXISTING BUILDING OR STRUCTURE
- PROPERTY LINE
- FENCE LINE
- 2 — SUBGRADE ELEVATION CONTOURS (FT) AS OF AUGUST 2017
- RMZ-1 — LOCATION AND DESIGNATION OF RESIDUAL MANAGEMENT ZONE SAMPLE
- TP-1/TP-2 — LOCATION AND DESIGNATION OF SOIL BORING LOCATION FOR AREAS OF ADDITIONAL INVESTIGATION
- RX-SW-1 — LOCATION AND DESIGNATION OF SIDEWALL SAMPLE (2016–2017)
- RX-B-13 — LOCATION AND DESIGNATION OF BOTTOM SAMPLE (2016–2017)

NOTES

1. BASEMAP PREPARED FROM SURVEY PERFORMED BY POSILUCO ENVIRONMENTAL INC, 2017.
2. HORIZONTAL LOCATIONS AND COORDINATES ARE IN U.S. FEET RELATIVE TO THE NEW YORK STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

| Parameter (Concentrations in mg/kg) | Standards* (mg/kg) |
|---|---|
| PCBs | 0.39 |
| Total SVOCs | 12 |

CONCENTRATIONS IN mg/kg
mg/kg – MILLIGRAMS PER KILOGRAM
* – NYSDEC RAWP SOIL CLEANUP OBJECTIVES
NYSDEC – NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
PCBS – POLYCHLORINATED BIPHENYLS
SVOCs – SEMI-VOLATILE ORGANIC COMPOUNDS
ELEVATION FEET (FT) IN NAVD 88
– RESULTS WITH GRAY BACKGROUND EXCEED NYSDEC RAWP SOIL CLEANUP OBJECTIVES
– RESULTS SHOWN IN RED TYPE EXCEED TSCA HAZARDOUS LEVELS

| NO. | DATE | REVISION DESCRIPTION | INT. |
|---|---|---|---|

UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF STATE LAW.

THESE DOCUMENTS (OR COPIES OF ANY THEREOF) PREPARED BY OR BEARING THE SEAL OF THE ENGINEER, SHALL NOT BE REUSED FOR ANY EXTENSIONS OF THE PROJECT OR ANY OTHER PROJECT WITHOUT THE WRITTEN CONSENT OF THE ENGINEER.

| | |
|---|---|
| PROJ. ENGINEER: C.M. | DRAWN BY: J.A.D. |
| DESIGNED BY: L.D. | CHECKED BY: M.A. |
| DRAWING SCALE: AS SHOWN | PLOT SCALE: 1:1 |
| DRAWING DATE: 15DEC17 | PRINT TYPE: COLOR |
| OFFICE: NY | PAPER SIZE: ARCH D |
| PROJECT NO.: 2705.00011Y000 | |
| DRAWING FILE: 2705.00011181.05.DWG | |

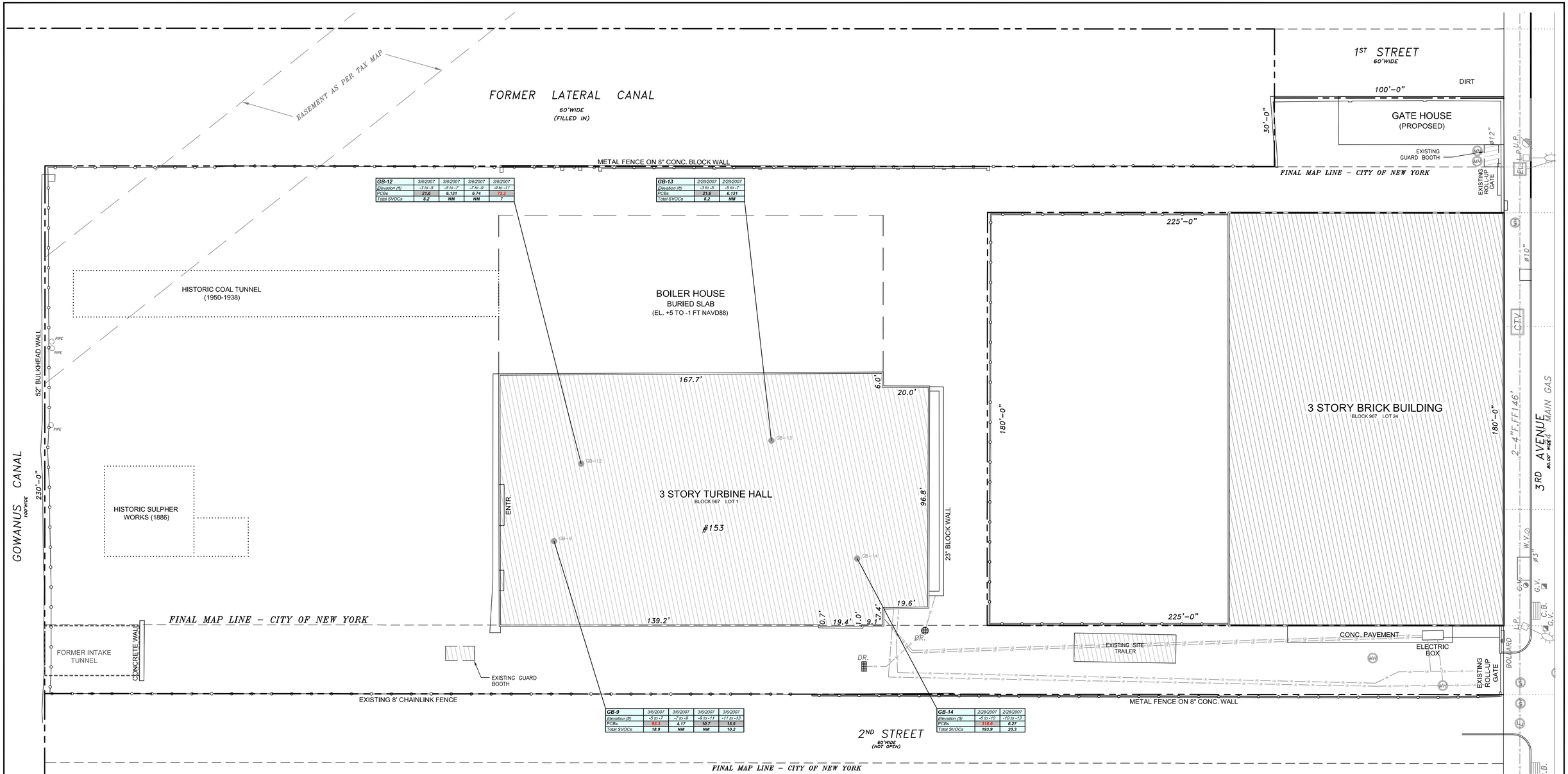
Remedial
REMEDIAL ENGINEERING, P.C.
209 Shafter Street
Islandia, New York 11749 (631) 232-2600

PROJECT NAME:
SITE MANAGEMENT PLAN
GOWANUS VILLAGE I, LLC - BROOKLYN, NEW YORK
PROJECT FOR:
BRT POWERHOUSE LLC

TITLE:
REMAINING TOTAL SVOCs & PCB CONCENTRATIONS IN SOIL

FIGURE
6
FIGURE 6 OF 8

V:\CAD\PROJECTS\2705\00011Y\181\2705.00011181.05.DWG




| Parameter (Concentrations in mg/kg) | Standards* (mg/kg) | Standards** (mg/kg) |
|---|---|---|
| | | |
| **PCBs, Total** | **10** | **50** |

CONCENTRATIONS IN mg/kg

mg/kg – MILLIGRAMS PER KILOGRAM

* – NYSDEC RAWP SOIL CLEANUP OBJECTIVES

NYSDEC – NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

TSCA – TOXIC SUBSTANCES CONTROL ACT

DUP – DUPLICATE SAMPLE

PCBS – POLYCHLORINATED BIPHENYLS

SVOCs – SEMI-VOLATILE ORGANIC COMPOUNDS

FT BLS – FEET BELOW LAND SURFACE

ELEVATION FEET (FT) IN NAVD 88

– RESULTS WITH GRAY BACKGROUND EXCEED NYSDEC RAWP SOIL CLEANUP OBJECTIVES

– RESULTS SHOWN IN RED TYPE EXCEED TSCA HAZARDOUS LEVELS

LEGEND

- EXISTING BUILDING OR STRUCTURE
- PROPERTY LINE
- FENCE LINE
- UE — UE — EXISTING UNDERGROUND ELECTRIC
- SS — SS — EXISTING STORM WATER SEWER
- MH — EXISTING MANHOLE
- DR. — EXISTING STORM WATER DRYWELL
- GB-9 — LOCATION OF AND DESIGNATION OF PREVIOUS INVESTIGATION SAMPLE (2007)

NOTES

1. BASE MAP PREPARED FROM SURVEY PERFORMED BY PERFECT POINT LAND SURVEYING, RT, JANUARY 2017.
2. ALL ELEVATION DATA IS IN FEET RELATIVE TO THE NEW YORK STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

20' 0 20'

V:\CAD\PROJECTS\2705\V\1001Y\181\2705.0001Y181.02.DWG

| NO. | DATE | REVISION DESCRIPTION | INT. |
|---|---|---|---|
| | | | |

UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF STATE LAW.

THESE DOCUMENTS (OR COPIES OF ANY THEREOF) PREPARED BY OR BEARING THE SEAL OF THE ENGINEER, SHALL NOT BE REUSED FOR ANY EXTENSIONS OF THE PROJECT OR ANY OTHER PROJECT WITHOUT THE WRITTEN CONSENT OF THE ENGINEER.

| | | | |
|---|---|---|---|
| PROJ. ENGINEER: C.M. | | DRAWN BY: J.A.D. | |
| DESIGNED BY: J.K. | | CHECKED BY: C.P. | |
| DRAWING SCALE: AS SHOWN | | PLOT SCALE: 1:1 | |
| DRAWING DATE: 06NOV17 | | PRINT TYPE: COLOR | |
| OFFICE: NY | | PAPER SIZE: ARCH D | |
| PROJECT NO.: 2705.0001Y000 | | | |
| DRAWING FILE: 2705.0001Y181.02.DWG | | | |

Remedial
REMEDIAL ENGINEERING, P.C.
209 Shafter Street
Islandia, New York 11749 (631) 232-2600

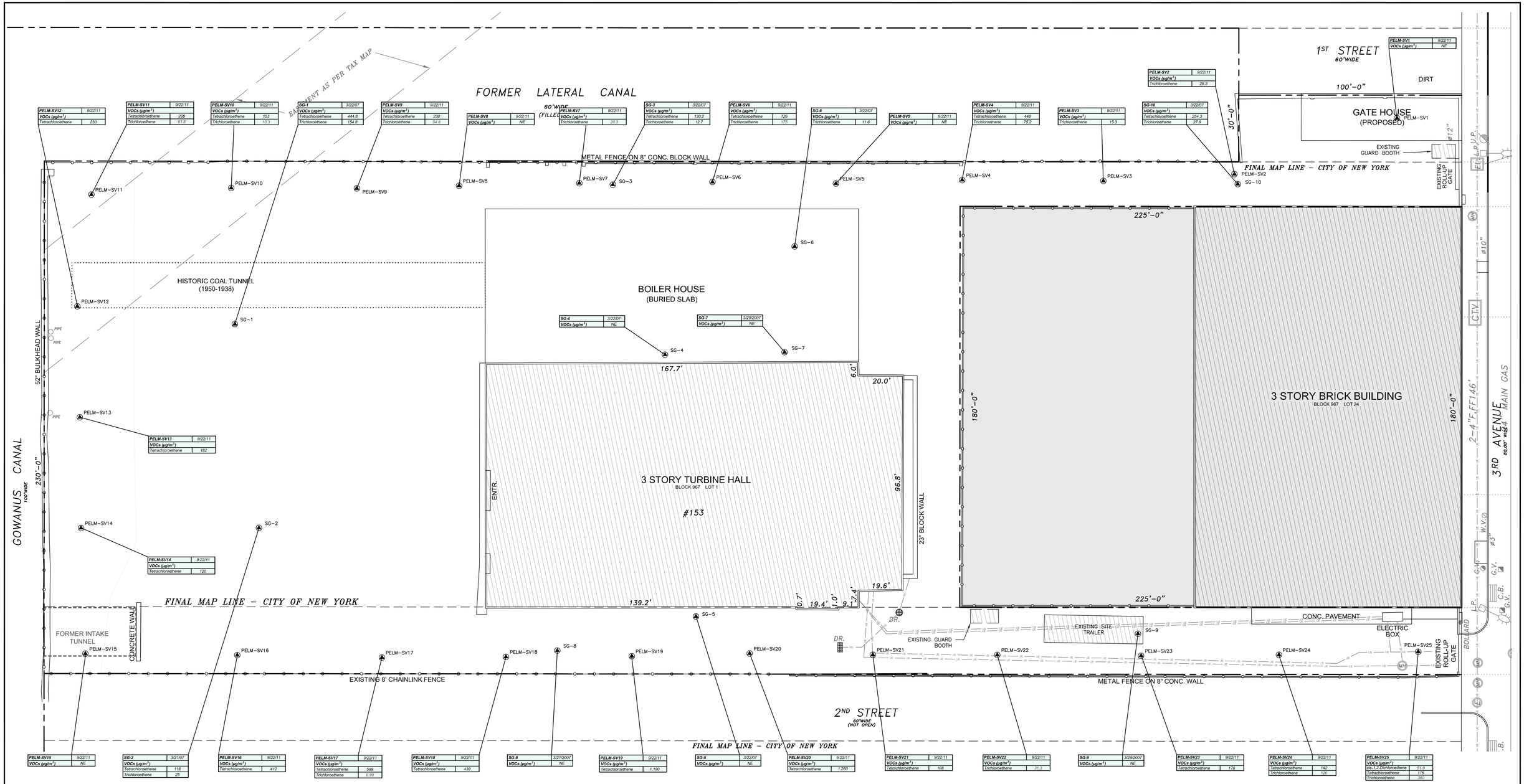
PROJECT NAME:
SITE MANAGEMENT PLAN
GOWANUS VILLAGE I, LLC - BROOKLYN, NEW YORK

PROJECT FOR:
BRT POWERHOUSE LLC

TITLE:
REMAINING PCB AND SVOC SOIL EXCEEDANCES BELOW TURBINE HALL BUILDING SLAB

FIGURE
7

FIGURE
7 OF 8




LEGEND

- EXISTING BUILDING OR STRUCTURE
- PROPERTY LINE
- FENCE LINE
- UE — UE — EXISTING UNDERGROUND ELECTRIC
- SS — SS — EXISTING STORM WATER SEWER
- MH EXISTING MANHOLE
- DR. EXISTING STORM WATER DRYWELL
- SG-1 SOIL VAPOR SAMPLE LOCATION (LANGAN 2017)
- PELM-SV1 SOIL VAPOR SAMPLE LOCATION (CES 2012)

NOTES

1. BASE MAP PREPARED FROM SURVEY PERFORMED BY PERFECT POINT LAND SURVEYING, RT, JANUARY 2017.
2. SOIL VAPOR SAMPLES COLLECTED IN 2012 AS PART OF CREATIVE ENVIRONMENTAL SOLUTIONS CORP. (CES) SUPPLEMENTAL REMEDIAL INVESTIGATION WORK PLAN.
3. SOIL VAPOR SAMPLES COLLECTED IN 2017 AS PART OF LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES (LANGAN) REMEDIAL INVESTIGATION WORK PLAN.

| Matrix A | |
|---|---|
| Parameter | NYSDEC DOH Soil Vapor/ Indoor Air Guidance Value |
| VOCs (µg/m³) | |
| cis-1,2-Dichloroethene | 6 |
| Trichloroethene | 6 |

| Matrix B | |
|---|---|
| Parameter | NYSDEC DOH Soil Vapor/ Indoor Air Guidance Value |
| VOCs (µg/m³) | |
| Methylene Chloride | 100 |
| 1,1,1-Trichloroethane | 100 |
| Tetrachloroethene | 100 |

(µg/m³)– MICROGRAMS PER CUBIC METER
VOCs – VOLATILE ORGANIC COMPOUNDS
NYSDEC – NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DOH – DEPARTMENT OF HEALTH

20' 0 20'

| NO. | DATE | REVISION DESCRIPTION | INT. |
|---|---|---|---|

UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF STATE LAW.

THESE DOCUMENTS (OR COPIES OF ANY THEREOF) PREPARED BY OR BEARING THE SEAL OF THE ENGINEER, SHALL NOT BE REUSED FOR ANY EXTENSIONS OF THE PROJECT OR ANY OTHER PROJECT WITHOUT THE WRITTEN CONSENT OF THE ENGINEER.

| | | | |
|---|---|---|---|
| PROJ. ENGINEER: | C.M. | DRAWN BY: | J.A.D. |
| DESIGNED BY: | J.K. | CHECKED BY: | C.P. |
| DRAWING SCALE: | AS SHOWN | PLOT SCALE: | 1:1 |
| DRAWING DATE: | 06NOV17 | PRINT TYPE: | COLOR |
| OFFICE: | NY | PAPER SIZE: | ARCH D |
| PROJECT NO.: | 2705.0001Y000 | | |
| DRAWING FILE: | 2705.0001Y181.07.DWG | | |

Remedial
REMEDIAL ENGINEERING, P.C.
209 Shafter Street
Islandia, New York 11749 (631) 232-2600

PROJECT NAME:
SITE MANAGEMENT PL
GOWANUS VILLAGE I, LLC - BROOKLYN, NEW YORK

PROJECT FOR:
BRT POWERHOUSE LLC

TITLE:
HISTORICAL SOIL VAPOR EXCEEDANCES

FIGURE
8
FIGURE 8 OF 8

V:\CAD\PROJECTS\2705\VOL001\Y181\2705.0001Y181.07.DWG

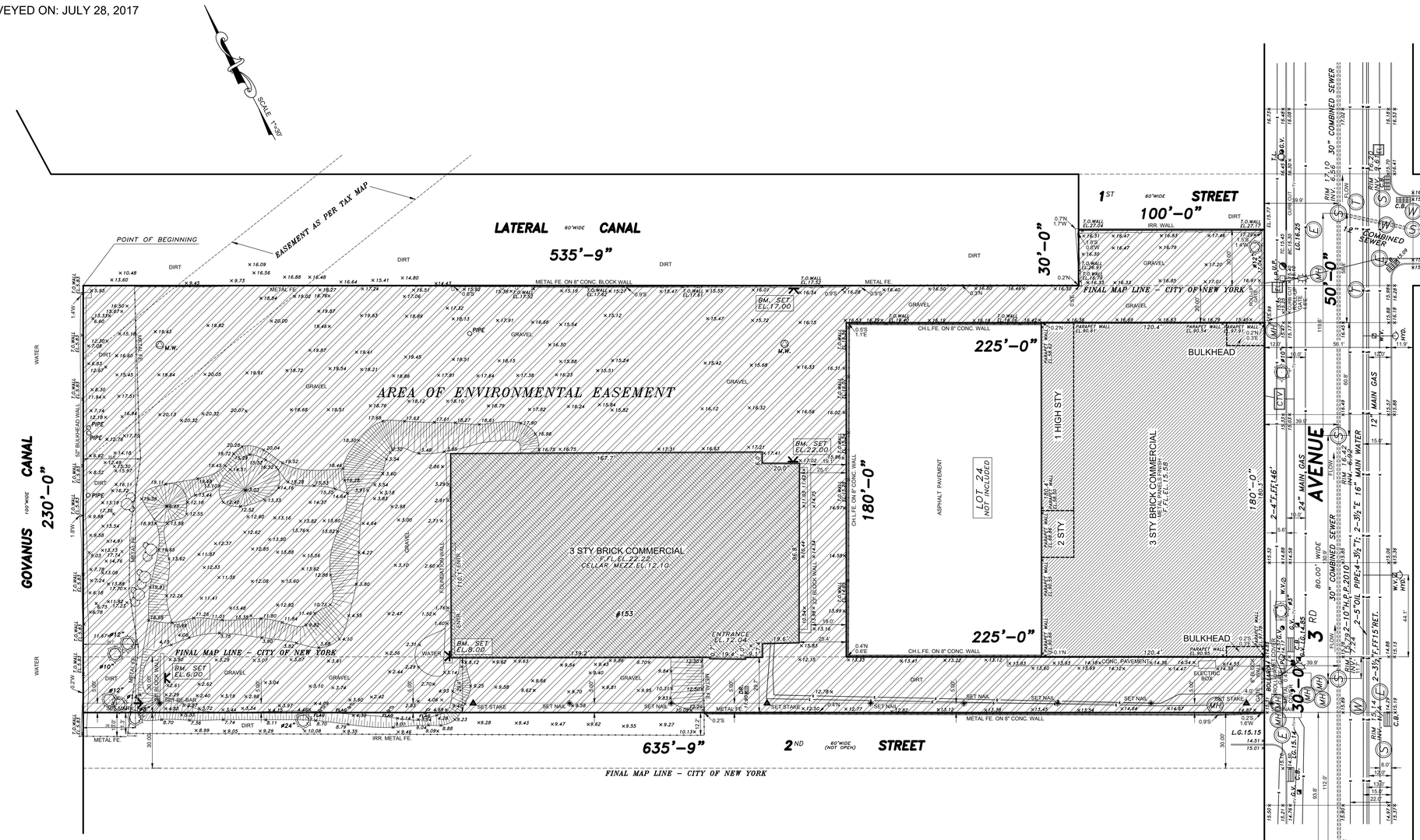
# APPENDICES

A Environmental Easement
B List of Site Contacts
C Excavation Work Plan
D Site Specific Boring Logs
E Monitoring Well Boring and Construction Logs
F Site-Specific Health and Safety Plan & Community Air Monitoring Plan
G Operation and Maintenance Manual
H Quality Assurance Project Plan
I Site Management Forms
J Field Sampling Plan

# APPENDIX A

Environmental Easement

JOB NO. B 967-1-ENVI
SURVEYED ON: JULY 28, 2017




– ENVIRONMENTAL EASEMENT

*NOTES:*
*This property is subject to an environmental easement held by the New York State Department of Environmental Conservation pursuant to Title 36 of Article 71 of the New York Environmental Conservation Law. The engineering and institutional controls for this Easement are set forth in the Site Management Plan (SMP). A copy of the SMP must be obtained by any party with an interest in the property. The SMP can be obtained from NYS Department of Environmental Conservation, Division of Environmental Remediation, Site Control Section, 625 Broadway, Albany, NY 12233 or at derweb@dec.ny.gov*

LOT AREA = 108721.12 sq.ft. = 2.4959 acres

GRAPHIC SCALE

ALL WRITTEN MEASUREMENTS AND OFFSETS NOTED ON THIS SURVEY SUPERSEDE MEASUREMENTS SCALED OF THIS PLOT.

SCALE 1:30

4.57 m 9.14 m 13.72 m 18.29 m 22.86 m 45.72 m
7.5 22.5 37.5 52.5 67.5
0 15 30 45 60 75 150

*ENVIRONMENTAL EASEMENT DESCRIPTION*

*All that certain plot, piece of parcel of land, situate, lying and being in the Borough of Brooklyn, County of Kings, City and State of New York, bounded and described as follows:*

*BEGINNING at the corner formed by the intersection of the easterly line of Gowanus Canal and the southerly side line of Lateral Canal;*

*RUNNING THENCE eastwardly along the southerly line of Lateral Canal a distance of 535.75 feet to the intersection with the westerly building line of First Street;*

*THENCE northwardly along the westerly building line of first street a distance of 30 feet to the intersection with the center line of First Street;*

*THENCE eastwardly along the center line of First Street, a distance of 100 feet to the intersection with the westerly building line of 3rd Avenue prolonged;*

*THENCE southwardly along the westerly building line of 3rd Avenue prolonged a distance of 50 feet;*

*THENCE westwardly along a line parallel with the southerly building of First Street, a distance 225 feet;*

*THENCE southwardly along a line parallel with the westerly building line of 3rd Avenue, a distance of 180 feet;*

*THENCE eastwardly along the northerly building line of 2nd Street 225 feet to the intersection with the westerly building line of 3rd Avenue;*

*THENCE southwardly along the westerly building line of 3rd Avenue 30 feet to the center line of 2nd Street;*

*THENCE westwardly along the center line of 2nd Street, 635.75 feet to the easterly line of Gowanus Canal;*

*THENCE northwardly along the easterly line of Gowanus Canal, 230 feet to the corner, the point or place of BEGINNING.*

SYMBOLS AND ABBREVIATIONS

| | |
|---|---|
| FENCE | CH.L.FE. / WOOD FE. |
| UTILITY POLE | U.P. |
| PARKING METER | P.M. |
| OIL FILL | O.F. |
| MONITORING WELL | M.W. |
| TRAFFIC LIGHT | T.L. |
| LIGHT | L. |
| STREET LIGHT | L.P. |
| FIRE HYDRANT | HYD. |
| SIAMESE CONNECTION | SPR. |
| SHUT OFF VALVE | G.V. / G.V. / W.V. / W.V. |
| HANDICAPPED PARKING | |
| EXISTING TREE | #12" |
| DRAINS | DR. / DR. |
| ROOF OVER | R.O. |
| EXISTING ELEVATIONS | ×43.15 TOP OF CURB, ×42.93 BOTTOM OF CURB / ×43.78 |
| CITY ESTABLISHED GRADES | L.G.7.52 |
| CURB AND CURB CUT | CURB CUT |
| OVERHEAD SERVICE | OH.S.W. |
| CABLE TV MANHOLE | CTV |
| MANHOLES | M.H. E T W S RIM EL. INV.EL. |
| CATCH BASIN | C.B. |
| FIRE ESCAPE | F.E. |
| PLATFORM | PL. or PLTF. |
| BASEMENT ENTRANCE | B.E. |
| CELLAR ENTRANCE | C.E. |
| AIR WAY | A.W. |
| BAY WINDOW | B.W. |
| CONCRETE | CONC. |
| OVERHANG | O.H. |
| AIR CONDITION | AC |
| METAL | MET. |
| NORTH OF PROPERTY LINE | N |
| SOUTH OF PROPERTY LINE | S |
| EAST OF PROPERTY LINE | E |
| WEST OF PROPERTY LINE | W |

GENERAL NOTES

SUBSURFACE UTILITIES ARE NOT GUARANTEED BY SURVEYOR. HIGH CAUTION RECOMMENDED AND VERIFICATION WITH PROPER CITY AGENCIES, IS MANDATORY BEFORE COMMENCING ALL NEW WORK.

ALL SUBSURFACE AND OVERHEAD UTILITIES (AS TO SIZE , TYPE AND DEPTH) SHOWN ON THIS SURVEY ARE TAKEN FROM RECORDS OF GOVERNMENTAL AGENCIES AND UTILITY COMPANIES, UNLESS OTHERWISE NOTED AND SHOWN.

COVER OR DEPTH OF UTILITIES WHICH DERIVED FROM FIELD MEASUREMENTS SHOWN ON THIS SURVEY SHOULD BE VERIFIED WITH PROPER AGENCY PRIOR TO CONSTRUCTION OF PROJECT. INVERT ELEVATIONS ARE DERIVED FROM CITY AGENCY RECORDS WHEN NOT AVAILABLE BY FIELD SURVEY AND NOTED AS 'PER RECORD' ON THE SURVEY.

ALL SUBSURFACE UTILITY AS TO LOCATION AND DEPTH, SHOULD BE RECHECKED AND LEGAL GRADES SHOULD BE VERIFIED WITH THE TOPOGRAPHICAL BUREAU, PREFERABLY IN WRITING BEFORE COMMENCING CONSTRUCTION.

THIS IS TO CERTIFY THAT THERE ARE NO STREAMS OR NATURAL WATER COURSES ON THE SURVEYED PROPERTY EXCEPT AS SHOWN AND/OR DESCRIBED ON THIS SURVEY.

ALL OPERATIONS OF UNDERGROUND FACILITIES AND ALL EXCAVATORS ARE OBLIGATED TO COMPLY WITH ARTICLE 36 OF THE GENERAL BUSINESS LAW AND WITH PROVISIONS OF INDUSTRIAL CODE PART (RULE NO.35) BEFORE ANY EXCAVATION OR DEMOLITION IS COMMENCED. EVERY EXCAVATOR IS REQUIRED BY THESE LAWS TO GIVE ADVANCE NOTICE TO EVERY OPERATOR OF UNDERGROUND FACILITIES OF HIS INTENT TO PERFORM EXCAVATION OR DEMOLITION WORK IN THE SPECIFIED AREA

ALL ELEVATIONS SHOWN REFER TO THE NAVD 1988 DATUM. TO OBTAIN:
- NGVD 1929 DATUM - ADD 1.098 FEET
- BROOKLYN BOROUGH DATUM - SUBTRACT 1.447 FEET

EASEMENTS IF ANY ARE NOT SHOWN ON THIS SURVEY. NO INFORMATION PROVIDED TO SURVEYOR AT THIS TIME.

UNDERGROUND UTILITIES NOTES

UNDERGROUND, OVERHEAD AND GROUND LEVEL UTILITIES ARE NOT GUARANTEED AS TO ACCURACY, EXACT LOCATION, TYPE OR USE, ACTIVE OR INACTIVE. VERIFICATION IS MANDATORY WITH MUNICIPAL AGENCIES, PUBLIC AND PRIVATE UTILITY COMPANIES PRIOR TO TAKING TITLE AND OR DESIGN WORK. BOUNDARIES ARE NOT GUARANTEED UNLESS SO NOTED.


PROFESSIONAL LAND SURVEYOR
**RICHARD TOM**
N.Y.S. L.L.S. 049844
7914 ROCKAWAY BEACH BLVD
ROCKAWAY BEACH, NY 11693
TEL. 718-474-7700



UNAUTHORIZED ALTERATION OR ADDITION TO THIS SURVEY IS A VIOLATION OF SECTION 7209 OF THE NEW YORK STATE EDUCATION LAW. COPIES OF THIS SURVEY MAP NOT BEARING THE LAND SURVEYOR'S INKED SEAL OR EMBOSSED SEAL SHALL NOT BE CONSIDERED TO BE A VALID COPY. GUARANTEES OR CERTIFICATIONS INDICATED HEREON SHALL RUN ONLY TO THE PERSON FOR WHOM THE SURVEY IS PREPARED AND ON HIS BEHALF TO THE TITLE COMPANY, GOVERNMENTAL AGENCY AND LENDING INSTITUTION LISTED HEREON, AND TO THE ASSIGNEES OF THE LENDING INSTITUTION. GUARANTEES OR CERTIFICATIONS ARE NOT TRANSFERABLE TO ADDITIONAL INSTITUTIONS OR SUBSEQUENT OWNERS.


GUARANTEED TO:
New York City Department of Environmental Conservation

COUNTY: KINGS CITY: BROOKLYN
SECTION: 4 BLOCK: 967 LOT(S): 1
PROPERTY ADDRESS: 322 3rd AVENUE, 11215

# ENVIRONMENTAL EASEMENT SURVEY


PREPARED BY
**PERFECT POINT**
*LAND SURVEYING RT*
brooklyn - queens - manhattan - bronx
staten island - nassau
phone: (718) 474-7700
fax: (718) 872-9699
info@ppsurveying.com
www.ppsurveying.com


STATE OF NEW YORK RICHARD TOM LICENSED LAND SURVEYOR

N.Y.S. L.L.S. 049844

**NYC DEPARTMENT OF FINANCE**
**OFFICE OF THE CITY REGISTER**

This page is part of the instrument. The City Register will rely on the information provided by you on this page for purposes of indexing this instrument.The information on this page will control for indexing purposes in the event of any conflict with the rest of the document.

2017100500079001001E218E

**RECORDING AND ENDORSEMENT COVER PAGE** **PAGE 1 OF 10**

**Document ID: 2017100500079001** Document Date: 09-11-2017 Preparation Date: 10-05-2017
Document Type: EASEMENT
Document Page Count: 9

**PRESENTER:**
CHICAGO TITLE INSURANCE CO. (PICK-UP)
711 THIRD AVE, 5TH FLOOR
CT15-00740-K (CB)
NEW YORK, NY 10017
212-880-1200
CTINYRECORDING@CTT.COM

**RETURN TO:**
HIRSCHEN SINGER & EPSTEIN LLP
902 BROADWAY 13THFLOOR
NEW YORK, NY 10010

**PROPERTY DATA**

| Borough | Block | Lot | Unit | Address |
|---|---|---|---|---|
| BROOKLYN | 967 | 1 | Entire Lot | 322 3 AVENUE |

**Property Type:** COMMERCIAL REAL ESTATE Easement

**CROSS REFERENCE DATA**

CRFN_____ *or* DocumentID_____ *or* _____ Year_____ Reel____ Page_____ *or* File Number_____

**PARTIES**

**GRANTOR/SELLER:**
BRT POWERHOUSE LLC
98 4TH STREET, 406
BROOKLYN, NY 11231

**GRANTEE/BUYER:**
THE PEOPLE OF THE STATE OF NEW YORK
COMMISSIONER OF DEPT. OF ENVIR.
CONSERVATION,, 625 BROADWAY
NEW YORK, NY 12233

**FEES AND TAXES**

| **Mortgage :** | | |
|---|---|---|
| Mortgage Amount: | $ | 0.00 |
| Taxable Mortgage Amount: | $ | 0.00 |
| Exemption: | | |
| TAXES: County (Basic): | $ | 0.00 |
| City (Additional): | $ | 0.00 |
| Spec (Additional): | $ | 0.00 |
| TASF: | $ | 0.00 |
| MTA: | $ | 0.00 |
| NYCTA: | $ | 0.00 |
| Additional MRT: | $ | 0.00 |
| TOTAL: | $ | 0.00 |
| Recording Fee: | $ | 82.00 |
| Affidavit Fee: | $ | 0.00 |

| | | |
|---|---|---|
| Filing Fee: | $ | 100.00 |
| NYC Real Property Transfer Tax: | $ | 0.00 |
| NYS Real Estate Transfer Tax: | $ | 0.00 |

**RECORDED OR FILED IN THE OFFICE OF THE CITY REGISTER OF THE CITY OF NEW YORK**
Recorded/Filed 10-06-2017 15:41
City Register File No.(CRFN): **2017000371814**

*City Register Official Signature*

9pp

## ENVIRONMENTAL EASEMENT GRANTED PURSUANT TO ARTICLE 71, TITLE 36 OF THE NEW YORK STATE ENVIRONMENTAL CONSERVATION LAW

**THIS INDENTURE** made this 11th day of September, 2017, between Owner(s) BRT Powerhouse LLC, having an office at 98 4th Street, Suite 406, Brooklyn, New York 11231, County of Kings, State of New York (the "Grantor"), and The People of the State of New York (the "Grantee."), acting through their Commissioner of the Department of Environmental Conservation (the "Commissioner", or "NYSDEC" or "Department" as the context requires) with its headquarters located at 625 Broadway, Albany, New York 12233,

**WHEREAS,** the Legislature of the State of New York has declared that it is in the public interest to encourage the remediation of abandoned and likely contaminated properties ("sites") that threaten the health and vitality of the communities they burden while at the same time ensuring the protection of public health and the environment; and

**WHEREAS,** the Legislature of the State of New York has declared that it is in the public interest to establish within the Department a statutory environmental remediation program that includes the use of Environmental Easements as an enforceable means of ensuring the performance of operation, maintenance, and/or monitoring requirements and the restriction of future uses of the land, when an environmental remediation project leaves residual contamination at levels that have been determined to be safe for a specific use, but not all uses, or which includes engineered structures that must be maintained or protected against damage to perform properly and be effective, or which requires groundwater use or soil management restrictions; and

**WHEREAS,** the Legislature of the State of New York has declared that Environmental Easement shall mean an interest in real property, created under and subject to the provisions of Article 71, Title 36 of the New York State Environmental Conservation Law ("ECL") which contains a use restriction and/or a prohibition on the use of land in a manner inconsistent with engineering controls which are intended to ensure the long term effectiveness of a site remedial program or eliminate potential exposure pathways to hazardous waste or petroleum; and

**WHEREAS,** Grantor, is the owner of real property located at the address of 153 2nd Street a/k/a 322 3rd Avenue in the City of New York, County of Kings and State of New York, known and designated on the tax map of the New York City Department of Finance as tax map parcel number: Block 967 Lot 1, being the same as that property conveyed to Grantor by deed dated August 20, 2012 and recorded in the City Register of the City of New York as CRFN # 2012000362780. The property subject to this Environmental Easement (the "Controlled Property") comprises approximately 2.4959 +/- acres, and is hereinafter more fully described in the Land Title Survey dated July 28, 2017 prepared by Richard Tom, L.L.S. of Perfect Point Land Surveying RT, which will be attached to the Site Management Plan. The Controlled Property description is set forth in and attached hereto as Schedule A; and

**WHEREAS,** the Department accepts this Environmental Easement in order to ensure the protection of public health and the environment and to achieve the requirements for remediation

established for the Controlled Property until such time as this Environmental Easement is extinguished pursuant to ECL Article 71, Title 36; and

**NOW THEREFORE**, in consideration of the mutual covenants contained herein and the terms and conditions of Brownfield Cleanup Agreement Index Number: W2-1069-05-06 as amended June 6, 2013, Grantor conveys to Grantee a permanent Environmental Easement pursuant to ECL Article 71, Title 36 in, on, over, under, and upon the Controlled Property as more fully described herein ("Environmental Easement")

1. Purposes. Grantor and Grantee acknowledge that the Purposes of this Environmental Easement are: to convey to Grantee real property rights and interests that will run with the land in perpetuity in order to provide an effective and enforceable means of encouraging the reuse and redevelopment of this Controlled Property at a level that has been determined to be safe for a specific use while ensuring the performance of operation, maintenance, and/or monitoring requirements; and to ensure the restriction of future uses of the land that are inconsistent with the above-stated purpose.

2. Institutional and Engineering Controls. The controls and requirements listed in the Department approved Site Management Plan ("SMP") including any and all Department approved amendments to the SMP are incorporated into and made part of this Environmental Easement. These controls and requirements apply to the use of the Controlled Property, run with the land, are binding on the Grantor and the Grantor's successors and assigns, and are enforceable in law or equity against any owner of the Controlled Property, any lessees and any person using the Controlled Property.

A. (1) The Controlled Property may be used for:

**Restricted Residential as described in 6 NYCRR Part 375-1.8(g)(2)(ii), Commercial as described in 6 NYCRR Part 375-1.8(g)(2)(iii) and Industrial as described in 6 NYCRR Part 375-1.8(g)(2)(iv)**

(2) All Engineering Controls must be operated and maintained as specified in the Site Management Plan (SMP);

(3) All Engineering Controls must be inspected at a frequency and in a manner defined in the SMP;

(4) The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the New York City Department of Health and Mental Hygiene to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;

(5) Groundwater and other environmental or public health monitoring must be performed as defined in the SMP;

(6) Data and information pertinent to Site Management of the Controlled

Property must be reported at the frequency and in a manner defined in the SMP;

(7) All future activities on the property that will disturb remaining contaminated material must be conducted in accordance with the SMP;

(8) Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in the SMP;

(9) Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical components of the remedy shall be performed as defined in the SMP;

(10) Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by this Environmental Easement.

B. The Controlled Property shall not be used for Residential purposes as defined in 6NYCRR 375-1.8(g)(2)(i), and the above-stated engineering controls may not be discontinued without an amendment or extinguishment of this Environmental Easement.

C. The SMP describes obligations that the Grantor assumes on behalf of Grantor, its successors and assigns. The Grantor's assumption of the obligations contained in the SMP which may include sampling, monitoring, and/or operating a treatment system, and providing certified reports to the NYSDEC, is and remains a fundamental element of the Department's determination that the Controlled Property is safe for a specific use, but not all uses. The SMP may be modified in accordance with the Department's statutory and regulatory authority. The Grantor and all successors and assigns, assume the burden of complying with the SMP and obtaining an up-to-date version of the SMP from:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, New York 12233
Phone: (518) 402-9553

D. Grantor must provide all persons who acquire any interest in the Controlled Property a true and complete copy of the SMP that the Department approves for the Controlled Property and all Department-approved amendments to that SMP.

E. Grantor covenants and agrees that until such time as the Environmental Easement is extinguished in accordance with the requirements of ECL Article 71, Title 36 of the ECL, the property deed and all subsequent instruments of conveyance relating to the Controlled Property shall state in at least fifteen-point bold-faced type:

**This property is subject to an Environmental Easement held**

**by the New York State Department of Environmental Conservation pursuant to Title 36 of Article 71 of the Environmental Conservation Law.**

F. Grantor covenants and agrees that this Environmental Easement shall be incorporated in full or by reference in any leases, licenses, or other instruments granting a right to use the Controlled Property.

G. Grantor covenants and agrees that it shall, at such time as NYSDEC may require, submit to NYSDEC a written statement by an expert the NYSDEC may find acceptable certifying under penalty of perjury, in such form and manner as the Department may require, that:

(1) the inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under the direction of the individual set forth at 6 NYCRR Part 375-1.8(h)(3).

(2) the institutional controls and/or engineering controls employed at such site:

(i) are in-place;

(ii) are unchanged from the previous certification, or that any identified changes to the controls employed were approved by the NYSDEC and that all controls are in the Department-approved format; and

(iii) that nothing has occurred that would impair the ability of such control to protect the public health and environment;

(3) the owner will continue to allow access to such real property to evaluate the continued maintenance of such controls;

(4) nothing has occurred that would constitute a violation or failure to comply with any site management plan for such controls;

(5) the report and all attachments were prepared under the direction of, and reviewed by, the party making the certification;

(6) to the best of his/her knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program, and generally accepted engineering practices; and

(7) the information presented is accurate and complete.

3. Right to Enter and Inspect. Grantee, its agents, employees, or other representatives of the State may enter and inspect the Controlled Property in a reasonable manner and at reasonable times to assure compliance with the above-stated restrictions.

4. Reserved Grantor's Rights. Grantor reserves for itself, its assigns, representatives, and successors in interest with respect to the Property, all rights as fee owner of the Property, including:

A. Use of the Controlled Property for all purposes not inconsistent with, or limited by the terms of this Environmental Easement;

B. The right to give, sell, assign, or otherwise transfer part or all of the underlying fee interest to the Controlled Property, subject and subordinate to this Environmental Easement;

5. Enforcement

A. This Environmental Easement is enforceable in law or equity in perpetuity by Grantor, Grantee, or any affected local government, as defined in ECL Section 71-3603, against the owner of the Property, any lessees, and any person using the land. Enforcement shall not be defeated because of any subsequent adverse possession, laches, estoppel, or waiver. It is not a defense in any action to enforce this Environmental Easement that: it is not appurtenant to an interest in real property; it is not of a character that has been recognized traditionally at common law; it imposes a negative burden; it imposes affirmative obligations upon the owner of any interest in the burdened property; the benefit does not touch or concern real property; there is no privity of estate or of contract; or it imposes an unreasonable restraint on alienation.

B. If any person violates this Environmental Easement, the Grantee may revoke the Certificate of Completion with respect to the Controlled Property.

C. Grantee shall notify Grantor of a breach or suspected breach of any of the terms of this Environmental Easement. Such notice shall set forth how Grantor can cure such breach or suspected breach and give Grantor a reasonable amount of time from the date of receipt of notice in which to cure. At the expiration of such period of time to cure, or any extensions granted by Grantee, the Grantee shall notify Grantor of any failure to adequately cure the breach or suspected breach, and Grantee may take any other appropriate action reasonably necessary to remedy any breach of this Environmental Easement, including the commencement of any proceedings in accordance with applicable law.

D. The failure of Grantee to enforce any of the terms contained herein shall not be deemed a waiver of any such term nor bar any enforcement rights.

6. Notice. Whenever notice to the Grantee (other than the annual certification) or approval from the Grantee is required, the Party providing such notice or seeking such approval shall identify the Controlled Property by referencing the following information:

County, NYSDEC Site Number, NYSDEC Brownfield Cleanup Agreement, State Assistance Contract or Order Number, and the County tax map number or the Liber and Page or computerized system identification number.

Parties shall address correspondence to:

Site Number: C224099
Office of General Counsel
NYSDEC
625 Broadway
Albany New York 12233-5500

With a copy to:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, NY 12233

All notices and correspondence shall be delivered by hand, by registered mail or by Certified mail and return receipt requested. The Parties may provide for other means of receiving and communicating notices and responses to requests for approval.

7. Recordation. Grantor shall record this instrument, within thirty (30) days of execution of this instrument by the Commissioner or her/his authorized representative in the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

8. Amendment. Any amendment to this Environmental Easement may only be executed by the Commissioner of the New York State Department of Environmental Conservation or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

9. Extinguishment. This Environmental Easement may be extinguished only by a release by the Commissioner of the New York State Department of Environmental Conservation, or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

10. Joint Obligation. If there are two or more parties identified as Grantor herein, the obligations imposed by this instrument upon them shall be joint and several.

**Remainder of Page Intentionally Left Blank**

**IN WITNESS WHEREOF,** Grantor has caused this instrument to be signed in its name.

BRT Powerhouse LLC:

By: The Powerhouse Environmental Arts Foundation, Inc.

By: _____

Print Name: Katie Dixon

Title: Executive Director Date: August 16, 2017

**Grantor's Acknowledgment**

STATE OF NEW YORK )
) ss:
COUNTY OF KINGS )

On the 16 day of August, in the year 20 17, before me, the undersigned, personally appeared Katie Dixon, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

_____
Notary Public - State of New York

Wayne B Utnick

WAYNE B. UTNICK
Notary Public, State of New York
No. 24-4848119 01UT6219119
Qualified In Kings County
Commission Expires March 30, 2019

SEAL

**THIS ENVIRONMENTAL EASEMENT IS HEREBY ACCEPTED BY THE PEOPLE OF THE STATE OF NEW YORK**, Acting By and Through the Department of Environmental Conservation as Designee of the Commissioner,

By: _____
Robert W. Schick, Director
Division of Environmental Remediation

**Grantee's Acknowledgment**

STATE OF NEW YORK )
) ss:
COUNTY OF ALBANY )

On the 11 day of September, in the year 2017, before me, the undersigned, personally appeared Robert W. Schick, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/ executed the same in his/her/ capacity as Designee of the Commissioner of the State of New York Department of Environmental Conservation, and that by his/her/ signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

_____
Notary Public - State of New York

SEAL

**David J. Chiusano**
**Notary Public, State of New York**
**No. 01CH5032146**
**Qualified in Schenectady County**
**Commission Expires August 22, 2018**

## SCHEDULE "A" PROPERTY DESCRIPTION

ALL that certain plot, piece or parcel of land, situate, lying and being in the Borough of Brooklyn, County of Kings, City and State of New York, bounded and described as follows:

BEGINNING at the corner formed by the intersection of the easterly line of Gowanus Canal and the southerly line of Lateral Canal;

RUNNING THENCE eastwardly along the southerly line of Lateral Canal, a distance of 535.75 feet to the intersection with the westerly building line of 1st Street;

THENCE northwardly along the westerly building line of 1st Street, a distance of 30 feet to the intersection with the center line of 1st Street;

THENCE eastwardly along the center line of 1st Street, a distance of 100 feet to the intersection with the westerly building line of 3rd Avenue prolonged;

THENCE southwardly along the westerly building line of 3rd Avenue prolonged, a distance of 50 feet;

THENCE westwardly along a line parallel with the southerly building line of 1st Street, a distance of 225 feet;

THENCE southwardly along a line parallel with the westerly building line of 3rd Avenue, a distance of 180 feet;

THENCE eastwardly along the northerly building line of 2nd Street, 225 feet to the intersection with the westerly building line of 3rd Avenue;

THENCE southwardly along the westerly building line of 3rd Avenue, 30 feet to the center line of 2nd Street;

THENCE westwardly along the center line of 2nd Street, 635.75 feet to the easterly line of Gowanus Canal;

THENCE northwardly along the easterly line of Gowanus Canal, 230 feet to the corner, the point or place of BEGINNING.

# APPENDIX B

List of Site Contacts

# APPENDIX B – LIST OF SITE CONTACTS

| Name | Phone/Email Address |
|---|---|
| Site Owner:<br>BRT Powerhouse, LLC | |
| Owner Representative:<br>Katie Dixon; Executive Director | (917) 822-1787<br>katie@powerhousearts.org |
| Remedial Party:<br>BRT Powerhouse, LLC<br>Gemini Arts Initiative, Inc.<br>Gemini Arts Subsidiary LLC | |
| Qualified Environmental Professional:<br>Charles J. McGuckin, P.E.<br>Remedial Engineering, P.C. | (631) 232-2600 (office)<br>(631) 921-6857 (mobile)<br>cmcguckin@rouxinc.com |
| NYSDEC DER Project Manager<br>NYSDEC, DER, Bureau of Technical Support Site Control Section | Chief, Site Control Section<br>New York State Department of Environmental Conservation<br>Division of Environmental Remediation, 625 Broadway, Albany NY 12233-7020 |
| NYSDEC Regional HW Engineer<br>John Grathwol | 518-402-9767<br>john.grathwol@dec.gov |
| NYSDEC Site Control<br>Jonathan Greco | 518-402-9767<br>jonathan.greco@dec.gov |
| NYSDOH<br>Steven Lawrence, Project Manager | 518-402-7860<br>BEEI@health.ny.gov |

# APPENDIX C

Excavation Work Plan

# APPENDIX C– EXCAVATION WORK PLAN (EWP)

## C-1 NOTIFICATION

At least 15 days prior to the start of any activity that is anticipated to encounter remaining contamination, the site owner or their representative will notify the NYSDEC. Table 1 includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of site-related contact information is provided in Appendix B.

**Table 1: Notifications***

| | |
|---|---|
| NYSDEC, DER, Bureau of Technical Support Site Control Section | Chief, Site Control Section<br>New York State Department of Environmental Conservation<br>Division of Environmental Remediation,<br>625 Broadway, Albany NY 12233-7020 |
| John Grathwol, NYSDEC | 518-402-9767<br>john.grathwol@dec.gov |
| Jonathan Greco, NYSDEC | 518-402-9767<br>jonathan.greco@dec.gov |
| Steven Lawrence, Project Manager, NYSDOH | 518-402-7860<br>BEEI@health.ny.gov |

* Note: Notifications are subject to change and will be updated as necessary.

This notification will include:

- A detailed description of the work to be performed, including the location and areal extent of excavation, plans/drawings for site re-grading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of contaminated soil to be excavated and any work that may impact an engineering control;
- A summary of environmental conditions anticipated to be encountered in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling;
- A schedule for the work, detailing the start and completion of all intrusive work;
- A summary of the applicable components of this EWP;
- A statement that the work will be performed in compliance with this EWP and 29 CFR 1910.120;

- A copy of the contractor's health and safety plan (HASP), in electronic format, if it differs from the HASP provided in Appendix F of this SMP;
- Identification of disposal facilities for potential waste streams; and
- Identification of sources of any anticipated backfill, along with all required chemical testing results.

## C-2 SOIL SCREENING METHODS

Visual, olfactory and instrument-based (e.g. photoionization detector) soil screening will be performed by a qualified environmental professional during all excavations into known or potentially contaminated material (remaining contamination). Soil screening will be performed when invasive work is done and will include all excavation and invasive work performed during development, such as excavations for foundations and utility work, after issuance of the COC.

Soils will be segregated based on previous environmental data and screening results into material that requires off-site disposal and material that requires testing to determine if the material can be reused on-site as soil beneath a cover or if the material can be used as cover soil. Further discussion of off-site disposal of materials and on-site reuse is provided below.

## C-3 SOIL STAGING METHODS

Soil stockpiles will be continuously encircled with a berm and/or silt fence. Hay bales will be used as needed near catch basins, surface waters and other discharge points.

Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected and damaged tarp covers will be promptly replaced. Stockpiles will be inspected at a minimum once each week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by the NYSDEC.

## C-4 MATERIALS EXCAVATION AND LOAD-OUT

A qualified environmental professional or person under their supervision will oversee all invasive work and the excavation and load-out of all excavated material.

The owner of the property and remedial party (if applicable) and its contractors are responsible for safe execution of all invasive and other work performed under this Plan.

The presence of utilities and easements on the site will be investigated by the qualified environmental professional. It will be determined whether a risk or impediment to the planned work under this SMP is posed by utilities or easements on the site.

Loaded vehicles leaving the site will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and all other applicable transportation requirements). A truck wash will be operated on-site, as appropriate. The qualified environmental professional will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the site until the activities performed under this section are complete Truck wash waters will be collected and disposed of off-site in an appropriate manner.

Locations where vehicles enter or exit the site shall be inspected daily for evidence of off-site soil tracking.

The qualified environmental professional will be responsible for ensuring that all egress points for truck and equipment transport from the site are clean of dirt and other materials derived from the site during intrusive excavation activities. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials.

## C-5 MATERIALS TRANSPORT OFF-SITE

All transport of materials will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded.

Material transported by trucks exiting the site will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used.

Truck transport routes are as follows: trucks will exit site from either entrance on the east boundary, on 3rd Avenue. Trucks can turn left and continue north on 3rd Avenue to either Atlantic Avenue or Flatbush Avenue. Alternatively, trucks may turn left of 3rd Avenue and head south to the Gowanus Expressway. See truck route attached ad Figure X. All trucks loaded with site materials will exit the vicinity of the site using only these approved truck routes. This is the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off-site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport.

Trucks will be prohibited from stopping and idling in the neighborhood outside the project site. Queuing of trucks will be performed on-site in order to minimize off-site disturbance. Off-site queuing will be prohibited.

Egress points for truck and equipment transport from the site will be kept clean of dirt and other materials during site remediation and development.

## C-6 MATERIALS DISPOSAL OFF-SITE

All material excavated and removed from the site will be treated as contaminated and regulated material and will be transported and disposed in accordance with all local, State (including 6NYCRR Part 360) and Federal regulations. If disposal of material from this site is proposed for unregulated off-site disposal (i.e. clean soil removed for development purposes), a formal request with an associated plan will be made to the NYSDEC. Unregulated off-site management of materials from this site will not occur without formal NYSDEC approval.

Off-site disposal locations for excavated soils will be identified in the pre-excavation notification. This will include estimated quantities and a breakdown by class of disposal facility if appropriate, i.e. hazardous waste disposal facility, solid waste landfill, petroleum treatment facility, C/D recycling facility, etc. Actual disposal quantities and associated documentation will be reported to the NYSDEC in the Periodic Review

Report. This documentation will include: waste profiles, test results, facility acceptance letters, manifests, bills of lading and facility receipts.

Non-hazardous historic fill and contaminated soils taken off-site will be handled, at minimum, as a Municipal Solid Waste per 6NYCRR Part 360-1.2. Material that does not meet Unrestricted SCOs is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility).

## C-7 MATERIALS REUSE ON-SITE

The qualified environmental professional will ensure that procedures defined for materials reuse in this SMP are followed and that unacceptable material does not remain on-site. Contaminated on-site material, including historic fill and contaminated soil, that is acceptable for reuse on-site will be placed below the demarcation layer or impervious surface, and will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines.

Any demolition material proposed for reuse on-site will be sampled for asbestos and the results will be reported to the NYSDEC for acceptance. Concrete crushing or processing on-site will not be performed without prior NYSDEC approval. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the site will not be reused on-site.

## C-8 FLUIDS MANAGEMENT

All liquids to be removed from the site, including but not limited to, excavation dewatering, decontamination waters and groundwater monitoring well purge and development waters, will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. Dewatering, purge and development fluids will not be recharged back to the land surface or subsurface of the site, and will be managed off-site, unless prior approval is obtained from NYSDEC.

Discharge of water generated during large-scale construction activities to surface waters (i.e. a local pond, stream or river) will be performed under a SPDES permit.

## C-9 COVER SYSTEM RESTORATION

After the completion of soil removal and any other invasive activities the cover system will be restored in a manner that complies with the Remedial Action Work Plan (RAWP). The existing cover system will consist of a minimum of 24 inches of clean soil, an asphalt cap of 3-inches of recycled concrete aggregate (RCA) and topped by 3-inches of asphalt, or existing building slabs]. The demarcation layer, consisting of orange snow fencing material or a change in backfill material (i.e., RCA to native material) will be utilized to provide a visual reference to the top of the remaining contamination zone, the zone that requires adherence to special conditions for disturbance of remaining contaminated soils defined in this SMP. If the type of cover system changes from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt), this will constitute a modification of the cover element of the remedy and the upper surface of the remaining contamination. A figure showing the modified surface will be included in the subsequent Periodic Review Report and in an updated SMP.

## C-10 BACKFILL FROM OFF-SITE SOURCES

All materials proposed for import onto the site will be approved by the qualified environmental professional and will be in compliance with provisions in this SMP prior to receipt at the site. A Request to Import/Reuse Fill or Soil form, which can be found at http://www.dec.ny.gov/regulations/67386.html, will be prepared and submitted to the NYSDEC project manager allowing a minimum of 5 business days for review.

Material from industrial sites, spill sites, or other environmental remediation sites or potentially contaminated sites will not be imported to the site.

All imported soils will meet the backfill and cover soil quality standards established in 6NYCRR 375-6.7(d). Soils that meet ‘exempt’ fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this site, will not be imported onto the site without prior approval by NYSDEC. Solid waste will not be imported onto the site.

Trucks entering the site with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials and covered to prevent dust releases.

## C-11 STORMWATER POLLUTION PREVENTION

Barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by the NYSDEC. All necessary repairs shall be made immediately.

Accumulated sediments will be removed as required to keep the barrier and hay bale check functional. All undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials. Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.

Erosion and sediment control measures identified in the SMP shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.

Silt fencing or hay bales will be installed around the entire perimeter of the construction area.

## C-12 EXCAVATION CONTINGENCY PLAN

If underground tanks or other previously unidentified contaminant sources are found during post-remedial subsurface excavations or development related construction, excavation activities will be suspended until sufficient equipment is mobilized to address the condition.

Sampling will be performed on product, sediment and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for a full list of analytes (Part 375 metals; Part 375 volatiles and semi-volatiles, Part 375 pesticides and PCBs), unless the site history and previous sampling

results provide a sufficient justification to limit the list of analytes. In this case, a reduced list of analytes will be proposed to the NYSDEC for approval prior to sampling.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone to NYSDEC's Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. These findings will be also included in the Periodic Review Report.

## C-13 COMMUNITY AIR MONITORING PLAN

The location of air sampling station based on generally prevailing wind conditions at the Site. These locations will be adjusted on a daily or more frequent basis based on actual wind directions to provide an upwind and at least two downwind monitoring stations.

Exceedances of action levels listed in the CAMP (included as Appendix F of the SMP) will be reported to NYSDEC and NYSDOH Project Managers.

## C-14 ODOR CONTROL PLAN

This odor control plan is capable of controlling emissions of nuisance odors off-site [and on-site, if there are residents or tenants on the property]. Specific odor control methods to be used on a routine basis will include the use of odor suppressants and controlled excavation procedures as discussed below. If nuisance odors are identified at the site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the remedial party's Remediation Engineer, and any measures that are implemented will be discussed in the Periodic Review Report.

All necessary means will be employed to prevent on- and off-site nuisances. At a minimum, these measures will include: (a) limiting the area of open excavations and size of soil stockpiles; (b) shrouding open excavations with tarps and other covers; and (c) using foams to cover exposed odorous soils. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) direct load-out

of soils to trucks for off-site disposal; (e) use of chemical odorants in spray or misting systems; and, (f) use of staff to monitor odors in surrounding neighborhoods.

If nuisance odors develop during intrusive work that cannot be corrected, or where the control of nuisance odors cannot otherwise be achieved due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering the excavation and handling areas in a temporary containment structure equipped with appropriate air venting/filtering systems.

## C-15 DUST CONTROL PLAN

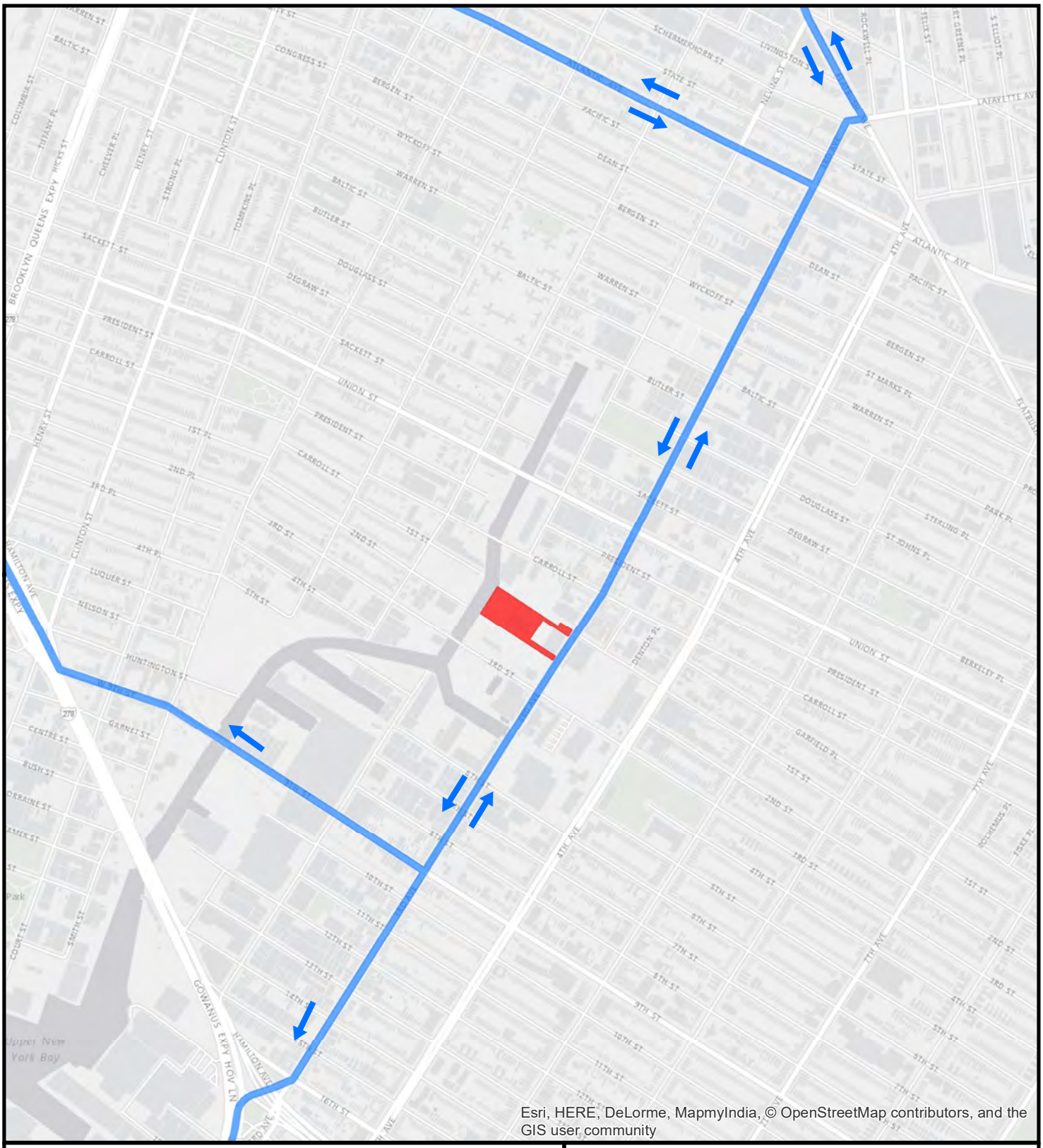
A dust suppression plan that addresses dust management during invasive on-site work will include, at a minimum, the items listed below:

- Dust suppression will be achieved through the use of a dedicated on-site water truck for road wetting. The truck will be equipped with a water cannon capable of spraying water directly onto off-road areas including excavations and stockpiles.
- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-site roads will be limited in total area to minimize the area required for water truck sprinkling.

## C-16 OTHER NUISANCES

A plan for rodent control will be developed and utilized by the contractor prior to and during site clearing and site grubbing, and during all remedial work.

A plan will be developed and utilized by the contractor for all remedial work to ensure compliance with local noise control ordinances.




LEGEND

TRUCK ROUTE

SITE

N

500 0 500 1,000 Feet

Title:

**TRUCK ROUTE**

153 2ND STREET, BROOKLYN, NEW YORK

Prepared For:

GEMINI ARTS INITIATIVE, INC.

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

| | |
|---|---|
| Compiled by: L.D. | Date: 07JUN17 |
| Prepared by: M.R. | Scale: AS SHOWN |
| Project Mgr: C.P. | Project: 2705.0001Y000 |
| File: 2705.0001Y181.1.mxd | |

FIGURE

**X**

V:\GIS\Projects\2705Y\0001Y\181\2705.0001Y181.1.mxd

# APPENDIX D

Site Specific Boring Logs

# LANGAN

Log of Boring **B-1 (OW)** Sheet 1 of 5

| | |
|---|---|
| Project: Powerhouse Workshop | Project No.: 170404201 |
| Location: 322 3rd Avenue Brooklyn, N.Y. | Elevation and Datum: Approx. 20 (NAVD) |
| Drilling Company: Aquifer Drilling And Testing | Date Started: 10/18/16 — Date Finished: 10/19/16 |
| Drilling Equipment: CME 55 Truck Rig | Completion Depth: 102 ft — Rock Depth: Not Encountered |
| Size and Type of Bit: 3-7/8" Roller Bit | Number of Samples: Disturbed 26 — Undisturbed 0 — Core 0 |
| Casing Diameter (in): 4 1/2" — Casing Depth (ft): 30 | Water Level (ft.): First ▽ 16 — Completion ▼ - — 24 HR. ▼ - |
| Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | Drilling Foreman: Matt Ficeto |
| Sampler: 2" O.D. Split Spoon | Field Engineer: Daniel O'Donnell |
| Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Casng blws/ ft Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | +20.0 | Class 7 | S-1: Black m-f silty SAND, some gravel, trace concrete, trace brick (dry) [FILL] | | 0–1 | S-1 | SS | 15 | 8 6 13 17 | 19 | Take S-1<br>Concrete observed in tip |
| | +18.0 | | 12" CONCRETE AND STELL DECKING | SPUN | 1–2 | | | | | | Case through concrete - 1' thick |
| | +17.0 | | S-2: Brown silty SAND, some gravel, trace brick (dry) [FILL] | | 2–4 | S-2 | SS | 7 | 9 15 24 32 | 39 | Drill to 3'<br>No return<br>Brown at end of concrete<br>Slow drilling. light rig chatter<br>Take S-2 |
| | | | S-3: Black gravelly SAND, some silt, trace brick (dry) [FILL] | | 4–6 | S-3 | SS | 5 | 9 24 61 25 | 85 | Install casing to 5'<br>Drill to 5'<br>Brown wash<br>Light racking<br>Take S-3 |
| | | | S-4: Black silty SAND, some gravel, some brick (dry) [FILL] | SPUN | 6–8 | S-4 | SS | 6 | 1 15 15 10 | 30 | Drill to 7'<br>Black wash<br>Quick, smooth drilling<br>Take S-4 |
| | | | S-5: Brown silty SAND, some gravel (moist) [FILL] | | 8–10 | S-5 | SS | 4 | 2 3 6 9 | 9 | Drill to 9'<br>Black wash<br>Smooth, slow drilling<br>Install casing to 9'<br>Take S-5 |
| | | Class 7 | S-6: Brown silty SAND, some gravel, trace concrete, trace fibers (dry) [FILL] | SPUN | 10–13 | S-6 | SS | 19 | 13 35 36 16 | 71 | Drill to 11'<br>Brown wash<br>Smooth drilling<br>Take S-6 |
| | | | S-7: Brown m-f SAND, trace gravel (wet) [FILL] ▽ | SPUN | 13–17 | S-7 | SS | 7 | 5 41 63 56 | 104 | Drill to 15'<br>Brown wash<br>Light rig chatter 13' to 15'<br>Take S-7<br>Install casing to 15' |
| | | | | | 17–20 | | | | | | |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:57:16 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-1 (OW)** Sheet 2 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 20 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Casng blws/ft Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Class 7 | S-8: Brown m-f SAND, some gravel (wet) [FILL] | | 20–21 | S-8 | SS | 1 | 3, 1, 4, 3 | 5 | Drill to 20'<br>Brown wash<br>Light rig chatter at 18'<br>Install casing to 20'<br>Take S-8 |
| | -2.0 | | | | 21–22 | | | | | | Take S-9 |
| | | Class 6 | S-9: Gray CLAY, trace sand, glass (wet) [CH] | SPUN | 22–23 | S-9 | SS | 2 | 2, 1, 1, 3 | 2 | |
| | | | S-10: Gray CLAY, trace sand and organics, odor observed (wet) [CH] | | 23–24 | S-10 | SS | 13 | WOH, WOH, WOH, 1 | | Install casing to 24'<br>Drill to 24'<br>Brown wash<br>Quick, smooth drilling<br>Take S-10 |
| | -6.0 | | | | 24–25 | | | | | | Take S-11 |
| | | | S-11: Gray m-f SAND, some silt, trace shell fragments (wet) [SP] | SPUN | 25–26 | S-11 | SS | 6 | 1, 3, 3, 4 | 6 | |
| | | Class 6 | | | 26–27 | | | | | | |
| | | | S-12: Brown m-f SAND, trace gravel (wet) [SW] | | 27–28 | S-12 | SS | 12 | 5, 4, 4, 6 | 8 | Install casing to 30'<br>Add revert to tub<br>Drill to 30'<br>Brown wash<br>Quick, smooth drilling<br>Take S-12 |
| | -13.5 | | | | 28–29 | | | | | | |
| | | | S-13: Brown m-f silty SAND, trace gravel (wet) [SM] | | 29–30 | S-13 | SS | 10 | 7, 7, 12, 12 | 19 | Drill to 35'<br>Brown wash<br>Light rig chatter at 33'<br>Take S-13 |
| | | Class 3b | | | 30–31 | | | | | | |
| | | | S-14: Brown m-f silty SAND, some gravel (wet) [SM] | | 31–32 | S-14 | SS | 2 | 8, 8, 6, 7 | 14 | Drill to 40'<br>Brown wash<br>Light rig chatter at 37'<br>Take S-14 |
| | | | | | 32–33 | | | | | | |
| | | | | | 33–34 | | | | | | |
| | | | | | 34–35 | | | | | | |
| | | | | | 35–36 | | | | | | |
| | | | | | 36–37 | | | | | | |
| | | | | | 37–38 | | | | | | |
| | | | | | 38–39 | | | | | | |
| | | | | | 39–40 | | | | | | |
| | | | | | 40–41 | | | | | | |
| | | | | | 41–42 | | | | | | |
| | | | | | 42–43 | | | | | | |
| | | | | | 43–44 | | | | | | |
| | | | | | 44–45 | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:57:16 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-1 (OW)** Sheet 3 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 20 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Casng blws/ft Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Class 3b | S-15: Brown m-f silty SAND, trace gravel (wet) [SM] | | 45–70 | S-15 | SS | 12 | 4 5 5 8 | 10 | Drill to 45' Brown wash Light rig chatter at 44' Take S-15 |
| | -28.5 | | | | | | | | | | |
| | | Class 3a | S-16: Brown m-f SAND, some silt and gravel (wet) [SW] | | | S-16 | SS | 7 | 18 17 17 26 | 34 | Drill to 50' Brown wash Heavy rig chatter at 49' Take S-16 |
| | -33.5 | | | | | | | | | | |
| | | | S-17: Brown m-f silty SAND (wet) [SM] | | | S-17 | SS | 9 | 6 7 10 9 | 17 | Drill to 55' Brown wash Light rig chatter 50' to 53' Take S-17 |
| | | Class 3b | S-18: Brown c-f SAND, trace gravel (wet) [SP] | | | S-18 | SS | 8 | 6 6 6 9 | 12 | Drill to 60' Brown wash Quick, smooth drilling Take S-18 |
| | | | S-19: Brown c-f SAND, trace gravel (wet)[SP] | | | S-19 | SS | 11 | 4 5 8 8 | 13 | Drill to 65' brown wash Light rig chatter at 62' Take S-19 |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:57:17 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-1 (OW)** Sheet 4 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 20 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description |
|---|---|---|---|
| | | | S-20: Brown c-f SAND, some silt, trace gravel (wet) [SP] |
| | | Class 3b | S-21: Brown c-f SAND, some silt and gravel (wet) [SP] |
| | | | S-22: Brown c-f SAND, some silt and gravel (wet) [SP] |
| | -63.5 | | |
| | | Class 3a | S-23: Brown c-f gravelly SAND, some silt (wet) [SW] |
| | -68.5 | | |
| | | Class 3b | S-24: brown c-f SAND, some silt and gravel (wet) [SW] |
| | -73.5 | | |
| | | Class 3a | |

Casng blws/ ft
Coring (min)

Depth Scale: 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95

Sample Data

| Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) |
|---|---|---|---|---|
| S-20 | SS | 12 | 10 11 13 14 | 24 |
| S-21 | SS | 4 | 12 15 11 10 | 26 |
| S-22 | SS | 4 | 7 9 8 9 | 17 |
| S-23 | SS | 9 | 15 15 23 20 | 38 |
| S-24 | SS | 8 | 8 6 9 14 | 15 |

N-Value (Blows/ft): 10 20 30 40

**Remarks**
(Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)

Drill to 70'
Brown wash
Quick, smooth drilling
Take S-20

Drill to 75'
Brown wash
Light rig chatter
Take S-21

Drill to 80'
Brown wash
Heavy rig chatter past 76'
Take S-22

Drill to 85'
Brown wash
Light rig chatter
Take S-23

Drill to 90'
Brown wash
Heavy rig chatter
Take S-24

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:57:18 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-1 (OW)** Sheet 5 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 20 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Casng blws/ ft Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Class 3a | S-25: Brown m-f SAND, some silt (wet) [SW] | | 95–96 | S-25 | SS | 10 | 10<br>14<br>18<br>15 | 32 | Drill to 95'<br>Brown wash<br>Light rig chatter at91'<br>Take S-25 |
| | -78.5 | | | | 97–99 | | | | | | |
| | | Class 3b | S-26: Brown m-f SAND, some gravel and oil staining (wet) [SW] | | 100–101 | S-26 | SS | 12 | 11<br>8<br>19<br>14 | 27 | Drill to 100'<br>Brown wash<br>Heavy racking at 98'<br>Take S-26 |
| | -82.0 | | End of boring at 102' | | 102–120 | | | | | | |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:57:19 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-10** Sheet 1 of 4

| | |
|---|---|
| Project: Powerhouse Workshop | Project No.: 170404201 |
| Location: 322 3rd Avenue Brooklyn, N.Y. | Elevation and Datum: Approx. 19 (NAVD) |
| Drilling Company: Aquifer Drilling And Testing | Date Started: 10/12/16 — Date Finished: 10/13/16 |
| Drilling Equipment: CME 55 Truck Rig | Completion Depth: 77 ft — Rock Depth: Not Encountered |
| Size and Type of Bit: 3-7/8" Roller Bit | Number of Samples: Disturbed 18 — Undisturbed 0 — Core 0 |
| Casing Diameter (in): 4 1/2" — Casing Depth (ft): 24 | Water Level (ft.): First ▽ - — Completion ▼ - — 24 HR. ▼ - |
| Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | Drilling Foreman: Matt Ficeto |
| Sampler: 2" O.D. Split Spoon | Field Engineer: Daniel O'Donnell |
| Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Casng blws/ ft | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | +19.0 | | | | | 0 | | | | | 10 20 30 40 | |
| | | | S-1: Brown loose silty SAND, some concrete, trace brick (dry) [FILL] | | 18 | 1 | S-1 | SS | 22 | 15 17 10 7 | 27 | Take S-1 |
| | | | | | 61 | | | | | | | |
| | | | S-2: Brown loose medium silty SAND, some asphalt, trace brick (dry) [FILL] | 64.3 | 24 | 2 | S-2 | SS | 4 | 2 6 5 9 | 11 | Take S-2 |
| | | | | | 17 | 3 | | | | | | |
| | | | S-3: Brown loose medium silty SAND, some brick, concrete, asphalt, trace wood (dry) [FILL] | 3.4 | 105 | 4 | S-3 | SS | 6 | 7 10 7 15 | 17 | Take S-3 |
| | | | | | 69 | 5 | | | | | | |
| | | | S-4: Brown loose medium silty SAND, some brick and concrete, trace fiber material (dry) [FILL] | | 86 | 6 | S-4 | SS | 3 | 7 6 5 100/5" | 11 | Drill to 6'<br>Brown wash<br>Heavy rig chatter at 5'<br>Install casing to 6'<br>Take S-4 |
| | | | | | 50 | 7 | | | | | | |
| | | | | | SPUN | 8 | | | | | | Obstruction at 8'<br>Install casing to 8'<br>Pull casing, switch to spin |
| | | Class 7 | | | | 9 | | | | | | |
| | | | | | | 10 | | | | | | Install casing to 10'<br>Drill to 10'<br>Clear wash<br>Slow drilling, heavy rig chatter |
| | | | | | SPUN | 11 | | | | | | |
| | | | | | | 12 | | | | | | |
| | | | | | | 13 | | | | | | |
| | | | | | | 14 | | SS | 0 | 100/0"" | | Attempt to take spoon at 14'; refusal |
| | | | | | | 15 | | | | | | Install casing to 15'<br>Drill to 15'<br>Gray-clear wash<br>Slow drilling, heavy rig chatter<br>Oil odor at 17'<br>Black wash<br>Concrete and metal fragments observed in tub |
| | | | | | SPUN | 16 | | | | | | |
| | | | | | | 17 | | | | | | |
| | | | | | | 18 | | | | | | |
| | | | | | | 19 | | | | | | |
| | | | | | | 20 | | | | | | |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:57:28 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-10** Sheet 2 of 4

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 19 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Casng blws/ ft | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Class 7 | S-5: No recovery | | | 20 | S-5 | SS | 0 | 1<br>WOH<br>WOH<br>1 | | Drill to 20'<br>Dark gray wash<br>Take S-5 |
| | -3.0 | | | | | 21 | | | | | | |
| | | | | | SPUN | 22 | | | | | | Take S-6 |
| | | | S-6: Black CLAY with some gravel, trace silt (wet) [CH] | | | 23 | S-6 | SS | 6 | 2<br>4<br>8<br>8 | 12 | |
| | | Class 4b | | | | 24 | | | | | | Install casing to 24'<br>Drill to 24' |
| | | | S-7: Black CLAY, some gravel (wet) [CH] | | | 25 | S-7 | SS | 4 | 10<br>9<br>9<br>7 | 18 | Gray wash<br>Light rig chatter<br>Add mud to tub<br>Take S-7 |
| | | | S-8: No recovery | | | 26 | S-8 | SS | 0 | 4<br>8<br>9<br>8 | 17 | Take S-8 |
| | -8.0 | | | | | 27 | | | | | | |
| | | | | | | 28 | | | | | | Drill to 28'<br>Brown wash |
| | | | S-9: Brown m-f Silty SAND, trace Gravel (wet) [SM] | | | 29 | S-9 | SS | 9 | 7<br>10<br>7<br>10 | 17 | Light rig chatter<br>Take S-29 |
| | | | | | | 30 | | | | | | |
| | | | | | | 31 | | | | | | |
| | | | | | | 32 | | | | | | |
| | | | | | | 33 | | | | | | |
| | | | | | | 34 | | | | | | |
| | | | | | | 35 | | | | | | Drill to 35' |
| | | Class 3b | S-10: Brown-orange m-f SAND, some silt, trace gravel (wet) [SP] | | | 36 | S-10 | SS | 8 | 1<br>10<br>8<br>7 | 18 | Hole collapse<br>Install casing to 25'<br>Brown wash<br>Quick, smooth drilling<br>Take S-10 |
| | | | | | | 37 | | | | | | |
| | | | | | | 38 | | | | | | |
| | | | | | | 39 | | | | | | |
| | | | | | | 40 | | | | | | Drill to 40' |
| | | | S-11: Brown m-f SAND, some silt (wet) [SP] | | | 41 | S-11 | SS | 12 | 5<br>6<br>6<br>8 | 12 | Brown wash<br>Light rig chatter<br>Add mud to tub<br>Take S-11 |
| | | | | | | 42 | | | | | | |
| | | | | | | 43 | | | | | | |
| | | | | | | 44 | | | | | | |
| | | | | | | 45 | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:57:29 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-10** Sheet 3 of 4

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 19 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Casng blws/ ft | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 45 | | | | | | Drill to 45'<br>Brown wash<br>Light rig chatter at 47'<br>Take s-12 |
| | | Class 3b | S-12: Brown m-f SAND, some silt, trace gravel (wet) [SP] | | | 46 | S-12 | SS | 7 | 5 7 6 6 | 13 | |
| | -29.5 | | | | | 47 | | | | | | |
| | | | | | | 48 | | | | | | |
| | | | | | | 49 | | | | | | |
| | | | | | | 50 | | | | | | Drill to 50'<br>Brown wash<br>Quick, smooth drilling<br>Take S-13 |
| | | | S-13: Brown medium SAND, trace Silt (wet) [SP] | | | 51 | S-13 | SS | 10 | 3 4 4 6 | 8 | |
| | | | | | | 52 | | | | | | |
| | | | | | | 53 | | | | | | |
| | | | | | | 54 | | | | | | |
| | | | | | | 55 | | | | | | Drill to 55'<br>Brown wash<br>Quick, smooth drilling<br>Take S-14 |
| | | Class 6 | S-14: Brown m-f SAND, some silt, trace gravel (wet) [SP] | | | 56 | S-14 | SS | 9 | 3 4 4 5 | 8 | |
| | | | | | | 57 | | | | | | |
| | | | | | | 58 | | | | | | |
| | | | | | | 59 | | | | | | |
| | | | | | | 60 | | | | | | Drill to 60'<br>Brown wash<br>Quick, smooth drilling<br>Add mud to tub<br>Take S-15 |
| | | | S-15: Brown m-f SAND, some silt, trace gravel (wet) [SP] | | | 61 | S-15 | SS | 8 | 5 4 4 5 | 8 | |
| | -44.5 | | | | | 62 | | | | | | |
| | | | | | | 63 | | | | | | |
| | | | | | | 64 | | | | | | |
| | | | | | | 65 | | | | | | Drill to 65'<br>Brown wash<br>Quick drilling<br>Light rig chatter at 66'<br>Take S-16 |
| | | Class 3b | S-16: Brown m-f SAND, some silt (wet) [SP] | | | 66 | S-16 | SS | 7 | 2 5 5 5 | 10 | |
| | -49.5 | | | | | 67 | | | | | | |
| | | | | | | 68 | | | | | | |
| | | | | | | 69 | | | | | | |
| | | Class 6 | | | | 70 | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:57:30 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-10** Sheet 4 of 4

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 19 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Casng blws/ ft |
|---|---|---|---|---|---|
| | | Class 6 | S-17: Brown m-f SAND, some silt (wet) [SP] | | |
| | -54.5 | | | | |
| | | Class 3b | S-18: Brown m-f SAND, some Silt (wet)[SP] | | |
| | -58.0 | | End of boring at 77' | | |

Depth Scale: 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95

Sample Data

| Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) |
|---|---|---|---|---|
| S-17 | SS | 11 | 2 4 5 5 | 9 |
| S-18 | SS | 8 | 3 6 6 7 | 12 |

N-Value (Blows/ft): 10 20 30 40

**Remarks**
(Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)

Drill to 70'
Brown wash
Quick, smooth drilling
Take S-17

Drill to 75'
Brown wash
Quick, smooth drilling
Take S-18

Hole was backfilled to grade with grout and covered with existing gravel

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:57:31 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-11** Sheet 1 of 4

| | |
|---|---|
| Project: Powerhouse Workshop | Project No.: 170404201 |
| Location: 322 3rd Avenue Brooklyn, N.Y. | Elevation and Datum: Approx. 7 (NAVD) |
| Drilling Company: Aquifer Drilling And Testing | Date Started: 9/27/16 — Date Finished: 9/29/16 |
| Drilling Equipment: Acker Track Rig | Completion Depth: 77 ft — Rock Depth: Not Encountered |
| Size and Type of Bit: 3-7/8" Roller Bit | Number of Samples: Disturbed 17 — Undisturbed 0 — Core 1 |
| Casing Diameter (in): 4" O.D. — Casing Depth (ft): 35 | Water Level (ft.): First ▽ - — Completion ▼ - — 24 HR. ▼ - |
| Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | Drilling Foreman: Anatoli Kholodilin |
| Sampler: 2" O.D. Split Spoon | Field Engineer: Kenan Sooklall |
| Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | +7.0 | | | | | 0 | | | | | 10 20 30 40 | 9:00 Langan and ADT on site |
| | +6.7 | | CONCRETE TOPPING SLAB (4 IN) | | | | | | | | | Core through concrete slab |
| | | Class 7 | S-1: Black WOOD, trace m-f Sand, trace fine Gravel, trace Silt [FILL] | | | 1 | S-1 | SS | 10 | 6 3 5 | 8 | Take S-1 |
| | +5.0 | | | | | 2 | | | | | | Petroleum staining<br>Encountered mat foundation at 2' below top of slab |
| | | | CONCRETE MAT SLAB (6.5 FT) (Petroleum staining) | | 7:00 | 3 | C-1 | NX CORE | REC=60"/60" =100% | RQD=60"/60" =100% | | Install 3' casing |
| | | | | | 2:41 | 4 | | | | | | Core through mat |
| | | | | | 2:08 | 5 | | | | | | Gray wash |
| | | | | | 2:12 | 6 | | | | | | Collect C-1 |
| | | | | | 2:11 | 7 | | | | | | Install 3' casing |
| | | | | | 1:58 | | C-2 | NX | 100% | 100% | | Start coring C-2 |
| | | | | 29.6 | 1:20 | 8 | | | | | | Collect C-2, barrel slips |
| | -1.5 | | | | | 9 | | | | | | |
| | | | | | | 10 | | | | | | |
| | | | | | | 11 | | | | | | REC=18"/18" =100%<br>RQD=18"/18" =100% |
| | | Class 6 | S-2: Black-gray m-f SAND, some Silt [SM] | | | 12 | S-2 | SS | 16 | 1 2 1 1 | 3 | Take S-2 |
| | | | S-3: Gray m-f SAND, some Silt (wet) [SM] | | | 13 | S-3 | SS | 18 | 3 4 5 8 | 9 | Take S-3 |
| | -8.0 | | | | | 14 | | | | | | |
| | | Class 3b | S-4: Gray m-f SAND, trace Silt (wet) [SP] | 18 | | 15 | S-4 | SS | 24 | 17 9 10 10 | 19 | Take S-4<br>Strong odor in S-4, product |
| | -10.0 | | | | | 16 | | | | | | |
| | | Class 2b | S-5: Gray c-f GRAVEL, trace m-f Sand, trace Silt [GP] | 2.1 | | 17 | S-5 | SS | 4 | 9 10 19 13 | 29 | End of day at 17'<br>7:00 Langan and ADT on site<br>Redrill to 17'<br>Install 15' casing (17')<br>Gray wash<br>Take S-5 |
| | -12.0 | | | | | 18 | | | | | | |
| | | Class 3b | | | | 19 | S-6 | SS | 18 | 11 13 | | Take S-6 |
| | | | | | | 20 | | | | | 27 | |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:57:38 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-11** Sheet 2 of 4

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 7 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Coring (min) | Depth Scale |
|---|---|---|---|---|---|---|
| | | | S-6: Gray m-f SAND, trace Silt (wet)[SP] | 0.5 | | 20 |
| | | Class 3b | | | | 21 |
| | | | | | | 22 |
| | | | | | | 23 |
| | | | | | | 24 |
| | | | | | | 25 |
| | | | S-7: Gray m-f SAND, trace Silt (wet)[SP | 20.7 | | 26 |
| | | | | | | 27 |
| | -21.5 | | | | | 28 |
| | | | | | | 29 |
| | | Class 6 | | | | 30 |
| | | | S-8: Gray m-f SAND, trace Silt (wet)[SP] | 22 | | 31 |
| | -25.0 | | | | | 32 |
| | | | | | | 33 |
| | | | | | | 34 |
| | | | | | | 35 |
| | | | S-9: Gray m-f SAND (wet)[SP] | 5.1 | | 36 |
| | | Class 3b | | | | 37 |
| | | | | | | 38 |
| | | | | | | 39 |
| | | | | | | 40 |
| | | | S-10: Gray m-f SAND, trace Silt (wet)[SP] | 1.5 | | 41 |
| | | | | | | 42 |
| | | | | | | 43 |
| | | | | | | 44 |
| | | | | | | 45 |

**Sample Data**

| Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) |
|---|---|---|---|---|
| S-6 | SS | 18 | 14<br>16 | 27 |
| S-7 | SS | 14 | 9<br>9<br>8<br>9 | 17 |
| S-8 | SS | 10 | 5<br>4<br>4<br>4 | 8 |
| S-9 | SS | 18 | 8<br>10<br>13<br>14 | 23 |
| S-10 | SS | 14 | 8<br>10<br>13<br>17 | 23 |

N-Value (Blows/ft) axis: 10 20 30 40

**Remarks**
(Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)

- Install 8' casing (25')
  Gray wash
  Take S-7
  Petroleum staining
- Install 5' casing (30')
  Gray wash
  Swap out CME rig for Acker rig
  Take S-8
- Install 5' casing (35')
  Gray wash
  Take S-9
- Drill to 40'
  Gray wash
  Take S-10

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:57:39 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-11** Sheet 3 of 4

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 7 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 45 | | | | | | Drill to 45' |
| | | | | | | 46 | S-11 | SS | 14 | 11<br>11<br>18<br>22 | 29 | Gray wash<br>End of day at 45'<br>Leave spoon in hole |
| | | | | | | 47 | | | | | | |
| | | | | | | 48 | | | | | | |
| | | | | | | 49 | | | | | | |
| | | Class 3b | S-11: Gray m-f SAND, trace Silt (wet)[SP] | 2.7 | | 50 | | | | | | 9/29/16-7:00 |
| | | | | | | 51 | S-12 | SS | 16 | 11<br>12<br>13<br>15 | 25 | Drill to 50'<br>Gray wash<br>Take S-12 |
| | | | S-12: Gray m-f SAND, trace Silt (wet)[SP] | 1.1 | | 52 | | | | | | |
| | -46.4 | | | | | 53 | | | | | | |
| | | | | | | 54 | | | | | | |
| | | | | | | 55 | | | | | | Drill to 55' |
| | | | | | | 56 | S-13 | SS | 14 | 15<br>16<br>23<br>20 | 39 | Gray wash<br>Take S-13<br>Losing water |
| | | | S-13: Gray m-f SAND, trace Silt (wet)[SP] | 0.2 | | 57 | | | | | | |
| | | | | | | 58 | | | | | | |
| | | | | | | 59 | | | | | | |
| | | | | | | 60 | | | | | | Drill to 60' |
| | | | | | | 61 | S-14 | SS | 16 | 14<br>19<br>25<br>18 | 44 | Gray wash<br>Take S-14<br>Losing water |
| | | Class 3a | S-14: Gray m-f SAND, trace Silt (wet)[SP] | 2.0 | | 62 | | | | | | |
| | | | | | | 63 | | | | | | |
| | | | | | | 64 | | | | | | |
| | | | | | | 65 | | | | | | Drill to 65' |
| | | | | | | 66 | S-15 | SS | 14 | 23<br>28<br>31<br>50 | 59 | Gray wash<br>Take S-15 |
| | | | S-15: Gray m-f SAND, trace Silt (wet)[SP] | 0.3 | | 67 | | | | | | |
| | | | | | | 68 | | | | | | |
| | | | | | | 69 | | | | | | |
| | | | | | | 70 | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:57:40 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-11** Sheet 4 of 4

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 7 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Class 3a | S-16: Gray c-f SAND, trace Silt, trace fine gravel (wet)[SP] | 0.5 | | 70–71 | S-16 | SS | 18 | 21, 32, 45, 40 | 77 | Drill to 70'<br>Gray wash<br>Take S-16<br>Losing water at 73' |
| | | | S-17: Gray c-f SAND, trace Silt (wet)[SP] | 2.1 | | 75–76 | S-17 | SS | 16 | 22, 21, 25, 27 | 46 | Drill to 75'<br>Gray wash<br>Take S-17 |
| | -70.0 | | End of boring at 77' | | | 77 | | | | | | End of boring at 77' |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:57:41 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-12** Sheet 1 of 4

| | |
|---|---|
| Project: Powerhouse Workshop | Project No.: 170404201 |
| Location: 322 3rd Avenue Brooklyn, N.Y. | Elevation and Datum: Approx. 7 (NAVD) |
| Drilling Company: Aquifer Drilling And Testing | Date Started: 10/14/16 — Date Finished: 10/18/16 |
| Drilling Equipment: Acker Restricted Access Drill | Completion Depth: 77 ft — Rock Depth: Not Encountered |
| Size and Type of Bit: 3-7/8" Roller Bit | Number of Samples: Disturbed 17 — Undisturbed 1 — Core 2 |
| Casing Diameter (in): 4" O.D. — Casing Depth (ft): 35 | Water Level (ft.): First ▽ - — Completion ▼ - — 24 HR. ▼ - |
| Casing Hammer: Donut — Weight (lbs): 140 — Drop (in): 30 | Drilling Foreman: Anatoli Kholodilin |
| Sampler: 2" O.D. Split Spoon | Field Engineer: Joe Como |
| Sampler Hammer: Donut — Weight (lbs): 140 — Drop (in): 30 | |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Casng blws/ ft Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) 10 20 30 40 | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | +7.0 | | CONCRETE TOPPING SLAB (9 INCH) | | | 0 | | | | | | 9:15 AM Begin B-12<br>Drill through concrete slab<br>Take S-1<br>Refusal at 1.5' |
| | +6.3 | Class 7 | S-1: Dark gray c-f SAND, some coarse gravel, some silt (wet) [FILL] | 1.0 | SPUN | 1 | S-1 | SS | 8 | 37<br>70/3" | 70/3" | |
| | +4.0 | | CONCRETE SLAB (6 FT) | | 2:32 | 3 | C-1 | NX CORE | REC=60"/60" =100% | RQD=54"/60" =90% | | Spin casing to 3'<br>Begin C-1 at 3' through concrete |
| | | | | | 3:03SPUN 3:24 | 6 | | | | | | |
| | | | | 1.2 | 2:18 | 7 | | | | | | |
| | | | | | 2:10 | | | | | | | |
| | | | | 3.2 | 2:0221 | 8 | C-2 | NX | 12 | | | Begin C-2 at 8' through concrete |
| | -2.0 | | | | 37 | 9 | S-2 | SS | 18 | 2<br>WOH<br>WOH<br>1 | | Take S-2<br>$q_u$=0.25 tsf $s_u$=0.1 tsf |
| | | Class 6 | S-2: Dark gray CLAY (wet) [CL] | 15.2 | 15 | 10 | | | | | | |
| | | | | | 25 | 11 | U-1 | SH | 24 | | | Drill to 11'<br>Dark gray wash<br>Take shelby tube U-1 |
| | -6.0 | | | | 33 | 12 | | | | | | |
| | | | | | 12 | 13 | S-3 | SS | 24 | 3<br>2<br>2<br>3 | 4 | Take S-3<br>$q_u$=0.25 tsf $s_u$=0.2 tsf |
| | | Class 4c | S-3: Dark gray CLAY (wet) [CL] | 1.5 | 11 | 14 | | | | | | |
| | | | S-4: Dark gray CLAY (wet) [CL] | 1.5 | PUSH | 15 | S-4 | SS | 2 | 3<br>3<br>3<br>5 | 6 | Take S-4 |
| | -10.0 | | | | 37 | 16 | | | | | | |
| | | Class 4b | S-5: Dark gray-black CLAY, some organics (wet) [CL] | 7.5 | 46 | 17 | S-5 | SS | 24 | WOH<br>4<br>17<br>32 | 21 | Take S-5<br>End of the day 10/17/16<br>Advance casing to 19'<br>Clear out casing<br>Take S-6<br>$q_u$=0.25 tsf $s_u$=0.05 tsf |
| | -12.0 | Class 3a | | | 54 | 18 | S-6 | SS | 14 | 15<br>31 | 67 | |
| | | | | | | 19 | | | | | | |
| | | | | | | 20 | | | | | | |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:57:51 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-12** Sheet 2 of 4

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 7 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Casng blws/ ft Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | S-6: Gray m-f SAND, some silt, trace gravel (wet) [SP] | 3.7 | 62 | 20 | S-6 | SS | 14 | 36<br>31 | 67 | |
| | | | | | 47 | 21 | | | | | | |
| | | | | | 45 | 22 | | | | | | |
| | | | | | 38 | 23 | | | | | | |
| | | | | | 36 | 24 | | | | | | |
| | | | | | 68 | 25 | S-7 | SS | 12 | 21<br>18<br>23<br>23 | 41 | Drill to 25'<br>Brown wash<br>Take S-7<br>Advance casing to 25' |
| | | | S-7: Brown m- f SAND, some silt (wet) [SP] | 0.5 | 54 | 26 | | | | | | |
| | | | | | 48 | 27 | | | | | | |
| | | | | | 46 | 28 | | | | | | |
| | | | | | 39 | 29 | | | | | | |
| | | | | | 43 | 30 | S-8 | SS | 13 | 16<br>17<br>18<br>17 | 35 | Drill to 30'<br>Brown wash<br>Take S-8 |
| | | | S-8: Brown m-f SAND, some silt, trace gravel (wet) [SP] | 0.3 | 42 | 31 | | | | | | |
| | | Class 3a | | | 45 | 32 | | | | | | |
| | | | | | 41 | 33 | | | | | | |
| | | | | | 38 | 34 | | | | | | |
| | | | | | | 35 | S-9 | SS | 15 | 14<br>16<br>16<br>17 | 32 | Take S-9<br>Install casing to 35' |
| | | | S-9: Brown c-f SAND, some silt (wet) [SP] | 0.5 | | 36 | | | | | | |
| | | | | | | 37 | | | | | | |
| | | | | | | 38 | | | | | | |
| | | | | | | 39 | | | | | | |
| | | | | | | 40 | S-10 | SS | 13 | 11<br>18<br>23<br>25 | 41 | Drill to 40'<br>Brown wash<br>Take S-10 |
| | | | S-10: Brown m-f SAND, some silt (wet) [SP] | | | 41 | | | | | | |
| | | | | | | 42 | | | | | | |
| | | | | | | 43 | | | | | | |
| | | | | | | 44 | | | | | | |
| | | | | | | 45 | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:57:52 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-12** Sheet 3 of 4

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 7 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Casng blws/ ft Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | S-11: Brown m-f SAND, some silt (wet) [SP] | | | 45 | S-11 | SS | 11 | 13<br>14<br>18<br>19 | 32 | Drill to 45'<br>Brown wash<br>Take S-11 |
| | | | | | | 46 | | | | | | |
| | | | | | | 47 | | | | | | |
| | | | | | | 48 | | | | | | |
| | | | | | | 49 | | | | | | |
| | | | | | | 50 | S-12 | SS | 20 | 12<br>18<br>25<br>29 | 43 | Take S-12 |
| | | | S-12: Brown m-f SAND, some silt (wet) [SP] | 0.4 | | 51 | | | | | | |
| | | | | | | 52 | | | | | | |
| | | | | | | 53 | | | | | | |
| | | | | | | 54 | | | | | | |
| | | | | | | 55 | S-13 | SS | 18 | 20<br>21<br>24<br>27 | 45 | Drill to 55'<br>Brown wash<br>Take S-13 |
| | | | S-13: Brown m-f SAND, some silt (wet) [SP] | 0.5 | | 56 | | | | | | |
| | | Class 3a | | | | 57 | | | | | | |
| | | | | | | 58 | | | | | | |
| | | | | | | 59 | | | | | | |
| | | | | | | 60 | S-14 | SS | 14 | 17<br>21<br>29<br>33 | 50 | Drill to 60'<br>Brown wash<br>Take S-14<br>End of the day<br>10/18/16<br>Pull up S-14 |
| | | | S-14: Brown m-f SAND, some silt (wet) [SP] | 0.5 | | 61 | | | | | | |
| | | | | | | 62 | | | | | | |
| | | | | | | 63 | | | | | | |
| | | | | | | 64 | | | | | | |
| | | | | | | 65 | S-15 | SS | 15 | 25<br>28<br>35<br>48 | 63 | Drill to 65'<br>Brown wash<br>Take S-15 |
| | | | S-15: Brown m-f SAND, some silt (wet) [SP] | 0.5 | | 66 | | | | | | |
| | | | | | | 67 | | | | | | |
| | | | | | | 68 | | | | | | |
| | | | | | | 69 | | | | | | |
| | -63.0 | | | | | 70 | | | | | | |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:57:53 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-12** Sheet 4 of 4

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 7 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Casng blws/ ft Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 70 | | | | | | Drill to 70' Brown wash Take S-16 |
| | | Class 5a | S-16: Brown SILT, some sand, trace clay (wet) [MH] | 0.4 | | 71 | S-16 | SS | 21 | 18 27 33 48 | 60 | |
| | | | | | | 72 | | | | | | |
| | | | | | | 73 | | | | | | |
| | | | | | | 74 | | | | | | |
| | | | | | | 75 | | | | | | Drill to 75' Brown wash Take S-17 |
| | | | S-17: Brown SILT, some clay (wet) [MH] | 0.4 | | 76 | S-17 | SS | 16 | 33 42 47 52 | 89 | |
| | -70.0 | | End of boring at 77' | | | 77 | | | | | | |
| | | | | | | 78 | | | | | | |
| | | | | | | 79 | | | | | | |
| | | | | | | 80 | | | | | | |
| | | | | | | 81 | | | | | | |
| | | | | | | 82 | | | | | | |
| | | | | | | 83 | | | | | | |
| | | | | | | 84 | | | | | | |
| | | | | | | 85 | | | | | | |
| | | | | | | 86 | | | | | | |
| | | | | | | 87 | | | | | | |
| | | | | | | 88 | | | | | | |
| | | | | | | 89 | | | | | | |
| | | | | | | 90 | | | | | | |
| | | | | | | 91 | | | | | | |
| | | | | | | 92 | | | | | | |
| | | | | | | 93 | | | | | | |
| | | | | | | 94 | | | | | | |
| | | | | | | 95 | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:57:54 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-13A** Sheet 1 of 1

| | |
|---|---|
| Project: Powerhouse Workshop | Project No.: 170404201 |
| Location: 322 3rd Avenue Brooklyn, N.Y. | Elevation and Datum: Approx. 16 (NAVD) |
| Drilling Company: Aquifer Drilling And Testing | Date Started: 10/13/16 — Date Finished: 10/13/16 |
| Drilling Equipment: CME 55 Truck Rig | Completion Depth: 6 ft — Rock Depth: Not Encountered |
| Size and Type of Bit: 3-7/8" Roller Bit | Number of Samples: Disturbed 3, Undisturbed 0, Core 0 |
| Casing Diameter (in): 4 1/2" — Casing Depth (ft): 4 | Water Level (ft.): First - , Completion - , 24 HR. - |
| Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | Drilling Foreman: Matt Ficeto |
| Sampler: 2" O.D. Split Spoon | Field Engineer: Daniel O'Donnell |
| Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Casng blws/ ft Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | +16.0 | | | | | 0 | | | | | 10 20 30 40 | |
| | | | S-1: Brown m-f silty SAND, some brick, trace concrete (dry) [FILL] | 4.2 | | 1 | S-1 | SS | 20 | 8 8 8 3 | 16 | Take S-1 |
| | | Class 7 | S-2: Brown m-f silty SAND, some concrete and brick (dry) [FILL] | 8.2 | SPUN | 2 | S-2 | SS | 8 | 3 6 5 3 | 11 | Take S-2 |
| | | | S-3: Brown-black m-f silty SAND, some gravel, trace brick and concrete (dry) [FILL] | | | 3 | | | | | | Install casing to 4' |
| | | | Obstruction at 6' | | | 4 | S-3 | SS | 12 | 4 5 2 3 | 7 | Take S-3 |
| | +10.0 | | End of boring at 6' | | | 5 | | | | | | Refusal at 6' |
| | | | | | | 6 | | | | | | Drill through obstruction |
| | | | | | | 7 | | | | | | Water seepage onto neighboring site |
| | | | | | | 8 | | | | | | Abandon hole due to water loss |
| | | | | | | 9 | | | | | | Grout hole back to grade and cover with existing gravel |
| | | | | | | 10 | | | | | | |
| | | | | | | 11 | | | | | | |
| | | | | | | 12 | | | | | | |
| | | | | | | 13 | | | | | | |
| | | | | | | 14 | | | | | | |
| | | | | | | 15 | | | | | | |
| | | | | | | 16 | | | | | | |
| | | | | | | 17 | | | | | | |
| | | | | | | 18 | | | | | | |
| | | | | | | 19 | | | | | | |
| | | | | | | 20 | | | | | | |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:01 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-13B** Sheet 1 of 4

| | |
|---|---|
| Project: Powerhouse Workshop | Project No.: 170404201 |
| Location: 322 3rd Avenue Brooklyn, N.Y. | Elevation and Datum: Approx. 16 (NAVD) |
| Drilling Company: Aquifer Drilling And Testing | Date Started: 10/21/16 — Date Finished: 10/24/16 |
| Drilling Equipment: CME 55 Truck Rig | Completion Depth: 77 ft — Rock Depth: Not Encountered |
| Size and Type of Bit: 3-7/8" Roller Bit | Number of Samples: Disturbed 21 — Undisturbed 0 — Core 0 |
| Casing Diameter (in): 4 1/2" — Casing Depth (ft): 30 | Water Level (ft.): First ▽ 18 — Completion ▼ - — 24 HR. ▼ - |
| Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | Drilling Foreman: Matt Ficeto |
| Sampler: 2" O.D. Split Spoon | Field Engineer: Daniel O'Donnell |
| Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Casng blws/ ft Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | +16.0 | | | | 0 | | | | | 10 20 30 40 | |
| | | | S-1: Brown m-f silty SAND, some concrete and trace brick (dry) [FILL] | | 1 | S-1 | SS | 8 | 9<br>10<br>9<br>9 | 19 | Take S-1 |
| | | | S-2: Brown m-f silty SAND, some brick and concrete (dry) [FILL] | SPUN | 2<br>3 | S-2 | SS | 15 | 6<br>9<br>17<br>37 | 26 | Drill to 2'<br>Brown wash<br>Light rig chatter<br>Take S-2 |
| | | | S-3: Red-brown m-f silty SAND, some brick (dry) [FILL] | | 4<br>5 | S-3 | SS | 7 | 11<br>45<br>30<br>5 | 75 | Install casing to 4'<br>Drill to 4'<br>Brown wash<br>Light rig chatter<br>Take S-3 |
| | | Class 7 | S-4: Brown m-f silty SAND, some gravel (moist) [FILL] | SPUN | 6<br>7 | S-4 | SS | 1 | 1<br>WOH<br>WOH<br>1 | | Take S-4 |
| | | | S-5: No recovery | | 8<br>9 | S-5 | SS | 0 | 1<br>2<br>2<br>2 | 4 | Drill to 8'<br>Brown wash<br>Light rig chatter<br>Take S-5 |
| | | | S-6: No recovery | SPUN | 10<br>11 | S-6 | SS | 0 | 2<br>2<br>58<br>100/2" | 60 | Install casing to 10'<br>Drill to 10'<br>No return<br>Quick smooth drilling<br>Take S-6<br>Install casing to 11.5'<br>Drill through concrete obstruction<br>Gray wash<br>Slow drilling. light trig chatter |
| | +4.5 | | CONCRETE (6 FT 6 IN) | | 12<br>13<br>14<br>15 | | | | | | |
| | -2.0 | | | SPUN | 16<br>17<br>18 | S-7 | SS | 24 | WOH<br>WOH<br>WOH<br>WOH | | Broke through at 17.5' to 18'<br>Take S-7 |
| | | Class 6 | S-7: Gray-black CLAY, trace wood and oil staining (wet) [CL] | | 19<br>20 | | | | | | |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:04 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-13B** Sheet 2 of 4

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 16 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Casng blws/ ft Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 20 | | | | | 10 20 30 40 | Take S-8 |
| | | | S-8: Gray CLAY, trace wood, trace silt (wet) [CL] | | 21 | S-8 | SS | 24 | WOH WOH WOH WOH | | |
| | | | | | 22 | | | | | | Take S-9 |
| | | Class 6 | S-9: Gray CLAY, trace silt, trace wood, trace shells (wet) [CL] | SPUN | 23 | S-9 | SS | 24 | WOH WOH WOH WOH | | |
| | | | S-10: Gray CLAY, trace wood (wet) [CL] | | 24 | | | | | | Install casing to 24' |
| | | | | | 25 | S-10 | SS | 16 | WOH WOH WOH | | Drill to 24' Gray wash Quick smooth drilling Take S-10 |
| | -9.5 | | | | | S-11 | SS | 3 | 6 | | Take S-11 |
| | | Class 6 | S-11: Gray m-f silty SAND (wet) [ SM] | | 26 | | | | | | |
| | | | | SPUN | 27 | | | | | | |
| | -12.0 | | | | 28 | | | | | | |
| | | | | | 29 | | | | | | |
| | | | | | 30 | | | | | | Drill to 30' Gray wash |
| | | Class 3b | S-12: Gray m-f Silty SAND (wet)[ SM] | | 31 | S-12 | SS | 15 | 4 8 8 12 | 16 | |
| | | | | | 32 | | | | | | |
| | -17.5 | | | | 33 | | | | | | |
| | | | | | 34 | | | | | | |
| | | | | | 35 | | | | | | Drill to 35' Brown wash Quick smooth drilling Take S-13 |
| | | Class 6 | S-13: Gray m-f SAND, some silt (wet) [SP] | | 36 | S-13 | SS | 8 | 2 4 5 6 | 9 | |
| | | | | | 37 | | | | | | |
| | -22.5 | | | | 38 | | | | | | |
| | | | | | 39 | | | | | | |
| | | | | | 40 | | | | | | Drill to 40' Brown wash Quick smooth drilling Take S-14 |
| | | Class 3b | S-14: Brown m-f SAND, some silt (wet) [SP] | | 41 | S-14 | SS | 12 | 3 5 5 7 | 10 | |
| | | | | | 42 | | | | | | |
| | | | | | 43 | | | | | | |
| | | | | | 44 | | | | | | |
| | | | | | 45 | | | | | | |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:05 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-13B** Sheet 3 of 4

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 16 (NAVD) |

| MATERIAL SYMBOL | Elev. (ft) | Building Code | Sample Description | Casng blws/ ft Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 45 | | | | | 10 20 30 40 | Drill to 45' Brown wash Quick smooth drilling Take S-15 |
| | | | S-15: Brown m-f SAND, some silt, trace gravel (wet) [SW] | | 46 | S-15 | SS | 16 | 5 5 6 9 | 11 | |
| | | | | | 47 | | | | | | |
| | | | | | 48 | | | | | | |
| | | | | | 49 | | | | | | |
| | | | | | 50 | | | | | | Drill to 50' Brown-gray wash Light rig chatter Take S-16 |
| | | | S-16: Brown m-f SAND, some silt (wet) [SP] | | 51 | S-16 | SS | 10 | 4 4 7 9 | 11 | |
| | | | | | 52 | | | | | | |
| | | | | | 53 | | | | | | |
| | | | | | 54 | | | | | | |
| | | | | | 55 | | | | | | Drill to 55' Brown wash Quick smooth drilling Take S-17 |
| | | | S-17: Brown m-f SAND, some silt (wet) [SP] | | 56 | S-17 | SS | 13 | 3 4 6 8 | 10 | |
| | | Class 3b | | | 57 | | | | | | |
| | | | | | 58 | | | | | | |
| | | | | | 59 | | | | | | |
| | | | | | 60 | | | | | | Drill to 60' Brown wash Quick smoot drilling Take S-18 |
| | | | S-18: Brown m-f silty SAND (wet) [SM] | | 61 | S-18 | SS | 9 | 4 5 6 8 | 11 | |
| | | | | | 62 | | | | | | |
| | | | | | 63 | | | | | | |
| | | | | | 64 | | | | | | |
| | | | | | 65 | | | | | | Drill to 65' Brown wash Quick smooth drilling Take S-19 |
| | | | S-19: Brown m-f silty SAND (wet)[ SM] | | 66 | S-19 | SS | 17 | 5 9 11 12 | 20 | |
| | | | | | 67 | | | | | | |
| | | | | | 68 | | | | | | |
| | | | | | 69 | | | | | | |
| | | | | | 70 | | | | | | |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:06 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-13B** Sheet 4 of 4

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 16 (NAVD) |

| MATERIAL SYMBOL | Elev. (ft) | Building Code | Sample Description | Casng blws/ ft Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Class 3b | S-20: Brown m-f silty SAND (wet) [SM] | | 70–71 | S-20 | SS | 11 | 7<br>11<br>12<br>14 | 23 | Drill to 70'<br>Brown wash<br>Quick smooth drilling<br>Take S-20 |
| | | | | | 71–72 | | | | | | |
| | | | | | 72–73 | | | | | | |
| | | | | | 73–74 | | | | | | |
| | | | | | 74–75 | | | | | | |
| | | | S-21: Brown m-f silty SAND (wet) [SM] | | 75–76 | S-21 | SS | 12 | 4<br>5<br>7<br>8 | 12 | Drill to 75'<br>Brown wash<br>Quick smooth drilling<br>Take S-21 |
| | -61.0 | | End of boring at 77' | | 76–77 | | | | | | Borehole backfilled with clean cuttings and grouted to grade and covered with existing gravel |
| | | | | | 77–78 | | | | | | |
| | | | | | 78–79 | | | | | | |
| | | | | | 79–80 | | | | | | |
| | | | | | 80–81 | | | | | | |
| | | | | | 81–82 | | | | | | |
| | | | | | 82–83 | | | | | | |
| | | | | | 83–84 | | | | | | |
| | | | | | 84–85 | | | | | | |
| | | | | | 85–86 | | | | | | |
| | | | | | 86–87 | | | | | | |
| | | | | | 87–88 | | | | | | |
| | | | | | 88–89 | | | | | | |
| | | | | | 89–90 | | | | | | |
| | | | | | 90–91 | | | | | | |
| | | | | | 91–92 | | | | | | |
| | | | | | 92–93 | | | | | | |
| | | | | | 93–94 | | | | | | |
| | | | | | 94–95 | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:07 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-14 (OW)** Sheet 1 of 4

| | |
|---|---|
| Project: Powerhouse Workshop | Project No.: 170404201 |
| Location: 322 3rd Avenue Brooklyn, N.Y. | Elevation and Datum: Approx. 16 (NAVD) |
| Drilling Company: Aquifer Drilling And Testing | Date Started: 10/6/16 — Date Finished: 10/7/16 |
| Drilling Equipment: CME 55 Truck Rig | Completion Depth: 77 ft — Rock Depth: Not Encountered |
| Size and Type of Bit: 3-7/8" Roller Bit | Number of Samples: Disturbed 21, Undisturbed 1, Core 0 |
| Casing Diameter (in): 4 1/2" — Casing Depth (ft): 25 | Water Level (ft.): First ▽, Completion ▼, 24 HR. ▼ |
| Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | Drilling Foreman: Matt Ficeto |
| Sampler: 2" O.D. Split Spoon | Field Engineer: Daniel O'Donnell |
| Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Casng blws/ ft Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) 10 20 30 40 | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | +16.0 | | | | 0 | | | | | | Take S-1 |
| | | Class 7 | S-1: Brown/Black fine Silty SAND, concrete block fragments, trace Gravel (dry)[FILL] | | 1 | S-1 | SS | 15 | 41 41 13 12 | 54 | |
| | | | S-2: Brown/Black fine Silty SAND, concrete and brick (dry)[FILL] | SPUN | 2 | S-2 | SS | 16 | 4 8 7 16 | 15 | Drill to 2' Brown wash Take S-2 |
| | | | S-3: Browm m-f Gravelly SAND, trace brick (dry)[FILL] | | 3 4 5 | S-3 | SS | 2 | 3 1 2 6 | 3 | Install casing to 4' No return Drill to 4' Brown wash Quick drilling Take S-3 |
| | | | S-4: Black fine Gravelly SAND, trace brick (moist)[FILL] | SPUN | 6 7 | S-4 | SS | 8 | 4 1 2 8 | 3 | Drill to 6' Red wash Quick drilling Take S-4 |
| | | | S-5: Black GRAVEL, trace fine Sand, trace brick (moist)[FILL] | | 8 9 | S-5 | SS | 8 | 2 13 8 2 | 21 | Drill to 8' Brown wash Quick drilling Install casing to 8' Take S-5 |
| | | | S-6: Brown GRAVEL, some fine Sand (wet)[FILL] | SPUN | 10 11 12 | S-6 | SS | 10 | 3 6 10 12 | 16 | Drill to 10' Take S-6 |
| | +2.5 | | | | 13 14 | | | | | | |
| | | Class 6 | S-7: No recovery | SPUN | 15 16 17 | S-7 | SS | 0 | WOH WOH WOH WOH | | Drill to 15' Gray wash Quick drilling Light rig chatter Revert added to mud tub Take S-7 Take S-8 |
| | | | S-8: Black soft SILT with some clay (wet) [MH] | | 18 | S-8 | SS | 7 | WOH 1 2 1 | 3 | |
| | | | | | 19 20 | S-9 | SS | 24 | WOH WOH | | Take S-9 |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:15 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-14 (OW)** Sheet 2 of 4

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 16 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Casng blws/ ft Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Class 6 | S-9: Black soft SILT with some clay (wet) [MH] | | 20 | S-9 | SS | 24 | WOH WOH | | |
| | -5.0 | | | | 21 | | | | | | Drill to 21' Gray wash Quick drilling Take S-10 |
| | | Class 6 | S-10: Black soft CLAY, trace silt (wet) [CH] | SPUN | 22 | S-10 | SS | 3 | 1 1 2 3 | 3 | |
| | | | | | 23 | U-1 | SH | 19 | | | Drill to 23' Black wash Smooth, quick drilling Take U-1 |
| | -8.0 | | | | 24 | | | | | | |
| | | Class 3b | S-11: Brown m-f SAND, trace Silt (wet)[SP] | | 25 | S-11 | SS | 13 | 6 8 8 7 | 16 | Install casing to 25' Drill to 25' Black wash Smooth drilling Take S-11 |
| | | | | | 26 | | | | | | |
| | | | | | 27 | | | | | | |
| | | | | | 28 | | | | | | |
| | | | | | 29 | | | | | | |
| | -14.0 | | | | 30 | | | | | | |
| | | | S-12: Black fine Silty SAND (wet) [SM] | | 31 | S-12 | SS | 20 | 3 3 3 6 | 6 | Drill to 30' Gray wash Smooth drilling Take S-12 |
| | | | | | 32 | | | | | | |
| | | | | | 33 | | | | | | |
| | | | | | 34 | | | | | | |
| | | Class 6 | S-13: Brown m-f SAND, trace Silt (wet)[SW] | | 35 | S-13 | SS | 13 | 2 4 4 4 | 8 | Drill to 35' Gray wash Smooth drilling Take S-13 |
| | | | | | 36 | | | | | | |
| | | | | | 37 | | | | | | |
| | | | | | 38 | | | | | | |
| | | | | | 39 | | | | | | |
| | -24.0 | | | | 40 | | | | | | |
| | | | S-14: Brown m-f SAND, trace Silt (wet)[SP] | | 41 | S-14 | SS | 11 | 3 7 6 8 | 13 | Drill to 40' Gray wash Smooth, quick drilling Take S-14 |
| | | Class 3b | | | 42 | | | | | | |
| | | | | | 43 | | | | | | |
| | | | | | 44 | | | | | | |
| | | | | | 45 | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:15 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-14 (OW)** Sheet 3 of 4

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 16 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Casng blws/ ft Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 45 | | | | | 10 20 30 40 | Drill to 45' Gray wash Smooth, quick drilling Take S-15 |
| | | | S-15: Brown m-f SAND, trace Silt, trace Gravel (wet) [SP] | | 46 | S-15 | SS | 12 | 3 6 6 6 | 12 | |
| | | | | | 47 | | | | | | |
| | | | | | 48 | | | | | | |
| | | | | | 49 | | | | | | |
| | | | | | 50 | | | | | | Drill to 50' Gray wash Smooth, quick drilling Take S-16 |
| | | | S-16: Brown m-f SAND, trace Silt (wet) [SP] | | 51 | S-16 | SS | 14 | 4 8 6 8 | 14 | |
| | | | | | 52 | | | | | | |
| | | | | | 53 | | | | | | |
| | | | | | 54 | | | | | | |
| | | | | | 55 | | | | | | Drill to 55' Gray wash Smooth, quick drilling Take S-17 |
| | | | S-17: Brown m-f SAND, trace Silt (wet) [SP] | | 56 | S-17 | SS | 12 | 6 6 8 9 | 14 | |
| | | Class 3b | | | 57 | | | | | | |
| | | | | | 58 | | | | | | |
| | | | | | 59 | | | | | | |
| | | | | | 60 | | | | | | Drill to 60' Gray wash Smooth, quick drilling Take S-18 |
| | | | S-18: Brown m-f SAND, trace Silt (wet) [SP] | | 61 | S-18 | SS | 11 | 6 8 13 12 | 21 | |
| | | | | | 62 | | | | | | |
| | | | | | 63 | | | | | | |
| | | | | | 64 | | | | | | |
| | | | | | 65 | | | | | | Drill to 65' Gray wash Smooth , quick drilling Take S-19 |
| | | | S-19: Brown m-f SAND, trace Silt (wet) [SP] | | 66 | S-19 | SS | 20 | 6 8 10 11 | 18 | |
| | | | | | 67 | | | | | | |
| | | | | | 68 | | | | | | |
| | | | | | 69 | | | | | | |
| | | | | | 70 | | | | | | |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:16 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-14 (OW)** Sheet 4 of 4

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 16 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Casng blws/ ft Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Class 3b | S-20: Brown m-f SAND, trace Silt (wet) [SP] | | 70 | S-20 | SS | 10 | 7<br>13<br>15<br>15 | 28 | Drill to 70'<br>Gray wash<br>Smooth, quick drilling<br>Take S-20 |
| | | | | | 71 | | | | | | |
| | | | | | 72 | | | | | | |
| | | | | | 73 | | | | | | |
| | | | | | 74 | | | | | | |
| | | | | | 75 | S-21 | SS | 11 | 7<br>11<br>14<br>14 | 25 | Drill to 75'<br>Brown wash<br>Smooth, quick drilling<br>Take S-21 |
| | -61.0 | | S-21: Brown m-f Silty SAND (wet) [SM] | | 76 | | | | | | |
| | | | End of boring at 77' | | 77 | | | | | | Install well |
| | | | | | 78 | | | | | | |
| | | | | | 79 | | | | | | |
| | | | | | 80 | | | | | | |
| | | | | | 81 | | | | | | |
| | | | | | 82 | | | | | | |
| | | | | | 83 | | | | | | |
| | | | | | 84 | | | | | | |
| | | | | | 85 | | | | | | |
| | | | | | 86 | | | | | | |
| | | | | | 87 | | | | | | |
| | | | | | 88 | | | | | | |
| | | | | | 89 | | | | | | |
| | | | | | 90 | | | | | | |
| | | | | | 91 | | | | | | |
| | | | | | 92 | | | | | | |
| | | | | | 93 | | | | | | |
| | | | | | 94 | | | | | | |
| | | | | | 95 | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:17 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-15** Sheet 1 of 4

| | |
|---|---|
| Project: Powerhouse Workshop | Project No.: 170404201 |
| Location: 322 3rd Avenue Brooklyn, N.Y. | Elevation and Datum: Approx. 17 (NAVD) |
| Drilling Company: Aquifer Drilling And Testing | Date Started: 10/14/16 — Date Finished: 10/14/16 |
| Drilling Equipment: CME 55 Truck Rig | Completion Depth: 77 ft — Rock Depth: Not Encountered |
| Size and Type of Bit: 3-7/8" Roller Bit | Number of Samples: Disturbed 22, Undisturbed 0, Core 0 |
| Casing Diameter (in): 4" I.D. — Casing Depth (ft): 19 | Water Level (ft.): First ▽ 16, Completion ▼ -, 24 HR. ▼ - |
| Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | Drilling Foreman: Matt Ficeto |
| Sampler: 2" O.D. Split Spoon | Field Engineer: Keith Herman |
| Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | +17.0 | | | | 0 | | | | | 10 20 30 40 | 8:00 Started drilling |
| | | | S-1: Grayish brown c-f SAND, some c-f gravel, trace silt, trace concrete (dry) [FILL] | 1.7 | 1 | S-1 | SS | 5 | 6<br>75/4" | 75/4" | Take S-1 |
| | | | S-2: black m-f SAND, some silt, trace coarse sand, trace brick (moist) [FILL] | 0.7 | 2 | S-2 | SS | 3 | 75/5" | 75/5" | Advanced casing to 2'<br>Drill to 2'<br>Grayish brown wash<br>Take S-2 |
| | | | S-3: Gray fine GRAVEL, some concrete, some ceramic fragments (moist) [FILL] | 0.7 | 5 | S-3 | SS | 2 | 12<br>6<br>8<br>12 | 14 | Advanced casing to 4'<br>Drill to 4'<br>Gray wash<br>Take S-3<br>Advanced casing to 5' |
| | | Class 7 | S-4: Grayish brown c-f SAND, trace fine gravel, trace silt, trace concrete (moist) [FILL] | 0.8 | 7 | S-4 | SS | 6 | 10<br>65<br>4<br>2 | 69 | Drill to 6'<br>Take S-4 |
| | | | S-5: Dark gray c-f SAND, trace fine gravel, trace silt, trace brick (moist) [FILL] | 0.8 | 9 | S-5 | SS | 7 | 1<br>2<br>1<br>1 | 3 | Advanced casing to 8'<br>Drill to 8'<br>Gray wash<br>Take S-5 |
| | | | S-6: Dark gray c-f GRAVEL, some c-f sand, trace silt (moist) [FILL] | 0.3 | 11 | S-6 | SS | 1 | 1<br>WOH<br>WOH<br>WOH | | Advanced casing to 10'<br>Drill to 10'<br>Dark gray wash<br>Take S-6 |
| | | | S-7: Brown m-f SAND, some silt, trace coarse sand, trace coarse gravel (moist)[FILL] | 0.3 | 13 | S-7 | SS | 7 | 2<br>3<br>2<br>3 | 5 | Take S-7 |
| | +3.0 | Class 6 | S-8: Dark gray CLAY (moist)[CH] | 1.1 | 15 | S-8 | SS | 15 | 1<br>1<br>WOH<br>1 | | Advanced casing to 14'<br>Drill to 14'<br>Grayish brown wash<br>Take S-8 |
| | +1.0 | Class 6 | S-9: Dark grayish brown c-f Silty SAND (wet)[SP] | | 17 | S-9 | SS | 14 | 2<br>1<br>2<br>6 | 3 | Take S-9<br>$q_u$=0.75 tsf |
| | -3.0 | | | | 20 | | | | | | Advanced casing to 19'<br>Drill to 20'<br>Gray wash |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:24 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-15** Sheet 2 of 4

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 17 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 20 | | | | | | Take S-10 |
| | | | S-10: Grayish brown c-f SAND, some fine gravel, trace silt (wet)[SP] | 0.3 | 21 | S-10 | SS | 4 | 6<br>13<br>9<br>2 | 22 | |
| | | Class 3b | | | 22 | | | | | | |
| | | | | | 23 | | | | | | |
| | | | | | 24 | | | | | | |
| | -8.0 | | | | 25 | | | | | | Drill to 25'<br>Take S-11 |
| | | | S-11: No recovery (Inferred [CH] based on drilling observations) | | 26 | S-11 | SS | 0 | WOH<br>WOH<br>WOH<br>WOH | | |
| | | | | | 27 | | | | | | Take S-12 |
| | | Class 6 | S-12: Dark gray silty CLAY, trace fine gravel (wet)[CH] | 0.3 | 28 | S-12 | SS | 16 | WOH<br>WOH<br>1<br>1 | | |
| | | | | | 29 | | | | | | |
| | -13.5 | | S-13A: Dark gray silty CLAY, trace fine sand (wet)[CH] | | 30 | S-13A | | | 1<br>2 | | Drill to 30'<br>Dark gray wash<br>Take S-13A & S-13B |
| | | | S-13B: Gray fine SAND, some silt (wet)[SP] | | 31 | S-13B | SS | 24 | 8<br>9 | 10 | |
| | | | | | 32 | | | | | | |
| | | | | | 33 | | | | | | |
| | | | | | 34 | | | | | | |
| | | | | | 35 | | | | 4 | | Drill to 35'<br>Gray wash<br>Take S-14 |
| | | | S-14: Grayish brown m-f SAND (wet)[SP] | 0.3 | 36 | S-14 | SS | 17 | 6<br>10 | 16 | |
| | | Class 3b | | | 37 | | | | 13 | | |
| | | | | | 38 | | | | | | |
| | | | | | 39 | | | | | | |
| | | | | | 40 | | | | 3 | | Drill to 40'<br>Gray wash<br>Take S-15 |
| | | | S-15: Grayish-brown fine SAND (wet)[SP] | 0.3 | 41 | S-15 | SS | 16 | 5<br>5 | 10 | |
| | | | | | 42 | | | | 4 | | |
| | | | | | 43 | | | | | | |
| | | | | | 44 | | | | | | |
| | | | | | 45 | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:25 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-15** Sheet 3 of 4

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 17 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 45 | | | | | 10 20 30 40 | Drill to 45' Gray wash Take S-16 |
| | | | S-16: Grayish brown m-f SAND (wet)[SP] | | 46 | S-16 | SS | 8 | 3 4 6 4 | 10 | |
| | | | | | 47 | | | | | | |
| | | | | | 48 | | | | | | |
| | | | | | 49 | | | | | | |
| | | | | | 50 | | | | | | Drill to 50' Gray wash Take S-17 |
| | | | S-17: Grayish brown m-f SAND (wet)[SP] | 0.3 | 51 | S-17 | SS | 15 | 4 5 8 7 | 13 | |
| | | | | | 52 | | | | | | |
| | | | | | 53 | | | | | | |
| | | | | | 54 | | | | | | |
| | | Class 3b | | | 55 | | | | | | Drill to 55' Grayish brown wash Take S-18 |
| | | | S-18: Grayish brown fine SAND, trace silt (wet)[SP] | 0.3 | 56 | S-18 | SS | 17 | 4 6 6 7 | 12 | |
| | | | | | 57 | | | | | | |
| | | | | | 58 | | | | | | |
| | | | | | 59 | | | | | | |
| | | | | | 60 | | | | | | Drill to 60' Grayish brown wash Take S-19 |
| | | | S-19: Grayish brown c-f SAND, trace c-f gravel (wet)[SP] | 0.2 | 61 | S-19 | SS | 8 | 8 9 8 10 | 17 | |
| | | | | | 62 | | | | | | |
| | | | | | 63 | | | | | | |
| | | | | | 64 | | | | | | |
| | -48.0 | | | | 65 | | | | | | Drill to 65' Grayish brown wash Take S-20 |
| | | | S-20: Grayish brown SILT, some fine sand (wet)[MH] | 0.5 | 66 | S-20 | SS | 19 | 3 8 13 12 | 21 | |
| | | Class 5b | | | 67 | | | | | | |
| | | | | | 68 | | | | | | |
| | | | | | 69 | | | | | | |
| | -53.0 | | | | 70 | | | | | | |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:26 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-15** Sheet 4 of 4

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 17 (NAVD) |

| MATERIAL SYMBOL | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Class 3b | S-21: Grayish brown fine SAND, some silt (wet)[SP] | 0.5 | 70–71 | S-21 | SS | 22 | 4, 5, 8, 10 | 13 | Drill to 70' grayish brown wash Take S-21 |
| | -58.0 | | | | 72–75 | | | | | | |
| | | Class 5b | S-22: Grayish brown SILT, trace fine sand (wet)[MH] | 0.4 | 75–77 | S-22 | SS | 20 | 1, 3, 10, 18 | 13 | Drill to 75' Grayish brown wash Take S-22 |
| | -60.0 | | End of boring at 77' | | 77–95 | | | | | | Borehole grouted upon completion and all soil cuttings containerize in drums |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:27 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-2** Sheet 1 of 5

| | |
|---|---|
| Project: Powerhouse Workshop | Project No.: 170404201 |
| Location: 322 3rd Avenue Brooklyn, N.Y. | Elevation and Datum: Approx. 12 (NAVD) |
| Drilling Company: Aquifer Drilling And Testing | Date Started: 10/20/16 — Date Finished: 10/21/16 |
| Drilling Equipment: CME 55 Truck Rig | Completion Depth: 102 ft — Rock Depth: Not Encountered |
| Size and Type of Bit: 3-7/8" Roller Bit | Number of Samples: Disturbed 28, Undisturbed 0, Core 0 |
| Casing Diameter (in): 4 1/2" — Casing Depth (ft): 24 | Water Level (ft.): First ▽ 12, Completion ▼ -, 24 HR. ▼ - |
| Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | Drilling Foreman: Matt Ficeto |
| Sampler: 2" O.D. Split Spoon | Field Engineer: Daniel O'Donnell |
| Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | |

| Material Symbol | Elev. (ft) +12.0 | Building Code | Sample Description | Casng blws/ ft | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) 10 20 30 40 | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | S-1: Brown m-f silty SAND, some gravel and brick (dry) [FILL] | 16 62 | 0–1 | S-1 | SS | 11 | 5 12 13 12 | 25 | Take S-1 |
| | | | S-2: Brown m-f silty SAND, trace brick (dry) [FILL] | 78 83 | 2–4 | S-2 | SS | 15 | 12 9 7 6 | 16 | Take S-2 |
| | | | S-3: Black m-f silty SAND, some brick, gravel and concrete (dry) [FILL] | 14 29 | 4–6 | S-3 | SS | 15 | 22 49 27 19 | 76 | Install casing to 4'<br>Drill to 4'<br>Brown wash<br>Light rig chatter at 3'<br>Take S-3 |
| | | Class 7 | S-4: Brown and black m-f silty SAND, some brick, gravel and concrete (dry) [FILL] | 33 35 | 6–8 | S-4 | SS | 11 | 6 13 9 16 | 22 | Drill to 6'<br>Brown-red wash<br>Quick smooth drilling<br>Take S-4 |
| | | | S-5: Brown m-f silty SAND (dry) [FILL] | 95 | 8–9 | S-5 | SS | 2 | 50/5" | 50/5" | Drill to 8'<br>No wash return<br>Quick smooth drilling<br>Take S-5<br>Refusal at 8'-5"<br>Install casing through obstruction<br>Refusal at 8'-5"<br>Drill through obstruction 8.5' to 9.5' |
| | | | S-6: Brown m-f silty SAND, some gravel, brick and concrete, coal (dry) [FILL] | 56 25 5 | 9–12 | S-6 | SS | 14 | 43 51 29 12 | 80 | Take S-6<br>Take S-7 |
| | 0.0 | | S-7: black-gray CLAY, some gravel and silt (wet) [CH] | 2 4 | 12–13 | S-7 | SS | 16 | 1 WOH WOH 1 | | |
| | | | S-8: Black CLAY, trace gravel (wet) [CH] | 5 3 | 14–15 | S-8 | SS | 17 | 1 WOH WOH 1 | | Take S-8 |
| | | Class 6 | S-9: Black CLAY, trace organics (wet) [CH] | 6 4 | 16–17 | S-9 | SS | 16 | 3 4 WOH 1 | | Take S-9 |
| | | | S-10: Black-gray-tan CLAY, trace gravel (wet) [CH] | 6 9 | 18–20 | S-10 | SS | 4 | 1 1 2 1 1 | 2 | Take S-10 |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:35 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-2** Sheet 2 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 12 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Casng blws/ ft | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 20 | | | | | 10 20 30 40 | Drill to 20' |
| | | | | 21 | 21 | S-11 | SS | 24 | WOH<br>WOH<br>WOH<br>1 | | Black-gray wash<br>Quick smooth drilling<br>Install casing to 20' |
| | | | S-11: Black-gray CLAY, trace organics (wet) [CH] | 29 | | | | | | | Take S-11 |
| | | Class 6 | | | 22 | | | | | | Take S-12 |
| | | | | 21 | | S-12 | SS | 20 | WOH<br>WOH<br>3<br>7 | | |
| | | | S-12: Black CLAY (wet) [CH] | 13 | 23 | | | | | | |
| | -12.0 | | | | 24 | | | | | | Install casing to 24' |
| | | | | | | S-13 | SS | 18 | 7<br>8<br>14<br>15 | 22 | Drill to 24'<br>Gray wash<br>Quick smooth drilling<br>Take S-13 |
| | | | S-13: Gray m-f silty SAND (wet) [SM] | | 25 | | | | | | |
| | | | | | 26 | | | | | | |
| | | | | | 27 | | | | | | |
| | | | | | 28 | | | | | | |
| | | | | | 29 | | | | | | |
| | | | | | 30 | | | | | | Drill to 30' |
| | | | | | | S-14 | SS | 14 | 6<br>11<br>16<br>16 | 27 | Gray wash<br>Quick smooth drilling<br>Take S-14 |
| | | | S-14: Brown m-f silty SAND (wet) [SM] | | 31 | | | | | | |
| | | | | | 32 | | | | | | |
| | | | | | 33 | | | | | | |
| | | Class 3b | | | 34 | | | | | | |
| | | | | | 35 | | | | | | Drill to 35' |
| | | | | | | S-15 | SS | 17 | 6<br>11<br>15<br>13 | 26 | Gray wash<br>Quick smooth drilling<br>Take S-15 |
| | | | S-15: brown m-f silty SAND (wet) [SM] | | 36 | | | | | | |
| | | | | | 37 | | | | | | |
| | | | | | 38 | | | | | | |
| | | | | | 39 | | | | | | |
| | | | | | 40 | | | | | | Drill to 40' |
| | | | | | | S-16 | SS | 15 | 5<br>10<br>12<br>13 | 22 | Gray wash<br>Take S-16 |
| | | | S-16: Brown m-f silty SAND (wet) [SM] | | 41 | | | | | | |
| | | | | | 42 | | | | | | |
| | | | | | 43 | | | | | | |
| | | | | | 44 | | | | | | |
| | | | | | 45 | | | | | | |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:36 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-2** Sheet 3 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 12 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Casng blws/ ft | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | S-17: Brown m-f silty SAND (wet) [SM] | | 45–46 | S-17 | SS | 19 | 5, 10, 15, 17 | 25 | Drill to 45'<br>Gray wash<br>Quick smooth drilling<br>Take S-17 |
| | | | S-18: Brown m-f silty SAND with oil staining (wet) [SM] | | 50–51 | S-18 | SS | 14 | 7, 11, 11, 17 | 22 | Drill to 50'<br>Gray wash<br>Quick smooth drilling<br>Take S-18 |
| | | Class 3b | S-19: Brown m-f silty SAND with oil staining (wet) [SM] | | 55–56 | S-19 | SS | 14 | 5, 10, 12, 15 | 22 | Drill to 55'<br>Gray wash<br>Quick smooth drilling<br>Heavy oil odor<br>Take S-19 |
| | | | S-20: Brown m-f SAND, some silt, trace gravel (wet) [SW] | | 60–61 | S-20 | SS | 12 | 4, 7, 9, 11 | 16 | Drill to 60'<br>Brown wash<br>Quick smooth drilling<br>Take S-20 |
| | | | S-21: Brown c-f SAND, some silt and gravel (wet) [SW] | | 65–66 | S-21 | SS | 15 | 4, 10, 16, 15 | 26 | Drill to 65'<br>Brown wash<br>Light racking from 61' to 62'<br>Take S-21 |

N-Value (Blows/ft) scale: 10 20 30 40

Depth Scale: 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:36 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-2** Sheet 4 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 12 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description |
|---|---|---|---|
| | | Class 3b | S-22: Gray-brown c-f SAND, some silt (wet) [SW] |
| | | | S-23: Gray-brown c-f SAND, some silt, trace gravel (wet) [SW] |
| | | | S-24: brown c-f SAND, some gravel (wet) [SW] |
| | | | S-25: Brown-gray silty SAND (wet) [SM] |
| | -76.5 | Class 3a | S-26: Brown-gray c-f SAND, some silt and gravel (wet) [SW] |

Casng blws/ ft

Depth Scale: 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95

Sample Data

| Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) |
|---|---|---|---|---|
| S-22 | SS | 9 | 3, 6, 8, 9 | 14 |
| S-23 | SS | 8 | 8, 11, 10, 11 | 21 |
| S-24 | SS | 9 | 7, 13, 13, 12 | 26 |
| S-25 | SS | 14 | 8, 6, 17, 19 | 23 |
| S-26 | SS | 10 | 8, 22, 16, 20 | 38 |

N-Value (Blows/ft): 10 20 30 40

**Remarks**
(Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)

- Drill to 70' Brown wash Quick smooth drilling Take S-22
- Drill to 75' Brown wash Quick smooth drilling Take S-23
- Drill to 80' Brown wash Quick smooth drilling Take S-24
- Drill to 85' Brown wash Quick smooth drilling Take S-25
- Drill to 90' Brown wash Quick smooth drilling Take S-26

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:37 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-2** Sheet 5 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 12 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Casng blws/ ft | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Class 3a | S-27: Brown-gray c-f SAND, some gravel (wet) [SW] | | 95–96 | S-27 | SS | 8 | 13<br>16<br>20<br>20 | 36 | Drill to 95'<br>Brown wash<br>Light rig chatter from 92' to 93'<br>Take S-27 |
| | -86.5 | | | | 96–97 | | | | | | |
| | | Class 5a | S-28: Brown SILT (wet) [MH] | | 97–98 | | | | | | |
| | | | | | 98–99 | | | | | | |
| | | | | | 99–100 | | | | | | |
| | | | | | 100–101 | S-28 | SS | 21 | 8<br>9<br>36<br>20 | 45 | Drill to 100'<br>Brown wash<br>Obstruction at 97'<br>Take S-28 |
| | -90.0 | | End of boring at 102' | | 101–102 | | | | | | Backfilled hole with grout to grade then was covered with existing gravel |
| | | | | | 102–120 | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:38 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-4** Sheet 1 of 4

| | |
|---|---|
| Project: Powerhouse Workshop | Project No.: 170404201 |
| Location: 322 3rd Avenue Brooklyn, N.Y. | Elevation and Datum: Approx. 7 (NAVD) |
| Drilling Company: Aquifer Drilling And Testing | Date Started: 9/30/16 — Date Finished: 10/6/16 |
| Drilling Equipment: Acker Track Rig | Completion Depth: 86 ft — Rock Depth: Not Encountered |
| Size and Type of Bit: 3-7/8" Roller Bit | Number of Samples: Disturbed 19, Undisturbed 0, Core 2 |
| Casing Diameter (in): 4" O.D. — Casing Depth (ft): 83 | Water Level (ft.): First ▽ - , Completion ▼ - , 24 HR. ▼ - |
| Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | Drilling Foreman: Anatoli Kholodilin |
| Sampler: 2" O.D. Split Spoon | Field Engineer: Kenan Sooklall/Joe Como |
| Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Casng blws/ ft Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) 10 20 30 40 | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | +7.0 | | | | | 0 | | | | | | 7:00 Langan and ADT on site |
| | +6.5 | | CONCRETE TOPPING SLAB (6 IN) | | | | | | | | | Demobilize rig and remove decon plastic |
| | | Class 7 | S-1: Black m-f SAND, some concrete, some wood, trace Silt (wet) [FILL] | | | 1 | S-1 | SS | 16 | 9 8 28 | 36 | Mobilize to B-4 |
| | +5.0 | | | | | 2 | | | | | | Core through concrete slab |
| | | | | | 2:39 | 3 | | | | | | Take S-1 |
| | | | | | 2:40 | | | | | | | Encountered concrete mat |
| | | | CONCRETE MAT (6 FT 3 IN) | | 2:02 | 4 | C-1 | NX | 60 | | | Place decon mat around B-4 |
| | | | | | 2:12 | 5 | | | | | | Start coring concrete mat |
| | | | | | 11:36 | 6 | | | | | | Take C-1 |
| | | | | 37.9 | 2:09 | 7 | C-2 | NX | 15 | | | |
| | -1.3 | | | 88.9 | 45 | 8 | | | | | | Take C-2 |
| | | | S-2: No recovery | | 10 8 | 9 | S-2 | SS | 0 | WOH WOH WOh WOH | | |
| | -4.0 | | | | | 10 | | | | | | |
| | | | S-3: Dark gray CLAY (wet) [CH] | 35.3 | | 11 | S-3 | SS | 16 | WOH 1 1 2 | 2 | Take S-3 |
| | | Class 6 | S-4: Dark gray CLAY (wet) [CH] | 13.7 | | 12 | S-4 | SS | 14 | WOH 1 4 2 | 5 | Take S-4 |
| | | | S-5: Dark gray CLAY, some m-f Sand (wet) [CH] | | | 13 | S-5 | SS | 20 | WOH 2 2 11 | 4 | Take S-5 |
| | -9.6 | | | | | 14 | | | | | | |
| | | Class 3a | S-6: Gray-brown m-f Silty SAND, some coarse Gravel (wet) [SP] | 7.4 | | 15 | S-6 | SS | 12 | 20 22 28 33 | 50 | Take S-6 |
| | | | | | | 16 | | | | | | |
| | | | | | | 17 | | | | | | |
| | | | | | | 18 | | | | | | |
| | | | | | | 19 | | | | | | |
| | | | | | | 20 | | | | | | |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:47 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-4** Sheet 2 of 4

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 7 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Casng blws/ ft Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 20 | | | | | | Drill to 20'<br>Gray wash<br>Install 10' of casing to 19' depth |
| | | | | | | 21 | | | | | | |
| | | | | | | 22 | | | | | | |
| | | | | | | 23 | | | | | | |
| | | | | | | 24 | | | | | | |
| | | | | | | 25 | S-7 | SS | 15 | 22<br>20 | | Drill to 25'<br>Gray wash<br>Take S-7<br>Leave spoon in hole<br>Install casing to 25' |
| | | | S-7: Gray-brown c-f SAND, trace coarse Gravel, trace Silt (wet) [SP] | 3.2 | | 26 | | | | 29 | 49 | |
| | | | | | | 27 | | | | 19 | | |
| | | | | | | 28 | | | | | | |
| | | | | | | 29 | | | | | | |
| | | | | | | 30 | S-8 | SS | 20 | 57<br>22 | | Drill to 30'<br>Gray wash<br>Take S-8 |
| | | | S-8: Gray medium SAND, some Gravel, trace Silt (wet) [SP] | 4.5 | | 31 | | | | 17 | 39 | |
| | | Class 3a | | | | 32 | | | | 21 | | |
| | | | | | | 33 | | | | | | |
| | | | | | | 34 | | | | | | |
| | | | | | | 35 | S-9 | SS | 14 | 28<br>20 | | Drill to 35'<br>Gray wash<br>Take S-9<br>Install casing to 35' |
| | | | S-9: Gray c-f SAND, some Gravel, trace Silt (wet) [SP] | | | 36 | | | | 14 | 34 | |
| | | | | | | 37 | | | | 18 | | |
| | | | | | | 38 | | | | | | |
| | | | | | | 39 | | | | | | |
| | | | | | | 40 | S-10 | SS | 17 | 11<br>19 | | Drill to 40'<br>Gray wash<br>Take S-10 |
| | | | S-10: Gray fine silty SAND (wet) [SP] | | | 41 | | | | 22 | 41 | |
| | | | | | | 42 | | | | 24 | | |
| | | | | | | 43 | | | | | | |
| | | | | | | 44 | | | | | | |
| | | | | | | 45 | | | | | | |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:48 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-4** Sheet 3 of 4

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 7 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Casng blws/ ft Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 45 | | | | | | Drill to 45'<br>Gray wash<br>Take S-11<br>Install 3" casing to 45' |
| | | Class 3a | S-11: Gray m-f SAND, trace Silt (wet) [SP] | | | 46 | S-11 | SS | 12 | 14<br>14<br>17<br>19 | 31 | |
| | | | | | | 47 | | | | | | |
| | | | | | | 48 | | | | | | |
| | | | | | | 49 | | | | | | |
| | -43.0 | | | | | 50 | | | | | | |
| | | | S-12: Brown c-f SAND, trace Silt (wet) [SP] | 3.4 | | 51 | S-12 | SS | 18 | 14<br>19<br>21<br>22 | 40 | |
| | | | | | | 52 | | | | | | |
| | | | | | | 53 | | | | | | |
| | | | | | | 54 | | | | | | |
| | | | | | | 55 | | | | | | Drill to 55'<br>Hole collapsed before S-13 could be taken<br>End of day<br>10/4/16<br>Advance casing to 55'<br>Drill to 55'<br>Take S-13 |
| | | | S-13: Brown fine Silty SAND (wet) [SP] | 32.6 | | 56 | S-13 | SS | 24 | 19<br>29<br>30<br>36 | 59 | |
| | | | | | | 57 | | | | | | |
| | | | | | | 58 | | | | | | |
| | | | | | | 59 | | | | | | |
| | | Class 3a | | | | 60 | | | | | | Advance casing to 60'<br>Drill to 60'<br>Gray wash<br>Take S-14 |
| | | | S-14: Brown m-f SAND, some Silt (wet) [SP] | 78.8 | | 61 | S-14 | SS | 24 | 8<br>17<br>28<br>24 | 45 | |
| | | | | | | 62 | | | | | | |
| | | | | | | 63 | | | | | | |
| | | | | | | 64 | | | | | | |
| | | | S-15: Brown m-f Silty SAND, some Gravel (wet) [SP] | 88.3 | | 65 | S-15 | SS | 3 | 50/5" | 50/5" | Advance casing to 65'<br>Drill to 65'<br>Take S-15 |
| | | | | | | 66 | | | | | | |
| | | | | | | 67 | | | | | | |
| | | | | | | 68 | | | | | | |
| | | | | | | 69 | | | | | | |
| | | | | | | 70 | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:49 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-4** Sheet 4 of 4

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 7 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Casng blws/ ft Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | S-16: Brown fine Silty SAND (wet) [SP] | 72.2 | | 70 | S-16 | SS | 9 | 52<br>50/2" | 50/2" | Hole collapse re-drill to 70'<br>Take S-16 |
| | | | | | | 71 | | | | | | |
| | | | | | | 72 | | | | | | |
| | | | | | | 73 | | | | | | |
| | | | | | | 74 | | | | | | |
| | | | S-17: Brown m-f SAND, trace Silt (wet) [SP] | 1.0 | | 75 | S-17 | SS | 23 | 43<br>50/2" | 50/2" | Install casing to 75'<br>Drill to 75'<br>End of day 10/5/16<br>Take S-17<br>Only driven 8" but has 23" recovery |
| | | | | | | 76 | | | | | | |
| | | | | | | 77 | | | | | | |
| | | Class 3a | | | | 78 | | | | | | |
| | | | | | | 79 | | | | | | |
| | | | S-18: Brown c-f SAND, some Silt (wet) [SP] | 0.2 | | 80 | S-18 | SS | 14 | 48<br>54<br>50/2" | 50/2" | Install casing to 80'<br>Clear out casing to 80'<br>Take S-18 |
| | | | | | | 81 | | | | | | |
| | | | | | | 82 | | | | | | |
| | | | | | | 83 | | | | | | Advance casing to 83'<br>Clear out to 85'<br>Hole collapsed<br>End of the day 10/16/16<br>Begin at 7:30 AM<br>Pump broke on drill<br>Drill was down until 9:00 AM<br>Losing water at 85' |
| | | | | | | 84 | | | | | | |
| | -79.0 | | S-19: Brown m-f SAND, some Gravel (wet)[SP] | | | 85 | S-19 | SS | 8 | 67<br>61/2" | 61/2" | |
| | | | | | | 86 | | | | | | |
| | | | End of boring at 87' | | | 87 | | | | | | End of boring at 87' |
| | | | | | | 88 | | | | | | |
| | | | | | | 89 | | | | | | |
| | | | | | | 90 | | | | | | |
| | | | | | | 91 | | | | | | |
| | | | | | | 92 | | | | | | |
| | | | | | | 93 | | | | | | |
| | | | | | | 94 | | | | | | |
| | | | | | | 95 | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:50 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-5A** Sheet 1 of 1

| | |
|---|---|
| Project: Powerhouse Workshop | Project No.: 170404201 |
| Location: 322 3rd Avenue Brooklyn, N.Y. | Elevation and Datum: Approx. 7 (NAVD) |
| Drilling Company: Aquifer Drilling And Testing | Date Started: 10/7/16 — Date Finished: 10/7/16 |
| Drilling Equipment: Acker Track Rig | Completion Depth: 7 ft — Rock Depth: Not Encountered |
| Size and Type of Bit: 3-7/8" Roller Bit | Number of Samples: Disturbed 1, Undisturbed 0, Core 1 |
| Casing Diameter (in): 4" O.D. — Casing Depth (ft): - | Water Level (ft.): First - , Completion - , 24 HR. - |
| Casing Hammer: Donut — Weight (lbs): 140 — Drop (in): 30 | Drilling Foreman: Anatoli Kholodilin |
| Sampler: 2" O.D. Split Spoon | Field Engineer: Joe Como |
| Sampler Hammer: Donut — Weight (lbs): 140 — Drop (in): 30 | |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | +7.0 | | | | | 0 | | | | | | Began at 12:30 PM<br>Drilled through concrete slab<br>Take S-1 |
| | +6.5 | | CONCRETE TOPPING SLAB (6 IN) | | | 1 | | | | | | |
| | | Class 7 | S-1 Black silty m-f SAND, some gravel, some wood (wet) [FILL] | | | 2 | S-1 | SS | 12 | 27<br>28<br>12<br>56 | 40 | |
| | +4.5 | | | 15.5 | 1:54 | 3 | | | | | | Clear out to 2.5'<br>Black wash<br>Take C-1 |
| | | | | | 1:38 | 4 | | | | | | |
| | | | | | 1:58 | 5 | C-1 | NX CORE | REC=54"/60" =90% | RQD=13"/60" =22% | | |
| | | | | | 2:06 | 6 | | | | | | |
| | | | | | 2:03 | 7 | | | | | | |
| | | | | 89.4 | | 8 | | | | | | Take C-2<br>Advanced 3" then encountered steel |
| | | | | | | 9 | | | | | | |
| | | | | | | 10 | | | | | | |
| | | | | | | 11 | | | | | | |
| | | | | | | 12 | | | | | | |
| | | | | | | 13 | | | | | | |
| | | | | | | 14 | | | | | | |
| | | | | | | 15 | | | | | | |
| | | | | | | 16 | | | | | | |
| | | | | | | 17 | | | | | | |
| | | | | | | 18 | | | | | | |
| | | | | | | 19 | | | | | | |
| | | | | | | 20 | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:58:57 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-5B** Sheet 1 of 5

| | |
|---|---|
| Project: Powerhouse Workshop | Project No.: 170404201 |
| Location: 322 3rd Avenue Brooklyn, N.Y. | Elevation and Datum: Approx. 7 (NAVD) |
| Drilling Company: Aquifer Drilling And Testing | Date Started: 10/10/16 — Date Finished: 10/13/16 |
| Drilling Equipment: Acker Restricted Access Drill | Completion Depth: 102 ft — Rock Depth: Not Encountered |
| Size and Type of Bit: 3-7/8" Roller Bit | Number of Samples: Disturbed 19 — Undisturbed 1 — Core 2 |
| Casing Diameter (in): 4" O.D. — Casing Depth (ft): 35 | Water Level (ft.): First - — Completion - — 24 HR. - |
| Casing Hammer: Donut — Weight (lbs): 140 — Drop (in): 30 | Drilling Foreman: Anatoli Kholodilin |
| Sampler: 2" O.D. Split Spoon | Field Engineer: Joe Como |
| Sampler Hammer: Donut — Weight (lbs): 140 — Drop (in): 30 | |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) 10 20 30 40 | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | +7.0 | | | | 0 | | | | | | 7:00 Langan arrived on site<br>7:30 ADT arrived on site<br>Moved rig from B-5A to B-5B<br>8:30 Began B-5B<br>Core through 6" concrete |
| | +6.5 | Class 7 | 6" CONCRETE SLAB | | 1 | | | | | | |
| | +4.6 | 11-65 | 4 layers of 1/16" metal<br>2" wood recovered | | 2 | | | | | | |
| | | | | | 3 | C-1 | NX | | | | Install casing to 2'-8"<br>Take C-1<br>Steel encountered immediately |
| | +2.0 | | 3' CONCRETE MAT SLAB | | 4 | | | | | | Drill to 4'<br>Gray wash<br>Heavy rig chatter<br>Take C-2<br>Rods drop to 11'<br>3' void after concrete<br>REC=36"/36" =100%<br>RQD=34"/36" =94% |
| | | | | 4.4 | 5 | C-2 | NX CORE | REC=100% | RQD=94% | | |
| | -1.0 | | VOID | 223 | 6 | | | | | | |
| | | | | | 7 | | | | | | |
| | | | | | 8 | | | | | | |
| | | | | | 9 | | | | | | Rods drop to 11'<br>3' void after concrete |
| | -4.0 | | | | 10 | | | | | | |
| | | | | | 11 | | | | | | Take S-1 |
| | | Class 6 | S-1: Dark gray CLAY (wet) [CH] | 5.6 | 12 | S-1 | SS | 2 | 1 1 2 1 1 | | |
| | | | S-2: Dark gray CLAY, trace Gravel (wet) [CH] | 18.5 | 13 | | | | | | Take S-2 |
| | | | | | 14 | S-2 | SS | 19 | 1 1 2 3 1 1 | | |
| | -9.0 | | | | 15 | | | | | | |
| | | | | 18.5 | 16 | U-1 | SH | 24 | | | $q_u$=0.25 tsf $s_u$=0.1 tsf<br>Advance casing to 15'<br>Take shelby tube at 15' |
| | | Class 3a | S-3: Dark gray m-f SAND, some Silt (wet) [SP] | 18.2 | 17 | | | | | | |
| | | | | | 18 | S-3 | SS | 22 | 21 20 25 33 45 | | Take S-3<br>End of the day<br>10/11/16<br>Advance casing to 25' |
| | | | | | 19 | | | | | | |
| | | | | | 20 | | | | | | |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:59:02 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-5B** Sheet 2 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 7 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Class 3a | | | 20 21 22 | | | | | | |
| | -15.0 | | | | 23 24 25 | | | | | | |
| | | | S-4: Dark gray c-f SAND, some Silt, trace Gravel (wet) [SP] | 8.8 | 26 27 28 29 30 | S-4 | SS | 4 | 21 15 13 12 | 28 | Drill to 25' Brown wash Take S-4 |
| | | | S-5: Brown m-f SAND, some Silt (wet) [SP] | 10.8 | 31 32 33 34 35 | S-5 | SS | 9 | 11 10 9 15 | 19 | Spin casing to 30' Clean out casing Brown wash Take S-5 |
| | | Class 3b | S-6: Brown m-f Silty SAND, trace Gravel (wet) [SP] | 13.7 | 36 37 38 39 40 | S-6 | SS | 14 | 10 12 15 14 | 27 | Spin casing to 35' Clean out casing Brown wash Take S-6 |
| | | | S-7: Brown m-f Silty SAND (wet) [SP] | 11.8 | 41 42 43 44 45 | S-7 | SS | 12 | 12 15 14 16 | 29 | Drill to 40' Brown wash Take S-7 |
| | -37.0 | Class 3a | | | | | | | | | |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:59:03 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-5B** Sheet 3 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 7 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | S-8: Brown fine Silty SAND (wet) [SP] | 7.1 | 45–47 | S-8 | SS | 15 | 11, 16, 22, 27 | 38 | Drill to 45' Brown wash Take S-8 |
| | | | S-9: Brown fine Silty SAND (wet) [SP] | 121 | 48–52 | S-9 | SS | 16 | 13, 17, 26, 25 | 43 | Drill to 50' Brown wash Take S-9 |
| | | Class 3a | S-10: Brown m-f SAND, trace Silt (wet) [SP] | 20.2 | 53–57 | S-10 | SS | 12 | 23, 27, 24, 35 | 51 | Drill to 55' Brown wash Take S-10 |
| | | | S-11: Brown m-f Silty SAND (wet) [SP] | 20.9 | 58–62 | S-11 | SS | 15 | 31, 35, 36, 42 | 71 | Drill to 60' Brown wash Take S-11 |
| | | | S-12: Brown fine Silty SAND (wet) [SP] | 3.2 | 63–67 | S-12 | SS | 17 | 29, 30, 11, 52 | 41 | Drill to 65' brown wash Take S-12 |
| | | | | | 68–70 | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:59:03 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-5B** Sheet 4 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 7 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Class 3a | S-13: Brown fine Silty SAND (wet) [SP] | | 70–71 | S-13 | SS | 16 | 34 47 54 50/3" | 101 | Drill to 70' Brown wash Smooth drilling Take S-13 |
| | -66.5 | Class 5a | S-14: Brown Clayey SILT (wet) [MH] | 1.9 | 71–76 | S-14 | SS | 24 | 20 26 53 50/3" | 79 | Drill to 75' Brown wash Smooth drilling Take S-14 |
| | -71.5 | Class 3a | S-15: Brown Silty SAND (wet) [SM] | | 76–81 | S-15 | SS | 13 | 49 53 62 50/4" | 115 | Drill to 80' Smooth drilling Brown wash Take S-15 |
| | | Class 3a | S-16: Brown c-f SAND, some c-f Gravel, trace Silt (wet) [SP] | 39.7 | 81–86 | S-16 | SS | 16 | 48 62 56/4" | 56/4" | Drill to 85' Brown wash Smooth drilling Take S-16 |
| | | | S-17: Brown m-f SAND, some coarse Gravel, some Silt (wet) [SP] | 3.2 | 86–91 | S-17 | SS | 15 | 82 60 50 41 | 110 | Drill to 90' Losing water Slight rig chatter Take S-17 |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:59:04 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-5B** Sheet 5 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 7 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | PID Reading (ppm) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) 10 20 30 40 | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 95 | | | | | | Drill to 95' brown wash Take S-18 |
| | | | S-18: Brown m-f SAND, some Silt, trace coarse Gravel (wet) [SP] | | 96 | S-18 | SS | 13 | 17 22 19 31 | 41 | |
| | | | | 125.5 | 97 | | | | | | |
| | | Class 3a | | | 98 | | | | | | |
| | | | | | 99 | | | | | | |
| | | | | | 100 | | | | | | Drill to 100' Brown wash Smooth drilling Take S-19 |
| | | | S-19: No recovery | | 101 | S-19 | SS | 0 | 64 73 60/3" | 60/3" | |
| | -95.0 | | | | 102 | | | | | | |
| | | | End of boring at 102' | | 103 | | | | | | |
| | | | | | 104 | | | | | | |
| | | | | | 105 | | | | | | |
| | | | | | 106 | | | | | | |
| | | | | | 107 | | | | | | |
| | | | | | 108 | | | | | | |
| | | | | | 109 | | | | | | |
| | | | | | 110 | | | | | | |
| | | | | | 111 | | | | | | |
| | | | | | 112 | | | | | | |
| | | | | | 113 | | | | | | |
| | | | | | 114 | | | | | | |
| | | | | | 115 | | | | | | |
| | | | | | 116 | | | | | | |
| | | | | | 117 | | | | | | |
| | | | | | 118 | | | | | | |
| | | | | | 119 | | | | | | |
| | | | | | 120 | | | | | | |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:59:05 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-6** Sheet 1 of 5

| | |
|---|---|
| Project: Powerhouse Workshop | Project No.: 170404201 |
| Location: 322 3rd Avenue Brooklyn, N.Y. | Elevation and Datum: Approx. 17 (NAVD) |
| Drilling Company: Aquifer Drilling And Testing | Date Started: 10/4/16 — Date Finished: 10/5/16 |
| Drilling Equipment: CME 55 Truck Rig | Completion Depth: 102 ft — Rock Depth: Not Encountered |
| Size and Type of Bit: 3-7/8" Roller Bit | Number of Samples: Disturbed 19 — Undisturbed 0 — Core 1 |
| Casing Diameter (in): 4 1/2" — Casing Depth (ft): 25 | Water Level (ft.): First ▽ — Completion ▼ — 24 HR. ▼ |
| Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | Drilling Foreman: Matt Ficeto |
| Sampler: 2" O.D. Split Spoon | Field Engineer: Daniel O'Donnell |
| Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) 10 20 30 40 | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | +17.0 | | Refer to Log B-6a for subsurface conditions in general area | SPUN | 0 | | | | | | |
| | | | | | 1 | | | | | | |
| | | | | | 2 | | | | | | |
| | | | | | 3 | | | | | | |
| | | | | | 4 | | | | | | |
| | | | | | 5 | | | | | | |
| | | | | | 6 | | | | | | |
| | | | | | 7 | | | | | | |
| | | | | SPUN | 8 | | | | | | |
| | | | | | 9 | | | | | | |
| | | | | | 10 | | | | | | |
| | | | | | 11 | | | | | | Install casing to 10.5' Brown wash |
| | | | | | 12 | | | | | | |
| | | | | SPUN | 13 | S-10 | SS | 2 | 2 100/1" | 100/1" | |
| | +3.0 | | | | 14 | | | | | | |
| | | | CONCRETE MAT FOUNDATION (6 FT) | 11:45 | 15 | | | | | | Install casing to 14' No wash return Drill to 14' Brown wash (0'-10') No return (10'-14') Smooth drilling Core through mat Gray wash |
| | | | | 19:59 | 16 | | | | | | |
| | | | | 3:15 | 17 | C-1 | NX CORE | | | | |
| | | | | 4:43 | 18 | | | | | | |
| | | | | 2:57 | 19 | | | | | | |
| | -3.0 | | | 2:59 | 20 | | | | | | |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:59:15 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-6** Sheet 2 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 17 (NAVD) |

| Elev. (ft) | Building Code | Sample Description | Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Class 6 | S-11: Gray Silty CLAY, trace fine Sand (wet) [CH] | | 20 | S-11 | SS | 6 | WOH<br>WOH<br>WOH<br>WOH | | Take S-11 |
| -5.0 | | | | 21 | | | | | | |
| | | | | 22 | S-12 | SS | 16 | 1<br>1<br>3<br>2 | 4 | Drill to 22'<br>Gray wash<br>Take S-12 |
| | | S-12: Gray fine Silty SAND, some wood (wet) [SP] | SPUN | 23 | | | | | | |
| | | | | 24 | S-13 | SS | 24 | 2<br>8<br>21<br>18 | 29 | Drill to 24'<br>Gray wash<br>Take S-13<br>Drill to 25'<br>Gray wash<br>Smooth and steady drilling<br>Install casing to 25'<br>No wash return |
| | | S-13: Gray fine Silty SAND, trace wood (wet) [SP] | | 25 | | | | | | |
| | Class 3b | | | 26 | | | | | | |
| | | | | 27 | | | | | | |
| | | | | 28 | | | | | | |
| | | | | 29 | | | | | | |
| | | | | 30 | S-14 | SS | 12 | 6<br>10<br>12<br>11 | 22 | Drill to 30'<br>Add drilling mud<br>Brown wash<br>Smooth and quick drilling<br>Take S-14 |
| | | S-14: Gray fine Silty SAND (wet) [SP] | | 31 | | | | | | |
| -15.0 | | | | 32 | | | | | | |
| | | | | 33 | | | | | | |
| | | | | 34 | | | | | | |
| | | | | 35 | S-15 | SS | 11 | 3<br>5<br>6<br>5 | 11 | Drill to 35'<br>Brown wash<br>Quick drilling<br>Take S-15<br>Add drill mud |
| | | S-15: Brown m-f SAND and some Silt (wet) [SM] | | 36 | | | | | | |
| | Class 3b | | | 37 | | | | | | |
| | | | | 38 | | | | | | |
| | | | | 39 | | | | | | |
| | | | | 40 | S-16 | SS | 0 | 4<br>7<br>4<br>4 | 11 | Drill to 40'<br>Brown wash<br>Smooth and quick drilling<br>Take S-16 |
| | | S-16: No recovery | | 41 | | | | | | |
| -26.5 | | | | 42 | | | | | | |
| | | | | 43 | | | | | | |
| | | | | 44 | | | | | | |
| | Class 6 | | | 45 | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:59:16 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-6** Sheet 3 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 17 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Class 6 | S-17: Brown m-f SAND, some Silt (wet)[SM] | | 45–47 | S-17 | SS | 9 | 3 4 4 5 | 8 | Drill to 45'<br>Brown wash<br>Quick and smooth drilling<br>Take S-17 |
| | -33.0 | | | | 47–50 | | | | | | |
| | | Class 3b | S-18: Brown m-f SAND, some Silt, trace Gravel (wet)[SW] | | 50–52 | S-18 | SS | 11 | 4 9 10 9 | 19 | Drill to 50'<br>Brown wash<br>Quick drilling<br>Light rig chatter<br>Take S-18<br>Add mud |
| | | | S-19: Brown m-f SAND, some Silt (wet)[SW] | | 52–57 | S-19 | SS | 10 | 5 7 8 8 | 15 | Drill to 55'<br>Brown wash<br>Quick and smooth drilling<br>Take S-19 |
| | | | S-20: Brown m-f SAND, some Silt, trace Gravel (wet)[SW] | | 57–62 | S-20 | SS | 10 | 7 13 12 15 | 25 | Drill to 60'<br>Brown wash<br>Quick and smooth drilling<br>Take S-20 |
| | | | S-21: Brown m-f SAND, some Silt, trace Gravel (wet)[SW] | | 62–67 | S-21 | SS | 10 | 5 7 10 9 | 17 | Drill to 65'<br>Brown wash<br>Quick and smooth drilling<br>Take S-21 |
| | | | | | 67–70 | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:59:16 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-6** Sheet 4 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 17 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | S-22: Brown m-f SAND, trace Silt (wet)[SP] | | 70–71 | S-22 | SS | 11 | 6, 10, 11, 10 | 21 | Drill to 70'<br>Brown wash<br>Quick and smooth drilling<br>Take S-22<br>Add mud |
| | | | | | 71–72 | | | | | | |
| | | | | | 72–73 | | | | | | |
| | | | | | 73–74 | | | | | | |
| | | | | | 74–75 | | | | | | |
| | | | S-23: Brown m-f SAND, some Silt (wet)[SM] | | 75–76 | S-23 | SS | 20 | 12, 15, 12, 20 | 27 | Drill to 75'<br>Brown wash<br>Quick and smooth drilling<br>Take S-23 |
| | | Class 3b | | | 76–77 | | | | | | |
| | | | | | 77–78 | | | | | | |
| | | | | | 78–79 | | | | | | |
| | | | | | 79–80 | | | | | | |
| | | | S-24: Brown m-f SAND, trace Gravel (wet)[SW] | | 80–81 | S-24 | SS | 9 | 7, 9, 10, 17 | 19 | Drill to 80'<br>Brown wash<br>Quick drilling<br>Light rig chatter<br>Take S-24 |
| | | | | | 81–82 | | | | | | |
| | -66.5 | | | | 82–83 | | | | | | |
| | | | | | 83–84 | | | | | | |
| | | | | | 84–85 | | | | | | |
| | | Class 2a | S-25: c-f GRAVEL with m-f SAND (wet)[GP] | | 85–86 | S-25 | SS | 2 | 25, 22, 17, 12 | 39 | Drill to 85'<br>Brown wash<br>Quick drilling<br>Light rig chatter<br>Add mud<br>Take S-25 |
| | -71.5 | | | | 86–87 | | | | | | |
| | | | | | 87–88 | | | | | | |
| | | | | | 88–89 | | | | | | |
| | | | | | 89–90 | | | | | | |
| | | | S-26: Brown m-f SAND (wet)[SW] | | 90–91 | S-26 | SS | 11 | 7, 11, 13, 14 | 24 | Drill to 90'<br>Brown wash<br>Heavy rig chatter<br>Add mud<br>Take S-26 |
| | | Class 3b | | | 91–92 | | | | | | |
| | | | | | 92–93 | | | | | | |
| | | | | | 93–94 | | | | | | |
| | | | | | 94–95 | | | | | | |
| | -78.0 | | | | | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:59:17 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-6** Sheet 5 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 17 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Class 2a | S-27: Brown GRAVEL, some medium sand (wet) [GP] | | 95–96 | S-27 | SS | 2 | 10, 17, 22, 24 | 39 | Drill to 95'<br>Brown wash<br>Quick drilling<br>Light rig chatter<br>Take S-27 |
| | -83.0 | | | | 96–97 | | | | | | |
| | | Class 3b | S-28: Brown m-f SAND, trace Silt (wet)[SP] | | 97–98 | | | | | | |
| | -85.0 | | End of boring at 102' | | 98–99 | | | | | | |
| | | | | | 99–100 | | | | | | |
| | | | | | 100–101 | S-28 | SS | 12 | 5, 9, 11, 14 | 20 | Drill to 100'<br>Brown wash<br>Heavy rig chatter<br>Take S-28 |
| | | | | | 101–102 | | | | | | |
| | | | | | 102–120 | | | | | | |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:59:18 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-7** Sheet 1 of 5

| | |
|---|---|
| Project: Powerhouse Workshop | Project No.: 170404201 |
| Location: 322 3rd Avenue Brooklyn, N.Y. | Elevation and Datum: Approx. 16 (NAVD) |
| Drilling Company: Aquifer Drilling And Testing | Date Started: 10/7/16 — Date Finished: 10/11/16 |
| Drilling Equipment: CME 55 Truck Rig | Completion Depth: 102 ft — Rock Depth: Not Encountered |
| Size and Type of Bit: 3-7/8" Roller Bit | Number of Samples: Disturbed 24 — Undisturbed 1 — Core 1 |
| Casing Diameter (in): 4 1/2" — Casing Depth (ft): 21 | Water Level (ft.): First ▽ — Completion ▼ — 24 HR. ▼ |
| Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | Drilling Foreman: Matt Ficeto |
| Sampler: 2" O.D. Split Spoon | Field Engineer: Daniel O'Donnell |
| Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | +16.0 | | | | 0 | | | | | 10 20 30 40 | Take S-1 |
| | | | S-1: Brown fine Silty SAND with brick, concrete and Gravel (dry) [FILL] | | 1 | S-1 | SS | 16 | 12 12 21 22 | 33 | |
| | | | | SPUN | 2 | | | | | | Drill to 2' Brown wash Smooth drilling Take S-2 |
| | | | S-2: Brown fine Silty SAND with some brick and concrete (dry) [FILL] | | 3 | S-2 | SS | 12 | 20 19 21 11 | 40 | |
| | | | | | 4 | | | | | | Drill to 4' Gray wash Smooth drilling Take S-3 |
| | | Class 7 | S-3: Gray medium Silty SAND with some Gravel and trace brick (dry) [FILL] | | 5 | S-3 | SS | 2 | 4 8 9 7 | 17 | |
| | | | | | 6 | | | | | | Install casing to 6' Take S-4 |
| | | | S-4: Gray medium Silty SAND with some Gravel and brick (dry) [FILL] | SPUN | 7 | S-4 | SS | 6 | 3 11 8 4 | 19 | |
| | | | | | 8 | | | | | | Drill to 8' Brown wash Light rig chatter Take S-5 |
| | | | S-5: Brown fine Clayey SAND with some brick (wet) [FILL] | | 9 | S-5 | SS | 10 | 8 6 4 WOH | 10 | |
| | | | S-6: Brown fine SAND with some brick and concrete (wet) [FILL] | | 10 | S-6 | SS | 10 | 5 7 | | Drill to 10' Red wash Light rig chatter Take S-6 Install casing to 11' Drill to 11.5' Gray wash Core through concrete mat |
| | +5.0 | | | 3:31 | 11 | | | | | | |
| | | | CONCRETE MAT SLAB (6 FT) | SPUN 6:09 | 12 | C-1 | NX CORE | REC=68"/72" =94% | RQD=0"/72" =0% | | |
| | | | | 4:24 | 13 | | | | | | |
| | | | | 3:01 | 14 | | | | | | |
| | | | | 2:57 | 15 | | | | | | |
| | | | | 2:31 | 16 | | | | | | |
| | -1.0 | | | | 17 | | | | | | Take S-7 |
| | | | S-7: Gray CLAY (wet) [CH] | SPUN | 18 | S-7 | SS | 16 | WOH WOH WOH WOH | | |
| | | Class 6 | | | 19 | S-8 | SS | 24 | WOH WOH | | Drill to 19' Gray wash Take S-8 |
| | | | | | 20 | | | | | | |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:59:27 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-7** Sheet 2 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 16 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Class 6 | S-8: Gray CLAY (wet) [CH] | SPUN | 20 | S-8 | SS | 24 | WOH<br>1 | | |
| | -5.0 | | | | 21 | U-1 | SH | 21 | | | Drill to 21'<br>Gray wash<br>Smooth drilling<br>Install casing to 21'<br>Drill to 21'<br>Gray wash<br>Quick and smooth drilling<br>Take U-1 |
| | | | U-1: Gray m-f Silty SAND (wet) [SM] | | 22 | | | | | | |
| | | | | | 23 | | | | | | |
| | | | | | 24 | | | | | | |
| | | | | | 25 | S-9 | SS | 12 | 6<br>12<br>11<br>12 | 23 | Drill to 25'<br>Gray wash<br>Quick and smooth drilling<br>Add mud<br>Take S-9 |
| | | | S-9: Gray m-f SAND , some Silt (wet) [SM] | | 26 | | | | | | |
| | | | | | 27 | | | | | | |
| | | | | | 28 | | | | | | |
| | | | | | 29 | | | | | | |
| | | | | | 30 | S-10 | SS | | 8<br>13<br>17<br>18 | 30 | Drill to 30'<br>Gray wash<br>Quick and smooth drilling<br>Take S-10 |
| | | | S-10: Gray m-f SAND , some Silt (wet) [SW] | | 31 | | | | | | |
| | | Class 3b | | | 32 | | | | | | |
| | | | | | 33 | | | | | | |
| | | | | | 34 | | | | | | |
| | | | | | 35 | S-11 | SS | 18 | 4<br>6<br>7<br>7 | 13 | Drill to 35'<br>Gray wash<br>Quick and smooth drilling<br>Take S-11 |
| | | | S-11: Gray m-f Silty SAND, trace Gravel (wet) [SP] | | 36 | | | | | | |
| | | | | | 37 | | | | | | |
| | | | | | 38 | | | | | | |
| | | | | | 39 | | | | | | |
| | | | | | 40 | S-12 | SS | 18 | 5<br>7<br>10<br>12 | 17 | Drill to 40'<br>Gray wash<br>Quick and smooth drilling<br>Take S-12 |
| | | | S-12: Brown fine Silty SAND (wet) [SM] | | 41 | | | | | | |
| | | | | | 42 | | | | | | |
| | | | | | 43 | | | | | | |
| | | | | | 44 | | | | | | |
| | | | | | 45 | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:59:28 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-7** Sheet 3 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 16 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | S-13: Brown/gray fine silty SAND, trace gravel (wet) [SM] | | 45–46 | S-13 | SS | 16 | 4, 10, 10, 11 | 20 | Drill to 45'<br>Gray wash<br>Quick and smooth drilling<br>Take S-13 |
| | | | S-14: Brown m-f SAND, some Silt (wet) [SM] | | 50–51 | S-14 | SS | 8 | 7, 9, 8, 9 | 17 | Drill to 50'<br>Gray wash<br>Take S-14 |
| | | Class 3b | S-15: Brown m-f SAND, some Silt, trace Gravel (wet)[SP] | | 55–56 | S-15 | SS | 8 | 6, 7, 6, 9 | 13 | Drill to 55'<br>Brown wash<br>Light rig chatter<br>Take S-15 |
| | | | S-16: Brown m-f SAND, trace Gravel (wet)[SW] | | 60–61 | S-16 | SS | 9 | 6, 11, 9, 10 | 20 | Drill to 60'<br>Brown wash<br>Quick and smooth drilling<br>Take S-16 |
| | | | S-17: Brown m-f SAND, trace Silt (wet)[SW] | | 65–66 | S-17 | SS | 11 | 5, 11, 12, 10 | 23 | Drill to 65'<br>Brown wash<br>Quick and smooth drilling<br>Take S-17<br>Add mud |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:59:29 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-7** Sheet 4 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 16 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Class 3b | S-18: Brown m-f SAND (wet)[SW] | | 70–71 | S-18 | SS | 9 | 5, 10, 10, 11 | 20 | Drill to 70'<br>Brown wash<br>Quick and smooth drilling<br>Take S-18<br>Add mud |
| | | | | | 71–72 | | | | | | |
| | | | | | 72–73 | | | | | | |
| | | | | | 73–74 | | | | | | |
| | | | | | 74–75 | | | | | | |
| | | | S-19: Brown m-f SAND, some Silt (wet)[SW] | | 75–76 | S-19 | SS | 15 | 6, 13, 15, 17 | 28 | Drill to 75'<br>Brown wash<br>Quick and smooth drilling<br>Take S-19 |
| | -61.0 | | | | 76–77 | | | | | | |
| | | Class 3a | S-20: Brown fine SAND, trace Silt (wet)[SP] | | 77–78 | | | | | | |
| | | | | | 78–79 | | | | | | |
| | | | | | 79–80 | | | | | | |
| | | | | | 80–81 | S-20 | SS | 15 | 11, 18, 14, 14 | 32 | Drill to 80'<br>Brown wash<br>quick and smooth drilling<br>Take S-20 |
| | | | | | 81–82 | | | | | | |
| | | | | | 82–83 | | | | | | |
| | | | | | 83–84 | | | | | | |
| | -69.0 | | | | 84–85 | | | | | | |
| | | Class 3b | S-21: Brown c-f SAND, some Silt and Gravel (wet)[SP] | | 85–86 | S-21 | SS | 11 | 1, 13, 12, 12 | 25 | Drill to 85'<br>Brown wash<br>Quick and smooth drilling<br>Take S-21 |
| | | | | | 86–87 | | | | | | |
| | | | | | 87–88 | | | | | | |
| | | | | | 88–89 | | | | | | |
| | | | | | 89–90 | | | | | | |
| | -74.0 | | | | 90–91 | S-22 | SS | 14 | 11, 19, 21, 23 | 40 | Drill to 90'<br>Brown wash<br>Light rig chatter<br>Take S-22 |
| | | Class 3a | S-22: Brown m-f SAND, some Silt (wet)[SW] | | 91–92 | | | | | | |
| | | | | | 92–93 | | | | | | |
| | | | | | 93–94 | | | | | | |
| | | | | | 94–95 | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:59:30 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-7** Sheet 5 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 16 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Coring (min) | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Class 3a | S-23: Browm m-f SAND, some Silt, trace Gravel (wet)[SW] | | 95–96 | S-23 | SS | 11 | 15, 23, 20, 24 | 43 | Drill to 95'<br>Brown wash<br>Quick and smooth drilling<br>Take S-23 |
| | -82.5 | | | | 96–97 | | | | | | |
| | | | | | 97–98 | | | | | | |
| | | | | | 98–99 | | | | | | |
| | | | | | 99–100 | | | | | | |
| | | Class 2a | S-24: Brown Sandy GRAVEL, some Silt (wet)[GW] | | 100–101 | S-24 | SS | 10 | 25, 28, 31, 27 | 59 | Drill to 100'<br>Brown wash<br>Heavy rig chatter at 99'<br>Take S-24 |
| | -86.0 | | End of boring at 102' | | 101–102 | | | | | | Backfill with grout and cover with existing gravel |
| | | | | | 102–120 | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:59:30 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-8** Sheet 1 of 5

| | |
|---|---|
| Project: Powerhouse Workshop | Project No.: 170404201 |
| Location: 322 3rd Avenue Brooklyn, N.Y. | Elevation and Datum: Approx. 16 (NAVD) |
| Drilling Company: Aquifer Drilling And Testing | Date Started: 10/17/16 — Date Finished: 10/18/16 |
| Drilling Equipment: CME 55 Truck Rig | Completion Depth: 102 ft — Rock Depth: Not Encountered |
| Size and Type of Bit: 3-7/8" Roller Bit | Number of Samples: Disturbed 29 — Undisturbed 0 — Core 0 |
| Casing Diameter (in): 4 1/2" — Casing Depth (ft): 29 | Water Level (ft.): First ▽ 14 — Completion ▼ - — 24 HR. ▼ - |
| Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | Drilling Foreman: Matt Ficeto |
| Sampler: 2" O.D. Split Spoon | Field Engineer: Daniel O'Donnell |
| Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30 | |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Casng blws/ ft | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | +16.0 | | | | 0 | | | | | 10 20 30 40 | |
| | | | S-1: Brown-black Silty SAND, some Gravel, trace brick (dry) [FILL] | 20 | 1 | S-1 | SS | 18 | 5 17 38 12 | 55 | Take S-1 |
| | | | | 72 | 2 | | | | | | |
| | | | S-2: Brown-gray Silty SAND, some Gravel (dry) [FILL] | 61 | 3 | S-2 | SS | 21 | 20 26 27 16 | 53 | Drill to 2'<br>Brown wash<br>Smooth drilling<br>Take S-2 |
| | | | | 53 | 4 | | | | | | |
| | | | S-3: brown Silty SAND, some Gravel (moist) [FILL] | 10 | 5 | S-3 | SS | 10 | 7 17 12 8 | 29 | Install casing to 4'<br>Drill to 4'<br>Brown wash<br>Light racking<br>Take S-3 |
| | | | | 3 | 6 | | | | | | |
| | | | S-4: Brown m-f Silty SAND, some Gravel, trace concrete (wet) [FILL] | 17 | 7 | S-4 | SS | 7 | 5 3 3 5 | 6 | Take S-4 |
| | | | | 22 | 8 | | | | | | |
| | | Class 7 | S-5: Tan m-f Silty SAND, some Gravel (wet) [ FILL] | 32 | 9 | S-5 | SS | 11 | 7 3 3 31 | 6 | Drill to 8'<br>No return<br>Quick drilling, light rig chatter<br>Install casing to 8'<br>Take S-5 |
| | | | | 59 | 10 | | | | | | |
| | | | S-6: Tan m-f Silty SAND, some Gravel and concrete (wet) [FILL] | 67 | 11 | S-6 | SS | 3 | 13 17 9 8 | 26 | Drill to 10'<br>Brown wash<br>Smooth drilling<br>Take S-6 |
| | | | | 113 | 12 | | | | | | |
| | | | S-7: Gray m-f Silty SAND, some Gravel, trace concrete (wet) [FILL] | 31 | 13 | S-7 | SS | 10 | 5 4 2 3 | 6 | Take S-7<br>Install casing to 12' |
| | | | | 52 | 14 | | | | | | |
| | | | | 15 | 15 | | | | | | |
| | | | S-8: Black Silty SAND, some Gravel, trace steel fragments (wet) [FILL] | 33 | 16 | S-8 | SS | 9 | 3 10 6 4 | 16 | Drill to 15'<br>Brown wash, metallic items<br>Light rig chatter<br>Take S-8 |
| | -1.0 | | | 11 | 17 | | | | | | |
| | | Class 6 | S-9: Black m-f Silty SAND, some Clay (wet) [SP] | SPUN | 18 | S-9 | SS | 14 | 4 2 2 2 | 4 | Take S-9 |
| | | | | | 19 | S-10 | SS | 9 | WOH WOH | | Install casing to 19'<br>Obstruction at 13.5'<br>Redrill to 14' |
| | | | | | 20 | | | | | | |

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:59:40 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-8** Sheet 2 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 16 (NAVD) |

| Elev. (ft) | Building Code | Sample Description | Casng blws/ ft | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Class 6 | S-10: Brown m-f Silty SAND, some Clay (wet) [SP] | | 20 | S-10 | SS | 9 | WOH<br>WOH | | Casing observed to be bent<br>Rig mechanical issues lasting until 12:15 PM<br>Drill to 19'<br>Brown wash<br>Heavy racking at 18'<br>Take S-10<br>Take S-11<br>Take S-12 |
| -5.0 | | | | 21 | | | | | | |
| | | S-11: Black Clayey PEAT, some fibers (wet) [Pt] | SPUN | 22 | S-11 | SS | 11 | WOH<br>1<br>WOH<br>WOH | | |
| | | | | 23 | | | | | | |
| | | S-12: Brown-black Clayey PEAT, some fibers (wet) [Pt] | | 24 | S-12 | SS | 24 | WOH<br>WOH<br>WOH<br>2 | | |
| | Class 6 | | | 25 | | | | | | Install casing to 25'<br>Drill to 25'<br>Brown wash<br>Quick, smooth drilling<br>Take S-13<br>Take S-14 |
| | | S-13: No recovery | | 26 | S-13 | SS | 0 | WOH<br>WOH<br>WOH<br>WOH | | |
| | | | SPUN | 27 | | | | | | |
| | | S-14: Brown Clayey PEAT, some fibers (wet) [Pt] | | 28 | S-14 | SS | 22 | 3<br>6<br>14<br>7 | 20 | |
| -13.0 | | | | 29 | | | | | | Install casing to 29'<br>Drill to 29'<br>Take S-15<br>Add mud to tub |
| | | S-15: Gray m-f Silty SAND (wet) [SM] | | 30 | S-15 | SS | 18 | 9<br>15<br>12<br>14 | 27 | |
| | Class 3b | | | 31 | | | | | | |
| | | | | 32 | | | | | | |
| | | | | 33 | | | | | | |
| | | | | 34 | | | | | | |
| -19.0 | | | | 35 | | | | | | Drill to 35'<br>Brown wash<br>Quick, smooth drilling<br>Take S-16 |
| | | S-16: Gray m-f Silty SAND (wet) [SP] | | 36 | S-16 | SS | 11 | 4<br>5<br>6<br>8 | 11 | |
| | | | | 37 | | | | | | |
| | | | | 38 | | | | | | |
| | | | | 39 | | | | | | |
| | Class 6 | | | 40 | | | | | | Drill to 40'<br>Brown wash<br>Quick, smooth drilling<br>Take S-17<br>Add mud to tub |
| | | S-17: Brown m-f Silty SAND (wet) [SP] | | 41 | S-17 | SS | 9 | 3<br>3<br>4<br>5 | 7 | |
| | | | | 42 | | | | | | |
| | | | | 43 | | | | | | |
| | | | | 44 | | | | | | |
| | | | | 45 | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:59:41 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-8** Sheet 3 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 16 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Casng blws/ ft | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | S-18: Brown m-f Silty SAND (wet) [SP] | | 45–70 | S-18 | SS | 13 | 2, 3, 4, 4 | 7 | Drill to 45' Brown wash Quick, smooth drilling Take S-18 |
| | | | S-19: Brown m-f Silty SAND (wet) [SP] | | | S-19 | SS | 14 | 2, 3, 6, 5 | 9 | Drill to 50' Brown wash Quick, smooth drilling Take S-19 |
| | | Class 6 | S-20: Brown m-f Silty SAND (wet) [SP] | | | S-20 | SS | 10 | 3, 3, 6, 6 | 9 | Drill to 55' Brown wash Quick, smooth drilling Take S-20 |
| | -42.5 | | S-21: Brown m-f Silty SAND (wet) [SP] | | | S-21 | SS | 15 | 3, 5, 6, 6 | 11 | Drill to 60' Brown wash Quick, smooth drilling Take S-21 |
| | | Class 3b | S-22: Brown m-f Silty SAND (wet) [SP] | | | S-22 | SS | 11 | 4, 7, 8, 10 | 15 | Drill to 65' Brown wash Quick, smooth drilling Take S-22 |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:59:42 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-8** Sheet 4 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 16 (NAVD) |

| Material Symbol | Elev. (ft) | Building Code | Sample Description | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Class 3b | S-23: Brown m-f SAND, some Silt (wet) [SP] | 70–71 | S-23 | SS | 19 | 7, 9, 12, 9 | 21 | Drill to 70'<br>Brown wash<br>Quick, smooth drilling<br>Take S-23 |
| | -57.5 | Class 5a | S-24: Grayish-brown SILT (wet) [MH] | 75–76 | S-24 | SS | 19 | 7, 13, 19, 21 | 32 | Drill to 75'<br>Brown wash<br>Quick, smooth drilling<br>Take S-24 |
| | -62.5 | Class 3a | S-25: Brown m-f SAND, some Silt, trace Gravel (wet) [SW] | 80–81 | S-25 | SS | 13 | 10, 13, 32, 32 | 45 | Drill to 80'<br>Brown wash<br>Quick, smooth drilling<br>Take S-25 |
| | | | S-26: Brown m-f SAND, some Clay and Gravel (wet) [SW] | 85–86 | S-26 | SS | 13 | 13, 9, 32, 21 | 41 | Drill to 85'<br>Brown wash<br>Heavy rig chatter from 82' to 85'<br>Take S-26 |
| | | | S-27: Brown fine silty SAND, trace Gravel (wet) [SM] | 90–91 | S-27 | SS | 21 | 26, 19, 15, 5 | 34 | Drill to 90'<br>Brown wash<br>Heavy rig chatter from 86' to 90'<br>Take S-27 |

Casng blws/ ft

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:59:43 PM ... Report: Log - LANGAN

# LANGAN

Log of Boring **B-8** Sheet 5 of 5

| Project | Project No. |
|---|---|
| Powerhouse Workshop | 170404201 |
| **Location** | **Elevation and Datum** |
| 322 3rd Avenue Brooklyn, N.Y. | Approx. 16 (NAVD) |

| MATERIAL SYMBOL | Elev. (ft) | Building Code | Sample Description | Casng blws/ ft | Depth Scale | Sample Data: Number | Type | Recov. (in) | Penetr. resist BL/6in | N-Value (Blows/ft) | Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 95 | | | | | | Drill to 95'<br>Brown wash<br>Heavy rig chatter at 92', then smooth<br>Take S-28 |
| | | Class 3a | S-28: Brown fine silty SAND, trace Gravel (wet) [SM] | | 96 | S-28 | SS | 14 | 6<br>13<br>25<br>40 | 38 | |
| | | | | | 97 | | | | | | |
| | | | | | 98 | | | | | | |
| | | | | | 99 | | | | | | |
| | | | | | 100 | | | | | | Drill to 100'<br>Brown wash<br>Light racking from 97' to 99'<br>Take S-29 |
| | | | S-29: Brown m-f Gravelly Silty SAND (wet) [SM] | | 101 | S-29 | SS | 14 | 23<br>53<br>101<br>86 | 154 | |
| | -86.0 | | End of boring at 102' | | 102 | | | | | | Borehole was filled in with grout and clean cuttings then covered with existing gravel |
| | | | | | 103 | | | | | | |
| | | | | | 104 | | | | | | |
| | | | | | 105 | | | | | | |
| | | | | | 106 | | | | | | |
| | | | | | 107 | | | | | | |
| | | | | | 108 | | | | | | |
| | | | | | 109 | | | | | | |
| | | | | | 110 | | | | | | |
| | | | | | 111 | | | | | | |
| | | | | | 112 | | | | | | |
| | | | | | 113 | | | | | | |
| | | | | | 114 | | | | | | |
| | | | | | 115 | | | | | | |
| | | | | | 116 | | | | | | |
| | | | | | 117 | | | | | | |
| | | | | | 118 | | | | | | |
| | | | | | 119 | | | | | | |
| | | | | | 120 | | | | | | |

N-Value (Blows/ft) scale: 10 20 30 40

\\LANGAN.COM\DATA\NYC\DATA2\170404201\ENGINEERING DATA\GEOTECHNICAL\GINTLOGS\170404201.GPJ ... 11/17/2016 1:59:43 PM ... Report: Log - LANGAN

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **TP-1/TP-2** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Lukas Reiss** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/26/16-10/26/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Dark brown, fine to coarse SAND and SILT, some Gravel and Fill Material (Concrete, Brick); moist. | | 1.2 | |
| 1 | | | | | Collect sample TP-1/TP-2 (0-2) for PCBs. |
| 2 | | Brown, fine to coarse SAND and SILT, little Fill Material (Concrete); moist. | | 0.2 | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | 2.7 | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | 0.8 | Collect sample TP-1/TP-2 (11-13) for PCBs & VOCs. |
| 11 | | | | | |
| 12 | | | | | |
| 13 | | | | | End of boring 13' bls. |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **TP-1-E** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Joe Sakellis** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/24/16-10/24/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Dark brown, fine to coarse SAND and SILT, some Fill Material (Glass, Brick, Concrete, Fabric); moist. | | 1.1 | |
| 1 | | | | | Collect sample TP-1-E (0-3) for PCBs. |
| 2 | | | | 1.3 | |
| 3 | | | | | |
| 4 | | | | | Collect sample TP-1-E (4-6) for PCBs. |
| 5 | | | | 2.8 | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | 1.2 | |
| 10 | | | | | |
| 11 | | Very dark grey/black, fine to coarse SAND, little Gravel; moist. | | 1.4 | Brick & Metal observed in sampler tip. End of boring 11' bls. |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **TP-1-N** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Joe Sakellis** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/24/16-10/24/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Dark brown, SILT and fine SAND, some Gravel and Fill Material (Brick, Fabric, Concrete); moist. | | 1.4 | |
| 1 | | | | | Collect sample TP-1-N (0-3) for PCBs. |
| 2 | | | | | |
| 3 | | | | 1.8 | |
| 4 | | | | | Collect sample TP-1-N (4-6) for PCBs. |
| 5 | | | | | |
| 6 | | | | 2.8 | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | 1.6 | |
| 11 | | | | | |
| 12 | | | | | |
| 13 | | | | | |
| 14 | | | | | End of boring 14' bls. |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **TP-1-N2** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Joe Sakellis** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/24/16-10/24/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| | | Dark brown, SILT and fine SAND, some Gravel and Fill Material (Brick, Concrete, Wood); moist. | | 3.9 | Collect sample TP-1-N2 (0-3) for PCBs. |
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | 4.3 | |
| 4 | | | | | Collect sample TP-1-N2 (4-6) for PCBs. |
| 5 | | | | 2.6 | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | Rock and Rubber observed in sampler tip.<br>End of boring 8' bls. |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| | | | | |
|---|---|---|---|---|
| WELL NO.<br>**TP-1-S** | NORTHING<br>**Not Measured** | EASTING<br>**Not Measured** | | |
| PROJECT NO./NAME<br>**153 2nd Street / BRT Powerhouse** | | LOCATION<br>**Brooklyn, NY** | | |
| APPROVED BY | LOGGED BY<br>**Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER<br>**Trinity Environmental / Joe Sakellis** | | GEOGRAPHIC AREA | | |
| DRILL BIT DIAMETER/TYPE<br>**2" / Drive Sampler** | BOREHOLE DIAMETER<br>**2"** | DRILLING EQUIPMENT/METHOD<br>**Geoprobe 7720 / Geoprobe** | SAMPLING METHOD<br>**2" Macro-Core** | START-FINISH DATE<br>**10/24/16-10/24/16** |
| LAND SURFACE ELEVATION<br>**Not Measured** | DEPTH TO WATER<br>**Not Measured** | BACKFILL<br>**Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| | | Brown, fine to coarse SAND and SILT, some Fill Material (Brick, Concrete); moist. | | 1.0 | |
| | | | | | Collect sample TP-1-S (0-3) for PCBs. |
| 1 | | | | | 1 |
| 2 | | | | 1.2 | 2 |
| 3 | | | | | 3 |
| 4 | | | | | 4 |
| | | | | | Collect sample TP-1-S (4-6) for PCBs. |
| 5 | | | | | 5 |
| 6 | | | | | 6 |
| 7 | | | | | 7 |
| | | | | | Rock & Brick observed in sampler tip. |
| 8 | | | | | End of boring 8' bls. 8 |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **TP-1-S2** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Joe Sakellis** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/24/16-10/24/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Brown, BRICK, some Silt and fine to coarse Sand, little Gravel; moist. | | 7.8 | |
| 1 | | | | | Collect sample TP-1-S2 (0-3) for PCBs. |
| 2 | | Brown, fine to coarse SAND and SILT, some Fill Material (Concrete, Brick); moist. | | | |
| 3 | | | | 16.2 | |
| 4 | | | | | Collect sample TP-1-S2 (4-6) for PCBs. |
| 5 | | Crushed Concrete. | | | |
| 6 | | Brown, fine to coarse SAND and SILT, some Fill Material (Concrete, Brick); moist. | | 4.4 | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | Brown, fine to coarse SAND and SILT, some Brick; moist. | | 5.1 | |
| 11 | | | | | |
| 12 | | | | | Metal observed in sampler tip. End of boring 12.5' bls. |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **TP-1-W** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Joe Sakellis** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/24/16-10/24/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Brown, fine to coarse SAND and SILT, some Fill Material (Wood, Brick, Concrete, Glass); moist. | | 0.8 | |
| 1 | | | | | Collect sample TP-1-W (0-3) for PCBs. |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | Collect sample TP-1-W (4-6) for PCBs. |
| 6 | | Brown to grey, GRAVEL and BROKEN ROCK, some Fill Material (Brick), little fine to coarse Sand; moist. | | 1.5 | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | Brown, fine to coarse SAND and SILT, some Gravel, little Fill Material (Glass, Brick, Concrete); moist. | | 0.9 | |
| 12 | | | | | |
| 13 | | | | 2.4 | |
| 14 | | | | | Concrete observed in sampler tip. End of boring 14' bls. |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| | | | | |
|---|---|---|---|---|
| WELL NO.<br>**TP-2/TP-3** | NORTHING<br>**Not Measured** | EASTING<br>**Not Measured** | | |
| PROJECT NO./NAME<br>**153 2nd Street / BRT Powerhouse** | | LOCATION<br>**Brooklyn, NY** | | |
| APPROVED BY | LOGGED BY<br>**Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER<br>**Trinity Environmental / Lukas Reiss** | | GEOGRAPHIC AREA | | |
| DRILL BIT DIAMETER/TYPE<br>**2" / Drive Sampler** | BOREHOLE DIAMETER<br>**2"** | DRILLING EQUIPMENT/METHOD<br>**Geoprobe 7720 / Geoprobe** | SAMPLING METHOD<br>**2" Macro-Core** | START-FINISH DATE<br>**10/25/16-10/25/16** |
| LAND SURFACE ELEVATION<br>**Not Measured** | DEPTH TO WATER<br>**Not Measured** | BACKFILL<br>**Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Brown, WOOD, fine to coarse SAND, and SILT, some Fill Material (Concrete, Brick, Plastic); moist. | | 3.7 | |
| 1 | | | | | Collect sample TP-2/TP-3 (0-2) for PCBs. |
| 2 | | Dark grey to black, fine to coarse SAND and GRAVEL, some Fill Material (Concrete, Brick, Ceramic); moist. | | 3.3 | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | Brown, fine to coarse SAND and SILT, some Fill Material (Concrete, Brick); moist. | | 2.6 | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | Dark grey to black, fine to coarse SAND and SILT; moist. | | 187.3 | Collect sample TP-2/TP-3 (10-11) for PCBs & VOCs. Odor observed. End of boring 11' bls. |
| 11 | | | | | |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **TP-2-E** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Lukas Reiss** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/21/16-10/21/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Brown, SILT and GRAVEL, some Fill Material (Brick, Metal); moist. | | 0.0 | |
| | | | | | Collect sample TP-2-E (0-2) for PCBs. |
| 1 | | | | | 1 |
| 2 | | | | 0.2 | 2 |
| 3 | | | | | 3 |
| 4 | | | | | 4 |
| 5 | | | | 0.4 | 5 |
| 6 | | | | | 6 |
| | | | | | Collect sample TP-2-E (6-8) for PCBs. |
| 7 | | | | | 7 |
| 8 | | | | | End of boring 8' bls. 8 |

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **TP-2-E9'** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Lukas Reiss** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/21/16-10/21/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Brown, fine to coarse SAND and SILT, some Gravel and Fill Material (Brick, Wood, Concrete, Glass); moist. | | 11.3 | |
| 1 | | | | | Collect sample TP-2-E9' (0-2) for PCBs. |
| 2 | | | | 2.2 | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | 19.0 | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | Stained wood observed at 10' bls. |
| | | | | 263.7 | Collect sample TP-2-E9' (10-12) for PCBs & VOCs. |
| 11 | | | | | Staining and odor observed. |
| 12 | | | | | Concrete observed in sampler tip.<br>End of boring 12' bls. |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **TP-2-N** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Lukas Reiss** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/21/16-10/21/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Brown, SILT and GRAVEL, some Fill Material (Plastic, Concrete, Brick); moist. | | 5.4 | |
| 1 | | | | | Collect sample TP-2-N (0-2) for PCBs. |
| 2 | | | | 1.3 | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | 2.4 | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| 10 | | Brown, fine SAND and GRAVEL, little Fill Material (Brick, Concrete); moist. | | 4.5 | Collect sample TP-2-N (10-12) for PCBs. |
| 11 | | | | | |
| 12 | | | | | Concrete observed in sampler tip.<br>End of boring 12' bls. |

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **TP-2-N2** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Joe Sakellis** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/24/16-10/24/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| | | Brown, SILT and fine to coarse SAND, some Fill Material (Fabric, Concrete, Brick); moist. | | 0.2 | Collect sample TP-2-N2 (0-2) for PCBs. |
| | | | | 5.8 | |
| 5 | | | | 8.7 | 5 |
| 10 | | | | 103.3 | 10 |
| | | Very dark grey/black, fine to coarse SAND and SILT, trace metal; moist. | | 199.9 | Odor observed. Collect sample TP-2-N2 (12-13) for PCBs & VOCs. |
| | | Brown, fine to coarse SAND, little Cobble; moist. | | 10.1 | Collect sample TP-2-N2 (13-15) for PCBs. |
| 15 | | Broken rock. | | | End of boring 15' bls. 15 |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **TP-2-S** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Lukas Reiss** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/21/16-10/21/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Brown, fine to coarse SAND and SILT, some Fill Material (Brick, Concrete); moist. | | 0.2 | |
| 1 | | | | | |
| 2 | | | | 0.2 | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | Very dark grey/black to brown, fine to coarse SAND and SILT, some Fill Material (Brick, Concrete); moist. | | 81.7 | Collect sample TP-2-S (5-8) for PCBs & VOCs. |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | Brown, fine to coarse SAND and SILT, some Fill Material (Brick, Concrete); moist. | | 2.2 | |
| 10 | | | | | Collect sample TP-2-S (9.5-11.5) for PCBs & VOCs. |
| 11 | | | | 31.2 | |
| 12 | | Broken concrete. | | | End of boring 12.5' bls. |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **TP-2-S2** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Lukas Reiss** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/21/16-10/21/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Brown, SILT and fine SAND, some Gravel and Fill Material (Concrete, Brick, Metal); moist. | | 5.7 | Collect sample TP-2-S2 (0-2) for PCBss. |
| 1 | | | | | |
| 2 | | | | 8.2 | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | 6.5 | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | 5.4 | |
| 11 | | | | | |
| 12 | | | | | Collect sample TP-2-S2 (12.5-13) for PCBs & VOCs. |
| 13 | | Very dark grey/black, fine to coarse SAND; moist. | | 2.4 | End of boring 13' bls. |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **TP-2-W** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Lukas Reiss** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/21/16-10/21/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Brown, SILT and GRAVEL, some Fill Material (Plastic, Wood, Fabric, Brick); moist. | | 1.0 | |
| 1 | | | | | Collect sample TP-2-W (0-2) for PCBs. |
| 2 | | | | 6.3 | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | 1.0 | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | 4.3 | |
| 11 | | | | | Collect sample TP-2-W (11-13) for PCBs. |
| 12 | | | | | Metal observed in sampler tip. |
| 13 | | | | | End of boring 13' bls. |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **TP-3-E** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Lukas Reiss** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/21/16-10/21/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| | | Brown, CONCRETE, some fine to coarse Sand and Silt; moist. | | 1.9 | Collect sample TP-3-E (0-2) for PCBs. |
| | | Brown, fine to coarse SAND and SILT, some Fill Material (Concrete, Brick); moist. | | | |
| 5 | | | | 4.0 | 5 |
| 10 | | Brown to dark brown, fine to medium SAND; moist. | | 93.0 | Collect sample TP-3-E (9-10) for PCBs & VOCs. Staining and odor observed. 10 |
| | | Brown, fine to coarse SAND and SILT, some Fill Material (Concrete, Brick); moist. | | 4.6 | Collect sample TP-3-E (13-15) for PCBs. |
| | | | | 2.4 | |
| 15 | | | | | End of boring 15' bls. 15 |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **TP-3-E2** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Lukas Reiss** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/25/16-10/25/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| | | Brown, fine to coarse SAND, some Silt and Fill Material (Concrete, Brick); moist. | | 0.2 | Collect sample TP-3-E2 (0-2) for PCBs. |
| | | | | 0.3 | |
| 5 | | | | 1.6 | 5 |
| | | Brown, fine to medium SAND, little Gravel; moist. | | 42.9 | Collect sample TP-3-E2 (9-10) for PCBs & VOCs. Staining and odor observed. |
| 10 | | Brown, fine to coarse SAND and SILT, some Fill Material (Concrete, Brick); moist. | | 5.0 | 10 |
| | | | | | Collect sample TP-3-E2 (13-15) for PCBs. |
| | | | | 5.6 | |
| 15 | | | | | End of boring 15' bls. 15 |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **TP-3-N** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Lukas Reiss** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/25/16-10/25/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| | | Brown, fine to coarse SAND and SILT, some Fill Material (Concrete, Brick); moist. | | 4.9 | Collect sample TP-3-N (0-2) for PCBs. |
| | | | | 2.0 | |
| 5 | | | | 0.4 | |
| 10 | | Dark grey, SILT and fine SAND; moist. | | 75.3 | |
| | | Brown, fine to coarse SAND and SILT, some Fill Material (Concrete, Brick); moist. | | 1.7 | |
| | | | | 1.0 | Collect sample TP-3-N (13-15) for PCBs. Staining and odor observed. |
| 15 | | | | 40.8 | Collect sample TP-3-N (15-17) for PCBs & VOCs. |
| | | Dark brown to grey, fine to coarse SAND, some Gravel; wet. | | 1.8 | Collect sample TP-3-N (17-20) for PCBs. Staining and odor observed. |
| 20 | | | | | End of boring 20' bls. |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **TP-3-S** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Lukas Reiss** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/25/16-10/25/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| | | Brown, fine to coarse SAND and SILT, some Gravel and Fill Material (Concrete, Brick, Glass); moist. | | 1.5 | Collect sample TP-3-S (0-2) for PCBs. |
| | | | | 0.8 | |
| 5 | | | | 1.2 | 5 |
| 10 | | Very dark brown, fine to coarse SAND and SILT, some Gravel and Fill Material (Concrete, Brick, Glass); moist. | | 1.8 | 10 |
| | | Very dark grey, coarse SAND and GRAVEL; moist. | | 0.8 | Collect sample TP-3-S (13-15) for PCBs. |
| 15 | | | | | End of boring 15' bls. 15 |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **TP-3-W** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Lukas Reiss** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/25/16-10/25/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Brown, fine to coarse SAND and SILT, some Fill Material (Concrete, Brick); moist. | | 0.5 | |
| 1 | | | | | Collect sample TP-3-W (0-2) for PCBs. |
| 2 | | | | 1.2 | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | 0.9 | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | 1.1 | Collect sample TP-3-W (8-10) and DUP-102516 for PCBs. |
| 9 | | | | | |
| 10 | | | | | End of boring 10' bls. |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **ZEB-SB-3-E** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Lukas Reiss** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/26/16-10/26/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Brown, fine to coarse SAND and SILT, some Fill Material (Brick, Concrete, Fabric, Metal); moist. | | 0.0 | |
| 1 | | | | | Collect sample ZEB-SB-3-E (0-2) and DUP-102616 for PCBs & VOCs. |
| 2 | | | | 0.1 | |
| 3 | | | | | |
| 4 | | | | 0.0 | Collect sample ZEB-SB-3-E (4-6) for PCBs & VOCs. |
| 5 | | | | | |
| 6 | | | | 0.6 | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | Concrete observed in sampler tip.<br>End of boring 10' bls. |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **ZEB-SB-3-E2** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Lukas Reiss** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/26/16-10/26/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Brown, fine to coarse SAND and SILT, little Fill Material (Concrete, Brick); moist. | | 119.1 | |
| 1 | | | | | Collect sample ZEB-SB-3-E2 (0-2) for PCBs & VOCs. |
| 2 | | | | 13.7 | |
| 3 | | | | | |
| 4 | | | | 3.7 | Collect sample ZEB-SB-3-E2 (4-6) for PCBs & VOCs. |
| 5 | | | | | |
| 6 | | | | 0.7 | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | No Recovery. | | | |
| 11 | | | | | |
| 12 | | | | | End of boring 12' bls. |

BORING/FEET 2705.001Y000 TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **ZEB-SB-3-N** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Lukas Reiss** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/26/16-10/26/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Brown, SILT and fine SAND, some Gravel and medium to coarse Sand, little Fill Material (Concrete, Brick); moist. | | 0.1 | |
| 1 | | | | | Collect sample ZEB-SB-3-N (0-2) for PCBs & VOCs. |
| 2 | | | | 0.2 | |
| 3 | | | | | |
| 4 | | | | 0.3 | Collect sample ZEB-SB-3-N (4-6) and DUP-102616-2 for PCBs & VOCs. |
| 5 | | | | | |
| 6 | | | | 0.0 | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | Brown, fine to coarse SAND and SILT, some Fill Material (Fabric, Plastic); moist. | | 0.4 | |
| 11 | | | | | |
| 12 | | | | | |
| 13 | | | | | End of boring 13' bls. |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **ZEB-SB-3-N2** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Lukas Reiss** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/26/16-10/26/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Brown, SILT and fine SAND, some medium to coarse Sand and Gravel, little Fill Material (Brick, Concrete, Plastic, Fabric, Rubber); moist. | | 642.9 | |
| 1 | | | | | Collect sample ZEB-SB-3-N2 (0-2) for PCBs & VOCs. |
| 2 | | | | 41.3 | Collect sample ZEB-SB-3-N2 (2-4) for PCBs & VOCs. |
| 3 | | | | | |
| 4 | | | | 6.1 | |
| 5 | | Crushed concrete. | | | |
| 6 | | | | | |
| 7 | | Asphalt. | | | |
| 8 | | Crushed concrete. | | | |
| 9 | | Brown, SILT and fine SAND, some medium to coarse Sand, Gravel, and Fill Material (Brick, Plastic, Fabric); moist. | | 84.1 | Collect sample ZEB-SB-3-N2 (8-10) for PCBs & VOCs. |
| 10 | | | | | |
| 11 | | | | 18.4 | |
| 12 | | | | | End of boring 10' bls. |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **ZEB-SB-3-S** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Lukas Reiss** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/26/16-10/26/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Brown, fine to coarse SAND and SILT, some Fill Material (Brick, Concrete, Wood, Tile); moist. | | 0.0 | |
| 1 | | | | | Collect sample ZEB-SB-3-S (0-2) for PCBs & VOCs. |
| 2 | | | | 0.0 | |
| 3 | | | | | |
| 4 | | | | 0.0 | Collect sample ZEB-SB-3-S (4-6) for PCBs & VOCs. |
| 5 | | | | | |
| 6 | | | | 0.2 | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | | | | Metal observed in sampler tip. End of boring 11' bls. |

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **ZEB-SB-3-S2** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Lukas Reiss** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/26/16-10/26/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Brown to dark brown, fine to coarse SAND and SILT, some Fill Material (Brick, Concrete, Glass, Fabric, Metal, Rubber); moist. | | 7.5 | |
| 1 | | | | | Collect sample ZEB-SB-3-S2 (0-2) for PCBs & VOCs. |
| 2 | | | | 2.1 | |
| 3 | | | | 0.0 | |
| 4 | | | | | Collect sample ZEB-SB-3-S2 (4-6) for PCBs & VOCs. |
| 5 | | | | | |
| 6 | | | | 1.1 | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | End of boring 10' bls. |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **ZEB-SB-3-W** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Lukas Reiss** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/26/16-10/26/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Brown, fine to coarse SAND and SILT, some Fill Material (Brick, Wood, Plastic); moist. | | 0.6 | |
| 1 | | | | | Collect sample ZEB-SB-3-W (0-2) for PCBs & VOCs. |
| 2 | | | | 0.1 | |
| 3 | | | | 0.0 | |
| 4 | | | | | Collect sample ZEB-SB-3-W (4-6) for PCBs & VOCs. |
| 5 | | | | | |
| 6 | | | | 0.0 | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | End of boring 10' bls. |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **ZEB-SB-3-W2** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **153 2nd Street / BRT Powerhouse** | | | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| | **Lauren Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Trinity Environmental / Lukas Reiss** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **2" / Drive Sampler** | **2"** | **Geoprobe 7720 / Geoprobe** | **2" Macro-Core** | **10/26/16-10/26/16** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Brown, fine to coarse SAND and SILT, some Fill Material (Concrete, Brick, Wood, Metal); moist. | | 57.3 | Collect sample ZEB-SB-3-W2 (0-2) for PCBs & VOCs. |
| 1 | | | | | |
| 2 | | | | 2.3 | Black (tar-like) material observed at 2' bls. Odor observed. |
| 3 | | | | 3.4 | |
| 4 | | | | | Collect sample ZEB-SB-3-W2 (4-6) for PCBs & VOCs. |
| 5 | | | | | |
| 6 | | | | 0.3 | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | End of boring 10' bls. |

BORING/FEET 2705.001Y000_TESTPITBORINGS.GPJ ROUX.GDT 5/24/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **WC-1** | **185968.1114** | **987279.1535** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **/ BRT Powerhouse** | | **153 2nd St** | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| **M. Abbene** | **M. Abbene** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Brookside Environmental / Brian Graham** | | **Shoreline Embankment** | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **/** | | **/** | **Cuttings** | **3/28/17-3/28/17** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|---|
| 1 | | Brown, SILT and GRAVEL, some Fill Material (Brick, Fabric, Concrete, Plastic); moist. | | | 0.0 | Collect composite sample "WC-1" from 0-6 ft bls for TCL VOCs, TCL SVOCs, PCBs, Herbicides, TCL Pesticides, Cyanide, Paint Filter, TCLP RCRA Metals, pH, TCLP Mercury, and RCRA Characterization: Reactivity, Ignitability, and Corrosivity. |
| 2 | | | | | | |
| 3 | | | | G | | Large concrete debris observed. |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | End of test pit 6 ft bls. |

BORING/FEET 2705.0001Y000_WC_TESTPITS.GPJ ROUX.GDT 4/27/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **WC-2** | **185952.3709** | **987271.638** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **/ BRT Powerhouse** | | **153 2nd St** | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| **M. Abbene** | **M. Abbene** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Brookside Environmental / Brian Graham** | | **Shoreline Embankment** | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **/** | | **/** | **Cuttings** | **3/28/17-3/28/17** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|---|
| | | GRAVEL | | | | Collect composite sample "WC-2" from 0-5 ft bls for TCL VOCs, TCL SVOCs, PCBs, Herbicides, TCL Pesticides, Cyanide, Paint Filter, TCLP RCRA Metals, pH, TCLP Mercury, and RCRA Characterization: Reactivity, Ignitability, and Corrosivity. Filter fabric observed beneath Gravel. |
| | | Brown, medium SILT, some Sand, Gravel, and Fill Material (Tire, Bricks, Plastic); moist. | | | 0.0 | |
| 1 | | | | | | 1 |
| | | | | | 0.0 | |
| 2 | | | | | | 2 |
| | | | | G | | |
| 3 | | | | | | 3 |
| 4 | | | | | | 4 |
| 5 | | | | | | End of test pit 5 ft bls. 5 |

BORING/FEET 2705.0001Y000_WC_TESTPITS.GPJ ROUX.GDT 4/27/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **WC-3** | **185928.5291** | **987257.6609** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **/ BRT Powerhouse** | | **153 2nd St** | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| **M. Abbene** | **M. Abbene** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Brookside Environmental / Brian Graham** | | **Shoreline Embankment** | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **/** | | **/** | **Cuttings** | **3/28/17-3/28/17** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|---|
| 1 | | Brown, SILT, some Sand, Cobbles, and Fill Material (Brick, Plastic, Fibers); moist. | | G | 0.0 | Collect composite sample "WC-3" from 0-6 ft bls for TCL VOCs, TCL SVOCs, PCBs, Herbicides, TCL Pesticides, Cyanide, Paint Filter, TCLP RCRA Metals, pH, TCLP Mercury, and RCRA Characterization: Reactivity, Ignitability, and Corrosivity. |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | End of test pit 6 ft bls. |

BORING/FEET 2705.0001Y000_WC_TESTPITS.GPJ ROUX.GDT 4/27/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **WC-4** | **185895.8546** | **987236.1114** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **/ BRT Powerhouse** | | **153 2nd St** | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| **M. Abbene** | **M. Abbene** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Brookside Environmental / Brian Graham** | | **Shoreline Embankment** | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **/** | | **/** | **Cuttings** | **3/28/17-3/28/17** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|---|
| 0 | | Brown, fine SAND and SILT, some Gravel, Cobbles, and Fill Material; moist. | | | 0.0 | Collect composite sample "WC-4" from 0-5 ft bls for TCL VOCs, TCL SVOCs, PCBs, Herbicides, TCL Pesticides, Cyanide, Paint Filter, TCLP RCRA Metals, pH, TCLP Mercury, and RCRA Characterization: Reactivity, Ignitability, and Corrosivity. |
| 1 | | | | | | |
| 2 | | | | G | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | End of test pit 5 ft bls. |

BORING/FEET 2705.0001Y000_WC_TESTPITS.GPJ ROUX.GDT 4/27/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING |
|---|---|---|
| **WC-5** | **185860.8063** | **987230.0241** |

| PROJECT NO./NAME | LOCATION |
|---|---|
| **/ BRT Powerhouse** | **153 2nd St** |
| APPROVED BY: **M. Abbene** / LOGGED BY: **M. Abbene** | **Brooklyn, NY** |
| DRILLING CONTRACTOR/DRILLER: **Brookside Environmental / Brian Graham** | GEOGRAPHIC AREA: **Shoreline Embankment** |

| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
|---|---|---|---|---|
| **/** | | **/** | **Cuttings** | **3/28/17-3/28/17** |

| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL |
|---|---|---|
| **Not Measured** | **Not Measured** | **Soil Cuttings** |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|---|
| 0 | | Brown, fine SAND and SILT, some Gravel, Cobbles, and Fill Material (Brick, Plastic, Fibers); moist. | | G | 0.0 | Collect composite sample "WC-5" from 0-6 ft bls for TCL VOCs, TCL SVOCs, PCBs, Herbicides, TCL Pesticides, Cyanide, Paint Filter, TCLP RCRA Metals, pH, TCLP Mercury, and RCRA Characterization: Reactivity, Ignitability, and Corrosivity. |
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | End of test pit 6 ft bls. |

BORING/FEET 2705.0001Y000_WC_TESTPITS.GPJ ROUX.GDT 4/27/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **WC-6** | **185835.992** | **987209.2846** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **/ BRT Powerhouse** | | **153 2nd St** | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| **M. Abbene** | **M. Abbene** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Brookside Environmental / Brian Graham** | | **Shoreline Embankment** | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **/** | | **/** | **Cuttings** | **3/28/17-3/28/17** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|---|
| 0 | | Brown, fine SAND and SILT, some Gravel, Cobbles, and Fill Material (Brick, Plastic, Fibers); moist. | | G | 0.0 | Collect composite sample "WC-6" from 0-5 ft bls for TCL VOCs, TCL SVOCs, PCBs, Herbicides, TCL Pesticides, Cyanide, Paint Filter, TCLP RCRA Metals, pH, TCLP Mercury, and RCRA Characterization: Reactivity, Ignitability, and Corrosivity. |
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | End of test pit 5 ft bls. |

BORING/FEET 2705.0001Y000_WC_TESTPITS.GPJ ROUX.GDT 4/27/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **WC-7** | **185805.3815** | **987189.1006** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **/ BRT Powerhouse** | | **153 2nd St** | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| **M. Abbene** | **M. Abbene** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Brookside Environmental / Brian Graham** | | **Shoreline Embankment** | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **/** | | **/** | **Cuttings** | **3/28/17-3/28/17** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|---|
| 0 | | Brown, fine SAND and SILT, some Gravel, Cobbles, and Fill Material (Brick, Plastic, Fibers); moist. | | G | 0.0 | Collect composite sample "WC-7" from 0-5 ft bls for TCL VOCs, TCL SVOCs, PCBs, Herbicides, TCL Pesticides, Cyanide, Paint Filter, TCLP RCRA Metals, pH, TCLP Mercury, and RCRA Characterization: Reactivity, Ignitability, and Corrosivity. |
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | End of test pit at 5 ft bls. |

BORING/FEET 2705.0001Y000_WC_TESTPITS.GPJ ROUX.GDT 4/27/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **WC-8** | **185937.6342** | **987299.0438** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **/ BRT Powerhouse** | | **153 2nd St** | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| **M. Abbene** | **L. Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Brookside Environmental / William Ryan** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **/** | | **/** | **Cuttings** | **3/30/17-3/30/17** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|---|
| 1 | | Brown, fine SAND and SILT, some Gravel and Cobble, little Fill Material (Brick, Concrete, Wood, Plastic); moist. | | | 0.6 | Collect composite sample "WC-8" from 0-6 ft bls for TCL VOCs, TCL SVOCs, PCBs, Herbicides, TCL Pesticides, Cyanide, Paint Filter, TCLP RCRA Metals, pH, TCLP Mercury, and RCRA Characterization: Reactivity, Ignitability, and Corrosivity. |
| | | | | | 0.1 | |
| 2 | | | | | 0.1 | |
| 3 | | | | G | 0.0 | |
| 4 | | Brown, fine SAND and SILT, some Gravel, Cobble, and Fill Material (Metal, Concrete, Brick); moist. | | | 0.1 | |
| 5 | | | | | 0.1 | |
| 6 | | | | | | Pipe and large metal debris observed.<br>End of test pit 6 ft bls. |

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING |
|---|---|---|
| **WC-9** | **185937.6342** | **987299.0438** |

| PROJECT NO./NAME | LOCATION |
|---|---|
| **/ BRT Powerhouse** | **153 2nd St** |
| APPROVED BY: **M. Abbene** / LOGGED BY: **L. Dolginko** | **Brooklyn, NY** |
| DRILLING CONTRACTOR/DRILLER: **Brookside Environmental / William Ryan** | GEOGRAPHIC AREA |

| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
|---|---|---|---|---|
| **/** | | **/** | **Cuttings** | **3/30/17-3/30/17** |

| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL |
|---|---|---|
| **Not Measured** | **Not Measured** | **Soil Cuttings** |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|---|
| 0 | | Brown, fine SAND and SILT, some Gravel and Cobble, little Fill Material (Brick, Metal, Concrete); moist. | | | 0.0 | Collect composite sample "WC-9" from 0-6 ft bls for TCL VOCs, TCL SVOCs, PCBs, Herbicides, TCL Pesticides, Cyanide, Paint Filter, TCLP RCRA Metals, pH, TCLP Mercury, and RCRA Characterization: Reactivity, Ignitability, and Corrosivity. |
| 1 | | | | | 0.0 | |
| 2 | | | | | 0.0 | |
| 3 | | | | G | 0.0 | |
| 4 | | Brown, fine SAND and SILT, some Gravel, Cobble, and Fill Material (Metal, Brick, Concrete, Tires); moist. | | | 0.1 | Large metal debris observed. |
| 5 | | | | | 0.0 | |
| 6 | | | | | | End of test pit 6 ft bls. |

BORING/FEET 2705.0001Y000_WC_TESTPITS.GPJ ROUX.GDT 4/27/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING |
|---|---|---|
| **WC-10** | **185908.8657** | **987350.8968** |

| PROJECT NO./NAME | LOCATION |
|---|---|
| **/ BRT Powerhouse** | **153 2nd St** |
| APPROVED BY: **M. Abbene** / LOGGED BY: **L. Dolginko** | **Brooklyn, NY** |
| DRILLING CONTRACTOR/DRILLER: **Brookside Environmental / William Ryan** | GEOGRAPHIC AREA |

| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
|---|---|---|---|---|
| **/** | | **/** | **Cuttings** | **3/30/17-3/30/17** |

| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL |
|---|---|---|
| **Not Measured** | **Not Measured** | **Soil Cuttings** |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|---|
| 0 | | Brown, fine SAND and SILT, some Gravel, Cobble, and Fill Material (Concrete, Brick, Plastic, Metal); moist. | | | 0.1 | Collect composite sample "WC-10" from 0-4.5 ft bls for TCL VOCs, TCL SVOCs, PCBs, Herbicides, TCL Pesticides, Cyanide, Paint Filter, TCLP RCRA Metals, pH, TCLP Mercury, and RCRA Characterization: Reactivity, Ignitability, and Corrosivity. |
| 1 | | | | | 0.0 | |
| 2 | | | | | 0.0 | |
| 3 | | | | G | 0.0 | |
| 4 | | | | | 0.1 | |
| 5 | | Concrete. | | | | |
| 5 | | Brown, fine SAND and SILT, some Gravel, Cobble, and Fill Material (Brick, Concrete, Wood, Metal); moist. | | | 0.6 | |
| 6 | | | | | | End of test pit 6 ft bls. |

BORING/FEET 2705.0001Y000_WC_TESTPITS.GPJ ROUX.GDT 4/27/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **WC-11** | **185871.9247** | **987338.4308** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **/ BRT Powerhouse** | | **153 2nd St Brooklyn, NY** | | |
| APPROVED BY | LOGGED BY | | | |
| **M. Abbene** | **M. Abbene** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Brookside Environmental / William Ryan** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **/** | | **/** | **Cuttings** | **3/29/17-3/29/17** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|---|
| | | GRAVEL | | | | Collect composite sample "WC-11-0-4" from 0-4 ft bls for TCL VOCs, TCL SVOCs, PCBs, Herbicides, TCL Pesticides, Cyanide, Paint Filter, TCLP RCRA Metals, pH, TCLP Mercury, and RCRA Characterization: Reactivity, Ignitability, and Corrosivity. Filter fabric observed beneath Gravel. |
| | | Brown, SILT and SAND, some Cobble and Fill Material (Brick, Debris, Concrete); moist. | | | 1.0 | |
| 1 | | | | | | 1 |
| 2 | | | | | | 2 |
| 3 | | | | G | | 3 |
| 4 | | | | | | 4 Concrete structure observed in at west end of test pit. |
| | | Dark brown to black, SAND, SILT, and PEBBLE, some Cobble; moist. | | | | Staining and odor observed. |
| 5 | | | | | 5.0 | 5 Collect composite sample "WC-11-4.5-5.0" from 4.5-5 ft bls for TCL VOCs, PCBs, and TCLP RCRA Metals. |
| | | Dark brown, SAND and SILT, some Pebble and Fill Material (Concrete); moist. | | | | Staining and odor observed. |
| 6 | | | | | 2.5 | 6 |
| 7 | | | | | | End of test pit 7 ft bls. 7 |

BORING/FEET 2705.0001Y000_WC_TESTPITS.GPJ ROUX.GDT 4/27/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING |
|---|---|---|
| **WC-12** | **185878.3848** | **987375.8709** |

| PROJECT NO./NAME | LOCATION |
|---|---|
| **/ BRT Powerhouse** | **153 2nd St** |
| APPROVED BY: **M. Abbene** / LOGGED BY: **L. Dolginko** | **Brooklyn, NY** |
| DRILLING CONTRACTOR/DRILLER: **Brookside Environmental / William Ryan** | GEOGRAPHIC AREA |

| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
|---|---|---|---|---|
| **/** | | **/** | **Cuttings** | **3/30/17-3/30/17** |

| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL |
|---|---|---|
| **Not Measured** | **Not Measured** | **Soil Cuttings** |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|---|
| 0 | | Brown, fine SAND and SILT, some Gravel and Cobble, little Fill Material (Metal, Plastic, Brick); moist. | | | 0.0 | Collect composite sample "WC-12" from 0-4 ft bls for TCL VOCs, TCL SVOCs, PCBs, Herbicides, TCL Pesticides, Cyanide, Paint Filter, TCLP RCRA Metals, pH, TCLP Mercury, and RCRA Characterization: Reactivity, Ignitability, and Corrosivity. |
| 1 | | | | | 0.0 | |
| 2 | | | | G | 0.0 | |
| 3 | | | | | 0.0 | |
| 4 | | | | | | End of test pit 4 ft bls. |

BORING/FEET 2705.0001Y000_WC_TESTPITS.GPJ ROUX.GDT 4/27/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **WC/ITP-13-1** | **185834.796** | **987412.1503** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **/ BRT Powerhouse** | | **153 2nd St** | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| **M. Abbene** | **M. Abbene** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Brookside Environmental / William Ryan** | | **Former Boiler House Footprint** | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **/** | | **/** | **Cuttings** | **3/29/17-3/29/17** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|---|
| 0 | | Brown, SILT, some Sand, Gravel, Cobble, and Fill Material (Brick, Fabric, Concrete); moist. | | G | | Collect composite sample "WC-13" from 0-2 ft bls for TCL VOCs, TCL SVOCs, PCBs, Herbicides, TCL Pesticides, Cyanide, Paint Filter, TCLP RCRA Metals, pH, TCLP Mercury, and RCRA Characterization: Reactivity, Ignitability, and Corrosivity. |
| 5 | | | | | | |
| 10 | | | | | | Concrete slab encountered. |
| 15 | | | | | | End of test pit 15 ft bls. Concrete slab encountered. |

BORING/FEET 2705.0001Y000_WC_TESTPITS.GPJ ROUX.GDT 4/27/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **ITP-13-2** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **/ BRT Powerhouse** | | **153 2nd St** | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| **M. Abbene** | **L. Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Brookside Environmental / Brian Graham** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **/** | | **/** | **Cuttings** | **4/3/17-4/3/17** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|---|
| 1 | | Brown, fine SAND and SILT, some Cobble, Gravel, and Fill Material (Brick, Concrete); moist. | | G | | End of test pit 1 ft bls. Concrete slab encountered, approximately 8" thick. Slab observed to extend at least 19 ft off north property line. |



BORING/FEET 2705.0001Y000_WC_TESTPITS.GPJ ROUX.GDT 4/27/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **WC/ITP-14-1** | **185856.6749** | **987487.975** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **/ BRT Powerhouse** | | **153 2nd St** | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| **M. Abbene** | **L. Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Brookside Environmental / William Ryan** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **/** | | **/** | **Cuttings** | **3/31/17-3/31/17** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|---|
| | | Dark brown, fine SAND and SILT, some Gravel and Cobble, little Fill Material (Brick, Concrete, Wood, Plastic); moist. | | | 0.0 | Collect composite sample "WC-14" from 0-2 ft bls for TCL VOCs, TCL SVOCs, PCBs, Herbicides, TCL Pesticides, Cyanide, Paint Filter, TCLP RCRA Metals, pH, TCLP Mercury, and RCRA Characterization: Reactivity, Ignitability, and Corrosivity. |
| | | | | | 0.0 | |
| | | Brown, fine SAND and SILT, some Gravel, Cobble, and Fill Material (Brick, Concrete, Tire, Fabric); moist. | | | | |
| 5 | | | | | | 5 |
| | | | | G | | |
| 10 | | | | | | 10 |
| | | Brown, fine to medium SAND, some Gravel and Fill Material (Brick); moist. | | | | |
| 15 | | | | | | End of test pit 15 ft bls. No structures encountered. 15 |

BORING/FEET 2705.0001Y000_WC_TESTPITS.GPJ ROUX.GDT 4/27/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING |
|---|---|---|
| **ITP-14-2** | **185828.3431** | **987531.6045** |

| PROJECT NO./NAME | LOCATION |
|---|---|
| **/ BRT Powerhouse** | **153 2nd St** |
| APPROVED BY: **M. Abbene** / LOGGED BY: **L. Dolginko** | **Brooklyn, NY** |
| DRILLING CONTRACTOR/DRILLER: **Brookside Environmental / William Ryan** | GEOGRAPHIC AREA |

| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
|---|---|---|---|---|
| **/** | | **/** | **Cuttings** | **3/31/17-3/31/17** |

| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL |
|---|---|---|
| **Not Measured** | **Not Measured** | **Soil Cuttings** |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|---|
| | | Brown, fine SAND and SILT, some Cobble, Gravel, and Fill Material (Brick, Concrete); moist. | | | | |
| 5 | | Black, fine to coarse SAND, some Metal; moist. | | | 0.4 | |
| | | Brown, fine to medium SAND, some Gravel and Fill Material (Brick); moist. | | G | | |
| 10 | | | | | | |
| 15 | | | | | | End of test pit 14 ft bls. No structures encountered. |

BORING/FEET 2705.0001Y000_WC_TESTPITS.GPJ ROUX.GDT 4/27/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **ITP-14-3** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **/ BRT Powerhouse** | | **153 2nd St** | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| **M. Abbene** | **L. Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Brookside Environmental / Brian Graham** | | **Former Boiler House Footprint** | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **/** | | **/** | **Cuttings** | **4/3/17-4/3/17** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|---|
| 1 | | Brown, fine SAND and SILT, some Cobble, Gravel, and Fill Material (Brick, Concrete); moist. | | G | | End of test pit 1 ft bls. Concrete slab encountered, approximately 6-10" thick. Slab observed to extend 10 ft from northern property line to 40 ft from northern property line. |



BORING/FEET 2705.0001Y000_WC_TESTPITS.GPJ ROUX.GDT 4/27/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **ITP-15** | **185827.4445** | **987469.8436** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **/ BRT Powerhouse** | | **153 2nd St** | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| **M. Abbene** | **L. Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Brookside Environmental / William Ryan** | | **Former Boiler House Footprint** | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **/** | | **/** | **Cuttings** | **3/31/17-3/31/17** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|---|
| 0 | | Brown, fine SAND and SILT, some Gravel, Cobble, and Fill Material (Brick, Concrete, Fabric, Metal); moist. | | | | |
| 5 | | Brown, fine SAND and SILT, some Gravel, Cobble, and Fill Material (Brick, Concrete); moist. | | G | | Layer of weathered/broken up concrete observed. Approximately 2 ft by 2 ft concrete structure observed in northeast corner of test pit. |
| 7 | | Brown, fine to medium SAND, some Gravel; moist. | | | | |
| 12 | | | | | | End of test pit 12 ft bls. Concrete slab encountered. |

BORING/FEET 2705.0001Y000_WC_TESTPITS.GPJ ROUX.GDT 4/27/17

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | NORTHING | EASTING | | |
|---|---|---|---|---|
| **ITP-16** | **185796.5108** | **987534.9341** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **/ BRT Powerhouse** | | **153 2nd St** | | |
| APPROVED BY | LOGGED BY | **Brooklyn, NY** | | |
| **M. Abbene** | **L. Dolginko** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **Brookside Environmental / William Ryan** | | **Former Boiler House Footprint** | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **/** | | **/** | **Cuttings** | **3/31/17-3/31/17** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | **Soil Cuttings** | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|---|
| 0 | | Brown, fine SAND and SILT, some Gravel, Cobble, and Fill Material (Brick, Concrete, Metal); moist. | | G | | Large metal debris observed throughout test pit. Pieces up to 6 ft long. |
| 14 | | | | | | End of test pit 14 ft bls. Concrete slab encountered. |

BORING/FEET 2705.0001Y000_WC_TESTPITS.GPJ ROUX.GDT 4/27/17

# APPENDIX E

Monitoring Well Boring and Construction Logs

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | LATITUDE | LONGITUDE | | |
|---|---|---|---|---|
| **EPA-SB-1** | **Not Measured** | **Not Measured** | | |
| PROJECT NO./NAME | | LOCATION | | |
| **2705.0001Y002 / Powerhouse** | | **322 3rd Avenue** | | |
| APPROVED BY | LOGGED BY | **Brooklyn, New York** | | |
| | **D. Miserendino** | | | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA | | |
| **ADT / B. Karshick** | | | | |
| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
| **6-in. / Sonic** | **6-inches** | **CRS-XL Max / Rotosonic** | **Sonic** | **2/20/20-2/20/20** |
| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL | | |
| **Not Measured** | **Not Measured** | | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| | | Grey, CONCRETE; dry. | | 0.0 | 2 ft recovery. |
| | | Brown, fine to medium SAND, some Silt, trace gravel and brick (FILL); moist. | | 0.8 | |
| 5 | | Reddish grey, fine to coarse SAND, some Gravel, little Brick and Concrete (FILL); moist. | | 0.3 | 3 ft recovery. |
| | | Brown to dark grey, fine to coarse SAND, little Gravel, trace cobble (FILL); moist. | | 1.5 | |
| 10 | | Grey to brown, fine to coarse SAND, little Concrete and Gravel (FILL); moist. | | 10.5 | 3.5 ft recovery. Soil sample EPA-SB-1 (10-12) collected to be analyzed for Part 375 VOCs, SVOCs, Metals, Pesticides, Herbicides, PCBs, Cyanide and Hex/Tri Chrom. |
| | | Dark grey to light brown, fine to coarse SAND, some Silt, trace brick and gravel (FILL); moist. | | 0.0 | Staining observed. |
| 15 | | Dark grey, SILT and CLAY, trace organics (roots and shells) and fine sand; moist. | | 0.0 | 3.5 ft recovery. |
| | | Dark brown, fine SAND and SILT, some medium Sand, trave gravel; moist. | | 0.2 | Soil sample EPA-SB-1 (16-18) collected to be analyzed for Part 375 VOCs, SVOCs, Metals, Pesticides, Herbicides, PCBs, Cyanide and Hex/Tri Chrom. |
| 20 | | Brown, fine to medium SAND, trace gravel; wet. | | 0.3 | 2 ft recovery. |
| | | | | 0.1 | |
| 25 | | | | 0.0 | 3 ft recovery. |
| | | Brown, fine SAND, some Silt, trace gravel; wet. | | 0.0 | |
| 30 | | Light brown, fine to medium SAND, trace gravel; wet. | | 0.0 | 4 ft recovery. |
| | | | | 0.0 | Grab sample EPA-SB-1 (32-34) collected to be analyzed for Part 375 VOCs, SVOCs, Metals, Pesticides, Herbicides, PCBs, Cyanide and Hex/Tri Chrom. |
| 35 | | | | 0.1 | 3 ft recovery. |
| | | | | 0.2 | |
| 40 | | | | | End of boring at 40 ft bls. |

BORING/FEET 2705.0001Y002_2018MWS.GPJ ROUX.GDT 5/15/20

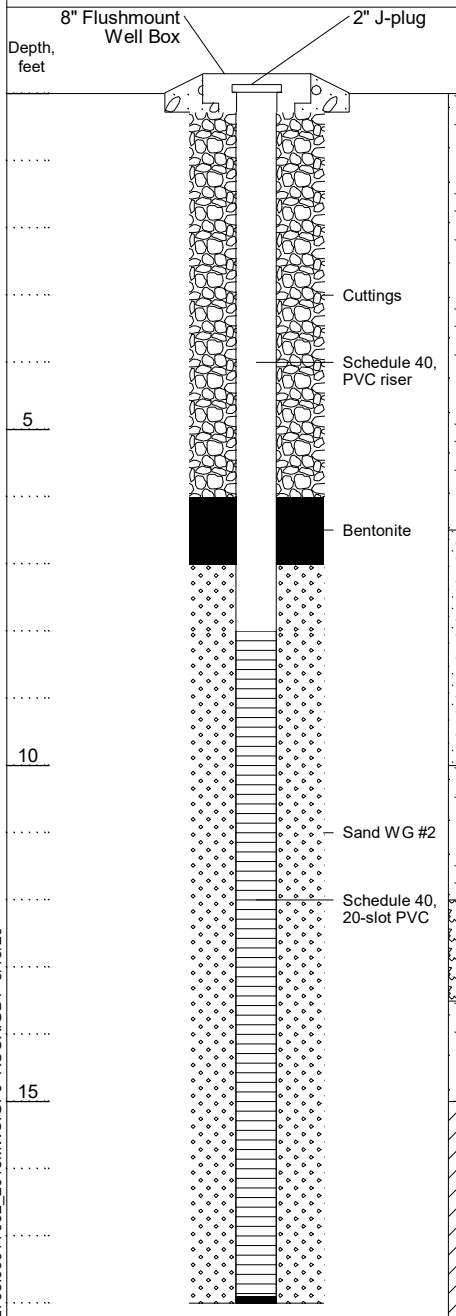
ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# WELL CONSTRUCTION LOG

| | | | | |
|---|---|---|---|---|
| WELL NO.<br>**MW-10** | LATITUDE<br>**Not Measured** | LONGITUDE<br>**Not Measured** | | |
| PROJECT NO./NAME<br>**2705.0001Y002 / Powerhouse** | | LOCATION<br>**322 3rd Avenue**<br>**Brooklyn, New York** | | |
| APPROVED BY | LOGGED BY<br>**M. Smith** | | | |
| DRILLING CONTRACTOR/DRILLER<br>**ADT / B. Karshick** | | GEOGRAPHIC AREA<br>**South Entrance Driveway** | | |
| DRILL BIT DIAMETER/TYPE<br>**6-in. / Sonic** | BOREHOLE DIAMETER<br>**6-inches** | DRILLING EQUIPMENT/METHOD<br>**CRS-XL Max / Rotosonic** | SAMPLING METHOD<br>**Sonic** | START-FINISH DATE<br>**7/27/18-7/27/18** |
| CASING MAT./DIA.<br>**PVC / 2-inch** | SCREEN:<br>TYPE **Slotted** | MAT. **PVC** | TOTAL LENGTH **10.0** ft | DIA. **2-inch** SLOT SIZE **20-Slot** |




| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Brown, SILT and fine SAND, some Gravel; dry. | | 0.0 | Handcleared to 5 ft bls. Recovery not noted. |
| 5 | | Light brown, fine SAND, trace gravel; dry. | | 0.0 | 40" recovery. |
| 10 | | Brown to dark brown, SILT and fine SAND, some Gravel, trace sand; wet. | | 0.0 | 2 ft recovery. Water observed at 11 ft bls. |
| | | Grey to dark grey, GRAVEL, trace sand; wet. | | | |
| | | Grey, SILT and fine SAND, some Gravel; wet. | | | |
| 15 | | Grey, CLAY, trace organic material (shells) and gravel; wet. | | 0.0 | 60" recovery. |
| 20 | | | | | End of boring at 20 ft bls. |

BORING/FEET 2705.0001Y002_2018MWS.GPJ ROUX.GDT 5/15/20

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# WELL CONSTRUCTION LOG

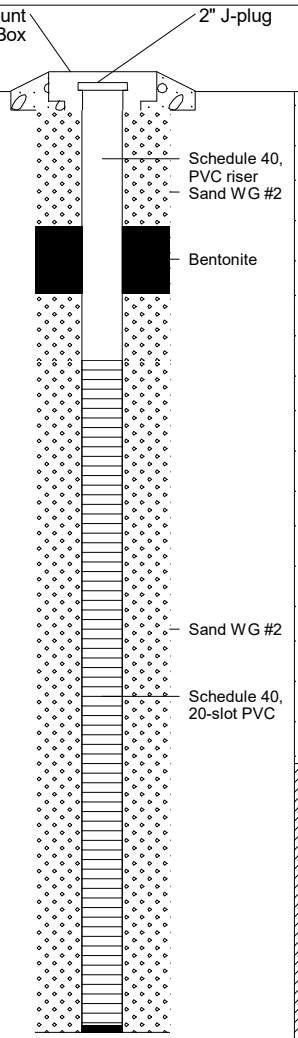
| WELL NO. | LATITUDE | LONGITUDE |
|---|---|---|
| **MW-11** | **Not Measured** | **Not Measured** |

| PROJECT NO./NAME | LOCATION |
|---|---|
| **2705.0001Y002 / Powerhouse** | **322 3rd Avenue** |
| APPROVED BY | LOGGED BY |
| | **M. Smith** |
| | **Brooklyn, New York** |

| DRILLING CONTRACTOR/DRILLER | GEOGRAPHIC AREA |
|---|---|
| **ADT / B. Karshick** | **South of Turbine Hall** |

| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
|---|---|---|---|---|
| **6-in. / Sonic** | **6-inches** | **CRS-XL Max / Rotosonic** | **Sonic** | **7/27/18-7/27/18** |

| CASING MAT./DIA. | SCREEN: | | | | | |
|---|---|---|---|---|---|---|
| **PVC / 2-inch** | TYPE **Slotted** | MAT. **PVC** | TOTAL LENGTH **10.0** ft | DIA. **2-inch** | SLOT SIZE **20-Slot** |




| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| | | Brown, SILT and fine SAND, some Gravel; dry. | | 0.0 | 18" recovery. Handcleared to 5 ft bls. |
| 5 | | | | 0.0 | 48" recovery. |
| | | | | | Water observed at 7 ft bls. |
| 10 | | Grey to dark grey, SILT and CLAY, trace gravel; wet. | | 0.0 | Recovery not noted. |
| 15 | | Grey, CLAY, trace organic material (shells); wet. | | 0.0 | 60" recovery. |
| 20 | | | | | End of boring at 20 ft bls. |

BORING/FEET 2705.0001Y002_2018MWS.GPJ ROUX.GDT 5/15/20

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



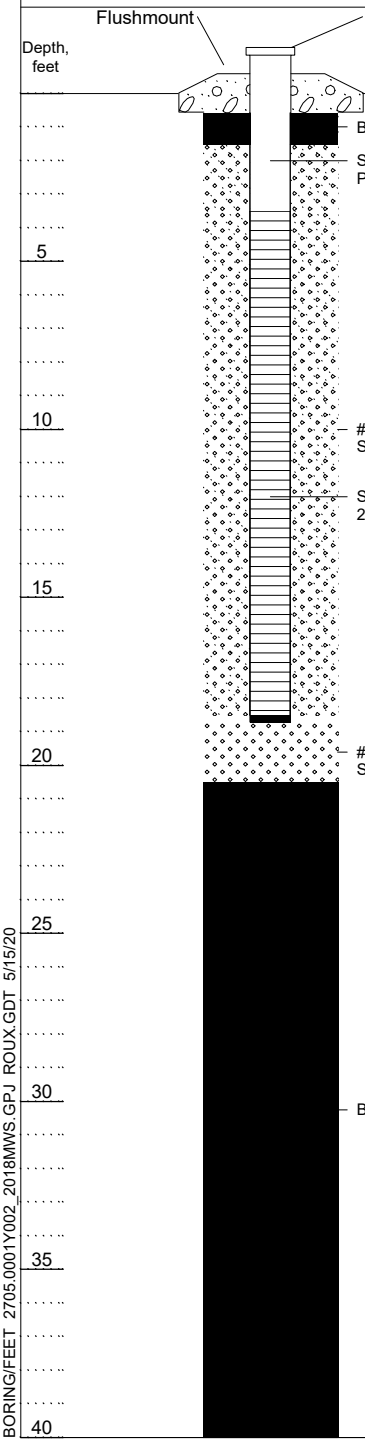
# WELL CONSTRUCTION LOG

| WELL NO. | LATITUDE | LONGITUDE |
|---|---|---|
| **MW-12** | **Not Measured** | **Not Measured** |

| PROJECT NO./NAME | LOCATION |
|---|---|
| **2705.0001Y002 / Powerhouse** | **322 3rd Avenue** |
| APPROVED BY | LOGGED BY: **C. Wygel** — **Brooklyn, New York** |
| DRILLING CONTRACTOR/DRILLER: **ADT / B. Karshick** | GEOGRAPHIC AREA |

| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
|---|---|---|---|---|
| **6-in. / Sonic** | **6-inches** | **CRS-XL Max / Rotosonic** | **Sonic** | **12/18/19-12/18/19** |

CASING MAT./DIA.: **PVC / 2-inch** — SCREEN: TYPE **Slotted** MAT. **PVC** TOTAL LENGTH **15.0** ft DIA. **2-inch** SLOT SIZE **20-Slot**




| Depth, feet | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|
| | Brown, fine to coarse SAND, some Silt and fine Gravel, little Brick (FILL); moist. | | | 2 ft recovery. |
| | | | 1.3 | Soil sample MW-12 (3.5-5.5) to be analyzed for Part 375 VOCs, SVOCs, Metals, Pesticides, Herbicides, PCBs, Cyanide and Hex/Tri Chrom. |
| 5 | Dark brown, fine to medium SAND, some Silt and fine to coarse Gravel, little Brick (FILL); moist. | | 2.0<br>1.5 | 4.5 ft recovery. |
| | Brown to grey, CLAY, some fine Sand and Brick, little fine to coarse Gravel (FILL); moist. | | 3.3<br>2.4 | |
| 10 | Brown, fine to coarse SAND and fine GRAVEL, some Silt and Brick (FILL); moist. | | | 3.5 ft recovery. |
| | Brown, fine to coarse SAND, some Silt and Gravel, little Brick (FILL); wet. | | 1.7 | Water observed at 12 ft bls. |
| 15 | Dark brown, fine to coarse SAND and fine GRAVEL, some Silt, trace brick (FILL); wet. | | 1.8<br>3.8 | 4 ft recovery. |
| 20 | | | 7.6 | 4.5 ft recovery. |
| | Grey, CLAY, trace shells; wet. | | 0.0 | |
| 25 | Brown, fine SAND; wet. | | 0.0<br>0.1<br>7.0 | 5 ft recovery. |
| 30 | Grey, CLAY and fine GRAVEL, some Silt; wet. | | | 4 ft recovery. |
| 35 | Dark brown, fine SAND; wet. | | 263.5<br>165 | Soil sample MW-12 (34.5-36.5) to be analyzed for Part 375 VOCs, SVOCs, Metals, Pesticides, Herbicides, PCBs, Cyanide and Hex/Tri Chrom. |
| | Brown, fine SAND; wet. | | 153.7 | 5 ft recovery. Odor observed. End of boring at 40 ft bls. |
| 40 | | | | |

BORING/FEET 2705.0001Y002_2018MWS.GPJ ROUX.GDT 5/15/20

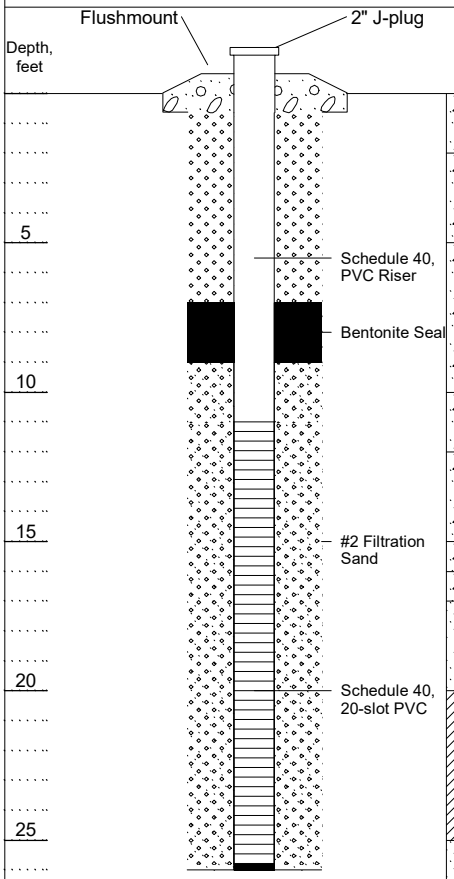
ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# WELL CONSTRUCTION LOG

| | | | | |
|---|---|---|---|---|
| WELL NO.: **MW-13** | LATITUDE: **Not Measured** | LONGITUDE: **Not Measured** | | |
| PROJECT NO./NAME: **2705.0001Y002 / Powerhouse** | | LOCATION: **322 3rd Avenue, Brooklyn, New York** | | |
| APPROVED BY | LOGGED BY: **D. Miserendino** | | | |
| DRILLING CONTRACTOR/DRILLER: **ADT / B. Karshick** | | GEOGRAPHIC AREA | | |
| DRILL BIT DIAMETER/TYPE: **6-in. / Sonic** | BOREHOLE DIAMETER: **6-inches** | DRILLING EQUIPMENT/METHOD: **CRS-XL Max / Rotosonic** | SAMPLING METHOD: **Sonic** | START-FINISH DATE: **2/21/20-2/21/20** |
| CASING MAT./DIA.: **PVC / 2-inch** | SCREEN: TYPE **Slotted** MAT. **PVC** TOTAL LENGTH **15.0** ft DIA. **2-inch** SLOT SIZE **20-Slot** | | | |




| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| | | Brown, fine to coarse SAND, some Silt, little Brick, trace gravel (FILL); moist. | | 1.0 | 3 ft recovery. |
| | | Reddish brown, fine to coarse SAND and SILT, some Clay, little Brick, trace gravel (FILL); moist. | | 0.0<br>0.0<br>0.0 | |
| 5 | | | | | 5 |
| | | Brown, fine to coarse SAND, some Silt, little Brick, trace gravel (FILL); moist. | | 0.0<br>0.3<br>0.1 | 3 ft recovery. |
| 10 | | | | | 10 |
| | | Greyish brown fine to coarse SAND and SILT, some Brick (FILL); moist. | | 0.2 | 3 ft recovery. |
| | | Brown, fine to medium SAND, some Brick and Gravel (FILL); moist. | | 0.1 | |
| 15 | | | | | 15 |
| | | Dark grey, fine to medium SAND and SILT, little Brick and Concrete (FILL); moist. | | 18.6<br>18.6<br>2.6 | Soil sample MW-13 (14-16) collected to be analyzed for Part 375 VOCs, SVOCs, Metals, Pesticides, Herbicides, PCBs, Cyanide and Hex/Tri Chrom. |
| | | Dark grey, fine to medium SAND and SILT, little Brick and Concrete (FILL); wet. | | 2.6 | 3 ft recovery. |
| | | Grey to brown, fine to medium SAND and Silt, some Gravel; wet. | | 2.6 | Water observed at 16 ft bls. |
| 20 | | | | | 20 |
| | | Grey, SILT and CLAY, trace fine sand and organics (shells); moist. | | 0.0<br>0.0 | 5 ft recovery. |
| 25 | | | | | 25 |
| | | Greyish brown, fine SAND, trace gravel; wet. | | 0.0<br>0.0 | 4 ft recovery. |
| 30 | | | | | 30 |
| | | Light brown, fine to medium SAND, trace gravel; wet. | | 0.0<br>0.0 | 3 ft recovery. |
| 35 | | | | | 35 |
| | | | | 0.0<br>0.1 | 2 ft recovery. |
| 40 | | | | 0.0 | Soil sample MW-13 (38-40) to be analyzed for Part 375 VOCs, SVOCs, Metals, Pesticides, Herbicides, PCBs, Cyanide and Hex/Tri Chrom. 40 |
| | | Light brown, fine SAND, some Silt; wet. | | 0.0<br>0.0 | End of boring at 45 ft bls. |
| 45 | | | | | 45 |

BORING/FEET 2705.0001Y002_2018MWS.GPJ ROUX.GDT 5/15/20

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# WELL CONSTRUCTION LOG

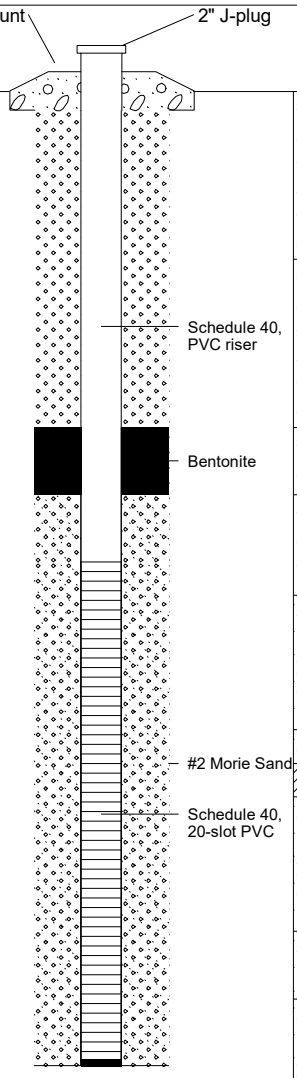
| WELL NO. | LATITUDE | LONGITUDE |
|---|---|---|
| **MW-14** | **Not Measured** | **Not Measured** |

| PROJECT NO./NAME | LOCATION |
|---|---|
| **2705.0001Y002 / Powerhouse** | **322 3rd Avenue** |
| APPROVED BY | LOGGED BY: **D. Miserendino** |
| | **Brooklyn, New York** |

| DRILLING CONTRACTOR/DRILLER | GEOGRAPHIC AREA |
|---|---|
| **ADT / B. Karshick** | |

| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
|---|---|---|---|---|
| **6-in. / Sonic** | **6-inches** | **CRS-XL Max / Rotosonic** | **Sonic** | **2/20/20-2/20/20** |

| CASING MAT./DIA. | SCREEN: TYPE | MAT. | TOTAL LENGTH | DIA. | SLOT SIZE |
|---|---|---|---|---|---|
| **PVC / 2-inch** | **Slotted** | **PVC** | **15.0** ft | **2-inch** | **20-Slot** |




| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Brown, fine to medium SAND, some Brick and Concrete, little Silt and Gravel, (FILL); moist. | | 0.1 | 2.5 ft recovery. |
| | | | | 0.9 | |
| 5 | | Brown, fine SAND and SILT, some Brick and Concrete, little Gravel, trace cobble, (FILL); moist. | | 0.9 | No recovery noted. |
| | | | | 1.3 | |
| | | | | 0.3 | |
| 10 | | Grey, fine to coarse SAND, some Silt, little Concrete, (FILL); moist. | | 1.7 | Soil sample MW-14 (10-12) collected to be analyzed for Part 375 VOCs, SVOCs, Metals, Pesticides, Herbicides, PCBs, Cyanide and Hex/Tri Chrom. |
| | | Brown, fine SAND, some Silt, trace gravel and concrete, (FILL); moist. | | 0.8 | 4 ft recovery. |
| 15 | | Brown to reddish brown, fine SAND and SILT; moist. | | 0.0 | Staining and odor observed. 5 ft recovery. |
| | | | | 0.0 | Soil sample MW-14 (17-19) to be analyzed for Part 375 VOCs, SVOCs, Metals, Pesticides, Herbicides, PCBs, Cyanide and Hex/Tri Chrom. |
| 20 | | Brown to reddish brown, fine SAND and SILT; wet. | | 0.0 | Water observed at 19 ft bls. 4.5 ft recovery. |
| | | Grey, SILT and CLAY, trace organics (shells); moist. | | 0.0 | |
| | | Greyish brown, fine SAND, some Silt; wet. | | 0.0 | |
| 25 | | Greyish brown, fine Sand, some Silt, trace gravel; wet. | | 0.0 | 5 ft recovery. |
| | | Greyish brown, fine to medium SAND, trace gravel; wet. | | 0.0 | |
| 30 | | | | 0.0 | 4 ft recovery. |
| | | | | 0.0 | |
| | | Light brown, fine to medium SAND, trace gravel; wet. | | 0.0 | Soil sample MW-14 (33-35) to be analyzed for Part 375 VOCs, SVOCs, Metals, Pesticides, Herbicides, PCBs, Cyanide and Hex/Tri Chrom. |
| 35 | | | | 0.0 | |
| | | | | 0.0 | |
| | | | | 0.0 | End of boring at 40 ft bls. |
| 40 | | | | 0.0 | |

BORING/FEET 2705.0001Y002_2018MWS.GPJ ROUX.GDT 5/15/20

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



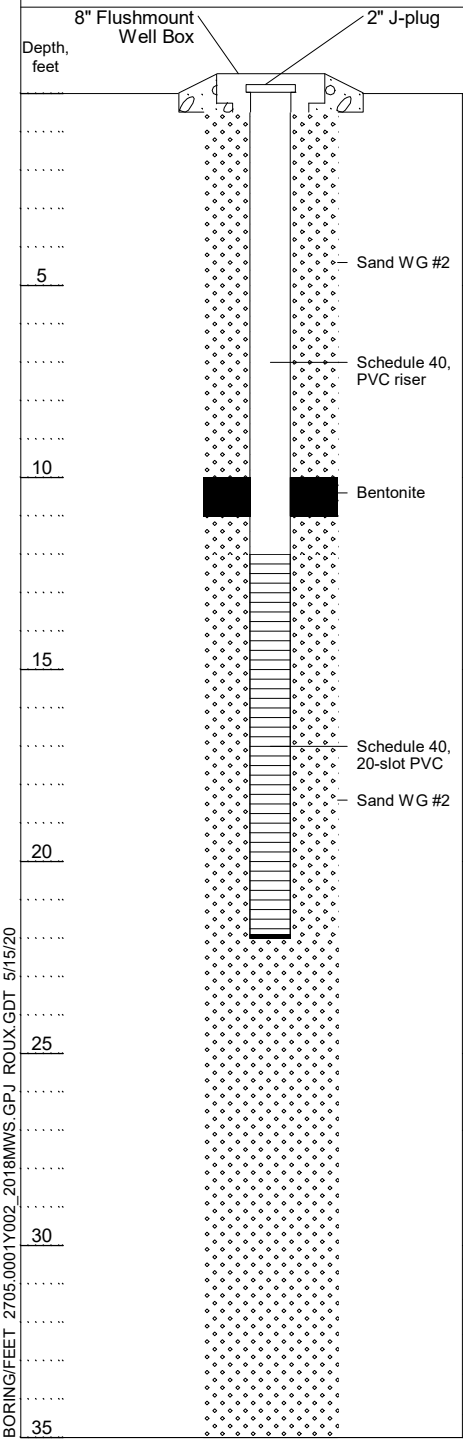
# WELL CONSTRUCTION LOG

| WELL NO. | LATITUDE | LONGITUDE |
|---|---|---|
| **MW-16** | **Not Measured** | **Not Measured** |

| PROJECT NO./NAME | LOCATION |
|---|---|
| **2705.0001Y002 / Powerhouse** | **322 3rd Avenue** |
| APPROVED BY / LOGGED BY: **M. Smith** | **Brooklyn, New York** |
| DRILLING CONTRACTOR/DRILLER: **ADT / B. Karshick** | GEOGRAPHIC AREA: **Western Lateral Discharge Tunnel** |

| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
|---|---|---|---|---|
| **6-in. / Sonic** | **6-inches** | **CRS-XL Max / Rotosonic** | **Sonic** | **7/20/18-7/20/18** |

CASING MAT./DIA.: **PVC / 2-inch**
SCREEN: TYPE **Slotted** MAT. **PVC** TOTAL LENGTH **10.0** ft DIA. **2-inch** SLOT SIZE **20-Slot**




| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| 0 | | Brown, SILT and fine SAND, some Gravel and Brick (FILL); dry. | G | 0.0 | 18" recovery. Handcleared to 5 ft bls. |
| 5 | | Brown, SILT and fine SAND, some Gravel (FILL); dry. | | 0.0 | 16" recovery. |
| 10 | | Brown, SILT and fine SAND, some Gravel and Brick (FILL); dry. | | 0.0 | Recovery not noted. |
| 15 | | Wood Pile. | | 0.0 | Soil sample MW-16 (13-15) collected to be analyzed for Part 375 VOCs, SVOCs, Metals, Pesticides, Herbicides, PCBs, Cyanide and Hex/Tri Chrom. Water observed at 14 ft bls. Recovery not noted. |
| 20 | | Wood Pile and Slough Material. | | 61.5 | Recovery not noted. |
| 25 | | Wood Pile and Slough Material. | | 77.8 | 48" recovery. |
| | | Wood Pile and Slough Material. | | 0.0 | Soil sample MW-16 (25-27) collected to be analyzed for Part 375 VOCs, SVOCs, Metals, Pesticides, Herbicides, PCBs, Cyanide and Hex/Tri Chrom. |
| 30 | | Grey, SILT and fine SAND, some Clay, trace Wood; wet. | | 0.0 | 18" recovery. Soil sample MW-16 (32-34) collected to be analyzed for Part 375 VOCs, SVOCs, Metals, Pesticides, Herbicides, PCBs, Cyanide and Hex/Tri Chrom. |
| 35 | | | | | End of boring at 35 ft bls. |

BORING/FEET 2705.0001Y002_2018MWS.GPJ ROUX.GDT 5/15/20

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| | | | | |
|---|---|---|---|---|
| WELL NO.<br>**MW-16E** | LATITUDE<br>**Not Measured** | LONGITUDE<br>**Not Measured** | | |
| PROJECT NO./NAME<br>**2705.0001Y002 / Powerhouse** | | LOCATION<br>**322 3rd Avenue** | | |
| APPROVED BY | LOGGED BY<br>**C. Prete & M. Narcisse** | **Brooklyn, New York** | | |
| DRILLING CONTRACTOR/DRILLER<br>**ADT / D. Moon** | | GEOGRAPHIC AREA<br>**Western Lateral Discharge Tunnel** | | |
| DRILL BIT DIAMETER/TYPE<br>**6-in. / Sonic** | BOREHOLE DIAMETER<br>**6-inches** | DRILLING EQUIPMENT/METHOD<br>**CRS-XL Max / Rotosonic** | SAMPLING METHOD<br>**Sonic** | START-FINISH DATE<br>**11/2/18-11/2/18** |
| LAND SURFACE ELEVATION<br>**Not Measured** | DEPTH TO WATER<br>**Not Measured** | BACKFILL | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| | | Brown, fine to coarse SAND and BRICK, (fill); moist. | | | |
| | | CONCRETE. | | G | |
| 5 | | | | | 5 |
| | | Light grey to white, CLAY and SILT, some Shells; wet. | | 0.5 | Soil sample MW-16E (7-9) collected for TCL VOCs, SVOCs, Metals, Mercury, PCBs, and Pesticides. |
| | | Brown, CLAY and SILT, trace coarse sand; wet. | | 0.3 | Soil sample MW-16E (9-10) collected for VOCS and PCBs. |
| 10 | | Slough Material. | | | 10<br>No recovery. Slough. |
| | | Dark grey, SAND and SILT, trace clay; wet. | | 1.2 | Soil sample MW-16E (12-14) collected for VOCs and PCBs. |
| | | Dark grey, CLAY and SILT, some medium to fine Sand and Wood; wet. | | 1.4 | Soil sample MW-16E (14-15) collected for TCL VOCs, SVOCs, Metals, Mercury, PCBs, and Pesticides. |
| 15 | | | | | 15<br>No recovery. |
| | | Light grey, CLAY and SILT, some coarse Gravel; wet. | | 0.8 | Soil sample MW-16E (18-20) collected VOCs and PCBs. |
| 20 | | | | | 20<br>No recovery. |
| 25 | | | | | End of boring at 25 ft bls. 25 |

BORING/FEET 2705.0001Y002_2018MWS.GPJ ROUX.GDT 5/15/20

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| | | | | |
|---|---|---|---|---|
| WELL NO.<br>**MW-16S** | LATITUDE<br>**Not Measured** | LONGITUDE<br>**Not Measured** | | |
| PROJECT NO./NAME<br>**2705.0001Y002 / Powerhouse** | | LOCATION<br>**322 3rd Avenue** | | |
| APPROVED BY | LOGGED BY<br>**C. Prete & M. Narcisse** | **Brooklyn, New York** | | |
| DRILLING CONTRACTOR/DRILLER<br>**ADT / D. Moon** | | GEOGRAPHIC AREA<br>**Western Lateral Discharge Tunnel** | | |
| DRILL BIT DIAMETER/TYPE<br>**6-in. / Sonic** | BOREHOLE DIAMETER<br>**6-inches** | DRILLING EQUIPMENT/METHOD<br>**CRS-XL Max / Rotosonic** | SAMPLING METHOD<br>**Sonic** | START-FINISH DATE<br>**11/2/18-11/2/18** |
| LAND SURFACE ELEVATION<br>**Not Measured** | DEPTH TO WATER<br>**Not Measured** | BACKFILL | | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| | | Brown, fine to coarse SAND and GRAVEL, some Brick (FILL); dry. | | | |
| | | CONCRETE. | | G | |
| | | Brown, GRAVEL, some Brick and some Sand (FILL); dry. | | 14 | Soil sample MW-16S (3-5) collected for VOCs and PCBs. |
| | | Brown to dark grey, GRAVEL, some Brick, some Sand and Silt; moist. | | | |
| 5 | | | | | 5 |
| | | Coarse GRAVEL, some fine Sand and Silt; moist. | | 43.2 | 1 ft recovery. Soil sample MW-16S (5-10) collected for TCL VOCs, SVOCs, Metals, Mercury, PCBs, and Pesticides. Sheen and chemical odor observed. |
| 10 | | | | | 10 |
| | | Brown, CLAY and SILT, trace gravel; wet. | | 55.1 | Soil sample MW-16S (12-13) collected for VOCs and PCBs. |
| | | Brown, SAND and CLAY, trace silt; wet. | | 29 | Soil sample MW-16S (13-15) collected for TCL VOCs, SVOCs, Metals, Mercury, PCBs, and Pesticides. Sheen, chemical, and petroleum odors observed. |
| 15 | | | | | 15 |
| | | Slough Material. | | | |
| | | Dark grey, CLAY, some Gravel and Sand; wet. | | 28.6 | Soil sample MW-16S (17-19) collected for VOCs and PCBs. Chemical odor and sheen observed. |
| | | Dark grey, SAND and CLAY, trace gravel; wet. | | | |
| 20 | | | | | 20 |
| | | Dark grey, CLAY and SILT, some Sand and Gravel; wet. | | 23.7 | Soil sample MW-16S (21-23) collected for VOCs and PCBs. Chemical odor and sheen observed. |
| | | Light brown, CLAY and SILT; wet. | | | |
| 25 | | | | | End of boring at 25 ft bls. 25 |

BORING/FEET 2705.0001Y002_2018MWS.GPJ ROUX.GDT 5/15/20

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# SOIL BORING LOG

| WELL NO. | LATITUDE | LONGITUDE |
|---|---|---|
| **MW-16W** | **Not Measured** | **Not Measured** |
| PROJECT NO./NAME | | LOCATION |
| **2705.0001Y002 / Powerhouse** | | **322 3rd Avenue** |
| APPROVED BY | LOGGED BY | **Brooklyn, New York** |
| | **C. Prete & M. Narcisse** | |
| DRILLING CONTRACTOR/DRILLER | | GEOGRAPHIC AREA |
| **ADT / D. Moon** | | **Western Lateral Discharge Tunnel** |

| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
|---|---|---|---|---|
| **6-in. / Sonic** | **6-inches** | **CRS-XL Max / Rotosonic** | **Sonic** | **11/2/18-11/2/18** |

| LAND SURFACE ELEVATION | DEPTH TO WATER | BACKFILL |
|---|---|---|
| **Not Measured** | **Not Measured** | |

| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| | | Brown, fine to coarse SAND and GRAVEL, some Brick (FILL); dry. | | | |
| | | Concrete. | | G | |
| 5 | | | | | 5 |
| | | No recovery. | | | |
| | | Dark grey, CLAY and SAND; wet. | | 7.0 | Soil sample MW-16W (8-10) collected for TCL VOCs, SVOCs, Metals, Mercury, PCBs, and Pesticides. Petroleum odor observed. |
| 10 | | | | | 10 |
| | | Dark grey to brown, CLAY and SAND; wet. | | 1.2 | Soil sample MW-16W/10-12 collected for VOCs and PCBs. |
| | | | | 1.1 | Soil sample MW-16W/12-14 collected for VOCs and PCBs. |
| | | | | 1.1 | Soil sample MW-16W/14-16 collected for TCL VOCs, SVOCs, Metals, Mercury, PCBs, and Pesticides. |
| 15 | | | | | 15 |
| | | | | 5.0 | Soil sample MW-16W/16-18 collected for VOCs and PCBs. |
| | | | | 9.8 | Soil sample MW-16W/18-20 collected for VOCs and PCBs. |
| 20 | | | | | 20 |
| | | No recovery. | | | No recovery. |
| 25 | | | | | End of boring at 25 ft bls. 25 |

BORING/FEET 2705.0001Y002_2018MWS.GPJ ROUX.GDT 5/15/20

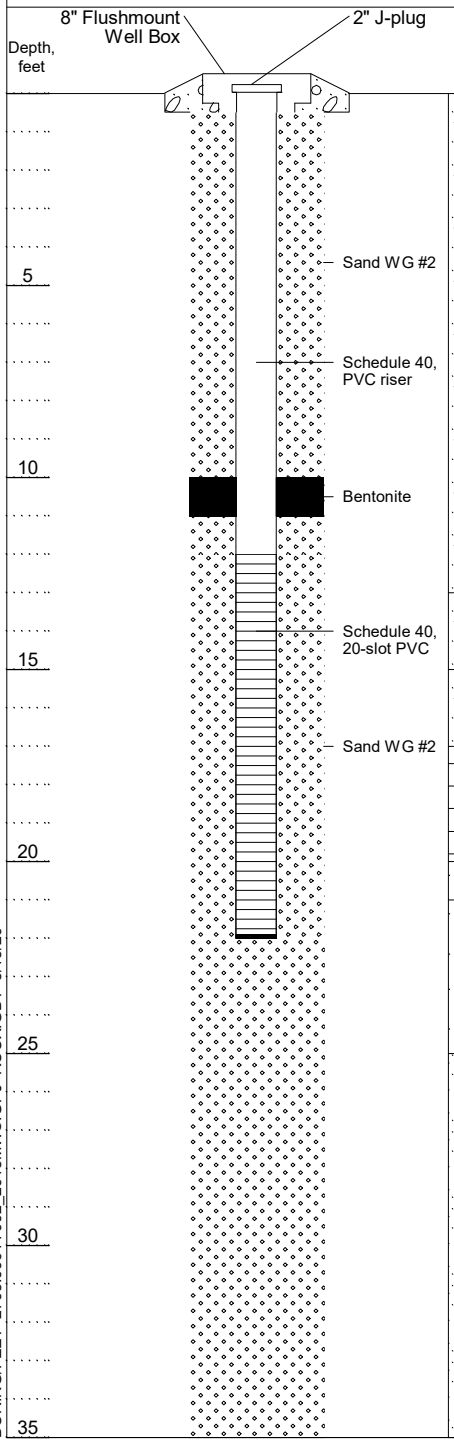
ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



# WELL CONSTRUCTION LOG

| | | | | |
|---|---|---|---|---|
| WELL NO.<br>**MW-17** | LATITUDE<br>**Not Measured** | LONGITUDE<br>**Not Measured** | | |
| PROJECT NO./NAME<br>**2705.0001Y002 / Powerhouse** | | LOCATION<br>**322 3rd Avenue**<br>**Brooklyn, New York** | | |
| APPROVED BY | LOGGED BY<br>**M. Smith** | | | |
| DRILLING CONTRACTOR/DRILLER<br>**ADT / B. Karshick** | | GEOGRAPHIC AREA<br>**Eastern Lateral Discharge Tunnel** | | |
| DRILL BIT DIAMETER/TYPE<br>**6-in. / Sonic** | BOREHOLE DIAMETER<br>**6-inches** | DRILLING EQUIPMENT/METHOD<br>**CRS-XL Max / Rotosonic** | SAMPLING METHOD<br>**Sonic** | START-FINISH DATE<br>**7/20/18-7/20/18** |
| CASING MAT./DIA.<br>**PVC / 2-inch** | SCREEN:<br>TYPE **Slotted** | MAT. **PVC** | TOTAL LENGTH **10.0** ft | DIA. **2-inch** SLOT SIZE **20-Slot** |




| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| | | Brown, SILT and fine SAND, some Gravel, trace brick (FILL); dry. | | 0.0 | Recovery not noted. |
| 5 | | | | 0.0 | 16" recovery. |
| 10 | | | | 0.0 | 16" recovery.<br>Soil sample MW-17 (11-13) collected to be analyzed for Part 375 VOCs, SVOCs, Metals, Pesticides, Herbicides, PCBs, Cyanide and Hex/Tri Chrom. |
| | | Red, broken BRICK (FILL); moist. | | 0.0 | |
| 15 | | | | | Water observed at 15 ft bls. |
| | | Brown, SILT and fine SAND, some Gravel, trace brick (FILL); wet. | | 0.0 | 18" recovery. |
| | | Dark grey, SILT and PEAT, some Clay; wet. | | 4.5 | Soil sample MW-17 (17-19) collected to be analyzed for Part 375 VOCs, SVOCs, Metals, Pesticides, Herbicides, PCBs, Cyanide and Hex/Tri Chrom. |
| 20 | | | | | |
| | | Dark grey, SILT and SAND, some Gravel, trace wood; wet. | | 1.4 | 2 ft recovery. |
| | | Dark grey, SILT and SAND, some Gravel; wet. | | 0.0 | |
| 25 | | | | | |
| | | Dark grey, medium SAND; wet. | | 0.0 | 32" recovery. |
| 30 | | | | 0.0 | 30" recovery.<br>Soil sample MW-17 (32-34) collected to be analyzed for Part 375 VOCs, SVOCs, Metals, Pesticides, Herbicides, PCBs, Cyanide and Hex/Tri Chrom. |
| 35 | | | | | End of boring at 35 ft bls. |

BORING/FEET 2705.0001Y002_2018MWS.GPJ ROUX.GDT 5/15/20

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898



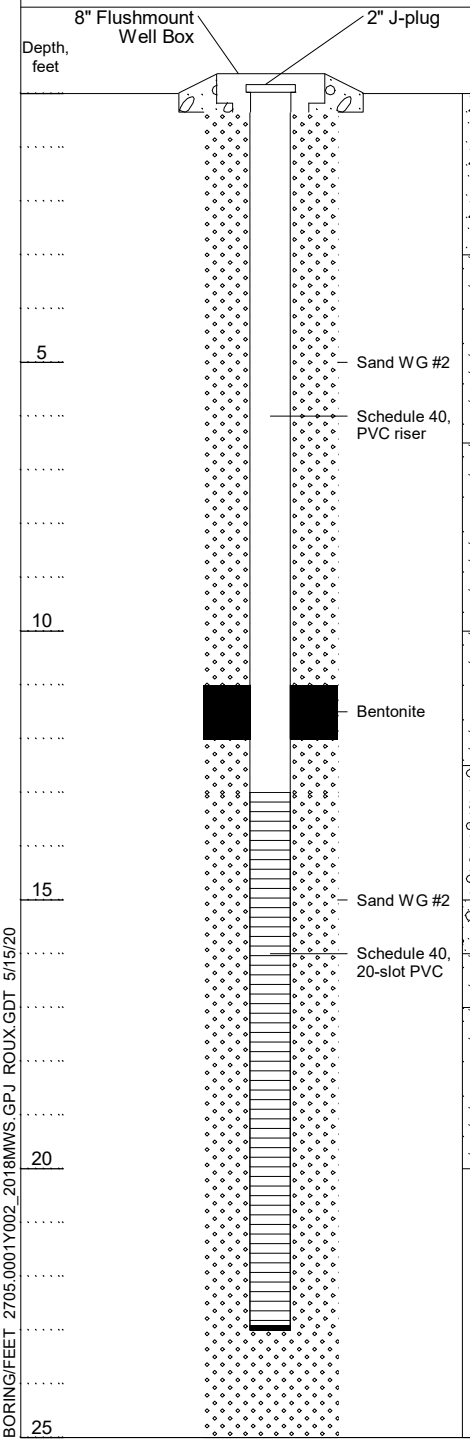
# WELL CONSTRUCTION LOG

| WELL NO. | LATITUDE | LONGITUDE |
|---|---|---|
| **MW-18** | **Not Measured** | **Not Measured** |

| PROJECT NO./NAME | LOCATION |
|---|---|
| **2705.0001Y002 / Powerhouse** | **322 3rd Avenue** |
| APPROVED BY / LOGGED BY: **M. Smith** | **Brooklyn, New York** |
| DRILLING CONTRACTOR/DRILLER: **ADT / B. Karshick** | GEOGRAPHIC AREA: **North Entrance Driveway** |

| DRILL BIT DIAMETER/TYPE | BOREHOLE DIAMETER | DRILLING EQUIPMENT/METHOD | SAMPLING METHOD | START-FINISH DATE |
|---|---|---|---|---|
| **6-in. / Sonic** | **6-inches** | **CRS-XL Max / Rotosonic** | **Sonic** | **7/27/18-7/27/18** |

CASING MAT./DIA.: **PVC / 2-inch**
SCREEN: TYPE **Slotted** MAT. **PVC** TOTAL LENGTH **10.0** ft DIA. **2-inch** SLOT SIZE **20-Slot**




| Depth, feet | Graphic Log | Visual Description | Blow Counts per 6" | PID Values (ppm) | REMARKS |
|---|---|---|---|---|---|
| | | Grey, SILT and fine SAND, some Gravel (RCA), Geotextile fabric, and Concrete (FILL). | | 0.0 | Full recovery. Encountered refusal at 10 ft bls; boring moved 8 ft north. |
| | | Brown, SILT and fine SAND, some Gravel; dry. | | | |
| 5 | | | | 0.0 | 16" recovery. |
| | | Light brown, SILT and fine SAND, some Gravel; dry. | | | |
| 10 | | | | 0.0 | 1 ft recovery. |
| | | Brown, SILT and fine SAND, some Gravel; dry. | | | |
| | | CRUSHED CONCRETE. | | | |
| 15 | | | | 0.0 | 26" recovery. |
| | | Light brown, fine SAND, some Gravel; dry. | | | |
| | | Brown, SILT and fine SAND, some Gravel; wet. | | | Water observed at 16 ft bls. |
| | | Dark grey, SILT and fine SAND, some Clay, trace gravel; wet. | | | |
| 20 | | | | | |
| | | Wood Pile. | | | 1 ft recovery. |
| 25 | | | | | End of boring at 25 ft bls. |

BORING/FEET 2705.0001Y002_2018MWS.GPJ ROUX.GDT 5/15/20

# APPENDIX F

Site-Specific Health and Safety Plan &
Community Air Monitoring Plan

**GOWANUS VILLAGE I, LLC**
**322 3rd AVENUE**
**BROOKLYN, KINGS COUNTY, NEW YORK**

---

# COMMUNITY AIR MONITORING PLAN
**NYSDEC BCP SITE NO. C224099**
**INDEX NO. W2-1069-0506**

Prepared For

Gemini Arts Initiative, Inc.

June 2013

LBG ENGINEERING SERVICES, P.C.
Professional Environmental & Civil Engineers
110 Corporate Park Drive, Suite 112
White Plains, NY 10604
(914) 694-5711

## TABLE OF CONTENTS


**Page**

1.0 INTRODUCTION ..... 1

2.0 REMEDIAL ACTION SCOPE OF WORK ..... 4

3.0 AIR MONITORING PROCEDURES FOR INTRUSIVE ACTIVITIES ..... 6
3.1 Particulates/Dust ..... 6
3.1.1 Particulates/Dust Monitoring ..... 7
3.1.2 Dust Control Plan ..... 8
3.1.2.1 *Passive Mitigation Measures* ..... 8
3.1.2.2 *Active Mitigation Measures* ..... 9
3.2 Volatile Organic Compounds/Odors ..... 10
3.2.1 Volatile Organic Compound Monitoring ..... 10
3.2.2 Odor Control Plan ..... 12
3.2.2.1 *Passive Mitigation Measures* ..... 12
3.2.2.2 *Active Mitigation Measures* ..... 13

4.0 ADDITIONAL NUISANCE CONTROL PLAN ..... 14
4.1 Noise Control Plan ..... 14
4.2 Other Nuisances ..... 15

5.0 PROJECT REPORTING ..... 16

APPENDIX I - NYSDOH Generic Community Air Monitoring Plan

APPENDIX II – Air Monitoring Field Sheet

**LIST OF FIGURE**
**(at end of report)**

**Figure**


1 Site Location Map

2 Site Plan

**GOWANUS VILLAGE I, LLC**
**322 3rd AVENUE**
**BROOKLYN, KINGS COUNTY, NEW YORK**

---

**COMMUNITY AIR MONITORING PLAN**
**NYSDEC BCP SITE NO. C224099**
**INDEX NO. W2-1069-0506**

## 1.0 INTRODUCTION

Gemini Arts Initiative, Inc. (heretofore referred to as "GAII" or the "Volunteer") is undertaking the remediation and potential redevelopment of the former Brooklyn Rapid Transit Corporation (BRT) Central Station powerhouse property located at 322 3rd Avenue in Brooklyn, New York (heretofore referred to as the "Site"). A Site Location Map is shown on Figure 1. The Site is located in the Gowanus neighborhood in Brooklyn, New York. The Site is located on the western half of the city block bounded by the historical 1st Street Basin (Lateral Canal) to the north, 2nd Street to the south, the Gowanus Canal to the west, and 3rd Avenue to the east. A Site Plan is presented as figure 2.

The Site is the subject of an environmental remediation pursuant to the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP). Under the Brownfield Cleanup Agreement executed on July 25, 2005, the Site was originally included in the BCP with the Site Name "Gowanus Village I, LLC". As per the original BCA, the Site was registered in the BCP as BCA Index Number W2-1069-0506, Site No. C224099. A three party limited liability company, Gowanus Village I, LLC (GVI), was the original volunteer for the Site. On August 5, 2009, the GVI consented to a change of party BCA amendment such that AI Gowanus Village, LLC (AIGV) became the new volunteer. AIGV subsequently consented to a change of party BCA amendment (submitted on July 29, 2012) such that BRT Powerhouse, LLC became the new volunteer on August 14, 2012. BRT Powerhouse, LLC submitted a BCA amendment application to the NYSDEC for Change in Party (approved on May 24, 2013) requesting that GAII be added as the Site Volunteer. GAII is listed as the current BCP Volunteer as per the NYSDEC approval for Change in Party.

On behalf of GAII, LBG Engineering Services, P.C. and/or Leggette, Brashears & Graham, Inc. (LBG) has developed a Remedial Action Work Plan (RAWP) for the Site to meet

requirements set by NYSDEC. LBG has prepared this Community Air Monitoring Plan (CAMP) as a supplemental governing document in association with the RAWP.

This CAMP will be implemented during the excavation of Site soils (or other ground invasive activities that involve moving existing Site soils around or off the Site) in connection with Site remediation activities. Specifically, this CAMP outlines the air quality monitoring procedures to be followed to protect the surrounding/downwind community (i.e. - offsite receptors, including residents and workers) from potential airborne contaminant releases that may be generated as a direct result of the Project excavation activities. This CAMP is consistent with the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan (included as Appendix I).

The Site is located along the eastern bank of the Gowanus Canal. A Site Plan is shown on Figure 2. The Site was historically utilized as a powerhouse (steam generating plant and dynamo building), an electrical sub-station and switching yard (frequency converting), a warehouse, and has subsequently been vacant for over the past decade. As a result of the historical property uses, the subsurface environmental condition at the Site has been negatively impacted by various contaminants.

Several historical environmental remedial investigation activities have been performed at the Site and surrounding properties. Based on the results of the historical environmental investigations completed at the Site, the identified contaminants of concern (COCs) included petroleum related volatile organic compounds (VOCs), chlorinated VOCs, semi-volatile organic compounds SVOCs, pesticides, poly-chlorinated biphenyls (PCBs) and historic fill related metals. Additionally, there is record of uncharacterized non-aqueous phase liquid present onsite in limited areas beneath he onsite building. The media impacted on the Site include soil, groundwater and soil vapor.

The concentrations of the chlorinated VOCs are relatively minor and do not indicate a pattern indicative of a release or source (either onsite or offsite). Based on the data evaluation, it was determined that the chlorinated VOCs are likely the result of residual impacts contained in historical fill and from regional subsurface impacts.

Significant petroleum related VOC and SVOC impacts were identified in the soil (to a depth of 26 ftbg) and groundwater, primarily in the area immediately west of the onsite

building. The impacts are generally localized onsite and do not appear to be migrating offsite.

Significant concentrations of PCBs were identified in the soil beneath the Site. These impacts extend to a depth of at least 20 ftbg, and the primary areas of impact are in the center of the Site (immediately west of the onsite building), beneath the building slab and extending to the west of the Site. The distribution of the PCB contaminated groundwater correlates with the locations of PCB impacted soil.

The pesticide/metals contamination at the Site is widespread and consistent throughout the Site. The impacts are generally contained within the shallow soils (top 4 feet) but extend to greater depths of up to 13 ftbg in isolated locations. The pesticide/metals contamination can be attributed to the historic fill material present beneath the Site.

## 2.0 REMEDIAL ACTION SCOPE OF WORK

The RAWP for the Site includes excavation, removal and disposal of the following contaminated materials: surface cover materials; contaminated surface soils (primarily consistent with historic fill material); as well as excavation of deep soil from select 'hot spot' locations where significantly elevated contaminant concentrations were identified during the historical remedial investigations. The majority of the excavated materials will be handled and disposed of as construction and demolition (C&D) debris and/or contaminated soil (historic fill and VOC contaminated soil) exceeding NYSDEC Part 375 Restricted Use Soil Cleanup Objectives (RUSCOs). In the 'hot spot' excavation locations, PCBs were detected in concentrations exceeding the Toxic Substance Control Act (TSCA) hazardous classification limit of 50 milligrams per kilogram (mg/kg).

The excavations will be advanced to the extent required to ensure a grade elevation that is two feet or more below the planned Site redevelopment grade elevation. This excavation plan will permit the Site re-grading to be compliant with the BCP in that the restoration of the undeveloped portions of the Site will have a minimum of two feet of certified clean fill material overlying any residual contaminated material left in place. This redevelopment scope will ensure that the onsite cover material is of sufficient thickness to comply with the redevelopment requirements for Restricted Residential property use. This will ensure that the undeveloped portions of the Site will meet the certified clean cover requirements in the event that there is a proposed property use modification request (for residential use).

The 'hot spot' excavations will be completed in areas where residual contamination is present at significantly elevated concentrations. These excavations will be completed (using required engineering controls) to facilitate the removal of the maximum amount of contaminated soil. It is anticipated that the 'hot spot' excavations will be advanced to various depths ranging from approximately 4 feet below grade (ft bg) to 22 ft bg.

Exclusive of two of the 'hot spot' excavations, none of the onsite excavation activities are anticipated to progress to or beyond the groundwater table. In these locations, required dewatering activities will be performed to permit the excavation and removal of the contaminated soils.

Although final Site redevelopment specifications have yet to be established, the RAWP anticipates excavation of approximately: 400 tons of C&D debris waste: 1,800 tons of PCB waste soil (TSCA hazardous classification TBD) and/or soil contaminated with significant concentrations of metals; 10,200 tons of historic fill/VOC contaminated soil; and a un-quantified volume of miscellaneous waste generated during the implementation of the RAWP (i.e.; decontamination waste, extracted NAPL...). The estimated historic fill/VOC contaminated soil excavation volume was established based on the removal of a two foot topsoil layer throughout the undeveloped portions of the Site. Therefore the volume of the historic fill/VOC contaminated soil will be impacted based on the proposed redevelopment grade determination. The requirement for the excavation will be to permit the re-grading in compliance with the RAWP (endpoint sampling, demarcation layer installation and backfilling/re-grading with a 2-foot layer of certified clean fill).

Additional environmental work proposed as part of the RAWP will include: dewatering activities; targeted high vacuum extraction in-situ remediation activities; waste material loading for hauling and offsite disposal; associated decontamination activities, the installation of monitoring/extraction wells and building reconstruction activities. These activities will be performed to facilitate the completion of proposed Remedial Actions and/or Engineering Controls at the Site.

All waste generated as a result of performing these activities will be appropriately stored onsite in contaminant compatible containers or stockpiled pending appropriate waste characterization and offsite disposal.

## 3.0 AIR MONITORING PROCEDURES FOR INTRUSIVE ACTIVITIES

Odor, dust and other nuisances will be maintained within acceptable levels to be protective of the health and safety of onsite workers and the community, and to minimize any potential impact to the community.

The monitoring programs and action levels for odor, dust and other nuisances are established in the Health and Safety Plan. The procedures below outline the monitoring programs as well as the passive mitigation measures inherent in the design of the RAWP followed by active measures which can be taken to prevent/should an action levels be exceeded.

In the event that action level is exceeded for odor and/or dust and/or other nuisances, it will likely be exceeded first in the work zone before being exceeded at the Site perimeter. Ongoing monitoring within the work zone and if necessary, immediate mitigation of potential impacts as action levels are approached will therefore serve to prevent action levels being exceeded at the Site perimeter.

Air monitoring will be performed during the following activities: ground invasive work; handling of free-phase product/NAPL; and any other activities which may release VOCs or particulates into the atmosphere. As such, the monitoring will ensure the prevention of over exposure to workers at the Site as well as tracking and minimizing the potential for negative impact to properties surrounding the Site.

Frequent air monitoring will be conducted at 30-minute intervals within the 20 Foot Zone. The monitoring frequency may be modified to conform with the requirements of the onsite activities. Determinations on the required monitoring frequency will be made by the Health and Safety Officer. The results of all air monitoring activities will be recorded on daily air monitoring logs. A copy of the air monitoring field sheet is presented as Appendix II.

### 3.1 Particulates/Dust

The air will be monitored in real-time during the excavation of Site soils (or other ground invasive activities that involve moving existing Site soils/fill around or off the Site) in connection with the construction of the Remedial Action activities or any related excavation or remediation. As a result, monitoring and potentially mitigation activities will be performed to

ensure minimal impact to the workers onsite as well as the surrounding community.

### 3.1.1 Particulates/Dust Monitoring

Air monitoring for particulates (i.e. - dust) will be performed continuously during any excavation or ground invasive activities using both air monitoring equipment and visual observations. Monitoring equipment capable of measuring particulate matter smaller than 10 microns (PM-10) and will be used to monitor upwind (background), work zone and downwind locations, at heights approximately 4 feet to 5 feet above land surface (i.e., the breathing zone). This equipment will log instantaneous concentrations for subsequent reporting. Upwind work zone and downwind concentrations will be measured at the start of each workday and periodically throughout the day (at 30 minute to 1 hour intervals) thereafter to establish background conditions. The CAMP coordinator (the onsite field supervisor or Health and Safety Officer) will record the wind direction and speed as described below. These readings will allow the CAMP coordinator to ensure that CAMP monitoring locations are appropriate based upon the wind direction. The particulate monitoring equipment will be calibrated at the start of each day and as necessary throughout the day. The monitoring results will be compared to the following:

- If the downwind PM-10 particulate level is 100 $\mu g/m^3$ greater than background (up-wind perimeter) or if airborne dust is observed leaving the work area, then dust suppression techniques shall be employed. Work may continue with dust suppression techniques, provided that downwind PM-10 particulate levels do not exceed 150 $\mu g/m^3$ above the upwind level and provided that no visible dust is migrating from the work area. (Dust suppression techniques will also be applied in other circumstances as described in the Health and Safety Plan [HASP]).
- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 $\mu g/m^3$ above the upwind level, work will cease. The situation will be re-evaluated and changes implemented to ensure particulate levels are less than 150 $\mu g/m^3$ above background conditions and to prevent visible dust migration.

Wind speed and wind direction will be observed and recorded continuously throughout the day. Meteorological data including temperature and barometric pressure will be recorded at a minimum once a day. These results will be utilized to position the particulate monitoring equipment in appropriate upwind and downwind locations.

There may also be situations where visible dust is generated by excavation activities and migrates to downwind locations but is not detected by the monitoring equipment at or above the action levels. Therefore, if visible dust is observed leaving the working area, dust suppression techniques such as those described in the RAWP and/or HASP will be employed.

If dust suppression techniques do not lower particulates to 150 $\mu g/m^3$ below background or if visible dust persists, additional measures, including work suspension if necessary, will be implemented to remedy the situation.

All air monitoring data, meteorological data, and the monitoring locations will be recorded in the daily air monitoring logs and will be available for NYSDEC and NYSDOH review.

### 3.1.2 Dust Control Plan

Dust emissions can occur from hauling debris and traffic over unpaved areas. All appropriate fugitive dust control measures will be employed to reduce the generation and spread of dust, and to ensure that the New York City Air Pollution Control Code regulating construction-related dust emissions is followed.

This dust control plan consists of passive and active mitigation measures capable of controlling emissions of dust during invasive onsite and/or offsite work. The following sections outline potential dust mitigation measures which may be utilized at the Site:

#### 3.1.2.1 *Passive Mitigation Measures*

Passive mitigation measures for excessive dust generation include*:*

- Most of the excavated materials will be moist to wet and have a low potential for dust generation.
- Most of the excavation work will occur below grade, which will serve to reduce the wind generation of dust and the spread of dust.

- The in situ waste classification and "load-and-go" approach (if utilized) will reduce the amount of dust generation associated with the double-handling of waste.
- Rolloffs will be covered and waste will be covered when not being excavated.
- The waste haul route will be directed through the industrial area to the east of the land-fill mitigating the potential for increased dust in the residential areas.
- Onsite roads will be limited in total area to minimize the area required for water spray-ing.

In the event that a dust action level is exceeded, the Contractor will identify the source of the elevated dust and take immediate steps to reduce dust to acceptable levels. The specific action taken will depend on the source of the elevated dust. Potential mitigation measures that the Contractor may use are presented below.

#### 3.1.2.2 *Active Mitigation Measures*

Active mitigation measures for excessive dust generation include*:*

- Dust suppression will be achieved through the use of water misting (provided by onsite municipal water).
- The rate and height of waste release from the excavator bucket into the trailers will be monitored to minimize dust generation.
- Work may be suspended if conditions of high dust generation cannot be controlled.
- Vehicles will be decontaminated before departing the Site.

The Contractor will maintain a supply of dust control material onsite. Dust control materials may include water spraying or application of materials like wood chips.

### 3.2 Volatile Organic Compounds/Odors

The air will be monitored in real-time during the excavation of Site soils (or other ground invasive activities that involve moving existing Site soils/fill around or off the Site) in connection with the construction of the Remedial Action activities or any related excavation or remediation. As a result, monitoring and potentially mitigation activities will be performed to ensure proper personal protection equipment is utilized by workers, to minimize impact to the workers onsite as well as minimize impact to the surrounding community.

#### 3.2.1 Volatile Organic Compound Monitoring

Air monitoring for volatile organic compounds (VOCs) will be performed continuously during any excavation or ground invasive activities and/or handling/disruption of contaminated materials (concurrent with particulate monitoring). This activity description includes handling of contaminated soil, groundwater and/or free-phase/NAPL, as well as any other activities which may release VOCs into the atmosphere. The monitoring will ensure the prevention of over exposure to workers at the Site and to citizens surrounding the Site.

VOCs will be monitored at the downwind perimeter of the immediate work area or Site perimeter on a continuous basis. Upwind concentrations will be measured at the start of each workday and periodically thereafter (not less than three times per day) to establish background conditions.

The monitoring work will be performed using equipment appropriate to measure the types of contaminants known to be present at the Site. This equipment will consist of a MiniRAE 2000 Photoionization detector (PID) or equivalent PID capable of detecting total hydrocarbons at a sensitivity of 0.1 ppm. The equipment will be calibrated daily at a minimum.

While performing the air monitoring activities, the following qualifying criteria will dictate required actions with respect to onsite work activities as well as required mitigation procedures.

- If the ambient air concentration of organic vapors exceeds 5 ppm above background at the perimeter of the work area, activities will be halted and monitoring continued. If the organic vapor level decreases below 5 ppm above background, work activities

can resume. If the organic vapor levels are greater than 5 ppm over background but less than 25 ppm over background at the perimeter of the work area, activities can resume provided the organic vapor level 200 feet downwind of the work area or half the distance to the nearest residential or commercial structure, whichever is less, is below 5 ppm over background.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities will be shutdown. When work shutdown occurs, downwind air monitoring as directed by the Safety Officer will be implemented to ensure that vapor emission does not impact the nearest residential or commercial structure at levels exceeding those specified in the Major Vapor Emission section.
- If any organic levels greater than 5 ppm over background are identified 200 feet downwind from the work area or half the distance to the nearest residential or commercial property, whichever is less, all work activities will be halted.
- If, following the cessation of the work activities, or as the result of an emergency, organic levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the work area, then the air quality will be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20 Foot Zone).

If efforts to abate the emission source are unsuccessful and if the following levels persist for more than 30 minutes in the 20 Foot Zone, then the Major Vapor Emission Response Plan shall automatically be placed into effect. Additionally, the Major Vapor Emission Response Plan shall be immediately placed into effect if organic vapor levels are greater than 10 ppm above background. Upon activation, the following activities will be undertaken:

- All Emergency Response Contacts as listed in the Health and Safety Plan of the RAWP will be notified.
- Frequent air monitoring will be conducted at 30-minute intervals within the 20 Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the Health and Safety Officer.

The location of air monitoring stations will vary based on wind direction and will be determined daily by the onsite supervisor (HSO, project manager, etc.). The location of air monitoring stations for each day's activities will be recorded in the Daily Report.

Exceedances observed in the CAMP will be reported to NYSDEC and NYSDOH Project Managers and included in the Daily Report.

### 3.2.2 Odor Control Plan

This odor control plan consists of passive and active mitigation measures capable of controlling emissions of nuisance odors onsite and offsite. The following odor mitigation measures may be utilized at the Site: VOC and/or nuisance odor emissions can occur from excavation activities, hauling debris and traffic over unpaved areas. All appropriate odor control measures will be employed to minimize the potential for negative impact to the surrounding community.

The following sections outline potential odor control measures which may be utilized at the Site.

#### 3.2.2.1 *Passive Mitigation Measures*

Passive mitigation measures VOC/odor impacts to surrounding properties include*:*

- If possible, in-situ waste classification and "load-and-go" approach may be utilized to reduce the amount of odor generation associated with the total surface area and duration of exposure from stockpiles, and from the double-handling of waste.
- Open excavations that are not being actively excavated may be shrouded with tarps and/or other covers.
- Rolloffs will be covered with plastic polyethylene liner.
- The waste trucking route will be directed through the approved truck route (see Section 5.4.4) mitigating the potential for increased odor in the residential areas.
- Trucks transporting wastes offsite will be covered.

### 3.2.2.2*Active Mitigation Measures*

***Active Mitigation Measures:***

- The rate of work may be slowed or suspended in times of high odor release.
- Highly odoriferous processes may be limited to specific times of day, temperatures or wind conditions.
- A smaller excavation may be uncovered at one time.
- If necessary, an odor control system utilizing a non-toxic, odor neutralizing solution, such as "airSolution" (Ecolo Odor Control Systems) or an odor controlling foam may be used at the Site.
- In the event that odor cannot be controlled within the work area and/or the community, excavation of odoriferous waste may be suspended during times when winds are blowing toward the residential areas, warm weather, and/or during times of day when there is generally a higher public presence outside (commuting times, lunch hour and after school).
- Where odor nuisances have developed during remedial work and cannot be corrected, or where the release of nuisance odors cannot otherwise be avoided due to onsite conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering excavation and handling areas under tented containment structures equipped with appropriate air venting/filtering systems.

If nuisance odors are identified, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of all other complaints about the project. Implementation of all odor controls, including the halt of work, will be the responsibility of the Volunteer and performed under the direction of the Volunteer's Remedial Engineer, who is responsible for certifying the FER.

## 4.0 ADDITIONAL NUISANCE CONTROL PLAN

In addition to the outlined air monitoring activities, the completion of the onsite remediation and construction activities will comply with applicable control measures for construction noise as well as rodent control.

### 4.1 Noise Control Plan

Noise levels are expected to remain below the action level at the Site perimeter. In the event that a noise action level is exceeded, the Contractor will identify the source of the elevated noise and take immediate steps to reduce noise to acceptable levels. The specific action taken will depend on the source of the elevated noise and may include, for example, installation of a barrier wall, turning off all idling vehicles or removing a piece of equipment from service.

Construction noise is regulated by the New York City Noise Control Code and by the Environmental Protection Agency noise emission standards for construction equipment. These federal and local requirements mandate that certain classifications of construction equipment and motor vehicles meet specified noise emissions standards. Except under exceptional circumstances, construction activities must be limited to weekdays between the hours of 7 AM and 6 PM. Construction material will also be handled and transported in such a manner as to not create unnecessary noise. Therefore, no significant adverse noise impacts are expected to occur as a result of the construction.

Community complaints will be handled in a manner similar to the exceedance of an action level, but will also include assessment of the root cause analysis of the complaint and adequacy of monitoring measures in addition to revising mitigation measures if appropriate. If a community complaint is received, the following will be documented under this procedure to address the steps taken to further mitigate the impacts identified, and the follow-up measures/monitoring to confirm that appropriate corrective action(s) have been implemented:

- time, date and person that identified an issue;
- the nature of the issue;
- the steps taken to assess the root cause of the issue;
- mitigation measures implemented; and

- follow-up measures or monitoring conducted to confirm the issue is resolved.

## 4.2 Other Nuisances

If necessary, pest control tasks related to the onsite activities may be required within construction areas or adjacent areas. This could include control of insects or vertebrates other than rats and mice.

This work is to be performed prior to demolition, excavation, and site preparation and throughout the Contract, so that rodents and other pests do not disperse from or infest the project area. If required, the rodent control plan will be developed and implemented by a contractor that has specific training and experience in vertebrate pest management, commercial rodent control, general pest control, and integrated pest management

## 5.0 PROJECT REPORTING

Daily Field Sheets will be maintained by onsite field personnel. These field sheets will outline remedial activities performed for each day. These Daily Field Sheets will be submitted to the NYSDEC and NYSDOH Project Managers (via e-mail) at the end of each day following the reporting period. Daily Reports will include a description of daily activities as well as a summary of air monitoring results, odor and dust problems and corrective actions, and all complaints received from the public.

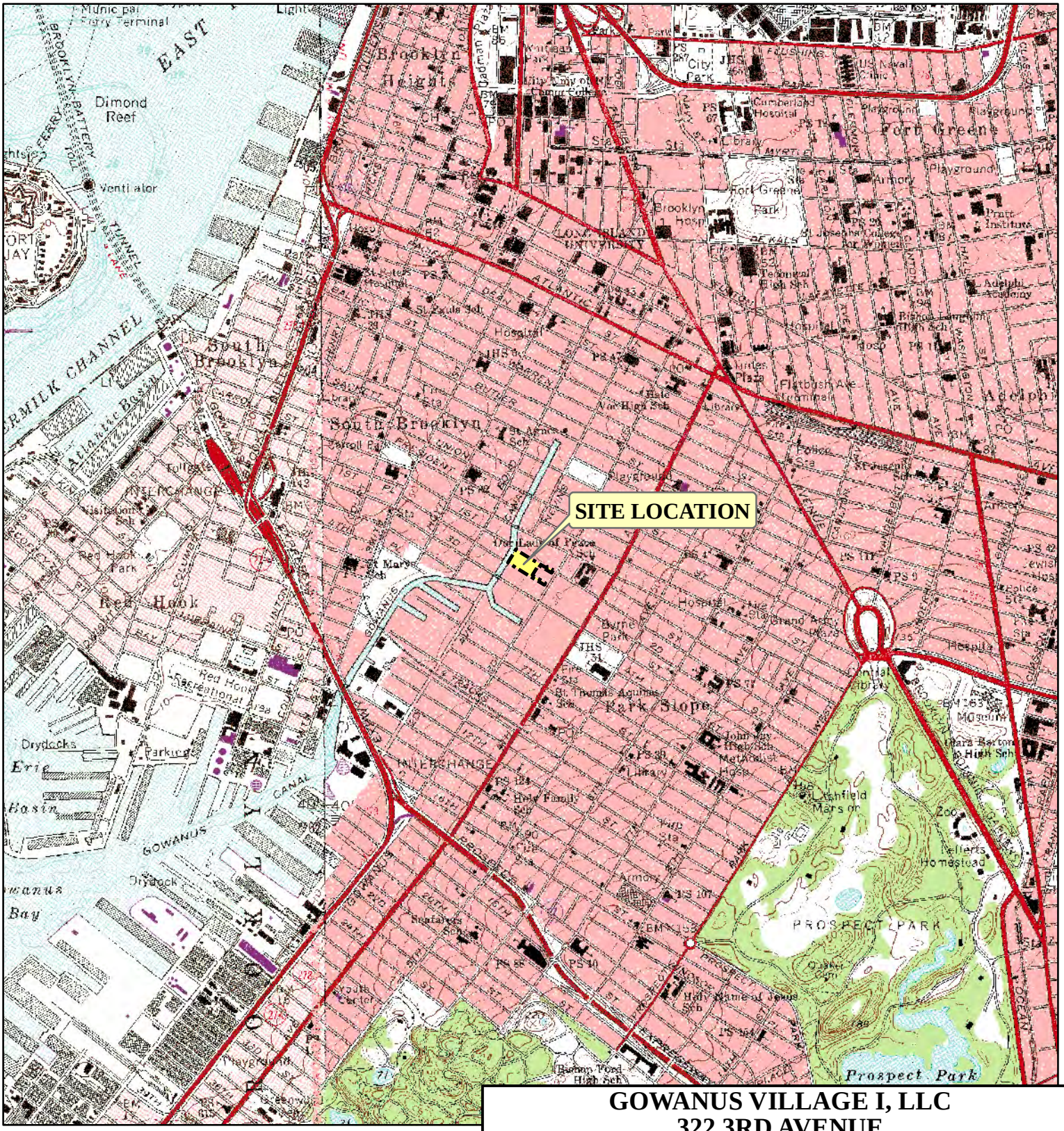
Monthly reports (if requested) will be submitted to NYSDEC and NYSDOH Project Managers within one week following the end of the month of the reporting period.

Complaints from the public regarding nuisance or other site conditions will be handled on an individual basis. Once a complaint is filed with regards to site remedial action activities, the NYSDEC will be notified and all required steps will be taken to rectify the cause of the complaint.

A Final Engineers Report (FER) and a Site Management Plan (SMP) will be submitted to NYSDEC following implementation of the Remedial Action defined in the RAWP. The FER will provide the documentation that the remedial work required under this RAWP has been completed and has been performed in compliance with this plan. This will include a summary of the community air monitoring plan activities and the results. The FER will include the following certification by the Remedial Engineer: "I certify that all invasive work during the remediation and all invasive development work were conducted in accordance with Site control monitoring and mitigation actions as defined in the Remedial Action Work Plan and its inclusive Community Air Monitoring Plan."

scg
June 2013
f:\reports\sive paget\gowanus\phase 3 - bcp remedial action work plan\community air monitoring plan\camp.doc

**FIGURES**




**LEGEND**

PROPERTY BOUNDARY

SOURCE: USGS DIGITIAL RASTER GRAPHIC, BROOKLYN QUADRANGLE, USGS, 1979

# GOWANUS VILLAGE I, LLC
# 322 3RD AVENUE
# BROOKLY KING'S COUNTY, NEW YORK
# NYSDEC BCP SITE NO. C224099
# INDEX NO. W2-1069-0506

## SITE LOCATION MAP

| DATE: | REVISED: |
|---|---|
| | |
| | |
| | |
| | |
| | |

PREPARED BY:


**LEGGETTE, BRASHEARS & GRAHAM, INC.**
Professional Groundwater and Environmental Engineering Services
110 Corporate Park Drive, Suite 112
White Plains, New York 10604
(914) 694-5711


| DRAWN: | CHECKED: | DATE: | FIGURE: |
|---|---|---|---|
| PAS | SG | 6/10/13 | 1 |




**LEGEND**

PROPERTY BOUNDARY

EXISTING BUILDING FOOTPRINT

ELEVATION CONTOURS (1-FOOT)

N

W E

S

NOTES:

DIGITIZED CONTOURS - BRT POWERHOUSE, LLC, TOPOGRAPHICAL SURVEY, PERFECT POINT LAND SURVEYING, 2013 (FOR REFERENCE USE ONLY)

ELEVATION - BASED ON BROOKLN DATUM WHICH IS 2.56' ABOVE MEAN SEA LEVEL AT SANDY HOOK, US COAST AND GEODETIC SURVEY.

AERIAL IMAGE - 2012 COVERAGE, NYS CLEARINGHOUSE, (http://gis.ny.gov/) GEOREFERENCED USING ARCGIS 10.1.

0 30 60 Feet

1 inch equals 60 feet

# GOWANUS VILLAGE I, LLC
# 322 3RD AVENUE
# BROOKLY KING'S COUNTY, NEW YORK
# NYSDEC BCP SITE NO. C224099
# INDEX NO. W2-1069-0506

SITE PLAN

| DATE: | REVISED: |
|---|---|
| | |
| | |
| | |
| | |
| | |

PREPARED BY:

**LEGGETTE, BRASHEARS & GRAHAM, INC.**
**Professional Groundwater and Environmental Engineering Services**
110 Corporate Park Drive, Suite 112
White Plains, New York 10604
(914) 694-5711

| DRAWN: | CHECKED: | DATE: | FIGURE: |
|---|---|---|---|
| PAS | SG | 6/10/13 | 2 |

**APPENDIX I**

# APPENDIX 1A

## New York State Department of Health
## Generic Community Air Monitoring Plan

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

### Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for volatile organic compounds (VOCs) and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate NYSDEC/NYSDOH staff.

**Continuous monitoring** will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

**Periodic monitoring** for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

## VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

All 15-minute readings must be recorded and be available for State (DEC and DOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

## Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter ($mcg/m^3$) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 $mcg/m^3$ above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 $mcg/m^3$ above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 $mcg/m^3$ of the upwind level and in preventing visible dust migration.

All readings must be recorded and be available for State (DEC and DOH) personnel to review.

**APPENDIX II**

# Air Monitoring Log

**Date** _____ Page: _____ of _____

**HSO Name** _____

**Project Location** _____

**Weather Conditions** _____

| Equipment | Calibration | Background |
|---|---|---|
| Dust Meter (ug/m$^3$) | | |
| PID (ppm) | | |

| Work Area | Work Coments | Time | Wind Direction | PID Reading (ppm) | | | Particulate Reading (ug/m$^3$) | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Upwind | Workzone | Downwind | Upwind | Workzone | Downwind |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | |

**May 17, 2016**
**Revision 1. November 30, 2016**
**Revision 2. December 8, 2016**

# SITE SPECIFIC HEALTH AND SAFETY PLAN

## 153 2nd Street
## Brooklyn, New York

***Prepared for***

**BRT POWERHOUSE FACILITY**
**153 2nd Street**
**Brooklyn, New York**

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

ROUX *209 Shafter Street, Islandia, New York 11749 ♦ 631-232-2600*

## TABLE OF CONTENTS

APPROVALS ..... i

1.0 INTRODUCTION ..... 1
1.2.2 Project Management/Health and Safety Personnel ..... 3
1.2.3 Other Important Phone Numbers ..... 3
1.2.4 Directions to New York Methodist Hospital ..... 3

**2.0 HEALTH AND SAFETY STAFF** ..... 4
2.1 Project Principal (PP) – Frank Cherena – Roux Associates ..... 4
2.2 Corporate Health and Safety Manager (CHSM) – Joseph W. Gentile – Roux Associates ..... 4
2.3 Site Safety and Health Officer (SSO) – Michele Abbene – Roux Associates ..... 4
2.4 Field Personnel and Subcontractors ..... 5

**3.0 SITE LOCATION AND PHYSICAL DESCRIPTION** ..... 6

4.0 WASTE DESCRIPTION/CHARACTERIZATION ..... 7
4.1 General ..... 7
4.2 Chemical Data Sheets ..... 7
4.2.1 Contaminants of Concern ..... 7

5.0 HAZARD ASSESSMENT ..... 8
5.1 Chemical Hazards ..... 8
5.1.1 Exposure Pathways ..... 8
5.1.2 Operational Action Levels ..... 9
5.1.3 Additional Precautions ..... 9
5.2 Physical Hazards ..... 9
5.2.1 Noise ..... 10
5.2.2 Heat Stress ..... 10
5.2.3 Cold Stress ..... 12
5.2.4 Asbestos ..... 12
5.2.5 Structural Integrity ..... 13
5.2.6 Lockout/Tagout ..... 13
5.3 Biological Hazards ..... 14
5.3.1 Insect Stings ..... 14
5.3.2 Animals and Animal Wastes ..... 14
5.3.3 Mold ..... 15
5.3.4 Bloodborne Pathogens ..... 16
5.3.5 Poison Ivy ..... 17
5.4 Hazard Assessment ..... 17

6.0 TRAINING ..... 18
6.1 General Health and Safety Training ..... 18
6.2 Annual Eight-Hour Refresher Training ..... 18
6.3 Site-Specific Training ..... 18
6.4 Onsite Safety Meetings ..... 19
6.5 First Aid and CPR ..... 19
6.6 Additional Training ..... 19
6.7 Subcontractor Training ..... 19

## TABLE OF CONTENTS

**(Continued)**


7.0 MEDICAL SURVEILLANCE PROCEDURES ..... 20
7.1 General ..... 20

8.0 SITE CONTROL, PERSONAL PROTECTIVE EQUIPMENT, AND COMMUNICATIONS ..... 21
8.1 Site Control ..... 21
8.1.1 Support Zone ..... 21
8.1.2 Contamination Reduction Zone ..... 22
8.1.3 Exclusion Zone ..... 22
8.2 Personal Protective Equipment ..... 23
8.2.1 General ..... 23
8.2.2 Personal Protective Equipment Specifications ..... 23
8.2.3 Initial Levels of Protection ..... 25
8.3 Communications ..... 25

9.0 MONITORING PROCEDURES ..... 27
9.1 General ..... 27
9.2 Exclusion Zone Monitoring ..... 27
9.2.1 Instrumentation ..... 27
9.2.2 Action Levels ..... 27
9.2.3 Monitoring During Field Activities ..... 28

10.0 SAFETY CONSIDERATIONS ..... 29
10.1 General ..... 29
10.2 Traffic Control ..... 30
10.3 Sample Handling ..... 30
10.4 Barge Safety ..... 30
10.5 Working Over or Near Water ..... 31
10.5.1 Hazards ..... 31
10.5.2 Prevention ..... 31

11.0 DECONTAMINATION AND DISPOSAL PROCEDURES ..... 32
11.1 Contamination Prevention ..... 32
11.2 Personnel Decontamination ..... 32
11.3 Equipment Decontamination ..... 33
11.4 Decontamination during Medical Emergencies ..... 34
11.5 Disposal Procedures ..... 34

12.0 EMERGENCY PLAN ..... 36
12.1 Evacuation ..... 36
12.2 Personnel Injury ..... 37
12.3 Accident/Incident Reporting ..... 37
12.4 Personnel Exposure ..... 38
12.5 Adverse Weather Conditions ..... 38
12.6 Short Service Employee Program ..... 39

## TABLE OF CONTENTS

**(Continued)**

13.0 LOGS, REPORTS AND RECORD KEEPING ..... 40
13.1 Medical and Training Records ..... 40
13.2 Onsite Log ..... 40
13.3 Exposure Records ..... 40
13.4 Accident/Incident Reports ..... 40
13.5 Daily Safety Logs ..... 40
13.6 Weekly Safety Reports ..... 40
13.7 Close-Out Safety Report ..... 41
14.0 FIELD TEAM REVIEW ..... 42

**TABLE**

1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site
2. Action Levels for Worker Breathing Zone

**FIGURES**

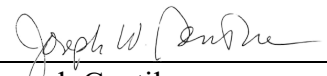
1. Site Location Map
2. Hospital Route Map
3. Clinic Route Map

**APPENDICES**

A. Job Safety Analysis
B. Heat and Cold Stress Guidelines
C. Medical Data Form
D. Heavy Equipment Exclusion Zone Policy
E. Accident Report and Accident Investigation Form
F. *ACORD*® Automobile Loss Notice Form
G. Short Service Employee Policy
H. Health & Safety Briefing/Tailgate Meeting Form
I. Weekly Safety Report

**APPROVALS**

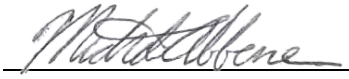
By their signature, the undersigned certify that this Health and Safety Plan (HASP) is approved and will be utilized at the project site located at 153 2nd Street, in Brooklyn, New York.



05/17/2016

Joseph Gentile
Corporate Health and Safety Manager
Roux Associates, Inc.

Date



05/17/2016

Michele Abbene
Site Health and Safety Officer
Roux Associates, Inc.

Date



05/17/2016 FC

Frank Cherena
Project Principal
Roux Associates, Inc.

Date

Rev. 1
11/30/2016
Rev. 2
12/8/2016
FC

## 1.0 INTRODUCTION

This site-specific Health and Safety Plan (HASP) has been prepared in accordance with 29 CFR 1910.120 Occupational Safety and Health Act (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) and Roux Associates, Inc. (Roux Associates) Standard Operating Procedures (SOPs). It addresses all activities to be performed during the implementation of the supplemental sampling activities at the property identified as the BRT Powerhouse (Powerhouse) facility located at 153 2nd Street, Brooklyn, New York (Site) (Figure 1). The HASP will be implemented by the designated Site Health and Safety Officer (SSO) during work at the Site. The HASP attempts to identify all potential hazards at the Site; however, Site conditions are dynamic and new hazards may appear constantly. Personnel must remain alert to existing and potential hazards as Site conditions change and protect themselves accordingly.

Compliance with this HASP is required for all Roux Associates personnel and subcontractors contracted directly by Roux Associates. Assistance in implementing this HASP can be obtained from the Roux Associates Corporate Health and Safety Manager (CHSM). The content of this HASP may undergo revision based upon additional information made available, monitoring results, or changes in the technical scope of work. Any changes proposed to this HASP must be reviewed and approved by the CHSM or with the SSO implementing the changes to the HASP. The Client contact will be provided these changes to the HASP prior to implementation for review and approval if applicable.

Upon entering the Site, all visitors are required to sign in. All visitors entering the Contamination Reduction Zone (CRZ) (defined in Section 8.1.2), the Contamination Reduction Corridor (CRC) (defined in Section 8.1.2), or the Exclusion Zone (EZ) (defined in Section 8.1.3) will be required to read and comply with the provisions of this HASP. Visitors will be required to comply with applicable OSHA requirements such as training, medical monitoring, and respiratory protection.

In the event that a visitor does not adhere to the provisions of the HASP, he or she will be required to leave the Site. Mobilization activities not requiring intrusive activities (e.g., survey, equipment staging, etc.) or exposure to potentially impacted areas may only be performed if supervised by a competent Roux Associates employee.

### 1.1 Scope of Work

The Scope of Work activities will include the implementation of Site Investigation activities.

The Scope of Work activities are as follows:

1. Obtain necessary permits and approvals.
2. Preparation and implementation of an approved Health and Safety Plan (HASP).
3. Implementation of site investigation activities, consisting of site inspection/reconnaissance, drilling, soil boring and sampling, concrete boring and sampling, and waste characterization sampling, as necessary.
4. Mobilization and demobilization.
5. Maintain good site housekeeping at all times.
6. Identification, protection, and/or relocation of any utilities within the work area.
7. Construct a decontamination area with proper containment and collection system, if necessary.

### 1.2 Emergency Numbers

#### 1.2.1 Emergency Phone Numbers

Emergency Medical Service .....911

Police: New York City Police Department (NYCPD) .....911

Fire: .....911

Hospital: New York Methodist Hospital.....718-780-3137

City MD Urgent Care.....877-852-3082

National Response Center.....800-424-8802

Poison Control Center.....800-222-1222

CHEMTREC.....800-262-8200

Fire: New York City Fire Department.....911

Center for Disease Control.....800-311-3435

USEPA (Region II).....212-637-5000

NYSDEC Emergency Spill Response.....800-457-7362

### 1.2.2 Project Management/Health and Safety Personnel

| Title | Contact | Telephone/Cell |
|---|---|---|
| Roux Associates | | |
| Project Principal | Frank Cherena | 631-232-2600<br>Cell – 631-445-0357 |
| Site Health and Safety Officer | Michele Abbene | 631-232-2600<br>Cell – 631-680-4650 |
| Corporate Health and Safety Manager | Joseph Gentile | 856-423-3768<br>Cell – 610-844-6911 |
| Powerhouse Environmental Arts Foundation | | |
| Director of Operations | Jessica Lysons | Cell – 718-522-1188 |

### 1.2.3 Other Important Phone Numbers

New York City Emergency Response Team .....911

### 1.2.4 Directions to New York Methodist Hospital

**See Figure 2 for street map.**

- Turn right onto 3rd Avenue.
- Turn left onto 7th Street.
- Turn left onto 8th Avenue.
- Turn left onto 6th Street.
- Arrive at New York Methodist Hospital on the left (total distance is 1.1 miles).

## 2.0 HEALTH AND SAFETY STAFF

This section briefly describes all Site personnel and their health and safety responsibilities for the supplemental sampling work to be implemented at the Site. All personnel are responsible for ensuring compliance with the HASP.

### 2.1 Project Principal (PP) – Frank Cherena – Roux Associates

- Has the overall responsibility for the health and safety of Site personnel.
- Ensures that adequate resources are provided to the field health and safety staff to carry out their responsibilities as outlined below.

### 2.2 Corporate Health and Safety Manager (CHSM) – Joseph W. Gentile – Roux Associates

- Implements the HASP.
- Performs or oversees site-specific training and approves revised or new safety protocols or field operations.
- Coordinates revisions of this HASP with Project Principal.
- Is responsible for the development of new task safety protocols and procedures and resolution of any outstanding safety issues which may arise during the performance of site work.
- Reviews and approves all health and safety training and medical surveillance records for personnel and subcontractors.

### 2.3 Site Safety and Health Officer (SSO) – Michele Abbene – Roux Associates

- Directs and coordinates health and safety monitoring activities.
- Ensures that field teams utilize proper personal protective equipment.
- Conducts initial onsite specific training prior to personnel and/or subcontractors commencing work.
- Conducts and documents periodic safety briefings.
- Ensures that field team members comply with this HASP.
- Completes and maintains Accident Report and Investigation Forms.
- Notifies PP and CHSM of all accidents/incidents.

- Notifies PP of daily field operations and work progress, who will then communicate at the end of the day to the designated representative the following:
    1. End of day tasks completed
    2. Next day's planned activities
    3. Third party issues
    4. Change of Plans – approvals
- Maintains contact with Contractors.
- Determines upgrade or downgrade of personal protective equipment (PPE) based on Site conditions and/or real time monitoring results.
- Ensures that monitoring instruments are calibrated daily or as manufacturers suggested instructions determine.
- Submits and maintains health and safety field log books, daily safety logs, training logs, air monitoring result reports, and weekly safety report.

### 2.4 Field Personnel and Subcontractors

- Report any unsafe or potentially hazardous conditions to the SSO.
- Maintain knowledge of the information, instructions, and emergency response actions contained in the HASP.
- Comply with rules, regulations, and procedures as set forth in this HASP and any revisions, which are instituted.
- Prevent admittance to work Site by unauthorized personnel.

## 3.0 SITE LOCATION AND PHYSICAL DESCRIPTION

Descriptions of the Site and surrounding property usage are included in the following sections. The location of the Site is presented in Figure 1.

The site is approximately 2.5 acres that is located in an industrial area of Brooklyn, New York located at 153 2nd street with the Gowanus Canal located north west of the site. Currently there is a 24,200 square foot 3-story building located in the eastern section of the site. There is some vegetation cover but the site is mostly covered with debris. The site is underlain by urban fill to a depth of 8 feet below land surface (ft bls), in some areas down to 24 ft bls. Below the urban fill is an organic silt layer representative of a historic wetland. The ground water ranges from 7 – 24 ft bls and flows northwest toward the Gowanus Canal.

Sanborn maps dating to 1886 show that the site was occupied by the Nassau Sulfur Works as well as the Smith and Shaw Mattress Materials and Paper Works. In 1904 the property was acquired by the Brooklyn Rapid Transit RR Power Plant. During operation of the Brooklyn Rapid Transit RR Power Plant coal was brought in by water and transferred below the site via a tunnel. In 1938 the site was turned over to the Williamsburg Power Plant Corporation and was used as a central power station. New York City Transit System acquired the site in 1950 and used this area as an electrical substation and switching yard until 1996.

Currently the site is inactive and is zoned as a manufacturing district by the City of New York. The area around the site is mostly light industrial use with very little residential. The site is bounded to the north by a 60ft filled in canal. To the east of the site is a storage facility. To the south there is a Verizon truck depot. To the west is the Gowanus Canal.

## 4.0 WASTE DESCRIPTION/CHARACTERIZATION

### 4.1 General

The following information is presented in order to identify the types of materials that may be encountered at the Site. The detailed information on these materials was obtained from:

- Sax's Dangerous Properties of Industrial Materials – Lewis Eight Edition
- Chemical Hazards of the Workplace – Proctor/Hughes
- Condensed Chemical Dictionary – Hawley
- Rapid Guide to Hazardous Chemical in the Workplace – Lewis 1990
- NIOSH Pocket Guide to Chemical Hazards – 2005
- ACGIH TLV Values and Biological Exposure Indices
- OSHA 29 CFR 1910.1000

### 4.2 Chemical Data Sheets

Several chemicals that may potentially be present in soils and groundwater at the Site, based on previous soil, soil vapor and groundwater sampling results and historic operations conducted at the Site that have been identified. The Summary of Toxicological Data is found in Table 1 and is provided for review of chemicals that may be encountered. The Summary of Toxicological Data Sheets provides information such as each chemical's characteristics, health hazards, protection, and exposure limits.

#### 4.2.1 Contaminants of Concern

Soil and groundwater contaminants that may be encountered during drilling and sampling activities include both organic and inorganic compounds. Prior investigations at the site have indicated detection of Volatile Organic Compounds (VOCs), Semivolatile Organic Compounds (SVOCs), Polychlorinated Biphenyls (PCB), and metals.

The toxicological, physical, and chemical properties of potential contaminants are also presented in Table 1.

## 5.0 HAZARD ASSESSMENT

The potential to encounter chemical hazards is dependent upon the work activity performed (intrusive versus non-intrusive) and the duration and location of the work activity. Such hazards could include inhalation and/or skin contact with chemicals/gases that could cause: dermatitis, skin burns, being overcome by vapors or asphyxiation.

Physical hazards that may be encountered during Site work include: heat and cold stress, exposure to excessive noise, loss of limbs, being crushed, head injuries, punctures, cuts, falls, electrocution, bruises, structural integrity of buildings, asbestos and lead paint exposure, and other physical hazards due to motor vehicle operation, heavy equipment and power tools.

Biological hazards may exist during Site activities. These hazards include exposure to insect bites/stings, animals and animal wastes, mold and bloodborne pathogens.

Prior to the beginning of each new phase of work, an activity hazard analysis will be prepared by the SSO with assistance from the CHSM. The analysis will address the hazards for each activity performed in the phase and will present the procedures and safeguards necessary to eliminate the hazards or reduce the risk. The Job Safety Analysis Sheets are located in Appendix A.

### 5.1 Chemical Hazards

The potential for personnel and subcontractors to come in contact with chemical hazards may occur during the following tasks:

- Drilling Activities
- Decontamination Activities

For chronic and acute toxicity data, refer to the Summary of Toxicological Data Sheets in Table 1 for further details on compound characteristics.

#### 5.1.1 Exposure Pathways

Exposure to these compounds during ongoing activities may occur through inhalation of contaminated dust particles, inhalation of VOCs, SVOCs, PCBs and metals, dermal absorption,

and accidental ingestion of the contaminant by either direct or indirect cross-contamination activities.

Inhalation of contaminated dust particles (VOCs, SVOCs, and inorganics) can occur during adverse weather conditions (high or changing wind directions) or during operations that may generate airborne dust such as excavation and loading of contaminated soils. Dust control measures such as applying water to roadways and excavations will be implemented where visible dust is generated. Where dust control measures are not feasible or effective, respiratory protection will be used when necessary (see Section 9.2.2 for monitoring procedures and action levels).

### 5.1.2 Operational Action Levels

A decision-making protocol for an upgrade in levels of protection and/or withdrawal of personnel from an area based on atmospheric hazards is outlined in Table 2.

### 5.1.3 Additional Precautions

Dermal absorption or skin contact with chemical compounds is possible during intrusive activities at the Site. The use of PPE in accordance with Section 8.2 and strict adherence to proper decontamination procedures should significantly reduce the risk of skin contact.

The potential for accidental ingestion of potentially hazardous chemicals is expected to be remote when good hygiene practices are used.

## 5.2 Physical Hazards

A variety of physical hazards may be present during Site activities. These hazards include typical construction activities: operation of motor vehicles and heavy equipment operation, the use of power and hand tools, roping and rigging of steel sheeting, walking on objects, tripping over objects, working on surfaces which have the potential to promote falling, skin burns, crushing of fingers, toes, limbs, head injuries caused by falling objects, temporary loss of one's hearing and/or loss of one’s eyesight. The referenced hazards are not unique and are generally familiar to most hazardous waste site workers at construction sites. Task specific safety requirements for each phase will be covered during safety briefings. Job Safety Analysis summaries are contained in Appendix A.

### 5.2.1 Noise

Noise is a potential hazard associated with operation of heavy equipment, power tools, pumps, and generators. High noise equipment operations will be evaluated at the discretion of the SSO. Employees with an 8-hour time weighted average exposure exceeding 85 dBA will be included in a hearing conservation program in accordance with 29 CFR 1910.95 and 1926.52.

It is mandated that employees working around heavy equipment or using power tools that produce noise levels exceeding 90 dBA wear hearing protection that shall consist of earplugs or protective earmuffs.

### 5.2.2 Heat Stress

Heat stress is a significant potential hazard associated with the use of protective equipment in a hot weather environment. The human body is designed to function at a certain internal temperature. When metabolism or external sources (fire or hot summer day) cause the body temperature to rise, the body seeks to protect itself by triggering cooling mechanisms. The SSO will monitor the air temperature (as described later in this section) to determine potential adverse effects the weather can cause onsite personnel. Excess heat is dissipated by two means:

- Changes in blood flow to dissipate heat by convection, which can be seen as "flushing" or reddening of the skin in extreme cases.
- Perspiration is the release of water through skin and sweat glands. While working in hot environments, evaporation of perspiration is the primary cooling mechanism.

Protective clothing worn to guard against chemical contact effectively stops the evaporation of perspiration. Thus the use of protective clothing increases heat stress concerns.

The major disorders due to heat stress are heat cramps, heat exhaustion, and heat stroke. Heat cramps are painful spasms, which occur in the skeletal muscles of workers who sweat profusely in the heat and drink large quantities of water, but fail to replace the body’s lost salts or electrolytes. Drinking water while continuing to lose salt tends to dilute the body's extracellular fluids. Soon water seeps by osmosis into active muscles and causes pain. Muscles fatigued from work are usually most susceptible to cramps.

Extreme weakness or fatigue, dizziness, nausea, and headache characterize heat exhaustion. In serious cases, a person may vomit or lose consciousness. The skin is clammy and moist, complexion pale or flushed, and body temperature normal or slightly higher than normal. Treatment is rest in a cool place and replacement of body water lost by perspiration. Mild cases may recover spontaneously with this treatment; severe cases may require care for several days. There are no permanent effects.

Heat stroke is a medical emergency. It is a very serious condition caused by the breakdown of the body's regulating mechanisms. The skin is very dry and hot with red mottled or bluish appearance. Unconsciousness, mental confusion, or convulsions may occur. Without quick and adequate treatment, the result can be death or permanent brain damage. As first aid treatment, the person should be moved to a cool place. Body heat should be reduced artificially, but not too rapidly, by soaking the person's clothes in water and fanning the individual.

Steps that can be taken to reduce heat stress are:

- Acclimate the body. Allow a period of adjustment to make further heat exposure endurable.
- Drink more liquids to replace the body water lost during sweating.
- Rest is necessary and should be conducted under the direction of the SSO.
- Wear personal cooling devices. These are two basic designs; units with pockets for holding frozen packets and units that circulate fluid from a reservoir through tubes to different parts of the body. Both designs can be in the form of a vest, jacket, or coverall. Some circulating units also have a cap for cooling the head.
- Wear long cotton underwear under chemical protective clothing. The cotton will absorb perspiration and will hold it close to the skin. This will provide the body with the maximum cooling available from the limited evaporation that takes place beneath chemical resistant clothing. It also allows for rapid cooling of the body when the protective clothing is removed.

Heat stress is a significant hazard associated with using protective equipment in hot weather environments. Local weather conditions may produce conditions which will require restricted work schedules in order to protect employees.

Appendix B contains procedures for heat stress; these will be used as a guideline and to provide additional information.

### 5.2.3 Cold Stress

Cold temperatures are a significant potential hazard. Examples of cold temperature hazards are frostbite and hypothermia.

Frostbite is the most common injury resulting from exposure to cold. The extremities of the body are most often affected. The signs of frostbite are:

- The skin turns white or grayish-yellow.
- Pain is sometimes felt early but subsides later. Often there is no pain.
- The affected parts feel intensely cold and numb.

Hypothermia is characterized by shivering, numbness, drowsiness, muscular weakness, and a low internal body temperature when the body feels extremely warm. This can lead to unconsciousness and death. With both frostbite and hypothermia, the affected areas need to be warmed quickly. Immersion in warm water is an effective means of warming the affected areas quickly. In such cases, medical assistance will be sought.

To prevent these effects from occurring, persons working in the cold should wear adequate clothing and reduce the time spent in the cold area. The field SSO is responsible for determining appropriate time personnel should spend in adverse weather conditions and will monitor this.

Appendix B, which contains the Heat and Cold Stress Guidelines, provides additional information.

### 5.2.4 Asbestos

Asbestos was a widely used, mineral-based material that is resistant to heat and corrosive chemicals. Depending on the chemical composition, fibers may range from coarse to silky. The properties that make asbestos fibers valuable to industry are its high-tensile strength, flexibility, heat and chemical resistance, and good frictional properties. Asbestos is a common naturally occurring group of fibrous minerals. Asbestos fibers had been used in a variety of building materials; generally, most asbestos that remains today is found in pipe insulation, doors, textured

paints and plasters, structural fireproofing, roofing materials, and floor tiles. Friable asbestos (that is, material that contains more than 0.1% asbestos by weight and can be crumbled by hand) is a potential hazard because it can release fibers into the air if disturbed. Roux Associates personnel will not disturb any suspected asbestos material. If asbestos material is suspected, work in the area will stop and will be cordoned off to limit access to the suspected material. The material will be analyzed and sampled by a qualified professional before additional work is completed in the area. If the material is classified as asbestos material it will be sealed in place of removed by qualified professionals.

### 5.2.5 Structural Integrity

The structural integrity of a building and the safety of the individuals inside depend on meeting and maintaining national and local building codes. Structural integrity can range from minor defects such as loose floorboards and roof leaks to major defects such as floors and walls sagging and collapsed roofs. Numerous other structural defects can exist with or without consequence to the occupants. If Roux Associates personnel detect a problem, they should notify their supervisor, who in turn, should seek the opinion of a qualified structural engineer to offer an opinion regarding the integrity of the building. If in the opinion of the qualified engineer it is unsafe, no work can proceed until a solution to rectify the situation has been implemented.

It is presently known that the onsite buildings have been unoccupied for some time and the security guard reports vandalism and stripping/theft of equipment, spare materials, wiring, copper piping, and metals within the buildings and leaking roofs in some areas. As such, personnel will take this into consideration during the initial site visits and communicate this potential hazard during the safety tailgate meetings to all workers entering the site.

### 5.2.6 Lockout/Tagout

Roux Associates and all Site contractors will develop a lockout/tagout plan in the event of the repair of electrical, pneumatic, hydraulic, and/or mechanical systems, per OSHA requirements under 29 CFR 1910.147.

### 5.3 Biological Hazards

The biological hazards, which have the potential to cause adverse health effects, are from exposure to domestic flies, mosquitoes, insects, animals and animal wastes, mold, bloodborne pathogens, and poison ivy. The Job Safety Analysis (Appendix A) suggests controls for various hazards to be potentially encountered onsite.

#### 5.3.1 Insect Stings

Stings from insects are often painful, cause swelling and can be fatal if a severe allergic reaction such as anaphylactic shock occurs. If a sting occurs, the stinger should be scraped out of the skin, opposite of the sting direction. The area should be washed with soap and water followed by application of an ice pack.

If the victim has a history of allergic reaction, s/he should be taken to the nearest medical facility. If the victim has medication to reverse the effects of the sting, it should be taken immediately with follow-up at the medical facility.

If the victim experiences a severe reaction, a constricting band should be placed between the site of the sting and the heart. The site should be kept below the heart if possible. A physician should be contacted immediately for further instructions.

#### 5.3.2 Animals and Animal Wastes

Due to most of the onsite structures being abandoned for several years, there lies the potential for various wildlife to reside within the structures, including, but not limited to, pigeons, bats, mice, rats, squirrels, raccoons and feral cats. Certain animals can represent significant sources (vectors) of disease transmission. Precautions to avoid or minimize potential contact with (biting) animals (such as some of the above listed) or animal waste and/or deceased animals should be considered prior to all field activities. Rats, squirrels, raccoons, feral cats and other wild animals can inflict painful bites which can also cause disease (i.e. rabies, as in the case of rabid animals). Site personnel should avoid contact with any of the above animals.

If contact occurs, be sure to clean the area thoroughly with soap and water as soon as possible. If a bite occurs, the area should be cleaned thoroughly immediately with soap and water and medical attention should be sought.

### 5.3.3 Mold

The various states of disrepair of the majority of the onsite structures have led to leaking roofs and the collection of water which may have led to the growth of mold within the buildings.

Although mold affects individuals differently and to different degrees, the following are some of the most common adverse health effects:

- Respiratory problems – wheezing, difficulty breathing;
- Nasal and sinus congestion;
- Eyes – burning, watery, reddened, blurry vision, light sensitivity;
- Dry, hacking cough;
- Sore throat;
- Nose and throat irritation;
- Shortness of breath and lung disease;
- Chronic fatigue;
- Skin irritation;
- Central nervous system (headaches, loss of memory, and mood changes);
- Aches and pains;
- Fever;
- Headaches;
- Diarrhea; and
- Immune system suppression.

Decisions about removing individuals from an affected area must be based on the results of a medical evaluation and made on a case-by-case basis.

Workers that discover the visible presence of mold in excess of 10 sq. feet need to notify the SSO for consultation. If a worker smells mold and feels that he/she is experiencing symptoms of exposure, he/she should retreat and report the symptoms to the SSO.

### 5.3.4 Bloodborne Pathogens

The majority of the occupational tasks onsite will not involve a significant risk of exposure to blood, blood components, or body fluids. The highest risk of acquiring any bloodborne pathogen for onsite employees will be following an injury. When administering first aid care, there are potential hazards associated with bloodborne pathogens that cause diseases such as Human Immunodeficiency Virus (HIV), Hepatitis B (HBV), Hepatitis A (HAV), Hepatitis C (HCV), or the Herpes Simplex Virus (HSV). An employee who has not received the appropriate certifications and been trained in bloodborne pathogens should never perform first aid and/or CPR.

In order to minimize any potential pathogen exposure, all employees should use hand washing facilities on a regular basis. Additionally, the following universal precautions should be followed to prevent further potential risk:

- Direct skin or mucous membrane contact with blood should be avoided.
- Open skin cuts or sores should be covered to prevent contamination from infectious agents.
- Body parts should be washed immediately after contact with blood or body fluids that might contain blood, even when gloves or other barriers have been used.
- Gloves and disposable materials used to clean spilled blood shall be properly disposed of in an approved medical waste container.
- First aid responders shall wear latex or thin mil nitrile gloves when performing any procedure risking contact with blood or body substances.
- Safety glasses will be worn to protect the eyes from splashing or aerosolization of body fluids.
- A CPR mask will be worn when performing CPR to avoid mouth-to-mouth contact.
- Work gloves will be worn to minimize the risk of injury to the hands and fingers when working on all equipment with sharp or rough edges.
- Never pick up broken glass or possible contaminated material with your unprotected hands.
- Never handle wildlife (living or deceased) encountered onsite.

### 5.3.5 Poison Ivy

There are vegetated areas of the site that may serve as adequate growing areas for poison ivy. If exposed to poison ivy, personnel will wash skin thoroughly with soap and water as soon as possible.

## 5.4 Hazard Assessment

| Task | Hazards | Risk of Exposure |
|---|---|---|
| Decontamination | Inhalation/Skin Contact | Moderate |
| | Heat Stress/Cold Stress | Moderate |
| | Physical Injury | Moderate |
| | Noise | Low |
| Drilling/Sampling | Inhalation/Skin Contact | Moderate |
| | Heat Stress/Cold Stress | Moderate |
| | Noise | Moderate/High |
| | Physical Injury | Moderate |

## 6.0 TRAINING

### 6.1 General Health and Safety Training

In accordance with Roux Associates' corporate policies, and pursuant to 29 CFR 1910.120, hazardous waste site workers shall, at the time of the job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations. As a minimum, the training shall have consisted of instruction in the topics outlined in the above reference. Personnel who have not met the requirements for initial training will not be allowed to work in any Site activities in which they may be exposed to hazards (chemical or physical).

Completion of a 40-hour Health and Safety Training Course for Hazardous Waste Operations or an approved equivalent will fulfill the requirements of this section.

In addition to the required initial training, each employee shall have received 3 days of directly supervised on-the-job training. This training will address the duties the employees are expected to perform.

Roux Associates' SSO has the responsibility of ensuring that personnel assigned to this project comply with these requirements.

### 6.2 Annual Eight-Hour Refresher Training

Current, annual 8-hour refresher training will be required of all hazardous waste site field personnel in order to maintain their qualifications for fieldwork. The following topics may be included; toxicology, respiratory protection, including air purifying devices and self-contained breathing apparatus (SCBA), medical surveillance, decontamination procedures, and personal protective clothing. In addition, topics deemed necessary by Roux Associates' Health and Safety Director may be added to the above list.

### 6.3 Site-Specific Training

Site personnel will receive training that will specifically address the activities, procedures, monitoring and equipment for Site operations. It will include Site and facility layout, hazards, first aid equipment locations and emergency services at the Site, and will highlight all provisions contained within this HASP. This training will also allow field workers to clarify anything they do

not understand and to reinforce their responsibilities regarding safety and operations for their particular activity.

### 6.4 Onsite Safety Meetings

Daily safety meetings will be presented each morning to discuss potential safety concerns for the upcoming activities.

The briefings will also provide a forum to facilitate conformance with safety requirements and to identify performance deficiencies related to safety during daily activities or as a result of safety audits by Roux Associates or other involved parties.

### 6.5 First Aid and CPR

The SSO will identify those individuals having first aid, CPR and Bloodborne Pathogen training in order to ensure that emergency medical treatment is available during field activities. The training will be consistent with the requirements of the American Red Cross Association and, as applicable, the American Heart Association. Certification and appropriate training documentation will be kept with the Site personnel records.

### 6.6 Additional Training

The CHSM may require additional or specialized training throughout the project. Such training shall be in the safe operation of heavy or power tool equipment or hazard communication training or other topic deemed Site appropriate.

### 6.7 Subcontractor Training

All subcontractor personnel working on the Site shall have completed the 40-hour and 8-hour training requirements and meet the medical surveillance requirements found in Section 7.1. Subcontractor training shall be performed in accordance with 29 CFR 1910.120 and HASP specifications. In certain unique situations (e.g., mechanical failure of equipment), the non-trained individual performing emergency repairs may be allowed, at the discretion of the SSO, to perform repairs when no intrusive activities are being performed and provisions have been made to mitigate potential exposure.

## 7.0 MEDICAL SURVEILLANCE PROCEDURES

### 7.1 General

A Medical Surveillance Program has been established as part of this plan and is included in Appendix C. Roux Associates and subcontractor personnel performing field work at the Site are required to have passed a complete medical surveillance examination in accordance with 29 CFR 1910.120(f). A physician's medical release for work will be confirmed by the SSO before an employee can begin Site activities. Such examinations shall include a statement as to the worker's present health status, the ability to work in a hazardous environment (including any required PPE, which may be used during temperature extremes), and the worker's ability to wear respiratory protection.

In the event that personal medical information is needed for emergency treatment, information will be made available to the treating health care professional through Roux Associates' Human Resources Department and the CHSM.

## 8.0 SITE CONTROL, PERSONAL PROTECTIVE EQUIPMENT, AND COMMUNICATIONS

A modified Site control approach may be utilized since activities will be limited to site inspection/geophysical survey, drilling and sampling only during this phase of work. If invasive excavation work is necessary, the following four-zone approach will be used.

### 8.1 Site Control

Based on the Site history and operations, a potential for the presence of hazardous material does exist. During drilling and sampling work areas will be delineated with high visibility cones and/or caution tape. A dedicated decontamination area will be established to decontaminate all equipment used for sampling.

If remedial activities are necessary, a four-zone approach will be employed in order to prevent the spread of contamination from the disturbed areas onsite. The four zones include: the Exclusion Zone (EZ), the Contamination Reduction Zone (CRZ), Contamination Reduction Corridor (CRC) and the Support Zone (SZ). A stepped remedial approach will be managed and the zones modified as the work progresses. Each of the areas will be defined through the use of control barricades and/or construction/hazard fencing. A clearly marked delineation between the SZ and the remaining three zones, the CRZ, CRC and EZ, will be maintained. The preferred method will utilize high visibility orange fencing and hand-driven metal posts, or orange cones. Signage will be posted to further identify and delineate these areas.

#### 8.1.1 Support Zone

The Support Zone (SZ) is an uncontaminated area that will be the field support area for the Site operations. The SZ will contain the temporary project trailers and provides for field team communications and staging for emergency response. Appropriate sanitary facilities and safety equipment will be located in this zone. Potentially contaminated personnel or materials are not allowed in this zone. The only exception will be appropriately packaged/decontaminated and labeled samples. Meteorological conditions will be observed and noted from this zone, as well as those factors pertinent to heat and cold stress.

### 8.1.2 Contamination Reduction Zone

A Contamination Reduction Zone (CRZ) is established between the exclusion zone and the support zone. The CRZ contains the Contamination Reduction Corridor (CRC) and provides an area for decontamination of personnel and equipment. The CRZ will be used for general Site entry and egress in addition to access for heavy equipment and emergency support services. Personnel are not allowed in the CRZ without:

- A buddy (co-worker);
- Appropriate PPE;
- Medical authorization;
- Training certification; and
- A need to be in the zone.

### 8.1.3 Exclusion Zone

The area where contamination exists is considered to be the Exclusion Zone (EZ). All areas where excavation, heavy equipment use, and handling of contaminated materials take place are considered the EZ. This zone will be clearly delineated by orange high visibility fencing. Safety tape may be used as a secondary delineation within the EZ. The zone delineation markings may be opened in areas for varying lengths of time to accommodate equipment operation or specific construction activities. The SSO may establish more than one EZ where different levels of protection may be employed or where different hazards exist. Personnel are not allowed in the EZ without:

- A buddy (co-worker);
- Appropriate PPE;
- Medical authorization;
- Training certification; and
- A need to be in the zone.

The purpose of the Exclusion Zone Policy is to establish the minimum clearance distance that must be maintained between workers and heavy equipment while equipment is in operation (i.e., engaged or moving). The intent is to have no personnel or other equipment entering the

Exclusion Zone while the equipment is in operation/moving to ensure that Roux and Subcontractor employees are not unnecessarily exposed to the hazards of the equipment. The complete Heavy Equipment Exclusion Zone Program is detailed in Appendix D.

## 8.2 Personal Protective Equipment

### 8.2.1 General

The level of protection worn by field personnel will be enforced by the SSO. Levels of protection for general operations are provided below and are defined in this section. Levels of protection may be upgraded at the discretion of the SSO. All decisions on the level of protection will be based upon a conservative interpretation by the SSO of the information provided by air monitoring results, environmental results and other appropriate information. Any changes in the level of protection shall be recorded in the health and safety field logbook.

### 8.2.2 Personal Protective Equipment Specifications

The initial level of personal protective equipment is Level D. It is not anticipated that either Level B or Level C protection will be necessary.

Although not anticipated, any tasks requiring Level B personal protective equipment (PPE) will utilize the following equipment:

- Positive pressure, full facepiece, self-contained breathing apparatus (SCBA) or positive pressure, supplied air respirator with escape SCBA (NIOSH approved)
- Disposable coveralls (Tyvek, Poly-coated Tyvek, or Saranex)
- Gloves, inner: latex or nitrile
- Gloves, outer: cut-resistant
- Chemical resistant boots over the work boots
- Steel toe work boots
- Hard hat
- Hearing protection (as needed)
- Boot cover (as needed)

For tasks requiring Level C PPE, the following equipment may be used in any combination:

- Full-face, air purifying, canister-equipped respirators (NIOSH approved) utilizing Organic Vapor/Acid Gas and P-100 filters (half-face if approved by SSO)
- Disposable coveralls (Tyvek, Poly-coated Tyvek, or Saranex) as required
- Gloves, inner: latex or nitrile as required
- Gloves, outer: cut-resistant
- Chemical resistant boots over the work boots as required
- Steel toe work boots
- Hard hat
- Hearing protection (as needed)
- Safety glasses (if half-mask is utilized)
- Boot covers (as needed)

The Minimum level of PPE for entry onto the Site is Level D PPE. The following equipment shall be used:

- Work uniform (long pants, sleeved shirt)
- Hard hat
- Steel toe work boots
- Safety glasses
- Boot covers (as needed)
- Hearing protection (as needed)
- Reflective safety vest

Modified Level D PPE consists of the following:

- Regular Tyvek coveralls (Poly-coated Tyvek as required)
- Outer gloves: cut-resistant, leather, cotton (as required)
- Inner gloves: latex or nitrile (doubled) as required
- Chemical resistant boots over work boots (as required)

- Steel toe work boots
- Hard hat
- Safety glasses
- Hearing protection as needed
- Reflective safety vest

### 8.2.3 Initial Levels of Protection

Levels of protection for the proposed scope of work may be upgraded or downgraded depending on direct-reading instruments or personal monitoring. The following are the initial levels of protection that shall be used for each planned field activity:

| Activity | Initial level of PPE |
|---|---|
| Mobilization/Demobilization | D |
| Site Inspection/Geophysical Survey | D |
| Decontamination | D |
| Drilling | D |
| Monitoring Well Gauging, Purging and Sampling | D |

## 8.3 Communications

If working in level C/B respiratory protection is required, personnel may find that communication becomes a more difficult task and process to accomplish. Distance and space further complicate this. In order to address this problem, electronic instruments, mechanical devices, or hand signals will be used as follows:

Telephones – Mobile telephones will be carried by designated personnel for communication with emergency support services/facilities.

Radios – Two-way radios will be utilized onsite for communications between field personnel in areas where visual contact cannot be maintained and where hand signals cannot be employed.

Air Horn – Available as posted in the Site trailer or support zone to alert field personnel to an emergency situation. The emergency signal will be three sharp blasts of the air horn.

Hand Signals – This communication method will be employed by members of the field team along with use of the buddy system. Signals become especially important when in the vicinity of heavy moving equipment and when using Level B respiratory equipment. The signals shall

become familiar to the entire field team before Site operations commence, and will be reinforced and reviewed during site-specific training.

| **Signal** | **Meaning** |
|---|---|
| Hand gripping throat | Out of air; can't breathe |
| Grip partner's wrist | Leave area immediately; no debate |
| Hands on top of head | Need assistance |
| Thumbs up | OK; I'm all right; I understand |
| Thumbs down | No; Unable to understand you, I'm not all right |

## 9.0 MONITORING PROCEDURES

### 9.1 General

Monitoring will be performed to verify the adequacy of respiratory protection, to aid in Site layout, and to document worker exposure. If air monitoring in these areas indicates the presence of potentially hazardous materials, control measures will be implemented. All monitoring instruments shall be operated by qualified personnel only and will be calibrated daily prior to use or, more often, as necessary. General air monitoring will be performed in accordance with the general Community Air Monitoring Plan as described by the NYSDEC.

### 9.2 Exclusion Zone Monitoring

#### 9.2.1 Instrumentation

The following monitoring instruments will be available for use during field operations as necessary. There will be a minimum of one of each piece of equipment on the Site at all times during intrusive activities:

- Photoionization Detector (PID) with 10.6 EV probe or Flame Ionization Detector (FID) or equivalent.
- Dust/Particulate Monitor (DM), Dusttrak II, or equivalent.

A PID will be used to monitor VOCs in active work areas during intrusive activities. VOCs shall also be measured upwind of the work areas to determine background concentrations.

A particulate monitor shall be used to measure concentrations of dust and particulate matter.

When deemed necessary, a CGI/$O_2$ meter shall be used to monitor for combustible gases and oxygen content during confined space entry or when the SSO deems necessary.

Calibration records shall be documented and recorded daily and included in the daily air monitoring report. This report will be specific to work area monitoring. All instruments shall be calibrated before and after each daily use in accordance with manufacturer's procedures.

#### 9.2.2 Action Levels

Action levels for the upgrading of PPE requirements in the HASP will apply to all Site work during investigation and remediation activities at the Site. Action levels are for known

contaminants using direct reading instruments in the Breathing Zone (BZ) for VOCs and particulates, and at the source for combustible gases. The BZ will be determined by the SSO, but is typically 4 to 5 feet above the work area surface or elevation. The action levels to be utilized for the Site are found in Table 2.

### 9.2.3 Monitoring During Field Activities

Intrusive Operations – Continuous Breathing Zone Air Monitoring will be performed by the SSO during drilling activities. Real-time monitoring for all onsite activities will be accomplished as follows:

- Monitoring of VOCs in and around the work zones.
- Monitoring for particulates in and around the work zones, when necessary.

The frequency of monitoring may be modified by the SSO, after consultation with the Project Principal. The rationale for any modification must be documented in the HASP.

## 10.0 SAFETY CONSIDERATIONS

### 10.1 General

In addition to the specific requirements of this HASP, common sense should be used at all times.

The following general safety rules and practices will be in effect at the site.

- All open holes, trenches, and obstacles will be properly barricaded in accordance with local Site needs and requirements. Proximity to traffic ways, both pedestrian and vehicular, and location of the open hole, trench, or obstacle will determine these needs.

- All excavation and other Site work will be planned and performed with consideration for underground lines.

- Smoking and ignition sources in the vicinity of potentially flammable or contaminated material are strictly prohibited.

- Drilling, boring, and use of cranes and drilling rigs, erection of towers, movement of vehicles and equipment, and other activities will be planned and performed with consideration for the location, height, and relative position of aboveground utilities and fixtures, including signs; lights; canopies; buildings and other structures and construction; and natural features such as trees, boulders, bodies of water, and terrain.

- When working in areas where flammable vapors may be present, particular care shall be exercised with tools and equipment that may be sources of ignition. All tools and equipment provided must be properly bonded and/or grounded.

- Approved and appropriate safety equipment (as specified in this HASP), such as eye protection, hard hats, hand protection (nitrile, leather and/or cut resistant gloves as necessary), foot protection, and respirators, must be worn in areas where required. In addition, eye protection must be worn when sampling soil or water that may be contaminated.

- No smoking, eating, chewing tobacco, gum chewing, applying cosmetics or drinking will be allowed outside the SZ.

- Contaminated tools and hands must be kept away from the face.

- Personnel must use personal hygiene safe guards (washing up) at the end of the shift.

- Each sample must be treated and handled as though it was contaminated.

- Persons with long hair and/or loose-fitting clothing that could become entangled in power equipment must take adequate precautions.

- Horseplay is prohibited in the work area.

- Work while under the influence of intoxicants, narcotics, controlled substances or prescription medication that adversely affects performance is strictly prohibited.

### 10.2 Traffic Control

Traffic control methods and barricades will be used as needed when working in areas of vehicular traffic. Since the site is fenced off and the areas of investigation are not in current use, outside vehicular and pedestrian traffic is not considered to be an issue when working in other areas of the Site.

### 10.3 Sample Handling

Personnel responsible for handling of samples will wear the prescribed level of protection. Samples are to be identified as to their hazard and packaged as to prevent spillage or breakage. Any unusual sample conditions shall be noted. Laboratory personnel and all field personnel shall be advised of sample hazard levels and the potential contaminants present. This can be accomplished by a phone call to the lab coordinator and/or including a written statement with the samples reviewing lab safety procedures in handling in order to assure that the practices are appropriate for the suspected contaminants in the sample.

### 10.4 Barge Safety

The land behind the bulkhead is a steep embankment. A ladder shall be placed on the slope and secured at the top to allow safe access down the slope to the bulkhead. The contractor will provide a ladder to get on and off the drill barge from the bulkhead. The barge ladder shall be secured to the bulkhead and set at a maximum slope of 4 vertical to 1 horizontal. A spotter shall be present at the barge ladder when in use. Only essential personnel shall be allowed to approach the barge. All personnel shall wear leather gloves while accessing the barge; personal floatation device shall be worn by all personnel working over the water, on the barge, or within 15 ft of the shoreline.

The deck of the barge shall be kept clean and dry to minimize the potential from trip, slip and fall hazards. During inclement weather (e.g., rain, snow, high winds), the deck of the barge, access ladders, and shoreline slope can become slippery and dangerous to work on. In the event of inclement weather, all personnel shall disembark from the barge. Work shall not resume on the barge until weather conditions permit.

### 10.5 Working Over or Near Water

This section describes safety considerations and procedures while working from land over or near water on the Site.

#### 10.5.1 Hazards

Hazards associated with working around water include drowning, frostbite, hypothermia, and injury from falling into the water. All personnel working on the water or within 15 feet of the bulkhead are required to wear life vests.

#### 10.5.2 Prevention

When working over or near water where there is potential for drowning. Engineering controls such as the installation of guardrails or other personal protective equipment shall be used to prevent falling into the water. In addition, flotation devices must be worn and other lifesaving devices must be available. Guardrails or secured fencing shall be provided for deck openings, elevated surfaces, and similar locations where persons may slip or fall from them. Any obstruction in a passageway that restricts normal passage shall be posted with warning signs or distinctively marked. All personnel shall not be permitted to pass fore and aft, over or around the deck loads unless there is a safe passage. Decks and other working surfaces will be maintained in a safe condition and adequate safe walkways will be maintained for passage around the deck.

## 11.0 DECONTAMINATION AND DISPOSAL PROCEDURES

### 11.1 Contamination Prevention

Contamination prevention should minimize worker exposure and help ensure valid sample results by precluding cross-contamination. Procedures for contamination avoidance include:

Personnel

- Do not walk through areas of obvious or known contamination.
- Do not directly handle or touch contaminated materials.
- Make sure that there are no cuts, tears or other signs of deterioration in PPE.
- Fasten all closures in suits; cover with tape, if necessary.
- Particular care should be taken to protect any skin injuries.
- Stay upwind of airborne contaminants.
- Do not carry cigarettes, cosmetics, gum, etc., into contaminated areas.

Sampling/Monitoring

- When required by the SSO, cover instruments with clear plastic, leaving openings for sampling ports.
- Bag sample containers prior to emplacement of sample material.

Heavy Equipment

- Care should be taken to limit the amount of contamination that comes in contact with heavy equipment (tires, contaminated augers).
- If contaminated tools are to be placed on non-contaminated equipment for transport to a decontamination area, plastic should be used to keep the equipment clean.

### 11.2 Personnel Decontamination

A field wash for equipment and PPE shall be set up and maintained for all persons exiting the EZ. The system will include a gross wash and rinse for all disposable clothing and boots worn in the EZ. As necessary, equipment and facilities will be available for personnel to wash their hands, arms, neck, and face.

### 11.3 Equipment Decontamination

All potentially contaminated equipment used at the Site will be decontaminated to prevent contaminants from leaving the Site. The decontamination area will provide for the containment of all wastewater from the decontamination process. Respirators and any other PPE that comes in contact with contaminated materials shall pass through a field wash in the decontamination area, and a thorough decontamination at the end of the day. All decontamination rinse water will be collected and managed in accordance with all applicable regulations.

Due to one of the contaminants of concern at the site being PCBs, a more aggressive decontamination will be required for equipment used throughout the scope of work. Disposable equipment (i.e., Tyvek suits, gloves, boot covers, etc.) will containerized in a plastic lined 55-gallon drum or similar container to be sealed and transported offsite for disposal.

For non-disposable equipment (i.e., tools, sampling devices and containers, monitoring instruments (as applicable), etc.), decontamination will be competed on plastic sheeting so all contaminated material can be contained for proper disposal. This will be completed during typical Level D or modified Level D PPE. All PCB impacted material shall be decontaminated as per 40 CFR Part 761.79 – Decontamination Standards and Procedures for removing PCBs, with reference to 40 CFR Part 761 Subpart S (Subpart S).

If visible PCB-containing liquid is present on the surface to be cleaned, thoroughly wipe or mop the entire surface with absorbent paper or cloth until no liquid is visible on the surface. For this scope of work, it is assumed that equipment surfaces will be relatively clean and can be decontaminated using a double wash/rinse method as described in Subpart S.

Cover the entire surface with organic solvent in which PCBs are soluble to at least 5 percent by weight. Contain and collect any runoff solvent for disposal. Scrub rough surfaces with a scrub brush or disposable scrubbing pad and solvent such that each 900 $cm^2$ (1 square foot) of the surface is always very wet for 1 minute. Wipe smooth surfaces with a solvent-soaked, disposable absorbent pad such that each 900 $cm^2$(1 square foot) is wiped for 1 minute. Any surface <1 square foot shall also be wiped for 1 minute. Wipe, mop, and/or sorb the solvent onto absorbent material until no visible traces of the solvent remain.

Wet the surface with clean rinse solvent such that the entire surface is very wet for 1 minute. Drain and contain the solvent from the surface. Wipe the residual solvent off the drained surface using a clean, disposable absorbent pad until no liquid is visible on the surface.

The above steps will be completed a minimum of two times to complete decon of equipment. Approved solvents to be used can be either a decon solution, such as Simple Green, or detergent/water.

### 11.4 Decontamination during Medical Emergencies

If emergency life-saving first aid and/or medical treatment are required, normal decontamination procedures may need to be abbreviated or omitted. The Site SSO or designee will accompany contaminated victims to the medical facility to advise on matters involving decontamination, when necessary. The outer garments can be removed if they do not cause delays, interfere with treatment, or aggravate the problem. Respiratory equipment must always be removed. Protective clothing can be cut away. If the outer contaminated garments cannot be safely removed, a plastic barrier between the individual and clean surfaces should be used to help prevent contaminating the inside of ambulances and/or medical personnel. Outer garments are then removed at the medical facility. Attempt to wash or rinse the victim if it is known that the individual has been contaminated with an extremely toxic or corrosive material, which could also cause severe injury or loss of life to emergency response personnel. For minor medical problems (ambulatory) or injuries, the normal decontamination procedures will be followed. Note that heat stroke requires prompt treatment to prevent irreversible damage or death. Protective clothing must be promptly removed. Less serious forms of heat stress also require prompt attention and removal of protective clothing immediately. Unless the victim is obviously contaminated, decontamination should be omitted or minimized, and treatment begun immediately.

### 11.5 Disposal Procedures

A system of segregating all waste will be developed by the SSO.

All discarded materials, waste materials, or other objects shall be handled in such a way as to preclude the potential for spreading contamination, creating a sanitary hazard, or causing litter to be left onsite. All potentially contaminated materials (e.g., clothing, gloves, etc.,) will be bagged

or drummed as necessary, labeled and segregated for disposal. All non-contaminated materials shall be collected and bagged for appropriate disposal as domestic waste.

## 12.0 EMERGENCY PLAN

Should an emergency situation occur, the emergency plan, outlined in this section, shall be known by Roux Associates and all Subcontractors prior to the start of work. The emergency plan will be available for use at all times during Site work. The plan provides the phone numbers for the fire, police, ambulance, hospital, poison control centers, and directions to the hospital from the Site. This information is to be found in Section 1.2 of the HASP.

Various individual Site characteristics will determine preliminary actions taken to assure that this emergency plan is successfully implemented in the event of a Site emergency. Careful consideration must be given to the proximity of neighborhood housing or places of employment, and to the relative possibility of Site release of vapors, which could affect the surrounding community.

The emergency coordinator shall implement the contingency plan whenever conditions at the Site warrant such action. The coordinator will be responsible for coordination of the evacuation, emergency treatment, and transport of Site personnel as necessary, and notification of emergency response units and the appropriate management staff.

In cases where the project principal is not available, the SSO shall serve as the alternate emergency coordinator.

The SSO during an emergency will perform air monitoring as needed, as well as lend assistance and provide health and safety information to responding emergency personnel.

Site Personnel will endeavor to keep non-essential personnel away from the incident until the appropriate emergency resources arrive. At that time the responders will take control of the Site. Site personnel may be asked to lend assistance to emergency personnel such as during evacuations, help with the injured, etc.

### 12.1 Evacuation

Evacuation procedures will be discussed prior to the start of work and periodically during safety meetings. In the event of an emergency situation, such as fire, or explosion, an air horn,

automobile horn, or other appropriate device will be sounded for three (3) sharp blasts indicating the initiation of evacuation procedures. The emergency evacuation route shall be known by all site workers. Under no circumstances will incoming personnel or visitors be allowed to proceed into the area once the emergency signal has been given. The SSO or project principal must ensure that access for emergency equipment is provided and that all sources of ignition have been shut down once the alarm has been sounded. All Site personnel will assemble in the designated nearest safe location. Once the safety of all personnel is established, the fire department and other emergency response groups will be notified by telephone of the emergency.

### 12.2 Personnel Injury

Emergency first aid shall be applied onsite as appropriate. If necessary, the individual shall be decontaminated and transported to the nearest hospital. The SSO will coordinate with the CHSM and HR in the event that medical personnel need any health records on the injured worker and will complete the accident/incident reports in accordance with Section 13.4 of the HASP.

The ambulance/rescue squad shall be contacted for transport as necessary in an emergency. However, since non-emergency situations may require transport of an injured party by other means, the injured person shall be escorted to the occupational health clinic or hospital. Maps to these facilities are shown in Figure 2 and 3.

### 12.3 Accident/Incident Reporting

As soon as first aid and/or emergency response needs have been met, the following parties are to be contacted by telephone: (Direct contact, no phone messages).

| | | **Office:** | **Cell:** |
|---|---|---|---|
| 1. Project Principal: | Frank Cherena | 631-232-2600 | 631-445-0357 |
| 2. Office Health and Safety Manager: | Joe Gentile | 856-423-3768 | 610-844-6911 |
| 3. Site Health and Safety Officer: | Michele Abbene | 631-232-2600 | 631-680-4650 |

4. The employer of any injured worker, if not a Roux Associates employee.

Written confirmation of verbal reports are to be submitted within 24 hours. The report form entitled "Accident Report and Investigation Form" (Appendix E) is to be used for this purpose.

All representatives contacted by telephone are to receive a copy of this report. If the employee involved is not a Roux Associates employee, his employer shall complete an accident report and send it to Roux Associates for review and distribution. In addition to filling out the Accident Report and Investigation Form, if a Roux employee is involved in a motor vehicle accident, the employee must also complete the Accord form (Appendix F).

For reporting purposes, the term accident refers to fatalities, lost time injuries, restricted duty, job transfers, medical treatment, spill or exposure to hazardous materials (radioactive materials, toxic materials, explosive or flammable materials), fire, explosion, property damage, or potential occurrence (i.e., near miss) of the above.

Any information released from the health care provider, which is not deemed confidential patient information, is to be attached to the appropriate form. Any medical information, which is released by patient consent, is to be filed in the individual's medical record and treated as confidential.

### 12.4 Personnel Exposure

| | |
|---|---|
| Skin Contact: | Use copious amounts of soap and water. Wash/rinse affected area thoroughly, then provide appropriate medical attention. Eyes should be rinsed for 15 minutes upon chemical contamination. |
| Inhalation: | Move to fresh air and/or, if necessary, decontaminate/transport to hospital. |
| Ingestion: | Decontamination and transport to emergency medical facility. |
| Puncture Wound or Laceration: | Decontamination and transport to emergency medical facility. |

### 12.5 Adverse Weather Conditions

In the event of adverse weather conditions, the SSO or project principal will determine if work can continue without sacrificing the health and safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat stress and heat-related injuries.
- Potential for cold stress and cold-related injuries.
- Treacherous weather-related conditions.
- Limited visibility.

- Electrical storm potential.

Site activities will be limited to daylight hours and acceptable weather conditions. Inclement working conditions include heavy rain, fog, high winds, and lightning. Observe daily weather reports and evacuate if necessary in case of inclement weather conditions.

### 12.6 Short Service Employee Program

A Roux employee or a Roux subcontractor employee with less than six (6) months continuous service in the same job type or less than six (6) months continuous service with his/her current employer is a Short Service Employee (SSE).

Roux Associates senior management will, at a minimum, perform an annual assessment of the Short Service Employee Policy to determine its effectiveness and identify improvement opportunities.

SSEs shall not exceed 50% of Roux's workforce at any job site without prior written approval from the Office Manager (OM) and, when required by client contract or policy, approval from the designated client representative. The complete SSE Program is detailed in Appendix G.

## 13.0 LOGS, REPORTS AND RECORD KEEPING

The following is a summary of required health and safety logs, reports, and record keeping for this project.

### 13.1 Medical and Training Records

The employer keeps medical and training records. The subcontractor employer must provide verification of training and medical qualifications to the SSO. The SSO will keep a log of personnel meeting appropriate training and medical qualifications for Site work. The log will be kept in the project file. Roux Associates will maintain medical records in accordance with 29 CFR 1910.20.

### 13.2 Onsite Log

The SSO will keep a log of onsite personnel daily in the designated field book.

### 13.3 Exposure Records

Any personal monitoring results, laboratory reports, calculations, and air sampling data sheets are part of an employee exposure record. These records will be kept by Roux Associates in accordance with 29 CFR 1910.20.

### 13.4 Accident/Incident Reports

An accident/incident report must be completed following procedures given in Appendix F. The originals will be sent to Roux Associates for maintenance. Copies will be distributed as stated. A copy of the forms will be kept in the project file.

### 13.5 Daily Safety Logs

The Daily Safety Log form in Appendix H will be completed daily by the SSO and submitted to the project principal.

### 13.6 Weekly Safety Reports

The Weekly Safety Reports in Appendix I will be completed by the SSO and submitted to the designated Owner's representative, if requested.

### 13.7 Close-Out Safety Report

At the completion of the work, Roux Associates will submit a closeout Safety Report that will include all logs and reports generated during the project. The report will be signed and dated by the SSO and submitted to the Owner's Safety Manager and/or Owner's representative, if requested.

## 14.0 FIELD TEAM REVIEW

Each Roux Associates employee or subcontractor shall sign this section after site-specific training is completed and before being permitted to work at the Site.

*I have read and reviewed the Site Health and Safety Plan prepared for this Site. I understand and will comply with the provisions contained therein.*

Site/Project: BRT Powerhouse Facility
153 2nd Street
Brooklyn, New York

| Date | Name | Signature | Company |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**SSO CERTIFICATION OF**
**OCCUPATIONAL HEALTH CLINIC AND HOSPITAL DIRECTIONS**

Name of Roux Associates SSO: Michele Abbene

Date:_____

This is to certify that on _____, I personally drove the route to the CityMD urgent care facility and the New York Methodist Hospital as listed in the HASP. The Map Routings and Directions were/were not as listed in the plan. Listed below were conditions that resulted in different directions.

_____
Roux Associates Site Health and Safety Officer

# TABLES

1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site
2. Action Levels for Worker Breathing Zone

**Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at 153 2nd Street, Brooklyn, New York**

| Compound | CAS # | ACGIH TLV | NIOSH REL | OSHA PEL | IDLH | Routes of Exposure | Toxic Properties | Target Organs | Physical/Chemical Properties |
|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 83-32-9 | None established | None established | None established | None established | inhalation, ingestion, skin and/or eye contact | Irritation eyes, skin, respiratory system | Eyes, skin, respiratory system | Brown solid |
| Acetone | 67-64-1 | TWA 250 ppm<br>STEL 500 ppm | TWA 250 ppm (590 mg/m$^3$) | TWA 1000 ppm (2400 mg/m$^3$) | 2500 ppm [10%LEL] | inhalation, ingestion, skin and/or eye contact | Irritation eyes, nose, throat; headache, dizziness, central nervous system depression; dermatitis | Eyes, skin, respiratory system, central nervous system | Colorless liquid with a fragrant, mint-like odor<br>BP: 133°F<br>FLP: 0°F<br>UEL: 12.8%<br>LEL: 2.5%<br>Class IB Flammable Liquid |
| Anthracene (Coal Tar Pitch Volatile) | 65996-93-2 | TWA 0.2 mg/m$^3$ | Ca TWA 0.1 mg/m$^3$ (cyclohexane-extractable fraction) | TWA 0.2 mg/m$^3$ (benzene-soluble fraction) | Ca [80 mg/m$^3$] | inhalation, skin and/or eye contact | Dermatitis, bronchitis, [potential occupational carcinogen] | respiratory system, skin, bladder, kidneys | Black or dark-brown amorphous residue.<br>Combustible Solids |
| Antimony | 7440-36-0 | TWA 0.5 mg/m$^3$ | TWA 0.5 mg/m$^3$ | TWA 0.5 mg/m$^3$ | 50 mg/m$^3$ (as Sb) | inhalation, ingestion, skin and/or eye contact | Irritation eyes, skin, nose, throat, mouth; cough; dizziness; headache; nausea, vomiting, diarrhea; stomach cramps; insomnia; anorexia; unable to smell properly | Eyes, skin, respiratory system, cardiovascular system | Silver-white, lustrous, hard, brittle solid; scale-like crystals; or a dark-gray, lustrous powder.<br>BP: 2975°F |
| Arsenic (inorganic) | 7440-38-2 (metal) | TWA 0.01 mg/m3 | Ca<br>C 0.002 mg/m3 [15-min] | TWA 0.010 mg/m3 | Ca [5 mg/m3 (as As)] | Inhalation; ingestion; skin absorption; skin and/or eye contact | Ulceration of nasal septum, dermatitis, GI disturbances, peripheral neuropathy, resp irritation, hyperpigmentation of skin, [potential occupational carcinogen] | Liver, kidneys, skin, lungs, lymphatic sys | Metal: sliver-gray or tin-white, brittle, odorless solid<br>BP: sublimes |
| Asphalt fumes | 8052-42-4 | TWA 0.5 mg/m$^3$(fumes) | Ca<br>C 5 mg/m3 [15 min] | None established | Ca [IDLH value has not been determined] | Skin absorption;<br>inhalation;<br>skin and/or eye contact | Irritation eyes, resp sys | Eyes, respiratory system | Black or dark brown cement-like substance<br>Combustible solid |
| Barium | 7440-39-3 | TWA 0.5 mg/m3 | None established | TWA 0.5 mg/m3 | None established | Inhalation, ingestion, skin contact | Irritation skin, respiratory system, digestive system | Skin, eyes, respiratory system | Yellow white powder<br>BP: 1640 C |
| Benzene | 71-43-2 | TWA 0.5 ppm<br>STEL 2.5 ppm | Ca TWA 0.1 ppm<br>STEL 1 ppm | TWA 1 ppm ST 5 ppm | Ca [500 ppm] | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen] | Eyes, skin, respiratory system, blood, central nervous system, bone marrow | Colorless to light yellow liquid with an aromatic odor [Note: Solid below 42 °F]<br>BP: 176°F<br>FlPt. = 12°F<br>LEL: 1.2%<br>UEL: 7.8%<br>Class B Flammable liquid |
| Benz[a]anthracene | 56-55-3 | None established [skin cancer] | None established | None established | None established | Inhalation; ingestion; skin absorption; skin and/or eye contact | Irritation eyes, skin, respiratory system, CNS; skin cancer | Skin | Pale Yellow crystal, solid<br>BP: 438 C |
| Benzo[a]pyrene | 50-32-8 | None established [cancer] | TWA 0.1 mg/m3 | TWA 0.2 mg/m3 | None established | Inhalation; ingestion; skin absorption; skin and/or eye contact | POISON. This material is an experimental carcinogen, mutagen, tumorigen, neoplastigen and teratogen. It is a probable carcinogen in humans and a known human mutagen. IARC Group 2A carcinogen. It is believed to cause bladder, skin and lung cancer. Exposure to it may damage the developing fetus. May cause reproductive damage. Skin, respiratory and eye irritant or burns. | Skin, eye, bladder, lung, reproductive | Yellow crystals or powder [found in cigarette smoke, coal tar, fuel exhaust gas and in many other sources]<br>BP: 495 C |
| Benzo[b]fluoranthene | 205-99-2 | None established [cancer] | TWA 0.1 mg/m3 | TWA 0.2 mg/m3 | None established | Inhalation; ingestion; skin and/or eye contact | No data were identified on the toxicity of benzo[b]fluoranthene to humans. Based on results of studies in animals, IARC concluded that benzo[b]fluoranthene is possibly carcinogenic to humans | Respiratory system, skin, bladder, kidneys | Off-white to tan powder |
| Benzo[k]fluoranthene | 207-08-9 | None established | None established | None established | None established | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, skin, respiratory tract, gastrointestinal; fatal if swallowed, inhaled, absorbed through the skin; vomiting, nausea, diarrhea | Lungs, respiratory system | Yellow crystals<br>BP: 480 C |
| Beryllium | 7440-41-7 (metal) | TWA 0.00005 mg/m$^3$ | Ca<br>C 0.0005 mg/m$^3$ | TWA 0.002 mg/m$^3$<br>C 0.005 mg/m$^3$ (30 minutes) with a maximum peak of 0.025 mg/m$^3$ | Ca [4 mg/m$^3$ (as Be)] | inhalation, skin and/or eye contact | Berylliosis (chronic exposure): anorexia, weight loss, lassitude (weakness, exhaustion), chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation eyes; dermatitis; [potential occupational carcinogen] | Eyes, skin, respiratory system | Metal: A hard, brittle, gray-white solid.<br>BP: 4532°F |
| Bis(2-ethylhexyl) phthalate (Di(2-ethylhexyl)phthalate) | 117-81-7 | TWA 5 mg/m$^3$ | TWA 5 mg/m$^3$<br>STEL 10 mg/m3 (do not exceed during any 15-minute work period) | TWA 5 mg/m$^3$ | None established | inhalation, skin and/or eye contact | Irritation eyes, skin, nose, throat; affect the nervous system and liver; damage to male reproductive glands | Eyes, skin, nose, respiratory system, nervous system, reproductive system, liver | Colorless to light colored, thick liquid with slight odor |
| Butane | 106-97-8 | STEL 1000 ppm | TWA 800 ppm (1900 mg/m$^3$) | None established | None established | inhalation, skin and/or eye contact (liquid) | Drowsiness, narcosis, asphyxia; liquid: frostbite | central nervous system | Colorless gas with a gasoline-like or natural gas odor.<br>BP: 31°F<br>UEL: 8.4%<br>LEL: 1.6%<br>Flammable Gas |

**Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at 153 2nd Street, Brooklyn, New York**

| Compound | CAS # | ACGIH TLV | NIOSH REL | OSHA PEL | IDLH | Routes of Exposure | Toxic Properties | Target Organs | Physical/Chemical Properties |
|---|---|---|---|---|---|---|---|---|---|
| 2-Butanone (Methyl Ethyl Ketone or MEK) | 78-93-3 | TWA 200 ppm (590 mg/m$^3$)<br>STEL 300 ppm (885 mg/m$^3$) | TWA 200 ppm (590 mg/m$^3$)<br>STEL 300 ppm (885 mg/m$^3$) | TWA 200 ppm (590 mg/m$^3$) | 3000 ppm | inhalation, ingestion, skin and/or eye contact | Irritation eyes, skin, nose; headache; dizziness; vomiting; dermatitis | Eyes, skin, respiratory system, central nervous system | Colorless liquid with a moderately sharp, fragrant, mint- or acetone-like odor.<br>BP: 175°F<br>FlP: 16°F<br>UEL(200°F): 11.4%<br>LEL(200°F): 1.4%<br>Class IB Flammable Liquid |
| n-Butylbenzene | 104-51-8 | None established | None established | None established | None established | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, skin; CNS depression, lung damage; nausea, vomiting, headache, dizziness, weakness, loss of coordination, blurred vision, drowsiness, confusion, disorientation | Eyes, skin, repiratory system, central nervous system | Colorless liquid with a sweet odor<br>BP: 183 C<br>FlP: 59 C<br>UEL: 5.8%<br>LEL: 0.8% |
| sec-Butylbenzene | 135-98-8 | None established | None established | None established | None established | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, skin, upper airway; central nervous system, headache, dizziness; gastrointestinal disturbance | Respiratory system, central nervous system, eyes, skin; | Colorless liquid<br>BP: 344°F<br>FlP: 126 °F<br>UEL: 6.9%<br>LEL: 0.8%<br>Combustible liquid |
| tert-Butylbenzene | 98-06-6 | None established | None established | None established | None established | inhalation, skin absorption, ingestion, | Eye and respiratory irritant; CNS depression; liver or kidney damage | Respiratory system, central nervous system, eyes, liver, kidney | Colorless liquid with an aromatic odor<br>BP: 168 - 169 C<br>FlP: 34 C<br>UEL:5.6 %<br>LEL: 0.8 % |
| Cadmium | 7440-43-9 (metal) | TWA 0.01 mg/m$^3$ | Ca | TWA 0.005 mg/m$^3$ | Ca [9 mg/m$^3$ (as Cd)] | inhalation, ingestion | Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen] | respiratory system, kidneys, prostate, blood | Metal: Silver-white, blue-tinged lustrous, odorless solid.<br>BP: 1409°F |
| Carbon Disulfide | 75-15-0 | TWA 1 ppm | TWA 1 ppm (3 mg/m$^3$)<br>STEL 10 ppm (30 mg/m$^3$) [skin] | TWA 20 ppm<br>C 30 ppm<br>100 ppm (30-minute maximum peak) | 500 ppm | inhalation, skin absorption, ingestion, skin and/or eye contact | Dizziness, headache, poor sleep, lassitude (weakness, exhaustion), anxiety, anorexia, weight loss; psychosis; polyneuropathy; Parkinson-like syndrome; ocular changes; coronary heart disease; gastritis; kidney, liver injury; eye, skin burns; dermatitis; reproductive effects | central nervous system, peripheral nervous system, cardiovascular system, eyes, kidneys, liver, skin, reproductive system | Colorless to faint-yellow liquid with a sweet ether-like odor.<br>BP: 116°F<br>FlP: -22°F<br>UEL: 50.0%<br>LEL: 1.3%<br>Class IB Flammable Liquid |
| Carbon Monoxide | 630-08-0 | TWA 25 ppm | TWA 35 ppm<br>C 200 ppm | TWA 50 ppm | 1,200 ppm | inhalation | Carboxyhemogloemia | Blood | Colorless, odorless gas |
| Chlorobenzene | 108-90-7 | TWA 10 ppm | None established | TWA 75 ppm (350 mg/m$^3$) | 1000 ppm | inhalation, ingestion, skin and/or eye contact | Irritation eyes, skin, nose; drowsiness, incoordination; central nervous system depression; in animals: liver, lung, kidney injury | Eyes, skin, respiratory system, central nervous system, liver | Colorless liquid with an almond-like odor<br>BP: 270°F<br>FlP: 82°F<br>UEL: 9.6%<br>LEL: 1.3% |
| Chloroethane (Ethyl Chloride) | 75-00-3 | TWA 100ppm | Handle with caution in the workplace | TWA 1000 ppm (2600 mg/m$^3$) | 3800 ppm [10%LEL] | inhalation, skin absorption (liquid), ingestion (liquid), skin and/or eye contact | Incoordination, inebriation; abdominal cramps; cardiac arrhythmias, cardiac arrest; liver, kidney damage | Liver, kidneys, respiratory system, cardiovascular system, central nervous system | Colorless gas or liquid (below 54°F) with a pungent, ether-like odor.<br>BP: 54°F<br>FlP: NA (Gas) -58°F (Liquid)<br>UEL: 15.4%<br>LEL: 3.8%<br>Flammable Gas |
| Chloroform | 67-66-3 | TWA 10 ppm | Ca<br>STEL 2 ppm (9.78 mg/m$^3$) [60-minute] | C 50 ppm (240 mg/m$^3$) | Ca [500 ppm] | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, skin; dizziness, mental dullness, nausea, confusion; headache, lassitude (weakness, exhaustion); anesthesia; enlarged liver; [potential occupational carcinogen] | Liver, kidneys, heart, eyes, skin, central nervous system | Colorless liquid with a pleasant odor<br>BP: 143°F |
| Chromium | 7440-47-3 | TWA 0.5 mg/m$^3$ (metal and Cr III compounds)<br>TWA 0.05 mg/m$^3$ (water-soluble Cr VI compounds)<br>TWA 0.01 mg/m$^3$ (insoluble Cr IV compounds) | TWA 0.5 mg/m$^3$ | TWA 1 mg/m$^3$ | 250 mg/m$^3$ (as Cr) | inhalation, ingestion, skin and/or eye contact | Irritation eyes, skin; lung fibrosis (histologic) | Eyes, skin, respiratory system | Blue-white to steel-gray, lustrous, brittle, hard, odorless solid.<br>BP: 4788°F |
| Chrysene; Phenanthrene; Pyrene; Coal tar pitch volatiles | 65996-93-2 | TWA 0.2 mg/m3 | Ca<br>TWA 0.1 mg/m$^3$ (cyclohexane-extractable fraction) | TWA 0.2 mg/m$^3$ (benzene-soluble fraction) | Ca [80 mg/m$^3$] | Inhalation, skin and/or eye contact | Dermatitis, bronchitis, [potential occupational carcinogen] | Respiratory system, skin, bladder, kidneys | Black or dark-brown amorphous residue.<br>Combustible Solids |
| Coal Tar Pitch Volatiles; Chrysene; Phenanthrene; Pyrene | 65996-93-2 | TWA 0.2 mg/m$^3$ | Ca TWA 0.1 mg/m$^3$ (cyclohexane-extractable fraction) | TWA 0.2 mg/m$^3$ (benzene-soluble fraction) | Ca [80 mg/m$^3$] | Inhalation, skin and/or eye contact | Dermatitis, bronchitis, [potential occupational carcinogen] | respiratory system, skin, bladder, kidneys | Black or dark-brown amorphous residue.<br>Combustible Solids |
| Copper | 7440-50-8 | TWA 0.2mg/m$^3$ (fume)<br>1 mg/m$^3$ (dusts and mists) | TWA 1 mg/m$^3$ | TWA 1 mg/m$^3$ | 100 mg/m$^3$ (as Cu) | Inhalation, ingestion, skin and/or eye contact | Irritation eyes, respiratory system; cough, dyspnea (breathing difficulty), wheezing | Eyes, skin, respiratory system, liver, kidneys (increase(d) risk with Wilson's disease) | Noncombustible Solid in bulk form, but powdered form may ignite.<br>BP: 4703°F |

**Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at 153 2nd Street, Brooklyn, New York**

| Compound | CAS # | ACGIH TLV | NIOSH REL | OSHA PEL | IDLH | Routes of Exposure | Toxic Properties | Target Organs | Physical/Chemical Properties |
|---|---|---|---|---|---|---|---|---|---|
| Crude Oil | 8002-05-9 | None established | TWA 350 mg/m3 | None established | 1100 ppm | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, skin, respiratory system; lung damage; dermatitis; central nervous system effects | central nervous system | Viscous clear, yellow, brown, greenish black liquid, strong hydrocarbon and sulfur (rotten egg) odor when containing H2S.<br>BP: 30 -1000°F<br>Fl.Pt.: -40°F<br>LEL: 3%<br>UEL: 12.5%<br>Flammable liquid and vapor |
| 1,2-Dichlorobenzene | 95-50-1 | TWA 25 ppm<br>STEL 50 ppm | C 50 ppm (300 mg/m$^3$) | C 50 ppm (300 mg/m$^3$) | 200 ppm | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, nose; liver, kidney damage; skin blisters | Eyes, skin, respiratory system, liver, kidneys | Colorless to pale-yellow liquid with a pleasant, aromatic odor. [herbicide]<br>BP: 357°F<br>Fl.P: 151°F<br>UEL: 9.2%<br>LEL: 2.2%<br>Class IIIA Combustible Liquid |
| 1,4-Dichlorobenzene | 106-46-7 | TWA 10 ppm | Ca | TWA 75 ppm (450 mg/m$^3$) | Ca [150 ppm] | inhalation, skin absorption, ingestion, skin and/or eye contact | Eye irritation, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury; [potential occupational carcinogen] | Liver, respiratory system, eyes, kidneys, skin | Colorless or white crystalline solid with a mothball-like odor. [insecticide]<br>BP: 345°F<br>Fl.P: 150°F<br>LEL: 2.5%<br>Combustible Solid |
| 1,1-Dichloroethane | 75-34-3 | TWA 100 ppm | TWA 100 ppm (400 mg/m$^3$) | TWA 100 ppm (400 mg/m$^3$) | 3000 ppm | inhalation, ingestion, skin and/or eye contact | Irritation skin; central nervous system depression; liver, kidney, lung damage | Skin, liver, kidneys, lungs, central nervous system | Colorless, oily liquid with a chloroform-like odor.<br>BP: 135°F<br>Fl.P: 2°F<br>UEL: 11.4%<br>LEL: 5.4% |
| 1,2-Dichloroethane (Ethylene Dichloride) | 107-06-2 | TWA 10 ppm | Ca TWA 1 ppm (4 mg/m$^3$)<br>STEL 2 ppm (8 mg/m$^3$) | TWA 50 ppm<br>C 100 ppm<br>200 ppm [5-minute maximum peak in any 3 hours] | Ca [50 ppm] | inhalation, ingestion, skin absorption, skin and/or eye contact | Irritation eyes, corneal opacity; central nervous system depression; nausea, vomiting; dermatitis; liver, kidney, cardiovascular system damage; [potential occupational carcinogen] | Eyes, skin, kidneys, liver, central nervous system, cardiovascular system | Colorless liquid with a pleasant, chloroform-like odor. [Note: Decomposes slowly, becomes acidic & darkens in color.]<br>BP: 182°F<br>Fl.P: 56°F<br>UEL: 16%<br>LEL: 6.2%<br>Class IB Flammable Liquid |
| 1,1-Dichloroethane | 75-35-4 | TWA **100** ppm | Ca (lowest feasible concentration) | TWA 1ppm | Ca [N.D.] | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, skin, throat; dizziness, headache, nausea, dyspnea (breathing difficulty); liver, kidney disturbance; pneumonitis; [potential occupational carcinogen] | Eyes, skin, respiratory system, central nervous system, liver, kidneys | Colorless liquid or gas (above 89°F) with a mild, sweet, chloroform-like odor.<br>BP: 89°F<br>Fl.P: -2°F<br>UEL: 15.5%<br>LEL: 6.5%<br>Class IA Flammable Liquid |
| 1,2-Dichloroethene (total) | 540-59-0 | TWA 200 ppm | TWA 200 ppm (790 mg/m$^3$) | TWA 200 ppm (790 mg/m$^3$) | 1000 ppm | inhalation, ingestion, skin and/or eye contact | Irritation eyes, respiratory system; central nervous system depression | Eyes, respiratory system, central nervous system | Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor<br>BP: 118-140°F<br>Fl.P: 36-39°F<br>UEL: 12.8%<br>LEL: 5.6%<br>Class IB Flammable Liquid |
| cis-1,2-Dichloroethene | 156-59-2 | TWA 200 ppm | TWA 200 ppm | TWA 200 ppm | None established | inhalation, skin absorption, ingestion | Harmful if swallowed, inhaled, or absorbed through skin. Irritant. Narcotic. Suspected carcinogen | Skin | Colorless liquid<br>BP: 60 C<br>Fl.P: 4 C<br>UEL: 12.8%<br>LEL: 9.7 % |
| trans-1,2-Dichloroethene | 156-60-5 | TWA 200 ppm | None established | TWA 200 ppm<br>STEL 250 ppm (skin) | None established | inhalation, skin absorption, ingestion, skin and/or eye contact | Narcotic. Irritation eyes, skin, respiratory tract, mucous membrane; CNS depression. | Respiratory tract, mucous membrane, eyes, skin, CNS | Colorless liquid with a fruity pleasant odor<br>BP: 48°C<br>Fl.P 6C<br>UEL: 12.8%<br>LEL: 9.7% |
| Dibenzo[a,h]anthracene | 53-70-3 | None established | None established | None established | None established | Inhalation, ingestion, skin and/or eye contact | Irritation eyes, skin | Eyes, skin; skin photosensitization. | Colorless crystalline powder<br>BP: 524°C |

**Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at 153 2nd Street, Brooklyn, New York**

| Compound | CAS # | ACGIH TLV | NIOSH REL | OSHA PEL | IDLH | Routes of Exposure | Toxic Properties | Target Organs | Physical/Chemical Properties |
|---|---|---|---|---|---|---|---|---|---|
| Diesel Fuel #2 | 68476-34-6 | TWA 100 mg/m$^3$ | None established | Designated as an OSHA Select Carcinogen | None established | ingestion, skin and/or eye contact | Kidney damage; potential lung damage; suspected carcinogen; irritation of eyes, skin, respiratory tract; dizziness, headache, nausea; chemical pneumonitis (from aspiration of liquid); dry, red skin; irritant contact dermatitis; eye redness, pain. | Eyes, skin, kidneys | Clear yellow brown combustible liquid; floats on water; distinct diesel petroleum hydrocarbon odor.<br>BP: 356-716°F<br>FlP: 154.4-165.2°F<br>LEL: 0.6%<br>UEL: 7.0% |
| 2,4-Dimethylphenol | 105-67-9 | None established | None established | None established | None established | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, skin, respiratory system, mouth, throat, stomach; dizziness, weakness, fatigue, nausea, headache; systemic damage; moderate to severe eye injury. | Skin, CVS, eyes, CNS | Clear, colorless liquid with a faint ether or chloroform-like odor<br>BP: 178°F |
| Duosol | 78207-03-1 | None established | None established | None established | None established | ingestion, skin and/or eye contact | Irritation eyes, skin; Dermatitis | Eyes, skin | White solid with alcohol odor |
| Ethylbenzene | 100-41-4 | TWA 20 ppm | TWA 100 ppm (435 mg/m$^3$)<br>STEL 125 ppm (545 mg/m$^3$) | TWA 100 ppm (435 mg/m$^3$) | 800 ppm [10%LEL] | inhalation, ingestion, skin and/or eye contact | Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma | Eyes, skin, respiratory system, central nervous system | Colorless liquid with an aromatic odor.<br>BP: 277°F<br>FlP: 55°F<br>UEL: 6.7%<br>LEL: 0.8%<br>Class IB Flammable Liquid |
| Fluoranthene | 206-44-0 | None established | None established | None established | None established | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, skin; possible burns; heart and liver injury, pulmonary edema, respiratory arrest, gastrointestinal disturbances. | Heart, liver, lungs. | Yellow needles. |
| Fluorene | 86-73-7 | None established | None established | None established | None established | inhalation, ingestion, skin and/or eye contact | Irritation skin, digestive tract | Skin | White crystals<br>BP: 563°F |
| Fuel Oil #2 | 68476-30-2 | TWA 100mg/m$^3$ | None established | None established | None established | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, skin; CNS effects; nausea, vomiting, headache, cramping, dizziness, weakness, loss of coordination,, drowsiness; kidney, liver damage | Eyes, skin, CNS | Clear or yellow to red oily liquid, kerosene-like odor<br>BP: 347 - 689 °F<br>UEL:5-6%<br>LEL: 0.7-1.0% |
| Furfural | 98-01-1 | TWA 2 ppm | None established | TWA 5 ppm (20 mg/m$^3$) [skin] | 100 ppm | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, skin, upper respiratory system; headache; dermatitis | Eyes, skin, respiratory system | Colorless to amber liquid with an almond-like odor.<br>BP: 323°F<br>FlP: 140°F<br>UEL: 19.3%<br>LEL: 2.1%<br>Class IIIA Combustible Liquid |
| Gasoline | 8006-61-9 | TWA 300 ppm<br>STEL 500 ppm | Carcinogen | None established | Ca [IDLH value has not been determined] | Skin absorption; inhalation; ingestion; skin and/or eye contact | Eyes and skin irritation, mucous membrane; dermatitis; headache; listlessness, blurred vision, dizziness, slurred speech, confusion, convulsions; chemical pneumonitis; possible liver, kidney damage [Potential occupational carcinogen] | Eyes, skin, respiratory system, CNS, Liver, Kidneys | Clear liquid with a characteristic odor, aromatic<br>FlPt. = -45°F<br>LEL = 1.4%<br>UEL = 7.6%<br>Class 1B Flammable Liquid |
| Hexachlorobutadiene | 87-68-3 | TWA 0.02 ppm | Ca TWA 0.02 ppm (0.24 mg/m$^3$) [skin] | None established | Ca [N.D.] | inhalation, skin absorption, ingestion, skin and/or eye contact | In animals: irritation eyes, skin, respiratory system; kidney damage; [potential occupational carcinogen] | Eyes, skin, respiratory system, kidneys | Clear, colorless liquid with a mild, turpentine-like odor.<br>BP: 419°F |
| Hydrogen Sulfide | 7783-06-4 | TWA 1 ppm<br>STEL 5 ppm | C 10 ppm (15 mg/m$^3$) [10-minute] | C 20 ppm 50 ppm [10-minute maximum peak] | 100 ppm | inhalation, skin and/or eye contact | Irritation eyes, respiratory system; apnea, coma, convulsions; conjunctivitis, eye pain, lacrimation (discharge of tears), photophobia (abnormal visual intolerance to light), corneal vesiculation; dizziness, headache, lassitude (weakness, exhaustion), irritability, insomnia; gastrointestinal disturbance; liquid: frostbite | Eyes, respiratory system, central nervous system | Colorless gas with a strong odor of rotten eggs.<br>BP: -77°F<br>UEL: 44.0%<br>LEL: 4.0%<br>Flammable Gas |
| Indeno[1,2,3-cd]pyrene | 193-39-5 | None established | None established | None established | None established | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, skin; possible human carcinogen (skin); weakness; affect liver, lung tissue, renal tissue; impairment of blood forming tissue | Skin | Fluorescent green-yellow crystalline solid<br>BP: 536 C |
| Isopropylbenzene (Cumene) | 98-82-8 | TWA 50 ppm | TWA 50 ppm (245 mg/m$^3$) [skin] | TWA 50 ppm (245 mg/m$^3$) [skin] | 900 ppm [10%LEL] | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, skin, mucous membrane; dermatitis; headache, narcosis, coma | Eyes, skin, respiratory system, central nervous system | Colorless liquid with a sharp, penetrating, aromatic odor.<br>BP: 306°F<br>FlP: 96°F<br>UEL: 6.5%<br>LEL: 0.9% |
| p-Isopropyltoluene | 99-87-6 | None established | None established | None established | None established | inhalation, skin absorption, eye contact | Irritation skin | CNS, skin | Colorless, clear liquid, sweetish aromatic odor<br>BP: 350.8°F<br>Class III Flammable liquid |

**Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at 153 2nd Street, Brooklyn, New York**

| Compound | CAS # | ACGIH TLV | NIOSH REL | OSHA PEL | IDLH | Routes of Exposure | Toxic Properties | Target Organs | Physical/Chemical Properties |
|---|---|---|---|---|---|---|---|---|---|
| Kerosene | 8008-20-6 | TWA 200 mg/m$^3$ | TWA 100 mg/m$^3$ | None established | IDLH value has not been determined | inhalation, ingestion, skin and/or eye contact | Irritation eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid) | Eyes, skin, respiratory system, central nervous system | Colorless to yellowish, oily liquid with a strong, characteristic odor.<br>BP: 347-617°F<br>FlP: 100-162°F<br>UEL: 5%<br>LEL: 0.7%<br>Class II Combustible Liquid |
| Lead | 7439-92-1 | TWA 0.05 mg/m$^3$ | TWA (8-hour) 0.050 mg/m$^3$ | TWA 0.050 mg/m$^3$ | 100 mg/m$^3$ (as Pb) | inhalation, ingestion, skin and/or eye contact | Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension | Eyes, gastrointestinal tract, central nervous system, kidneys, blood, gingival tissue | A heavy, ductile, soft, gray solid.<br>BP: 3164°F<br>Noncombustible Solid in bulk form |
| Manganese | 7439-96-5 (metal) | TWA 0.02 mg/m$^3$ | TWA 1 mg/m$^3$<br>STEL 3 mg/m$^3$ | C 5 mg/m$^3$ | 500 mg/m$^3$ (as Mn) | inhalation, ingestion | Manganism; asthenia, insomnia, mental confusion; metal fume fever: dry throat, cough, chest tightness, dyspnea (breathing difficulty), rales, flu-like fever; low-back pain; vomiting; malaise (vague feeling of discomfort); lassitude (weakness, exhaustion); kidney damage | respiratory system, central nervous system, blood, kidneys | A lustrous, brittle, silvery solid.<br>BP: 3564°F |
| Mercury (organo) alkyl compounds (as Hg) | 7439-97-6 | TWA 0.01 mg/m$^3$<br>STEL 0.03 mg/m$^3$ [skin] | TWA 0.01 mg/m$^3$<br>STEL 0.03 mg/m$^3$ [skin] | TWA 0.01 mg/m$^3$<br>C 0.04 mg/m$^3$ | 2 mg/m$^3$ (as Hg) | inhalation, skin absorption, ingestion, skin and/or eye contact | Paresthesia; ataxia, dysarthria; vision, hearing disturbance; spasticity, jerking limbs; dizziness; salivation; lacrimation (discharge of tears); nausea, vomiting, diarrhea, constipation; skin burns; emotional disturbance; kidney injury; possible teratogenic effects | Eyes, skin, central nervous system, peripheral nervous system, kidneys | Appearance and odor vary depending upon the specific (organo) alkyl mercury compound |
| Mercury compounds [except (organo) alkyls] (as Hg) Mercury | 7439-97-6 | TWA 0.025 mg/m$^3$ (elemental and inorganic forms)<br>TWA 0.01 mg/m$^3$ (aryl compounds) | Hg Vapor: TWA 0.05 mg/m$^3$ [skin]<br>Other: C 0.1 mg/m3 [skin] | TWA 0.1 mg/m$^3$ | 10 mg/m$^3$ (as Hg) | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria | Eyes, skin, respiratory system, central nervous system, kidneys | Metal: Silver-white, heavy, odorless liquid. [Note: "Other" Hg compounds include all inorganic & aryl Hg compounds except (organo) alkyls.]<br>BP: 674°F |
| Methyl Ethyl Ketone or MEK (2-Butanone) | 78-93-3 | TWA 200 ppm<br>STEL 300 ppm | TWA 200 ppm (590 mg/m$^3$)<br>STEL 300 ppm (885 mg/m$^3$) | TWA 200 ppm (590 mg/m$^3$) | 3000 ppm | inhalation, ingestion, skin and/or eye contact | Irritation eyes, skin, nose; headache; dizziness; vomiting; dermatitis | Eyes, skin, respiratory system, central nervous system | Colorless liquid with a moderately sharp, fragrant, mint- or acetone-like odor.<br>BP: 175°F<br>Fl.P: 16°F<br>UEL(200°F): 11.4%<br>LEL(200°F): 1.4%<br>Class IB Flammable Liquid |
| Methyl tert-butyl ether (MTBE) | 1634-04-4 | TWA 50 ppm | No established REL | None established | None established | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, mucous membrane, respiratory; dizziness, nausea, headache, intoxication | Eyes, skin, mucous membrane, respiratory system, central nervous system | Colorless liquid<br>BP: 55.2 C |
| Methylene Chloride (Dichloromethane) | 75-09-2 | TWA 50 ppm, A3 - suspected human carcinogen | Ca | TWA 25 ppm<br>STEL 125 ppm | Ca [2300 ppm] | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, skin; lassitude (weakness, exhaustion), drowsiness, dizziness; numbness, tingle limbs; nausea; [potential occupational carcinogen] | Eyes, skin, cardiovascular system, central nervous system | Colorless liquid with a chloroform-like odor<br>BP: 104°F<br>UEL: 23%<br>LEL: 13% |
| Naphtha (Rubber Solvent) | 8030-30-6 | None established | TWA 100 ppm (400 mg/m$^3$) | TWA 100 ppm (400 mg/m$^3$) | 1000 ppm [10%LEL] | inhalation, ingestion, skin and/or eye contact | Irritation eyes, skin, nose; dizziness, drowsiness; dermatitis; in animals: liver, kidney damage | Eyes, skin, respiratory system, central nervous system, liver, kidneys | Reddish-brown, mobile liquid with an aromatic odor<br>BP: 320-428°F<br>FLP: 100-109°F<br>Class II Combustible Liquid |
| Naphthalene | 91-20-3 | TWA 10 ppm [skin] | TWA 10 ppm (50 mg/m$^3$) STEL 15 ppm (75 mg/m$^3$) | TWA 10 ppm (50 mg/m$^3$) | 250 ppm | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage | Eyes, skin, blood, liver, kidneys, central nervous system | Colorless to brown solid with an odor of mothballs.<br>BP: 424°F<br>FLP: 174°F<br>UEL: 5.9%<br>LEL: 0.9% |
| Nickel | 7440-02-0 (Metal) | TWA 1.5 mg/m$^3$ (elemental)<br>TWA 0.1 mg/m$^3$ (soluble inorganic compounds)<br>TWA 0.2 mg/m$^3$ (insoluble inorganic compounds)<br>TWA 0.1 mg/m$^3$ (Nickel subsulfide) | Ca TWA 0.015 mg/m$^3$ | TWA 1 mg/m$^3$ | Ca [10 mg/m$^3$ (as Ni)] | inhalation, ingestion, skin and/or eye contact | Sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen] | Nasal cavities, lungs, skin | Metal: Lustrous, silvery, odorless solid.<br>BP: 5139°F |
| Nitrobenzene | 98-95-3 | TWA 1 ppm | TWA 1 ppm (5 mg/m$^3$) [skin] | TWA 1 ppm (5 mg/m$^3$) [skin] | 200 ppm | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, skin; anoxia; dermatitis; anemia; methemoglobinemia; in animals: liver, kidney damage; testicular effects | Eyes, skin, blood, liver, kidneys, cardiovascular system, reproductive system | Yellow, oily liquid with a pungent odor like paste shoe polish.<br>BP: 411°F<br>FLP: 190°F<br>LEL(200°F): 1.8% |
| Petroleum hydrocarbons(Petroleum distillates) | 8002-05-9 | None established | TWA 350 mg/m$^3$<br>C 1800 mg/m$^3$ [15 min] | TWA 500 ppm (2000 mg/m$^3$) | 1,100 [10% LEL] | Inhalation; ingestion; skin and/or eye contact | Irritation eyes, skin, nose, throat; dizziness, drowsiness, headache, nausea; dried/cracked skin; chemical pneumonitis | CNS, eyes, respiratory system, skin | Colorless liquid with a gasoline or kerosene-like odor<br>BP: 86-460°F<br>Fl. Pt = -40 to -86°F<br>UEL: 5.9%<br>LEL: 1.1%<br>Flammable liquid |

**Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at 153 2nd Street, Brooklyn, New York**

| Compound | CAS # | ACGIH TLV | NIOSH REL | OSHA PEL | IDLH | Routes of Exposure | Toxic Properties | Target Organs | Physical/Chemical Properties |
|---|---|---|---|---|---|---|---|---|---|
| Phenol | 108-95-2 | TWA 5 ppm [skin] | TWA 5 ppm (19 mg/m$^3$) C 15.6 ppm (60 mg/m$^3$) [15-minute] [skin] | TWA 5 ppm (19 mg/m$^3$) [skin] | 250 ppm | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, nose, throat; anorexia, weight loss; lassitude (weakness, exhaustion), muscle ache, pain; dark urine; cyanosis; liver, kidney damage; skin burns; dermatitis; ochronosis; tremor, convulsions, twitching | Eyes, skin, respiratory system, liver, kidneys | Colorless to light-pink, crystalline solid with a sweet, acrid odor.<br>BP: 359°F<br>UEL: 8.6%<br>LEL: 1.8% |
| Polychlorinated Biphenyls (PCBs) (Chlorodiphenyl (42% Chlorine) | 53469-21-9 | TWA 1 mg/m$^3$ [skin] | Ca TWA 0.001 mg/m$^3$ | 0.5 mg/m$^3$ | 5 ppm | Dermal; inhalation; ingestion; skin and/or eye contact | Irritation eyes; chloracne; liver damage; reproductive effects; [potential occupational carcinogen] | Eyes, skin, liver, respiratory system | Colorless to light-colored, viscous liquid, hydrocarbon odor, BP: 617 - 734°F, non-flammable, LEL: NA, UEL: NA |
| n-Propylbenzene | 103-65-1 | None established | None established | None established | None established | inhalation, ingestion, skin and/or eye contact | Harmful if swallowed, Irritation eyes, skin, digestive tract, respiratory tract, central nervous system | Eyes, skin, central nervous system, respiratory system | colorless or light yellow liquid<br>BP: 159 C<br>FLP: 47 C<br>UEL: 6%<br>LEL: 0.8% |
| Selenium | 7782-49-2 | TWA 0.2 mg/m$^3$ | TWA 0.2 mg/m$^3$ | TWA 0.2 mg/m$^3$ | 1 mg/m$^3$ (as Se) | inhalation, ingestion, skin and/or eye contact | Irritation eyes, skin, nose, throat; visual disturbance; headache; chills, fever; dyspnea (breathing difficulty), bronchitis; metallic taste, garlic breath, gastrointestinal disturbance; dermatitis; eye, skin burns; in animals: anemia; liver necrosis, cirrhosis; kidney, spleen damage | Eyes, skin, respiratory system, liver, kidneys, blood, spleen | Amorphous or crystalline, red to gray solid. [Note: Occurs as an impurity in most sulfide ores.]<br>BP: 1265°F |
| Silver | 7440-22-4 (metal) | TWA 0.1 mg/m$^3$ (metal, dust, fume)<br>TWA 0.01 mg/m$^3$ (Soluble compounds, as Ag) | TWA 0.01 mg/m$^3$ | TWA 0.01 mg/m$^3$ | 10 mg/m$^3$ (as Ag) | inhalation, ingestion, skin and/or eye contact | Blue-gray eyes, nasal septum, throat, skin; irritation, ulceration skin; gastrointestinal disturbance | Nasal septum, skin, eyes | Metal: White, lustrous solid<br>BP: 3632°F |
| Slop Oil | 69029-75-0 | None established | None established | None established | None established | Inhalation; ingestion | Irritation eyes, skin, gastrointestinal tract | Eyes, skin, gastrointestinal tract | Clear light to dark amber liquid, with mild hydrocarbon odor.<br>BP: >500°F<br>FLP : 250°F |
| Sulfuric Acid | 7664-93-9 | TWA 0.2 mg/m$^3$ | TWA 1 mg/m$^3$ | TWA 1 mg/m$^3$ | 15 mg/m$^3$ | inhalation, ingestion, skin and/or eye contact | Irritation eyes, skin, nose, throat; pulmonary edema, bronchitis; emphysema; conjunctivitis; stomatis; dental erosion; eye, skin burns; dermatitis | Eyes, skin, respiratory system, teeth | Colorless to dark-brown, oily, odorless liquid.<br>BP: 554°F<br>Noncombustible Liquid |
| Tetrachloroethene | 127-18-4 | TWA 25 ppm<br>STEL 100 ppm<br>listed as A3, animal carcinogen | Ca Minimize workplace exposure concentrations | TWA 100 ppm<br>C 200 ppm (for 5 minutes in any 3-hour period), with a maximum peak of 300 ppm | Ca [150 ppm] | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen] | Eyes, skin, respiratory system, liver, kidneys, central nervous system | Colorless liquid with a mild, chloroform-like odor.<br>BP: 250°F<br>Noncombustible Liquid |
| Toluene | 108-88-3 | TWA 20 ppm | TWA 100 ppm (375 mg/m$^3$)<br>STEL 150 ppm (560 mg/m$^3$) | TWA 200 ppm<br>C 300 ppm 500 ppm (10-minute maximum peak) | 500 ppm | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage | Eyes, skin, respiratory system, central nervous system, liver, kidneys | Colorless liquid with a sweet, pungent, benzene-like odor.<br>BP: 232°F<br>FLP: 40°F<br>UEL: 7.1%<br>LEL: 1.1%<br>Class IB Flammable Liquid |
| 1,1,1-Trichloroethane (Methyl Chloroform) | 71-55-6 | TWA 350 ppm<br>STEL 450 ppm | C 350 ppm (1900 mg/m$^3$) [15-minute] | TWA 350 ppm (1900 mg/m$^3$) | 700 ppm | inhalation, ingestion, skin and/or eye contact | Irritation eyes, skin; headache, lassitude (weakness, exhaustion), central nervous system depression, poor equilibrium; dermatitis; cardiac arrhythmias; liver damage | Eyes, skin, central nervous system, cardiovascular system, liver | Colorless liquid with a mild, chloroform-like odor.<br>BP: 165°F<br>UEL: 12.5%<br>LEL: 7.5% |
| 1,1,2-Trichloroethane | 79-00-5 | TWA 10 ppm [skin] | Ca TWA 10 ppm (45 mg/m$^3$) [skin] | TWA 10 ppm (45 mg/m$^3$) [skin] | Ca [100 ppm] | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, nose; central nervous system depression; liver, kidney damage; dermatitis; [potential occupational carcinogen] | Eyes, respiratory system, central nervous system, liver, kidneys | Colorless liquid with a sweet, chloroform-like odor.<br>BP: 237°F<br>UEL: 15.5%<br>LEL: 6% |
| Trichloroethene | 79-01-6 | TWA 10 ppm<br>STEL 25 ppm | Ca | TWA 100 ppm<br>C 200 ppm 300 ppm (5-minute maximum peak in any 2 hours) | Ca [1000 ppm] | inhalation, skin absorption, ingestion, skin and/or eye contact | Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen] | Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system | Colorless liquid (unless dyed blue) with a chloroform-like odor.<br>BP: 189°F<br>UEL(77°F): 10.5%<br>LEL(77°F): 8% |
| 1,2,4-Trimethylbenzene | 95-63-6 | TWA 25 ppm | TWA 25 ppm (125mg/m$^3$) | None established | N.D. | Inhalation;<br>ingestion; skin and/or eye contact | Eye, skin, nose, and throat, resp syst<br>irritation; bronchitis; hypochromic anemia; headache, drowsiness, weakness, dizziness, nausea, incoordination, vomit, confusion; chemical pneumonitis | Eyes, skin, resp sys, CNS, blood | Clear, colorless liquid with a distinctive, aromatic odor<br>BP: 337°F<br>FL.P: 112°F<br>UEL: 6.4%<br>LEL: 0.9%<br>Class II Flammable liquid |
| 1,2,4-Trimethylbenzene | 95-63-6 | TWA 25 ppm | TWA 25 ppm (125 mg/m$^3$) | None established | N.D. | inhalation, ingestion, skin and/or eye contact | Irritation eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, fatigue, dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid) | Eyes, skin, respiratory system, central nervous system, blood | Clear, colorless liquid with a distinctive, aromatic odor.<br>BP: 337°F<br>FLP: 112°F<br>UEL: 6.4%<br>LEL: 0.9%<br>Class II Flammable Liquid |

**Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at 153 2nd Street, Brooklyn, New York**

| Compound | CAS # | ACGIH TLV | NIOSH REL | OSHA PEL | IDLH | Routes of Exposure | Toxic Properties | Target Organs | Physical/Chemical Properties |
|---|---|---|---|---|---|---|---|---|---|
| 1,3,5-Trimethylbenzene | 108-67-8 | TWA 25 ppm | TWA 25 ppm (125mg/$m^3$) | None established | N.D. | Inhalation; ingestion; skin and/or eye contact | Eye, skin, nose, and throat, resp syst irritation; bronchitis; hypochromic anemia; headache, drowsiness, weakness, dizziness, nausea, incoordination, vomit, confusion; chemical pneumonitis | Eyes, skin, resp sys, CNS, blood | Clear, colorless liquid with a distinctive, aromatic odor<br>BP: 329°F<br>FL.P: 122°F<br>Class II Flammable liquid |
| 1,3,5-Trimethylbenzene | 108-67-8 | TWA 25 ppm | TWA 25 ppm (125 mg/$m^3$) | None established | N.D | inhalation, ingestion, skin and/or eye contact | Irritation eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid) | Eyes, skin, respiratory system, central nervous system, blood | Clear, colorless liquid with a distinctive, aromatic odor.<br>BP: 329°F<br>FLP: 122°F<br>Class II Flammable Liquid |
| Vinyl Chloride | 75-01-4 | TWA 1 ppm | Carcinogen | TWA 1 ppm<br>C 5 ppm [15-minute] | Ca [IDLH value has not been determined] | inhalation, skin, and/or eye contact (liquid) | Lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen] | Liver, central nervous system, blood, respiratory system, lymphatic system | Colorless gas or liquid (below 7°F) with a pleasant odor at high concentrations.<br>BP: 7°F<br>UEL: 33.0%<br>LEL: 3.6%<br>Flammable Gas |
| Xylene (m, o & p isomers) | 108-38-3,<br>95-47-6,<br>106-42-3 | TWA 100 ppm<br>STEL 150 ppm | TWA 100 ppm (435 mg/$m^3$) | TWA 100 ppm (435 mg/$m^3$) | 900 ppm | Skin absorption, inhalation, ingestion, skin, and/or eye contact | Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis | Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys | Colorless liquid with an aromatic odor<br>BP: 282°F, 292°F, 281°F<br>Fl. Pt. 82°F, 90°F, 81°F<br>LEL: 1.1%, 0.9%, 1.1%<br>UEL: 7.0%, 6.7%, 7.0%<br>Class C Flammable Liquid |
| Zinc Oxide | 1314-13-2 | TWA 2 mg/m3<br>STEL 10 mg/$m^3$ | None established | TWA 10 mg/m3 (for zinc oxide fume) | None established | skin and/or eye contact, inhalation, ingestion | Irritation eyes, skin, respiratory tract; gastrointestinal disturbances | Eyes, skin, respiratory system, | Bluish gray solid<br>BP: 1664.6°F<br>Flammable |


**References**

U.S. Department of Labor. 1990. OSHA Regulated Hazardous Substances, industrial Exposure and Control Technologies Government Institutes, Inc.
Hawley's Condensed Chemical Dictionary, Sax, N. Van Nostrand and Reinhold Company, 11th Edition, 1987.
Proctor, N.H., J.P. Hughes and M.L. Fischman, 1989. Chemical Hazards of the Workplace. Van Nostrand Reinhold. New York.
Sax, N.I. and R.J. Lewis. 1989. Dangerous Properties of Industrial Materials. 7th Edition. Van Nostrand Reinhold. New York.
Threshold Limit Values (TLVs®) and Biological Exposure Limits (BEIs®), American Conference of Governmental Industrial Hygienists, 2016.
NIOSH Pocket Guide to Chemical Hazards. 2005. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health


**Abbreviations:**

ACGIH – American Conference of Governmental Industrial Hygienists.
BP – boiling point at 1 atmosphere, °F
C – Ceiling, is a concentration that should not be exceeded during and part of the working exposure.
Ca - considered by NIOSH to be a potential occupational carcinogen
CAS# Chemical Abstracts Service registry number which is unique for each chemical.
Fl. Pt. – Flash point
and Health concentrations represent the
maximum concentration from which, in
the event of respirator failure, one could
LEL – Lower explosive (flammable) limit in air, % by volume (at room temperature)
mg/$m^3$ – Milligrams of substance per cubic meter of air
NIOSH -National Institute for Occupational Safety and Health.
OSHA – Occupational Safety and Health Administration
PEL - OSHA Permissible Exposure Limit (usually) a time weighted average concentration that must not be exceeded during any 8 hour work shift of a 40 hr work week.
ppm – parts per million
REL – NIOSH Recommended Limit indicated a time weighted average concentration that must not be exceeded during any 10 hour work shift of a 40 hr work week
STEL – Short-term exposure limit
TLV -ACGIH Threshold Limit Values (usually 8 hour time weighted average concentrations).
TWA – 8-hour, time-weighted average
UEL – Upper explosive (flammable) limit in air, % by volume (at room temperature)

## TABLE 2

## ACTION LEVELS FOR WORKER BREATHING ZONE

| Instrument | Action Level * | Level of Respiratory Protection/Action |
|---|---|---|
| PID | 0 to <5 ppm (one minute sustained) | Level D * |
| PID | >5 to <50 ppm (one minute sustained) | Utilize APR (Level C) |
| PID | >50 to <100 ppm (one minute sustained) | Level B |
| PID | >100ppm | Stop work** (ventilate, apply foam) |
| CGI/$H_2S$ Meter | <5ppm | Level D |
| CGI/$H_2S$ Meter | >5ppm to <10ppm | Level B |
| CGI/$H_2S$ Meter | >10ppm | Stop work** |
| CGI/CO Meter | >25ppm | Level B |
| CGI/CO Meter | >50pp | Stop work** (ventilate area) |
| CGI/$O_2$ Meter | <10% LEL, in excavation | Level D |
| | 19.5% oxygen – 23.5% | Level D |
| CGI/$O_2$ Meter | >10% LEL, in excavation | Allow to vent, apply foam** |
| | >23.5% oxygen | Stop work, Oxygen Enriched ATM** |
| Dust Monitor | 0 – 1.0 mg/$m^3$, 5-minutes average | Level D |
| Dust Monitor | >1.0 to 5.0 mg/$m^3$, 5-minutes average | Level D – Institute dust suppression measures |
| Dust Monitor | 5.0 to >50 mg/$m^3$, 5-minute average | Level C – Institute dust suppression measures |

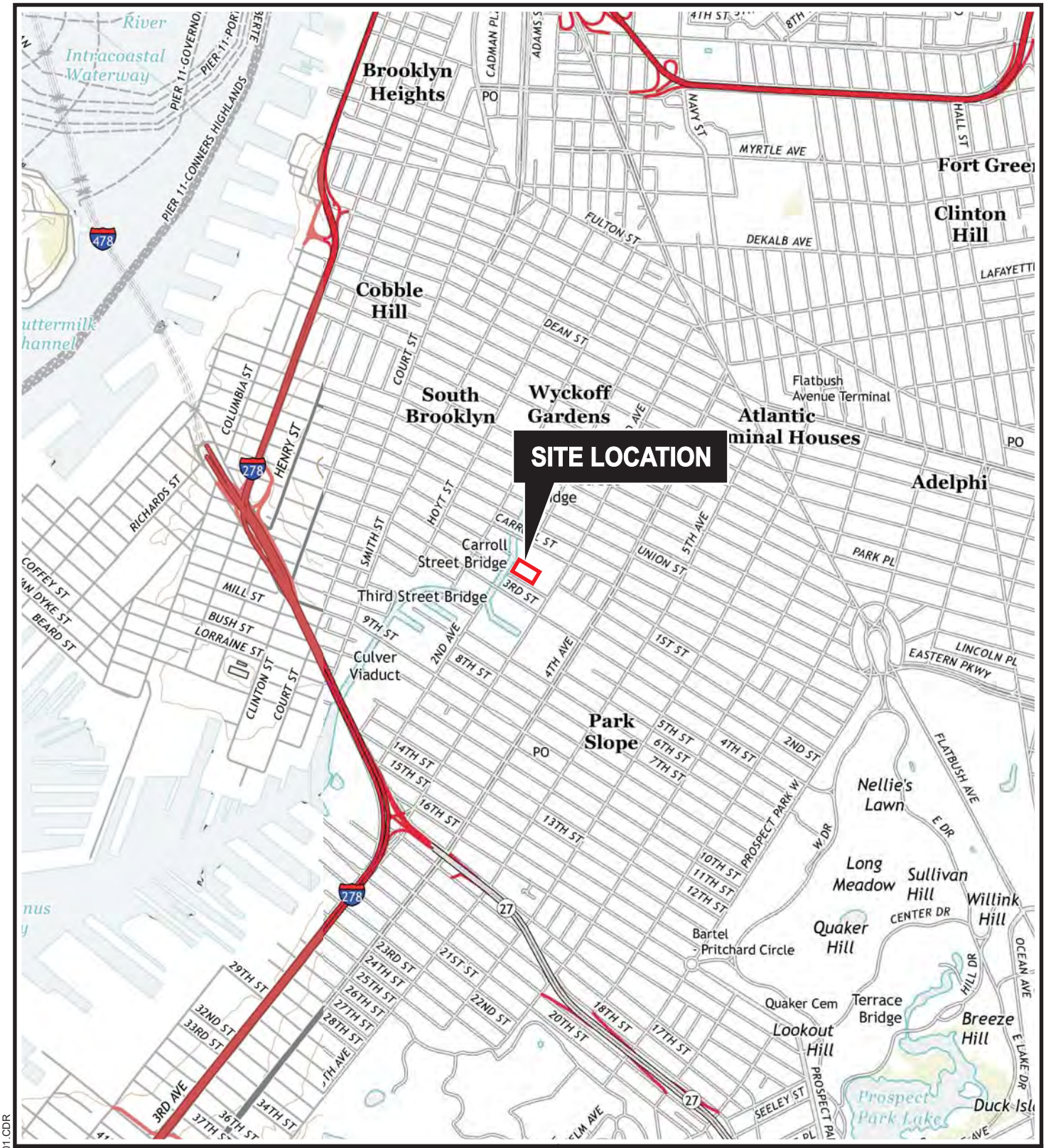
Note: Action levels are based on above background levels.

* Instrument readings will be taken in the breathing zone (BZ) of the workers, unless otherwise indicated.

** Suspend work in immediate area. Conduct air monitoring periodically to determine when work can continue. Implement mitigative measures.

# FIGURES

1. Site Location Map
2. Hospital Route Map
3. Clinic Route Map




QUADRANGLE LOCATION




SOURCE:
USGS; 2013, Brooklyn, NY
USGS; 2014, Jersey City, NY-NJ
7.5 Minute Topographic Quadrangle

N

0 2000'

Title:

# SITE LOCATION MAP

153 2ND STREET
BROOKLYN, NEW YORK

Prepared for:

GEMINI ARTS INITIATIVE, INC

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

| | | |
|---|---|---|
| Compiled by: A.B. | Date: 07JAN16 | FIGURE |
| Prepared by: G.M. | Scale: AS SHOWN | 1 |
| Project Mgr.: F.C. | Project No.: 2705.0001Y000 | |
| File: 2705.0001Y100.01.CDR | | |

V:\CAD\PROJECTS\2705\Y0001Y100\2705.0001Y100.01.CDR




Directions to New York Methodist Hospital

1. Turn Right onto 3rd Avenue.
2. Turn Left onto 7th Steet.
3. Turn Left onto 8th Avenue.
4. Turn Left onto 6th Street. Hospital on left.

New York Methodist Hospital
502 8th Avenue, Brooklyn, NY

Title:

# HOSPITAL ROUTE MAP

153 2ND STREET
BROOKLYN, NEW YORK

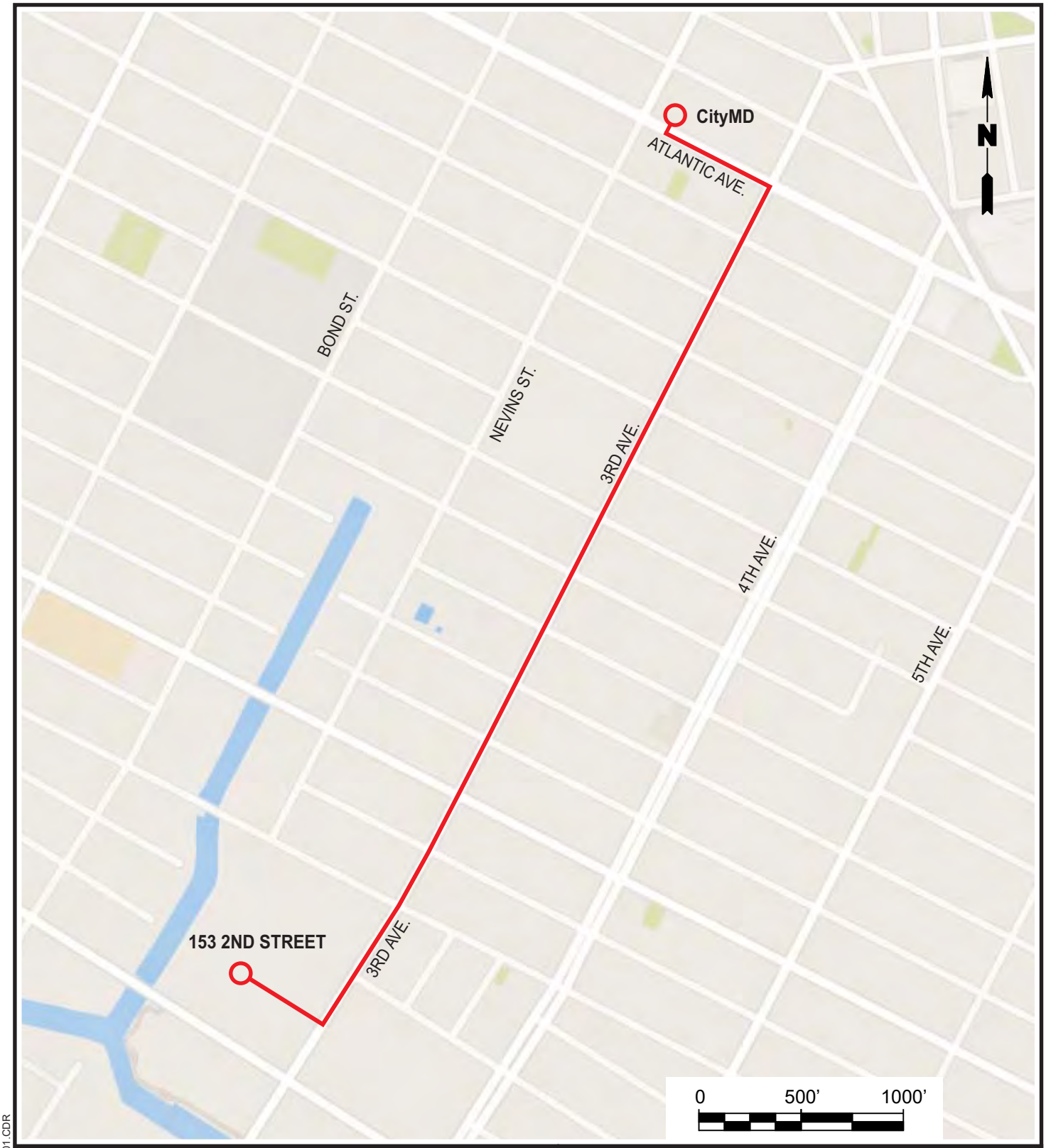
Prepared for:

GEMINI ARTS INITIATIVE, INC

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

| | | |
|---|---|---|
| Compiled by: A.B. | Date: 07JAN16 | FIGURE |
| Prepared by: G.M. | Scale: AS SHOWN | 2 |
| Project Mgr.: F.C. | Project No.: 2705.0001Y000 | |
| File: 2705.0001Y100.01.CDR | | |

V:\CAD\PROJECTS\2705\0001Y\100\2705.0001Y100.01.CDR




Directions to CityMD, 457 Atlantic Avenue

1. Turn Left onto 3rd Avenue.

2. Turn Left onto Atlantic Avenue. CityMD on Right.

CityMD, 457 Atlantic Avenue, Brooklyn, NY

Title:

# URGENT CARE ROUTE MAP

153 2ND STREET
BROOKLYN, NEW YORK

Prepared for:

GEMINI ARTS INITIATIVE, INC

ROUX ASSOCIATES, INC.
*Environmental Consulting & Management*

| | | |
|---|---|---|
| Compiled by: A.B. | Date: 07JAN16 | FIGURE |
| Prepared by: G.M. | Scale: AS SHOWN | 3 |
| Project Mgr.: F.C. | Project No.: 2705.0001Y000 | |
| File: 2705.0001Y100.01.CDR | | |

V:\CAD\PROJECTS\2705\Y0001Y\100\2705.0001Y100.01.CDR

# APPENDICES

A. Job Safety Analysis
B. Heat and Cold Stress Guidelines
C. Heavy Equipment Exclusion Zone Policy
D. Accident Report and Accident Investigation Form
E. *ACORD*® Automobile Loss Notice Form
F. Short Service Employee Policy
G. Health and Safety Briefing/Tailgate Meeting Form
H. Weekly Safety Report

# APPENDIX A

Job Safety Analysis

| JOB SAFETY ANALYSIS | Ctrl. No. | DATE 1/13/2015 | ☐ NEW ☒ REVISED | PAGE 1 of 2 |
|---|---|---|---|---|

| JSA TYPE CATEGORY: | WORK TYPE: | WORK ACTIVITY (Description): |
|---|---|---|
| **Site Specific**<br>**Site: Greenpoint** | **Drilling** | **Rotosonic Soil Borings / Well Installation** |

| DEVELOPMENT TEAM | POSITION / TITLE | REVIEWED BY: | POSITION / TITLE |
|---|---|---|---|
| William Poupis | Vice President ADT | Christopher Proce | Project Manager |
| Chris Stratton | Driller ADT | Michael Ritorto | Senior Hydrogeologist |

**REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT**

| | | | |
|---|---|---|---|
| ☐ LIFE VEST<br>☒ HARD HAT<br>☐ LIFELINE / BODY HARNESS<br>☒ SAFETY GLASSES | ☐ GOGGLES<br>☐ FACE SHIELD<br>☒ HEARING PROTECTION: (as needed)<br>☒ SAFETY SHOES steel or composite toe | ☐ AIR PURIFYING RESPIRATOR<br>☐ SUPPLIED RESPIRATOR<br>☒ PPE CLOTHING: fluorescent long sleeve shirt or long sleeve shirt and reflective safety vest. | ☒ GLOVES: Leather, Nitrile and cut resistant<br>☒ OTHER: Insect Repellant, sunscreen (as needed) |

**REQUIRED AND / OR RECOMMENDED EQUIPMENT**

Truck-Mounted Sonic Drilling Rig or Mini Sonic Rig, Hand Tools, Photoionization Detector, Multi-Gas Meter (or equivalent), Interface Probe, 20 lb. Fire Extinguisher, 42" Cones & Flags, "Work Area" Signs, Water

**COMMITMENT TO LPS -** All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.

**EXCLUSION ZONE (EZ): A minimum 10' exclusion zone will be maintained around equipment.**

**"SHOW ME YOUR HANDS"**
**Driller and helper should show that hands are clear from controls and moving parts**

| Assess [1]JOB STEPS | Analyze [2]POTENTIAL HAZARDS | Act [3]CRITICAL ACTIONS |
|---|---|---|
| 1. Mobilization of drilling rig (ensure the Subsurface Clearance Protocol and Drill Rig Checklist are completed)<br>**See Site Set-Up JSA** | 1a. **CONTACT/CRUSH**: Equipment/property damage during movement. Crush point between moving rig and other objects | 1a. The drill rig's tower/derrick will be lowered and secured prior to mobilization.<br>1a. A spotter should be utilized while moving the drill rig or backing operations. If personnel move into the path of the drill rig, the drill rig will be stopped until the path is again clear.<br>1a. Set-up the work area and position equipment in a manner that eliminates or reduces the need for backing of support trucks and trailers.<br>1a. When backing up truck rig with an attached trailer use a second spotter if there is tight clearance simultaneously on multiple sides of the equipment or if turning angles limit driver visibility.<br>1a. Inspect the driving path for uneven terrain. Level or avoid if needed.<br>1a. Drill rig should have a **minimum exclusion zone of 10 feet** for non-essential personnel (i.e., geologist) when the rig is moving/in operation. |
| | 1b. **FALL**: Slip/trip/fall hazards | 1b Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment.<br>1b. Do not climb over stored materials/equipment; walk around. Practice good housekeeping.<br>1b. Use established pathways and walk on stable, secure ground. |
| 2. Raising tower/derrick of drill rig | 2a. **CONTACT**: Overhead hazards | 2a. Prior to raising the tower/derrick, the area above the drilling rig will be inspected for wires, tree limbs, piping, or other structures, that could come in contact with the rig's tower and/or drilling rods or tools.<br>2a. Site requirements for raising a tower/derrick in the area of overhead wires must be reviewed prior to drilling. Maintain a minimum distance of 10 feet from overhead structures.<br>2a. The tower/derrick must not be raised beneath overhead power lines unless approved by both the Roux and Project PMs. |
| | 2b. **CONTACT**: Amputation points when raising the rig and instability of rig | 2b. Inspect the equipment prior to use and avoid amputation points when engaging tower/derrick.<br>2b. Lower out riggers on rig to ensure stability prior to raising rig tower/derrick.<br>2b. If the rig needs to be mounted, be sure to use three points of contact. |

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.
[2] A hazard is a potential danger. Break hazards into six types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards. Energy Source – electricity, pressure, compression/tension.
[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

| Assess<br>[1]JOB STEPS | Analyze<br>[2]POTENTIAL HAZARDS | Act<br>[3]CRITICAL ACTIONS |
|---|---|---|
| 3. Advancement of soil boring and well installation<br><br>**See also Soil Sampling JSA** | 3a. **CONTACT**: Flying debris | 3a. Be aware of and avoid potential lines of fire and wear required PPE such as eye, ear, and hand protection. |
| | 3b. **EXPOSURE**: Noise and dust | 3b. Wet borehole area with sprayer to minimize dust.<br>3b. Stand upwind and keep body away from rig.<br>3b. Dust mask should be worn if there is visible dust in the breathing zone.<br>3b. Wear hearing protection when the drill rig is in operation. |
| | 3c. **CAUGHT**: Limb/extremity amputation points; abrasion/crushing | 3c. Always wear leather gloves when making connections and using hand tools; wear cut-resistant (i.e., Kevlar) gloves when handling cutting tools.<br>3c. Inspect the equipment prior to use for potential amputation points. Keep hands away from being between connections and use of tools is preferable compared to fingers and hands.<br>3c. Inspect drill head for worn surface or missing teeth; replace if damaged or blunt.<br>3c. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body.<br>3c. All non-essential personnel should remain outside the heavy equipment exclusion zone.<br>3c. Drillers and helpers will understand and use the "Show Me Your Hands" Policy. Helpers will remain a **minimum of 2 feet** from augers/drill rods while in operation. |
| | 3d. **CONTACT/CRUSH**: Crushed between equipment due to imbalance during advancement of drill equipment | 3d. Drillers will advance the borehole with caution to avoid causing the rig to become imbalanced and/or tip.<br>3d. The blocking and leveling devices used to secure the rig will be inspected by drillers and Roux personnel regularly to see if shifting has occurred.<br>3d. In addition, personnel and equipment that are non-essential to the advancement of the borehole will be positioned away from the rig at a distance that is at least as far as the boom is high (**minimum exclusion zone of 10 feet**). |
| | 3e. **EXPOSURE**: Inhalation of contamination/vapors | 3e. Air monitoring using a calibrated photoionization detector (PID) will be used to periodically monitor the breathing zone of the work area.<br>3e. If a reading of >5ppm is recorded, the Roux field personnel must temporarily cease work, instruct all Site personnel to step away from the area of elevated readings and inform the Roux PM of the condition. The Roux PM will then recommend additional precautions in accordance with the site specific health and safety plan. |
| | 3f. **FALL**: Slip/trip/fall hazards | 3f. Contain drill cuttings and drilling water to prevent fall hazards from developing in work area.<br>3f. See 1b. |
| | 3g. **ERGONOMICS**: Potential for muscle strain/injury while installing well casings and/or lifting sonic rods/casings | 3g. Keep back straight and bend at the knees.<br>3g. Utilize team lifting for objects over 50lbs.<br>3g. Use mechanical lifting device for odd shaped objects. |
| 4. Decontaminate equipment | 4a. **EXPOSURE**: To contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated groundwater, vapors) | 4a. Wear chemical-resistant disposable gloves and safety glasses.<br>4a. Contain decontamination water so that it does not spill.<br>4a. Use an absorbent pad to clean spills, if necessary.<br>4a. See 3b. |
| | 4b. **EXPOSURE:** Chemicals in cleaning supplies | 4b. See 4a. |

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.
[2] A hazard is a potential danger. Break hazards into six types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards. Energy Source – electricity, pressure, compression/tension.
[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

| JOB SAFETY ANALYSIS | Ctrl. No. GEN-001 | DATE: 02/03/2015 | ☐ NEW ☒ REVISED | PAGE 1 of 2 |
|---|---|---|---|---|

| JSA TYPE CATEGORY | WORK TYPE | WORK ACTIVITY (Description) |
|---|---|---|
| **Generic** | **Construction - Excavation** | **Excavation / Trenching** |

| DEVELOPMENT TEAM | POSITION / TITLE | REVIEWED BY: | POSITION / TITLE |
|---|---|---|---|
| Ian Holst | Staff Engineer | Je Gentile | Corp H&S Mgr |
| | | Michael Ritorto | Project Hydrogeologist |

**REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT**

| | | | |
|---|---|---|---|
| ☐ LIFE VEST | ☐ GOGGLES | ☐ AIR PURIFYING RESPIRATOR | ☒ GLOVES: Leather or cut resistant |
| ☒ HARD HAT | ☐ FACE SHIELD | ☐ SUPPLIED RESPIRATOR | ☐ OTHER |
| ☒ LONG SLEEVED SHIRT | ☒ HEARING PROTECTION | ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility long sleeved clothing | |
| ☐ LIFELINE / BODY HARNESS | ☒ SAFETY SHOES: Steel-toe boots | | |
| ☒ SAFETY GLASSES | | | |

**REQUIRED AND / OR RECOMMENDED EQUIPMENT**

Jackhammer, Excavator, Backhoe, Hand Tools, Photoionization Detector, barrels, 42" traffic cones, snow fencing, telescoping poles, ladders, shovels, digging bars, power tools (cut-off saw), Two-way radios, Sheeting, Trench box, Retractable lanyard, Harness

**Commitment to LPS – All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.**

**EXCLUSION ZONE: Maintain 10' or greater exclusion zone around excavator while it is in motion.**

| Assess<br>[1]JOB STEPS | Analyze<br>[2]POTENTIAL HAZARDS | Act<br>[3]CRITICAL ACTIONS |
|---|---|---|
| 1. Pre-Clearance Protocol. | 1a. **CONTACT:** Damage to underground utility. | 1a. Confirm that (if applicable) "Call Before You Dig" and local utility companies were contacted prior to trenching in order to confirm utility mark outs. Must have a case # before digging. |
| | 1b. **ENERGY SOURCE/CONTACT:** Property damage; Pressurized water mains may cause lacerations or broken bones. Pressurized gas mains may explode causing serious injury, or death.<br>Underground electric may cause severe burns, shock, or death. | 1b. Pre-clearing of the trenching location must be conducted to a minimum of 5 vertical feet below the ground surface (10 feet minimum for Critical Zone) using hand tools (shovel and non-metallic dig bar) prior to trenching. Supervisor should be contacted to discuss appropriate pre-clearing depth.<br>Complete subsurface clearance checklist. |
| | 1c. **FALL:** Slip ,Trip or Fall may cause muscle strains or tears, abrasions or lacerations, or broken bones | 1c. Be aware of the conditions when walking or loading equipment and working. Walk within established pathway avoiding uneven surfaces. Remove potential slip/trip/fall hazards. |
| 2. Set up work zone. | 2a. **CONTACT/CAUGHT:** Cuts/lacerations from equipment. Broken bones from contact by vehicle. | 2a. Isolate work area from hazards with cones, barricades, and snow fencing or telescoping poles. Utilize a flag person when necessary (i.e., third party traffic in area). Install traffic signs in roadways and for detours. Spotters will maintain and enforce exclusion zone. |
| | 2b. **FALL:** Slip ,Trip or Fall may cause muscle strains or tears, abrasions or lacerations, or broken bones. | 2b. See 1c. |

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

[2] A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards, energy source; Energy Source – electricity, pressure, compression/tension.

[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

| Assess<br>[1]JOB STEPS | Analyze<br>[2]POTENTIAL HAZARDS | Act<br>[3]CRITICAL ACTIONS |
|---|---|---|
| 3. Trenching Activity. | 3a. **CONTACT:**<br>Serious injury including broken bones, muscle strains or tears, and possibly death due to contact with machine. | 3a. Spotter(s) required for all heavy equipment operation. No worker shall be allowed inside the exclusion zone or along the trench/excavation area while any equipment is digging. A minimum exclusion zone greater than the length of the equipment boom must be established. Workers only allowed in exclusion zone if the operator is in "Hands Off "mode. Operator will not operate equipment until worker is out of exclusion zone. Spotters and operators will have radios for communication, when either loses sight of one another, and/or in case of emergency. |
| | 3b. **FALL:**<br>Slip ,Trip or Fall may cause muscle strains or tears, abrasions or lacerations, or broken bones | 3b. Any trench/excavation deeper than 3' must have a ladder within 25' of any worker in the excavation. At least 3'(rungs) of the ladder shall be above the top of the excavation. All spoil piles shall be maintained 2' minimum from edge of excavation.<br>3b. Any trench/excavation deeper than 6' must have fall protection, retractable lanyard for ladder use, and 42" high guardrails along the edge of the trench/excavation. |
| | 3c. **EXPOSURE:**<br>Noise, Dust, Concrete- Asphalt, petroleum hydrocarbon vapors may cause damage to ears and lungs | 3c. Air monitoring using a calibrated photoionization detector (PID) will be used to monitor the breathing zone of the work area. If a reading of >5ppm is recorded, the oversight personnel must temporarily cease work and instruct all Site personnel to step away from the area of elevated readings. |
| 4. Setting Trench protections if necessary. | 4a. **CAUGHT:**<br>Injury due to contact with failed trench, may include muscle strains or tears, abrasions or lacerations, broken bones and possibly death. | 4a. To prevent cave-ins and avoid caught by/between, excavations over 4' in depth, unless working in stable rock, shall have engineer approved shoring, sheeting or trench box. Top of protection shall be at least 2' above top of excavation. |
| | 4b. **CONTACT/CAUGHT:**<br>Injury due to rigging activities and entering exclusion zone during lifting and/or transport of shoring box/material may include muscle strains or tears, abrasions or lacerations, broken bones and possibly death. | 4b. Use only inspected rigging with 2, 3 or 4 lift points; wear cut-resistant gloves. Rigging to be hooked up to factory installed hook up points on equipment. Control load with non-conductive tag lines with workers out of exclusion zone. Don't stand underneath suspended load; wear steel toed boots and hard hat. |
| | 4c. **FALL:**<br>Possible injury due to fall into excavation may include muscle strains or tears, abrasions or lacerations, or broken bones. | 4c. Shoring to be set and sides will be backfilled to avoid fall hazards before workers are allowed to enter area. Operator will be in "HANDS OFF" mode before workers enter work area to unhook rigging. An inspected ladder extending 3' above top of the shoring will be used to enter and exit the shoring. Workers will use three points of contact when using the ladder. |
| 5. Secure/Leave Site.<br>If backfilling, see excavation backfilling and compaction JSA for potential hazards and critical actions. | 5a. **FALL:**<br>Potential Slip ,Trip or Fall . may cause muscle strains or tears, abrasions or lacerations, or broken bones. | 5a. See 1c.<br>All open excavations must be backfilled or secured prior to departure with steel plates, orange construction fence or temporary chain link fencing. |

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

[2] A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy source – electricity, pressure, compression/tension.

[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

| JOB SAFETY ANALYSIS | Ctrl. No. GEN-004 | DATE 12/6/2012 | ☐ NEW ☒ REVISED | PAGE 1 of 2 |
|---|---|---|---|---|

| JSA TYPE CATEGORY: | WORK TYPE: | WORK ACTIVITY (Description): | |
|---|---|---|---|
| **Generic** | **Drilling** | **Direct Push Soil Borings / Well Installation** | |
| **DEVELOPMENT TEAM** | **POSITION / TITLE** | **REVIEWED BY:** | **POSITION / TITLE** |
| | | | |
| Jeffrey Wills | Project Hydrogeologist | Curtis Taylor | Health and Safety Officer |
| | | Michael Ritorto | Project Hydrogeologist |

**REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT**

| | | | |
|---|---|---|---|
| ☐ LIFE VEST<br>☒ HARD HAT<br>☐ LIFELINE / BODY HARNESS<br>☒ SAFETY GLASSES | ☐ GOGGLES<br>☐ FACE SHIELD<br>☒ HEARING PROTECTION: (as needed)<br>☒ SAFETY SHOES: Composite-toe or steel toe boots | ☐ AIR PURIFYING RESPIRATOR<br>☐ SUPPLIED RESPIRATOR<br>☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing, Long Sleeve Shirt | ☒ GLOVES: Leather, Nitrile and cut resistant<br>☒ OTHER: Insect Repellant, sunscreen (as needed) |

**REQUIRED AND / OR RECOMMENDED EQUIPMENT**

Geoprobe or Truck-Mounted Direct Push Drill Rig, Hand Tools, Photoionization Detector, Multi-Gas Meter (or equivalent), Macrocore liners, Liner Opening Tool, 20 lb. Fire Extinguisher, 42" Cones & Flags, "Work Area" Signs, Water

**COMMITMENT TO LPS -** All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.

**Exclusion Zone Policy –** All non-essential personnel will maintain a distance of 10' feet from drilling equipment while moving/engaged.

**"SHOW ME YOUR HANDS"**
**Driller and helper should show that hands are clear from controls and moving parts**

| Assess [1]JOB STEPS | Analyze [2]POTENTIAL HAZARDS | Act [3]CRITICAL ACTIONS |
|---|---|---|
| 1. Mobilization of drilling rig (ensure the Subsurface Clearance Protocol and Drill Rig Checklist are completed) | 1a. **CONTACT**: Equipment/property damage. | 1a. The drill rig's tower/derrick will be lowered and secured prior to mobilization.<br>1a. A spotter should be utilized while moving the drill rig. If personnel move into the path of the drill rig, the drill rig will be stopped until the path is again clear. Use a spotter for all required backing operations.<br>1a. Set-up the work area and position equipment in a manner that eliminates or reduces the need for backing of support trucks and trailers.<br>1a. When backing up truck rig with an attached trailer use a second spotter if there is tight clearance simultaneously on multiple sides of the equipment or if turning angles limit driver visibility.<br>1a. Inspect the driving path for uneven terrain. Level or avoid if needed.<br>1a. Drill rig should have a minimum **exclusion zone of 10 feet** for non-essential personnel (i.e., driller helper, geologist) when the rig is moving/ in operation. |
| | 1b. **FALL**: Slip/trip/fall hazards. | 1b Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment.<br>1b. Do not climb over stored materials/equipment; walk around. Practice good housekeeping.<br>1b. Use established pathways and walk on stable, secure ground. |
| 2. Raising tower/derrick of drill rig | 2a. **CONTACT**: Overhead hazards. | 2a. Prior to raising the tower/derrick, the area above the drilling rig will be inspected for wires, tree limbs, piping, or other structures, that could come in contact with the rig's tower and/or drilling rods or tools.<br>2a. Maintain a safe distance from overhead structures. |
| | 2b. **CONTACT**: Pinch Points when raising the rig and instability of rig | 2b. Inspect the equipment prior to use and avoid pinch points.<br>2b. Lower out riggers on rig to ensure stability prior to raising rig tower/derrick.<br>2b. If the rig needs to be mounted, be sure to use three points of contact. |
| 3. Advancement of drilling equipment and well installation | 3a. **CONTACT**: Flying debris | 3a. Be aware of and avoid potential lines of fire and wear required PPE such as eye, ear, and hand protection. |

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

[2] A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.

[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

| | | |
|---|---|---|
| 3. Advancement of drilling equipment and well installation (Continued) | 3b. **EXPOSURE**: Noise and dust. | 3b. Wet borehole area with sprayer to minimize dust.<br>3b. Stand upwind and keep body away from rig.<br>3b. Dust mask should be worn if conditions warrant.<br>3b. Wear hearing protection when the drill rig is in operation. |
| | 3c. **CAUGHT**: Limb/extremity pinching; abrasion/crushing. | 3c. Always wear leather gloves when making connections and using hand tools; wear cut-resistant (i.e., Kevlar) gloves when handling cutting tools.<br>3c. Inspect the equipment prior to use for potential pinch points. Keep hands away from being between pinch points and use of tools is preferable compared to fingers and hands.<br>3c. Inspect drill head for worn surface or missing teeth; replace if damaged or blunt.<br>3c. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body.<br>3c. All non-essential personnel should stay away from the immediate work area; position body out of the line-of-fire of equipment.<br>3c. Drillers and helpers will understand and use the “Show Me Your Hands” Policy.<br>3c. Spinning rods/casing have an **exclusion zone of 10 feet** while in operation. |
| | 3d. **CONTACT**: Equipment imbalance during advancement of drill equipment. | 3d. Drillers will advance the borehole with caution to avoid causing the rig to become imbalanced and/or tip.<br>3d. The blocking and leveling devices used to secure the rig will be inspected by drillers and Roux personnel regularly to see if shifting has occurred.<br>3d. In addition, personnel and equipment that are non-essential to the advancement of the borehole will be positioned away from the rig at a distance that is at least as far as the boom is high (**minimum exclusion zone of 10 feet**). |
| | 3e. **EXPOSURE**: Inhalation of contamination/vapors. | 3e. Air monitoring using a calibrated photoionization detector (PID) will be used to periodically to monitor the breathing zone of the work area.<br>3e. If a reading of >5ppm is recorded, the Roux field personnel must temporarily cease work, instruct all Site personnel to step away from the area of elevated readings and inform the Roux PM of the condition. The Roux PM will then recommend additional precautions in accordance with the site specific health and safety plan. |
| | 3f. **FALL**: Slip/trip/fall hazards. | 3f. Contain drill cuttings and drilling water to prevent fall hazards from developing in work area.<br>3f. See 1b. |
| | 3g. **EXERTION**: Potential for muscle strain/injury while lifting and installing well casings, lifting sand bags, and/or lifting rods. | 3g. Keep back straight and bend at the knees.<br>3g. Utilize team lifting for objects over 50lbs.<br>3g. Use mechanical lifting device for odd shaped objects. |
| 4. Decontaminate equipment. | 4a. **EXPOSURE/CONTACT**: To contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated groundwater, vapors). | 4a. Wear chemical-resistant disposable gloves and safety glasses.<br>4a. Contain decontamination water so that it does not spill.<br>4a. Use an absorbent pad to clean spills, if necessary.<br>4a. See 3b. |
| | 4b. **EXPOSURE:** To chemicals in cleaning solution including ammonia. | 4b. See 4a. Review MSDS to ensure appropriate precautions are taken and understood. |

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

[2] A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.

[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

| JOB SAFETY ANALYSIS | Ctrl. No. GEN 007 | DATE: 2/3/2015 | ☐ NEW ☒ REVISED | PAGE 1 of 1 |
|---|---|---|---|---|
| JSA TYPE CATEGORY **Generic** | WORK TYPE **O&M** | WORK ACTIVITY (Description) **Movement of 55-Gallon Drums/Drum Handling with Mobile Carrier** | | |

| DEVELOPMENT TEAM | POSITION / TITLE | REVIEWED BY: | POSITION / TITLE |
|---|---|---|---|
| Michael Smith | Senior Technician | Daniel Abberton | SHSM |
| | | Ray Greenidge | Project Engineer |

**REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT**

| | | | |
|---|---|---|---|
| ☐ LIFE VEST | ☐ GOGGLES | ☐ AIR PURIFYING RESPIRATOR | ☒ GLOVES: Cut-resistant gloves |
| ☒ HARD HAT | ☐ FACE SHIELD | ☐ SUPPLIED RESPIRATOR | ☐ OTHER: |
| ☐ LIFELINE / BODY HARNESS | ☐ HEARING PROTECTION | ☒ PPE CLOTHING: Fluorescent long sleeve shirt or long sleeve shirt and reflective safety vest. | |
| ☒ SAFETY GLASSES | ☒ SAFETY SHOES: Steel or composite toe | | |

**REQUIRED AND / OR RECOMMENDED EQUIPMENT**

Mobile Drum Carrier, safety cones, and caution tape

**Commitment to LPS** – All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.

**EXCLUSION ZONE: A 10' exclusion zone will be maintained around forklift.**

| Assess [1]JOB STEPS | Analyze [2]POTENTIAL HAZARDS | Act [3]CRITICAL ACTIONS |
|---|---|---|
| 1. Secure Work Area, Inspect 55-gal drums for proper condition, labeling, check drum ring and bolts for tightness, inspect mobile drum carrier. | 1a. **FALL:** Tripping/falling due to uneven surface terrain | 1a. Inspect walking path for uneven terrain, weather-related hazards (i.e. debris, puddles, ice, etc.), and other obstructions prior to accessing work area.<br>1a. Use established pathways and walk on stable, secure ground.<br>1a. Secure work area and coordinate and communicate the planned work activities with other personnel working in the area.<br>1a. Delineate work area with 42" safety cones. |
| | 1b. **CONTACT/EXPOSURE:** Drums could potentially be damaged and contain hazardous material. Mobil drum carrier could potentially not be in good working condition causing malfunctioning during operation. | 1b. Prior to inspecting drums don cut-resistant gloves. If drum is not properly labeled, do not open and cease all drum transport activities. Immediately contact project manager and inform him/her of drum situation.<br>1b. Do not continue drum transport activities until further actions are determined by the project manager.<br>1b. If the drum is properly labeled, but leaking, improperly sealed or in poor condition, place drum in an over-pack drum.<br>1b. Inspect mobile drum carrier to ensure the overall integrity of the carrier. Look for rust marks or potential weak points where the drum carrier could malfunction. Inspect the wheels to ensure that they easily turn and nothing is impeding their movement. |
| | 1c. **EXERTION/CAUGHT:** Potential pinching/exertion hazards while securing ring/ tightening bolts | 1c. Keep back straight and knees slightly bent while securing drum ring/tightening bolt. Wear cut-resistant gloves. |
| 2. Position drum clamp in between drum ribs, securing drum clamp to drum with chain | 2. **CAUGHT:** Pinching fingers between drum clamp and handle/chain. | 2. Attach drum clamp with chain and tighten until snug. Do not place hands between drum clamp and drum as the chain is tightened; wear cut resistant gloves. |
| 3. Disengage safety latches on handle, pull handle down until drum is lifted off ground and safety latches are reengaged; slightly suspending drum off of the ground | 3a. **EXERTION/ CONTACT:** Potential muscle strain associated with lifting/engaging drum/handle. Drum could shift/slip downward and crush toes. | 3a. Ascertain whether the drum is overweight; if it is, then two people are needed to lower handle while drum is secured with clamp so that safety latches can be engaged. Keep body out of the line of fire of the handle (do not position head above handle) as it is being pushed down. Do not allow feet/toes to be positioned under the drum as it is being lifted; wear steel/composite toe boots. |
| | 3b. **CAUGHT:** Fingers could be pinched while engaging/disengaging safety latches on handle | 3b. Wear cut-resistant gloves while disengaging/reengaging safety latches. |
| 4. Transport drums to designated location and disengage drum clamp (repeat Step 3 in reverse order) | 4a. **FALL:** Tripping/ falling due to obstructions and uneven terrain. Potential for drum to fall during transport. | 4a. Ensure transport path is free of potential obstructions that may cause the drum/carrier to become unstable. Position drum clamp between the ribs on the drum to prevent possible slipping. |

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.
[2] A hazard is a potential danger. Break hazards into six types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy source – electricity, pressure, compression/tension.
[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift." Avoid general statements such as, "be careful."

| JOB SAFETY ANALYSIS | Ctrl. No. GEN-008 | DATE 2/5/2015 | ☐ NEW ☒ REVISED | PAGE 1 of 2 |
|---|---|---|---|---|

| JSA TYPE CATEGORY | WORK TYPE: | WORK ACTIVITY (Description): |
|---|---|---|
| **Generic** | **Construction - General** | **Installation or Repair of Chain Link Fence** |

| DEVELOPMENT TEAM | POSITION / TITLE | REVIEWED BY: | POSITION / TITLE |
|---|---|---|---|
| Mark Emmons | Project Engineer | Joseph W. Gentile | Corporate Health and Safety Manager |
| | | Michael Ritorto | Project Hydrogeologist |

**REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT**

| | | | |
|---|---|---|---|
| ☐ LIFE VEST | ☐ GOGGLES | ☐ AIR PURIFYING RESPIRATOR | ☒ GLOVES: Cut-resistant |
| ☒ HARD HAT | ☐ FACE SHIELD | ☐ SUPPLIED RESPIRATOR | ☐ OTHER |
| ☐ LIFELINE / BODY HARNESS | ☒ HEARING PROTECTION | ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing | |
| ☒ SAFETY GLASSES | ☒ SAFETY SHOES: Steel or Composite toed boots | | |

**REQUIRED AND / OR RECOMMENDED EQUIPMENT**

Required Equipment: Fence materials, Hand tools, Power Tools, GFCI

**Commitment to LPS** – All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.

| Assess [1]JOB STEPS | Analyze [2]POTENTIAL HAZARDS | Act [3]CRITICAL ACTIONS |
|---|---|---|
| 1. Secure work zone | 1a. **FALL:** Slip, trip, or fall hazards associated with site conditions.<br><br>1b. **CONTACT**: Vehicular and pedestrian traffic. | 1a. Inspect work area to identify potential hazards: Slip, Trip, Fall hazards<br>1a. Conduct housekeeping as required (debris removal).<br><br>1b. Utilize Traffic Control devices to secure work zone (42" traffic cones with flags, and caution tape).<br>1b. Secure and demarcate w/ traffic control hazards which cannot be directly mitigated if necessary (e.g., jersey barriers). |
| 2. Development of anchor locations for Post-Holes for fences using either a Hammer drill or Post-Hole digger. | 2a. **CONTACT:** Potential cut/abrasion hazards. Operation of hammer drill can result in ejected debris, and eye hazard.<br><br>2b. **ERGONOMICS**: Operating Post-Hole digger as with any shoveling activity can result in soft tissue injury.<br><br>2c. **EXPOSURE:** Operation of hammer drill can generate greater than 85 dBA.<br><br>2d. **ENERGY SOURCE:** Electric hazards from operation of power tools.<br><br>2e. **EXPOSURE:** Exposure to generator noise/fumes.<br><br>2f. **FALL:** Trip hazards from equipment being left in work zone. | 2a. Wear cut-resistant gloves.<br>2a. De-energize power tools by removing battery packs or unplugging electrical supply prior to switching out components (i.e., Sawsall blades or drill bits).<br>2a. PPE: Safety Glasses required.<br><br>2b. PPE: work gloves.<br>2b. Utilize proper lifting techniques when using digging tools. Keep back straight, bend at the knees, keep load close to body, turn with arms, and do not twist back.<br>2b. Inspect post-hole digger prior to use. Ensure there are no splinters on handle. Ensure that the shovel section bolts are in good working condition.<br><br>2c. PPE: Hearing protection required. If you are not operating the hammer drill, stand greater than 10' away.<br><br>2d. Heavy-duty, outdoor cords w/ ground rated for the electrical load required. Inspect extension cords, verify good condition; no exposed wires, cuts, damage, not worn, shielding, damaged plugs.<br>2d. If the use of a generator is required, do not refuel generator while it is running.<br>2d. Use GFCI.<br><br>2e. Position generator such that exhaust is pointed away from workers or downwind of work area. Wear hearing protection if generator cannot be positioned out of the work area and if noise levels exceed 85 dBA.<br><br>2f. Conduct housekeeping to mitigate trip hazards, Stage tools in designated areas at lowest potential energy.<br>2f. Remove tripping hazards caused by extension cords/hoses. |
| 3. Manual lifting of fence materials | 3a. **EXERTION/ERGONOMICS:** Back strain and personal injury from lifting heavy loads.<br><br>3b. **CONTACT:** Potential cut/abrasion hazards. | 3a. 50 lbs is the maximum allowable weight per manual lift. Use a mechanical lifting device if weight is greater than 50 lbs.<br>3a. Keep back straight, bend at the knees, and keep load close to body when lifting.<br>3a. Use buddy system when lifting awkward materials.<br><br>3b. Ensure long sleeves are covering arms, wear cut-resistant gloves. Avoid grabbing cut ends. |

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.
[2] A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.
[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift." Avoid general statements such as, "be careful."

| Assess<br>[1]JOB STEPS | Analyze<br>[2]POTENTIAL HAZARDS | Act<br>[3]CRITICAL ACTIONS |
|---|---|---|
| 4. Installation of chain link fence. | 4a. **OVEREXERTION:** Back strain and personal injury from lifting heavy loads | 4a. See 3a. |
| | 4b. **CONTACT:** Potential cut/abrasion hazards on fencing. | 4b. Avoid sharp edges on fencing; ensure long sleeved shirts are fully covering arms, wear cut-resistant gloves. |
| 5. Housekeeping. | 5a. **FALL:** Slip, trip, fall hazards from items left in the work zone. | 5a. Clean up loose items including tent components, tools, etc.<br>5a. Inspect work zone to verify it is left in safe condition. |

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.
[2] A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.
[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

| JOB SAFETY ANALYSIS | Cntrl. No. GEN-009 | DATE: 12//31/2012 | ☐ NEW ☒ REVISED | PAGE 1 of 2 |
|---|---|---|---|---|

| JSA TYPE CATEGORY | WORK TYPE | WORK ACTIVITY (Description) |
|---|---|---|
| **GENERIC** | **Hand Tools** | **Pre-Clearing activities, including Air Knifing and Soil Vacuuming** |

| DEVELOPMENT TEAM | POSITION / TITLE | REVIEWED BY: | POSITION / TITLE |
|---|---|---|---|
| Alyssa Lau | Staff Engineer | Curtis Taylor | SHSM |
| | | Mike Ritorto | Project Hydrogeologist |
| | | | |

**REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT**

| | | | |
|---|---|---|---|
| ☐ LIFE VEST | ☐ GOGGLES | ☐ AIR PURIFYING RESPIRATOR | ☒ GLOVES: Nitrile and cut resistant |
| ☒ HARD HAT | ☒ FACE SHIELD (while air knifing) | ☐ SUPPLIED RESPIRATOR | |
| ☐ LIFELINE / BODY HARNESS | ☒ HEARING PROTECTION (as needed) | ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing | ☒ OTHER: Dust mask (as needed) |
| ☒ SAFETY GLASSES | ☒ SAFETY SHOES: Steel or composite toed | | |

**REQUIRED AND / OR RECOMMENDED EQUIPMENT**

Required Equipment: Air Knife, Vactor Truck (Vac Truck), Compressor, Hand Tools, Photoionization Detector, Multi-Gas Meter, Traffic Cones, 20 lb. Fire Extinguisher, "Work Area" and/or "Exclusion Zone" Signs

**Commitment to LPS** – All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.

**EXCLUSION ZONE: A 10 foot exclusion zone will be maintained around air knife and/or soil vacuum operations.**

| Assess [1]JOB STEPS | Analyze [2]POTENTIAL HAZARDS | Act [3]CRITICAL ACTIONS |
|---|---|---|
| 1. Verify pre-clearance protocol. | 1a. **CONTACT**: Underground utility damage; property damage; personal injury.<br><br>See Site Walk Inspection JSA for potential hazards. | 1a. Confirm that local utility companies were contacted prior to drilling.<br>1a. Walk the Site to evaluate utility markings and review maps (**See Site Walk Inspection JSA for critical actions**).<br>1a. Review pre-clearing checklist form and sub-surface clearance form. Pre-clearing protocol indicates that clearance must be conducted to a minimum of 5 vertical feet below ground surface or 8 vertical feet below ground surface in the critical zone using hand tools. |
| 2. Mobilize/demobilize and establish work area. | 2a. **See Mobilization / Demobilization JSA for potential hazards.** | 2a. **See Mobilization / Demobilization JSA for critical actions.** |
| 3. Pre-clear with air knife and soil vacuum, and/or clearance with hand tools | 3a. **CONTACT**: Flying debris. | 3a. **Maintain 10 foot exclusion zone.** Only (air knife/vac truck) operator and designated helper shall remain within exclusion zone while air knife/vac truck is active. Use the required PPE, including (at a minimum), cut resistant gloves, safety glasses with side shields, and long sleeved shirt.<br>3a. Wear a face shield to protect face from flying debris when using air knife.<br>3a. Aim air knife tip away from self and others, so to avoid line-of-fire hazards.<br>3a. Use anti-whip devices on compressor hoses. |
| | 3b. **EXPOSURE/ENERGY SOURCE**: Inhalation/exposure to hazardous vapors; inhalation/exposure to dust; electrocution. | 3b. Monitor breathing zone with a calibrated PID and multi-gas meter. If vapors sustain levels > 5 ppm, the Roux field personnel must temporarily cease work, instruct all Site personnel to step away from the area of elevated readings and inform the Roux Project Manager of the condition. The Roux Project Manager will then recommend additional precautions.<br>3b. Wear dust masks as needed.<br>3b. Ensure no open flames/heat sources are present within the work area.<br>3b. Ensure vac truck is properly grounded prior to use.<br>3b. Do not use metal dig bar; use fiberglass or equivalent. |
| | 3c. **CONTACT:** Damage to unknown/known utility with air knife. | 3c. Avoid contacting utilities directly with the high pressure air stream and using the air knife tip as a physical digging tool.<br>3c. Keep the air knife tip constantly moving to reduce direct pressure on a potential utility.<br>3c. Increase the distance between air knife tip and soil/utility.<br>3c. Continually remove soil slurry from hole with vacuum, which may have an abrasive effect on utility casings. |
| | 3d.**OVEREXERTION**: Poor body positioning when handling equipment and materials. | 3d. Use proper body positioning and lifting techniques that minimizes muscle strain; keep back straight, lift with legs, keep |

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

[2] A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.

[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift." Avoid general statements such as, "be careful."

| | | |
|---|---|---|
| | | load close to body, and never reach with a load. |
| 3. Pre-clearing with air knife and soil vacuum, and/or clearance with hand tools (continued) | 3d. **OVEREXERTION**: (continued) Poor body positioning when handling equipment and materials. | 3d. Ensure that loads are balanced to reduce the potential for muscle strain.<br>3d. Two people or a mechanical lifting aid are required when lifting objects over 50 lb. or when the shape makes the object difficult to lift. |
| | 3e. **FALL**: Tripping/falling due to uneven terrain, weather conditions, and materials/equipment stored at the Site. | 3e. Inspect walking path for uneven terrain, weather-related hazards (e.g., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment.<br>3e. Walk around any stored materials/equipment; do not climb over. Practice good housekeeping.<br>3e. Use established pathways and walk on stable, secure ground.<br>3e. Equipment and tools will be stored at the lowest point of potential energy and out of the walkway and immediate work area (i.e., tools should not be propped against walls or nearby equipment or vehicles).<br>3e. Equipment and tools that are not anticipated to be used will be returned to a storage area that is out of the immediate work area.<br>3e. Ensure power cords/hoses are grouped when used within the work area. Mark out cords/hoses that cross pathways with traffic cones.<br>3e. Ensure all Site personnel and equipment stay a minimum of 2 feet from an open hole. Mark out open holes with traffic cones/caution tape, etc.<br>3e. Pre-cleared location will be finished flush to grade as to prevent a slip/trip hazard. |
| | 3f. **CAUGHT**: Pinch points associated with the equipment and vacuum hose. | 3f. Always wear cut-resistant gloves when making connections and using hand tools.<br>3f. Inspect the equipment prior to use for potential pinch points.<br>3f. Test all emergency shutdown devices prior to using equipment.<br>3f. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body.<br>3f. **All non-essential personnel shall maintain a 10 foot exclusion zone**; position body out of the line-of-fire of equipment.<br>3f. **Drillers and helpers will understand and use the "Show Me Your Hands Policy".** |
| | 3g. **EXPOSURE**: Noise from vac truck and/or air compressor. | 3g. Wear hearing protection when vac truck and air compressor are in operation. Otherwise, if sound levels exceed 85 dB, don hearing protection. |
| 4. Move drum to staging area using drum cart. | 4a. **EXPOSURE/CONTACT**: Contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated groundwater, soil). | 4a. Wear chemically resistant gloves (i.e., Nitrile; worn in addition to cut resistant gloves).<br>4a. Do not overfill drums. Ensure that the drum lids are attached securely.<br>4a. Stage all drums in the designated storage area (per Roux Project Manager) and ensure they are labeled. |
| | 4b. **EXERTION**: Muscle strain while maneuvering drums with drum cart/lift gate. | 4b. See 3d. Do not overfill drums. Use lift gate on back of truck to load and unload drums or drum cart to transport drums. |
| | 4c. **CAUGHT**: Pinch points associated with handling drum lid. | 4c. Ensure that fingers are not placed under the lid of the drum. Wear cut-resistant gloves. Use 15/16" ratchet while sealing drum lid. |
| 5. Decontaminate equipment and tools. | 5a. **EXPOSURE/CONTACT**: To contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated groundwater, vapors). | 5a. See 4a.<br>5a. Contain decontamination water (closed lid) so that it does not spill.<br>5a. Use an absorbent pad to clean spills, if necessary.<br>5a. Store all impacted materials/PPE in a designated storage container (per Roux Project Manager) and ensure the container is labeled. |
| | 5b. **EXPOSURE**: To chemicals in cleaning solution. | 5b. See 4a. |

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

[2] A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.

[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

| JOB SAFETY ANALYSIS | Cntrl. No. GEN-010 | DATE: 12/31/2012 | ☐NEW ☒REVISED | PAGE 1 of 2 |
|---|---|---|---|---|

| JSA TYPE CATEGORY | WORK TYPE | WORK ACTIVITY (Description) | |
|---|---|---|---|
| **GENERIC** | **Site Recon** | **Mobilization/Demobilization** | |
| **DEVELOPMENT TEAM** | **POSITION / TITLE** | **REVIEWED BY:** | **POSITION / TITLE** |
| Jared Lefkowitz | Staff Assistant Scientist | Curtis Taylor | SHSM |
| | | Mike Ritorto | Project Hydrogeologist |
| | | | |

**REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT**

| | | | |
|---|---|---|---|
| ☐ LIFE VEST<br>☒ HARD HAT<br>☐ LIFELINE / BODY HARNESS<br>☒ SAFETY GLASSES | ☐ GOGGLES<br>☐ FACE SHIELD<br>☒ HEARING PROTECTION (as needed)<br>☒ SAFETY SHOES: Steel Toe or composite toe | ☐ AIR PURIFYING RESPIRATOR<br>☐ SUPPLIED RESPIRATOR<br>☒ PPE CLOTHING: Fluorescent reflective vest of high-visibility clothing; long sleeve shirt; long pants | ☐ GLOVES: Leather, nitrile, and cut resistant (as needed)<br>☐ OTHER |

**REQUIRED AND / OR RECOMMENDED EQUIPMENT**

Required Equipment:

**Commitment to LPS** – All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.

**EXCLUSION ZONE: A minimumexclusion zone of 10' will be maintained around moving equipment (if necessary)**

| Assess<br>[1]JOB STEPS | Analyze<br>[2]POTENTIAL HAZARDS | Act<br>[3]CRITICAL ACTIONS |
|---|---|---|
| 1. Mobilize/demobilize and establish work area | **1a. FALL:** Slip/trips/falls from obstructions, uneven terrain, weather conditions, heavy loads, and/or poor housekeeping. | 1a. Use 3 points-of-contact/ensure secure footing when entering and exiting vehicle.<br>1a. Inspect walking path for uneven terrain, steep hills, obstructions, and/or weather-related hazards (i.e., ice, snow, and puddles) prior to mobilizing equipment. Use established pathways.Walk on stable/secure ground.<br>1a. Do not climb over stored materials/equipment; walk around. Practice good housekeeping.<br>1a. Wear boots with adequate treads.<br>1a. Delineate unsafe areas with 42" cones, caution tape and/or flagging. |
| | **1b. CONTACT:** Personal injury and/or property damage caused by being struck by Site traffic or equipment used in Site activities. | 1b. Observe and maintain the posted speed limits.<br>1b. When first arriving onsite, park vehicles in designated parking space and/or out of the way locations. Use parking brake on all vehicles and tire chocks on work trucks and trailers.<br>1b. Check in with Site Manager/Supervisor to ensure coordination with other Site activities.<br>1b. Identify potential traffic sources.<br>1b. Wear PPE including high visibility clothing or reflective vest.<br>1b. Use a spotter while moving work vehicles; plan ahead to avoid backing when unnecessary.<br>1b. Maintain a minimum 10' exclusion zone when vehicles are in motion. When backing up truck rig with an attached trailer use a second spotter if there is tight clearance simultaneously on multiple sides of the equipment or if turning angles limit driver visibility.<br>1b. Delineate work area with 42" cones, flags, caution tape, and/or other barriers.<br>1b. Position "Work Area" signs at Site entrances, if possible, or at either side of work area.<br>1b. Position largest vehicle to protect against oncoming traffic.<br>1b. Face traffic, maintain eye contact with oncoming vehicles, use a spotter, and establish a safe exit route. |
| | **1c. CAUGHT:** Personal injury from pinch points and being in line-of-fire of vehicle and/or equipment. | 1c. Make sure driver has engaged parking brake and placed wheel chocks in a position to prevent movement. Be sure that vehicle is parked in front/down gradient of work area.<br>1c. Wear leather gloves when handling any tools or equipment. Avoid wearing loose clothing. Wear cut-resistant gloves (Kevlar or similar) when handling sharp objects/cutting tools.<br>1c. Keep body parts away from line-of-fire of equipment.<br>1c. Always carry tools by the handles and/or designated carrier. Ensure sharp-edged tools are sheathed/secure.<br>1c. Remove any loose jewelry. Ensure loose clothing is secure. |

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

[2] A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.

[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift." Avoid general statements such as, "be careful."

| Assess<br>[1]JOB STEPS | Analyze<br>[2]POTENTIAL HAZARDS | Act<br>[3]CRITICAL ACTIONS |
|---|---|---|
| | **1d. OVEREXERTION:** Muscle strains while lifting/carrying equipment. | 1d. Use body positioning and lifting techniques that avoid muscle strain; keep back straight, lift with legs, keep load close to body, and never reach with a load.<br>1d. Ensure that loads are balanced. Use assistance (mechanical or additional person) to carry equipment that is either awkward to carry or over 50 lbs. |
| | **1e. EXPOSURE:** Personal injury from exposure to biological and environmental hazards. | 1e. Inspect area to avoid contact with biological hazards (i.e. poisonous plants, stinging insects, ticks, etc.).<br>1e. Wear long sleeved clothes, apply insect repellant containing DEET, and inspect clothes and skin for ticks during and after work.<br>1e. Apply sunscreen (SPF 15+) if exposure to sun for 30 minutes or more is expected. |
| | **1f. EXPOSURE:** Heat and cold related injuries. | 1f. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, rapid and shallow breathing). Take breaks as needed.<br>1f. Watch for cold stress symptoms (severe shivering, slowing of body movement, weakness, stumbling or inability to walk, collapse). Take breaks as needed.<br>1f. Wear clothing appropriate for weather and temperature conditions (e.g., rain jackets, snow pants, multiple layers).<br>1f. If lightning is observed, wait 30 minutes in a sheltered location (car is acceptable) before resuming work. |
| | **1g. EXPOSURE:** Personal injury from noise hazards. | 1g. Wear hearing protection if sound levels exceed 85 dBA. |

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

[2] A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.

[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

| JOB SAFETY ANALYSIS | Cntrl. No. GEN-011 | DATE: 12/31/2012 | ☐NEW ☒REVISED | PAGE 1 of 2 |
|---|---|---|---|---|

| JSA TYPE CATEGORY | WORK TYPE | WORK ACTIVITY (Description) | |
|---|---|---|---|
| **GENERIC** | **Site Recon** | **Site Walk and Inspection** | |
| **DEVELOPMENT TEAM** | **POSITION / TITLE** | **REVIEWED BY:** | **POSITION / TITLE** |
| Chelsea Willett | Staff Assistant Geologist | Curtis Taylor | SHSM |
| | | Mike Ritorto | Project Hydrogeologist |

**REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT**

| | | | |
|---|---|---|---|
| ☐ LIFE VEST<br>☒ HARD HAT<br>☐ LIFELINE / BODY HARNESS<br>☒ SAFETY GLASSES | ☐ GOGGLES<br>☐ FACE SHIELD<br>☒ HEARING PROTECTION: ear plugs as necessary<br>☒ SAFETY SHOES: Steel or composite toed | ☐ AIR PURIFYING RESPIRATOR<br>☐ SUPPLIED RESPIRATOR<br>☒ PPE CLOTHING: High-visibility vest, long sleeves | ☒ GLOVES: Leather/cut-resistant/chemical resistant<br>☒ OTHER: tyvek and rubber boots as necessary, dust mask as necessary |

**REQUIRED AND / OR RECOMMENDED EQUIPMENT**

Required Equipment: Site map and/or guide familiar with Site, operating cell phone or walkie-talkie if Site allows.

**Commitment to LPS** – All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.

**EXCLUSION ZONE (EZ): A minimum 10' exclusion zone will be maintained around equipment.**

| Assess<br>[1]JOB STEPS | Analyze<br>[2]POTENTIAL HAZARDS | Act<br>[3]CRITICAL ACTIONS |
|---|---|---|
| 1. Check in with Site manager. | **1a. CONTACT/EXPOSURE/FALL:** Lack of communication could result in H&S incident. | 1a. Inform Site personnel of work scope, timeline and location(s).<br>1a. Inquire about other activities taking place at the Site. |
| 2. Traversing the Site and setting up at work locations. | **2a. CONTACT:** Property damage and personal injury caused by obstructions/vehicles. | 2a. Maintain speed limit of 5 mph on-site.<br>2a. All equipment must be stowed and secured prior to moving. Use wheel chocks on all construction vehicles when not in motion.<br>2a. Drive on established roadways.<br>2a. Yield to all pedestrians.<br>2a. Do not back up vehicle without spotter where visibility is limited; use pull-through spots or back into parking spots; use an audible signal (horn/back-up alarm) when backing up vehicles.<br>2a. Wear high visibility clothing/safety vest. |
| | **2b. FALL:** Uneven terrain and weather conditions. Overgrown shrubs and vines. Equipment in the workzone. | 2b. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment.<br>2b. Use established pathways and walk on stable, secure ground. |
| | **2c. OVEREXERTION:** Muscle strain while carrying equipment. | 2c. When carrying equipment to/from work area, use proper lifting techniques; keep back straight, lift with legs, keep load close to body, never reach with a load. Ensure that loads are balanced to reduce the potential for muscle strain. Use mechanical assistance or make multiple trips to carry equipment.<br>2c. Two people or a mechanical lifting device are required when lifting objects over 50 lbs or when the shape makes the object difficult to lift. |
| | **2d. EXPOSURE:** Biological hazards - ticks, bees/wasps, poison ivy, insects, etc. (Ticks are most active any time the temperature is above freezing, typically from March to November) | 2d. Inspect area to avoid contact with biological hazards.<br>2d. Ticks:<br>• Treat outer clothing including pants, shirts, socks, boots and hats the evening before use with Permethrin (allowing at least two hours before use).<br>• Apply DEET to exposed skin before travelling to the Site and reapply after two hours.<br>• Check for ticks during and after work.<br>2d. Bees: Use bee spray to remove nests. Protect exposed skin with insect repellent.<br>2d. Poison Ivy:<br>• Identify areas of poison ivy and spray with weed killer. Don Tyvek and rubber boots while traversing poison ivy areas.<br>• If skin comes in contact with poison ivy, wash skin thoroughly with soap and water. |
| | **2e. EXPOSURE:** Sun, possibly causing sunburn. | 2e. Wear sunscreen with SPF 15 or greater on exposed skin whenever 30 minutes or more of sun exposure is expected. |

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

[2] A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.

[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift." Avoid general statements such as, "be careful."

| Assess<br>[1]JOB STEPS | Analyze<br>[2]POTENTIAL HAZARDS | Act<br>[3]CRITICAL ACTIONS |
|---|---|---|
| 3. Define and secure the work area. | **3a. CONTACT:** Personal injury or property damage from other vehicles on-site. | 3a. Face traffic, maintain eye contact with oncoming vehicles, and establish a safe exit route.<br>3a. Look both ways in high traffic areas.<br>3a. Position vehicle to protect against oncoming traffic.<br>3a. Use 42" traffic cone and caution tapesto delineate work area. Use a spotter in high traffic areas.<br>3a. Wear high visibility clothing/safety vest. |
| 4. Walking near heavy equipment and machinery. | **4a. CONTACT:** Personal injury from Site and roadway traffic.<br>Personal injury from flying debris. | 4a. See 3a.<br>4a. Place traffic cones to re-direct traffic flow around work area and to alert others as to activity taking place.<br>4a. Maintain a minimum exclusion zone of 10 feet from all equipment. Task specific JSAs should be referenced to determine the actual exclusion zone for that piece of equipment being used.<br>4a. Keep body parts from being present within the line of fire of pinch points.<br>4a. Routinely inspect work area and be aware of location of all Site personnel. Make eye contact with operator prior to entering the work area.<br>4a. Wear safety glasses. |
| | **4b. OVEREXERTION:** Personal injury from lifting/moving/rotating equipment. | 4b. See 2c. |
| | **4c. EXPOSURE:** Hearing damage from excavation activities.<br>Inhalation/exposure to hazardous vapors and or dust. | 4c. Monitoring air quality with multi-gas meter and dust meter, if necessary. Utilize water to suppress dust, if necessary. Wear dust mask, if necessary.<br>4c. Wear hearing protection if >85 dB.<br>4c. Always wear leather gloves when handling any tools or equipment. Wear cut-resistant gloves (Kevlar or similar) when handling sharp objects or cutting tools. |
| | **4d. EXPOSURE:** Working in a remote area. | 4d. Use the "buddy system" whenever possible. If working alone, contact PM upon arrival/departure, as well as during work activities to be established by the PM prior to commencing work.<br>4d. Always carry a communication (i.e., cell phone, walkie-talkie) or directional (i.e., map, compass, etc.) device when traversing remote areas. |
| 5. Working in adverse weather conditions. | **5a. EXPOSURE:**<br>Heat Stress & Cold Stress. Personal injury from working in inclement weather conditions. | 5a. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, rapid and shallow breathing). Take breaks as needed.<br>5a. Watch for cold stress symptoms (severe shivering, slowing of body movement, weakness, stumbling or inability to walk, collapse). Take breaks as needed.<br>5a. Wear appropriate rain gear.<br>5a. Take frequent breaks if tired, wet, or cold/hot. Drink water.<br>5a. If lightning is observed, wait 30 minutes after last thunder boom/lightning bolt in a sheltered location (car acceptable) before starting work again. |
| 6. Departing Site. | **6a. EXPOSURE:** Exposure to hazards should personnel believe Roux is on-Site during an emergency. | 6a. Sign out or notify Site personnel of your departure. |

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

[2] A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.

[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

| JOB SAFETY ANALYSIS | Cntrl. No. GEN-012 | DATE: 12/31/2012 | ☐NEW ☒REVISED | PAGE 1 of 2 |
|---|---|---|---|---|

| JSA TYPE CATEGORY: **GENERIC** | WORK TYPE: **Gauging & Sampling** | WORK ACTIVITY (Description): **Soil Sampling** | |
|---|---|---|---|
| **DEVELOPMENT TEAM** | **POSITION / TITLE** | **REVIEWED BY:** | **POSITION / TITLE** |
| Michael Hodess | Staff Environmental Scientist | Curtis Taylor | SHSM |
| | | Mike Ritorto | Project Hydrogeologist |
| | | | |

**REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT**

| | | | |
|---|---|---|---|
| ☐ LIFE VEST<br>☒ HARD HAT<br>☐ LIFELINE / BODY HARNESS<br>☒ SAFETY GLASSES<br>☒ FLAME RESISTANT CLOTHING (as needed) | ☐ GOGGLES<br>☐ FACE SHIELD:<br>☒ HEARING PROTECTION: (as needed)<br>☒ SAFETY SHOES: Composite-toe or steel toe boots | ☐ AIR PURIFYING RESPIRATOR<br>☐ SUPPLIED RESPIRATOR<br>☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing | ☒ GLOVES: Leather, Nitrile and cut resistant<br>☒ OTHER: Insect Repellant, sunscreen (as needed) |

**REQUIRED AND / OR RECOMMENDED EQUIPMENT**

Recommended Equipment; 42" traffic cones, caution tape, trowel

**COMMITMENT TO LPS - All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.**

**EXCLUSION ZONE: A minimum 10' exclusion zone will be maintained around moving equipment, if present.**

| Assess [1]JOB STEPS | Analyze [2]POTENTIAL HAZARDS | Act [3]CRITICAL ACTIONS |
|---|---|---|
| 1. Secure location | 1a. **CONTACT:** Personnel and vehicular traffic may enter the work area. | 1a. If in an area with foot or vehicle traffic, delineate the work area with 42" traffic cones and/or caution tape to prevent exposure to traffic and inform others of work activity.<br>1a. Wear reflective vest and/or fluorescent clothing.<br>1a. Face the direction of any vehicular traffic. Position vehicle to protect worker from traffic.<br>1a. Communicate work activity with adjacent work areas. |
| | 1b. **FALL:** Tripping/falling due to uneven terrain or entry/exit from excavations. | 1b. Inspect pathways and work area for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions.<br>1b. Use established pathways and walk on stable, secure ground.<br>1b. Stage equipment and tools will in a convenient, stable, and orderly manner. Store equipment at lowest potential energy.<br>1b. Roux employees should stay 5 feet from in-progress excavations and trenches. Should entry to an excavation be appropriate (when stabilization is complete), ladders must be employed for steep embankments, excavations, pits, and trenches. |
| | 1c. **EXPOSURE:** Exposure to sun and excessive heat, possibly causing sunburn, heat exhaustion or heat stroke,<br><br>Exposure to cold temperatures possibly causing cold stress.<br><br>Skin burn as a result of fire if occurred. Exposure to explosive vapors due to tank farm operations,<br><br>Biological hazards - ticks, bees/wasps, poison ivy, thorns, insects, etc. | 1c. Wear sunscreen with an SPF 15 or greater whenever 30 minutes or more of exposure is expected.<br>1c. Use a tent to shade the work area from direct sunlight particularly when warm temperatures are also expected.<br>1c. Be aware of the location of all Site personnel.<br>1c. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, rapid and shallow breathing).<br>1c. Watch for cold stress symptoms (severe shivering, slowing of body movement, weakness, stumbling or inability to walk, collapse).<br>1c. Take breaks for rest and water as necessary. Move to an area that is well shaded or an area with air conditioning (i.e., car, site trailer, etc.). Move to an area that is warm.<br>1c. No open flames/heat sources.<br>1c. Flame resistant clothing must be worn when specified by Site policy.<br>1c. Cell phones should be disabled when specified by Site policy.<br>1c. Pre-treat field clothing with Permethrin prior to site visit to kill/repel ticks and insects.<br>1c. Wear long sleeved shirts and tuck in (or tape) pant legs into socks or boots to prevent ticks from reaching skin.<br>1c. Spray insect repellant containing DEET on exposed skin when working in overgrown areas of the Site.<br>1c. Inspect area to avoid contact with biological hazards.<br>1c. Wear cut-resistant gloves when handling branches, shrubs, etc. that may lie within the walking path.<br>1c. Personnel shall examine themselves and co-worker's outer clothing for ticks periodically when onsite.<br>1c. If skin comes in contact with poison ivy, wash skin thoroughly with soap and water. |

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

[2] A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.

[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

| Assess<br>[1]JOB STEPS | Analyze<br>[2]POTENTIAL HAZARDS | Act<br>[3]CRITICAL ACTIONS |
|---|---|---|
| 2. Collect Soil Sample | 2a. **CONTACT:** Personal injury from pinch points, cuts, and abrasions from sampling equipment tools, and material within soil sample. Personal injury from contact with moving equipment while sampling. | 2a. Wear cut-resistant (i.e., Kevlar) gloves under chemical-resistant disposable gloves when handling soil samples and sampling jars.<br>2a. Where possible, use trowel or equivalent tool to avoid contact with soil.<br>2a. If sampling from bucket of heavy equipment, ensure all equipment is off and operator utilizes the "show me your hands" policy.<br>2a. See 1a. |
| | **2b. EXPOSURE:** Exposure to contamination (impacted soil) and/or lab preservatives. | 2b. Wear chemical-resistant disposable gloves over cut resistant gloves to protect hands when handling samples; use containment material or plastic sheeting to protect surrounding areas.<br>2b. When collecting soil sample from hand auger, put large zip lock bag over entire auger to prevent spillage of soil on to the ground.<br>2b. Open sample jars slowly and fill carefully to avoid contact with preservatives. |
| 3. Decontaminate equipment | 3a. **EXPOSURE/CONTACT:** Contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated vapors and/or soil). | 3a. Wear chemical-resistant disposable gloves and safety glasses.<br>3a. Use an absorbent pad to clean spills.<br>3a. Properly dispose of used materials/PPE in provided drums in designated drum storage area. |
| | 3b. **EXPOSURE:** Chemicals in cleaning solution including ammonia. | 3b. Wear chemical-resistant disposable gloves and safety glasses.<br>3b. Work on the upwind side of decon area.<br>3b. Use an absorbent pad to clean spills.<br>3b. Properly dispose of used materials/PPE in provided drums in designated drum storage area. |

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

[2] A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.

[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

| JOB SAFETY ANALYSIS | Cntrl. No. GEN-004 | 11/23/2016 | ☒ NEW ☐ REVISED | PAGE 1 of 2 |
|---|---|---|---|---|

| JSA TYPE CATEGORY | WORK TYPE | WORK ACTIVITY (Description) |
|---|---|---|
| **GENERIC** | **Drilling & Sampling** | **Soil Borings from Barge in Canal** |

| DEVELOPMENT TEAM | POSITION / TITLE | REVIEWED BY: | POSITION / TITLE |
|---|---|---|---|
| | | | |
| Kenneth Huber (Langan) | Project Geotechnical Engineer | | |
| | | | |

**REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT**

| | | | |
|---|---|---|---|
| ☒ LIFE VEST | ☐ GOGGLES | ☐ AIR PURIFYING RESPIRATOR | ☒ GLOVES: Leather, Nitrile and cut resistant |
| ☒ HARD HAT | ☐ FACE SHIELD | ☐ SUPPLIED RESPIRATOR | ☒ OTHER: Insect Repellant, sunscreen (as needed) |
| ☐ LIFELINE / BODY HARNESS | ☒ HEARING PROTECTION: (as needed) | ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing, Long Sleeve Shirt | |
| ☒ SAFETY GLASSES | ☒ SAFETY SHOES: Composite-toe or steel toe boots | | |

**REQUIRED AND / OR RECOMMENDED EQUIPMENT**

Barge-Mounted Mud Rotary Drill Rig, Hand Tools, Photoionization Detector, Multi-Gas Meter (or equivalent), 20 lb. Fire Extinguisher, Water, Trowel

**Commitment to LPS** – All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.

**EXCLUSION ZONE: A _ foot exclusion zone will be maintained around (indicate equipment).**

| Assess [1]JOB STEPS | Analyze [2]POTENTIAL HAZARDS | Act [3]CRITICAL ACTIONS |
|---|---|---|
| 1. Mobilization of barge & drill rig (ensure the Subsurface Clearance Protocol and Drill Rig Checklist are completed) | **1a. CONTACT:** Equipment/property damage. | 1a. The drill rig's tower/derrick will be lowered and secured prior to mobilization.<br>1a. A spotter should be utilized while launching the barge and while placing the drill rig on the barge. Non-essential personnel shall be outside the launch area. No personnel shall be under the lift area if a crane is used to set the barge in the canal or the rig on the barge.<br>1a. Use a spotter when backing up delivery truck with an attached trailer. Use a second spotter if there is tight clearance simultaneously on multiple sides of the equipment or if turning angles limit driver visibility.<br>1a. Inspect the driving path for uneven terrain. Level or avoid if needed.<br>1a. Launch area should have a minimum exclusion zone of 10 feet for non-essential personnel (i.e., driller helper, geologist) when the barge and rig are being moilized. |
| | **1b. FALL:** Slip/trip fall hazards. | 1b. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.) and obstruction prior to mobilizing equipment.<br>1b. Do not climb over stored materials/equipment; walk around. Practice good housekeeping.<br>1b. Use established pathways and walk on stable, secure ground. |
| 2. Raising tower/derrick of drill rig | **2a. CONTACT:** Overhead hazards. | 2a. Prior to raising the tower/derrick, the area above the drilling rig will be inspected for wires, tree limbs, piping, or other structures, that could come in contact with the rig's tower and/or drilling rods or tools.<br>2a. Maintain a safe distance from overhead structures. |
| | **2b. CAUGHT:** Pinch Points when raising the rig and instability of rig | 2b. Inspect the equipment prior to use and avoid pinch points.<br>2b. Use at least three points of contact when mounting the drill rig to the barge. |
| 3. Advancement of drilling equipment and soil sampling | **3a. CONTACT:** Flying debris<br><br>Equipment imbalance during advancement of drill equipment. | 3a. Be aware of and avoid potential lines of fire and wear required PPE such as head, eye, ear, and hand protection.<br><br>3a. Drillers will advance the borehole with caution to avoid causing the rig to become imbalanced and/or tip.<br>3a. The blocking and leveling devices used to secure the rig will be inspected by drillers and Langan personnel regularly to see if shifting has occurred.<br>3a. Non-essential personell and equipment will not be allowed on the barge. |

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

[2] A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards.

[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift." Avoid general statements such as, "be careful."

| | | |
|---|---|---|
| | **3b. EXPOSURE:**<br>Noise | 3b. Wear hearing protection when the drill rig is in operation. |
| | Inhalation of contamination/vapors | 3b. Air monitoring using a calibrated photoionization detector (PID) will be used to periodically monitor the breathing zone of the work area.<br>3b. If a reading of >5ppm is recorded, the Langan field personnel must temporarily cease work, instruct all personnel to leave the barge and inform the Roux PM of the condition. The Roux PM will then recommend additional precautions in accordance with the site specific health and safety plan. |
| | To contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated groundwater, vapors). | 3b. Wear chemical-resistant disposable gloves and safety glasses. |
| | **3c. CAUGHT:**<br>Limb/extremity pinching; abrasion/crushing. | 3c. Always wear leather gloves when making connections and using hand tools; wear cut-resistant (i.e., Kevlar) gloves when handling cutting tools.<br>3c. Inspect the equipment prior to use for potential pinch points. Keep hands away from being between pinch points and use of tools is preferable compared to fingers and hands.<br>3c. Inspect drill head for worn surface or missing teeth; replace if damaged or blunt.<br>3c. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body.<br>3c. All non-essential personnel sahll stay off the barge; position body out of the line-of-fire of equipment.<br>3c. Drillers and helpers will understand and use the “Show Me Your Hands” Policy.<br>3c. The entire barge is an exclusion zone while the drill rig is in operation. |
| | **3f. FALL:**<br>Slip/trip/fall hazards | 3f. Contain drill cuttings and drilling water to prevent fall hazards from developing in work area.<br>3f. See 1b.<br>3f. All personell shall wear a personal floatation device while working on the barge or within 5 feet of the canal. |
| | **3g. EXERTION:**<br>Potential for muscle strain/injury while lifting and installing well casings, lifting sand bags, and/or lifting rods. | 3g. Keep back straight and bend at the knees.<br>3g. Utilize team lifting for objects over 50lbs.<br>3g. Use mechanical lifting devices for odd shaped objects. |
| 4. Decontaminate equipment. | **4a. EXPOSURE/CONTACT:**<br>To contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated groundwater, vapors). | 4a. Wear chemical-resistant disposable gloves and safety glasses.<br>4a. Contain decontamination water so that it does not spill.<br>4a. Use an absorbent pad to clean spills, if necessary.<br>4a. See 3b. |
| | **4b. EXPOSURE:**<br>To chemicals in cleaning solution Including ammonia. | 4b. See 4a.<br>4b. Review MSDS to ensure appropriate precautions are taken and understood. |

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

[2] A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards.

[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

# APPENDIX B

Heat and Cold Stress Guidelines

**Heat Stress**

Heat stress is a significant potential hazard and can be associated with heavy physical activity and/or the use of personal protective equipment (PPE) in hot weather environments.

Heat cramps are brought on by prolonged exposure to heat. As an individual sweats, water and salts are lost by the body resulting in painful muscle cramps. The signs and symptoms of heat cramps are as follows:

- severe muscle cramps, usually in the legs and abdomen;
- exhaustion, often to the point of collapse; and
- dizziness or periods of faintness.

First aid treatment includes moving to a shaded area, rest, and fluid intake. Normally, the individual should recover within one-half hour. If the individual has not recovered within 30 minutes and the temperature has not decreased, the individual should be transported to a hospital for medical attention.

Heat exhaustion may occur in a healthy individual who has been exposed to excessive heat. The circulatory system of the individual fails as blood collects near the skin in an effort to rid the body of excess heat. The signs and symptoms of heat exhaustion are as follows:

- rapid and shallow breathing;
- weak pulse;
- cold and clammy skin with heavy perspiration;
- skin appears pale;
- fatigue and weakness;
- dizziness; and
- elevated body temperature.

First aid treatment includes cooling the victim, elevating the feet, and replacing fluids and electrolytes. If the individual has not recovered within 30 minutes and the temperature has not decreased, the individual should be transported to the hospital for medical attention.

Heat stroke occurs when an individual is exposed to excessive heat and stops sweating. This condition is classified as a **MEDICAL EMERGENCY**, requiring immediate cooling of the victim and transport to a medical facility. The signs and symptoms of heat stroke are as follows:

- dry, hot, red skin;
- body temperature approaching or above 105°F;
- large (dilated) pupils; and
- loss of consciousness – the individual may go into a coma.

First aid treatment requires immediate cooling and transportation to a medical facility.

Heat stress (heat cramps, heat exhaustion, and heat stroke) is a significant hazard if any type of protective equipment (semi-permeable or impermeable) which prevents evaporative cooling is worn in hot weather environments. Local weather conditions may require restricted work schedules in order to adequately protect personnel. The use of work/rest cycles (including working in the cooler periods of the day or evening) and training on the signs and symptoms of heat stress should help prevent heat-related illnesses from occurring. Work/rest cycles will depend on the work load required to perform each task, type of protective equipment, temperature, and humidity. In general, when the temperature exceeds 88°F, a 15 minute rest cycle will be initiated once every two hours. In addition, potable water and fluids containing electrolytes (e.g., Gatorade) will be available to replace lost body fluids.

**Cold Stress**

Cold stress is a danger at low temperatures and when the wind-chill factor is low. Prevention of cold-related illnesses is a function of whole-body protection. Adequate insulating clothing must be used when the air temperature is below 40°F. In addition, reduced work periods followed by rest in a warm area may be necessary in extreme conditions. Training on the signs and symptoms of cold stress should prevent cold-related illnesses from occurring. The signs and symptoms of cold stress include the following:

- severe shivering;
- abnormal behavior;

- slowing of body movement;
- confusion;
- weakness;
- stumbling or repeated falling;
- inability to walk;
- collapse; and/or
- unconsciousness.

First aid requires removing the victim from the cold environment and seeking medical attention immediately. Also, prevent further body heat loss by covering the victim lightly with blankets. Do not cover the victim's face. If the victim is still conscious, administer hot drinks, and encourage activity, such as walking wrapped in a blanket.

# APPENDIX C

Heavy Equipment Exclusion Zone Policy

**FINAL**

# STANDARD OPERATING PROCEDURE 1.13

# HEAVY EQUIPMENT EXCLUSION ZONE POLICY

| | | |
|---|---|---|
| CORPORATE HEALTH AND SAFETY MANAGER | : | Joseph W. Gentile |
| EFFECTIVE DATE | : | February 2014 |
| REVISION NUMBER | : | 1 |

## Objective

The purpose of the Exclusion Zone Policy is to establish the minimum clearance distance that must be maintained between workers and heavy equipment while equipment is in operation (i.e., engaged or moving). The intent is to have no personnel or other equipment entering the Exclusion Zone while the equipment is in operation/moving to ensure that Roux and Subcontractor employees are not unnecessarily exposed to the hazards of the equipment.

### A. Definition

For the purpose of this policy, heavy equipment includes, but is not necessarily limited to: excavation equipment, drill rigs, vacuum trucks, forklifts, lull telehandlers, man lifts, bobcats, delivery trucks, etc.

### B. Requirements

1. Exclusion Zones must be established and maintained during activities involving the movement/operation of heavy equipment. The Exclusion Zone requirements apply to all personnel on the site but are primarily focused on those personnel who are required to be working in the vicinity of the equipment. The exclusion zone is in effect when heavy equipment is moving or engaged (ex. movement of an arm or bucket of an excavator, rotation of an auger, lifting of a load with a forklift, raising/lowering of a man lift, etc.).

2. The Exclusion Zone must meet the following minimum requirements:

- A minimum distance of 10 feet from all heavy equipment and loads being moved by the equipment; and
- Greater than the swing/reach radius of any moving part on the heavy equipment (i.e., for large equipment this may mean an exclusion zone distance larger than 20 feet);
- Greater than the tip-over distance of the heavy equipment; and
- Greater than the radius of blind spots.

3. The size of the Exclusion Zone will need to be determined on a task-specific basis considering the size of the heavy equipment in use and the task being performed. Prior to all heavy equipment operations, the Exclusion Zone(s) distance must be specifically identified in the Job Safety Analysis (JSA).

4. The spotter (or another individual) should be assigned responsibility for enforcing the Exclusion Zone. This spotter should be positioned immediately outside of the Exclusion Zone within a clear line of sight of the equipment operator. The spotter must signal the operator to stop work if anyone or anything has the potential to enter or compromise the Exclusion Zone. The operator should stop work if the spotter is not within his/her line of sight. If multiple pieces of equipment are being used, each piece of equipment must have its own Exclusion Zone and spotter. For large excavation and demolition projects the spotter should be in constant radio contact (not cell phone) with the machine driver.

5. If an individual must enter the Exclusion Zone, the designated Spotter must signal the Equipment Operator to stop the equipment. Once the equipment is no longer moving (ex. movement of an arm of an excavator is STOPPED, lifting of a load with a forklift STOPPED, raising/lowering of a man lift is STOPPED, etc.), the operator must **DISENGAGE THE CONTROLS and STOP and SIGNAL BY "SHOWING HIS HANDS"**. This signal will indicate that it is safe for the personnel to enter the limits of the Exclusion Zone to perform the required activity. The

equipment must remain completely stopped/disengaged until all personnel have exited the limits of the Exclusion Zone and the designated Spotter has signaled by "SHOWING HIS HANDS" to the Equipment Operator that it is safe to resume.

6. When entering the limits of the Exclusion Zone, personnel must at a minimum:
   - Establish eye contact with the operator and approach the heavy equipment in a manner that is in direct line of sight to the Equipment Operator;
   - Never walk under any suspended loads or raised booms/arms of the heavy equipment; and
   - Identify a travel path that is free of Slip/Trip/Fall hazards.

7. The Exclusion Zone should be delineated using cones with orange snow fence or solid poles between the cones, barrels, tape or other measures. For work in rights-of-way rigid barriers, such as Jersey barriers or temporary chain link fence should be used. For certain types of wide-spread or moving/mobile equipment operations, such delineation may not be practicable around pieces of equipment or individual work areas. In such instances it is expected that the entire operation will be within a larger secure work area or that additional means will be utilized to ensure security of the work zone.

## C. Exceptions

It is recognized that certain heavy equipment activities may require personnel to work within the limits of the Exclusion Zone as specified in this policy. Such activities may include certain excavation clearance tasks, drill crew activities or construction tasks. However, any such activity must be pre-planned with emphasis on limiting the amount and potential exposure of any activity required within the zone. The critical safety steps to mitigate the hazards associated with working within the Exclusion Zone must be defined in the JSA and potentially other project-specific plans (i.e., critical lift plans, etc.), and approved by the Roux Project Principal and client representative, if required, prior to implementation.

## D. Responsibilities

1. Corporate Health and Safety Manager

   Overall responsibility for administration, implementation and auditing of this policy.

2. Office Managers

   Responsible for communicating this policy to all of their employees who perform or may perform field work involving heavy equipment.

3. Office Health and Safety Managers

   Providing training to office field staff in this policy.

4. Project Principals

   a. Responsible for ensuring their projects address heavy equipment exclusion zones.

   b. Approving exceptions to this policy.

5. Project Managers

a. Responsible for incorporating this policy into their project HASPs and applicable procedures to include JSAs.

b. Communicating to and enforcing the policy requirements for subcontractors who work on their projects.

6. Field Workers

a. Attending training in the policy.

b. Following the requirements of the policy.

**E. Project and Site-Specific Orientation and Training**

Many Roux projects have different requirements that are client-specific or site-specific in nature. It is the responsibility of the Project Principal (or Project Manager if delegated this responsibility by the Project Principal) to ensure that the workers assigned to his/her projects are provided orientation and training with respect to these client and/or site-specific requirements.

**F. Subcontractors**

All subcontractors who provide heavy equipment operations to field projects must implement a policy that meets or exceeds the expectations described above as well as any additional requirements that may be required on a client or site-specific basis.

**APPENDIX D**

# Accident Report and Accident Investigation Form

☐ **Roux Associates, Inc.** ☐ **Remedial Engineering, P.C.**
(Check applicable company name)

# ACCIDENT REPORT

**Joe Gentile, Corporate Health and Safety Manager**
Cell: (610) 844-6911; Office: (856) 423-8800; Office FAX: (856) 423-3220; Home: (484) 373-0953

## PART 1: ADMINISTRATIVE INFORMATION

**Project #:** _____
**Project Name:** _____
**Project Location** (street address/city/state)**:**
_____
_____
**Client Corporate Name / Contact / Address / Phone #:**
_____
_____
_____
_____
_____

**Immediate Verbal Notifications Given To:**

| | | |
|---|---|---|
| Corporate Health & Safety | ☐Yes | ☐No |
| Office Health & Safety | ☐Yes | ☐No |
| Office Manager | ☐Yes | ☐No |
| Project Principal | ☐Yes | ☐No |
| Project Manager | ☐Yes | ☐No |
| Client Contact | ☐Yes | ☐No |

**REPORT STATUS (time due):**
☐ Initial (24 hr) ☐ Final (5-10 days)
Date: _____ Date: _____

**Accident Report Delivered To:**

| | | |
|---|---|---|
| Corporate Health & Safety | ☐Yes | ☐No |
| Office Health & Safety | ☐Yes | ☐No |
| Office Manager | ☐Yes | ☐No |
| Project Principal | ☐Yes | ☐No |
| Project Manager | ☐Yes | ☐No |

**REPORT TYPE:** ☐ Loss ☐ Near Loss Estimated Costs: $ _____
_____

**OSHA CASE # Assigned by Corporate Health & Safety if Applicable:**

**Corporate Health & Safety Confirmed Final Accident Report**
☐Yes ☐No

**DATE OF INCIDENT:** _____

**TIME INCIDENT OCCURRED:** _____ ☐AM ☐PM

**INCIDENT LOCATION** – City, State, and Country (If outside U.S.A.)
_____

**INCIDENT TYPES:** (Select most appropriate if Loss occurred.)
From lists below, please select the option that best categories the incident. When selecting an injury or illness, also indicate the severity level.

☐**INJURY** ☐**ILLNESS**

----------**Severity Level**----------

☐Fatality ☐First Aid ☐Medical
☐Restricted Work ☐Lost Time ☐Treatment

**OTHER INCIDENT TYPES**

☐Spill / Release
Material involved:_____
Quantity (U.S. Gallons): _____

☐Misdirected Waste ☐Consent Order ☐NOV
☐Property Damage ☐Exceedance
☐Motor Vehicle ☐Fine / Penalty

**ACTIVITY TYPE** (Check most appropriate one.)

| | | |
|---|---|---|
| ☐Decommissioning | ☐Geoprobe | ☐Sampling |
| ☐Demolition | ☐Motor Vehicle | ☐System Start-up |
| ☐Dewatering | ☐Operations/ | ☐Trenching |
| ☐Drilling | Maintenance | ☐AST/UST Removal |
| ☐Excavation | ☐Pump/Pilot Test | ☐Other_____ |
| ☐Gauging | ☐Rigging/Lifting | |

**INJURY TYPE** (Check all applicable.)

| | |
|---|---|
| ☐Abrasion | ☐Occupational Illness |
| ☐Amputation | ☐Puncture |
| ☐Burn | ☐Rash |
| ☐Cold/Heat Stress | ☐Repetitive Motion |
| ☐Inflammation | ☐Sprain/Strain |
| ☐Laceration | ☐Other_____ |

**BODY PART AFFECTED** (Check all applicable.)

| | | |
|---|---|---|
| ☐Respiratory | ☐Shoulder | ☐Face |
| ☐Neck | ☐Arm | ☐Leg |
| ☐Chest | ☐Wrist | ☐Knee |
| ☐Abdomen | ☐Hand/Fingers | ☐Ankle |
| ☐Groin | ☐Eye | ☐Foot/Toes |
| ☐Back | ☐Head | ☐Other_____ |

**I. PERSON(S) DIRECTLY / INDIRECTLY INVOLVED IN INCIDENT** (Attach additional information as necessary/applicable.)

| Name/Phone # of Each Person Directly/Indirectly Involved in Incident: | Designate: Roux/Remedial Employee; Roux/Remedial Subcontractor; Client Employee; Client Contractor; Third Party | As applicable, Current Occupation; Yrs in Current Occupation; Current Position; and Yrs in Current Position: | As applicable, Employer Name; Address; and Phone #: | As applicable, Supervisor Name; and Phone #: |
|---|---|---|---|---|
| 1) | | | | |
| 2) | | | | |

**II. PERSONS INJURED IN INCIDENT** (Attach additional information as necessary/applicable.)

| Name/Phone # of Each Person Injured in Incident: | Designate: Roux/Remedial Employee; Roux/Remedial Subcontractor; Client Employee; Client Contractor; Third Party | As applicable, Current Occupation; Yrs in Current Occupation; Current Position; and Yrs in Current Position: | As applicable, Employer Name; Address; and Phone #: | As applicable, Supervisor Name; and Phone #: | Description of Injury: |
|---|---|---|---|---|---|
| 1) | | | | | |
| 2) | | | | | |

**III. PROPERTY DAMAGED IN INCIDENT** (Attach additional information as necessary/applicable.)

| Property Damaged: | Property Location: | Owner Name, Address & Phone #: | Description of Damage: | Estimated Cost: |
|---|---|---|---|---|
| 1) | | | | |

**No One Gets Hurt!**

| | | | | |
|---|---|---|---|---|
| 2) | | | | $ |

**IV. WITNESSES TO INCIDENT** (Attach additional information as necessary/applicable.)

| Witness Name: | Address: | Phone #: |
|---|---|---|
| 1) | | |
| 2) | | |

## PART 2: WHAT HAPPENED AND INCIDENT DETAILS

**PROVIDE FACTUAL DESCRIPTION OF INCIDENT** (e.g., describe loss/near loss, injury, response / treatment).

**I. AUTHORITIES/GOVERNMENTAL AGENCIES NOTIFIED** (Attach additional information as necessary/applicable.)

| Authority/Agency Notified: | Name/Phone #/Fax # of Person Notified: | Address of Person Notified: | Date & Time of Notification: | Exact Information Reported/Provided: |
|---|---|---|---|---|
| | | | | |

**II. PUBLIC RESPONSES TO INCIDENT (if applicable)**

| Response/Inquiry By: (check one) | Entity Name: | Name/Phone # of Respondent/ Inquirer: | Address of Entity/Person: | Date & Time of Response/Inquiry: |
|---|---|---|---|---|
| ☐Newspaper<br>☐Television<br>☐Community Group<br>☐Neighbors<br>☐Other _____ | | | | |

Describe Response/Inquiry:

Roux/Remedial Response:

(Check all that apply.) (Attach photos, drawings, etc. to help illustrate the incident.)

**ATTACHED INFORMATION:** ☐Photo ☐Sketches ☐Vehicle Acord Form ☐Police Report ☐Other

| **Name(s) of person(s) who prepared Initial and Final Report:** | **Title(s):** | **Phone number(s):** |
|---|---|---|
| | | |

## PART 3: INVESTIGATION TEAM ANALYSIS

### CONCLUSION: WHY IT HAPPENED (LIST CAUSAL FACTORS AND CORRESPONDING ROOT CAUSES)

(Root Causes: Lack of knowledge or skill, Doing the task according to procedures or acceptable practices takes more time or effort, Short-cuts or not following acceptable practices is reinforced or tolerated, Not following procedures or acceptable practices did not result in an accident, Lack of or inadequate procedures, Inadequate communications of expectations regarding procedures or acceptable practices, Inadequate tools or equipment, External Factors)

### ROOT CAUSE(S) AND SOLUTION(S): HOW TO PREVENT INCIDENT FROM RECURRING

**PERSONAL FACTORS:**

A. LACK OF SKILL OR KNOWLEDGE

B. DOING THE JOB ACCORDING TO PROCEDURES OR ACCEPTABLE PRACTICES TAKES MORE TIME OR EFFORT

C. SHORT-CUTTING PROCEDURES OR ACCEPTABLE PRACTICES IS POSITIVELY REINFORCED OR TOLERATED

D. IN PAST, DID NOT FOLLOW PROCEDURES OR ACCEPTABLE PRACTICES AND NO INCIDENT OCCURRED

**JOB FACTORS:**

E. LACK OF OR INADEQUATE PROCEDURES

F. INADEQUATE COMMUNICATION OF EXPECTATIONS REGARDING PROCEDURES OR ACCEPTABLE STANDARDS

G. INADEQUATE TOOLS OR EQUIPMENT (available, maintained, etc.)

| CAUSAL FACTOR / BEHAVIOR / CONDITION | ROOT CAUSE | SOLUTION(S) [Must Match Root Cause(s)] | | PERSON RESPONSIBLE | AGREED DUE DATE | ACTUAL COMPLETION DATE |
|---|---|---|---|---|---|---|
| | | # | Solution(s) | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

**INVESTIGATION TEAM:**

| PRINT NAME | JOB POSITION | DATE | SIGNATURE |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

**QUALITY REVIEW** Correct root cause(s) identified? Do root cause(s) and solution(s) match? Are solution(s) feasible / maintainable?

**Name:** **Job Title:**

## PART 4: Date Solutions were Implemented & Validated (Were Solutions Effective?)

| Date | Solution | Verifier / Validator Name and Job Title | **Details** (of I & V performed) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

# HEALTH & SAFETY LESSONS LEARNED
## ROUX REPORT FORM

☐ **Roux Associates, Inc.** ☐ **Remedial Engineering, P.C.**
(Check applicable company name)

## PART 1: ADMINISTRATIVE INFORMATION

**Office:** ☐ New York ☐ Massachusetts ☐ New Jersey ☐ Illinois ☐ CA - Los Angeles ☐ CA - Oakland

| | |
|---|---|
| **Project Manager:** | **Project Principal:** |
| **Project Name:** | **Project Location:** |

## PART 2: LESSONS LEARNED INCIDENT DETAILS

| | |
|---|---|
| **Date\Time Occurred** (MM/DD/YYYY HH:MM)**:** | **Date\Time Submitted** (MM/DD/YYYY HH:MM)**:** |

**LESSONS LEARNED INCIDENT TYPE - What could have happened? - Select all that apply (1-7)**

1. ☐ Fire / Explosion
2. ☐ Injury / Illness
3. ☐ Security (e.g, theft, trespassing, vandalism)
4. ☐ Environmental (spill, permit exceedance, etc.)
5. ☐ Transportation of personnel (vehicle accident)
6. ☐ Property/Equipment Damage
7. ☐ Business Interruption

**Event Leading to Potential Injury/Illness:**

| | |
|---|---|
| **Job Task*:** | **Equipment Involved*:** |

**WHAT HAPPENED?** Do not include individuals' names. Ensure photos, sketches, etc. are not personally identifiable unless written consent has been obtained.

**Summary** (1-2 sentences. Provide brief description of the incident. Provide facts only, no speculation or opinion)**:**

**Incident Details** (Brief factual details of what, where, when; include photos, sketches, etc. as attachments)**:**

**Immediate Corrective Actions Taken:**

**SERIOUS INJURY OR FATALITY (SIF): IF AN ACTUAL SIF, USE EXISTING ROUX ACCIDENT REPORTING FORM**

**Could this have resulted in a SIF?** ☐ **Yes** ☐ **No**

A potential SIF is defined as likely to have caused an injury resulting in significant physical body damage with probable long term and/or life altering complications.

**INCIDENT INVOLVED:**

**Roux Employee:** ☐ **Yes** ☐ **No** **Subcontractor Company Name:**

**INVESTIGATION TEAM**

| NAME | JOB TITLE | NAME | JOB TITLE |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

## PART 3: INCIDENT INVESTIGATION FINDINGS AND REPORT QUALITY REVIEW

**Date Investigation Team Assigned (mm/dd/yyyy):**

**INVESTIGATION SUMMARY:** Determine from list below what behaviors and/or conditions may have contributed to the H&S Lessons Learned Incident. Then, use the "Multiple-Why Technique" for each of these behaviors/conditions; provide a narrative for each that explains how the associated Root Cause(s) was determined. Do not include individuals' names.

**ROOT CAUSES: HOW TO REDUCE POSSIBILITY OF INCIDENT RECURRING**

Selection of RCs and solutions reflects the analysis of investigation team. It is not meant as a legally binding conclusion as to causal factors and/or solutions.

**PERSONAL FACTORS:**

A. LACK OF SKILL OR KNOWLEDGE

B. DOING THE JOB ACCORDING TO PROCEDURES OR ACCEPTABLE PRACTICES TAKES MORE TIME OR EFFORT

C. SHORT-CUTTING PROCEDURES OR ACCEPTABLE PRACTICES IS POSITIVELY REINFORCED OR TOLERATED

D. IN PAST, DID NOT FOLLOW PROCEDURES OR ACCEPTABLE PRACTICES AND NO INCIDENT OCCURRED

**JOB FACTORS:**

E. LACK OF OR INADEQUATE PROCEDURES

F. INADEQUATE COMMUNICATION OF EXPECTATIONS REGARDING PROCEDURES OR ACCEPTABLE STANDARDS

G. INADEQUATE TOOLS OR EQUIPMENT (available, maintained, etc.)

| Behavior / Condition | Root Cause | Solution(s) (Must Match Root Cause) | Person Responsible for Completion | Completion Target Date | Completion Actual Date |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

**QUALITY REVIEW** Correct root cause(s) identified? Do root cause(s) and solution(s) match? Are solution(s) feasible / maintainable?

**Name:** **Job Title:**

## PART 4: Date Solutions were Implemented & Validated (Were Solutions Effective?)

| Date | Solution | Verifier / Validator Name and Job Title | **Details** (of I & V performed) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

**JOB TASK - Select the most appropriate one** (primary job associated with incident-related work activity, avoid "Other" if possible)

1. Carbon Change
2. Construction
3. Demolition
4. Dewatering
5. Drilling (well install)
6. Excavation / Trenching
7. Gauging
8. Geoprobe / Direct Push
9. Mobil Remediation (includes vacuum event and chemical injection)
10. NAPL Recovery
11. O&M (remediation system)
12. Pavement Cutting
13. Pump Test
14. Sampling
15. Site Visit / Survey
16. Subsurface Clearance
17. System Install
18. System Startup
19. UST Removal (includes exposure and backfill)
20. Waste Management
21. Well Abandonment
22. Other:

**EQUIPMENT INVOLVED THAT CONTRIBUTED TO H&S LESSONS LEARNED - Select all that apply**

1. Air Stripper
2. API Separator
3. Automobile
4. Boom Material
5. Bulldozer
6. Cable
7. Carbon Drum / Vessel
8. Chain Block
9. Compressor, Air
10. Control Panel (local)
11. Crane (mobile)
12. Drill Rig
13. Drilling Equipment, Vacuum
14. Drum, Vertical
15. Dump Truck
16. Electric Heater
17. Electrical Power Supply
18. Engine, Combustion
19. Equipment Safety Grounding
20. Excavator / Power Shovel
21. Exclusion Zone Equipment
22 Fan / Blower
23 Fencing
24 Filter
25. Fire Extinguisher
26. Forklift
27. Front End Loader
28. Grader
29. Hammer
30. Knife
31. Non-Powered Equipment
32. Powered Equipment
33. Drill
34. Grinder
35. Hydraulic Torque Wrench
36. Powered Saw
37. Impact Wrench
38. Saw
39. Screwdriver
40. Shears
41. Shovel
42. Snip
43. Wrench
44. Hoist
45, Hook/Clamp/Buckle, etc.
46. Jack
47. Ladder, Extension
48. Ladder, Platform
49. Ladder, Step
50. Lock Out / Tag Out
51. Maintenance Tool, General
52. Manifold
53, Manlift/Basket/Cherry Picker
54. Motor, Electric
55. Oxidizer
56. Pallet
57. Piping
58. Piping, Hose
59. Piping, Injection/Mixing Point
60. Hydrojet
61. Centrifugal Pump
62. Diaphragm Pump
63. Reciprocating Pump
64. Regenerative Pump
65. Rotary Pump
66. Transfer Pump
67. Submersible Pump
68. Face Shield
69. Fall Protection
70. Gloves
71. Hard Hat / Helmet
72. Hearing Protection
73. Respiratory PPE (Chemical)
74. Respiratory PPE (Particulate)
75. Safety Glasses
76. Safety Goggles
77. Safety Shoes / Boots
78. Safety Vest / Clothing
79. Rope
80. Bailer
81. Geoprobe
82. Hand Auger
83. PID
84. Multi-Gas Meter
85. Sample Container
86. Split-Spoon Sampler
87. Sling
88. Snow Blower
89. Snow Plow
90. Space Heater
91. Air Sparging System
92. Carbon Treatment System
93. Chemical Oxidation System
94. Dual Phase Product Recovery System
95. Groundwater Pump and Treat System
96. POET System
97. Shed or Trailer
98. Vapor Extraction System
99. Vapor-Phase Treatment System
100. Other System, Type:_____
101. Surge Tank
102. Underground Tank
103. Telemetry System
104. Testing Devices
105. Tractor Trailer
106. Truck, Flatbed
107. Truck, Pickup
108. Truck, Tank Truck
109. Truck, Vacuum
110. Safety Valve
111. Block Valve
112. Extraction Well
113. Monitoring Well
114. Recovery Well
115. Winch
116. Wire Rope
117. No Equipment Involved
118. MPT – Traffic Control Devices
118. Not in List (describe):_____

# APPENDIX E

ACORD® Automobile Loss Notice Form

# AUTOMOBILE LOSS NOTICE

DATE (MM/DD/YYYY): 09/15/2014

**AGENCY**
AJ Gallagher Risk Management Services
377 Oak Street
Garden City, NY 11530

CONTACT NAME: Teresa Garzia
PHONE (A/C, No, Ext): 516.622.2418
FAX (A/C, No):
E-MAIL ADDRESS:
CODE: SUBCODE:
AGENCY CUSTOMER ID: ROUXASS-01

INSURED LOCATION CODE: DATE OF LOSS AND TIME: AM / PM

**CARRIER**: Great Divide Insurance Company — NAIC CODE: 25224

POLICY NUMBER: BAP154979912

POLICY TYPE: Commercial Automobile

## INSURED

NAME OF INSURED (First, Middle, Last): Roux Assiciates, Inc.

DATE OF BIRTH: FEIN (if applicable): 11-2579482 — MARITAL STATUS / CIVIL UNION (if applicable):

PRIMARY PHONE #: ☐ HOME ☒ BUS ☐ CELL 631.232.2600
SECONDARY PHONE #: ☐ HOME ☐ BUS ☐ CELL

INSURED'S MAILING ADDRESS: 209 Shafter Street, Islandia, NY 11749

PRIMARY E-MAIL ADDRESS: legaldept@rouxinc.com
SECONDARY E-MAIL ADDRESS: Fax Notice of Loss to: 631.232.1525

## CONTACT

☐ CONTACT INSURED

NAME OF CONTACT (First, Middle, Last): Cindy Albanese

PRIMARY PHONE #: ☐ HOME ☐ BUS ☐ CELL
SECONDARY PHONE #: ☐ HOME ☐ BUS ☐ CELL

WHEN TO CONTACT:

CONTACT'S MAILING ADDRESS: Cindy Albanese, 209 Shafter Street, Islandia, NY 11749

PRIMARY E-MAIL ADDRESS: legaldept@rouxinc.com
SECONDARY E-MAIL ADDRESS: Fax Notice of Loss to 631.232.1525

## LOSS

LOCATION OF LOSS
STREET:
CITY, STATE, ZIP:
COUNTRY:

POLICE OR FIRE DEPARTMENT CONTACTED:
REPORT NUMBER:

DESCRIBE LOCATION OF LOSS IF NOT AT SPECIFIC STREET ADDRESS:

DESCRIPTION OF ACCIDENT (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

## INSURED VEHICLE

| VEH # | YEAR | MAKE | BODY TYPE | PLATE NUMBER | STATE |
|---|---|---|---|---|---|
| | | MODEL: | V.I.N.: | | |

OWNER'S NAME AND ADDRESS ☐ (Check if same as insured)
PRIMARY PHONE #: ☐ HOME ☐ BUS ☐ CELL — SECONDARY PHONE #: ☐ HOME ☐ BUS ☐ CELL
PRIMARY E-MAIL ADDRESS:
SECONDARY E-MAIL ADDRESS:

DRIVER'S NAME AND ADDRESS ☐ (Check if same as owner)
PRIMARY PHONE #: ☐ HOME ☐ BUS ☐ CELL — SECONDARY PHONE #: ☐ HOME ☐ BUS ☐ CELL
PRIMARY E-MAIL ADDRESS:
SECONDARY E-MAIL ADDRESS:

| RELATION TO INSURED (Employee, family, etc.) | DATE OF BIRTH | DRIVER'S LICENSE NUMBER | STATE | PURPOSE OF USE | USED WITH PERMISSION? (Y/N) |
|---|---|---|---|---|---|
| | | | | | |

DESCRIBE DAMAGE

| | |
|---|---|
| 1. WAS A STANDARD CHILD PASSENGER RESTRAINT SYSTEM (CHILD SEAT) INSTALLED IN THE VEHICLE AT THE TIME OF THE ACCIDENT? | Y/N |
| 2. WAS THE CHILD PASSENGER RESTRAINT SYSTEM (CHILD SEAT) IN USE BY A CHILD DURING THE TIME OF THE ACCIDENT? | Y/N |
| 3. DID THE CHILD PASSENGER RESTRAINT SYSTEM (CHILD SEAT) SUSTAIN A LOSS AT THE TIME OF THE ACCIDENT? | Y/N |

ESTIMATE AMOUNT: | WHERE CAN VEHICLE BE SEEN?: | WHEN CAN VEHICLE BE SEEN?:
OTHER INSURANCE ON VEHICLE - CARRIER: | POLICY NUMBER:


© 1988-2013 ACORD CORPORATION. All rights reserved.
The ACORD name and logo are registered marks of ACORD

## OTHER VEHICLE / PROPERTY DAMAGED

NON - VEHICLE? ☐

AGENCY CUSTOMER ID: _____

| VEH # | YEAR | MAKE: | BODY TYPE: | PLATE NUMBER | STATE |
|---|---|---|---|---|---|
| | | MODEL: | V.I.N.: | | |

DESCRIBE PROPERTY (Other Than Vehicle) | OTHER VEH/PROP INS? (Y/N) ☐

CARRIER OR AGENCY NAME | NAIC CODE | POLICY NUMBER

OWNER'S NAME AND ADDRESS

PRIMARY PHONE # ☐ HOME ☐ BUS ☐ CELL | SECONDARY PHONE # ☐ HOME ☐ BUS ☐ CELL

PRIMARY E-MAIL ADDRESS:

SECONDARY E-MAIL ADDRESS:

DRIVER'S NAME AND ADDRESS ☐ (Check if same as owner)

PRIMARY PHONE # ☐ HOME ☐ BUS ☐ CELL | SECONDARY PHONE # ☐ HOME ☐ BUS ☐ CELL

PRIMARY E-MAIL ADDRESS:

SECONDARY E-MAIL ADDRESS:

DESCRIBE DAMAGE

ESTIMATE AMOUNT | WHERE CAN DAMAGE BE SEEN?

## INJURED

| NAME & ADDRESS | PHONE (A/C, No) | PED | INS VEH | OTH VEH | AGE | EXTENT OF INJURY |
|---|---|---|---|---|---|---|
| | | ☐ | ☐ | ☐ | | |
| | | ☐ | ☐ | ☐ | | |
| | | ☐ | ☐ | ☐ | | |
| | | ☐ | ☐ | ☐ | | |

## WITNESSES OR PASSENGERS

| NAME & ADDRESS | PHONE (A/C, No) | INS VEH | OTH VEH | OTHER (Specify) |
|---|---|---|---|---|
| | | ☐ | ☐ | |
| | | ☐ | ☐ | |
| | | ☐ | ☐ | |

REPORTED BY | REPORTED TO

## REMARKS (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

## APPLICABLE IN ALABAMA

Any person who knowingly presents a false or fraudulent claim for payment of a loss or benefit or who knowingly presents false information in an application for insurance is guilty of a crime and may be subject to restitution fines or confinement in prison, or any combination thereof.

## APPLICABLE IN ALASKA

A person who knowingly and with intent to injure, defraud, or deceive an insurance company files a claim containing false, incomplete, or misleading information may be prosecuted under state law.

## APPLICABLE IN ARIZONA

For your protection, Arizona law requires the following statement to appear on this form. Any person who knowingly presents a false or fraudulent claim for payment of a loss is subject to criminal and civil penalties.

## APPLICABLE IN ARKANSAS, DELAWARE, KENTUCKY, LOUISIANA, MAINE, MICHIGAN, NEW JERSEY, NEW MEXICO, NORTH DAKOTA, PENNSYLVANIA, RHODE ISLAND, SOUTH DAKOTA, TENNESSEE, TEXAS, VIRGINIA, AND WEST VIRGINIA

Any person who knowingly and with intent to defraud any insurance company or another person, files a statement of claim containing any materially false information, or conceals for the purpose of misleading, information concerning any fact, material thereto, commits a fraudulent insurance act, which is a crime, subject to criminal prosecution and civil penalties. In LA, ME, TN, and VA, insurance benefits may also be denied.

## APPLICABLE IN CALIFORNIA

For your protection, California law requires the following to appear on this form: Any person who knowingly presents a false or fraudulent claim for payment of a loss is guilty of a crime and may be subject to fines and confinement in state prison.

## APPLICABLE IN COLORADO

It is unlawful to knowingly provide false, incomplete, or misleading facts or information to an insurance company for the purpose of defrauding or attempting to defraud the company. Penalties may include imprisonment, fines, denial of insurance, and civil damages. Any insurance company or agent of an insurance company who knowingly provides false, incomplete, or misleading facts or information to a policy holder or claimant for the purpose of defrauding or attempting to defraud the policy holder or claimant with regard to a settlement or award payable from insurance proceeds shall be reported to the Colorado Division of Insurance within the Department of Regulatory Agencies.

## APPLICABLE IN THE DISTRICT OF COLUMBIA

Warning: It is a crime to provide false or misleading information to an insurer for the purpose of defrauding the insurer or any other person. Penalties include imprisonment and/or fines. In addition, an insurer may deny insurance benefits, if false information materially related to a claim was provided by the applicant.

## APPLICABLE IN FLORIDA

Pursuant to S. 817.234, Florida Statutes, any person who, with the intent to injure, defraud, or deceive any insurer or insured, prepares, presents, or causes to be presented a proof of loss or estimate of cost or repair of damaged property in support of a claim under an insurance policy knowing that the proof of loss or estimate of claim or repairs contains any false, incomplete, or misleading information concerning any fact or thing material to the claim commits a felony of the third degree, punishable as provided in S. 775.082, S. 775.083, or S. 775.084, Florida Statutes.

## APPLICABLE IN HAWAII

For your protection, Hawaii law requires you to be informed that presenting a fraudulent claim for payment of a loss or benefit is a crime punishable by fines or imprisonment, or both.

## APPLICABLE IN IDAHO

Any person who knowingly and with the intent to injure, defraud, or deceive any insurance company files a statement of claim containing any false, incomplete or misleading information is guilty of a felony.

## APPLICABLE IN INDIANA

A person who knowingly and with intent to defraud an insurer files a statement of claim containing any false, incomplete, or misleading information commits a felony.

## APPLICABLE IN KANSAS

Any person who, knowingly and with intent to defraud, presents, causes to be presented or prepares with knowledge or belief that it will be presented to or by an insurer, purported insurer, broker or any agent thereof, any written statement as part of, or in support of, an application for the issuance of, or the rating of an insurance policy for personal or commercial insurance, or a claim for payment or other benefit pursuant to an insurance policy for commercial or personal insurance which such person knows to contain materially false information concerning any fact material thereto; or conceals, for the purpose of misleading, information concerning any fact material thereto commits a fraudulent insurance act.

## APPLICABLE IN MARYLAND

Any person who knowingly or willfully presents a false or fraudulent claim for payment of a loss or benefit or who knowingly or willfully presents false information in an application for insurance is guilty of a crime and may be subject to fines and confinement in prison.

## APPLICABLE IN MINNESOTA

A person who files a claim with intent to defraud or helps commit a fraud against an insurer is guilty of a crime.

## APPLICABLE IN NEVADA

Pursuant to NRS 686A.291, any person who knowingly and willfully files a statement of claim that contains any false, incomplete or misleading information concerning a material fact is guilty of a felony.

## APPLICABLE IN NEW HAMPSHIRE

Any person who, with purpose to injure, defraud or deceive any insurance company, files a statement of claim containing any false, incomplete or misleading information is subject to prosecution and punishment for insurance fraud, as provided in RSA 638:20.

## APPLICABLE IN NEW YORK

Any person who knowingly and with intent to defraud any insurance company or other person files an application for commercial insurance or a statement of claim for any commercial or personal insurance benefits containing any materially false information, or conceals for the purpose of misleading, information concerning any fact material thereto, and any person who in connection with such application or claim knowingly makes or knowingly assists, abets, solicits or conspires with another to make a false report of the theft, destruction, damage or conversion of any motor vehicle to a law enforcement agency, the Department of Motor Vehicles or an insurance company, commits a fraudulent insurance act, which is a crime, and shall also be subject to a civil penalty not to exceed five thousand dollars and the value of the subject motor vehicle or stated claim for each violation.

## APPLICABLE IN OHIO

Any person who, with intent to defraud or knowing that he/she is facilitating a fraud against an insurer, submits an application or files a claim containing a false or deceptive statement is guilty of insurance fraud.

## APPLICABLE IN OKLAHOMA

WARNING: Any person who knowingly and with intent to injure, defraud or deceive any insurer, makes any claim for the proceeds of an insurance policy containing any false, incomplete or misleading information is guilty of a felony.

## APPLICABLE IN WASHINGTON

It is a crime to knowingly provide false, incomplete, or misleading information to an insurance company for the purpose of defrauding the company. Penalties include imprisonment, fines and denial of insurance benefits.

# APPENDIX F

Short Service Employee Policy

# STANDARD OPERATING PROCEDURE 1.12

# SHORT SERVICE EMPLOYEE PROGRAM

| | | |
|---|---|---|
| CORPORATE HEALTH AND SAFETY MANAGER | : | Joseph W. Gentile |
| ORIGINAL ISSUE DATE | : | September 2010 |
| EFFECTIVE DATE | : | September 2013 |
| REVISION NUMBER | : | 3 |

## Objective

The objective of this policy and procedure is to ensure that Roux and Subcontractor short service employees are identified, appropriately supervised, trained, and managed in order to prevent accidents such as personal injury, injury to others, environmental damage, or property damage. This policy is a requirement for all employees and subcontractors throughout the firm. In addition, there are additional requirements specific to ExxonMobil policies that are required on all of their projects, and are identified where applicable below.

### A. Definitions

Short Service Employee

A Roux employee or a Roux subcontractor employee with less than six (6) months continuous service in the same job type or less than six (6) months continuous service with his/her current employer is a Short Service Employee (SSE).

The Roux SSE process was developed and periodically updated to satisfy all expectations included in ExxonMobil's Environmental Services Short Service Worker Guidance. Roux Associates senior management will, at a minimum, perform an annual assessment of the Short Service Employee Policy to determine its effectiveness and identify improvement opportunities. It should be noted that ExxonMobil refers to SSE as Short Service Workers or SSWs. For all ExxonMobil projects, a SSE is defined as a Roux employee or a Roux subcontractor employee with less than six (6) months of ExxonMobil worksite experience or has not worked on an ExxonMobil worksite in the last two (2) years.

SSEs shall not exceed 50% of Roux's workforce at any job site without prior written approval from the Office Manager (OM) and, when required by client contract or policy, approval from the designated client representative.

The SSE process excludes workers not performing physical work onsite, visitors, regulatory agency staff, client employees or affiliates, and members of contractor management staff. In addition, certain elements of this SSE process may not be appropriate for short-duration workers (i.e., specialized workers onsite for a short period of time to perform a very specific task and unlikely to return). If the SSE process is deemed not appropriate, the individual Project Manager will develop a case-specific risk mitigation plan to address these short duration workers or consider subcontracting the task through a long-duration contractor who has an effective SSE policy.

Site Safety Mature Person (SSMP)

An SSMP is a worker who is working on an ExxonMobil site that has demonstrated knowledge and skills with regard to site hazards, hazard management, and safe working practices, and is qualified to act as an SSMP. Our "graduation" process includes administration of an LPS® written test followed by a one-on-one interview with a senior safety or project manager of the project team to ensure competence. Graduation to a SSMP typically takes 6 total months of applicable work at ExxonMobil sites. Graduation in less than 6 months requires approval by the ExxonMobil PM.

Mentor

A Mentor is a designated person(s) who is responsible and accountable for guiding and monitoring performance of SSEs in the field. The Mentor cannot be another SSE. The Mentor can be a member of the same working team, but should not be an employee of ExxonMobil or any of its affiliates. The Mentor is a SSMP and has demonstrated knowledge and skills with regard to site and task-related hazards, hazard management, and safe working practices and is able to communicate with the SSE. The Mentor is trained and/knowledgeable of Loss Prevention System (LPS) tools such as SPSAs, LPOs and JSAs. The Mentor should have a positive safety attitude and understanding of both ExxonMobil's and Roux's corporate safety cultures. The Mentor should be capable of practicing Safety Leadership skills, but does not necessarily have to be the SSE's Supervisor. The Mentor should have received appropriate training and be qualified for the role by Roux management. The Mentor is expected to either be onsite with the SSE or assign a SSMP to be onsite with the SSE until the SSE graduates and becomes a SSMP. Deviation from a Mentor or SSMP being onsite with the SSE while conducting field operations requires approval by the Project Principal or the Client PM (in the case of ExxonMobil work).

Supervisor

A Supervisor is the designated person(s) who is responsible and accountable for the overall stewardship of the SSE Policy for each project or office. The Supervisor shall be a senior member of the Roux management team.

## B. Orientation, Training, and Clearance

***Pre-Assignment Orientation, Training, and Clearance***

An initial First Day employee orientation is required before the SSE can perform any field work. Orientation must be conducted by the OM or the designated Supervisor of the SSE. The initial orientation shall at a minimum communicate the following information:

- Even though risks do exist:
  - Accidents and injuries are preventable.
  - Each worker has a personal responsibility for his or her safety and the safety of others both on and off the job.
  - No business objective is so important that it will be pursued at the sacrifice of safety.
  - Safe conduct is a condition of employment.
  - Work is done well only if it is done safely.
  - Roux employees are expected to have the best safety performance.
- Overview of Roux's Safety Procedures and Practices
- General requirements for Personal Protective Equipment
- Injury reporting and medical follow-up procedures

- Requirements regarding participation in safety meetings, Safe Performance Self Assessments (SPSAs), pre-job Job Safety Analyses (JSAs) and the Loss Prevention Observation (LPO) / Roux Peer Observation process

- Requirements of this SSE Policy

Other pre-assignment training (or verification of prior training) is also typically required and will be determined by the OM and Supervisor of the SSE. Examples of this additional training include OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) training, one-one-one Safety and Procedures Review with the Office Health and Safety Manager (OHSM), client-specific training program requirements (i.e., LPS®, railroad worker safety, etc.), and job skills training requirements specific to immediate job tasks (i.e., various field procedures training, equipment usage, etc.).

Medical clearance and drug testing clearance are also required prior to the performance of field work on some sites.

***Project and Site-Specific Orientation and Training***
Many Roux projects have different requirements that are client-specific or site-specific in nature. It is the responsibility of the Project Principal (PP) (or Project Manager (PM) if delegated this responsibility by the PP) to ensure that the SSE assigned to his/her projects is provided orientation and training with respect to these client and/or site-specific requirements. Minimum site-specific orientation shall include operations overview, review of the site-specific HASP, emergency action plan, facility sign-in and sign-out, hazard identification and reporting, MSDS information and $H_2S$ if applicable. In addition, any restrictions on communications with non-Roux personnel, site access or operation of site equipment (both Roux and Client owned) should be reviewed.

Client-specific and site-specific orientation topics shall also include work permit training, reporting incidents and hazards, emergency response procedures, appropriate PPE requirements, and general importance and use of LPS® tools (including a client's Core Safety Expectations and consequences).

***Additional SSE Training***
While classified as an SSE, it is the employee's responsibility to actively seek out and participate in available training opportunities. The SSE will utilize the attached SSE Form to track the completion of training and other experience gained while an SSE. Specific training that is recommended to be completed within the first six (6) months of employment in order for the employee to graduate from SSE status is listed on the SSE Form. Individuals completing the training are required to sign-off on each type of training.

**C. Notifications and Responsibilities**
The following individuals have responsibilities for notification under this policy.

Office Manager (OM) and SSE Supervisor: Have the responsibility of notifying the PP when a SSE employee is assigned to his/her project. They also have the responsibility for confirming that field assessments are conducted to verify the effectiveness of the SSE's performance.

SSE: Roux employees who are SSEs are required to identify themselves as such to the Roux PM prior to reporting to the job Site and to provide the PM with an up-to-date copy of his/her Roux SSE Training and Assignments Documentation Form. SSEs are required to wear company-supplied fluorescent green colored arm bands (or other project-specific distinct identification) when in the field in order to be easily identifiable.

Project Principals (PPs) and Project Managers (PMs): PPs are responsible for notifying the PM when a SSE is assigned to his/her project and for ensuring that the requirements of this SSE Policy are adhered to on their projects. When required by Client contract or policy, the Roux PP (or PM if delegated this authority by the PP) shall provide applicable notice to the client's designated representative regarding SSE's being assigned to field work. The notice should be completed in advance using any applicable client SSE notification forms and shall be acknowledged / approved by the client representative prior to the SSE commencing work.

The Roux PM shall notify the Field Manager / Supervisor who will be responsible for field mentoring/training of the SSE on their project and for making sure everyone on the job site is aware that SSEs are present. All personnel are expected to help the SSE and to explain potential hazards before each job. The Roux PM shall maintain a list of SSE workers, their entry date and date that they complete the SSE process.

For ExxonMobil projects, the PP and PM shall ensure that the requirements of this SSE Program are implemented for all subcontractor employees performing field work on ExxonMobil projects.

Mentor
The PP (or PM if delegated this authority by the PP) must designate an onsite Supervisor for the SSE. A Mentor shall be capable of demonstrating safety leadership, will not currently be a SSE, have a positive safety attitude, will be capable of providing effective training / coaching, and will have good communication skills. The Mentor will have a positive safety attitude, will be motivated and is to have good knowledge of client-specific and site-specific safety programs/culture and requirements (e.g., ExxonMobil LPS® program). An SSE may only work under the direct on-site supervision of the designated Supervisor who, as one of his or her duties, serves as a mentor/trainer in safety for the SSE. The onsite Supervisor or Mentor must provide close supervision and not allow the SSE to perform any task in which the SSE has not been properly trained. The onsite Supervisor will review with the SSE any hazards associated with the task and review all emergency equipment and response procedures. The Mentor must actively work with and engage the SSE on a daily basis to provide mentoring and monitoring of the SSE with respect to safe work practices and identification of hazards.

Site-specific Mentor responsibilities shall also include applicable work permit training, reporting of incidents and hazards, emergency response procedures, appropriate PPE requirements, and general importance and use of LPS® tools. At the completion of each field assignment, the onsite Supervisor/Mentor will complete the applicable section of the employee's SSE form to document the work experience and provide feedback to the Project Manager as well as the OM and Project Principal regarding the SSE's performance and capabilities.

**D. Short Service Employee Policy Exceptions**
Any exception to this Short Service Employee Policy must be approved in writing by the OM and PP, and, when required by client contract or policy, by the designated client representative.

An exception to the onsite Supervisor / Mentor requirement and 50 percent SSE limitation may be granted for activities typically performed by one Roux employee (e.g., field work oversight, field inspections, etc.). To be eligible for an exception, the employee must have had training and demonstrated prior experience in the specific work area. In addition, the PM shall also provide additional communications during the course of each day to review safety requirements and work progress to ensure work is being performed safely and in accordance with expectations.

An exception to the 50% SSE limitation may be granted for work that requires increased staffing levels by Roux or Roux subcontractors (e.g., construction projects). The exception request must be submitted in writing, using a form similar to the attached Roux SSE Exception Form, by the contractor, outlining SSE expectations limitations, types of work to be performed, and mitigative measures that will be taken to minimize risks associated with the increased utilization of SSEs. The exception request must be approved by the OM and, when required by client contract or policy, approval from the designated client representative.

Exceptions to the Short Service Employee Policy at ExxonMobil sites must be approved in writing by the ExxonMobil Project Manager.

**E. Completion**

To be removed from SSE status, the OM and the SSE's Supervisor must be convinced that the SSE has a working knowledge of both Roux and any applicable client Safety Policies and has demonstrated safe work practices and behavior. In addition, the SSE must have completed all required initial SSE training (as documented in his/her SSE Form) and have performed all activities without a serious loss incident (i.e., property damage, OSHA-Recordable injury). At that time, if the OM and Supervisor are convinced of the SSE's capabilities, the OM may remove the employee from the Roux SSE process by completing and signing the applicable section of the employee's SSE Form. The signed form will then be forwarded to Human Resources to be included in the employee's personnel file. If the SSE has been actively working on a client site under client-specific SSE requirements, the PM may need to obtain approval from the client representative as well.

If within six (6) months, the SSE is not capable of demonstrating the appropriate level of task, project, or safety knowledge, they shall be restricted from performing field activities until a point in time when they qualify to do so or are to be removed from the site.

For those SSE workers performing work at ExxonMobil worksites, they will have to successfully complete an LPS® assessment and demonstrate sufficient knowledge to complete the SSE requirements and be removed from the SSE process. Prior to being removed from SSE status workers performing work at ExxonMobil worksites will at a minimum complete the following:

- SSE shall participate in creating a minimum of one JSA;
- SSE shall identify and prepare two near loss reports, including participation in the root cause analyses;
- SSE shall perform and communicate a minimum of twenty SPSAs to a peer or manager;
- SSE shall lead a minimum of two toolbox safety meetings; and

- SSE shall participate in two LPOs as observee or observer.

SSEs will also complete a one-on-one interview with their associated Supervisor to confirm that they are ready to complete the program. At ExxonMobil sites, completion of the SSE program in less than six months needs to be approved by the ExxonMobil Project Manager.

### F. Subcontractors

All subcontractors who supply field personnel to Roux job sites must implement a policy that meets or exceeds the expectations described above as well as any additional requirements that may be required on a client or site-specific basis.

**SHORT SERVICE EMPLOYEE PROGRAM**

**SHORT SERVICE EMPLOYEE TRAINING AND ASSIGNMENTS DOCUMENTATION FORM**

**I. SSE Information**

SSE Name:_____ Current Job Title:_____

Date of Employment:_____ Experience:_____Years Current Position Experience:_____Years _____Mos.

SSE On-site Mentor:_____Designated SSE Supervisor:_____

**II. Orientation, Training and Clearance**

| Requirement | Date Completed | SSE Initial | Mentor Initials | Supervisor Initials |
|---|---|---|---|---|
| ----------First Day ---------- | | | | |
| Drug and Alcohol Screening | | | | |
| OHSA Medical Surveillance Physical Exam | | | | |
| OSHA 40-Hour HAZWOPER Training | | | | |
| Roux Policy Procedures Manual Review | | | | |
| Safety, Policies, and Procedures Orientation with OM or SSE Supervisor (including required PPE) | | | | |
| LPS® Initial Training | | | | |
| Emergency Response Procedures Review | | | | |
| Completion of 20 SPSAs/Safety Assessments | | | | |
| Completion of 2 LPOs/RPOs (Roux Peer Observations) | | | | |
| Completion of 2 LI/NLI/H&S Lessons Learned | | | | |
| Client Work Permit Procedures | | | | |
| Client-Specific Training (LPS, LIRR, Amtrak, NJ Transit) | | | | |
| Defensive Driving (i.e., Smith System) | | | | |
| Field Notebook | | | | |
| Subcontractor Oversight | | | | |
| Field Manager / SHSO | | | | |
| Lead 2 Toolbox Safety Meetings | | | | |
| Job Safety Analysis (create 1 new JSA) | | | | |

**III. Field Assignments (Attach additional sheets for each additional assignment while SSE)**

| Site | From:: | To: | Onsite Mentor | Supervisor |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

**IV. Release from SSE Status**

Based upon the SSE's successful completion of the above training and assignments, the SSE's Mentor, Supervisor, and OM indicated below have been convinced that the SSE has a working knowledge of both Roux and any applicable Client Safety Policies, and has demonstrated safe work practices and behavior. Additionally, the SSE has completed all applicable SSE training (as documented above) and performed all activities without a serious loss incident (i.e., property damage, OSHA recordable injury). The individual is thereby removed from status as an SSE.

_____ _____

SSE Mentor SSE Supervisor

_____ _____

Office Manager Date

**ROUX SSE EXCEPTION FORM**

This form is to be filled out and approved by the Roux Office Manager and Project Principal whenever the onsite Supervisor requirement and/or 50% SSE limitation will not be met on the project.

## IV. Variance Information

| | |
|---|---|
| Variance Justification:<br>(What are the current circumstances and what will be done to ensure an acceptable level of risk?) | |
| Alternatives to Variance:<br>(If the variance is denied, what are the alternatives to completing the scope of the work? Briefly detail the cost and operational impact of the alternatives.) | |

List the steps to be taken to manage the SSE risk to an acceptable level:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

## V. Variance Review and Approvals

Variance Expiration Date: _____

Project Principal ☐ Approves ☐ Denies

Signed: _____ Date: _____

Office Manager ☐ Approves ☐ Denies

Signed: _____ Date: _____

**SHORT SERVICE EMPLOYEE MENTOR DOCUMENTATION FORM**

**I. Mentor Information**

Mentor Name:_____ Current Job Title:_____

Date of Employment:_____ Experience:_____Years Current Position Experience:_____Years _____Mos.

**II. Demonstrated Experience**

**The mentor of any SSE will have demonstrated the following as endorsed by their supervisor or Office Manager**

**Requirement**

- Is not a Short Service Employee
- Is LPS® trained and is capable of providing quality review of LPS® tools effectively
- Demonstrates proper usage of SPSAs and actively coaches others
- Has developed multiple JSAs
- Understands emergency response procedures and can explain them to others
- Is proficient in preparing and reviewing work permits
- Understands injury reporting and case management responsibilities and is capable of explaining them to employees and subcontractors
- Has working knowledge of hazard identification, near loss, and loss reporting and has participated in multiple near loss investigations
- Demonstrates the ability to intervene when required during project execution
- Leads Toolbox Safety Meetings as part of project execution

**III. Approval of Employee to Participate in SSE Program as a Mentor**

Based upon the employee's demonstration of the above attributes, the employee's Supervisor / OM indicated below has been convinced that the employee is capable of being an effective Mentor as part of the SSE Program.

_____ _____

Supervisor / Office Manager Date

**APPENDIX G**

# Health and Safety Briefing/ Tailgate Meeting Form

# HEALTH AND SAFETY BRIEFING / TAILGATE MEETING FORM

Site Name / Location _____

Date: _____ Weather Forecast: _____

Names of Personnel Attending Briefing

_____ _____ _____

_____ _____ _____

_____ _____ _____

Planned Work

_____

_____

_____

Instrument Calibration: Instrument/Time/Cal. Gas/Cal. Concentration/Actual Concentration

_____

_____

_____

Items Discussed

_____

_____

_____

_____

_____

Work Permit Type and Applicable Restrictions

_____

_____

_____

Signatures of Attending Personnel

_____ _____ _____

_____ _____ _____

_____ _____ _____

# APPENDIX H

Weekly Safety Report

# APPENDIX H

## WEEKLY SAFETY REPORT

**Job Name_____ Job#_____**

**Week of:** **Days Without Lost Time Injury:**

**Describe any recordable incidents or accidents:**

**What actions were taken to prevent such incidents or accidents from occurring again?**

**Was training conducted addressing the incident? Y N What date?___**

**What level of PPE is currently in place?**

**Has PPE been upgraded or downgraded?**

**Have Perimeter Air Monitoring action limits been exceeded:**

**What action was taken to mitigate the exceedance?**

**Have personal air monitoring limits been exceeded:**

**What actions were taken?**

**List any problems with air monitoring equipment:**

**Write a summary of work completed during the week:**

**Write a summary of proposed work for the coming week:**

**Summarize any safety issues that are outstanding:**

**HSO Name:** _____ **HSO Signature:** _____

# APPENDIX G

Operation and Maintenance Manual

## APPENDIX G – OPERATIONS AND MAINTENANCE MANUAL

## TABLE OF CONTENTS


LIST OF ACRONYMS ..... iii

1.0 INTRODUCTION ..... 4

2.0 SITE DESCRIPTION ..... 5
- 2.1 Site Description ..... 5

3.0 SYSTEM PROCESS DECRIPTION ..... 6
- 3.1 LNAPL Recovery Spill Buster™ Systems ..... 6
  - 3.1.1 Clean Earth Magnum Spill Busters ..... 6
  - 3.1.2 LNAPL Storage Drums Disposal ..... 7
- 3.3 Additional LNAPL Recovery Processes ..... 7

4.0 OPERATIONS AND CONTROLS ..... 8
- 4.1 Spill Buster™ ..... 8
  - 4.1.1 System Start-Up ..... 8
  - 4.1.2 System Shutdown ..... 9

5.0 SYSTEM MONITORING AND RECORD KEEPING ..... 10
- 5.1 Field Book and Recovery Sheets ..... 10
- 5.2 System Monitoring ..... 10
  - 5.2.1 System Trend Monitoring ..... 10
  - 5.2.2 Critical Equipment Checklist ..... 11

6.0 MAINTENANCE AND INSPECTIONS ..... 12
- 6.1 Spill Buster™ Maintenance ..... 12
  - 6.1.1 Air Compressor Maintenance ..... 12
- 6.2 55-Gallon Drum Inspections ..... 13
- 6.3 Critical Equipment ..... 13

7.0 SAFETY PRECAUTIONS ..... 14

8.0 OWNER AND RESPONSIBILITIES ..... 15

9.0 AUTHORIZATIONS ..... 16

10.0 EMERGENCY CONTACT LIST ..... 17


### FIGURES


1. Site Location Map
2. Process and Instrumentation Diagram for Recovery System at MW-3


### APPENDICES


A. Magnum Spill Buster™ Operator's Manual

B. High Viscosity Magnum Spill Buster™ System Information
C. Critical Equipment Checklist

**LIST OF ACRONYMS**

| | |
|---|---|
| AC | Alternating Current |
| AST | Aboveground Storage Tank |
| CE | Critical Equipment |
| FDNY | Fire Department of New York |
| HASP | Health and Safety Plan |
| LNAPL | Light Non-Aqueous Phase Liquid |
| O&M | Operation and Maintenance |
| PI&D | Process and Instrumental Diagram |
| PRC | Product Recovery Cycle |

## 1.0 INTRODUCTION

This Operation and Maintenance (O&M) Manual has been prepared by Roux Associates, Inc. (Roux Associates), on behalf of Gemini Arts Initiative, Inc., for the recovery system which have been constructed for the recovery of light non-aqueous phase liquid (LNAPL) present at 153 2nd Street, Brooklyn, NY (Site), shown on Figure 1. There is currently one (1) LNAPL recovery system at the Site, installed at MW-3, that consists of an LNAPL skimmer system (High Viscosity Magnum Spill Buster™ (HVSB), one (1) 55-gallon drum, and an air compressor.

This O&M Manual is a reference for operating and maintaining the recovery system in conformance with their design, applicable regulations, and permit requirements. Detailed operation and maintenance manuals prepared by the equipment manufacturers for each major component of the system are also included within this O&M Manual. This O&M Manual also presents the O&M activities, which will occur from the time of system start-up and throughout the operation of the system. Should these activities be changed, modifications to this O&M Manual shall be documented through the preparation of revisions or addenda. Equipment-specific maintenance or those activities that would not be considered routine will be contracted out by Roux Associates, as required.

## 2.0 SITE DESCRIPTION

The following sections describes the Site and recovery system currently operating within the Site.

### 2.1 Site Description

The Site is located in Brooklyn, Kings County, New York and is identified as Block 967 and Lot 1 on the Brooklyn County Tax Map. The site is an approximately 108,722.5 square-feet (sf) area and is bounded by the historical 1st Street Basin (Lateral Canal) to the north, 2nd Street to the south, 3rd Avenue to the east, and the Gowanus Canal to the west. A 3-story building (Turbine Hall) with a footprint of approximately 24,200 sf remains in place. The Site was historically utilized for: sulfur-works, a power station, a paper mill, a lumber yard, a coal-fired electric powerhouse, an electrical sub-station and switching yards, and a warehouse. The Site is zoned as a manufacturing district (M2-1) and has subsequently been vacant over the past decade.

## 3.0 SYSTEM PROCESS DECRIPTION

This section provides a description of the major components of each LNAPL recovery system, as well as descriptions of additional LNAPL recovery methods that are conducted on a routine basis at the Site.

### 3.1 LNAPL Recovery Spill Buster™ Systems

There is currently one (1) LNAPL recovery systems at the Site. It is located at MW-3 in the basement of the Turbine Hall. The LNAPL recovery is comprised of a high viscosity automated pneumatic-powered pump (Clean Earth Technology, Inc. High Viscosity Magnum Spill Buster™), air compressor, and 55-gallon drum. Details for each of the Spill Buster™ components are provided in the sections below. In addition to the operation and maintenance information found in this document, the following documentation is provided:

- HVSB™ process and instrumental diagrams (P&IDs) (Figure 2)

#### 3.1.1 Clean Earth Magnum Spill Busters

The HVSB™ is comprised of a pneumatic-powered LNAPL recovery pump driven by an air compressor (Porter Cable Model C2002 Type 0). The motorized auto seeker reel assembly mounted above the well is designed to adjust the pump intake depth as LNAPL is recovered from the well. The controller can be used to adjust the pump cycle duration to set the average pump flow rate at a recovery rate that is less than the observed recharge rate of LNAPL into the well. Additional information on the HVSB™ and the operator's manual for the air compressor is provided in Appendix B; additional specifications for the air compressor are provided in Section 6.1.1. Personnel are required to receive training on the operation of the Spill Busters.

The Spill Buster™ unit is equipped with secondary containment. The 55-gallon drum is placed in an overpack drum, in the event that the 55-gallon drum reaches capacity, overflow will be caught by the overpack drum. In addition, each Spill Buster™ secondary containment unit is equipped with the following:

- High level alarm float switch or sensor

### 3.1.2 LNAPL Storage Drums Disposal

Recovered LNAPL is conveyed from the Spill Buster™ to a 55-gallon drum. Once the 55-gallon drum is full, the drum will be disposed of offsite to an appropriate facility as TSCA Hazardous material.

## 3.3 Additional LNAPL Recovery Processes

Absorbent socks and bailers are installed/used in monitoring wells observed with LNAPL thicknesses too low to be recovered using the Spill Buster™ (e.g. less than 0.3 ft). Absorbent socks are containerized in labeled 55-gallon drums for transport and disposal off-Site. Bailer recovered LNAPL is stored in labeled 55-gallon drums on-Site.

## 4.0 OPERATIONS AND CONTROLS

The overall responsibility for the operation and maintenance of the recovery system will be assumed by Gemini Arts Initiative, Inc. and Roux Associates. This O&M Manual is a reference for operating and maintaining the recovery systems and associated components in conformance with their design, applicable regulations, and permit requirements. Detailed operation and maintenance manuals prepared by equipment manufacturers for each major component of the system is maintained within this O&M Manual and will be stored on-Site.

### 4.1 Spill Buster™

A thorough understanding of the operating requirements and procedures for all of the system components is required prior to start-up of the system. In addition to the operation and maintenance information found in this document, supporting documentation can be found in the manufacturer's equipment manuals provided in Appendix A and B. The recovery systems are designed to be operating continuously and should only be shut down during system maintenance or an emergency.

#### 4.1.1 System Start-Up

Prior to starting up any recovery system, there must be no alarm conditions that exist in the Spill Buster™ secondary containment components. The following sequence assumes all electrical, pneumatic, influent, and effluent piping connections have been maintained and are in operational condition. The following procedures are performed to start-up the Spill Buster™ recovery system:

1. Ensure that the Spill Buster™ pump is installed within the well casing and can freely move up and down the well. Verify that the reel can spin freely above the well.
2. Verify that all float switches and sensors are hanging freely and in the correct position.
3. For the High Viscosity Magnum Spill Buster™, open the drain valve to discharge any moisture, and then close the drain valve.
4. Apply power to the control panels.
5. The System Power Switch governs all power to the system when it is connected to an alternating current (AC) power source, including the Control Box, Probe, and Auto Seeker.
6. A yellow lamp will light on the Spill Buster control panel indicating that the system power is ON.
7. After the system is turned ON and the Product Recovery Cycle (PRC) control switch is in the AUTO position, the system will begin its cycle after a 5 second delay.

Note: The Spill Buster™ probe needs to detect a LNAPL/water interface in order to operate with the Auto Seeker. For wells that do not have sufficient water volume, LNAPL may have to be manually pumped from the well to raise the LNAPL/water interface to an elevation that the Spill Buster™ probe can detect in order to operate. If the fluid column in the well is LNAPL only, the probe will not detect the interface and the cables may unspool from the Auto Seeker reel.

### 4.1.2 System Shutdown

The following procedures are performed prior to a scheduled shutdown of the Spill Buster™ recovery systems for routine maintenance:

1. Press the PRC control to the STOP position.
2. Hold the PRC control switch in the "Raise Probe" position for 5 seconds to raise the probe.
3. Turn the system power switch to the OFF position.
4. Disconnect and lock out power at the main breaker to the Spill Buster™.
5. For the High Viscosity Magnum Spill Buster™, do not start maintenance procedures until the air compressor powers off (this may take a few minutes).

## 5.0 SYSTEM MONITORING AND RECORD KEEPING

In order to properly maintain the Spill Buster™ system and minimize downtime, record keeping must be performed. This section summarizes monitoring and record keeping requirements for the recovery systems.

### 5.1 Field Book and Recovery Sheets

A field book is kept for a time-specific record of all maintenance and operations of the recovery systems. The field book is kept by the Roux Associates technicians whenever personnel are on-Site.

The information recorded in the field book includes, but is not limited to:

- Date and time of arrival;
- Personnel present on-Site;
- Objective of Site visit;
- Weather conditions;
- Operating status of the Spill Buster™;
- O&M performed; and
- Addition LNAPL recovery details.

Copies of the field book and any additional Site records are kept on the Roux Associates network and include, but are not limited to, drum disposal log, Spill Buster recovery log, and inspection logs.

### 5.2 System Monitoring

System monitoring is achieved through system trend monitoring, and a critical safety device checklist. A description of each can be found in the subsections below.

#### 5.2.1 System Trend Monitoring

System trends are logged in the field book and recovery sheets to monitor and evaluate the performance of the recovery systems. Roux Associates technicians monitor the system trends on a routine basis in an effort to optimize system recovery. Recovery rates of the Spill Buster™ systems are evaluated and altered, if necessary, and any changes are recorded in the field book.

### 5.2.2 Critical Equipment Checklist

The Critical Equipment (CE) Checklist is a list of all the switches, alarms, and any other piece of equipment used with the Spill Buster™ to prevent unauthorized discharges, access, modification, or damage to equipment. A copy of the CE Checklist for each Spill Buster™ is provided in Appendix C.

The CE Checklist is completed on a quarterly basis, at a minimum. Further details on the CE at the Site are provided in Section 6.3.

## 6.0 MAINTENANCE AND INSPECTIONS

All aspects of the recovery system are visually inspected on a weekly basis to ensure proper function. Important maintenance tasks and the proposed frequency required to ensure proper system function are described herein.

### 6.1 Spill Buster™ Maintenance

On a monthly basis the Spill Buster™ housing, filter, probe, and pump are cleaned of debris and natural biofilms. Complete the maintenance shut-off procedures defined in Sections 4.1.2.

1. Prepare a work area at standing height with spill pads and spray cleaner (e.g., Simple Green).
2. Remove the probe housing from the monitoring well.
3. Clean the probe housing with spray cleaner and spill pads.
4. Carefully pinch locking buttons located at the bottom of the probe housing to release the pump, spring, and locking mechanism.
5. Clean the filter, inlets, pump, and electrical connections with spray cleaner and spill pads; if the filter is severely clogged, soak the filter in cleaning solution.
6. The probe and sensor band array is now exposed within the probe housing; carefully clean the probe and sensor band array with spray cleaner and spill pads.
7. Reinstall the pump, filter, spring, and locking mechanism into the probe housing; note, the pump components must be aligned with the discharge seal and electrical contacts of the probe housing. If firm contact is not made, the pump will not function.
8. Return the probe housing to the well and begin system start-up procedures as seen in Section 4.1.1.

#### 6.1.1 Air Compressor Maintenance

On every Site visit, the air compressor drain valve will be opened to remove excess moisture. In addition, the desiccant dryer will be inspected and desiccant materials changed, as necessary; the filter dryer used is the ¼-inch DFD-10 Disposable In-Line Desiccant Filter Dryer. The outlet pressure is adjusted so that the pressure remains between 75-80 pounds per square inch for optimal operation. The surface of the air compressor is hot during operation; therefore the rear motor of the air compressor must be facing away from the enclosure opening at all times.

### 6.2 55-Gallon Drum Inspections

Each 55-gallon drum is visually inspected during each Site visit for signs of erosion, damage, tampering, etc. by Roux Associates personnel.

### 6.3 Critical Equipment

As discussed in Section 5.2.2, quarterly documentation of the CE checklist items are performed. CEs are devices located at the Site, which are intended to:

- Prevent unauthorized discharges, both vapor and liquid phase;
- Prevent unauthorized access or modification to the remediation equipment; and
- Prevent equipment damages that could result in personal injury or unauthorized discharge.

The CE for the Spill Buster™ are listed in the CE checklist (Appendix C). The CE located at the recovery systems are listed below:

- Control panel electrical grounds;
- AST high level alarm float switch or sensor;
- Spill Buster™ high level alarm float switch or sensor; and
- Pressure relief valve.

## 7.0 SAFETY PRECAUTIONS

Site-specific safety precautions and protocols will be considered for all activities associated with the Site. All activities on the Site will be performed in accordance with the Site-Specific Health and Safety Plan (HASP). The HASP will be kept on-Site in conjunction with this O&M Manual.

## 8.0 OWNER AND RESPONSIBILITIES

The designated owner of this O&M Manual for operating and maintaining the systems described herein is Roux Associates. The key personnel involved in the operations and maintenance at 153 2nd Street located in Brooklyn, New York are as follows:

1. Frank Cherena – Project Principal
2. Christina Prete – Project Manager / Senior Engineer
3. Lauren Dolginko – Project Geologist
4. Alfredo Fernandez – Senior Technician
5. Michael Sarni – Technician

## 9.0 AUTHORIZATIONS

Roux Associates' personnel and Roux Associates' subcontractors authorized to enter the Site must be approved by the Roux Associates' project manager. Approval will require demonstrable evidence of the completion of appropriate training courses and medical examination requirements as specified by OSHA 29 CFR 1910.120, and review and sign-off of the HASP.

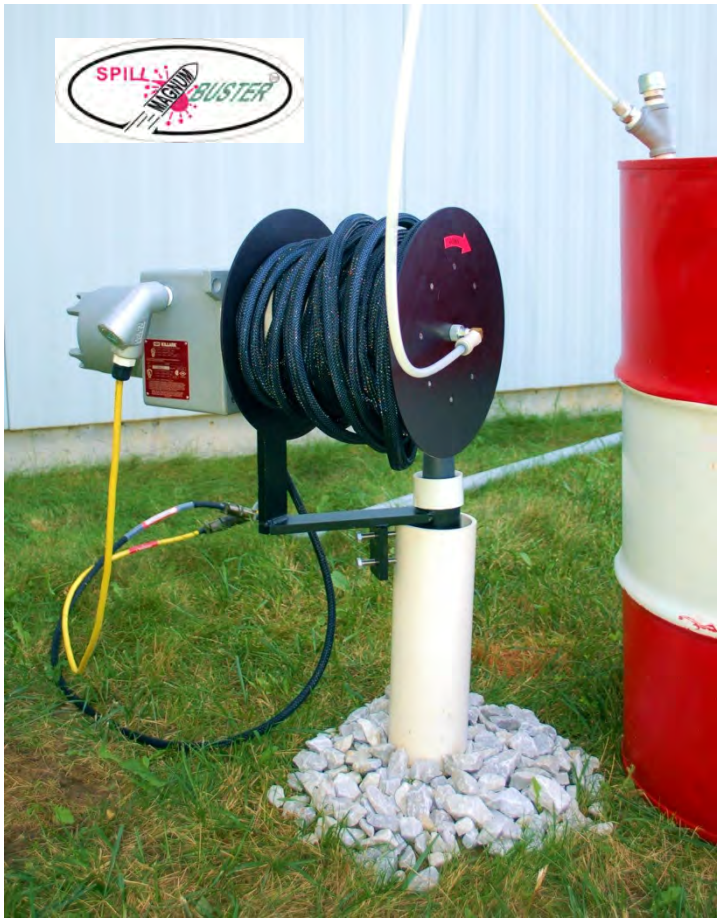
The following Roux Associates' personnel are authorized to adjust system operating parameters:

1. Frank Cherena – Project Principal
2. Christina Prete – Project Manager / Senior Engineer
3. Lauren Dolginko – Project Geologist
4. Alfredo Fernandez – Senior Technician
5. Michael Sarni – Technician

## 10.0 EMERGENCY CONTACT LIST

| Agency | Phone Number |
|---|---|
| FDNY (Engine 239, Brooklyn) | 911 or (718)-999-2056 |
| NYSDEC Spill Hotline (Call within 2 Hours) | 1-800-457-7362 |
| US Coast Guard | (718) 354-4353 |
| NYCDEP | 311 or (212) 639-9675 |
| EMS | 911 |
| Police – 78th Precinct | 911 or (718) 636-6411 |
| **Medical** | |
| City MD Urgent Care Center | (877) 852-3082 |
| New York Methodist Hospital | (718) 780-3137 |
| AllOne Health | 1-877-720-7770 |
| **NYSDEC** | |
| John Grathwol | (518) 402-9767 / Cell (518) 527-3065 |
| **Gemini Arts Initiative** | |
| Katie Dixon (Authorized Representative) | (718) 522-1188 |
| **Roux Associates** | |
| Frank Cherena (Project Principal) | (631) 226-2600 / Cell (516) 445-0357 |
| Christina Prete (Project Manager) | (631) 226-2600 / Cell (631) 291-0051 |
| Alfredo Fernandez (Senior Technician) | Cell (646) 898-9216 |
| Brian Hobbs (NY Health and Safety Manager) | (631) 226-2600 / Cell (631) 807-0193 |
| **Utility** | |
| National Grid | (718)-643-4050 |
| Con Edison | (800) 752-6633 |
| Fuel Oil (Buckeye Pipeline) | (800) 331-4115 |

# Magnum Spill Buster
## Product Recovery System




## Operator's Manual
**PN 3013**

**Rev- Initial Release**

| REVISIONS | | | |
|---|---|---|---|
| **REV** | **DESCRIPTION** | **INITIALS** | **DATE** |
| | Initial Release | DFB | 11/8/13 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

# Magnum Spill Buster Limited Warranty

All references to the customer herein shall mean the Purchaser or the Lessee as applicable. CLEAN EARTH TECHNOLOGY, INC. (CET) warrants the Magnum Spill Buster System to be free of substantial defects in material and workmanship for one year from the date of shipment. Pumps are warrantied for 90 days. CET's sole responsibility under this warranty shall be to either repair or replace, at its option, any component which fails during the applicable warranty period because of defect in workmanship or material. No other liabilities shall be assumed by the manufacturer or its agents, nor are they expressed or implied.

This warranty is contingent upon proper use of the Magnum Spill Buster System by the Customer in accordance with CET's published specifications. This warranty shall not be valid if the alleged defect is the result of abuse, misuse, accident, alteration, neglect, unauthorized repair, or acts of nature. Any repair shall be deemed unauthorized unless it is made by CET or with the written consent of CET. This warranty is the sole warranty made by CET to the Customer and is in lieu of all other warranties or obligations, expressed or implied.

System upgrades will be made available to customers as they are completed. Clean Earth Technology, Inc. is not obligated to provide those upgrades without cost.



**WARNING:** Logic board dip switch settings other than those shown herein are not approved by Clean Earth Technology, Inc., and may cause spillage of product. Please consult the factory for alternate settings.



**WARNING**: In the event that equipment is returned to the factory for any reason, a complete decontamination must be done before shipment. See page 89 of this manual for the decontamination procedure. Shipping hazardous materials improperly may be a Federal offense.



**WARNING:** Unauthorized user modifications or application beyond the published specifications may result in electrical shock hazards or improper operation. Clean Earth Technology, Inc. will not be responsible for any injuries sustained due to unauthorized equipment modifications.

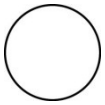
# Restrictions and Liabilities

Information in this document is subject to change and does not represent a commitment by Clean Earth Technology, Inc. Changes made to the information in this document will be incorporated in new editions of the publication. No responsibility is assumed by Clean Earth Technology, Inc. for the use or reliability of software or equipment that is not supplied by Clean Earth Technology, Inc. or by its affiliated dealers.

## Safety Considerations

Use of this instrument is restricted to qualified personnel who recognize shock hazards and are familiar with safety precautions used when operating electrical equipment. Read the manual carefully before operating the Magnum Spill Buster.

The following warnings and informational symbols may be found on the Magnum Spill Buster and/or in this manual:

| Symbol | Description |
|---|---|
|  | Caution: Risk of electric shock |
|  | Direct / Alternating Current |
|  | Direct Current |
|  | Alternating Current |
|  | Protective Earth (ground) |
|  | Warning: Refer to accompanying documentation |
|  | Off (Power: disconnection from Mains) |
|  | On (Power: Connection to Mains) |



## Hazard Warnings

- Warning! Explosive Vapors. Always disconnect AC power at its source prior to connecting/disconnecting any wires and/or cable connections located within any hazardous locations.

- Warning! Explosive Vapors. The control panel and Standard Auto Seeker are not explosion proof or intrinsically safe, and should be located outside of any classified hazardous areas where explosive vapors may be present.

- Warning! Electrical Shock. Correct grounding is absolutely necessary for the system to work properly and safely. Failure to do so may result in damage to the system and/or electrical shock, which may result in serious injury or death.

- Warning! Electrical Shock. All AC Power wiring must be done by a qualified electrician. Disconnect AC power at its source prior to connecting/disconnecting any wires at the terminal block. Electrical shock may result in serious injury or death.

- Warning! Chemical Incompatibility. Due to possible adverse reactions with some of the materials used in the standard Magnum Spill Buster, it should not be used to pump any Halogenated Hydrocarbon (HHC) solvent containing any of the following elements (examples are not all inclusive):

    - Flourine (f) "-flour-" Examples: Dichloroflouromethane, Trichloroflouromethane.
    - Bromine (Br) "-bromo-" Examples: Methyl bromine, Ethylene dibromide.
    - Chlorine (C1) "-chloro-" Examples: Perchloroethylene, Trichloroethane, Dichloromethane.
    - Iodine (I) "-iodi-" Examples: N-butyl Iodide, Methyl Iodide.

    If remediation of an HHC solvent is required, we can build the Magnum with an epoxy probe in place of standard materials and an alternate pump. Failure to heed this warning could result in severe damage to the system and the resultant possibility of injury to personnel and damage to the surrounding site.

**Any chemical of concern (COC) that may be present on a site must be disclosed to Clean Earth Technology at the time of all requests for quotes. Disclosure of COCs must also be made if a system is moved from its original site to another where COCs are present.**

# Precautions

The following precautions are provided to help you avoid damaging the system:

- **Caution: Service.** Authorized service personnel should service the Magnum Spill Buster. Only qualified technical personnel should perform troubleshooting and service procedures on internal components.
- **Caution: Site Security.** Access to the site and to the Magnum Spill Buster System must be controlled at all times. The equipment is specialized and must only be operated by qualified and trained personnel. Locked sheds, vaults, and fenced enclosures are

good examples of a secured site. Clean Earth Technology does not warranty damage to equipment due to vandalism or negligence.

- **Caution: Proper Grounding.** It is absolutely necessary to ground every system, whether powered by AC or battery-operated. Always call the factory if you have any questions about the proper way to ground your Magnum.
- **Caution: Regular Maintenance.** The down-well probe and pump should be regularly inspected and maintained, as detailed in Section 5.0, page 65 . The frequency of maintenance will depend on your site conditions. We recommend that you start with weekly checks of the pump and probe until experience dictates that a lengthier interval will suffice. Failure to provide regular maintenance will damage your Magnum and may result in unsafe operating conditions. Clean Earth Technology is not responsible for damage to equipment or injury to personnel resulting from improper maintenance practices.

The policy below applies to both equipment sales and repair orders. For a Return Material Authorization number, please call our Service Department. (802) 425-3710

**Clean Earth Technology, Inc.**

# Environmental Equipment Return Policy

This policy refers to ANY EQUIPMENT OR PARTS being returned to Clean Earth Technology, Inc. (CET), whether:

- Customer owned, leased, or rented.
- In warranty or out of warranty

NO equipment or parts should be shipped to CET without first contacting our service department for a Return Material Authorization number (RMA). Contact our service department at **(802) 425-3710** to be assigned an RMA number.

- CET reserves the right to refuse delivery of any equipment without a CET RMA number clearly displayed on the exterior of the package(s).
- CET reserves the right to refuse delivery of any equipment improperly decontaminated.
- CET reserves the right to add a fee of $500.00 to the repair invoice of any equipment or parts not decontaminated to the satisfaction of CET.

## Environmental Equipment Return Guidelines

- All equipment must be thoroughly cleaned, purged of product and decontaminated prior to shipment to CET. NOTE: CET recommends the use of Personal Protective Equipment, level C or D, as defined in OSHA 29 CFR 1910.120.

- CAREFULLY FOLLOW THE EQUIPMENT DECONTAMINATION PROCEDURES FOUND ON PAGE 89 OF THIS MANUAL

Any equipment or parts shipped to CET must include the following documentation:
CET RMA/Repair Order form completed by customer. An "RMA number/REPAIR ORDER" form to copy is found on page 93.

- Description/name of product pumped.
- Reason for return.
- The CET RMA number clearly marked on the outside of ALL packages and paperwork.

All items being returned (including all warranty-claim shipments) must be sent freight prepaid to our factory location:

**Clean Earth Technology, Inc.**
**445 Long Point Road**
**N. Ferrisburgh, VT. 05473**

When you ship an item to CET, we recommend using UPS, FedEx, or another reputable shipper. We also recommend that you insure your shipment for its actual replacement cost. Clean Earth Technology will not be responsible for lost shipments or instruments that are received in damaged condition due to improper packaging or handling.

Use the original carton and packaging material for shipment. If they are not available, we recommend the following guide for repackaging:

- Use a double walled carton of sufficient strength for the weight being shipped.
- Use sufficient industry approved, shock-absorbent packing material to protect all surfaces and projecting parts. The items packed should not be able to slide or shift their position within the box.

# CONTENTS

**Magnum Spill Buster Limited Warranty** ..... **i**
**Restrictions and Liabilities** ..... **ii**
Safety Considerations ..... ii
Hazard Warnings ..... iii
Precautions ..... iii
**Environmental Equipment Return Policy** ..... **iv**
Environmental Equipment Return Guidelines ..... iv
**Product Introduction** ..... **3**
**Explosion Proof and Intrinsic Safety 101** ..... **5**
Intrinsic Safety ..... 5
Explosion Proof Enclosures ..... 6
Flammability and Combustible Liquids Definitions 101 ..... 7
**1.0 System Installation** ..... **9**
System Equipment List ..... 10
Site Security ..... 11
Control Box Installation ..... 11
Installing the Standard Auto Seeker ..... 13
Installing the Explosion Proof Auto Seeker ..... 14
Product Discharge Tubing ..... 16
Product Tank Inlet Fitting ..... 16
Product Tank Override Probe ..... 17
Product Tanks ..... 17
System Grounding ..... 18
Installing System Extension Cables for a Standard Auto Seeker Magnum ..... 20
Standard System Wiring Diagram ..... 21
Installing System Extension Cables for an Explosion Proof Auto Seeker Magnum ..... 22
Explosion Proof System Wiring Diagram ..... 22
Pulling System Cables Through Conduit ..... 24
Connecting Cables at a Non-XP Control Box ..... 25
Connecting Cables at an Explosion Proof Control Box ..... 26
Control Box Terminal Block ..... 27
Connecting the Standard Auto Seeker Cables ..... 30
Connecting the XP Auto Seeker Cables ..... 31
Initial Pump Power Test ..... 32
Pump Flooding Procedure ..... 34
**2.0 Spill Buster System Operations** ..... **35**
Initial Power Up ..... 36
Magnum Spill Buster Front Panel ..... 37
Magnum Spill Buster System Cycle ..... 38
System Cycle Schematic with Auto Seeker ..... 39
Product Recovery Cycle (PRC) Control Switch ..... 41
System Cycle Operation (no Auto Seeker) ..... 42
**3.0 Spill Buster Advanced System Operations** ..... **43**
DIP Switches ..... 44
DNAPLs Operation ..... 46
DNAPLs System Cycle without Auto Seeker ..... 48
**4.0 Other Options** ..... **49**
Immediate Response Box ..... 50

Battery Operation ....51
Solar Panel Charging Operation ....52
Water Depression ....53
**5.0 Maintenance Operations ....65**
Probe/Product Pump ....66
Pump Flooding Procedure ....72
Pump Installation ....73
Logic Board and Power Supply ....74
Removing Probe from Auto Seeker Reel ....76
Resynchronizing Product Cable With The Standard Auto Seeker Rotation ....76
To Remove the Probe from a Standard Auto Seeker Reel ....77
To Install the Probe on a Standard Auto Seeker Reel ....78
To Remove the Probe from an Explosion Proof Auto Seeker Reel ....79
To Install the Probe on an Explosion Proof Auto Seeker Reel ....80
**6.0 Troubleshooting ....81**
**7.0 System Specifications ....85**
Magnum Spill Buster Pump Performance ....87
**8.0 Equipment Decontamination Procedures ....89**
**9.0 Equipment Return Policy ....91**
**Return Materials Authorization Form ....93**

# Product Introduction

The Magnum Spill Buster™ family of equipment is an automated free phase petroleum contamination pumping system. It is specifically designed to remove NAPL petroleum product from the water table via a 2″ or larger diameter well. Its unique auto-seeking device allows the pump intake to automatically follow the elevation of the oil/water interface as it fluctuates throughout the entire length of the well. The Magnum Spill Buster will not pump any amount of water.



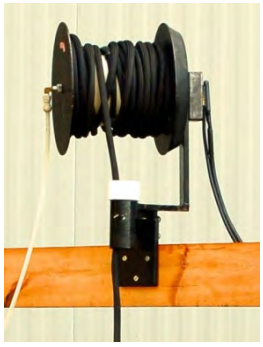
Control Boxes mounted in a NEMA enclosure

The Magnum Spill Buster is composed of three interactive modules: The Control Box, the Auto Seeker, and the down well Probe.

The **Control Box** coordinates and displays the condition of the system operation and also allows certain system parameters to be varied.



Magnum Control Box with protective cover removed



Standard Auto Seeker

The **Auto Seeker** is a small, motorized, reel assembly that automatically raises and lowers the probe to follow the NAPL interface through the entire depth of the well.

The 1.93” diameter **Probe** contains the patented ALPHA ARRAY™ interface sensors, as well as a small but powerful 12vdc electric product pump.



Magnum Spill Buster Probe



“Exploded” view of the Probe,
Showing the pump, filter, spring and end cap

The Spill Buster may also be used in a dual pump mode by adding a water depression control box and water pump (See page 53).



The Magnum Spill Buster has several options for its power source. Where electrical connection is available, the system can be hard wired for 115/230 VAC at 60 Hz. The operating system will also automatically adjust to European 230 VAC at 50 Hz. Battery power is also an option via two deep cycle 12V batteries in series for 24 VDC power. On remote sites where power is not available, the Magnum can run on solar power (See pages 52).

The Magnum Spill Buster can be used on a wide variety of groundwater remediation sites. Many of these sites contain classified hazardous areas with restrictions on the type of equipment that can be used within them. It is very important for the operator to be aware of all applicable codes on their site and confirm that their planned use of the Magnum Spill Buster is in compliance. Please note that we offer a range of options for meeting the requirements on different kinds of site situations, including versions that mount the Auto Seeker and/or Control Box in explosion proof containers for use in Class 1, Division 1, hazardous zones.



Control Box mounted inside explosion proof enclosure

The following section on the terms “Intrinsic Safety” and “Explosion Proof” provides more detail on the differences between the two and gives examples of how the Magnum Spill Buster systems’ design incorporates them.



NEC 2011 compliant explosion proof Auto Seeker

# Explosion Proof and Intrinsic Safety 101

Portions of the standard Spill Buster system operate in various “classified” flammable or explosive vapor zones or areas as defined in the US under the NEC codes. The location of the equipment on the site must be designed properly; or the equipment must be enclosed in appropriate enclosures, to prevent ignition of these vapors should the failure of a component occur. Since this is such an important topic we will present a few basics in this manual to help you or your customers understand the meaning of the various terms defining safe use when planning or installing our equipment. Please note that what we have written here is not meant to supersede anything that may be written in detail in the NEC codes or applicable local codes. ***It is your responsibility*** **and the responsibility of the Authority Having Jurisdiction** to study and follow these codes.

The Magnum Spill Buster system may need to be partially or completely located in areas that are classified as “Class 1, Division 1, Hazardous Atmospheres” as defined in the NEC code section 500. A Class 1, Division 1, safety rating is the highest rating in the US for flammable and combustible zones. There are several methods to insure that electrical systems are safe to operate in these areas. The Standard Spill Buster system can be modified when required to utilize two of these basic methods to achieve safe operations in these atmospheres per NEC 2011 electrical codes: the Intrinsically Safe method, and the Explosion Proof Enclosure method.

The sections below provide a brief explanation of these two methods and the different ways in which they make an electrical system safe for operation in Class 1 Div. 1 areas.

## Intrinsic Safety

Intrinsic safety (IS) is a protection technique for safe operation of electrical equipment in hazardous areas by limiting the energy available for ignition of explosive well gases. The concept of (IS) circuits was originally driven by some devastating coal mine explosions in Europe due to “firedamp” gases being ignited by “electrical shorts” in the wiring of early communication devices such as the electric telegraph.

In signal and control circuits that can operate with low currents and voltages, the intrinsic safety approach simplifies circuits and reduces installation costs over other protection methods. High-power circuits such as electric motors or lighting cannot use intrinsic safety methods for protection.

One of the most common methods for protection is to limit the current by using multiple series resistors (assuming that resistors always fail open); and to limit the voltage with multiple Zener devices to ground (assuming diodes always fail shorted). Approval standards for intrinsic safety barriers require that the barrier maintains approved levels of voltage and current to the

specified components. This is accomplished by preventing ignition of the protected device and stopping sparking of damaged wiring to the protected components.

An example of an Intrinsically Safe (IS) certified Zener barrier is shown here. Signals going to an electrical device located in a classified zone are wired into one end of the modular barrier and then wired out into the classified zone. These can be purchased off the shelf and are certified Intrinsically Safe by various 3rd body testing laboratories.



## Explosion Proof Enclosures

Explosion Proof (EXP) enclosures are not intended to seal the electrical equipment they contain from the entry of explosive atmospheres that may be outside the enclosure. Instead, they prevent any explosion that might occur within the enclosure from initiating a secondary fire or explosion in the surrounding area outside of the enclosure. Since they are not tightly sealed, liquids and gases may flow into the enclosure.

EXP enclosures are usually made of heavy cast aluminum or stainless steel and are of sufficient thermal mass and mechanical strength to safely contain an explosion should ignition of the flammable material occur within the housing. These enclosures are typically produced with wide, flat, flanges but may not have a gasket between those flanges. Should an explosive mixture ignite inside the enclosure because of an electrical short or an overheated component, the design of the flanges cools down any hot gases escaping between them enough to prevent the ignition of the external combustive atmosphere.

This is important to understand because it means that by design these enclosures are neither completely air tight nor waterproof. The EXP enclosure that can be used with the Magnum's control box includes a window to allow the operator to see the instrument panel. We strongly recommend that these enclosures be mounted in an upright position and raised off of the ground to prevent possible internal flooding. If the housing must be at ground level, and especially if it is laid flat with the control panel window in the horizontal position, a protective cover should be used to keep rain from leaking inside the enclosure and flooding the control box electronics.

Another example of the Explosion Proof methodology would be the manner in which electrical wire is fed through piping. Per the NEC electrical code spelled out in section 500, cabling fed through piping usually utilizes tapered pipe threads. The code requires a minimum engagement of six threads; and since it is tapered, the spaces between the threads get tighter as the pipe is tightened up. There still is the potential for vapors to leak through these threads, but once again any hot gases escaping through the threads are cooled enough to prevent a secondary explosion.

A third example of EXP methodology would be the use of a multi-conductor cable feed through. The feed through fittings are once again designed to be strong enough to contain an explosion.

These fittings leave sufficient room to provide for stripping the outermost wire jacket and enough room for separating the individual wires from each other. A powdered mixture is then mixed together with water and poured in through an access plug to completely surround each conductor. A common material used is a compound from Cooper Crouse-Hinds called Chico®, which cures to a cement-like consistency.  In the event of an internal explosion, any hot, explosive gases escaping through the hardened Chico are cooled before entering the explosive atmosphere outside.

Here are examples of these two types of enclosures:





## Flammability and Combustible Liquids Definitions 101

When using a Spill Buster system it is important to understand the difference between the definition of flammable liquids and combustible liquids. All flammable and combustible liquids will vaporize into flammable gases at certain temperatures and pressures. The temperature point at which a liquid turns to a gas vapor is referred to as the “flashpoint” of the liquid. The determination of the flashpoint for each flammable or combustible liquid is done by performing what is commonly known as the “closed cup” flashpoint test.

It should be mentioned that flashpoint was selected as the basis for classification of flammable and combustible liquids because it is directly related to a liquid's ability to generate vapor, i.e., its volatility. ***Since it is the vapor of the liquid, not the liquid itself that burns, vapor generation becomes the primary factor in determining the fire or explosive hazard.***

Furthermore, the liquids vapor pressure is an important factor and is a measure of a liquid's propensity to evaporate. The higher the vapor pressure, the more volatile the liquid and, thus, the more readily the liquid gives off flammable or explosive vapors.

The results of flashpoint testing have been used to help regulating bodies determine the temperatures at which potentially combustible liquids turn into a vapor, creating a flammable or explosive gas.

Hazardous locations are further defined by means of the class/division system and have been formulated by the NEC, CSA, OSHA, and the National Fire Protection Association (NFPA). These definitions are as follows:

**Flammable Liquids**

**Flammable fluids are defined as liquids having closed cup flash points below 100°F (37°C). Flammable liquids are referred to as Class I liquids.**

◆ A class IA flammable liquid is a liquid with a flashpoint below 73ºF (22.8ºC) and a boiling point below 100ºF (37.8ºC). An example of a class IA liquid is n-pentane, since its flashpoint and boiling point are 56ºF (49ºC) and 97ºF (36ºC), respectively.

◆ A class IB flammable liquid is a liquid with a flashpoint below 73ºF (22.8ºC) and a boiling point at or above 100ºF (37.8ºC). An example of a class IB liquid is acetone, since

its flashpoint and boiling point are 0ºF (18ºC) and 133ºF (56ºC), respectively.

◆ A class IC flammable liquid is a liquid with a flashpoint at or above 73ºF (22.8ºC) and

below 100ºF (37.8ºC). An example of a class IC liquid is turpentine, since its flashpoint

lies in the range from 95 to 102ºF (35 to 39ºC).

**Combustible Liquids**

**Combustible fluids are defined as liquids having closed cup flash points at or above 100°F (37°C). Combustible liquids are referred to as Class II or Class III liquids.**

◆ Class II liquids - flash points at or above 100°F (37.8°C) and below 140°F (60°C).

◆ Class IIIA liquids - flash points at or above 140°F (60°C) and below 200°F (93.4°C). c.

◆ Class IIIB liquids - flash points at or above 200°F (93.4°C).

An example of a Combustible liquid is the Lamplight® Ultra Pure Red Paraffin Lamp Oil that CET uses for testing new and repaired units before shipment. This material has a flashpoint of 250F (121C) making it a class III liquid. Furthermore, its low toxicity makes it a safe testing fluid due to its high ignition temperature and the lack of chemicals that are listed in the CERCLA Hazardous Substance list. CET uses a red colored fluid but it also can be found in clear, or colored green or blue.

This fluid is easily found and can also be used as a pump priming fluid as defined on page 71.

# 1.0 System Installation

## 8 Easy Installation Steps


1. Set up Control Box Page 11

2. Install Auto Seeker Page 13

3. Install Product Tank Inlet Fitting and Product Tube Page 16

4. Install Product Tank Override Probe Page 17

5. Ground System Page 18

6. Connect System Cables and Power Cables Page 20

7. Power Test Page 32

8. Pump Flooding Procedure Page 34


Time: Set-up time for the complete system should take from 30 to 60 minutes after connection to the power source is complete.

## System Equipment List

NEMA 4 weatherproof main Control Box (NON-Explosion proof)
***(For a complete Explosion Proof system, Control Box can be mounted in a Class 1 Div. 1 rated enclosure.)***

***For a Standard Magnum System:*** Auto Seeker System (NON Explosion proof) with 30 foot power cable extension
***For a Magnum System w/Explosion Proof Auto Seeker:*** Auto Seeker System mounted in Class 1, Div. 1 rated explosion proof enclosure with 30 foot power cable extension

NEC 2011 section 500 compliant Product Probe with 50 foot probe product tube. Longer probe cable lengths available upon request.

Product Tank Inlet Fitting

50 foot nylon product discharge tube

NEC 2011 section 500 compliant Product Tank Override Probe with bung and 30 foot cable

30 foot Probe signal and power cable extension. Longer extension cables available upon request.

30 foot Auto Seeker power cable extension. Longer extension cables available upon request.

One Pump Flooding Kit per order consisting of syringe, o-ring, and tubing.

## Site Security

**Warning**

**Access to the site and to the Magnum Spill Buster System must be controlled at all times. The equipment is specialized and must only be operated by qualified and trained personnel.**

Secure every site. Locked sheds, vaults and fenced enclosures are good examples of a secured site. Clean Earth Technology does not warranty damage to equipment due to vandalism or negligence.

## Control Box Installation

- .**Warning-** All AC Power wiring must be done by a qualified electrician who is familiar with all appropriate NEC and/or local codes. Electrical shock may result in serious injury or death.
- **Warning-** Explosive Vapors. Always disconnect AC power at its source prior to connecting/disconnecting any wires and/or cable connections located within any hazardous locations.

The standard Control Panel in its NEMA-4 enclosure is not rated for use in any classified explosive locations, as determined by the Authority Having Jurisdiction (AHJ). The control box can be used with an Explosion Proof (XP) Auto Seeker and meet all Class 1, Div 1 requirements as long as the panel is mounted in a nonhazardous area.



**Standard Control Box with covers off**



**Standard Control Box with covers on**

## Location

Mount the Control Box in a suitable non classified location (refer to all safety codes applicable to your site). Typical installations are in sheds, vaults, on the side of a building, or on a utility type pedestal mount. If the control panel is mounted vertically and the box door is latched with the I/O Extension cover correctly installed, the unit is weatherproof.

If the Control Box must be located in a Class 1, Div 1 or 2 areas, Clean Earth Technology can provide an explosion proof enclosure. This type of enclosed Control Box looks like the units shown in the figures below.

**Warning**

Control Box must be located outside of any classified hazardous areas. This includes explosive atmospheres or vapors. Refer to all applicable codes.



**Standard Control Box mounted in an Explosion Proof enclosure with cover removed.**



**Standard Control Box mounted in an XP enclosure. Note the optional XP power switch box located at bottom left.**



**The optional XP power switch box located at bottom left.**

Without the optional XP power switch, the XP Control Box must be turned on and off at the circuit breaker panel for the input power.

1. Ensure the unit is de-energized. Mount the Control Box in a suitable location (refer to all safety codes applicable to your site). Typical installations are in sheds, vaults, on the side of a building, interior of a building or on a utility type pedestal mount.

2. If the Control Box is installed in an explosion proof enclosure, it must be mounted in a vertical orientation to prevent the potential of rain water leakage and accumulation within the enclosure. (See “Explosion Proof 101” on page 5 for an explanation of the enclosure’s design in regards to weather proofing).

3. To meet the Intrinsically Safe (IS) requirements of this unit, a grounding circuit of one (1) ohm or less to the grounding electrode is required.

4. If the extension cables leading from the Control Box to the Auto Seeker and/or Override Probe must pass through an unclassified area the cables must be must be sealed at each boundary in accordance with NEC & local code requirements to prevent migration of combustible vapors within the cable. It is the responsibility of the AHJ and the local installer to meet the requirements of the local area.

5. For the initial installation of a Control Box mounted in an explosion proof enclosure, do not close the door or secure the bolts around the flange until after the initial pump power test has been performed (See page 32).

## Installing the Standard Auto Seeker

***If installing an Explosion Proof Auto Seeker, skip to page 14.***



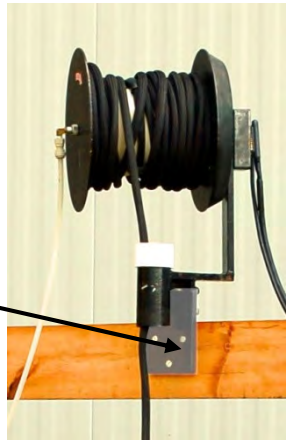
The Auto Seeker system is an integral part of the Magnum Spill Buster system. It is turned ON and OFF with the System Power switch on the Control Panel. The Auto Seeker is controlled by the Product Recovery Cycle (PRC) control switch.

The Standard Auto Seeker is not rated explosion proof or intrinsically safe. It should be mounted outside of all classified hazardous zones. (See Section 1.1 for information on installing an Auto Seeker with an Explosion Proof enclosure). Refer to all applicable NEC and local codes to determine how and where the Auto Seeker should be installed on your site.

On many sites it is possible to move the Standard Auto Seeker from the classified hazardous area by raising it above the well head. For example, the use of a wood or metal scaffolds such as the one pictured here may accomplish this.

### Installation

For the example shown above a custom adapter clamp plate was bolted to the wooden cross support as shown to the right. Slide the Auto Seeker mounting bracket clamp on to the adaptor plate and then thread the 2 clamping bolts in all the way until the ends engage the adapter plate. Then using a wrench to tighten the bolts until the Auto Seeker is securely supported on the adapter plate. Finally, carefully guide the probe through the white PVC collar and steel tube on the mounting bracket and let it hang there until the system is fully installed.




### "Home" Position

The Standard Auto Seeker system is shipped from the factory with the Probe fully wound on the reel. This is its "home" position. It is critical that the Probe NOT be unwound from the reel except by use of the motorized reel. The position of the Probe on the reel

is synchronized with a cable inside the reel housing. Refer to “Unwinding the Probe Manually” on page 32 for the correct way to advance or retract the Probe by hand so that synchronization is maintained.

### Product Seeking

After the system is fully installed and the system is turned ON, the Auto Seeker will automatically track the water table. [See 2.0 System Operation - Magnum Spill Buster System Cycle, page 38]

**NOTE: Always perform the pump flooding procedure found on page 34 before lowering probe inside well.**

## Installing the Explosion Proof Auto Seeker



The Explosion Proof Auto Seeker system is an integral part of the Magnum Spill Buster system. It is turned ON and OFF with the System Power switch on the Control Panel. The Auto Seeker is controlled by the Product Recovery Cycle (PRC) control switch.

### Adapters



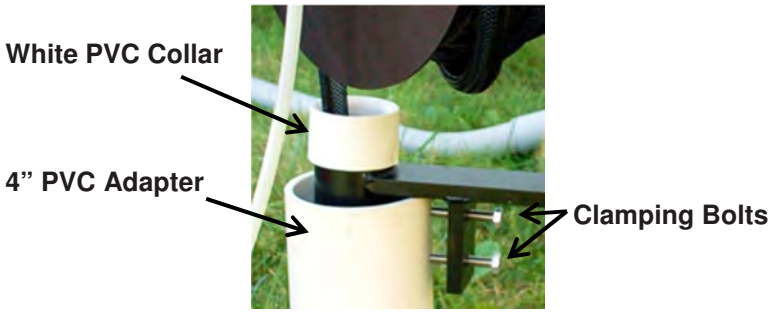
The well head adapter bracket provides a reinforced area to mount the Explosion Proof Auto Seeker unit and also locates the Auto Seeker reel and Probe directly over the well for proper operation. PVC fittings are available to accommodate well head diameters from 2” to 8”. Use PVC adhesive and install the appropriate fittings to reduce the well head to a 2” diameter.



If you did not receive the appropriate fittings for your application, please contact the factory for advice or to order preassembled fittings. These fittings can also be built up from standard PVC fittings found in most hardware and plumbing stores. The clamp incorporated into the Auto Seeker bracket can also be used for steel well heads 3” and larger, if applicable. An example of an XP Auto Seeker mounted on a 3’ metal culvert recovery well is shown to the right.

## Installation

Position the Explosion Proof Auto Seeker over the well and slide the Auto Seeker mounting bracket steel tube down fully into the well head adapter. Thread the 2 clamp bolts in towards the adapter until they press against the PVC adapter and then using a wrench tighten the clamp bolts firmly until the AS is fully secured. Finally, guide the probe through the white PVC tube collar and steel mounting tube of the mounting the bracket and slide it down into the well itself. Make sure the probe slides freely in the recovery well.




**Clamping Details on a PVC Well Head**

**Clamping Details on a Metal Culvert Recovery Well**




For culvert type of recovery wells, position the Explosion Proof Auto Seeker over the well and slide the Auto Seeker mounting bracket over the culvert wall as shown above. Thread the 2 clamp bolts in towards the well until they press against the metal and then, using a wrench, tighten the clamp bolts firmly until the Auto Seeker is fully secured. Finally, guide the probe through the white PVC tube collar and steel mounting tube of the mounting the bracket and slide it down into the well itself. Make sure the probe slides freely in the recovery well.

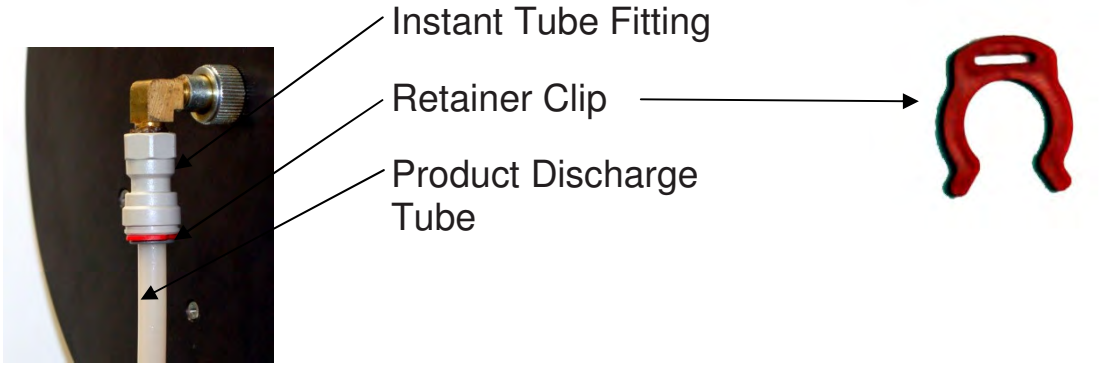
## Product Seeking

After the system is fully installed and the system is turned ON, the Auto Seeker will automatically track the water table. [See 2.0 System Operation - Magnum Spill Buster System Cycle, page 38]

**NOTE: Always perform the pump flooding procedure found on page 34 before lowering probe inside well.**

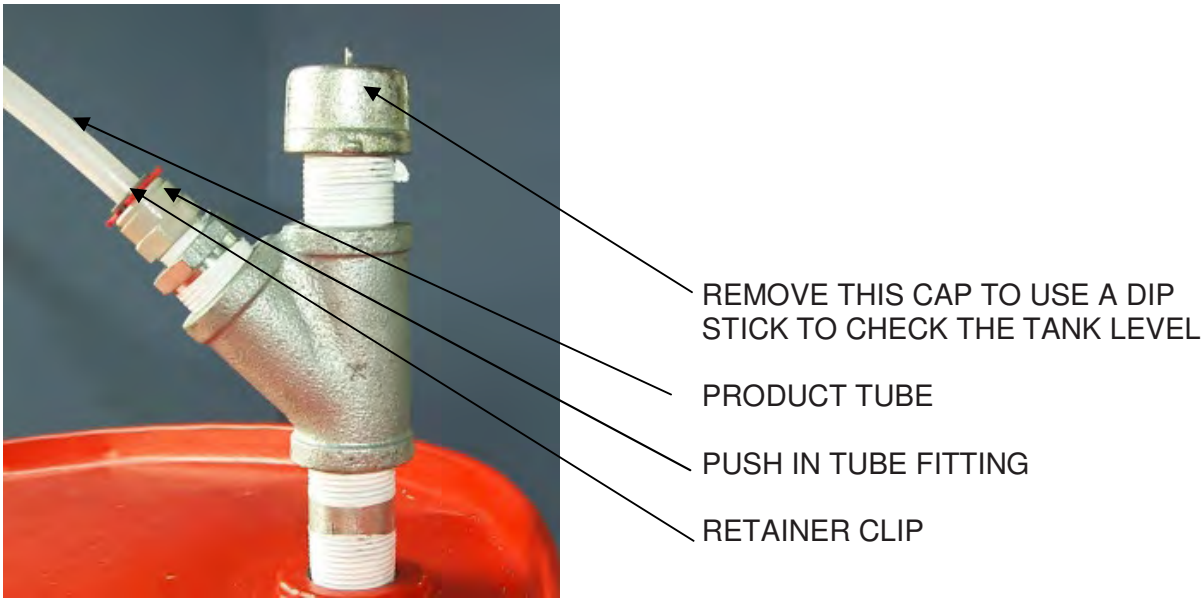
## Product Discharge Tubing

Connect the Product Discharge Tubing to the Instant tube fitting on the front of the Auto Seeker reel unit by pushing the tube firmly into the fitting until it “snaps”. Secure with a retainer clip. To remove tubing, remove retainer clip and push locking sleeve of fitting squarely into the fitting while pulling on tube.] NOTE: The retainer clip is an integral part of the Instant Tube Fitting and must be in place to maintain the integrity of the fitting. Failure to install the retainer clip could cause a leaking joint.




## Product Tank Inlet Fitting

The Product Tank Inlet Fitting screws into a standard 3/4” NPT fitting. Connect the product discharge tube coming from the Auto Seeker to the inlet fitting using the Instant Tube fitting supplied on the fitting assembly. First remove the red retainer clip on the fitting. Push the product discharge tube firmly into the fitting until it “snaps” into place. Re-install the retainer clip. NOTE: The retainer clip MUST be installed to insure against leaks. The product tank level can be checked manually by unscrewing the cap from the top of the fitting and inserting a dipstick into the product tank. The cap also contains a small vent. In the case of multiple recovery systems using one product tank the fittings can be stacked.



## Product Tank Override Probe



The Product Tank Override Probe must be connected to the control box prior to system operation. There is an electrical interlock to prevent the product pump from operation without having the Product Tank Override Probe connected. Dip Switch S2-4 will override this interlock when turned ON. **However, on this setting a tank full condition is not detected and a secondary spill may occur.**

Install the product tank override probe in the product tank and plug the cable into the slot marked INHIBIT in the I/O Extension of the Control Box [Second slot from lower left]. The tank fitting screws into a standard 2" bung threaded hole. Other options are available such as a "splitter" to allow use of multiple recovery systems using one product tank override probe.



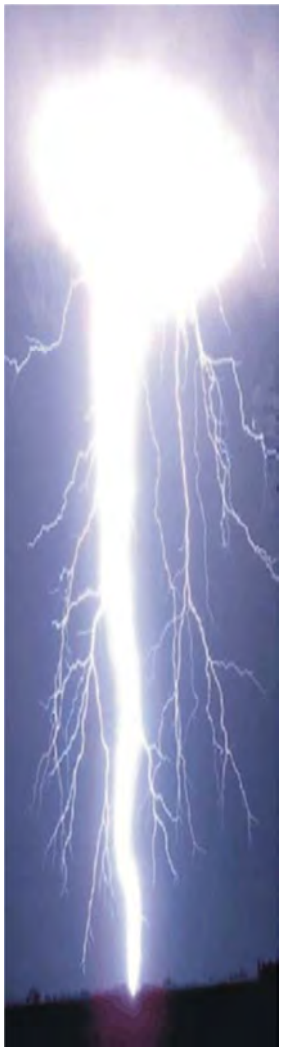
**The Product Tank Override Probe fitting screws into a 2" bung.**

## Product Tanks



Product tanks are NOT part of the Magnum Spill Buster system. Suitable receptacles for recovered product should be sized for the specific job and site, and should be monitored at regular intervals, along with the rest of the system. **Recovered product should be labeled and disposed of in an appropriate manner.**

# System Grounding



A proper ground is not an option! Correct grounding is absolutely necessary for the system to work properly and safely!

**WARNING**

CORRECT GROUNDING IS ABSOLUTELY NECESSARY FOR THE SYSTEM TO WORK PROPERLY, AND TO ENSURE ELECTRICAL SAFETY. ONLY A QUALIFIED ELECTRICIAN SHOULD INSTALL THE SYSTEM.

The interface sensors take advantage of the RF shielding effect of ground water normally present in the well. To enable the control to properly sense this shielding effect, its logic circuits must be referenced to ground. Grounding procedures are described in the following sections for five different installations:

1. Standard utility connection.

2. Remote power installations (with a portable AC generator).

3. Bench testing where the test water is not connected to earth ground.

4. 24 VDC battery operation.

5. 24 volt solar operation.

Note: A missing ground connection is indicated when the HI and LOW LIMITS lights stay off even when the probe is immersed in water.

**Warning! All power and grounding wiring should be performed by a qualified electrician. All wiring must meet the latest NEC and all applicable local codes.**

### Grounding a Utility Connection

When connecting to a utility power source, the green grounding wire must be connected to the power input ground terminal in the control box. This connection is marked on the overlay below the power input terminal block. A three-prong plug with a three-lead cable must be used for system power; typically a black “hot” lead, a white “neutral” lead, and a green grounding lead. However, in some cases due to site-specific conditions, it may be necessary to install a grounding rod, as described below.



A grounding rod employing a 5/8" copper rod, 8 gauge wire and copper clamp.

### Installing a Grounding Rod

The metal casing of a driven well can be used as the ground. Where this is not possible, a grounding rod can be constructed as follows:

- Drive a copper rod approximately 8 feet into undisturbed soil; use a 5/8" Copperweld type rod.

- Connect a No. 8 or larger copper wire from the ground rod to the power source (a generator, battery, or control box).

- Make certain all connections are free of corrosion or oxidation.

### Grounding a Portable Generator

A three-lead cable must be run from the generator to the control box; typically, a black "hot" lead, a white "neutral" lead, and a green grounding lead. In addition, the generator must be bonded to an earth ground (See "Installing a Grounding Rod" above).

Note: All connections must be clean without any oxidized layers.

### Grounding for Battery Operation

Magnum Spill Buster systems operated from a battery must have the negative terminal of the battery grounded directly to a copper rod driven into the ground (See "Installing a Grounding Rod" above). In addition, a 12 gauge or larger copper wire must run from the negative lug on the battery to the grounding lug on the terminal block in the control box.

Some examples of battery locations requiring a ground rod and cable for operation are as follows:

- a vehicle battery, whether in or out of a vehicle.
- a battery inside an Immediate Response Box (whether on the ground, in a truck, etc.)
- a battery with a solar (photovoltaic) panel

Note: For proper system operation, it is absolutely necessary to ground every battery operated system!

### Grounding for Lab or Bench Testing

For temporary operation in a lab or on the bench, where the test water is not connected to earth ground, the water must be grounded. This can be accomplished by submerging at least 6 inches of bare copper wire in the water and attaching the other end to the green grounding terminal of the control box.

# Installing System Extension Cables for a Standard Auto Seeker Magnum

***If installing system extension cables for an Explosion Proof Auto Seeker system, skip to page 22.***

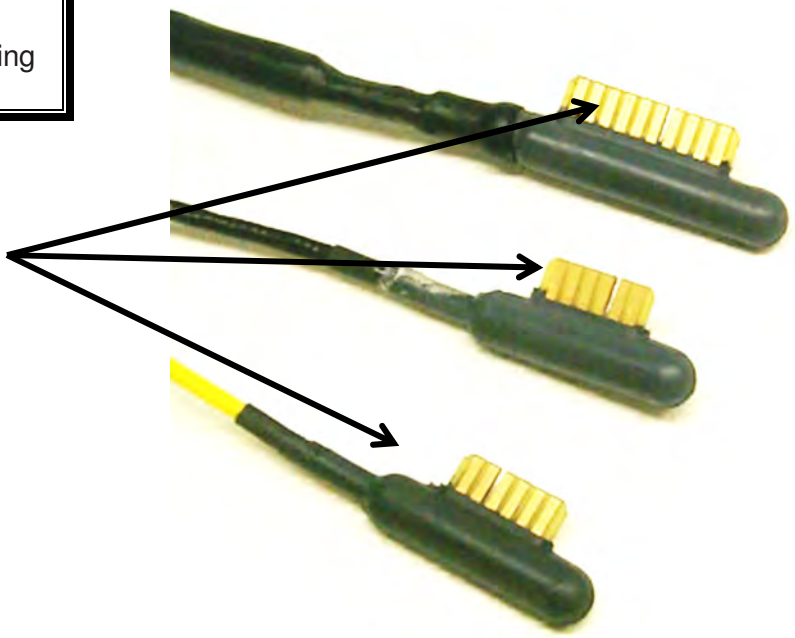
- .**Warning-** All AC Power wiring must be done by a qualified electrician who is familiar with all appropriate NEC and/or local codes. Electrical shock may result in serious injury or death.
- **Warning-** Explosive Vapors. Always disconnect AC power at its source prior to connecting/disconnecting any wires and/or cable connections located within any hazardous locations.

Make sure all cable connectors are free of dirt and debris before making connection. The standard extension cable lengths are 30 feet, but custom length cables are available up to 400 feet. If PVC conduit pipe is run between the control box and the well head, see “Pulling System Cables Through Conduit” on page 24.

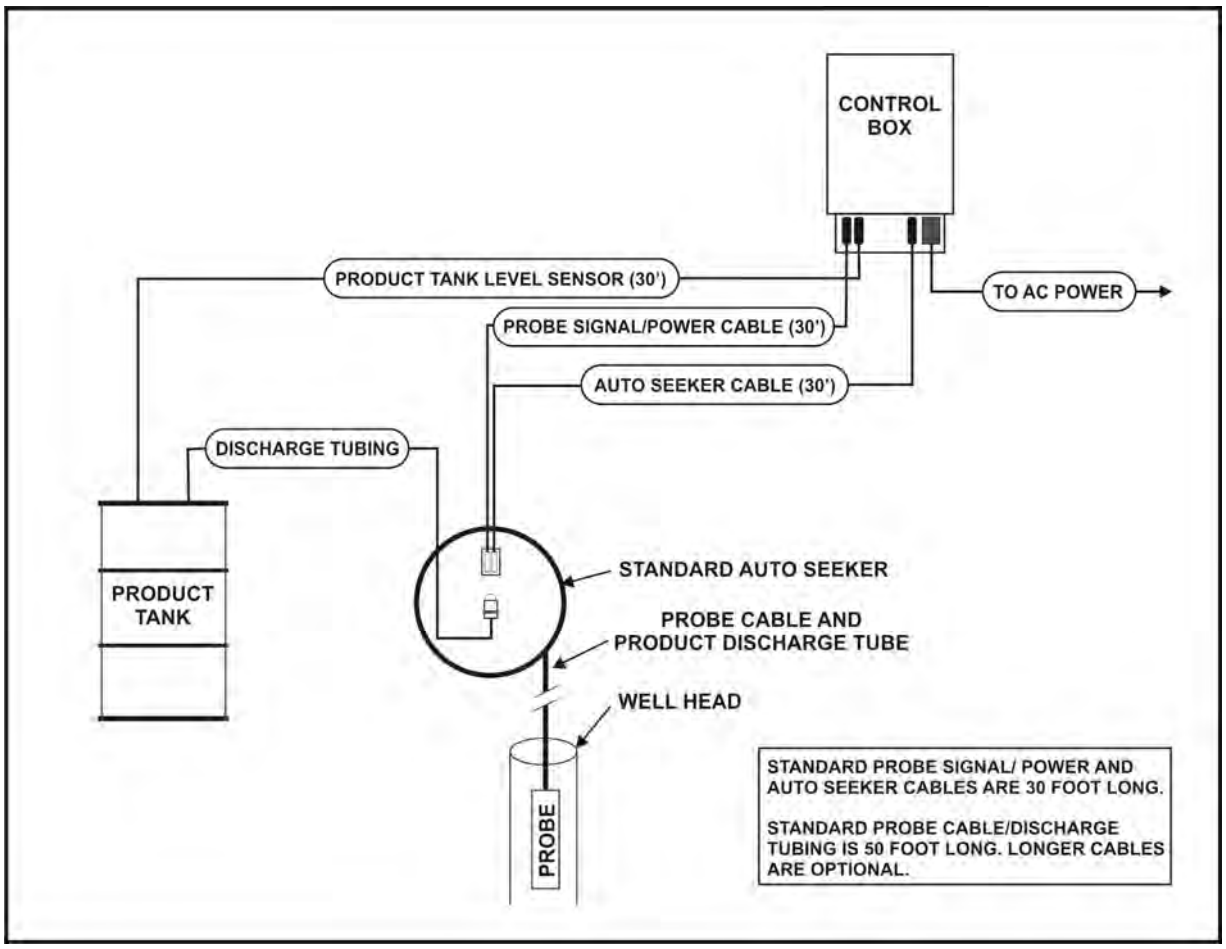
### Cable Connectors

NOTE: ALWAYS turn off power before removing or connecting cables

Slim-line™ CONNECTORS



## Standard System Wiring Diagram



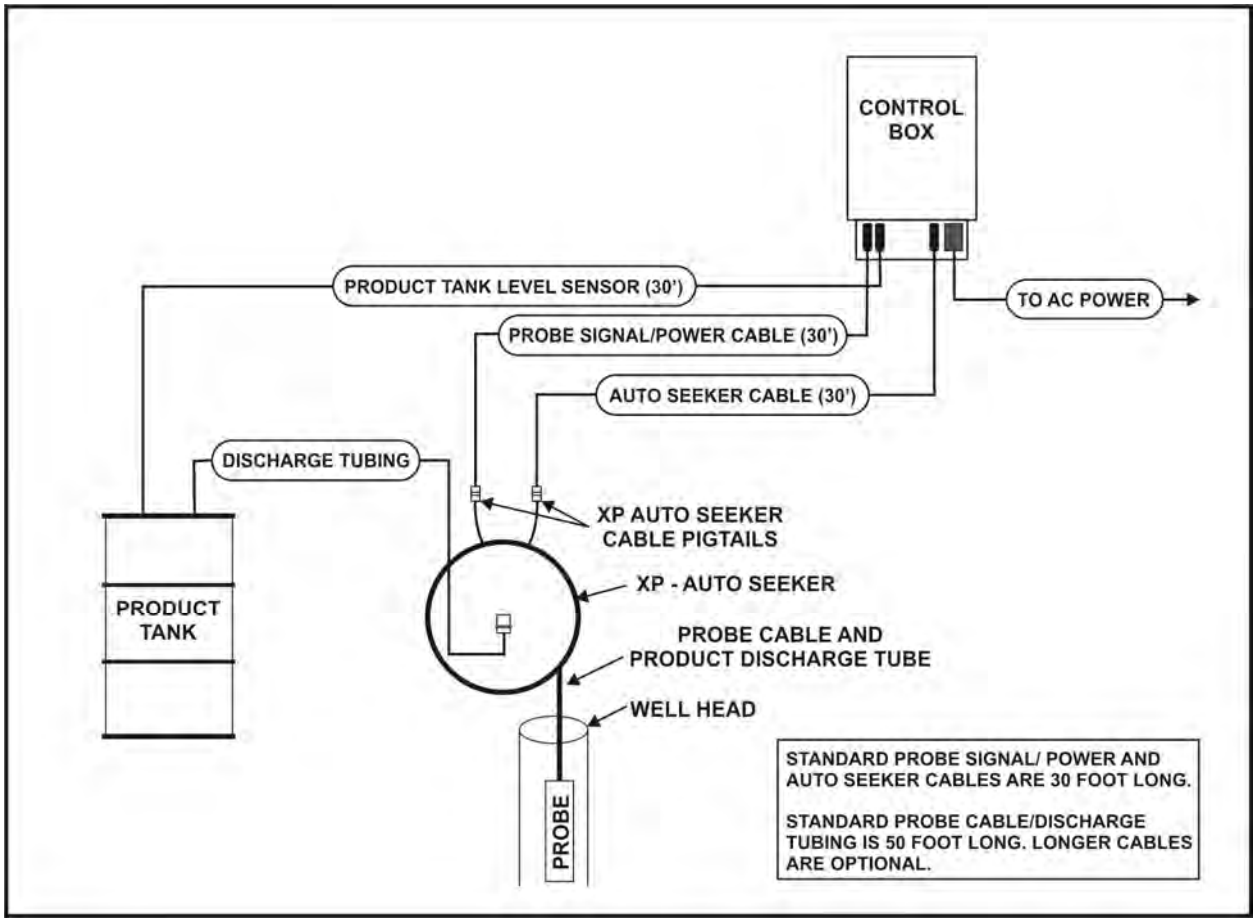

TYPICAL CABLE CONFIGURATION FOR A STANDARD MAGNUM SPILL BUSTER

Alternate cable lengths are readily available for deeper wells and control box placement further than 30 feet from the well head. The maximum allowable total cable length from the probe to the control box is 400 feet.

## Installing System Extension Cables for an Explosion Proof Auto Seeker Magnum

- .**Warning-** All AC Power wiring must be done by a qualified electrician who is familiar with all appropriate NEC and/or local codes. Electrical shock may result in serious injury or death.
- **Warning-** Explosive Vapors. Always disconnect AC power at its source prior to connecting/disconnecting any wires and/or cable connections located within any hazardous locations.

## Explosion Proof System Wiring Diagram




TYPICAL CABLE CONFIGURATION FOR AN EXPLOSION PROOF MAGNUM SPILL BUSTER

## Installing the XP System Cables

If the extension cables pass through an unclassified area the cables must be must be sealed at each boundary in accordance with NEC & local regulations requirements to prevent migration of combustible vapors within the cable. It is the responsibility of the local installer to meet the requirements of the local area. A typical cable with coupled connectors is shown below.



**Typical cable extension joined to an Auto Seeker cable pigtail.**

Make sure all cable connectors are free of dirt and debris before making connection. The standard cable lengths are 30 feet, but custom length cables are available up to 400 feet. If PVC conduit pipe is used, see “Pulling System Cables Through Conduit” on page 24.

Note: Cable extensions for an Explosion Proof Auto Seeker system have slim line connectors on one end. These cable ends should be pulled through any conduits to end nearest the Control Box and NOT the ends with Circular-Mil Spec connectors. This helps prevent debris or other contaminants from getting into the pins of the Mil-Spec Connector receptacles and prevent the degradation of system performance. If there is no way to pull cables from the Auto Seeker side of the conduit then a secure covering should be used over the connectors while pulling the cables through.



**Cable extensions showing the female socket receptacles.**

**! Turn off power before removing or connecting cables.**



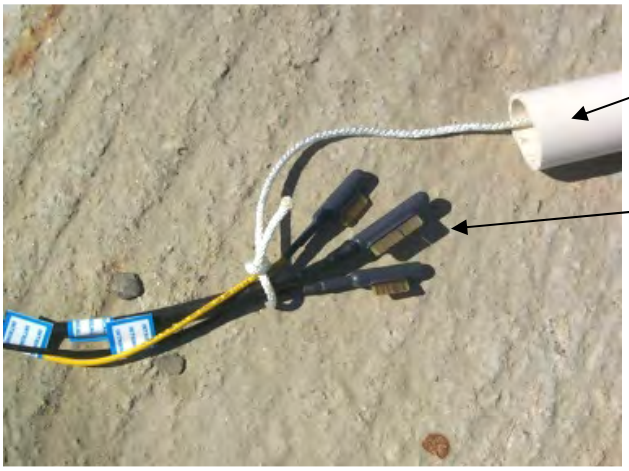
**Cable extensions for an Explosion Proof Auto Seeker will have a Slim-line™ connector on the Control Box side and a Mil- Spec circular connector one the other.**

# Pulling System Cables Through Conduit

The minimum recommended diameter is 4” pipe. Use long “sweep” type elbows in a conduit installation. This will help prevent any damage to system cabling caused by forcing cable connections through a smaller diameter pipe. Excess cable from the installation should be coiled and stored in a protected area.

## Typical Cable Segment

**THE WRONG WAY TO PULL CABLES THROUGH A PIPE**



Do not use smaller than 4” PVC.

Do not leave connectors exposed to contamination, especially during cable pulling operations.

**THE RIGHT WAY TO DO IT!**



Use 4” diameter pipe or larger. Tape the pull rope in place on the cable to prevent it from sliding up to the connectors. Tape the connectors to prevent contamination. Distribute the connectors over a few feet; don’t bunch them in one place.

# Connecting Cables at a Non-XP Control Box

*If connecting a Control Box mounted in an XP Enclosure, skip to page26.*

- .**Warning-** All AC Power wiring must be done by a qualified electrician who is familiar with all appropriate NEC and/or local codes. Electrical shock may result in serious injury or death.
- **Warning-** Explosive Vapors. Always disconnect AC power at its source prior to connecting/disconnecting any wires and/or cable connections located within any hazardous locations.

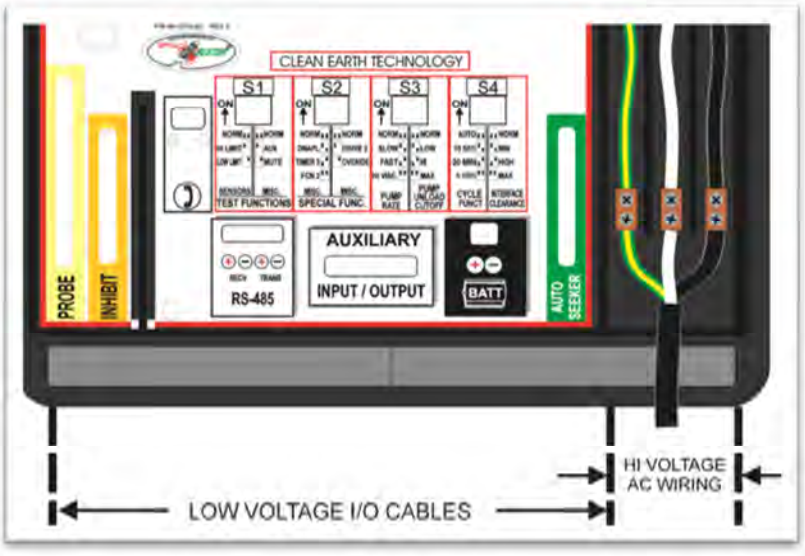
## I/O Extension Pouch



**Remove screws to access the I/O Extension Pouch**

All cables enter the Control Box via the I/O Extension Pouch (or I/O Pouch), which makes up the bottom portion of the control box. Access into the I/O Pouch is gained by loosening the two screws on the front of the I/O Pouch and removing the lid. The Slim-line™ connector cables and power cable for the system feed through the bottom of the I/O Pouch.





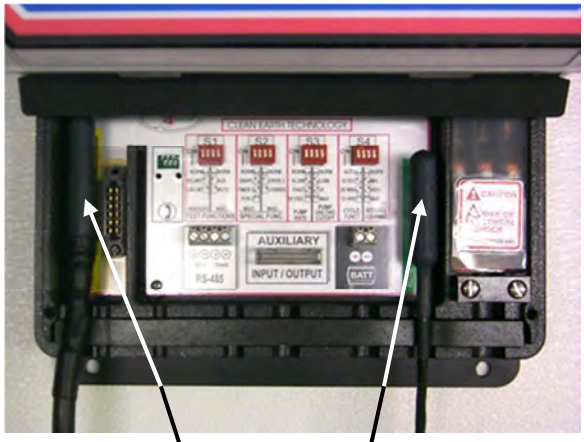

**I/O Board and Terminal Block inside I/O Extension**

### Connecting Probe, Auto Seeker, and Override Cables

Connect Slim-line™ connectors to receptacles, as labeled. Slim-line™ connector receptacles are keyed to help facilitate proper placement of plugs.

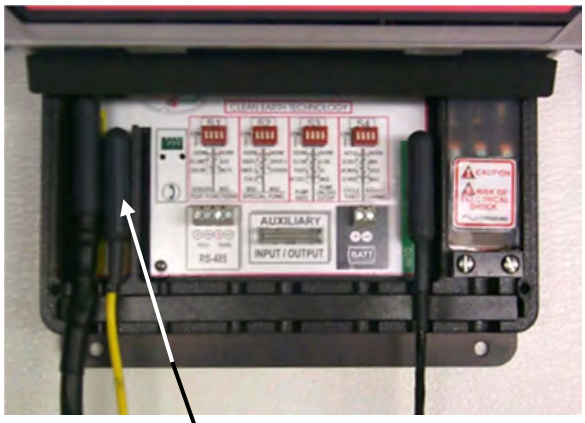
The power cable connects to the terminal block inside the I/O Pouch. See “Control Box Terminal Block” on page 27.

**NOTE: The System must be properly grounded for correct operation.**




PROBE CONNECTOR

AUTO SEEKER CONNECTOR




OVERRIDE PROBE CONNECTOR

Next, plug in the Override Probe connector as shown. **NOTE:** The Magnum Spill Buster system will not function unless the Override Probe is connected or the Override dip switch (S2-4) is ON. [See Dip Switches, page 44].

## Connecting Cables at an Explosion Proof Control Box

When cabling from system components are connected to the Control Panel through an XP Housing, sealed and potted XP feed-throughs must be threaded into the threaded holes provided in the XP enclosure. These feed-through fittings will typically look like the picture shown below.



**Example of a control box XP enclosure housing cable feed through.**

These cable feed-throughs should be threaded tightly into the bottom of the XP enclosure. There will be three of these fittings. Two will have Slim-line connectors, and one will not have any cable potted in. This last one will need to have the power wiring fed through it by the electrician and potted per NEC or local codes for explosive atmospheres.

Once the fittings are threaded in tightly and the power cable is installed and potted, attach all of them into the I/O section of the control panel as detailed in "Connecting Probe, Auto Seeker, and Override Cables" on page 26. Upon completion of these connections install the I/O pouch cover. In these installations the control box main cover has been removed so that the front panel LED lights can be viewed during operation.

# Control Box Terminal Block



- .**Warning-** All AC Power wiring must be done by a qualified electrician who is familiar with all appropriate NEC and/or local codes. Electrical shock may result in serious injury or death.
- **Warning-** Explosive Vapors. Always disconnect AC power at its source prior to connecting/disconnecting any wires and/or cable connections located within any hazardous locations.

### Hardwiring AC Power

The Magnum Spill Buster is designed to run either 115 or 230 VAC Power without any modifications to the internal wiring. Attach hardwiring to the Control Box as shown on the Power Cable overlay. The incoming power cable must be able to handle a minimum of 10 Amps.



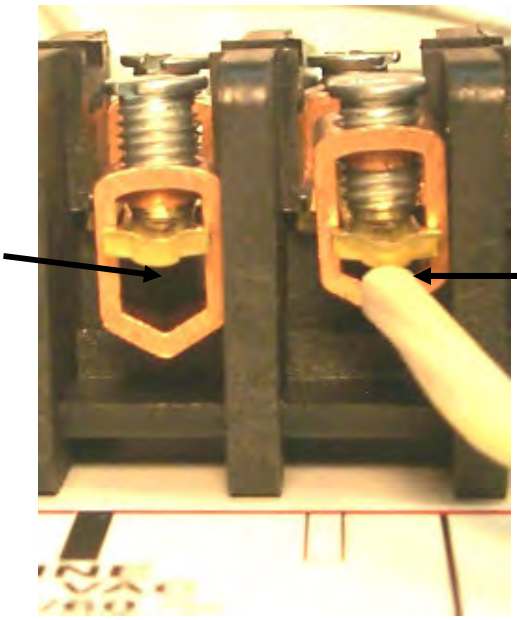
Terminal Block shown with the protective cover removed



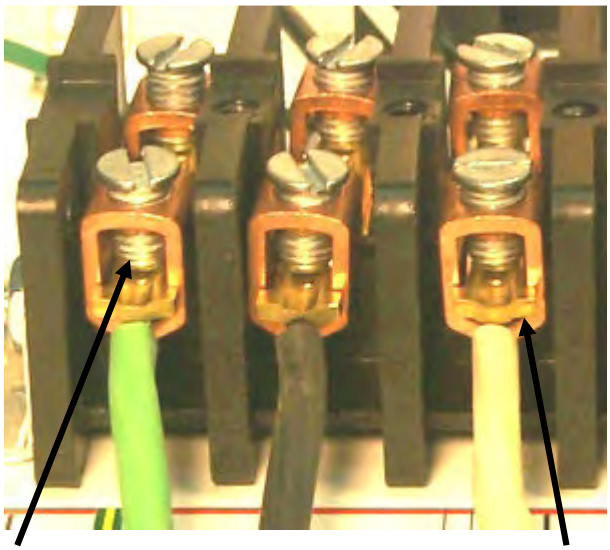

115/230 Volt Terminal Block with the protective cover attached.

## Correct Terminal Block Connections

This view looking at the side of the terminal block shows the correct location to insert the AC supply wire.




Installing the AC supply wire in the terminal block. **The wire must be installed correctly as shown.**



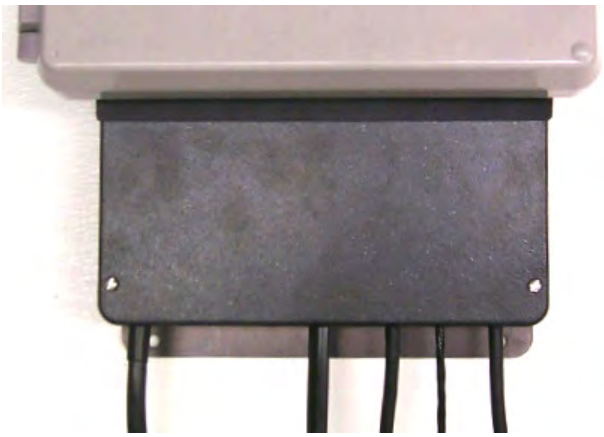

NOTE: Always replace the protective cover on the terminal block after installation or prior to providing power to the system. See page 29.

**Sealed I/O Extension with Cables Installed**




**I/O EXTENSION RUBBER GASKET SEAL**

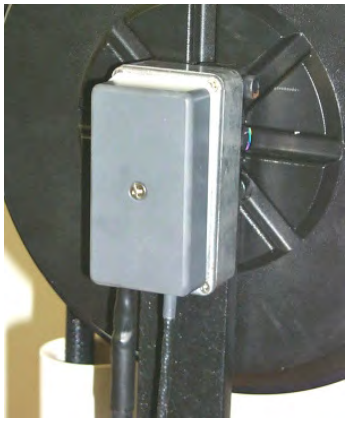
All cables must exit the I/O Extension through the appropriate sized slot in the bottom of the pouch in order to create a dust- and weather-proof seal. The perimeter of the lid and body of the I/O extension is lined with a foam rubber gasket that serves as weather stripping. The weather stripping will cause the lid to seal automatically against the cables when the lid is closed and fastened with the screws. The weather stripping will seal holes in the I/O Box, whether they contain cables or not.



**I/O extension must be closed and sealed for safety and weatherization!**

## Connecting the Standard Auto Seeker Cables

*If connecting an Explosion Proof Auto Seeker, skip to "Connecting the XP Auto Seeker Cables" on page 31.*

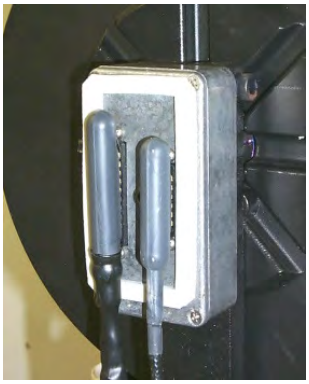


**Remove safety cover from Slim-line™ connector box.**





**Use Probe and Auto Seeker Slim-line™ connectors with rubber gaskets affixed.**



**Plug in Slim-line™ connectors to size-coded receptacles.**

**Replace safety cover over connector box and tighten screw down snugly.**



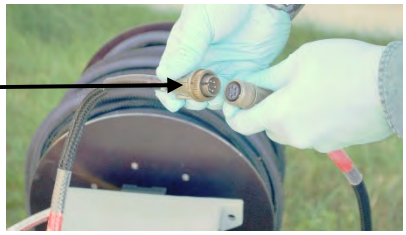
# Connecting the XP Auto Seeker Cables

The XP Auto Seeker has two 5 foot long pigtail cables terminated with Circular Mil-Spec connectors (see below). The respective cable extensions are connected to the pigtails as shown and each threaded locking collar should be firmly seated to insure an environmentally tight seal.



NOTE: These connectors should not be laid directly on the ground or vault. While they are weather resistant, they are **not** rated for direct water immersion. We recommend hanging the cables such that the connectors are above any potential water flooding areas.

Threaded Locking Collar →



Probe Cable Connector

Note the rotational locking key slot. →





**Warning:**
Always de-energize system power before connecting or disconnecting cables!

Auto Seeker Power Cable Connector



# Initial Pump Power Test

When all cabling and system components are connected, the system ground is installed, and power is supplied to the system, it is preferable to test the product pump for operation prior to putting the probe in the well. It is convenient to have two people for this operation; one near the Auto Seeker system to listen to the pump in the Probe, and one to operate the control box. ***NOTE: The Probe should be held outside of any classified zone around the well head while this test is being performed.*** This might be accomplished by manually unwinding enough of the Probe cable from the Auto Seeker to reach an unclassified zone if the zone is close enough. The proper procedure for doing this is as follows:

## Unwinding the Probe Manually

Disconnect the Auto Seeker cable from the Auto Seeker or the Control Box, whichever is more convenient. Once disconnected, the Auto Seeker's reel may be turned by hand without disrupting the synchronization built into the Auto Seeker assembly. The probe may be rewound by turning the reel in the opposite direction. To prepare to resume normal operation, rewind the Probe up to its home position (but no farther - stop when reel becomes difficult to turn). Then reconnect the Auto Seeker cable.

## Pump Power Test Procedure

(Refer to drawing below). The System Power Switch governs all power to the system when it is connected to an AC power source, including the Control Box, Probe, and Auto Seeker. A yellow lamp will light indicating that the system power is ON.

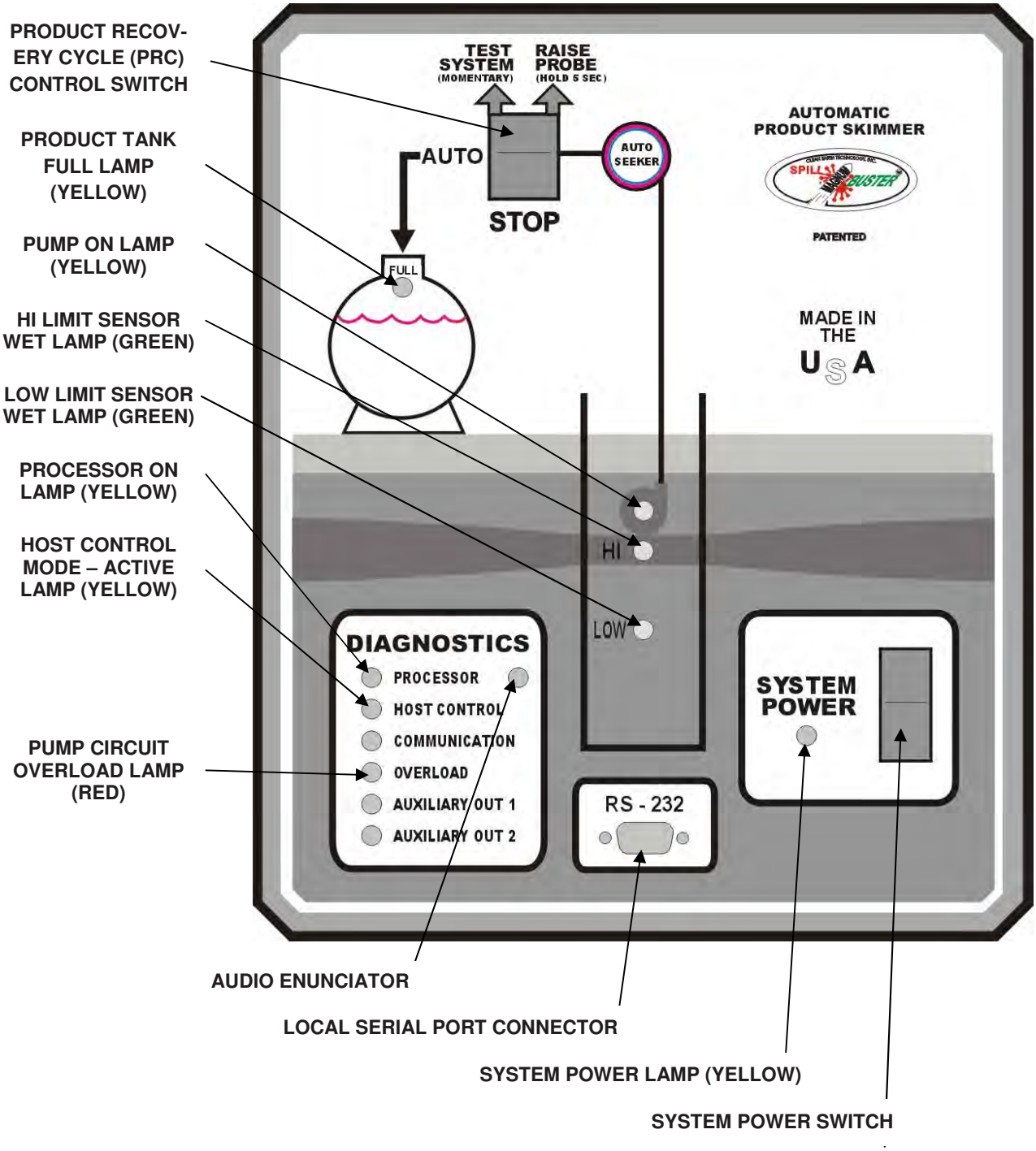
1. Turn the System Power switch ON. The System Power lamp, and Processor lamp, on the control panel will turn ON, and the audio tone in the control box will begin to beep once every 2 seconds.

2. Press and release quickly the TEST SYSTEM side of the Product Recovery Cycle (PRC) control switch. The product pump (in the probe) will operate for approximately 5 seconds and then stop. The yellow product pump lamp on the control panel will light and the audio tone in the control box will produce a warbling tone while the pump is ON. Simultaneously, along with the audible motor sound, starting the pump usually causes the entire probe and cable to visibly twist and jerk as a result of the pump torque reaction.

3. Immediately after the test, push STOP at the PRC switch. Otherwise, Auto Seeker will begin to cycle and unwind Probe cabling off the reel.

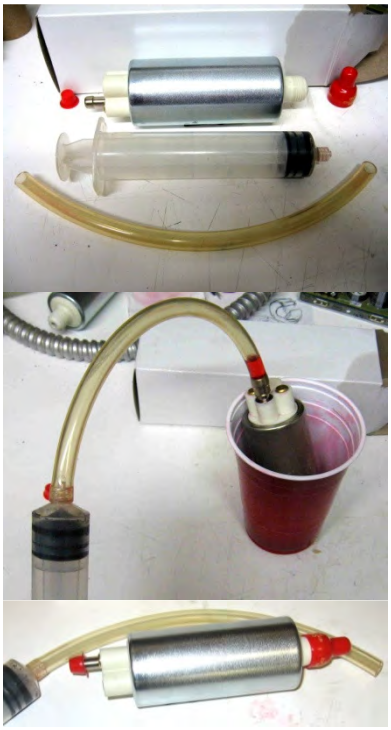
4. Turn the System Power switch to OFF.

**NOTE: You must remove the pump from the Probe (See "Removing the Product Pump" on page 69) and perform the Pump Flooding Procedure (page 34) before lowering the Probe into the well.**


PRODUCT RECOV-
ERY CYCLE (PRC)
CONTROL SWITCH
PRODUCT TANK
FULL LAMP
(YELLOW)
PUMP ON LAMP
(YELLOW)
HI LIMIT SENSOR
WET LAMP (GREEN)
LOW LIMIT SENSOR
WET LAMP (GREEN)
PROCESSOR ON
LAMP (YELLOW)
HOST CONTROL
MODE – ACTIVE
LAMP (YELLOW)
PUMP CIRCUIT
OVERLOAD LAMP
(RED)
TEST
SYSTEM
(MOMENTARY)
RAISE
PROBE
(HOLD 5 SEC)
AUTO
STOP
AUTO
SEEKER
AUTOMATIC
PRODUCT SKIMMER
PATENTED
MADE IN
THE
USA
FULL
HI
LOW
DIAGNOSTICS
PROCESSOR
HOST CONTROL
COMMUNICATION
OVERLOAD
AUXILIARY OUT 1
AUXILIARY OUT 2
RS - 232
SYSTEM
POWER
AUDIO ENUNCIATOR
LOCAL SERIAL PORT CONNECTOR
SYSTEM POWER LAMP (YELLOW)
SYSTEM POWER SWITCH

# Pump Flooding Procedure

Before a probe can be installed down the well (or re-installed after servicing), the pump must be flooded. The purpose of this procedure is to displace oxygen and vapors from within the pump body. Once the system is installed, the added fluid will be pumped out to the recovery container during the first recovery cycle. **Note:** CET does not ship new or serviced systems with the pump pre-flooded.



**Required Equipment:**

- A suction device, such as syringe pictured at right. **NOTE:** If purchasing device separately, any O-ring included should be replaced with a Viton ® O-ring to prevent swelling.
- Suitable container for the fluid
- Approximately 8 fl oz of flooding fluid, such as Ultra-Pure Paraffin Lamp Oil, mineral oil, material from the subject well, or similar non combustive fluid. DO NOT USE WATER, the pump internals are NOT corrosion resistant.
- Approximately 12”of 3/8 fuel line
- A product pump, CET P/N 90-1318-019

**Flood the pump**

- Attach the fuel line to the discharge side of the pump.
- Attach the other end of the fuel line to the suction device.
- Place the pump inlet in the container of fluid.
- Pull the fluid into the pump until it is observed in the fuel line.
- Remove the fuel line from the pump.
- Install (or re-install) the flooded pump into the probe (reference the “Pump Installation” section of the Maintenance Operations chapter of the Operator’s Manual).
- If the pump is not immediately installed in the probe, replace the red intake and discharge caps. The pump can then be bagged for later use or storage.

**Note:** Always save the red caps from installed pumps for future use.

Once the flooded pump has been replaced in the Probe (See “Pump Installation” on page 68), check through all the installation steps in this chapter to confirm that all have been completed properly. You are now ready to begin system operations.

If the Control Box is mounted in an explosion proof enclosure, make sure power at the circuit breaker panel is switched OFF. Then at the Control Box, turn the System Power switch to ON and set the PRC switch on Auto. Then close the enclosure door and install the fasteners around the flange. Torque the bolts to 30 ft. lbs. When ready to begin system operation, turn the power back on at the circuit breaker panel.

# 2.0 Spill Buster System Operations

## 7 Easy Operation Steps


1. Initial Power-Up Page 36

2. Front Panel Page 37

3. Magnum System Cycle Page 38

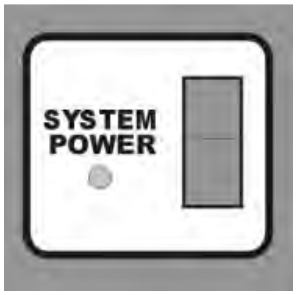
4. System Cycle and Schematic Page 39

5. Indicator Lamps & Audible Indicators Page 40

6. Product Recovery Cycle Control Switch Page 41

7. System Cycle Operation w/o Auto Seeker Page 42

# Initial Power Up

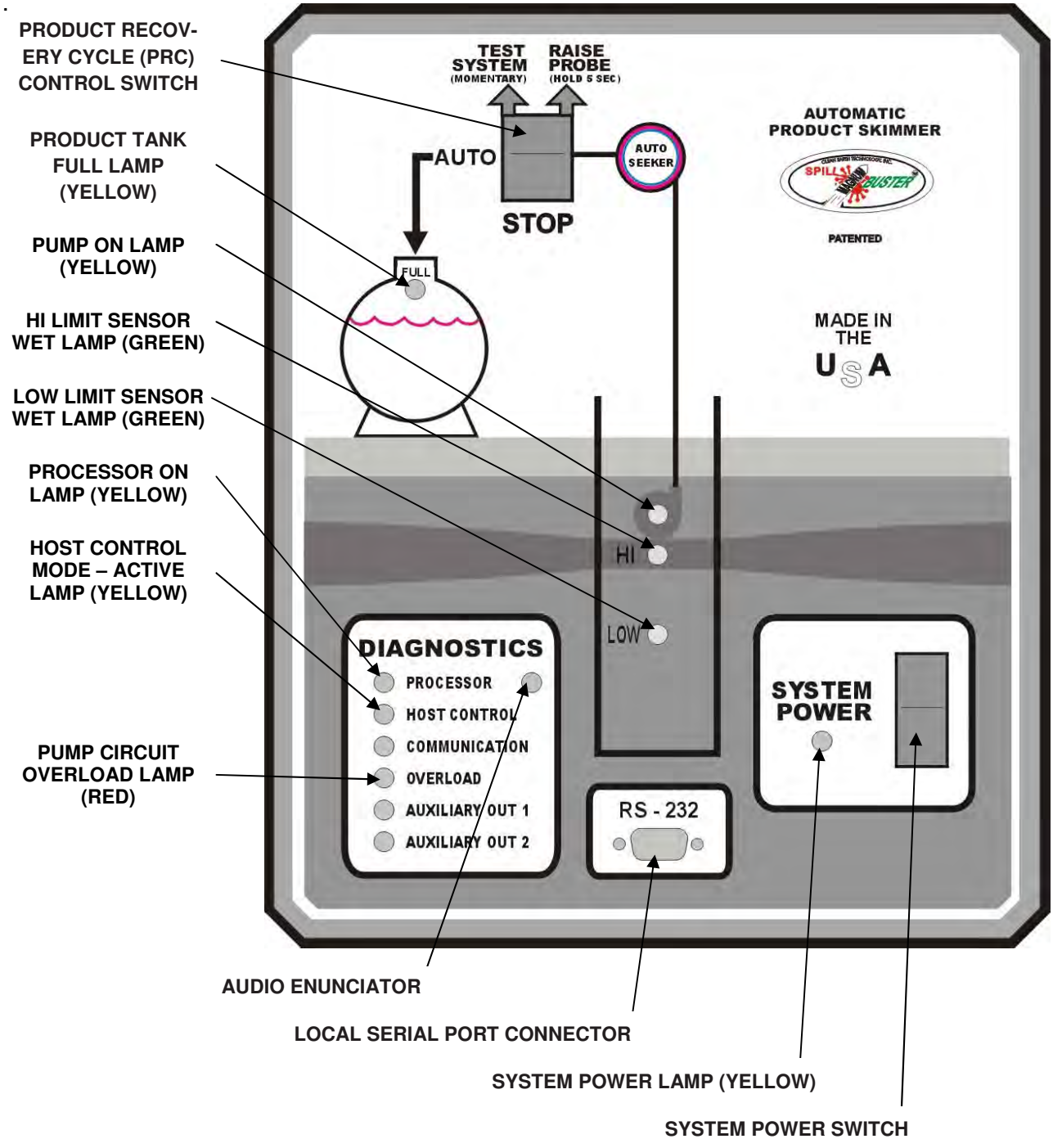



### System Power Switch

The System Power Switch governs all power to the system when it is connected to an AC power source, including the Control Box, Probe, and Auto Seeker. A yellow lamp will light indicating that the system power is ON. NOTE: When the system is connected to a battery, the function of the switch is overridden. After the system is turned ON and the PRC switch is in the AUTO position, the system will begin its cycle after a 5 second delay.

**NOTE: Audio tones operate for approx. 5 minutes after the system power is turned ON and when re-starting the Auto Cycle (PRC Switch). See charts for Indicator Lamps and Audio Indicators on page 32. The tones can be turned OFF altogether by altering DIP Switch S1-4 in the I/O Extension.**
**[See Dip Switch Settings, page 44]**

# Magnum Spill Buster Front Panel



# Magnum Spill Buster System Cycle

### Seeking the Interface

There is a 5 second delay between the time that the System Power switch is turned ON and the moment the cycle begins. The system will begin to automatically seek the water table by lowering the Probe. The Audio Enunciator in the Control Box will beep every 2 seconds. The Probe will pass through the layer of product and seek the level of water in the well. When the Low Limit sensor contacts the water, the Low Limit lamp will light, and the system will beep 2 times per second. When the HI Limit sensor contacts water, the HI Limit lamp will also light, and the Audio Enunciator will emit a continuous tone. When the HI limit sensor gets wet, the Auto Seeker will raise the Probe until the HI limit band is above the water table PLUS an additional amount as determined by the "Interface Clearance" dip switch S4-3 and S4-4. [See Dip Switch Settings, page 44] The HI limit lamp will go out when the sensor becomes dry.

Many system parameters including cycle time, pump rate, and probe interface clearance, may be altered by changing dip switches. See DIP Switch Settings, page 44

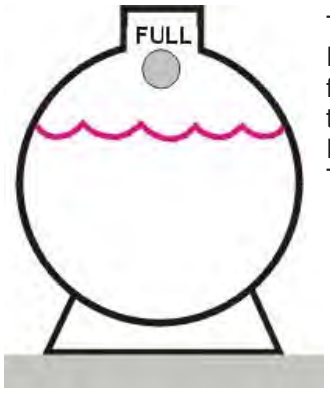
### Pump Cycle

The pump will begin to pump product, the yellow Pump lamp will light, and the system will emit a warbling tone. The pump will continue to operate until it pumps air (or unloads).

## Cycle Delay Time

The system cycle enters a time delay to allow more product to flow into -or recharge- the well. The Magnum Spill Buster system will automatically adjust the delay time interval from 10 seconds to up to 6 hours based on the length of the pump cycle, according to the standard factory configuration of the dip switches. The system cycle delay time is a function of the recharge rate. [See Dip Switch Settings, page 44]

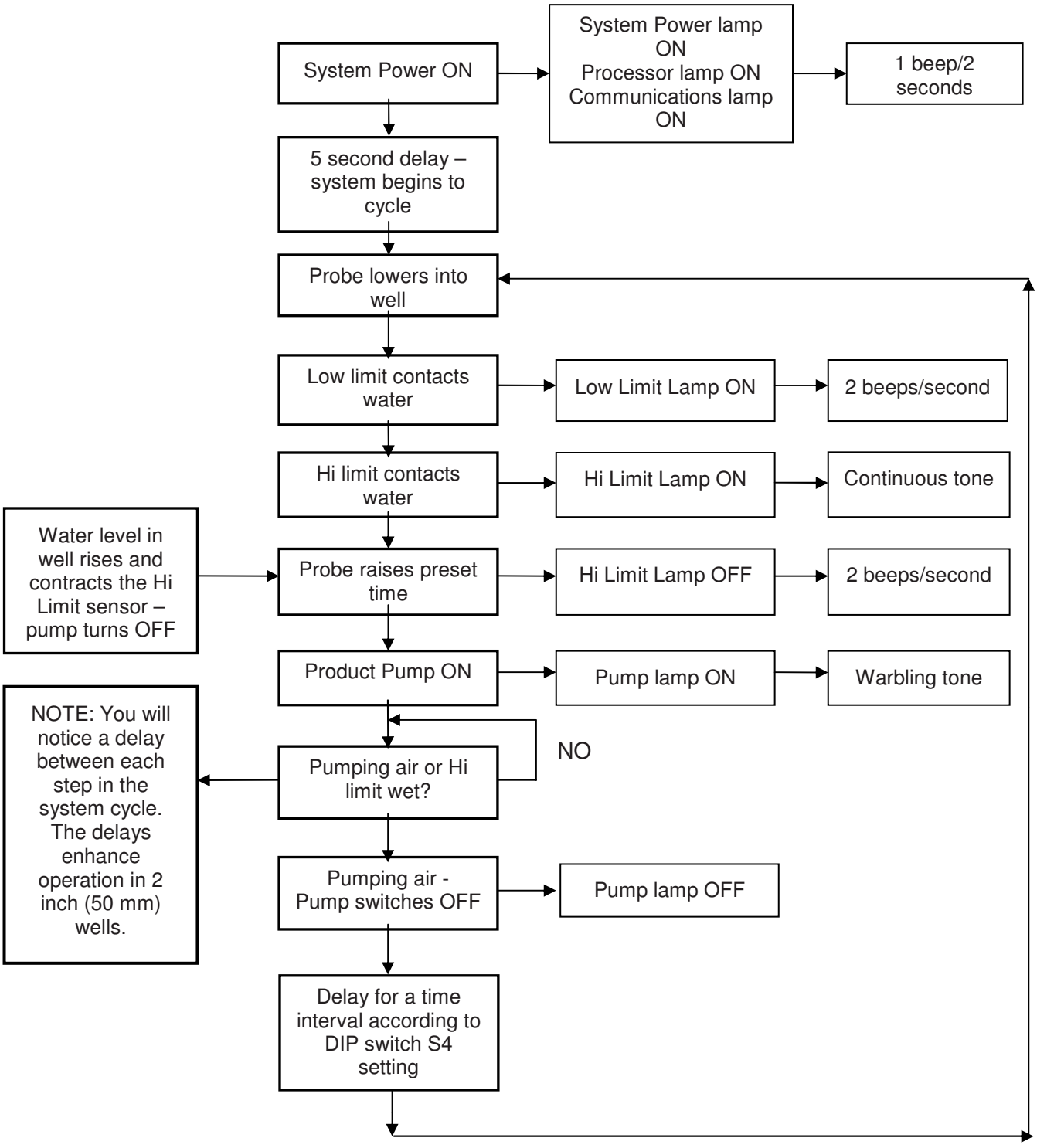
### Pump Override




The Magnum Spill Buster system is configured with a Product Tank Override Probe. This Override Probe will inhibit pump operation when the product tank is full, or when the Product Tank Override Probe is missing. When one of these two conditions exists, the "full" lamp will light in the product tank on the Control Panel. A Dip Switch (S2-4) is available to override this function when a Product Tank Override Probe is not used. [See Dip Switches Settings, page 44]

NOTE: The Product Tank Lamp should not light when the system is turned on, unless the Product Tank is full, or the product tank override probe is not connected.

# System Cycle Schematic with Auto Seeker



## Indicator Lamps

| Label | Color | Indication |
|---|---|---|
| System Power | yellow | ON when unit has been switched ON |
| Overload | yellow | ON when a pump overload condition has occurred |
| Full | yellow | ON when product tank is full (float switch closed)<br>or when Product Tank Override Probe is not connected to Control Panel |
| Pump ON | yellow | On when product pump is energized |
| HI | green | On when the high limit probe sensor is contacting water |
| LO | green | ON when the low limit probe sensor is contacting water |
| Processor | yellow | ON indicates normal control function.<br>Blinks when (a) pump circuit overloaded (e.g. failed pump) or<br>(b) pump circuit is open |

## Audible Indicators

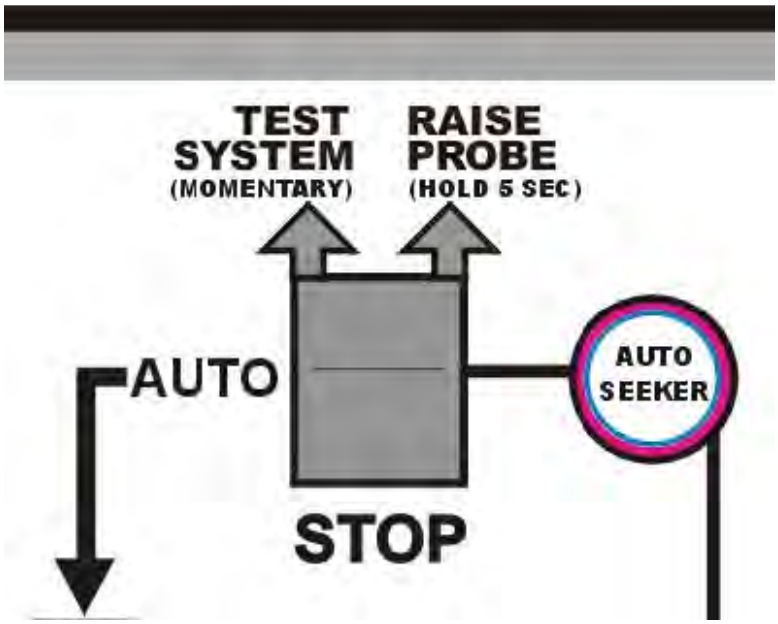
| Tone Sequence | Indication | Priority |
|---|---|---|
| Continuous tone | Hi limit sensor is contacting water | highest |
| Warbling tone | Product Pump is operating | *** |
| 2 beeps/second | LO limit sensor is contacting water | *** |
| 1 beep every 2 seconds | System Power is ON | lowest |

# Product Recovery Cycle (PRC) Control Switch

The PRC is a 3-way rocker switch, and is located on the upper left-hand corner of the Control Panel.

## Auto

At system power up, the PRC switch is in AUTO (its rest position), which allows the system to cycle automatically; that is, the Auto Seeker will lower the probe into the well after 5 seconds, etc. The system will start to lengthen its cycle time depending on the amount of product being pumped; i.e. a shorter cycle time for faster recharge rate. When depressed, this switch performs a test cycle, raises the probe, or stops the system from operating. **NOTE: System Power remains ON.**




## Test System

A momentary push on the top of the PRC Control switch causes the pump to run for 5 seconds; then the system will initiate a new cycle (i.e. the probe will seek the product/water interface and start to pump the product. This Test System cycle is typically used during system installation while holding onto the probe to determine if the pump is functioning properly, prior to lowering the probe into the well. After testing, press STOP to prevent the system from beginning to cycle, or AUTO to leave system operating.

## Raise Probe

If the top of the PRC Control switch is depressed and held for more than 5 seconds, the Auto Seeker will raise the probe to its upper limit for ease of Auto Seeker/probe removal. The system will not start normal operations again until the switch is moved to STOP and then to AUTO.

### Stop

Depressing the Stop side of the PRC switch will stop the product pump or the Auto Seeker mid-cycle. **NOTE: System Power will remain ON**. Returning the switch to the AUTO position will initiate a new cycle after 5 seconds. Pressing STOP will also reset the Automatic Cycle Timer to 10 seconds if dip switches S4-1 and S4-2 are set for AUTO (both OFF). Refer to section 3, Dip Switches.

## System Cycle Operation (no Auto Seeker)

The Auto Seeker is not used in the Magnum Spill Buster system in three modes as follows:

- In a water depression mode, where the Magnum Spill Buster is set up in tandem with a Water Depression Module,
- In a DNAPLs or “sinkers” mode, where the probe intake will be positioned as close to the bottom of the well as practicable,
- When there is no water in the well. [See OPTIONS: Magnum Spill Buster used for DNAPLS, page 46].

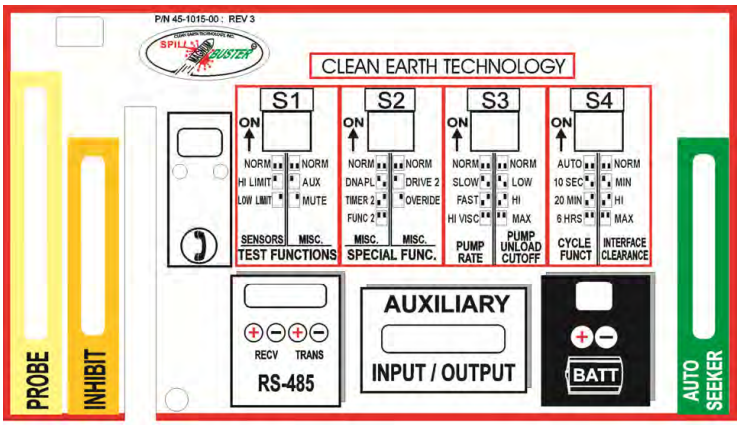
The Magnum Spill Buster system will automatically recognize that no Auto Seeker is plugged in. The pump will continuously pump product until there is no more product to pump, and it starts pumping air. The pump will cycle periodically (according to DIP Switch S4-1 and S4-2 settings, page 44) if the Hi sensor is not contacting water. The pump will also cycle whenever the Hi sensor goes through a transition from wet to dry.

When a Water Depression Interface is connected to the Magnum Spill Buster, the Auto Seeker is not moved up or down, but rather the probe is fixed at the desired water level. The depression pump will move the water/product interface past the product pump intake causing the product pump to cycle.

# 3.0 Spill Buster Advanced System Operations

## DIP Switches page 44

## DNAPLs (Sinkers) Operation page 46



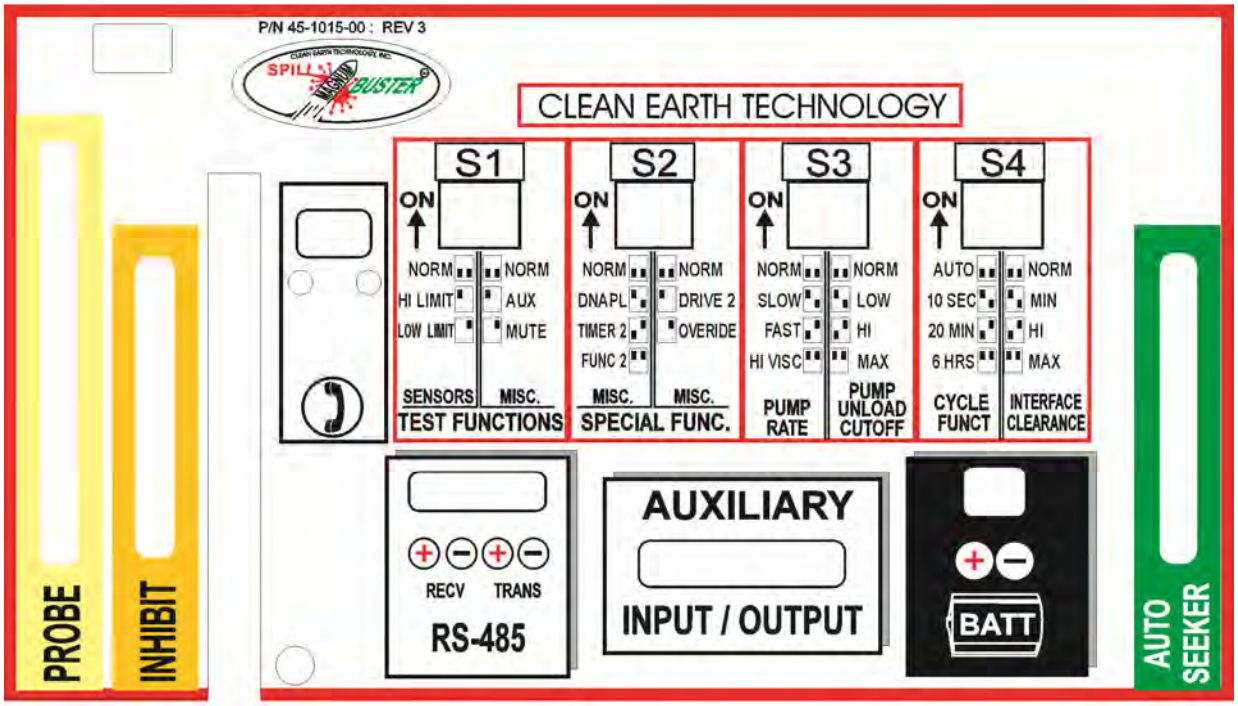

Advanced operations are defined as operating modes that are not set at the factory before shipment of the unit to customers and/or field sites. Modifying the standard operating modes is usually accomplished by changing the DIP Switch settings, which are located on the I/O panel located underneath the main Control Box enclosure.

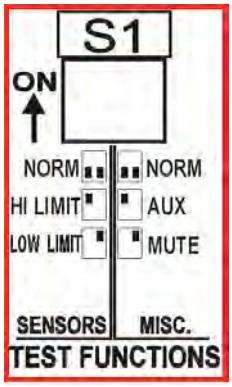
# DIP Switches

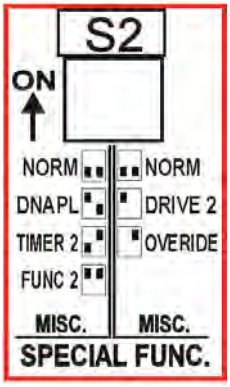
To access the DIP Switches, unscrew the two screws on the bottom corners of the I/O Extension and remove the cover.

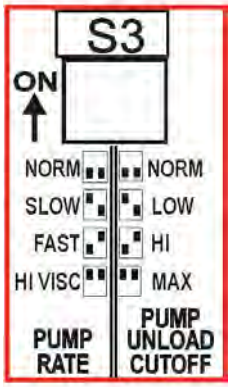
DIP Switches S3 and S4 are used to adjust and customize the Magnum Spill Buster system to individual sites and applications. The Magnum Spill Buster comes from the factory with DIP Switches preset to a standard configuration which automatically adjusts the cycle delay time interval from 10 seconds up to 6 hours [12 hours for versions previous to V.4], according to the recharge rate. This configuration will work for most sites. In some cases, changing DIP Switches from the standard configuration may increase the rate of product recovery or may increase pump life, depending upon the specific site conditions.

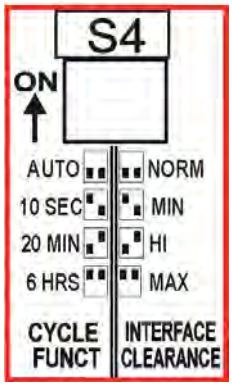
DIP Switches S1-1, S1-2, S1-3, S2-2, & S2-3 are used for factory testing and troubleshooting. These DIP Switches should **NOT** be changed unless directly requested by Clean Earth Technology personnel. DIP Switch Set Nos. 3 thru 4 control user functions of the system, and affect probe actions, including probe height above interface, pump speed, and pump cutoff. The DIP Switch functions are discussed below. For further help and instruction with the DIP Switches and the improvements they may make to your site, please call the factory.






**S1** - The group of switches labeled **S1** and **TEST FUNCTIONS** are all for CET test functions, with the exception of S1-4. This switch silences all audible indicators in the Magnum Spill Buster system. Normal setting is all four switches OFF.

**S2** - The group of switches labeled **S2** and **SPECIAL FUNCTIONS** contains more CET test functions with two exceptions: **S2-1**, which enables the Magnum Spill Buster system to pump DNAPLs; and **S2-4**, which allows the Magnum to operate without the product tank override probe connected. Normal setting is all four switches set to OFF. WARNING: WITHOUT OVERRIDE PROBE CONNECTED, FULL TANK IS NOT DETECTED AND SECONDARY SPILL MAY OCCUR.

**S3-1 & S3-2** - The group of switches labeled **S3** and **PUMP RATE (S3-1 & S3-2)** controls the pump motor speed. Slow is the lowest speed and may be used when the product layer is thin. A thin product layer may create foam when pumped too quickly. Normal is a middle speed, and fast is for maximum speed. Fast may be used when dealing with either medium viscosity product, or greater back pressure in the product tube, or greater well depth. High viscosity products are most effectively pumped using our High Viscosity Magnum Spill Buster system.

**S3-3 & S3-4** - The group of switches labeled **S3** and **PUMP UNLOAD CUTOFF** selects pump current cutoff threshold. The system should be started at normal. If the Magnum pumps air and doesn't cut off, or if the pump cuts off prematurely (i.e., product remains in the well that should be pumped out), then change switches **S3-3** and **S3-4** as follows: if cutoff is premature, decrease the setting; if the pump does not cut off while pumping air, increase the setting. Allow the Spill Buster to run through 2 or 3 cycles between changes in cutoff switch settings. Any change in PUMP RATE settings (**S3-1 and S3-2**) will affect **PUMP UNLOAD CUTOFF. Be sure the pump cuts off within 15 seconds when pumping air. Continued dry pumping will damage the pump. NOTE: MAX setting is intended for set up/demo use ONLY, and in most cases will not result in a desirable recovery rate.**

**S4-1 & S4-2** - The group of switches labeled **S4** and **CYCLE FUNCTIONS** determines the time delay interval between pump cycles. Automatic is the normal setting, directing the Magnum control to vary the delay time interval according to the amount of product pumped. The other three settings are fixed time intervals: 10 sec., 20 min., & 6 hrs. **NOTES: The fixed time intervals will override the automatic delay time adjustment feature of the Magnum system, and it will continuously cycle at the time delays specified. The 10 second setting is for test, and it may be useful when setting up the Magnum system. If left in the 10 second setting, the pump will automatically switch to the 20 minute interval after 20 cycles.**

**S4-3 & S4-4** - The group of switches labeled **S4 and INTERFACE CLEARANCE** determines how high the pump intake will be raised above the product/water interface. These settings are useful to avoid biological growth that accumulates at the product/water interface in some wells. The MIN setting is recommended in a well with no biological growth and will result in the maximum recovery of product and minimum product thickness (approximately 0.1" (0.25mm). NORMAL will give a greater distance from the interface, with MAX being the highest (approx. 2").

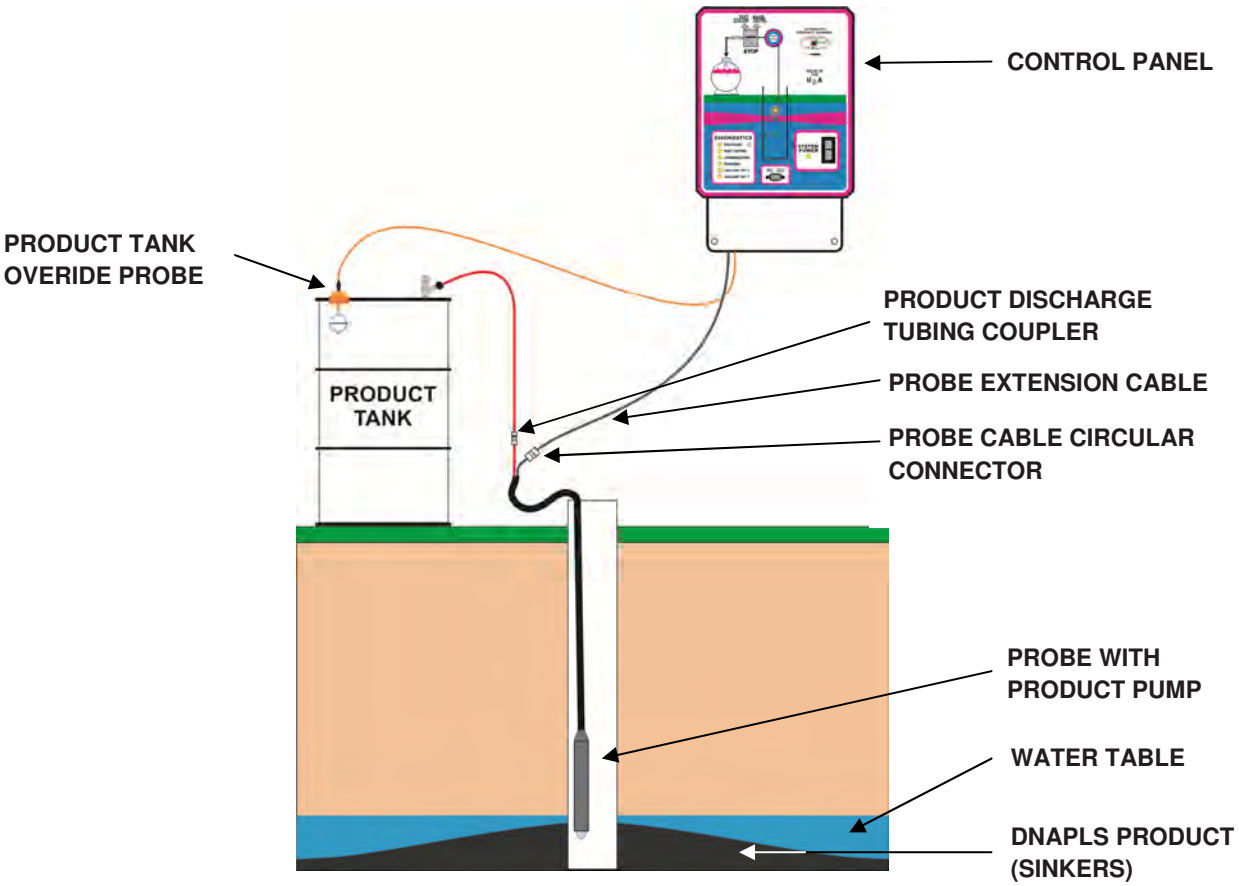
# DNAPLs Operation

## General Description

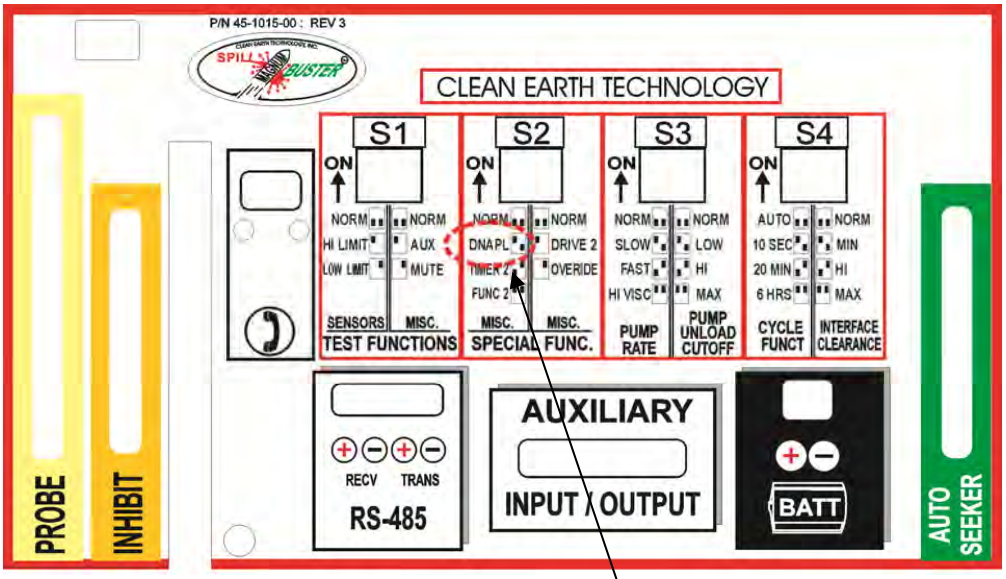
DNAPLs (or “Sinkers”) refer to those products that are heavier than the water and therefore are found below the water layer rather than above, as in the case of floating product. By following the procedure below, the Magnum Spill Buster may be adjusted to automatically pump low viscosity sinkers from a 2” well from depths of up to 150(?) feet.

## DNAPLs Procedure

The system should be run with no Auto Seeker or with Auto Seeker disconnected. **Set I/O board DIP Switches S2-1 to ON and S2-2 to OFF.** Lower the probe into the well to a point 3” - 4” above the bottom. This positions the probe to avoid sediment and sludge which could clog the intake.

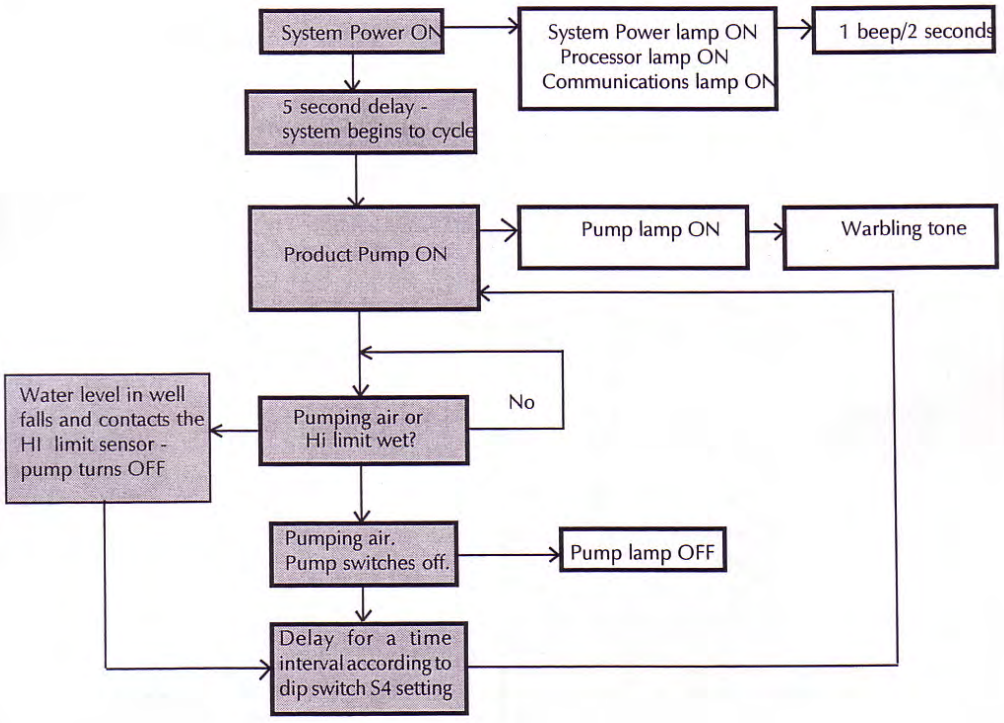



In the DNAPLs mode, the product recovery cycle differs somewhat from the standard cycle. The pump will run periodically according to the DIP switch **S4-1** and **S4-2** setting, as long as the HI limit sensor is not contacting water. As the sinker product is pumped off, the water/product interface will drop. When the HI limit sensor contacts water, the pump will stop and a delay will occur before the next cycle. If water is not present in the well, the pump will be stopped when it begins to pump air.




I/O board DIP switch setting for DNAPL operation

# DNAPLs System Cycle without Auto Seeker



# 4.0 Other Options


1. Immediate Response Box, page 50
2. Battery Operation, page 51
3. Solar Panel Charging System, page 52
4. Water Depression Control Manual, page 53




# Immediate Response Box

The Immediate Response Box (I.R. Box) is a rugged plastic box that contains a Standard Magnum Spill Buster system. The I.R. Box provides an extremely portable system to start removal of product in a 2" or larger well with minimal equipment set-up. A large forged shackle is attached on the left end of the box for security. Since the I.R. Box contains a standard control box, it can be used with any other Spill Buster options.

**WARNING**
Control Box and Standard Auto Seeker must be located outside of any classified hazardous areas. Refer to applicable codes



The I.R. box can easily be carried in a small pick-up truck or van. The basic setup involves mounting the Auto Seeker outside of any classified hazardous atmospheres (on many sites it is possible to move the Auto Seeker from the classified hazardous zone by raising it above the well head); then connecting the product tank discharge tube and overflow sensor to the product tank, and connecting the Auto Seeker cable and the probe signal cable.

The system is powered by 115VAC from an extension cord (see pg. 63 for extension sizing). In addition, cables can be provided to operate the system from a 24 volt deep cycle battery. See page 51 for battery operation of system.

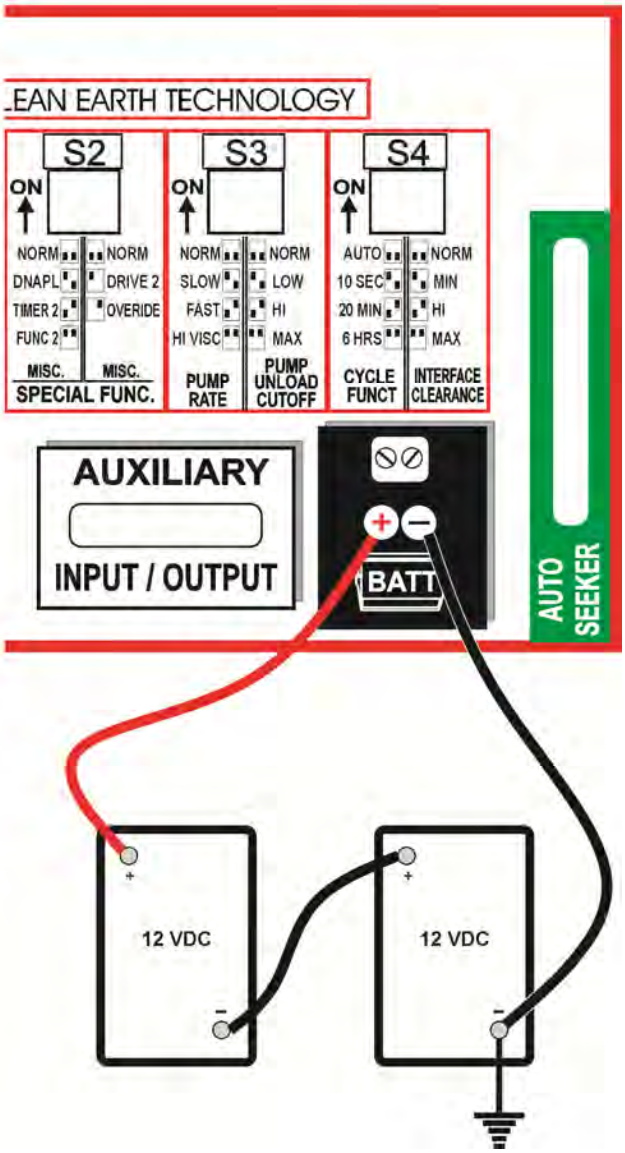


# Battery Operation

For sites with no utility connection available, batteries can be used. It is necessary to ground EVERY battery operated system. [See page 18]. The batteries should be deep cycle type. [NOTE use two 12 volt batteries in series for 24 volt power]. Use 12 AWG wire. One end of the cables will connect to the Control Box inside the I/O extension on the terminal block labeled “Batt”. Connect the other end to the battery, making sure that the polarity is correct. NOTE: hooking up a battery will bypass the power system switch. When the Magnum Spill Buster is hooked up to the battery, the system will activate, as if the power switch were turned on. No dip switch settings or board changes are necessary with battery operation. Battery life will be a function of the battery size, well depth, product viscosity and many other factors.



**NOTE:**
When operating the Magnum Spill Buster on battery power, remember to ground the system properly. Refer to page 18 for proper grounding procedures.



# Solar Panel Charging Operation



For sites with no utility connection available, batteries with a photovoltaic recharging system (solar panels) can be supplied. These systems are 24 VDC and work in conjunction with 2 or more Solar Panels. The solar system can be integrated with an Immediate Response box if desired.

The Solar Panel Charging system includes a heavy-duty frame and mounting hardware for 2 or more Solar Panels (depending on your site power requirements and geographic location relative to available sun power), 2 12VDC Deep cycle batteries, a fully potted waterproof control regulator, and custom cabling. A secondary condition on panel sizing is the amount of product present at the site to determine the duty cycle or percentage of time the system will run.

As with all Clean Earth Technology products, the Solar Panel Charging system features an easy set-up and operation. Complete wiring directions are supplied with each system and CET is available to assist if desired. Please contact your Clean Earth Technology products distributor for a quote specific to your site.

Clean Earth Technology currently uses the Specialty Concepts ASC line of Charge Controllers which are UL listed, FM and CSA rated for Class 1, Div. 2, Groups A, B, C, D hazardous locations. These controllers are fully encapsulated and thus are water proof. We do however, recommend that they be placed out of direct exposure to the environment along with the batteries and associated wiring.




The model specifically matched for operation with the Magnum Spill Buster is ASC 24/16 AE. Please confirm that this is the model received with your solar system upon delivery from the solar power manufacturer.

**NOTE:**
When operating the Magnum Spill Buster on battery power, remember to ground the system properly. Refer to page 18 for proper grounding procedures.



# Water Depression

Dual pump product recovery operation can be accomplished with the Magnum Spill Buster System plus a Clean Earth Technology Water Depression Control Module and a Grundfos Redi-Flo 3 SQE-NE pump sized to your well. The Magnum Water Depression system is designed specifically to take advantage of all the features of the Grundfos Redi-Flo 3 SQE-NE pump. This Module obtains its water level signals and control logic from the Magnum system control box and in turn controls water flow by using the soft start feature of the Grundfos pump to turn it on and off. This line of Grundfos pumps is upgraded to safely bring the high level AC voltage through the recovery zone to the pump without the need for specialized fittings.

A set of normally open contacts are provided for use with a safety override probe, which will shut down the water pump when closed.

**Typical installation of a Water Depression Control Module**

**alongside a Magnum Spill Buster Control Panel**



## Water Depression Specifications

| | |
|---|---|
| **Input Power** | 115 VAC or 230 VAC, 30 AMPS maximum |
| **Operating Temperature Range** | 40 to +140 degrees F or -40 to +60 degrees C |
| **Pumping Rate** | 0 to 33 GPM depending on water pump sizing |
| **Standard Well Depth** | 50’ max |
| **Maximum Well Depth** | 150’ on special order with 175’ water pump power cable. |

**Control Box Dimensions:** 9” wide x 10.5” high x 6.5” deep. An additional 10” clearance is required below for cable exit and an additional 9” clearance is required in front and to the left for door swing.

**Auxiliary Override Terminal Block:** Provides wire termination for an Auxillary set of Normally Open switch contacts. Used for emergency water depression pump shutoff if there is a water treatment failure. Switch contacts need to be rated for 1 Amp at 12 VDC minimum.

**Total Water Depression System Weight (w/o pump):** 8 lbs.

### Pump Requirements



**Due to the inherent design features of both the Magnum Water Depression System and the pump, the Grundfos Redi-Flo 3 SQE-NE Submersible Environmental Pump is the only acceptable water pump.**

120 VAC or 240 VAC motors are available
Standard flow ranges are as follow:

3 to 15 GPM
7 to 33 GPM

1/2 and 3/4 horse power motors available depending on head pressure.

**WARNING!**
The Grundfos Redi-Flo 3 SQE-NE is the only water pump approved for use with the Magnum Water Depression System.

### Options

Power Cable Lengths.
Standard length is 80’ from control box to water pump.
Other lengths available on special order.




**Front Panel**

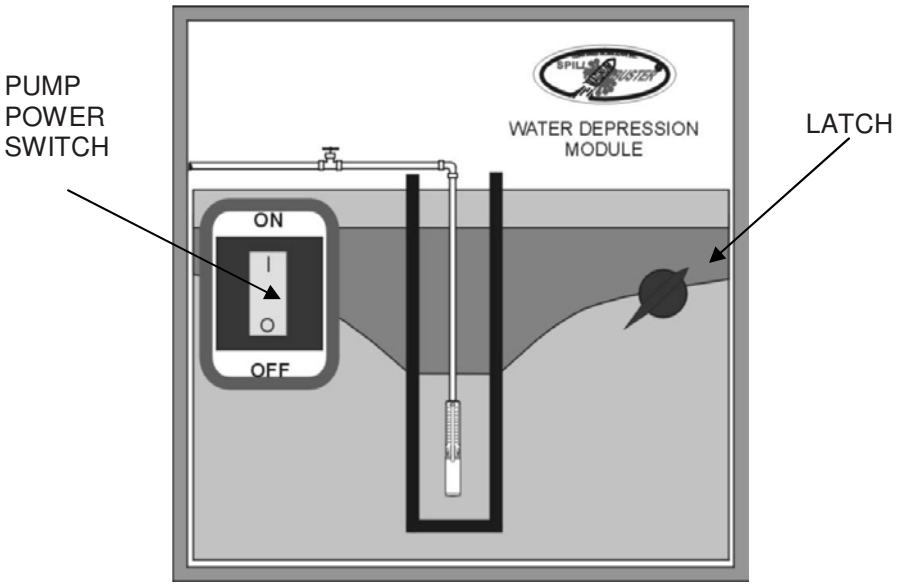
## Water Depression Control Panel (WDCP)

The Water Control Module is a NEMA 4 UL approved enclosure containing the water pump control solid state relay and the I/O wiring terminal blocks. The control box door should be kept latched at all times when not in use, and excessive moisture (e.g. rain) should not be allowed to enter the box. **Although there are no open contacts, this is not an explosion-proof enclosure; locate the Control Module in a non-hazardous location!**

The Control Panel is accessible by opening the front door of the Control Box. The Control Panel contains the main power switch for the depression pump. This switch also is a backup circuit breaker for the water pump, and is rated 25 Amps at 230 VAC.

The first (lower) position of the switch is water pump OFF. Once the switch is turned on the water system is enabled to follow orders from the Magnum Spill Buster control box, which gets its water level information from the product probe sensors. The Magnum control box will send signals to turn the water depression pump on and off as required to maintain the desired water depression level. All product skimming functions are still controlled by the Magnum Spill Buster control box as before.

**WARNING!**
This is not an explosion-proof enclosure; locate the Control Module in a non-hazardous location!



## Installation of the Water Depression Pump

The WDP should be installed near the bottom of the screened section of the recovery well, but should not rest on the bottom of the well. Placing the WDP on the bottom of the well may result in pumping sediment that collects on the bottom of the well.

- Determine the distance from the well head to the WDP intake. Cut a length of pipe that is 0.25 m longer than the distance from the well head to the WDP intake. We recommend that 1.25" flexible plastic piping is used. thread the WDP power cord through the pipe.
- Attach the pipe to the pump, using an appropriate fitting. At the well head end of the pipe, thread the WDP power cable through the "Y" fitting ("Y" fitting will be provided by CET). Thread the wire so that it enters the "Y" fitting at the bottom, and exits through the watertight seal. Attach the wellhead end of the pipe to the bottom of the "Y" fitting, using a 1.25" male NPT/1.25" barbed fitting. Secure the pipe to the barbed fitting, using two hose clamps.
- Secure the WDP at the desired depth, using a steel cable, nylon rope, or chain. Secure the cable, rope, or chain to the WDP, using the stainless steel loop at the top end of the pump housing. Lower the WDP into the well using the cable, rope or chain. Secure the cable, rope or chain at the wellhead to ensure that the pipe is not bearing the weight of the pump.
- Install pipe from "Y" fitting to the water treatment system. It is important to install a manual flow control valve in the water discharge line between the "Y" fitting and the water treatment system. The flow control valve is used to adjust the rate at which water is being pumped from the well. Doing so "sizes" the pump better to the actual well conditions. This will help maximize pump on/off cycle time, thereby extending the life of the pump motor. This will also tighten and smooth out depression level control.

## Installation of the Water Depression Control Module (WDCM)

Mount the Control Panel in a suitable location (outside of any classified hazardous area) within a few feet of the Magnum Spill Buster Control box. Typical installations are in sheds, on the side of buildings, or on a utility type pedestal mount.

Connect the 20 pin cable from the panel to the Auxillary I/O outlet in the MSB control box.

## Hard Wiring the Water Depression Control Panel

- .**Warning-** All AC Power wiring must be done by a qualified electrician who is familiar with all appropriate NEC and/or local codes. Electrical shock may result in serious injury or death.
- **Warning-** Explosive Vapors. Always disconnect AC power at its source prior to connecting/disconnecting any wires and/or cable connections located within any hazardous locations.

The Water Depression Control (WDC) Module is designed to operate on either 115 or 220 VAC Power just by making the appropriate hook ups into the terminal block. Wiring to the module will be routed to the 120 VAC or 220 VAC portions of the terminal block depending on the voltage of the pump. It should be noted that the power into the box should be rated the same voltage and amperage as the rating for the depression pump.

The cabling coming out of the well head should be long enough that it can be run directly to the WDC Module box. Excess cable can be coiled up at the well head or control shed. Next have a certified electrician wire AC power into the control box and to the appropriate spots on the terminal box as follows:




- Feed the WDC Power Cord thru the Control Panel bulkhead strain relief.
- Connect each of the three wires in the pump power cord to the connections (green, black, white) in the control panel at the space labeled “PUMP”.
- Connect the power supply cord from the circuit breaker to the WDC panel. Starting from a 25 Amp., 110 V or 220 V circuit breaker in the distribution box, run the cord (green, black, white) to the appropriate connections labeled “LINE”.

## Probe Installation for a Standard System

- The probe signal cable is hooked to the signal cable extension via the “No Auto Seeker Connector”. Insert both plugs into the connector and tightly bolt together with hardware provided. Connect the other end of the signal cable to the WDC Module control panel.



**NO AUTO SEEKER CONNECTOR USED WITH A STANDARD MAGNUM SYSTEM**

- Hook the product discharge tube to the probe termination module and to the recovery tank using the fittings provided.

- Lower probe into well until the HI/LO lights on the control panel just come on. This signifies that the probe is at the static product / water interface. Now lower the probe by the amount of depression desired (Example: To depress 1 foot, lower probe 1 more foot) and secure.

## Probe Installation for an Explosion Proof System

- The probe signal cable is hooked to the signal cable extension via the Mil-Spec connectors. Match polarity key on the connectors, push together and tighten connection nut Connect the other end of the signal cable to the WDC Module control panel.

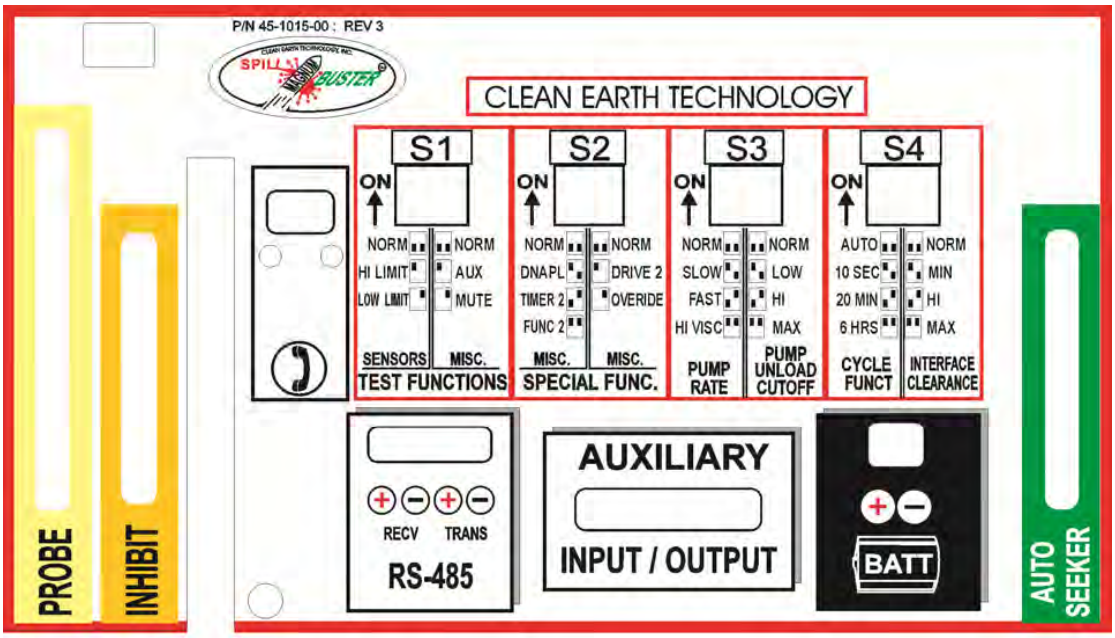


- Hook the product discharge tube to the probe termination module and to the recovery tank using the fittings provided.

- Lower probe into well until the HI/LO lights on the control panel just come on. This signifies that the probe is at the static product / water interface. Now lower the probe by the amount of depression desired (Example: To depress 1 foot, lower probe 1 more foot) and secure.

## Dip Switch Settings

In order for the Water Depression Module to work in configuration with the main Magnum Control Box, it is necessary to put DIP switches 1 and 2 on S2 in the UP position and all DIP switches on S4 in the DOWN position in the Magnum Control Box.

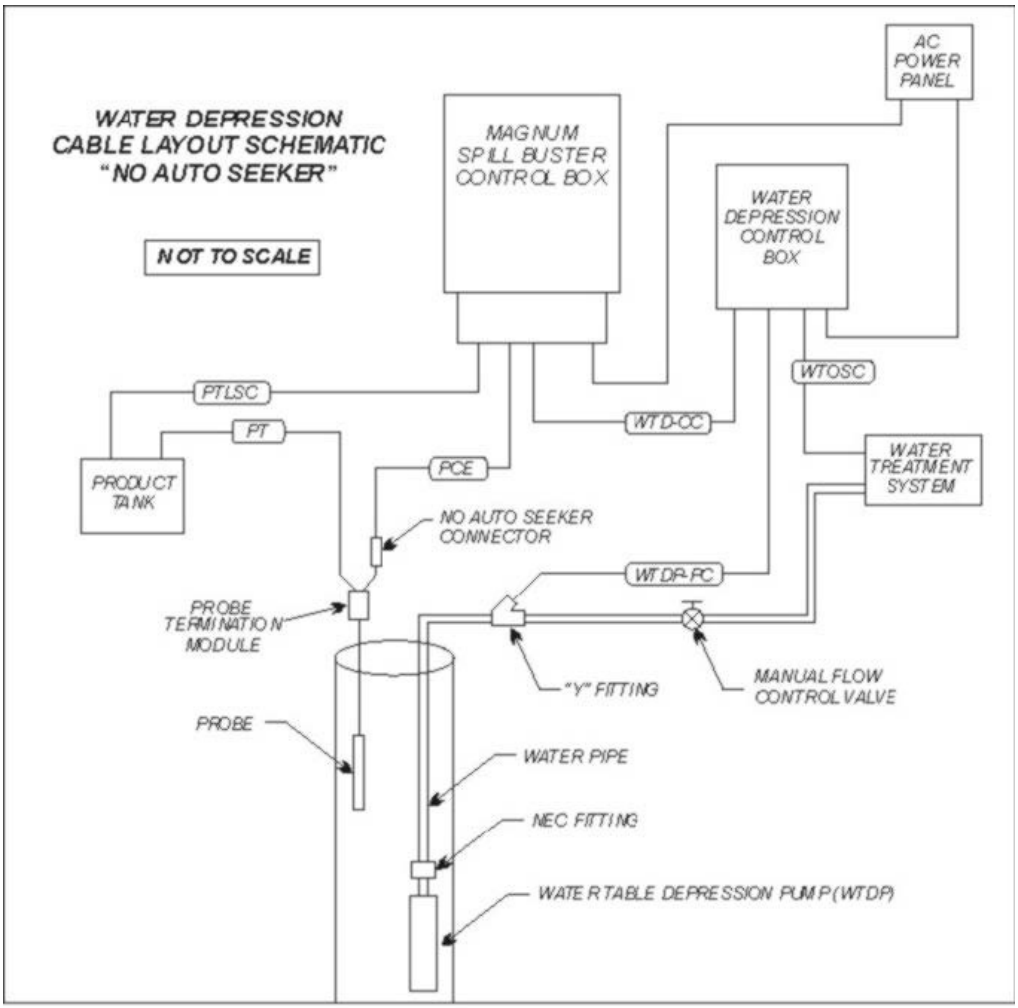



## Start Up

- Turn the power on in the MSB Control Panel. Observe that the HI/LO lights on the MSB control panel are on. When used with the WTD option, it is necessary to put dip switches 1 and 2 on S2 in the UP position to enable the product pump to come on each time the HI light goes off.

- Turn the power on in the WTD Control Panel. Watch for proper cycling to develop between the HI and LO lights. When the oil/water interface is pumped to the level of the High level sensor, the HI limit light will go out. The product pump will then start pumping product. The water pump will continue to pump until the LO level light goes out, and then the water pump shuts off. When the oil/water interface rebounds to the level of the high sensor band on the MSB probe, the water pump will automatically restart and the product pump will shut off briefly until the high level sensor goes out again. Throttle the water flow control between the pump restart and shut-off. This will help minimize pump on/off cycling, thus tightening depression level control and extending the life of the pump motor. Occasionally adjust further as the cone of depression develops or there are seasonal flow rate influences.

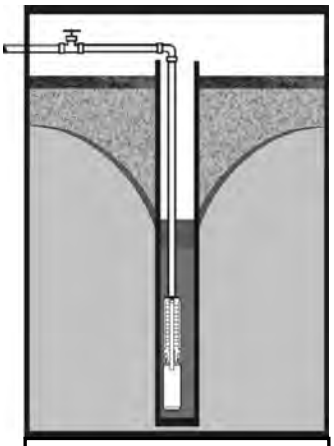
## System Schematic




| LABEL | DESCRIPTIONS | STANDARD LENGTHS | STANDARD OPTIONS |
|---|---|---|---|
| PCE | PROBE CABLE EXTENTION | 25' | 50, 75, 100 |
| WTD-CC | WATER TABLE DEPRESSION CONTROL CABLE | 5' | N/A |
| PTLSC | PRODUCT TANK LEVEL SENSOR CABLE | 25' | SPECIAL ORDER |
| WTDP-PC | WATER TABLE DEPRESSION PUMP POWER CABLE | 80' (FROM PUMP) | SPECIAL ORDER |
| PT | PRODUCT TUBING | 100' | 100' LENGTHS |
| WTOSC | WATER TREATMENT OVERRIDE SWITCH CABLE | CUSTOMER SUPPLIED | N/A |

## Development of a Hydraulic Cone of Depression: Tips and Good Practices

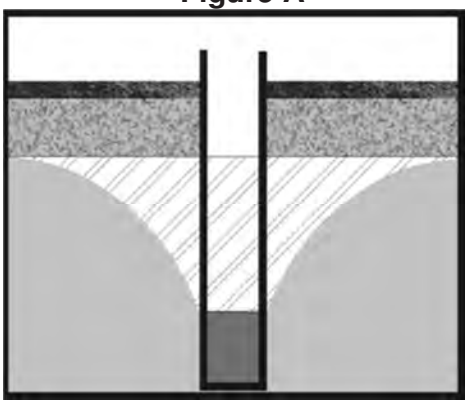
Proper development of a Hydraulic Cone of Depression is not as straight forward as it might seem. An attempt to rapidly depress to full desired depth during the initial startup can cause emulsification. The following information is offered to help you understand some of the basic principles of water depression and the development of a hydraulic cone. Be aware that no two sites are the same and all sites will behave differently from one another with respect to time and conditions.



**In the event a depression level of a foot or more is required for the site, the depression should be started with a depression level of 1 foot or less. Then, over a period of several days, the depression should be increased a foot or less at a time.**

### INITIAL WATER REMOVAL

**Figure A**



When initially developing a depression cone, take into consideration that the initial flow rates required will be much greater during steady state operation. This is due to the fact that initially the water located in the depression cone (hatched area in figure A to the right) must be pumped in addition to the normal recharge of water. This would be like pumping water out of a swimming pool while more water is being pumped in at the same time. Only when the pool is empty - and only then - will the pumping rate equal the recharge rate of the water.

This water can amount to a large quantity and can take days or weeks to pump out. For instance, a five foot depression with a radius of influence of fifty feet would require the removal of roughly 150,000 gallons of water! A five G.P.M. pump would require over twenty days to pump this much water without any recharge water coming in.

If a significant depression level (say several feet) is attempted all at once, many days/weeks may be required to get the depression level down to the intake of the pump. If product starts to accumulate during the time that the product pump intake is flooded, no product recovery will be achieved even when significant product accumulations occur. For this reason alone it is a much better practice to depress the water table in stages of 1/2' to 1 foot at a time, so that accumulated product can be pumped off sooner.

## Avoiding Cascading Water

It's important to understand how a hydraulic cone of depression typically develops, and the problems that can occur if it is not done properly.

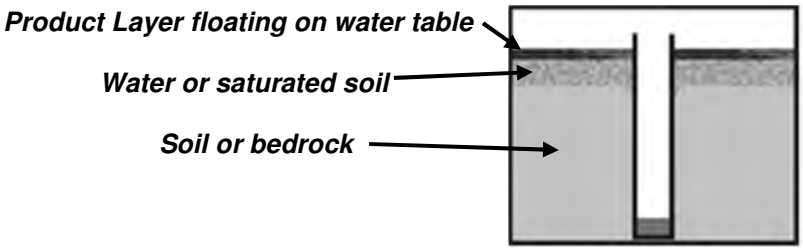



**Figure B**

When a deep level of depression is first initiated, the hydraulic cone should be developed in a progressive fashion similar to the one depicted in Figures B, C, and D. Figure E shows what happens if the water depression level is developed too quickly: when the water is initially up against the well screen for most of the depression height it can lead to water cascading into the well down to the product water level.

**Figure C**

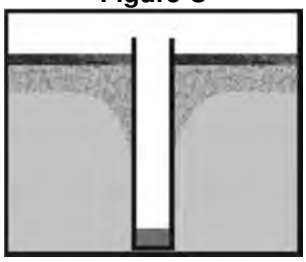


**Figure D**

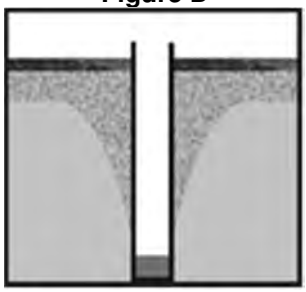
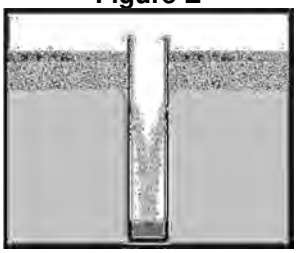
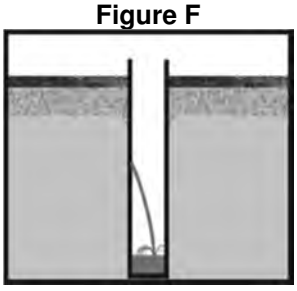


**Figure E**



This could be similar to putting a piece of well screen in a pool and trying to pump water out of the screened area - it would just pour in again from all levels. In the ground the effect on the flow of water into the well would be minimized by the resistance of the surrounding soil, but significant cascading water can occur none the less.

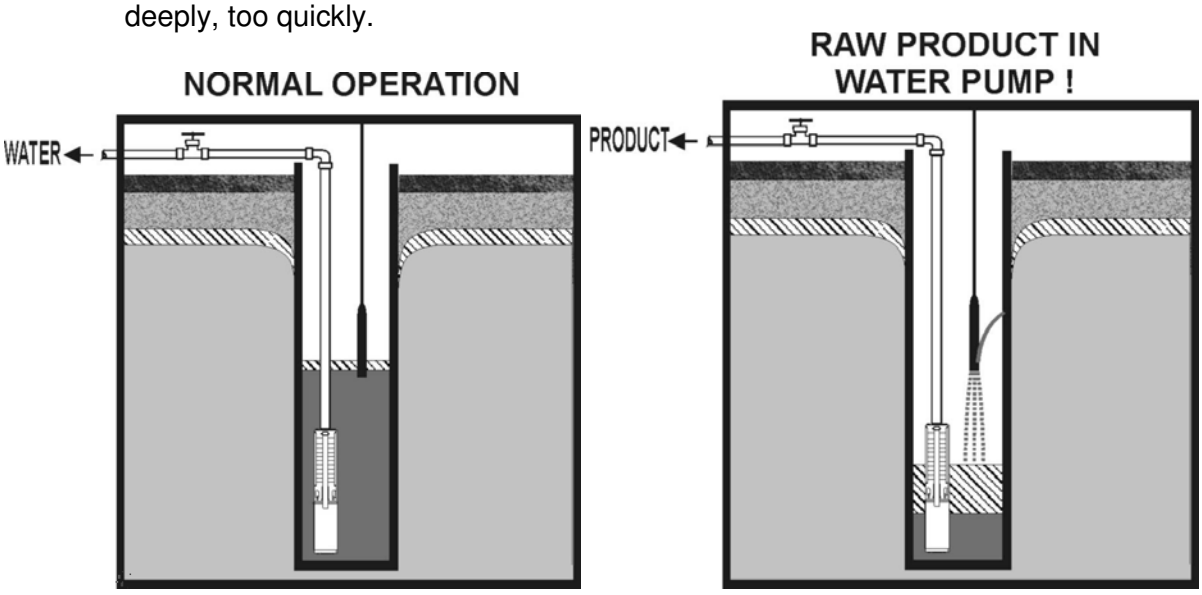
**Figure F**



Sometimes the cascading water can come in the form of a stream from a single spot where a fissure occurs in the soil, as shown in Figure F. This can actually look similar to a water fountain. A stream of water like this may result in serious mixing of water and product creating emulsions, especially with heating and diesel oils. Since any product recovery system relies on some form of liquid level detection sensor to position a pump inlet in the accumulated product area of the recovery well, this emulsification can significantly impair product recovery.

The Magnum Spill Buster's sensors will ignore cascading water as long as the water stream is broken up (like individual rain drops) and won't allow a conductive path back to the point of stream entry. However, if the stream becomes solid, then the sensor will falsely detect the water/product interface where the cascading water enters the well, rather than at the real interface. The resulting erratic activity of the system may lead the user to think that the system is defective when in reality **the depression level should be reduced.**

When cascading water causes the system to falsely detect that its sensors are flooded, it may signal the water depression pump to stay on longer than it should. This could result in lowering the water/product interface to the water pump intake, and pumping raw product into the water treatment system. This is usually a very bad situation since most water treatment systems are not intended to, or capable of, handling pure product and are overwhelmed. Subsequently, raw product can end up being discharged back into the environment. The moral of this story: don't depress too deeply, too quickly.




## Conclusions and Warnings

A) Cascading water may cause very erratic Magnum Spill Buster system behavior. Symptoms may include the panel lights for the product and depression pumps to act out of sequence and erratically.

B) Cascading water may cause the sensor to detect a continuous false product/water interface many feet above the real interface. **This may cause large quantities of pure product to be pumped into the water treatment system and be discharged into the environment.**

C) Cascading water may cause product and water to mix creating "mayonnaise like" emulsions which will immensely complicate product recovery.

# 5.0 Maintenance Operations


| Procedure | Page |
|---|---|
| Probe/Product Pump | 66 |
| Alpha Array™ Sensor Band Area | 66 |
| Cleaning the Probe | 67 |
| Product Pump | 68 |
| Removing the Product Pump | 69 |
| Pump Installation | 73 |
| Logic Board and Power Supply | 74 |
| Removing the Logic Board | 75 |
| Removing/Installing Probe Product Tube from the Reel | 76 |




- .**Warning-** All AC Power wiring must be done by a qualified electrician who is familiar with all appropriate NEC and/or local codes. Electrical shock may result in serious injury or death.

- **Warning-** Explosive Vapors. Always disconnect AC power at its source prior to connecting/disconnecting any wires and/or cable connections located within any hazardous locations.

# Probe/Product Pump

This is the down-well component of the system. The Probe/Product Pump contains circuits for sensing the product/water interface, as well as housing the product pump. Sensors assure that water will never be pumped into the product tank. The Probe/Product Pump assembly is constructed of state of the art polymer materials for very high corrosion and deterioration resistance.

## Probe Product Cable

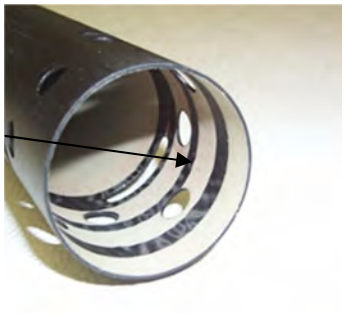


The Probe product cable is the "umbilical cord" of the down-well probe, connecting it to the above ground components. The cable carries signal and electrical power to and from the probe along with the product discharge tube. Examine the entire length of the probe product cable on a routine basis, looking for signs of unusual wear or strain. If present, these damaged areas may compromise the electrical wiring, leading an Intrinsic Safety barrier to trip which would then need replacement at the factory. Damage to the Probe product cable could also cause a leak in the product discharge tubing, potentially causing a secondary spill. Contact Clean Earth Technology if you detect damage to the Probe product cable.

## Alpha Array Sensor Band Location

There is an array of sensor bands, internal to the probe, including one dispensing a low limit signal, and one dispensing a high limit signal. The sensors use a low frequency, omni-directional signal to sense the product/water interface. The sensors operate on the principle that signal transmission varies significantly due to the transmission characteristics of the type of fluid surrounding the antenna. The variation in signal transmission is used to accurately determine the interface location relative to the product inlet. The sensors are constructed of "state of the art" polymer materials for corrosion resistance and long life.

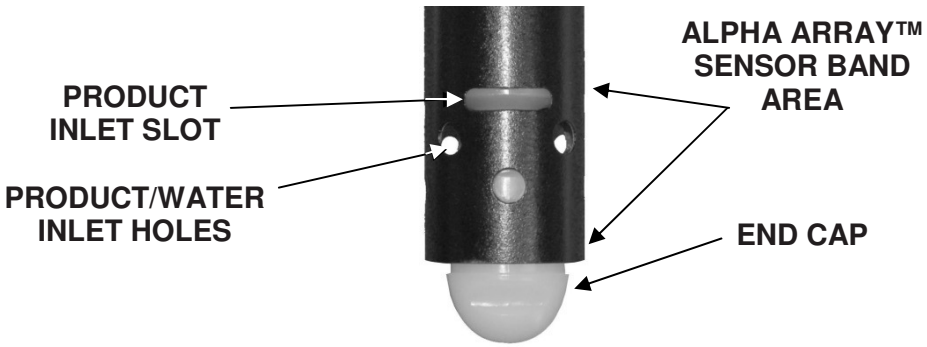
**ALPHA ARRAY™ SENSOR BAND AREA**



## Inlet Slot

Probe Inlet slots and holes in the sensor band area of the probe body allow the product and water to freely enter into the interior of the probe. These slots must be kept clean and free of debris in order for the system to function properly. Care must be taken when cleaning the inlet slots and holes to avoid damaging the probe and sensor band area. Avoid using sharp tools such as screwdrivers, knives, etc. to clean the probe inlet slots and holes.

The product inlet slots lie toward the end of the probe, which allows the product to flow into the pump filter. There are also several round holes, which allow water and product to freely flow into the inside of the probe pump cavity where the sensor bands are located. These holes must all be kept clean.




## Cleaning the Probe

If the Probe sensors become coated with a very heavy layer of biological growth, emulsions, or other materials, the Probe will not function properly. The Probe can be cleaned, as shown below, using spray cleaner or mild dish liquid in warm water and a cloth or soft bristled brush. Care must be taken to avoid damaging the Probe and sensor bands, either by brushing too hard or by using a very hard tool to perform cleaning.



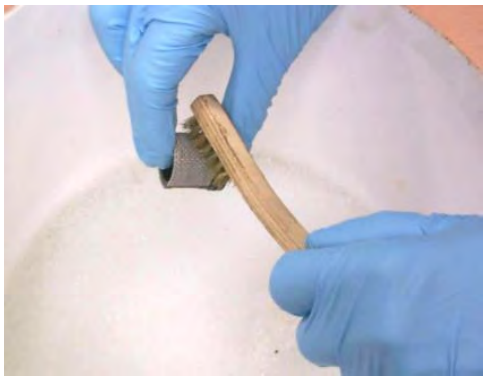


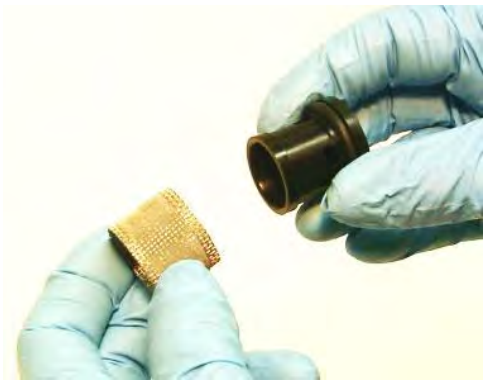
Make sure that the Product Inlet Slots and holes are clear, and the interior Alpha Array™ Sensor Band area is free of coating and debris

If persistent residue sticks inside the sensor area, a soft brush or tooth brush is recommended to fully clean sensors.



The pump inlet screen and inlet holes should be checked and cleaned also during inspection.



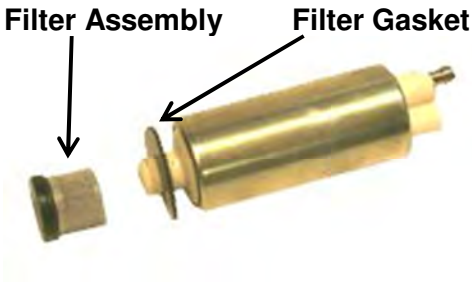


## The Product Pump

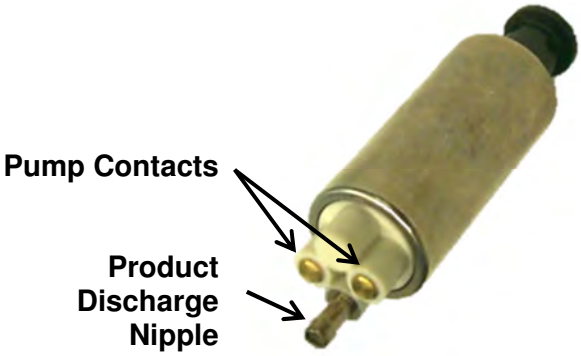
The product pump is a rugged and chemically resistant roller vane unit capable of pumping up to 46 gallons (174 liters) per hour of low viscosity liquids (up to 12 Cp) per day in shallow wells and to reliably recover product out of wells 150 feet in depth. In addition, it can withstand a certain amount of small solids such as dirt or sand passing through it. See Pump Performance Curve, page 87.



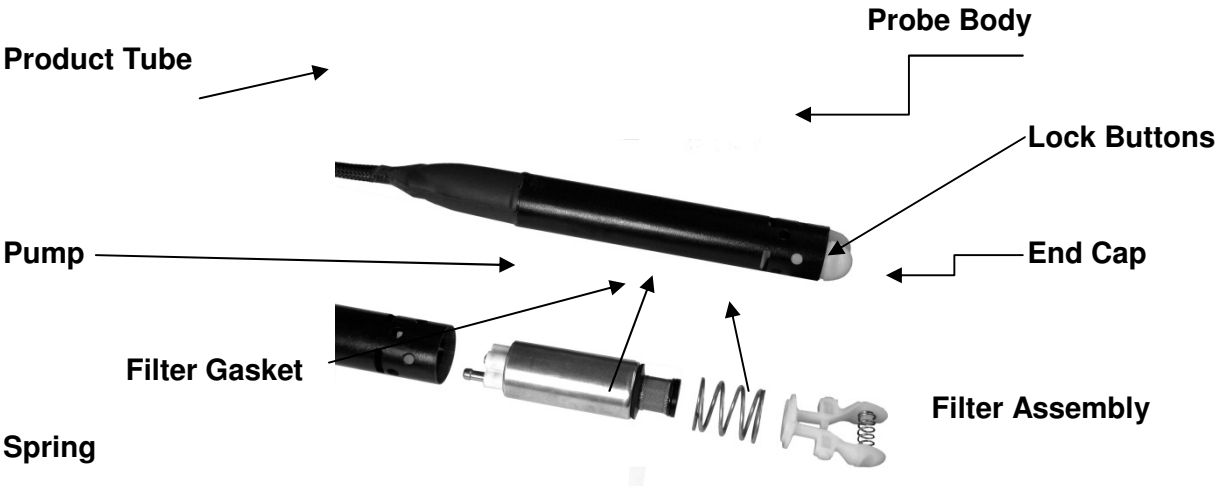
The Product Pump is located near the bottom of the probe and is easily accessible. The pump is inserted into the bottom of the probe body and is held in place by the spring and end cap.




The pump product nipple and the pump electrical contacts should also be kept clean.




## Removing the Product Pump




The Product Pump is located near the bottom of the probe and is easily accessible. The pump is inserted into the bottom of the probe body and is held in place by the end cap.
To remove pump, push end cap firmly into probe to loosen the locking buttons. While pushing end cap in, press locking buttons into probe.



**Releasing First Lock Button**



**Releasing Second Lock Button**



**Removing End Cap**

The Pump is removed from the Probe using a Pump Removal Tool supplied with the system. One end has two pins which are used to spin the filter & filter top off. The second end has a threaded hole, which is screwed onto the inlet end of the Pump. The Pump then is pushed out of the Probe.



**Pump Removal/Insertion Tool**



**Threaded Hole**



**Filter Adapter Pins**



**Remove the Pump**

## Pump Maintenance

After the filter is cleaned, clean Pump contacts with brush. Make sure that the contacts are free of any corrosion. If the pump will be immediately reinstalled in the probe and the system will be turned on again, then proceed to the pump flooding procedure on page 72.

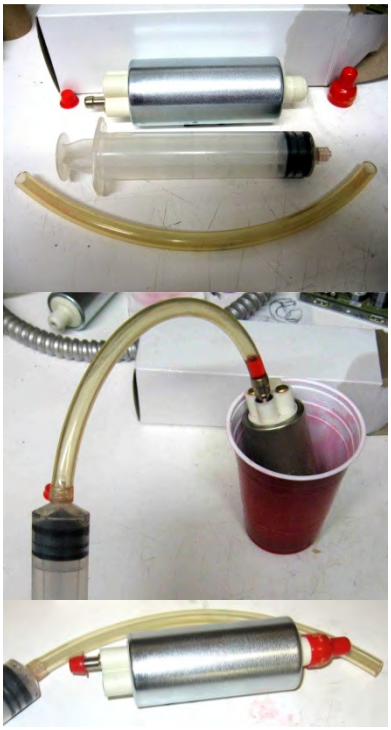
If the pump or the system as a whole is to be decommissioned and stored for a period of time, then the pump should be lubricated to prevent the pump rotor from corroding (which may lead to pump failure). In this case lubricate the pump internals with a Non-Flammable oil such as 3 In 1 Oil®. To lubricate, hold Pump upside down (intake hole up) and squirt lubricant into intake hole. This will allow lubricant to flow into working parts of Pump. Also, squirt lubricant into product discharge nipple in Pump.





# Pump Flooding Procedure

Before a probe can be installed down the well (or re-installed after servicing), the pump must be flooded. The purpose of this procedure is to displace oxygen and vapors from within the pump body. Once the system is installed, the added fluid will be pumped out to the recovery container during the first recovery cycle. **Note:** CET does not ship new or serviced systems with the pump pre-flooded.



**Required Equipment:**

- A suction device
- Suitable container for the fluid
- Approximately 8 fl oz of flooding fluid, such as Ultra-Pure Paraffin Lamp Oil, mineral oil, material from the subject well, or similar non combustive fluid. DO NOT USE WATER, the pump internals are NOT corrosion resistant.
- Approximately 12”of 3/8 fuel line
- A product pump, CET P/N 90-1318-019

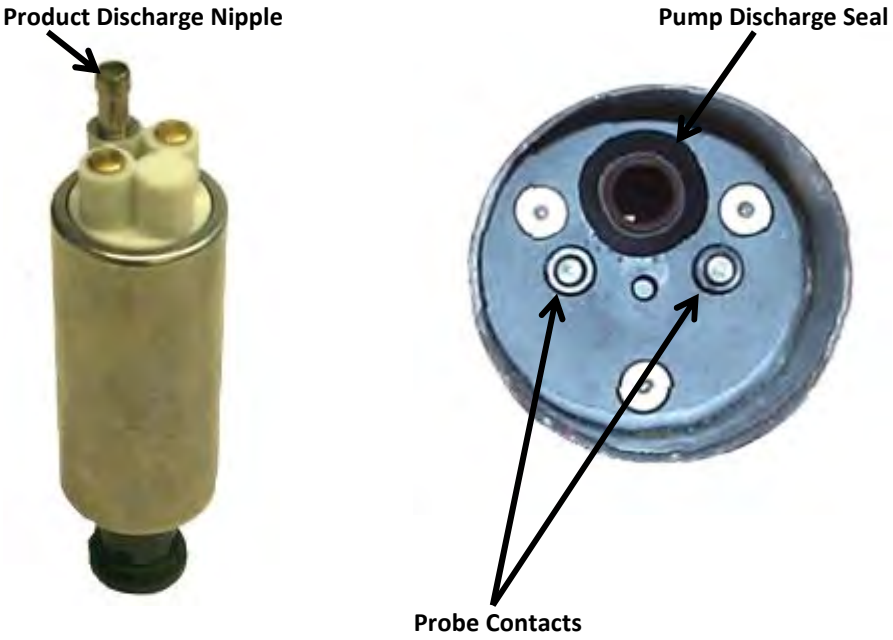
**Flood the pump**

- Attach the fuel line to the discharge side of the pump.
- Attach the other end of the fuel line to the suction device.
- Place the pump inlet in the container of fluid.
- Pull the fluid into the pump until it is observed in the fuel line.
- Remove the fuel line from the pump.
- Install (or re-install) the flooded pump into the probe (reference the “Pump Installation” section of the Maintenance Operations chapter of the Operator’s Manual).
- If the pump is not immediately installed in the probe, replace the red intake and discharge caps. The pump can then be bagged for later use or storage.

**Note:** Always save the red caps from installed pumps for future use.

# Pump Installation

Reinstall pump filter assembly. Don't forget to install filter gasket between filter and Pump. Make sure that the filter assembly is tight. When installing the Pump make sure the product discharge nipple is aligned with the Pump discharge seal.



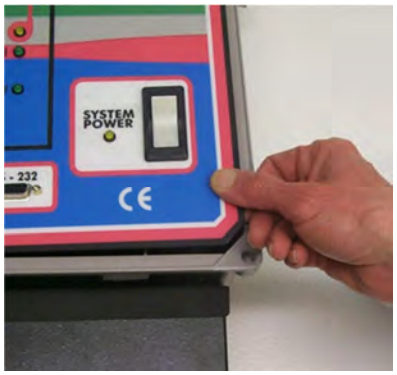

**Drop Pump into Probe and push Pump until the Pump contacts are seated firmly against Probe contacts. The Pump Tool can be used to align the Product Discharge Nipple with the seal. If firm contact is not made, the Pump may not function. Finally, insert the end cap such that both lock buttons snap in place.**

# Logic Board and Power Supply

- .**Warning-** All AC Power wiring must be done by a qualified electrician who is familiar with all appropriate NEC and/or local codes. Electrical shock may result in serious injury or death.
- **Warning-** Explosive Vapors. Always disconnect AC power at its source prior to connecting/disconnecting any wires and/or cable connections located within any hazardous locations.

On occasion, when troubleshooting with Clean Earth Service about an issue with your system, our technician may be able to pinpoint the problem to the Control Box's logic board. Use this section to properly remove and replace the board as required for service. The Logic Board is located on the back panel inside the Control Box. The Control Panel is held in place by four spring loaded catches (see below). The Control Panel can be removed to expose the Logic Board and Power Supply by carefully prying the Control Panel with a screwdriver near one of the four corners. The control panel will then "pop" out.

**"Popping" Off the Front Panel with a Screwdriver**

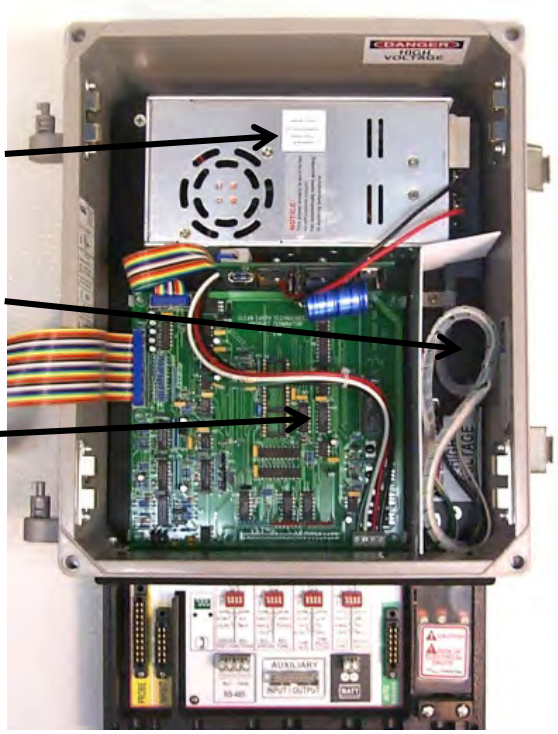



**Lift off Front Panel**

**POWER SUPPLY**

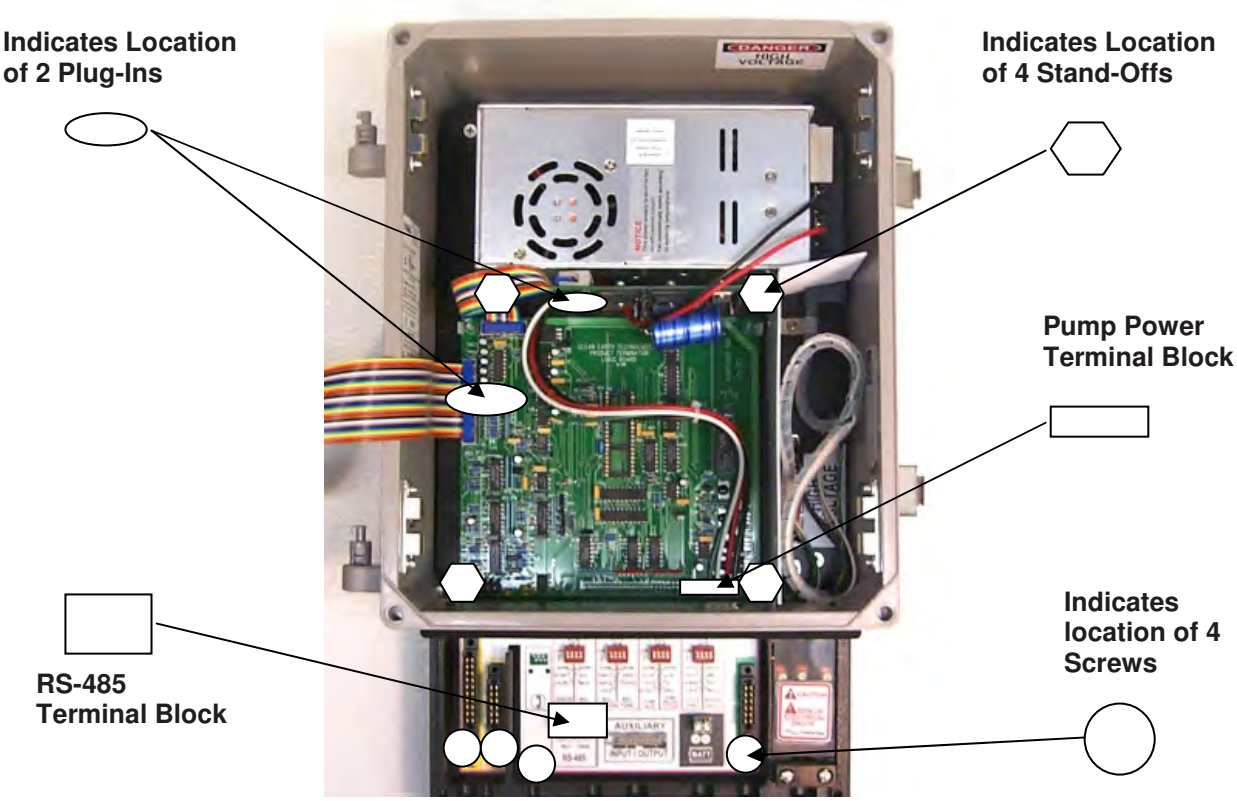
**HIGH VOLTAGE SAFETY BARRIER**

**LOGIC BOARD**



**[NOT SHOWN] UL APPROVED ISOLATION BARRIER (OPTIONAL)**

## Removing the Logic Board




1. Disconnect Power
2. Unplug two (2) plug-ins.
3. Remove pump power wires from terminal block.
   NOTE: When replacing wires - Green, White, Red & Black
4. Remove RS-485 wires from terminal block.
   [IMPORTANT -- Note/record position of color coded wires]
5. Unscrew four (4) screws.
6. Disengage four (4) stand-offs.
7. Slide board out toward the top of the box.

# Removing Probe from Auto Seeker Reel

**Warning!**

**To prevent damage to the logic board, DISCONNECT the Auto Seeker Extension cable from the control box before rotation of the Auto Seeker by hand.**

There are two cases in which it is necessary to remove the Probe Product Tubing from the reel:

1) If the Probe stops before reaching the interface; or, if the reel stops before the Probe is fully rewound when raising the Probe, then the Auto Seeker rotation is not fully synchronized with the Probe Product Tubing. The tubing must be fully unwound and removed from the reel; then reinstalled and rewound in order to correct the problem.

2) When decontaminating the Auto Seeker unit to return to the factory for service.

# Resynchronizing Product Cable With The Standard Auto Seeker Rotation

Rotate the Auto Seeker in the DOWN direction until the entire length of the Probe Product Tube is off the reel. This can best be accomplished by initiating a cycle with the PRC switch (see Diagram Pg. 29), while keeping the probe away from contact with a grounded surface. The system will continue to lower the Probe in search of the interface. Press STOP on the PRC switch when all the Product tubing is off the reel.

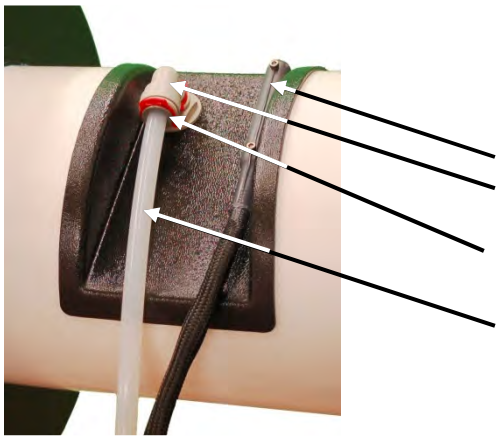
If the Auto Seeker stops before the tube is fully unwound, then the unsynchronized Auto Seeker has reached its extreme DOWN position. Press STOP and remove the remaining tubing by hand without moving the reel.

If the unsynchronized Auto Seeker continues to rotate past the point at which the Product Tube is fully unwound, then press STOP and detach the Product Tubing from the Auto Seeker at the reel. [See instruction, following page.] After the Product Tubing is detached, set PRC switch back to AUTO and allow the Auto Seeker to go in the DOWN direction until it stops on its own. The Auto Seeker reel is now in the extreme DOWN position. Set PRC switch to STOP.

Now, reattach the Product Tube to the reel. Don't forget the retainer clip! Rewind the tubing onto the reel by 1) moving the HI LIMIT dip switch (S1-1) to ON [see page 37] and then 2) by placing the PRC switch in the AUTO position. This will cause the Auto Seeker to rotate in the UP direction. [If the Auto Seeker does not start going up, carefully turn the reel by hand until it starts moving. It should only take about a quarter turn before beginning to wind automatically.] Feed the cable carefully back and forth in layers. Switch the PRC to STOP once the probe is in the full UP position.

Take care that the probe head is not dragged along the ground as the Auto Seeker rewinds. [Remember to turn OFF the HI LIMIT dip switch.]

# To Remove the Probe from a Standard Auto Seeker Reel



The Probe is connected to the hub of the reel by instant tube fittings and a Slim-line™ connector.

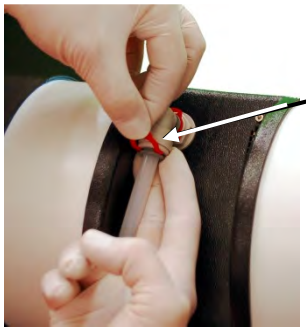
**SLIM LINE CONNECTOR™**
**DISCHARGE TUBE FITTING**

**RETAINER CLIP**

**DISCHARGE TUBE**



Unplug the Slim-line™ Connector using an Allen wrench and a pair of needle nose pliers to hold the stand-off nut in place, and remove the screws.

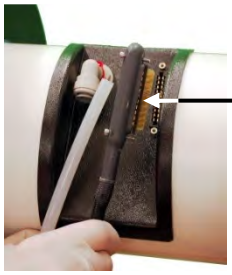


Remove the red locking clip on the discharge tube fitting by pushing the bottom of the clip up with two fingers and pulling up at the top with your other hand. Then push down on the locking sleeve of the discharge tube fitting with a screwdriver while pulling on the discharge tubing. Make sure to push the locking sleeve squarely into and against the fitting; otherwise, the tube will not be released.

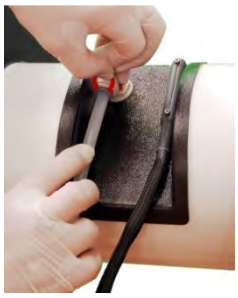
# To Install the Probe on a Standard Auto Seeker Reel



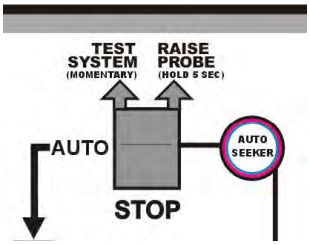
**WARNING:** To prevent damage to the logic board, DISCONNECT the Auto Seeker extension cable from the Control Box before rotating the Auto Seeker by hand. To wind the probe onto the reel, turn the reel a couple of turns by hand in order to reset the safety switch. This is an important step to ensure that the probe is synchronized with the Auto Seeker safety limit switches.



Check to be sure the Slim-line™ gasket is in place. Install the Slim-line™ connector using an Allen wrench to tightly install the screws.



Insert the product discharge tube into the discharge tube fitting. Install the red locking clip.

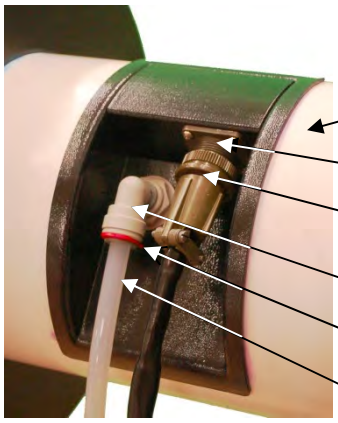



Reconnect the Auto Seeker to the Control Box I/O pouch

Power up system and press the PRC Switch to the RAISE PROBE position for 5 seconds until the Auto Seeker starts to rotate upward. [If the Auto Seeker does not start going up, carefully turn the reel by hand until it starts moving. It should only take about a quarter turn before beginning to wind automatically.] Feed the cable carefully back and forth in layers. Switch the PRC to STOP once the probe is in the full UP position.

Take care that the probe head is not dragged along the ground as the Auto Seeker rewinds.

# To Remove the Probe from an Explosion Proof Auto Seeker Reel



The Probe Cable is connected to the hub of the reel by instant tube fitting and the electrical connections are via a MIL-Spec circular connector.

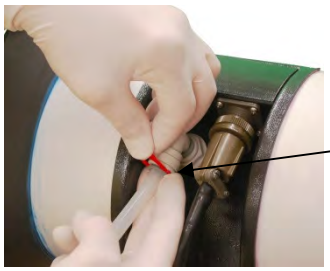
**CONNECTOR RECEPTACLE**

**CONNECTOR PLUG**

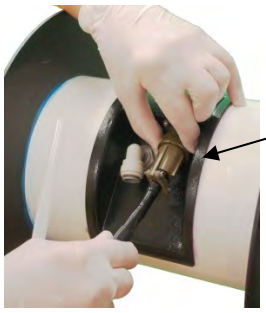
**DISCHARGE TUBE FITTING**

**RETAINER CLIP**

**DISCHARGE TUBE**



Remove the red locking clip on the discharge tube fitting by pushing the bottom of the clip up with two fingers and pulling up at the top with your other hand. Then push down on the locking sleeve of the discharge tube fitting with a screwdriver while pulling on the discharge tubing. Make sure to push the locking sleeve squarely into and against the fitting; otherwise, the tube will not be released.



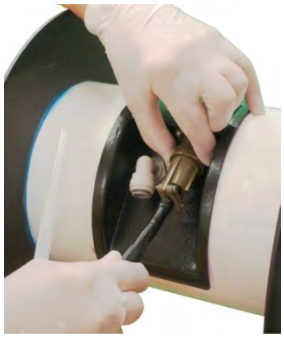
.
After removing the product discharge tubing remove the probe cable by threading the MIL-Spec plug collar off the receptacle and gently pull the connector plug out.



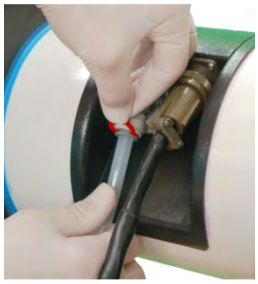
# To Install the Probe on an Explosion Proof Auto Seeker Reel



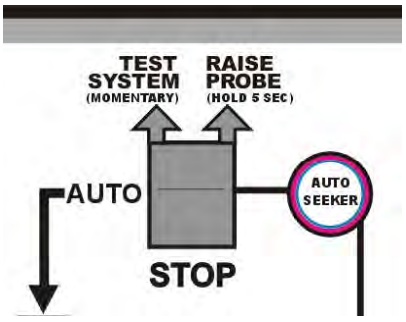
**WARNING:** To prevent damage to the logic board, DISCONNECT the Auto Seeker extension cable from the Control Box I/O pouch before rotating the Auto Seeker by hand. To reinstall the probe, turn the reel by hand to gain easy access as shown.



Insert the probe cable plug firmly into the MIL-Spec connector receptacle and then tread the collar down. Tighten the collar as tightly as possible in order to insure the connector gasket is fully sealed.



Install the product discharge tube: Insert the product discharge tube into the discharge tube fitting. Install the red locking clip




Reconnect the Auto Seeker to the Control Box I/O pouch.

Power up system and press the PRC Switch to the RAISE PROBE position for 10 seconds until the Auto Seeker starts to rotate upward. Feed the cable carefully back and forth in untangled layers . Switch the PRC to STOP once the probe is in the full UP position.

Take care that the probe head is not dragged along the ground as the Auto Seeker rewinds.

# 6.0 Troubleshooting

| | |
|---|---|
| **Problem** | **System doesn't power up when System Power switch is turned ON.** |
| **Possible Causes & Solutions** | 1. Make sure Control Box is connected to the power source.<br>2. Check for issues with the power source. |
| **Problem** | **System powers up, but pump won't run.** |
| **Possible Causes & Solutions** | 1. Probe Cable is not plugged in or is broken.<br>- Check that Probe cable connectors are properly and securely connected at both the Control Box I/O panel and at the Auto Seeker.- Inspect entire length of Probe Cable for signs of damage.<br>2. If the Product Tank lamp is ON:<br>- Make sure the Product Tank is not full<br>- Make sure Product Tank sensor is connected to Control Box<br>- Make sure the Pump contacts are seated firmly against probe contacts. (Remove end cap from probe and push pump up in probe using your thumb; then test system)<br>- Make sure the Pump is operating correctly. (Replace pump and try TEST SYSTEM on PRC switch). |
| **Problem** | **Probe stops before reaching interface, or when raising probe, Auto Seeker stops before being fully rewound on reel**. |
| **Possible Causes & Solutions** | Auto Seeker rotation and probe product tubing are not synchronized. To correct, See Section 5 on page 76. |
| **Problem** | **High Limit sensor is not sensing water, or probe moves to the bottom of the well.** |
| **Possible** | 1. Make sure there is enough water in the well for the Magnum to operate. There must be at least 3" of water in the well below the |

| | |
|---|---|
| **Causes & Solutions** | product.<br>2. Make sure the System is properly grounded. See page 18.<br>3. Make sure that the probe cable is not damaged or disconnected.<br>4. Make sure that the sensor bands in the probe head are not fouled. If needed, See page 67. |
| **Problem** | **Pump runs but no product is pumped.** |
| **Possible Causes & Solutions** | 1. Make sure there is enough product in the well for the Magnum to operate. There must be at approximately ½ inch (12mm) of product present.<br>2. Make sure that neither the pump intake nor filter screen is clogged. See page 67.<br>3. Make sure that the Interface clearance has not been set too high by checking the settings on dipswitches S4-3 & S4-4. See page 44.<br>4. Make sure that the product discharge tubing is not clogged or frozen.<br>Make sure the Pump is operating correctly. (Replace pump and try TEST SYSTEM on PRC switch). |
| **Problem** | **Pump runs briefly, but then cuts off prematurely.** |
| **Possible Causes & Solutions** | 1. Make sure Interface Clearance is not set too high. Check dipswitches S4-3 & 4. See page 44.<br>2. Make sure Pump Unload Cutoff setting is not too high. Check dipswitches S3-3 & 4. See page 44. |
| **Problem** | **System was cycling, but now appears to be inactive.** |
| **Possible Causes & Solutions** | If the cycle function is set on automatic (dipswitches S4-1 & 2), Magnum Spill Buster will automatically extend the pump delay time to match the recharge rate of the well. This delay can be as long as six hours between cycles. To see if system is still functioning properly, run TEST SYSTEM on PRC switch (See page 41) to see if pump will run. After the pump runs for 10 secs, STOP the system, and then push the PRC switch to the “Auto” setting. If it is operating properly, the System should then go through a cycle. |

| | |
|---|---|
| **Problem** | **PROCESSOR lamp on Control Panel does not light.** |
| **Possible Causes & Solutions** | 1. If the System is otherwise operating as expected, it is possible that the LED bulb is simply burned out.<br>2. If the System is not operating properly, the unlit Processor lamp indicates a problem with the logic board. Please call the factory to report the issue. |

| | |
|---|---|
| **Problem** | **AUTO SEEKER does not raise.** |
| **Possible Causes & Solutions** | 1. Make sure that the Auto Seeker cable is connected to the Control Box and shows no sign of damage.<br>2. Make sure that the System has not been set in DNAPL mode by checking that dipswitch S2-1 is not set. See page 46. |

| | |
|---|---|
| **Problem** | **Processor Lamp on Control panel blinks on and off and the System is not cycling** |
| **Possible Causes & Solutions** | 1. The Pump may have experienced an overload. Make sure that neither the pump intake nor filter screen is clogged. See page 67.<br>2. The pump circuit may be stuck open, possibly due to a failed pump. Replace pump and try TEST SYSTEM on PRC switch.<br>3. Make sure that the probe cable is connected to the Control Box. |

# 7.0 System Specifications

**Complete Magnum Spill Buster™ System includes:** Magnum Spill Buster™ Control Box, Magnum Spill Buster™ Probe with 50' down well cable, Auto Seeker with 30' cable, and Product Tank Shutoff Probe with 30' cable, and 50 ft. Nylon Product Discharge Tubing.

**Input Power:** 115vac or 230vac, 100 watts max. or 24vdc, 75 watts max. with optional battery cable and deep discharge batteries. A 5 amp AC circuit breaker is built into the System Power switch.

**Operating Temperature Range:** Ambient air temperature of -40F to +140F (-40C to 60C).

**Pumping Rate:** up to 46 gal/hr (175 liter/hr) @ 0 psi (zero depth & no discharge back pressure), or up to 37 gal/hr (140 liter/hr) @ 25 psi discharge back pressure.

**Product Viscosity:** Products with viscosity of less than 10 Cp at 70 degrees F. Examples: gasoline, diesel fuel, #2 heating oil, JP-4, JP-5, paint thinners.

**Well Diameter:** 2 inch minimum for product recovery only.

**Standard Well Depth:** 50 ft.(15.2m.) max

**Maximum Well Depth:** 150 ft (45.7 m) on special order with 150 ft (45.7m) down-well cable.

## Probe

The Probe is certified compliant with NEC2011 specifications for use in Class 1, Div 1 locations. DC power for the pump is supplied using a conductor pair that has an over woven metal shield along with a Tefzel overcoat. The signal wires also have a separate over woven metal shield. The two cable bundles, along with the discharge tubing, are contained in a tough woven plastic protective scuff jacket.
**Probe Dimensions:** 1.93" (4.9cm) dia. x 15.25" (38.7cm) long [cable size including the discharge tube is 5/8" thickness x 1 1/2' width]. Standard Probe cable length is 50 ft. (15.2m)

## Control Box

Certified IS barriers are wired into the Probe and Override circuits in the Control Box in order to make them compliant with NEC2011 specifications.
**Dimensions & Weight:** 14" (36cm) wide x 23" (59cm) high x 6" (15.4cm) deep. An additional 10" is required below for cable exit and an additional 14" is required in front and to the left for door swing. Weight: 25 lbs. (11.34 kg)

## Standard Auto Seeker

The Standard Auto Seeker is not rated for use in hazardous locations.
**Dimensions & Weight** (with 50' probe attached)**:** 14" (36cm) wide and deep; 20" tall (15.8cm). Weight: 32 lbs. (14.51 kg)

## Optional Explosion Proof Auto Seeker

The Explosion Proof Auto Seeker is certified compliant with NEC2011 specifications for use in Class 1 Div 1 locations. Connections to all cabling now have positive threaded Mil-Spec circular connectors.
**Dimensions & Weight** (with 50'probe attached)**:** 52 lbs. (23.59 kg)
**Minimum Well Head Clearance for EXPLOSION PROOF AUTO SEEKER:** 28"x24"x24" Deep (71 cm x 61 cm x 61 cm deep). **(Does not apply to Standard Auto Seeker, which must be mounted outside of any classified hazardous areas)**

## Optional Explosion Proof Enclosure for the Control Box

The Explosion Proof enclosure is certified compliant with NEC2011 specifications for use in Class 1 Div 1 locations. Comes with the control box mounted in a certified XP enclosure and includes three XP cable feed through fittings with Chico® seals.
**Dimensions & Weight:** 29" (73.66cm) tall; 11' (27.9cm) deep; 18' (45.7cm) wide, with an additional 18" required in front and to the left for door swing and an additional 10" (25.4cm) required below for cable exit. Weight (with Control Box mounted inside): 210 lbs. (95.25 kg)

## Optional Explosion Proof Enclosure AC Power Switch

This feature provides a convenient AC power switch mounted directly to the XP control box enclosure to enable the Spill Buster to be turned on and off at the box instead of back at the AC main power panel.

## Standard Extension Cable length: 30 ft (9.1m) from Control Box to well head.

## Override Product Tank Probe: Threads into a standard 2" barrel bung. Standard cable length is 30 ft (9.1m)

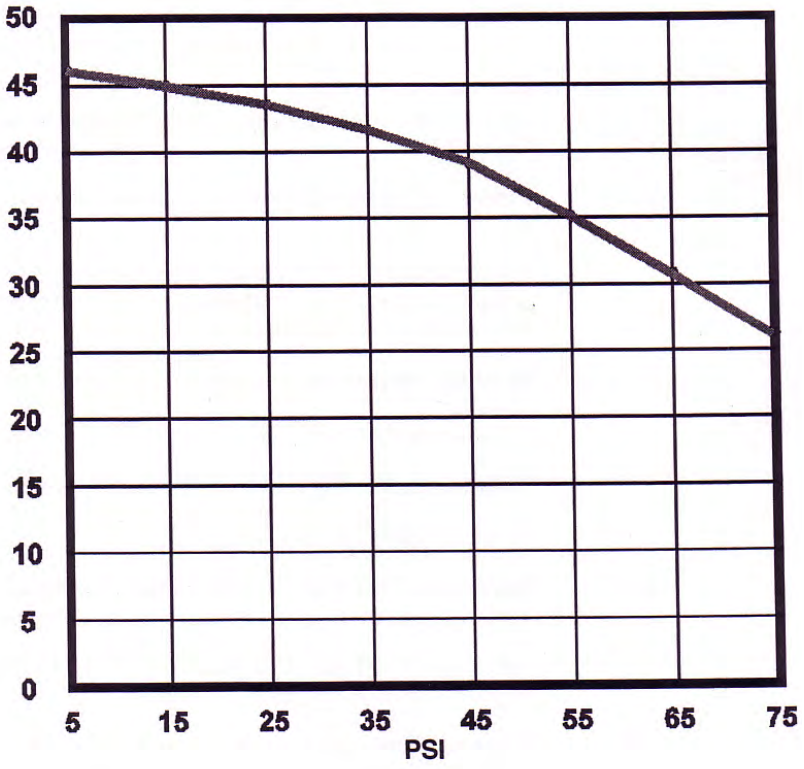
## Total System Shipping Weight:

Complete Standard Magnum System – aprox. 68 lbs. (30.84 kg)

Complete Magnum System with Explosion Proof Auto Seeker- aprox. 92 lbs. (41.73 kg)

Complete Explosion Proof Magnum System- aprox. 277 lbs. (125.65 kg) (includes Exp. Enclosure for Control Box)

## Magnum Spill Buster Pump Performance



# 8.0 Equipment Decontamination Procedures

Prior to return to Clean Earth Technology, Inc., all equipment must be thoroughly cleaned and decontaminated. Please follow your organization's prescribed decontamination procedures, and also carefully observe each step of the following procedure. During decontamination, make sure personnel are wearing the appropriate protective clothing and observing all safety precautions.

1. REMOVE PUMP- (See page 69). Remove pump, wipe off with absorbent cloth or paper towel, clean the filter, and seal parts in a plastic bag to send with your system.
2. REMOVE PROBE FROM AUTO SEEKER- (See page 76). Unwind the probe tubing from the Auto Seeker reel and disconnect the discharge hose and Slim-line connectors.
3. Depending on the individual requirements for your site, you may need a container to catch the waste for this step. Hold the probe upright and pour several gallons of hot soapy water through it. (Alconox, Simple Green, or other similar detergents work well).
4. Place the entire probe and tubing in a large tub with enough hot soapy water to cover the entire probe assembly. Soak for several hours or overnight.
5. Remove the probe from the tub and rinse with clean fresh water . Using a garden hose with an attachment, flush several gallons of water through the probe tube and the tubing (as in step 3).
6. Remove all remaining fluid left in the tubing by gravity: starting at the probe tube end, hold the tubing over your head and pass the entire tubing through your hands, holding it high all the while.
7. Wipe off the outside of the tubing with a dry absorbent cloth or towels. Push a clean rag into the end of the probe tube and secure a plastic bag around the end of the probe to contain any possible remaining leakage.
8. Wipe down the Auto Seeker reel with a cloth and hot soapy water.
9. If you have not already done so, call CET at (802) 425-3710 to request an RMA number AND an RMA form, if needed.
10. ***Completely*** fill out the RMA form. If at all possible, fax the form to us or scan it to attach to an email so that our service department has it ahead of your equipment's arrival. Make sure to include a copy with your return- preferably in a packing slip pouch on the outside of the box, or else placed inside the box.
11. Pack the equipment with care to ship to CET. If possible, use the custom foam box set that came with the system; otherwise use sturdy boxes and a generous amount of packing material. MAKE SURE that the RMA number is clearly written on the outside of all boxes. **CET reserves the right to refuse delivery of any equipment without a CET RMA number clearly displayed on the exterior of the package(s).**

# 9.0 Equipment Return Policy

Any equipment return must be authorized by Clean EarthTechnology (CET) prior to shipment. Call or FAX CET. A Return Material Autorization (RMA) number will be issued upon receipt of your request to return parts or equipment. An "RMA Number/ REPAIR ORDER" form must be completed by the user and the RMA number should appear on the form along with reasons for the return. Your shipment to CET must have the RMA number clearly marked on the outside of each packaged item.

**This policy applies to both equipment sales and repair orders. For a Return Material Authorization, please call our Service Department at (802) 425-3710.**

**Clean Earth Technology, Inc.**
**Environmental Equipment Return Policy**

This Policy refers to any equipment or parts being returned to Clean Earth Technology (CET), whether:

- Customer owned, leased or rented.
- In warranty or out of warranty.

NO equipment or parts should be shipped to CET without first contacting our service department for a **Return Materials Authorization number (RMA).** Contact our service department at (802) 425-3710 to be assigned an RMA number.

- CET reserves the right to refuse delivery of any equipment without an RMA number clearly displayed on the the package(s).
- CET reserves the right to refuse delivery of any equipment improperly decontaminated.
- CET reserves the right to add a fee of $500.00 to the repair invoice of any equipment or parts not decontaminated to the satisfaction of CET.

Environmental Equipment Return Guidelines:

- All equipment must be thoroughly cleaned, purged of product and decontaminated prior to shipment to CE, as detailed in Section 8 of this manaul- Equipment Decontamination Procedures. NOTE: CET recommends the use of Personal Protective Equipment, level C or D, as defined in OSHA 29 CFR 1910.120.

Any equipment or parts shipped to CET must include the following documentation:

- CET RMA/Repair Order form fully completed by customer, including description/name of product pumped, and the reason for the return.
- The CET RMA number clearly marked on the outside of ALL packages and paperwork.

# Return Materials Authorization Form

**RMA Number: _____**

Customer Name and Address:

_____

_____

_____

_____

Phone Number:_____

Fax Number:_____

**Clean Earth Technology, Inc.**
**445 Long Point Road**
**N. Ferrisburgh, VT 05473**
**T: (802) 425-3710 F: (802) 425-2896**

Date: _____

Contact Name:_____

Contact Email:_____

| Qty. | Items Being Returned (eg. Auto Seeker, Cables, etc.) | Serial Number(s) |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

Reason for Return:

_____

_____

_____

_____

Type of product(s) this equipment has been used to pump: _____

System Decontamination Date:_____

The undersigned confirms that the equipment or parts being returned to Clean Earth Technology have been properly and thoroughly decontaminated **using the approved procedure described on page 2 of this document.**

Name _____ *Signed:_____

(printed)

***No evaluation or repair work will be performed unless this form is signed.**

**Clean Earth Technology (CET) reserves the right to add a fee of $500.00 to the repair of any equipment or parts not decontaminated to the satisfaction of CET.**

**Clean Earth Technology, Inc.**
**Environmental Equipment Return Policy**

This policy refers to any equipment or parts being returned to Clean Earth Technology (CET), whether customer owned, leased, or rented; in warranty or out of warranty. NO equipment or parts should be shipped to CET without first contacting our service department for a **Return Materials Authorization Number (RMA)**. Contact our service department at **(802) 425-3710** to be assigned an RMA number.

- **CET reserves the right to refuse delivery of any equipment without a CET RMA number clearly displayed on the exterior of the package(s).**
- **CET reserves the right to refuse delivery of any equipment improperly decontaminated.**
- **CET reserves the right to add a fee of $500.00 to the repair invoice of any equipment or parts not decontaminated to the satisfaction of CET.**

**Environmental Equipment Return Guidelines**

- All equipment must be thoroughly cleaned, purged of product and decontaminated prior to shipment to CET. **NOTE: CET recommends the use of Personal Protective Equipment, Level C or D, as defined in OSHA 29 CFR 1910.120.**
- Any equipment or parts shipped to CET must include this RMA form, **completely** filled out by the customer; and the CET RMA number clearly marked on the outside of all packages and paperwork.

## Equipment Decontamination Procedure For the Magnum Spill Buster

(Also found in Section 8 of the manual)

The following procedures are aimed at protecting people and the environment from potential contact with hazardous materials. **Please be aware that CET reserves the right to refuse delivery of any equipment improperly decontaminated. CET also reserves the right to add a fee of $500.00 to the repair invoice of any equipment or parts not decontaminated to the satisfaction of CET.**

Please follow your organization's prescribed decontamination procedures, and then carefully observe each step of the following procedure prior to shipping anything back to CET (check each step off as you go). During decontamination, make sure personnel are wearing the appropriate protective clothing and observing all safety precautions.

CALL CET AT (802) 425-3710 FOR ASSISTANCE IF YOU HAVE ANY QUESTIONS ABOUT ANY PART OF THIS PROCEDURE.

12. _____ REMOVE PUMP- (See "Removing the Product Pump"- page 69- in Chapter 5- "Maintenance Operations" in the manual). Remove pump, wipe off with absorbent cloth or paper towel, clean the filter, and seal parts in a plastic bag to send with your system.
13. _____ REMOVE PROBE FROM AUTO SEEKER- (See "Removing the Probe from the Reel" – page 76 in Chapter 5- "Maintenance Operations" in the manual). Unwind the probe tubing from the Auto Seeker reel and disconnect the discharge hose and slimline connectors.
14. _____ Depending on the individual requirements for your site, you may need a container to catch the waste for this step. Hold the probe upright and pour several gallons of hot soapy water through it. (Alconox, Simple Green, or other similar detergents work well).
15. _____ Place the entire probe and tubing in a large tub with enough hot soapy water to cover the entire probe assembly. Soak for several hours or overnight.
16. _____ Remove the probe from the tub and rinse with clean fresh water . Using a garden hose with an attachment, flush several gallons of water through the probe tube and the tubing (as in step 3).
17. _____ Remove all remaining fluid left in the tubing by gravity: starting at the probe tube end, hold the tubing over your head and pass the entire tubing through your hands, holding it high all the while.
18. _____ Wipe off the outside of the tubing with a dry absorbent cloth or towels. Push a clean rag into the end of the probe tube and secure a plastic bag around the end of the probe to contain any possible remaining leakage.

Clean Earth Technology
North Ferrisburgh
VT 05473-7089

# Clean Earth Technology

## *Introducing*
# The High Viscosity Magnum Spill Buster



Clean Earth Technology's newest system is a turnkey automatic product recovery system that takes our time-proven Magnum Spill Buster to a new level of effective groundwater remediation performance in pumping NAPLS as thick as #6 oils.

We've found a way to adapt our unique sensing technology to work with standard pneumatic pumps, such as the Geotech Keck PRS and the QED 1301 Leachate pump. These new pneumatic probes include the same patented Alpha-Array sensing technology used in the Magnum Spill Buster system that keeps the pump intake positioned in the product layer. This reduces to the absolute minimum the amount of water that may be pumped.



### *The pneumatic probe features:*

⇨ The ability to pump high viscosity oils such as #6.

⇨ The potential for long cable runs, up to 1000' (305 m.), using our unique Down Well Solenoid (requires 4" well).

⇨ The capability to pump up to 150 vertical feet (46 m.).

⇨ The versatility to recover both LNAPL (using the Geotech Keck PRS pump) and DNAPL, (using the QED 1301 Leachate pump).

**CET's new system offers you the versatility to purchase a complete turnkey system, or a kit to retrofit a pneumatic pump you already own.**

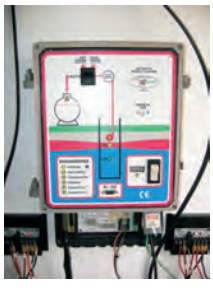
If we have not yet adapted our sensors to your particular pump model, we welcome the opportunity to do so- just contact us.



Sensor Module



Auto Seeker Reel



Control Panel

**Clean Earth Technology, Inc.**

445 Long Point Road N. Ferrisburgh, VT 05473

www.cleanearth.biz *T: 802-425-3710*

**FRANÇAIS : PAGE 21**
**ESPAÑOL: PÁGINA 41**

# Instruction manual

# Pancake Compressor




C2002

**IMPORTANT**

*Please make certain that the person who is to use this equipment carefully reads and understands these instructions before starting operations.*

The Model and Serial No. plate is located on the main housing of the tool. Record these numbers in the spaces below and retain for future reference.

Model No. _____

Type _____

Serial No. _____

To learn more about Porter-Cable visit our website at:

**http://www.porter-cable.com**

PORTER✦CABLE®

Copyright © 2006 Porter-Cable

Part No. **A15414**-1206-0

# TABLE OF CONTENTS

SAFETY GUIDELINES-DEFINITIONS . . . . . 2
IMPORTANT SAFETY INSTRUCTIONS. . . . . 2-8
SPECIFICATIONS . . . . . 8
GLOSSARY . . . . . 8
DUTY CYCLE. . . . . 9
ASSEMBLY . . . . . 9
INSTALLATION. . . . . 9-10
OPERATION. . . . . 11-13
MAINTENANCE . . . . . 13-14
SERVICE AND ADJUSTMENTS . . . . . 14-15
STORAGE . . . . . 16
SERVICE . . . . . 16
ACCESSORIES . . . . . 16
TROUBLESHOOTING GUIDE . . . . . 17-19
WARRANTY . . . . . 20
FRANÇAIS . . . . . 21-40
ESPAÑOL. . . . . 41-59

# SAFETY GUIDELINES - DEFINITIONS

This manual contains information that is important for you to know and understand. This information relates to protecting **YOUR SAFETY** and **PREVENTING EQUIPMENT PROBLEMS**. To help you recognize this information, we use the symbols below. Please read the manual and pay attention to these symbols.

| | |
|---|---|
| **⚠DANGER: Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.** | **⚠CAUTION: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.** |
| **⚠WARNING: Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.** | **CAUTION: Used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.** |

# IMPORTANT SAFETY INSTRUCTIONS

**⚠WARNING:** Some dust created by power sanding, sawing, grinding, drilling, and other construction activities contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm. Some example of these chemicals are:

- **lead from lead-based paints**
- **crystalline silica from bricks and cement and other masonry products**
- **arsenic and chromium from chemically-treated lumber**

**Your risk from these exposures varies, depending on how often you do this type of work. To reduce your exposure to these chemicals: work in a well ventilated area, and work with approved safety equipment, always wear OSHA/MSHA/NIOSH approved, properly fitting face mask or respirator when using such tools.**

**When using air tools, basic safety precautions should always be followed to reduce the risk of of personal injury.**

**⚠WARNING: This product contains chemicals, including lead, known to the State of California to cause cancer, and birth defects or other reproductive harm. Wash hands after handling.**

**⚠WARNING: Do not operate this unit until you read and understand this instruction manual for safety, operation and maintenance instructions.**



## SAVE THESE INSTRUCTIONS

| HAZARD | |
|---|---|
|  **⚠DANGER: RISK OF EXPLOSION OR FIRE** | |
| **What can happen** | **How to prevent it** |
| • It is normal for electrical contacts within the motor and pressure switch to spark. | • Always operate the compressor in a well ventilated area free of combustible materials, gasoline, or solvent vapors. |
| • If electrical sparks from compressor come into contact with flammable vapors, they may ignite, causing fire or explosion. | • If spraying flammable materials, locate compressor at least 20 feet (6.1 m) away from spray area. An additional length of air hose may be required.<br>• Store flammable materials in a secure location away from compressor. |
| • Restricting any of the compressor ventilation openings will cause serious overheating and could cause fire. | • Never place objects against or on top of compressor.<br>• Operate compressor in an open area at least 12" (304.8 mm) away from any wall or obstruction that would restrict the flow of fresh air to the ventilation openings.<br>• Operate compressor in a clean, dry well ventilated area. Do not operate unit indoors or in any confined area. |
| • Unattended operation of this product could result in personal injury or property damage. To reduce the risk of fire, do not allow the compressor to operate unattended. | • Always remain in attendance with the product when it is operating.<br>• Always turn off and unplug unit when not in use. |

## HAZARD



**⚠DANGER: RISK TO BREATHING (ASPHYXIATION)**

| What can happen | How to prevent it |
|---|---|
| • The compressed air directly from your compressor is not safe for breathing. The air stream may contain carbon monoxide, toxic vapors, or solid particles from the air tank. Breathing these contaminant's can cause serious injury or death. | • Air obtained directly from the compressor should never be used to supply air for human consumption. In order to use air produced by this compressor for breathing, suitable filters and in-line safety equipment must be properly installed. In-line filters and safety equipment used in conjunction with the compressor must be capable of treating air to all applicable local and federal codes prior to human consumption. |
| • Sprayed materials such as paint, paint solvents, paint remover, insecticides, weed killers, may contain harmful vapors and poisons. | • Work in an area with good cross ventilation. Read and follow the safety instructions provided on the label or safety data sheets for the materials you are spraying. Always use certified safety equipment: OSHA/MSHA/NIOSH respiratory protection designed for use with your specific application. |

## HAZARD



**⚠WARNING: RISK OF BURSTING**

**Air Tank:** The air tank on your Air Compressor is designed and may be UM coded (for units with air tanks greater than 6 inch diameter) according to ASME Section VIII, Div. 1 rules. All pressure vessels should be inspected once every two years. To find your state pressure vessels inspector, look under the Division of Labor and Industries in the government section of a phone book .

The following conditions could lead to a weakening of the air tank, and result in a violent air tank explosion:

| What can happen | How to prevent it |
|---|---|
| • Failure to properly drain condensed water from air tank, causing rust and thinning of the steel air tank. | • Drain air tank daily or after each use. If air tank develops a leak, replace it immediately with a new air tank or replace the entire compressor. |
| • Modifications or attempted repairs to the air tank. | • Never drill into, weld, or make any modifications to the air tank or its attachments. Never attempt to repair a damaged or leaking air tank. Replace with a new air tank. |

| | |
|---|---|
| • Unauthorized modifications to the safety valve or any other components which control air tank pressure. | • The air tank is designed to withstand specific operating pressures. Never make adjustments or parts substitutions to alter the factory set operating pressures. |
| **Attachments & accessories:** | |
| • Exceeding the pressure rating of air tools, spray guns, air operated accessories, tires, and other inflatables can cause them to explode or fly apart, and could result in serious injury. | • Follow the equipment manufacturers recommendation and never exceed the maximum allowable pressure rating of attachments. Never use compressor to inflate small low pressure objects such as children's toys, footballs, basketballs, etc. |

## HAZARD



**⚠WARNING: RISK OF ELECTRICAL SHOCK**

| What can happen | How to prevent it |
|---|---|
| • Your air compressor is powered by electricity. Like any other electrically powered device, If it is not used properly it may cause electric shock. | • Never operate the compressor outdoors when it is raining or in wet conditions.<br>• Never operate compressor with protective covers removed or damaged. |
| • Repairs attempted by unqualified personnel can result in serious injury or death by electrocution. | • Any electrical wiring or repairs required on this product should be performed by authorized service center personnell in accordance with national and local electrical codes. |
| • **Electrical Grounding:** Failure to provide adequate grounding to this product could result in serious injury or death from electrocution. Refer to "Grounding Instructions" paragraph in the "Installation" section. | • Make certain that the electrical circuit to which the compressor is connected provides proper electrical grounding, correct voltage and adequate fuse protection. |

## HAZARD



**⚠WARNING: RISK FROM FLYING OBJECTS**

| What can happen | How to prevent it |
|---|---|
| • The compressed air stream can cause soft tissue damage to exposed skin and can propel dirt, chips, loose particles, and small objects at high speed, resulting in property damage or personal injury. | • Always wear certified safety equipment: ANSI Z87.1 eye protection (CAN/CSA Z94.3) with side shields when using the compressor.<br>• Never point any nozzle or sprayer toward any part of the body or at other people or animals.<br>• Always turn the compressor off and bleed pressure from the air hose and air tank before attempting maintenance, attaching tools or accessories. |

## HAZARD



**⚠WARNING: RISK OF HOT SURFACES**

| What can happen | How to prevent it |
|---|---|
| • Touching exposed metal such as the compressor head, engine head, engine exhaust or outlet tubes, can result in serious burns. | • Never touch any exposed metal parts on compressor during or immediately after operation. Compressor will remain hot for several minutes after operation.<br>• Do not reach around protective shrouds or attempt maintenance until unit has been allowed to cool. |

## HAZARD



**⚠WARNING: RISK FROM MOVING PARTS**

| What can happen | How to prevent it |
|---|---|
| • Moving parts such as the pulley, flywheel, and belt can cause serious injury if they come into contact with you or your clothing. | • Never operate the compressor with guards or covers which are damaged or removed.<br>• Keep your hair, clothing, and gloves away from moving parts. Loose clothes, jewelry, or long hair can be caught in moving parts.<br>• Air vents may cover moving parts and should be avoided as well. |

| | |
|---|---|
| • Attempting to operate compressor with damaged or missing parts or attempting to repair compressor with protective shrouds removed can expose you to moving parts and can result in serious injury. | • Any repairs required on this product should be performed by autHorized service center personnell. |

**HAZARD**




**⚠WARNING: RISK OF UNSAFE OPERATION**

| What can happen | How to prevent it |
|---|---|
| • Unsafe operation of your air compressor could lead to serious injury or death to you or others. | • Review and understand all instructions and warnings in this manual.<br>• Become familiar with the operation and controls of the air compressor.<br>• Keep operating area clear of all persons, pets, and obstacles.<br>• Keep children away from the air compressor at all times.<br>• Do not operate the product when fatigued or under the influence of alcohol or drugs. Stay alert at all times.<br>• Never defeat the safety features of this product.<br>• Equip area of operation with a fire extinguisher.<br>• Do not operate machine with missing, broken, or unauthorized parts. |

**HAZARD**



**⚠WARNING: RISK OF FALLING**

| What can happen | How to prevent it |
|---|---|
| • A portable compressor can fall from a table, workbench, or roof causing damage to the compressor and could result in serious injury or death to the operator. | • Always operate compressor in a stable secure position to prevent accidental movement of the unit. Never operate compressor on a roof or other elevated position. Use additional air hose to reach high locations. |

| HAZARD | |
|---|---|
|  **⚠CAUTION: RISK FROM NOISE** | |
| **What can happen** | **How to prevent it** |
| • Under some conditions and duration of use, noise from this product may contribute to hearing loss. | • Always wear certified safety equipment: ANSI S12.6 (S3.19) hearing protection. |
| **SAVE THESE INSTRUCTIONS FOR FUTURE USE** | |

## SPECIFICATIONS

| **Model No.** | **C2002** |
|---|---|
| Bore | 1.875" |
| Stroke | 1.250" |
| Voltage-Single Phase | 120 |
| Minimum Branch Circuit Requirement | 15 amps |
| Fuse Type | Time Delay |
| Air Tank Capacity (Gallon) | 6 |
| Approximate Cut-in Pressure | 120 PSIG |
| Approximate Cut-out Pressure | 150 PSIG |
| SCFM @ 40 PSIG | 3.7 |
| SCFM @ 90 PSIG | 2.6 |

## GLOSSARY

Become familiar with these terms before operating the unit.

**CFM:** Cubic feet per minute.

**SCFM:** Standard cubic feet per minute; a unit of measure of air delivery.

**PSIG:** Pounds per square inch gauge; a unit of measure of pressure.

**Code Certification:** Products that bear one or more of the following marks: UL, CUL, ETL, CETL, have been evaluated by OSHA certified independent safety laboratories and meet the applicable Underwriters Laboratories Standards for Safety.

**Cut-In Pressure:** While the motor is off, air tank pressure drops as you continue to use your accessory. When the tank pressure drops to a certain low level the motor will restart automatically. The low pressure at which the motor automatically restarts is called "cut-in" pressure.

**Cut-Out Pressure:** When an air compressor is turned on and begins to run, air pressure in the air tank begins to build. It builds to a certain high pressure before the motor automatically shuts off - protecting your air tank from pressure higher than its capacity. The high pressure at which the motor shuts off is called "cut-out" pressure.

**Branch Circuit:** Circuit carrying electricity from electrical panel to outlet.

# DUTY CYCLE

This air compressor pump is capable of running continuously. However, to prolong the life of your air compressor, it is recommended that a 50%-75% average duty cycle be maintained; that is, the air compressor pump should not run more than 30-45 minutes in any given hour.

# ASSEMBLY

**Unpacking**

1. Remove unit from carton and discard all packaging.

# INSTALLATION

## HOW TO SET UP YOUR UNIT

**Location of the Air Compressor**

- Locate the air compressor in a clean, dry and well ventilated area.
- The air compressor should be located at least 12" (30 cm) away from the wall or other obstructions that will interfere with the flow of air.
- The air compressor pump and shroud are designed to allow for proper cooling. The ventilation openings on the compressor are necessary to maintain proper operating temperature. Do not place rags or other containers on or near these openings.

## GROUNDING INSTRUCTIONS

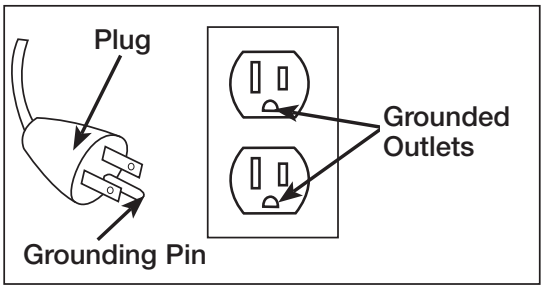
**⚠WARNING: Risk of Electrical Shock. In the event of a short circuit, grounding reduces the risk of shock by providing an escape wire for the electric current. This air compressor must be properly grounded.**

The portable air compressor is equipped with a cord having a grounding wire with an appropriate grounding plug (see following illustrations).

1. The cord set and plug with this unit contains a grounding pin. This plug MUST be used with a grounded outlet.

**IMPORTANT:** The outlet being used must be installed and grounded in accordance with all local codes and ordinances.

2. Make sure the outlet being used has the same configuration as the grounded plug. **DO NOT USE AN ADAPTER.** See illustration.




3. Inspect the plug and cord before each use. Do not use if there are signs of damage.
4. If these grounding instructions are not completely understood, or if in doubt as to whether the compressor is properly grounded, have the installation checked by a qualified electrician.

**⚠DANGER: Risk of Electrical Shock. IMPROPER GROUNDING CAN RESULT IN ELECTRICAL SHOCK.**

**Do not modify the plug provided. If it does not fit the available outlet, a correct outlet should be installed by a qualified electrician.**

**Repairs to the cord set or plug MUST be made by a qualified electrician.**

## Extension Cords

If an extension cord must be used, be sure it is:

- a 3-wire extension cord that has a 3-blade grounding plug, and a 3-slot receptacle that will accept the plug on the product
- in good condition
- no longer than 50 feet
- 14 gauge (AWG) or larger. (Wire size increases as gauge number decreases. 12 AWG and 10 AWG may also be used. DO NOT USE 16 OR 18 AWG.)

**CAUTION: The use of an undersized extension cord will cause voltage to drop resulting in power loss to the motor and overheating. Instead of using an extension cord, increase the working reach of the air hose by attaching another length of hose to its end. Attach additional lengths of hose as needed.**

## Voltage and Circuit Protection

Refer to the specification chart for the voltage and minimum branch circuit requirements.

**CAUTION: Risk of Operation. Certain air compressors can be operated on a 15 amp circuit if the following conditions are met.**

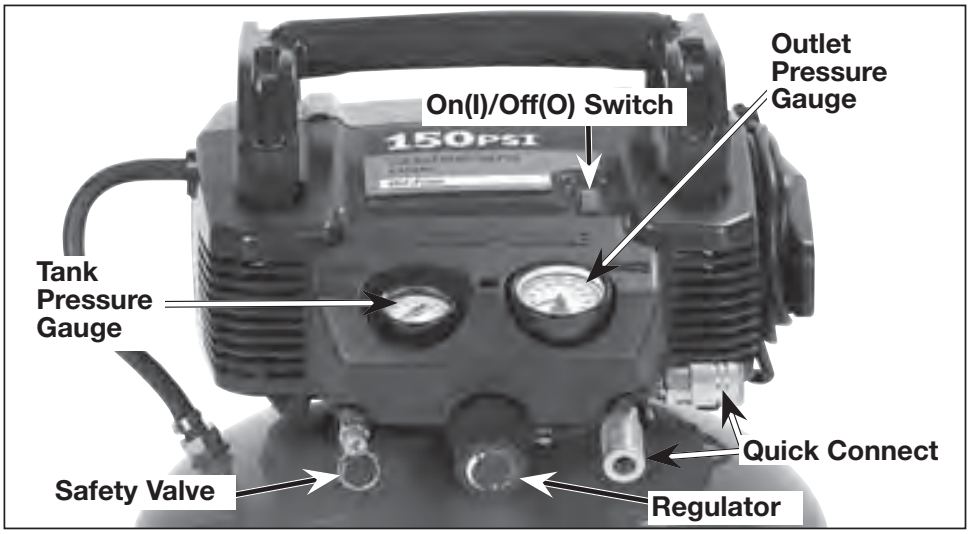
1. Voltage supply to circuit must comply with the National Electrical Code.
2. Circuit is not used to supply any other electrical needs.
3. Extension cords comply with specifications.
4. Circuit is equipped with a 15 amp circuit breaker or 15 amp time delay fuse. **NOTE:** If compressor is connected to a circuit protected by fuses, use only time delay fuses. Time delay fuses should be marked "D" in Canada and "T" in the US.

If any of the above conditions cannot be met, or if operation of the compressor repeatedly causes interruption of the power, it may be necessary to operate it from a 20 amp circuit. It is not necessary to change the cord set.

# OPERATION

## Know Your Air Compressor

READ THIS OWNER'S MANUAL AND SAFETY RULES BEFORE OPERATING YOUR UNIT. Compare the illustrations with your unit to familiarize yourself with the location of various controls and adjustments. Save this manual for future reference.




## Description of Operation

Become familiar with these controls before operating the unit.

**On(I)/Off(O) Switch**: Place this switch in the ON (I) position to provide automatic power to the pressure switch and OFF (O) to remove power at the end of each use.

**Pressure Switch (not shown):** The pressure switch automatically starts the motor when the air tank pressure drops below the factory set "cut-in" pressure. It stops the motor when the air tank pressure reaches the factory set "cut-out" pressure.

**Safety Valve:** If the pressure switch does not shut off the air compressor at its "cut-out" pressure setting, the safety valve will protect against high pressure by "popping out" at its factory set pressure (slightly higher than the pressure switch "cut-out" setting).

**Tank Pressure Gauge:** The tank pressure gauge indicates the reserve air pressure in the tank.

**Outlet Pressure Gauge:** The outlet pressure gauge indicates the air pressure available at the outlet side of the regulator. This pressure is controlled by the regulator and is always less than or equal to the tank pressure.

**Regulator:** Controls the air pressure shown on the outlet pressure gauge. Turn regulator knob clockwise to increase pressure and counterclockwise to decrease pressure.

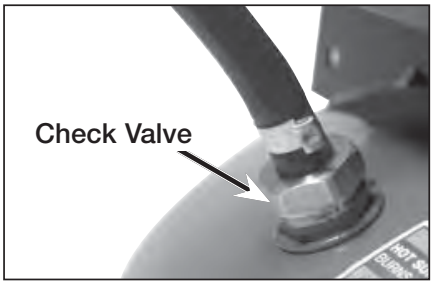
**Cooling System (not shown):** This compressor contains an advanced design cooling system. At the heart of this cooling system is an engineered fan. It is perfectly normal for this fan to blow air through the vent holes in large amounts. You know that the cooling system is working when air is being expelled.

**Air Compressor Pump (not shown):** Compresses air into the air tank. Working air is not available until the compressor has raised the air tank pressure above that required at the air outlet.

**Drain Valve:** The drain valve is located at the base of the air tank and is used to drain condensation at the end of each use.




**Check Valve:** When the air compressor is operating, the check valve is "open", allowing compressed air to enter the air tank. When the air compressor reaches "cut-out" pressure, the check valve "closes", allowing air pressure to remain inside the air tank.




## HOW TO USE YOUR UNIT

**How to Stop:**

1. Set the On/Auto/Off lever to "Off".

**Before Starting**

**⚠WARNING: Do not operate this unit until you read and understand this instruction manual for safety, operation and maintenance instructions.**

**Break-in Procedure**

**⚠CAUTION: Risk of Unsafe Operation. Serious damage may result if the following break-in instructions are not closely followed.**

This procedure is required **before** the air compressor is put into service and when the check valve or a complete compressor pump has been replaced.

1. Make sure the On/Auto/Off lever is in the "Off" position.
2. Plug the power cord into the correct branch circuit receptacle. (Refer to Voltage and Circuit Protection paragraph in the Installation section of this manual.)
3. Open the drain valve (counterclockwise) fully to permit air to escape and prevent air pressure build up in the air tank during the break-in period.
4. Move the On/Auto/Off lever to "On/Auto" position. The compressor will start.
5. Run the compressor for 15 minutes. Make sure the drain valve is open and there is minimal air pressure build-up in tank.
6. After 15 minutes, close the drain valve by turning clockwise. The air receiver will fill to "cut-out" pressure and the motor will stop.

The compressor is now ready for use.

**Before Each Start-Up**

1. Place On/Auto/Off lever to "Off".
2. Turn the regulator knob counterclockwise to set the outlet pressure to zero.
3. Visually inspect air hose, replace if needed.
4. Attach hose and accessories.
   **NOTE:** The hose or accessory will require a quick connect plug if the air outlet is equipped with a quick connect socket.

**⚠WARNING: Risk of Bursting. Too much air pressure causes a hazardous risk of bursting. Check the manufacturer's maximum pressure rating for air tools and accessories. The regulator outlet pressure must never exceed the maximum pressure rating.**

**⚠CAUTION: Risk of unsafe operation. Compressed air from the unit may contain water condensation and oil mist. Do not spray unfiltered air at an item that could be damaged by moisture. Some air tools and accessories may require filtered air. Read the instructions for the air tools and accessories.**

**How to Start**

1. Turn the On/Auto/Off lever to "On/Auto" and allow tank pressure to build. Motor will stop when tank pressure reaches "cut-out" pressure.
2. Turn regulator knob clockwise to increase pressure and stop when desired pressure is reached.

The compressor is ready for use.

# MAINTENANCE

## Customer Responsibilities

| | Before each use | Daily or after each use |
|---|---|---|
| Check Safety Valve | ● | |
| Drain Tank | | ● |

**⚠WARNING: Risk of Unsafe Operation. Unit cycles automatically when power is on. When servicing, you may be exposed to voltage sources, compressed air, or moving parts. Before servicing unit unplug or disconnect electrical supply to the air compressor, bleed tank of pressure, and allow the air compressor to cool.**

To ensure efficient operation and longer life of the air compressor, a routine maintenance schedule should be prepared and followed. The above routine maintenance schedule is geared to an air compressor in a normal working environment operating on a daily basis. If necessary, the schedule should be modified to suit the conditions under which your air compressor is used. The modifications will depend upon the hours of operation and the working environment. Compressors in an extremely dirty and/or hostile environment will require a greater frequency of all maintenance checks.

**NOTE:** See "Operation" section for the location of controls.

## TO CHECK SAFETY VALVE

**⚠WARNING: Risk of Bursting. If the safety valve does not work properly, over-pressurization may occur, causing air tank rupture or an explosion.**

**⚠WARNING: Risk from Flying Objects.** Always wear certified safety equipment: ANSI Z87.1 eye protection (CAN/CSA Z94.3) with side shields

1. Before starting compressor, pull the ring on the safety valve to make sure that the safety valve operates freely. If the valve is stuck or does not operate smoothly, it must be replaced with the same type of valve.

## To Drain Tank

**⚠WARNING: Risk of Unsafe Operation. Risk from noise. Air tanks contain high pressure air. Keep face and other body parts away from outlet of drain. Use safety glasses when draining as debris can be kicked up into face. Use ear protection (ANSI S12.6 (S3.19) hearing protection) as air flow noise is loud when draining.**

**NOTE:** All compressed air systems generate condensate that accumulates in any drain point (e.g., tanks, filter, aftercoolers, dryers). This condensate contains lubricating oil and/or substances which may be regulated and must be disposed of in accordance with local, state, and federal laws and regulations.

1. Set the On/Auto/Off lever to "Off" and unplug unit.

2. Turn the regulator knob counter-clockwise to set the outlet pressure to zero.
3. Remove the air tool or accessory.
4. Pull ring on safety valve allowing air to bleed from the tank until tank pressure is approximately 20 psi. Release safety valve ring.
5. Drain water from air tank by opening drain valve (counter-clockwise) on bottom of tank.

**⚠WARNING: Risk of Bursting. Water will condense in the air tank. If not drained, water will corrode and weaken the air tank causing a risk of air tank rupture.**

**⚠CAUTION: Risk of Property Damage. Drain water from air tank may contain oil and rust which can cause stains.**

6. After the water has been drained, close the drain valve (clockwise). The air compressor can now be stored.

**NOTE:** If drain valve is plugged, release all air pressure. The valve can then be removed, cleaned, the reinstalled.

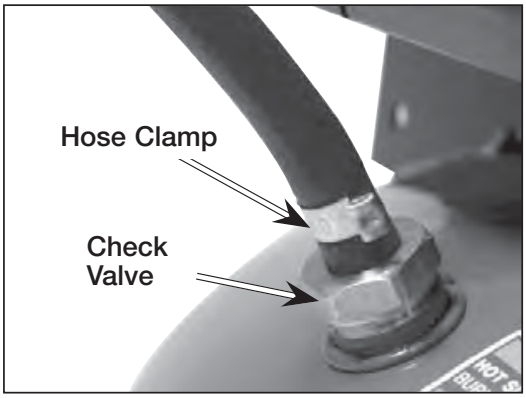
# SERVICE AND ADJUSTMENTS

ALL MAINTENANCE AND REPAIR OPERATIONS NOT LISTED MUST BE PERFORMED BY TRAINED SERVICE TECHNICIAN.

**⚠WARNING: Risk of Unsafe Operation. Unit cycles automatically when power is on. When servicing, you may be exposed to voltage sources, compressed air, or moving parts. Before servicing unit unplug or disconnect electrical supply to the air compressor, bleed tank of pressure, and allow the air compressor to cool.**

## TO REPLACE OR CLEAN CHECK VALVE

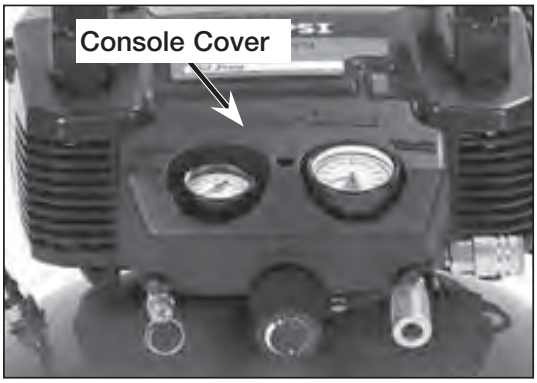
1. Release all air pressure from air tank. See "To Drain Tank" in the Maintenance section.
2. Unplug unit.
3. Remove the hose by removing the hose clamp. **NOTE:** The hose clamp is not reusable. You must purchase a new hose clamp, see the Parts List Manual or purchase a standard hose clamp at a local hardware store.



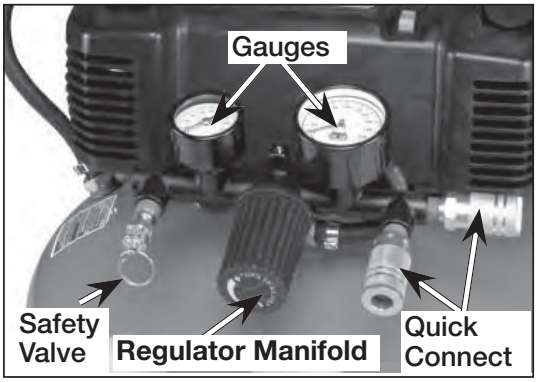

4. Unscrew the check valve (turn counter-clockwise) using a socket wrench.
5. Make sure the valve disc moves freely inside the check valve and the spring holds the disc in the upper, closed position. The check valve may be cleaned with a solvent, such as paint and varnish remover.
6. Apply sealant to the check valve threads. Reinstall the check valve (turn clockwise).
7. Replace hose and new hose clamp.
8. Perform the Break-in Procedure. See "Break-in Procedure" in the Operation section.

## TO REPLACE REGULATOR

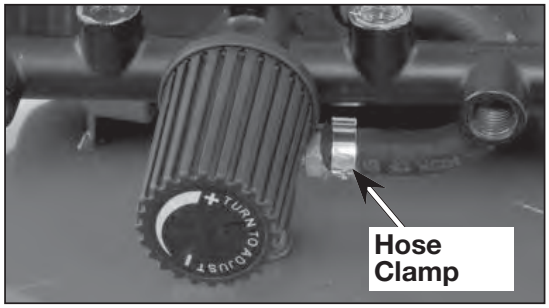
1. Release all air pressure from air tank. See "To Drain Tank" in the Maintenance section.
2. Unplug unit.
3. Remove the console cover.



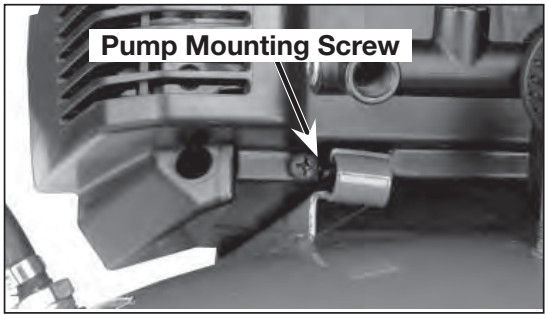

4. Using an adjustable wrench or specified wrench remove the gauges (7/16" wrench), quick connect (13/16" wrench), and safety valve (9/16" wrench) from the regulator manifold.



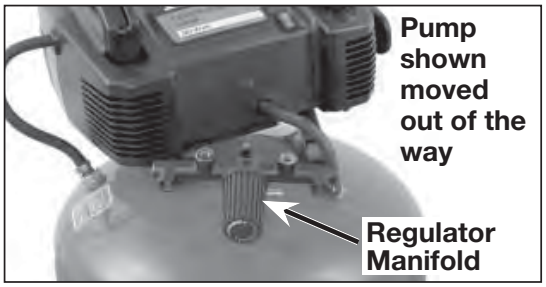

5. Remove the hose by removing the hose clamp. **NOTE:** The hose clamp is not reusable. You must purchase a new hose clamp, see the Parts List Manual or purchase a standard hose clamp at a local hardware store.




6. Remove pump mounting screws securing pump (one on each side).




7. Carefully slide pump from brackets and out of the way.




8. Using an adjustable wrench or 5/8" wrench remove the regulator manifold.
9. Apply pipe sealant to new regulator manifold and assemble, tighten with wrench.
10. Reapply pipe sealant to gauges, quick connect, and safety valve.
11. Reassemble all components in reverse order of removal. Make sure to orient gauges to read correctly and use wrenches to tighten all components.

# STORAGE

Before you store the air compressor, make sure you do the following:

1. Review the "Maintenance" section on the preceding pages and perform scheduled maintenance as necessary.
2. Set the On/Off switch to OFF (O) and unplug unit.
3. Turn the regulator counterclockwise and set the outlet pressure to zero.
4. Remove the air tool or accessory.
5. Pull ring on safety valve allowing air to bleed from the tank until tank pressure is approximately 20 psi. Release safety valve ring.
6. Drain water from air tank by opening drain valve on bottom of tank.

**⚠WARNING: Risk of Bursting. Water will condense in the air tank. If not drained, water will corrode and weaken the air tank causing a risk of air tank rupture.**

7. After the water has been drained, close drain valve by turning clockwise.

**NOTE:** If drain valve is plugged, release all air pressure. The valve can then be removed, cleaned, then reinstalled.

8. Wrap electrical cord onto the cord wrap.
9. Protect the air hose from damage (such as being stepped on or run over).
10. Store the air compressor in a clean and dry location.

# SERVICE

### REPLACEMENT PARTS

Use only identical replacement parts. For a parts list or to order parts, visit our website at **servicenet.porter-cable.com**. You can also order parts from your nearest factory-owned branch, or by calling our **Customer Care Center** at 1-888-848-5175 to receive personalized support from highly-trained technicians.

### FREE WARNING LABEL REPLACEMENT

If your warning labels become illegible or are missing, call **(888)-848-5175** for a free replacement.

### SERVICE AND REPAIRS

All quality tools will eventually require servicing and/or replacement of parts. For information about Porter-Cable, its factory-owned branches, or an Authorized Warranty Service Center, visit our website at **www.porter-cable. com or call our Customer Care Center** at (888)-848-5175. All repairs made by our service centers are fully guaranteed against defective material and workmanship. We cannot guarantee repairs made or attempted by others.

You can also write to us for information at PORTER-CABLE, 4825 Highway 45 North, Jackson, Tennessee 38305 - Attention: Product Service. Be sure to include all of the information shown on the nameplate of your tool (model number, type, serial number, etc.).

# ACCESSORIES

A complete line of accessories is available from your Porter-Cable•Delta Supplier, Porter-Cable•Delta Factory Service Centers, and Porter-Cable Authorized Service Stations. Please visit our Web Site **www.porter-cable. com** for a catalog or for the name of your nearest supplier.

**⚠WARNING Since accessories other than those offered by Porter-Cable•Delta have not been tested with this product, use of such accessories could be hazardous. For safest operation, only Porter-Cable•Delta recommended accessories should be used with this product.**

# TROUBLESHOOTING

**⚠WARNING: Performing repairs may expose voltage sources, moving parts or compressed air sources. Personal injury may occur. Prior to attempting any repairs, unplug the air compressor and bleed off all air tank air pressure.**

| PROBLEM | CAUSE | CORRECTION |
|---|---|---|
| Excessive tank pressure - safety valve pops off. | Pressure switch does not shut off motor when compressor reaches "cut-out" pressure. | Move On/Auto/Off lever to the "Off" position, if the outfit does not shut off contact a Trained Service Technician. |
| | Pressure switch "cut-out" too high. | Contact a Trained Service Technician. |
| Air leaks at fittings. | Tube fittings are not tight enough. | Tighten fittings where air can be heard escaping. Check fittings with soapy water solution. **Do Not Overtighten.** |
| Air leaks in air tank or at air tank welds. | Defective air tank. | Air tank must be replaced. Do not repair the leak. **⚠WARNING: Do not drill into, weld or otherwise modify air tank or it will weaken. The tank can rupture or explode.** |
| Air leaks between head and valve plate. | Leaking seal. | Contact a Trained Service Technician. |
| Air leak from safety valve. | Possible defect in safety valve. | Operate safety valve manually by pulling on ring. If valve still leaks, it should be replaced. |
| Knocking Noise. | Possible defect in safety valve. | Operate safety valve manually by pulling on ring. If valve still leaks, it should be replaced. |

| PROBLEM | CAUSE | CORRECTION |
|---|---|---|
| Pressure reading on the regulated pressure gauge drops when an accessory is used. | It is normal for "some" pressure drop to occur. | If there is an excessive amount of pressure drop when the accessory is used, adjust the regulator following the instructions in the "Description of Operation" paragraph in the "Operation Section. **NOTE:** Adjust the regulated pressure under flow conditions (while accessory is being used). |
| Compressor is not supplying enough air to operate accessories. | Prolonged excessive use of air. | Decrease amount of air usage. |
| | Compressor is not large enough for air requirement. | Check the accessory air requirement. If it is higher than the SCFM or pressure supplied by your air compressor, you need a larger compressor. |
| | Hole in hose. | Check and replace if required. |
| | Check valve restricted. | Remove and clean, or replace. |
| | Air leaks. | Tighten fittings. |
| Regulator knob has continuous air leak. | Damaged regulator. | Replace. |
| Regulator will not shut off air outlet. | Damaged regulator. | Replace. |

| PROBLEM | CAUSE | CORRECTION |
|---|---|---|
| Motor will not run. | Fuse blown, circuit breaker tripped. | Check fuse box for blown fuse and replace as necessary.<br>Reset circuit breaker.<br>Do not use a fuse or circuit breaker with higher rating than that specified for your particular branch circuit.<br><br>Check for proper fuse. You should use a time delay fuse.<br><br>Check for low voltage problem.<br><br>Check the extension cord.<br><br>Disconnect the other electrical appliances from circuit or operate the compressor on its own branch circuit. |
| | Extension cord is wrong length or gauge. | Check the extension cord. |
| | Loose electrical connections. | Check wiring connection inside terminal box. |
| | Faulty motor. | Have checked by a Trained Service Technician. |

# LIMITED WARRANTY

**PORTER-CABLE** warrants to the original purchaser that all products covered under this warranty are free from defects in material and workmanship. Products covered under this warranty include air compressors, air tools, service parts, pressure washers, and generators, which have the following warranty periods:

**3 YEARS** - Limited warranty on 2-stage oil-free air compressor pumps that operate at 1725 RPM.

**2 YEARS** - Limited warranty on oil-lubricated air compressor pumps.

**1 YEAR -** Limited warranty on all other air compressor components.

**2 YEARS** - Limited warranty on electric generator alternators.

**1 YEAR** - Limited warranty on other generator components.

**2 YEARS** - Limited warranty on pneumatic air tools as described in Porter-Cable general catalog.

**1 YEAR** - Limited warranty on pressure washers used in consumer applications (i.e. personal residential household usage only).

**90 DAY** - Pressure washers used for commercial applications (income producing) and service parts.

**1 YEAR** - Limited warranty on all accessories.

**Porter-Cable** will repair or replace, at **Porter-Cable'**s option, products or components which have failed within the warranty period. Service will be scheduled according to the normal work flow and business hours at the service center location, and the availability of replacement parts. All decisions of **Porter-Cable** with regard to this limited warranty shall be final.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

**RESPONSIBILITY OF ORIGINAL PURCHASER (initial User):**

- To process a warranty claim on this product, DO NOT return it to the retailer. The product must be evaluated by a **Porter-Cable** Authorized Warranty Service Center. For the location of the nearest **Porter-Cable** Authorized Warranty Service Center call 1-888-848-5175, 24 hours a day, 7 days a week.
- Retain original cash register sales receipt as proof of purchase for warranty work.
- Use reasonable care in the operation and maintenance of the product as described in the Owners Manual(s).
- Deliver or ship the product to the nearest **Porter-Cable** Authorized Warranty Service Center. Freight costs, if any, must be paid by the purchaser.
- Air compressors with 60 and 80 gallon tanks will be inspected at the site of installation. Contact the nearest **Porter-Cable** Authorized Warranty Service Center that provides on-site service calls, for service call arrangements.
- If the purchaser does not receive satisfactory results from the **Porter-Cable** Authorized Warranty Service Center, the purchaser should contact Porter-Cable.

**THIS WARRANTY DOES NOT COVER:**

- Merchandise sold as reconditioned, used as rental equipment, and floor or display models.
- Merchandise that has become damaged or inoperative because of ordinary wear, misuse*, cold, heat, rain, excessive humidity, freeze damage, use of improper chemicals, negligence, accident, failure to operate the product in accordance with the instructions provided in the Owners Manual(s) supplied with the product, improper maintenance, the use of accessories or attachments not recommended by **Porter-Cable**, or unauthorized repair or alterations.

  * An air compressor that pumps air more than the recommended duty cycle during a one hour period may be considered misuse.
- Repair and transportation costs of merchandise determined not to be defective.
- Costs associated with assembly, required oil, adjustments or other installation and start-up costs.
- Expendable parts or accessories supplied with the product which are expected to become inoperative or unuseable after a reasonable period of use, including but not limited to sanding disks or pads, saw and shear blades, grinding stones, springs, chisels, nozzles, o-rings, air jets, washers and similar accessories.
- Merchandise sold by **Porter-Cable** which has been manufactured by and identified as the product of another company, such as gasoline engines. The product manufacturer's warranty, if any, will apply.
- **ANY INCIDENTAL, INDIRECT OR CONSEQUENTIAL LOSS, DAMAGE, OR EXPENSE THAT MAY RESULT FROM ANY DEFECT, FAILURE OR MALFUNCTION OF THE PRODUCT IS NOT COVERED BY THIS WARRANTY**. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.
- **IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO ONE YEAR FROM THE DATE OF ORIGINAL PURCHASE.** Some states do not allow limitations on how long an implied warranty lasts, so the above limitations may not apply to you.

PORTER✦CABLE®

***Porter-Cable***

*Jackson, TN USA*

The following are PORTER-CABLE trademarks for one or more power tools and accessories: a gray and black color scheme; a ✦ “four point star” design; and three contrasting/outlined longitudinal stripes. The following are also trademarks for one or more Porter-Cable and Delta products: Les éléments ci-dessous sont des marques de commerce des outils et des accessoires de PORTER-CABLE : un agencement de couleurs grise et noire; un motif d’ « étoile à quatre pointes » ✦ et trois bandes longitudinales contrastantes/à contours. Les marques suivantes sont également des marques de commerce se rapportant à un ou plusieurs produits Porter-Cable ou Delta : Las siguientes son marcas comerciales PORTER-CABLE que distinguen a una o más herramientas y accesorios: un gráfico de color gris y negro; un diseño de ✦ “estrella de cuatro puntas” y tres franjas longitudinales contrastantes/ delineadas. Las siguientes también son marcas comerciales para uno o más productos de Porter-Cable y Delta: 2 BY 4®, 890™, Air America®, AIRBOSS™, Auto-Set®, B.O.S.S.®, Bammer®, Biesemeyer®, Builders Saw®, Charge Air®, Charge Air Pro®, CONTRACTOR SUPERDUTY®, Contractor's Saw®, Delta®, DELTA®, Delta Industrial®, DELTA MACHINERY & DESIGN™, Delta Shopmaster and Design®, Delta X5®, Deltacraft®, DELTAGRAM®, Do It. Feel It.®, DUAL LASERLOC AND DESIGN®, EASY AIR®, EASY AIR TO GO™, ENDURADIAMOND®, Ex-Cell®, Front Bevel Lock®, Get Yours While the Sun Shines®, Grip to Fit®, GRIPVAC™, GTF®, HICKORY WOODWORKING®, Homecraft®, HP FRAMER HIGH PRESSURE®, IMPACT SERIES™, Innovation That Works®, Jet-Lock®, Job Boss®, Kickstand®, LASERLOC®, LONG-LASTING WORK LIFE®, MAX FORCE™, MAX LIFE®, Micro-Set®, Midi-Lathe®, Monsoon®, MONSTER-CARBIDE™, Network®, OLDHAM®, Omnijig®, PC EDGE®, Performance Crew™, Performance Gear®, Pocket Cutter®, Porta-Band®, Porta-Plane®, Porter Cable®, Porter-Cable Professional Power Tools®, Powerback®, POZI-STOP™, Pressure Wave®, PRO 4000®, Proair®, Quicksand and Design®, Quickset II®, QUIET DRIVE TECHNOLOGY™, QUIET DRIVE TECHNOLOGY AND DESIGN™, Quik-Change®, QUIK-TILT®, RAPID-RELEASE™, RAZOR®, Redefining Performance®, Riptide®, Safe Guard II®, Sand Trap and Design®, Sanding Center®, Saw Boss®, Shop Boss®, Sidekick®, Site Boss®, Speed-Bloc®, Speedmatic®, Stair Ease®, Steel Driver Series®, SUPERDUTY®, T4 & DESIGN®, THE AMERICAN WOODSHOP®, THE PROFESSIONAL EDGE®, Thin-Line®, Tiger Saw®, TIGERCLAW®, TIGERCLAW AND DESIGN®, Torq-Buster®, TRU-MATCH®, T-Square®, Twinlaser®, Unifence®, Uniguard®, UNIRIP®, UNISAW®, UNITED STATES SAW®, Veri-Set®, Versa-Feeder®, VIPER®, VT™, VT RAZOR™, Water Driver®, WATER VROOM®, Waveform®, Whisper Series®, X5®, YOUR ACHIEVEMENT. OUR TOOLS.®

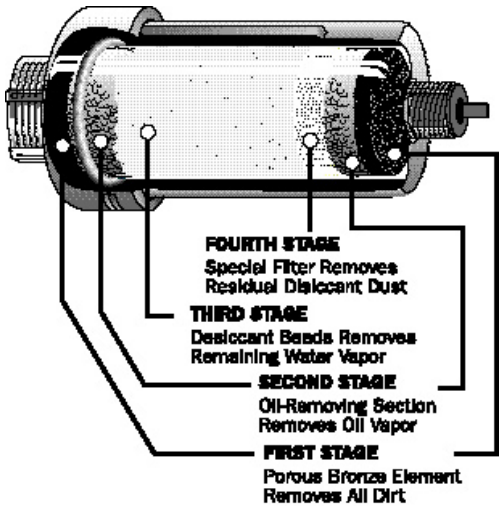
Trademarks noted with ® are registered in the United States Patent and Trademark Office and may also be registered in other countries. Other trademarks may apply. Les marques de commerce suivies du symbole ® sont enregistrées auprès du United States Patent and Trademark Office et peuvent être enregistrées dans d’autres pays. D’autres marques de commerce peuvent également être applicables. Las marcas comerciales con el símbolo ® están registradas en la Oficina de patentes y marcas comerciales de Estados Unidos (United States Patent and Trademark Office), y también pueden estar registradas en otros países. Posiblemente se apliquen otras marcas comerciales registradas.

PORTER✦CABLE®

4825 Highway 45 North
Jackson, TN 38305
(888)-848-5175
**www.porter-cable.com**

## DISPOSABLE IN-LINE FILTER/DRYER

Maximum Flow Capacity: 15 CFM
Maximum Pressure: 125 PSI
Maximum Temperature: 130°F




WARNING: This device will collect moisture which could freeze and rupture the unit if used below 32(F.

### GENERAL INSTRUCTIONS

This disposable filter/dryer is designed to remove oil aerosols and any moisture that might by-pass your current air filtration system. It will provide dry air during its life, but is not designed to replace your current air filtration system.

### INSTALLATION

The DFD-10 is equipped with a 1/4" NPT (F) & (M) ports and can be installed in either direction. When installing the filter/dryer hand tighten to a leak proof seal. Do not use any mechanical means to hold the filter/dryer and do not over torque the threads.

### OPERATION

1. The unique feature of the filter/dryer design allows you to visually see when it is time to install a new DFD-10 by observing the color change from the original dark color to a complete light transparent color in the desiccant beads.

2. Do not attempt to clean the filter/dryer as the use of solvents, ketones, etc., will adversely affect the plastic housing.

3. Keep the hose free of snags. Extra tension on the filter/dryer assembly could break the unit at the connecting ports. To clear stuck hoses, grasp hose below the filter/dryer.

# *Critical Equipment Inspection and Testing Checklist*

Reason for Inspection: _____ Date: _____ Time: _____

Name: _____

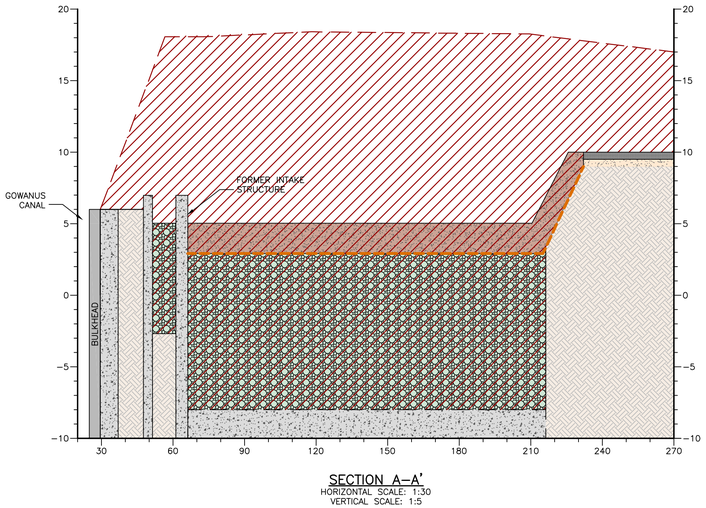
Reasons for Completing Critical Equipment Inspection Checks:

- Initial system start-up
- System re-start following temporary shutdown (does not include routine O&M shutdown)
- Immediately following any significant system modifications
- Manufacturer recommended inspection interval
- Quarterly Inspection
- Other (detail above)

| **Critical Equipment** | **MW-3** | | | | |
|---|---|---|---|---|---|
| Control Panel Electrical Grounds | | | | | |
| Spill Buster High Level Switch | | | | | |
| AST High Level Switch | | | | | |
| Pressure Relief Valve | | | | | |
| | | | | | |
| **Initial when completed** | | | | | |

| **Critical Equipment** | **Inspection Procedure** |
|---|---|
| Control Panel Electrical Grounds | Inspect control panel ground circuit for damage and continuity |
| Spill Buster High Level Switch | With the Spill Buster pump on, manually raise the float switch to the highest position to make sure the pump turns off. Clean and repair or replace float switch as necessary. |
| AST High Level Switch | Actuate switch and ensure the system deactivates |
| Pressure Relief Valve | Pull the spring loaded ring on the pressure relief valve and confirm it is easily removable and replaced without great force |

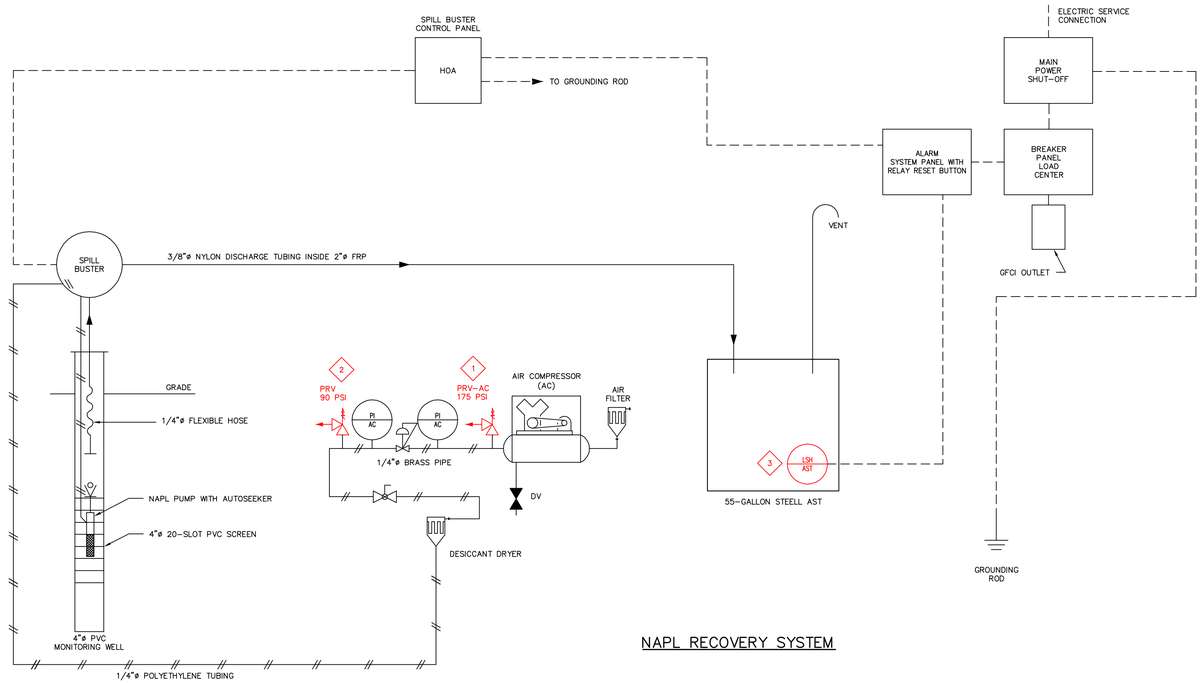
If CE fails, the system should be shut off until the CE component or components are repaired, or a decision to disarm, deactivate or by-pass has been approved.




## SECTION A–A'
HORIZONTAL SCALE: 1:30
VERTICAL SCALE: 1:5

KEY

- DEMARCATION LAYER
- EXTENT OF EXCAVATION
- TYPICAL COVER SYSTEM
- RCA BACKFILL
- EXISTING UNDISTURBED MATERIAL
- SAND LEVELING COARSE
- 3/4 INCH CLEAN STONE
- CONCRETE TOPPING SLAB
- ASPHALT
- EXISTING BRICK WALL OF TURBINE HALL
- TENCATE MIRAFI® 140N FILTER FABRIC




## NAPL RECOVERY SYSTEM

LEGEND

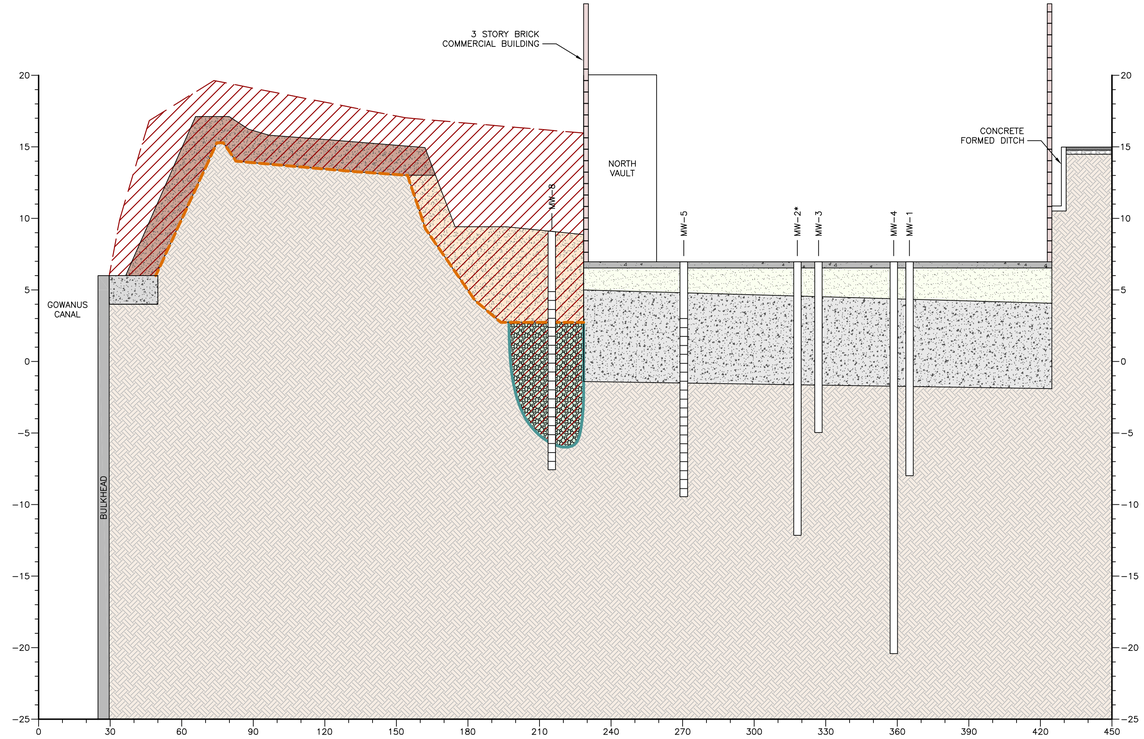
- RECOVERED LNAPL STREAM
- ELECTRICAL/SIGNAL CONDUITS
- PNEUMATIC LINE
- FLEXIBLE HOSE
- REGULATOR
- BALL VALVE
- BALL CHECK VALVE
- AST ABOVEGROUND STORAGE TANK
- FRP FIBRE–REINFORCED PLASTIC
- HOA SELECTOR SWITCH HAND–OFF–AUTO
- GM GALVANIZED
- PSI POUND PER SQUARE INCH
- AC AIR COMPRESSOR
- PVC POLYVINYL CHLORIDE
- LSH HIGH LEVEL SWITCH
- ERW ELECTRIC RECOVERY WELL AND PUMP
- PRV PRESSURE RELIEF VALVE
- NAPL NON–AQUEOUS PHASE LIQUID
- GFCI GROUND–FAULT CIRCUIT INTERRUPTER
- DV DRAIN VALVE
- MW MONITORING WELL

CRITICAL EQUIPMENT SCHEDULE

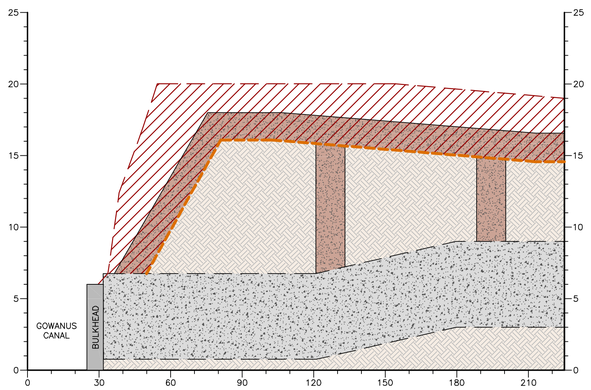
1. AIR COMPRESSOR PRESSURE RELIEF VALVE
2. IN–LINE PRESSURE RELIEF VALVE
3. AST HIGH LEVEL SWITCH

NOTE

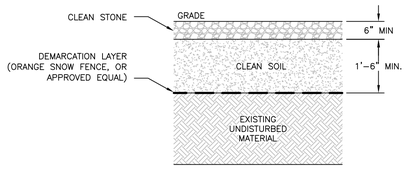
CRITICAL EQUIPMENT SHOWN IN RED.



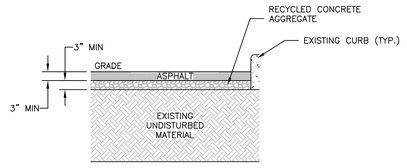

## SECTION B–B'
HORIZONTAL SCALE: 1:30
VERTICAL SCALE: 1:5




## SECTION C–C'
HORIZONTAL SCALE: 1:30
VERTICAL SCALE: 1:5




## 1/4 TYPICAL CLEAN SOIL COVER SYSTEM DETAIL
SCALE: 1"=2'




## 1A/4 TYPICAL ASPHALT COVER SYSTEM DETAIL
SCALE: 1"=2'

| NO. | DATE | REVISION DESCRIPTION | INT. |
|---|---|---|---|
| | | | |

UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF STATE LAW.

THESE DOCUMENTS (OR COPIES OF ANY THEREOF) PREPARED BY OR BEARING THE SEAL OF THE ENGINEER, SHALL NOT BE REUSED FOR ANY EXTENSIONS OF THE PROJECT OR ANY OTHER PROJECT WITHOUT THE WRITTEN CONSENT OF THE ENGINEER.

| | | | |
|---|---|---|---|
| PROJ. ENGINEER: C.M. | | DRAWN BY: J.A.D. | |
| DESIGNED BY: J.K. | | CHECKED BY: C.P. | |
| DRAWING SCALE: AS SHOWN | | PLOT SCALE: 1:1 | |
| DRAWING DATE: 06NOV17 | | PRINT TYPE: COLOR | |
| OFFICE: NY | | PAPER SIZE: ARCH D | |
| PROJECT NO.: 2705.0001Y000 | | | |
| DRAWING FILE: 2705.0001Y181.01.DWG | | | |

Remedial
REMEDIAL ENGINEERING, P.C.
209 Shafter Street
Islandia, New York 11749 (631) 232–2600

PROJECT NAME:
SITE MANAGEMENT PLAN
GOWANUS VILLAGE I, LLC - BROOKLYN, NEW YORK

PROJECT FOR:
BRT POWERHOUSE LLC

TITLE:
CROSS SECTIONS AND DETAILS

FIGURE
4

FIGURE 4 OF 8

V:\CAD\PROJECTS\2705\0001Y\181\2705.0001Y181.01.DWG

# APPENDIX H

Quality Assurance Project Plan

**GOWANUS VILLAGE I, LLC**
**322 3rd AVENUE**
**BROOKLYN, KINGS COUNTY, NEW YORK**

---

# QUALITY ASSURANCE PROTECTION PLAN
**NYSDEC BCP SITE NO. C224099**
**INDEX NO. W2-1069-0506**

Prepared For

Gemini Arts Initiative, Inc.

July 2013

Prepared By:

LBG ENGINEERING SERVICES, P.C.
Professional Environmental & Civil Engineers
110 Corporate Park Drive, Suite 112
White Plains, NY 10604
(914) 695-5711

## TABLE OF CONTENTS


**Page**

1.0 INTRODUCTION ..... 1
1.1 Site Contaminants and Cleanup Objectives ..... 2
1.2 QAPP Structure ..... 3
1.3 Data Quality Objectives and Criteria ..... 4

2.0 PROJECT MANAGEMENT ..... 10
2.1 Project Management Team ..... 10
2.1.1 Field Sampling ..... 10
2.1.2 Field Personnel ..... 11
2.1.3 Laboratories ..... 11
2.1.4 Third Party Data Validator ..... 12
2.1.5 Certifications ..... 13
2.2 Field Data Management ..... 13
2.2.1 Daily Field Sheets ..... 13
2.2.2 Sample Collection Field Sheets (SCFSs) ..... 14
2.2.3 Sample Labeling ..... 15
2.2.4 Electronic (Digital Data) ..... 16
2.2.5 Chain-of-Custody (COC) Documentation ..... 16
2.2.6 Laboratory Data Analytical Reports ..... 18
2.2.7 Project Reports ..... 21
2.2.8 Use of Historic Data ..... 22

3.0 DATA GENERATION AND ACQUISITION ..... 23
3.1 Sampling Process Design ..... 23
3.2 Sampling Methods ..... 23
3.2.1 Soil/Sediment Sampling ..... 25
3.2.1.1 Grab Sampling ..... 26
3.2.1.2 Hand Auger Sampling ..... 26
3.2.1.3 Geoprobe Macrocore Sampling ..... 26
3.2.1.4 Split-Spoon Sampling ..... 27
3.2.2 Groundwater Sampling ..... 27
3.2.3 Soil Gas, Indoor Air, Ambient Air and Effluent Vapor ..... 28
3.2.3.1 Soil Vapor ..... 29
3.2.3.2 Indoor Air ..... 29
3.2.3.3 Outdoor Ambient Air ..... 30
3.2.3.4 (Remediation System) Sampling ..... 30
3.3 Sample Handling and Custody ..... 30
3.3.1 Documentation/Chain-of-Custody ..... 31
3.3.2 Sample Handling ..... 31
3.3.3 Laboratory Chain-of- Custody Procedures ..... 32
3.3.4 Final Evidence File Custody Procedure ..... 32
3.4 Analytical Methods ..... 33
3.4.1 Field Analytical Procedures ..... 33

**TABLE OF CONTENTS**
**(continued)**

**Page**


3.4.2 Laboratory Analytical Procedures ..... 34
3.5 Quality Control ..... 36
3.5.1 Field Quality Control Requirements ..... 36
3.5.2 Laboratory Quality Control Requirements ..... 37
3.6 Instrument/Equipment Testing, Inspection and Maintenance ..... 39
3.6.1 Field Instrumentation ..... 39
3.6.2 Laboratory Instruments ..... 39
3.7 Instrument/Equipment Calibration and Frequency ..... 40
3.7.1 Field Instrument/Equipment Calibration and Frequency ..... 40
3.7.2 Laboratory Instrument/Equipment Calibration and Frequency ..... 40
3.8 Inspection/Acceptance of Supplies and Consumbable ..... 41
3.9 Non-Direct Measurements ..... 41
3.10 Data Management ..... 41

4.0 ASSESSMENT AND OVERSIGHT ..... 42
4.1 Technical System Audits ..... 42
4.1.1 Field Data ..... 43
4.1.2 Reports ..... 43
4.1.3 Laboratory Data ..... 44
4.2 Performance Evaluation Audits ..... 44
4.2.1 Field Performance Evaluation Audits ..... 44
4.2.2 Laboratory Performance Evaluation Audits ..... 44
4.3 Audit Records ..... 46
4.4 Reports to Management ..... 46
4.4.1 Progress Reports ..... 46
4.4.2 QA Reports ..... 47

5.0 DATA VALIDATION AND USABILITY ..... 47
5.1 Data Review, Verification, and Validation ..... 48
5.1.1 Data Review ..... 48
5.1.2 Data Verification ..... 48
5.1.3 Data Validation ..... 48
5.1.4 Data Usability Assessment ..... 49
5.2 Verification and Validation Methods ..... 50
5.2.1 Verification ..... 50
5.2.2 Validation ..... 50
5.2.3 Validation and Verification Procedures ..... 50
5.2.4 Data Assessment ..... 53
5.3 Data Requirement Compliance Evaluation ..... 53
5.3.1 Data Quality Indicators Evaluation Criteria Details ..... 54
5.3.1.1 Precision Assessment ..... 54

**TABLE OF CONTENTS**
**(continued)**

**Page**


5.3.1.2 Accuracy Assessment....55
5.3.1.3 Sample Representativeness....55
5.3.1.4 Completeness Assessment....56
5.3.1.5 Comparability Assessment....56
5.3.1.6 Sensitivity and Quantification Limits....56
5.3.1.7 Sample Bias Assessment....57
5.3.2 Data Limitations and Corrective Actions....57
5.3.2.1 Field Corrective Action....58
5.3.2.2 Laboratory Corrective Action....58
5.3.2.3 Corrective Action During Data Review/Validation and Assessment....58

APPENDICES

**LIST OF APPENDICES**
**(at end of report)**

**Appendix**


| | |
|---|---|
| I | Analytical Laboratories - QA Plans, SOPs and Certifications |
| II | Sample Collection Field Sheet Template |
| III | Sample Chain-of-Custody Form |

**LIST OF TABLES**
**(at end of report)**

**Table**


1 Sample Containers, Preservatives and Holding Times

2 General QA/QC Sample Collection and Analysis Frequency

## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| (J) | Quality Estimated |
| ASP | Analytical Services Protocol |
| ASTM | American Society for Testing and Materials |
| AWQS | Ambient Water Quality Standards |
| CCV | Continuing Calibration Verification |
| CERCLA | Comprehensive Environmental Response, Compensation and Liability Act |
| CFR | Code of Federal Regulation |
| COCs | Contaminants of Concern |
| DOT | Department of Transportation |
| DQA | Data Quality Assessment |
| DQIs | Data Quality Indicators |
| DQOs | Data Quality Objectives |
| DUSR | Data Usability Summary Reports |
| EarthSoft | EarthSoft, Inc. |
| EDD | Electronic Data Deliverable |
| EIMS | Environmental Information Management System |
| ELAP | Environmental Laboratory Accreditation Program |
| EPA | United States Environmental Protection Agency |
| FER | Final Engineering Report |
| GAII | Gemini Arts Initiative, Inc. |
| GC/MS | Gas Chromatography/Mass Spectrometer |
| GPS | Global Positioning System |
| GWPT | Groundwater Pump and Treat System |
| HASP | Health and Safety Plan |
| HAZWOPER | Hazardous Waste Operations and Emergency Response |
| ICAL | Initial Calibration |
| ICV | Initial Calibration Verification |

**ACRONYMS AND ABBREVIATIONS**
**(continued)**

| | |
|---|---|
| IDW | Investigation Derived Waste |
| LBGES/LBG | LBG Engineering Services, P.C./Leggette, Brashears & Graham, Inc. |
| LCS | Laboratory Control Sample |
| LCSD | Laboratory Control Sample Duplicate |
| LOQ | Limit of Quantitation |
| MDL | Method Detection Limit |
| ml/min | Milliliter Per Minute |
| MS | Matrix Spike |
| MSD | Matrix Spike Duplicate |
| NELAC | National Environmental Laboratory Accreditation Conference |
| NYCRR | New York Codes, Rules and Regulations |
| NYS | New York State |
| NYSDEC | New York State Department of Environmental Conservation |
| NYSDOH | New York State Department of Health |
| OQ | Operator Qualifications |
| OSHA | Occupational Safety and Health Administration |
| PCBs | Polychlorinated Biphenyls |
| PDF | Portable Document Format |
| PID | Photoionization Detector |
| QA/QC | Quality Assurance/Quality Control |
| QAO | Quality Assurance Officer |
| QAPP | Quality Assurance Protection Plan |
| QSM | Quality Systems Manual |
| RAOs | Remedial Action Objectives |
| RAWP | Remedial Action Work Plan |
| RL | Reporting Limit |

**ACRONYMS AND ABBREVIATIONS**
**(continued)**

| | |
|---|---|
| RPD | Relative Percent Differences |
| RUSCOs | Restricted Use Soil Cleanup Objectives |
| SCFS | Sample Collection Field Sheets |
| SCGs | Standards, Criteria and Guidance |
| SCOs | Site Cleanup Objectives |
| SOPs | Standard Operating Procedures |
| SSDS | Sub-Slab Depressurization System |
| SVE | Soil-Vapor Extraction |
| SWDA | Safe Drinking Water Act |
| TOGS | Technical and Operational Guidance Series |
| ug/kg | Micrograms Per Kilogram |
| USGS | United States Geological Survey |
| VOC | Volatile Organic Compounds |

**GOWANUS VILLAGE I, LLC**
**322 3rd AVENUE**
**BROOKLYN, KINGS COUNTY, NEW YORK**

# QUALITY ASSURANCE PROTECTION PLAN
**NYSDEC BCP SITE NO. C224099**
**INDEX NO. W2-1069-0506**

## 1.0 INTRODUCTION

This Quality Assurance Protection Plan (QAPP) provides a framework for how environmental characterization samples will be collected to achieve specific project objectives, and describes the procedures that will be implemented to obtain data of known and adequate quality. The QAPP has been prepared as a formal document describing in comprehensive detail the necessary Quality Assurance (QA)/Quality Control (QC) and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. This document includes proposed sampling methods and analytical methods for both characterization sampling and end-point sampling.

This QAPP will provide sufficient detail to demonstrate that:

- the project technical and quality objectives are identified and agreed upon;
- the intended measurements, data generation, or data acquisition methods are appropriate for achieving project objectives;
- assessment procedures are sufficient for confirming that data of the type and quality needed and expected are obtained; and,
- any limitations on the use of the data can be identified and documented.

Most environmental data operations require the coordinated efforts of many individuals, including managers, engineers, scientists, statisticians and others. This QAPP integrates the contributions and requirements of everyone involved into a clear, concise statement of what is to be accomplished, how it will be done, and by whom. It provides understandable instructions to those who must implement the QAPP, such as the field sampling team, the analytical laboratory, modelers, and the data reviewers. In all aspects of the QAPP, the use of national consensus standards and practices are encouraged.

In order to be effective, the QAPP specifies the level or degree of QA and QC activities needed for the particular environmental data operations. Because this will vary according to the purpose and type of work being done, a graded approach will be used in planning the work.

## 1.1 Site Contaminants and Cleanup Objectives

The Site-specific contaminants of concern (COCs) related to the Remedial Action Work Plan (RAWP) include:

1. polychlorinated biphenyls (PCBs);
2. metals;
3. volatile organic compounds (VOCs); and,
4. semivolatile organic compounds (SVOCs).

The onsite work activities will include collection of samples from some or all of the following media at the Site:

| Check All That Apply | Environmental Media |
|---|---|
| | **Air (Ambient, Indoor, and/or Subsurface)** |
| ☑ | Ambient air |
| ☑ | Indoor air |
| ☑ | Soil Vapor |
| ☐ | Sub-slab Soil Vapor |
| ☑ | **Sediment** |
| ☑ | **Sludge** |
| ☑ | **Soil** |
| | **Water** |
| ☐ | Drinking Water |
| ☑ | Groundwater (treated and/or untreated) |
| ☑ | Surface water (treated and/or untreated) |
| ☑ | Wastewater |
| | **Other Media** |
| ☑ | Surface Wipe Samples |

| Check All That Apply | Environmental Media |
|---|---|
| ☑ | Free Product (NAPL) |
| ☑ | Spent Carbon, Organo-Clay, and/or Zeolite |
| ☑ | Spent mitigation materials<br>(e.g., fabric filters, sorbent booms, tyvek, pipe, etc.) |
| ☑ | Spent sampling materials (e.g., gloves, bailer, rope, etc.) |
| ☐ | Other (specify): |

The overall Site Cleanup Objectives (SCOs) applicable to the RAWP are established by the Standards, Criteria & Guidance (SCGs) applicable to each medium sampled as outlined in the following regulatory guidance documents:

- Overall Project Implementation: New York State Department of Environmental Conservation (NYSDEC) DER-10/Technical Guidance for Site Investigation and Remediation;
- Soil/Fill/Sediment: NYSDEC's 6 New York Codes, Rules and Regulations (NYCRR) Part 375 Environmental Remediation Programs, 6 Part 375-6.8: Restricted Use Soil Cleanup Objectives ( RUSCOs) for Restricted Residential;
- Groundwater: NYSDEC's June 1998 Ambient Water Quality Standards (AWQS) and Guidance Values and Groundwater Effluent Limitations in the Technical and Operational Guidance Series (TOGS) 1.1.1; and,
- Soil Vapor: New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York - October 2006.

In the event that an additional/alternative regulatory guidance document is applicable to the SCOs, all substantive requirements will be complied with relative to the performance of the RAWP.

## 1.2 QAPP Structure

The QAPP is composed of elements covering the entire project from planning, through implementation, to assessment. These elements are presented in that order and have been ar-

ranged for convenience into four general groups. The four groups of elements and their intent are summarized as follows:

1. Project Management;
2. Data Generation and Acquisition;
3. Assessment and Oversight; and,
4. Data Validation and Usability.

All applicable elements, including the content and level of detail under each element, are addressed in the QAPP. If an element is not applicable, it will be stated in the QAPP. Documentation, such as the approved RAWP, may be referenced in response to a particular required QAPP element to reduce the size of the QAPP.

## 1.3 Data Quality Objectives and Criteria

Data Quality Objectives (DQOs) are qualitative and quantitative statements that specify the quality of the data that is required to support decisions made during the investigation or mitigation activities. The overall DQOs for this project are:

- to develop and implement procedures for field measurements and sampling, COC, laboratory analysis, and reporting that will provide legally defensible results;
- to define tolerable limits on the probability of making a decision error due to uncertainty in the data; and,
- to assess the adequacy of the data (new or existing) in relation to their intended use.

Data collected during the project will be used to evaluate the immediate and/or long-term risks to human health and the environment from residual onsite contamination, to characterize the magnitude and extent of impacted media, to define areas of concern, and to gauge the effectiveness of clean-up efforts to ensure protection of human health and the environment. The data will be compared to State-specific mandated codes or guidance for risk screening levels and/or corrective action objectives (clean-up criteria) that will be used to monitor risk and remedial progress for the project. A description of the remedial activities, project goals, con-

taminants and media of concern, and Site-specific mandated screening and/or clean-up criteria is presented in the RAWP.

Specific procedures for sampling, COC, laboratory instrument calibration, laboratory analysis, data reporting, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP.

Throughout the remedial project some sampling will be conducted for screening purposes. Data generated from screening samples will be produced by using portable equipment and/or field laboratory analyses. QA activities for the screening will be limited to calibration and periodic checks of the instrumentation. All analytical data will meet the requirements of these sections.

DQOs for field measurements and laboratory analytical data produced during this project will be addressed in terms of data quality indicators (DQIs) such as precision, accuracy, representativeness, completeness, comparability, sensitivity and bias. For each DQI, there are various quality assurance methodologies and objectives for both field data and laboratory data for the project. Meeting the DQOs will require that sampling and measurements are performed using consistent Standard Operating Procedures (SOPs) and standard methods, with properly operated and calibrated equipment, conducted by trained personnel. These project DQIs as well as the quality assurance methodologies and objectives that will apply to each respective DQI are outlined below.

**A. DQI – Precision**

The measure of agreement among repeated measurements of the same property under identical or substantially similar conditions; calculated as either the range or as the standard deviation. Precision may also be expressed as a percentage of the mean of the measurements, such as relative range or relative standard deviation (coefficient of variation).

**1. Field Data Quality Determination Methodologies and Objectives:**

- Collect and measure field blanks and trip blanks and adhere to all sample handling, preservation, and holding time criteria. Sample containers,

preservatives and holding times for each sample matrix and analytical methodology are summarized in table 1.

- Trip blanks are used when VOC analysis is required and are prepared with a sample of reagent grade water from the laboratory. *Every shipping container (e.g., cooler) with aqueous VOC samples will contain a trip blank sample.*
- Field blanks are collected by pouring distilled water over sampling equipment and collecting the effluent in the proper containers. *Field blanks will be collected once per sampling area.*
- Field duplicates are collected by using identical sampling methods from a single sampling location and storing the sample in the proper containers. *Field duplicates will be collected once per sampling area.*

**2. Laboratory Data Quality Determination Methodologies and Objectives:**

- Analysis of a laboratory control sample (LCS)/laboratory control sample duplicate (LCSD), matrix spike (MS)/matrix spike duplicate (MSD) and field duplicate pairs.
- Evaluation of the relative percent differences (RPD) between duplicate pairs (the relative percent difference is calculated by measuring the same sample twice and dividing the difference of those two results by the average of the two results).
- The precision limits are specific for each laboratory and analysis.

**B. DQI – Accuracy**

Accuracy is the measure of the overall agreement of a measurement to a known value; includes a combination of random error (precision) and systematic error (bias) components of both sampling and analytical operations.

**1. Field Data Quality Determination Methodologies and Objectives:**

- Collect and measure field blanks and trip blanks and adhere to all sample handling, preservation, and holding time criteria.
- Trip blanks are used when VOC analysis is required and are prepared with a sample of reagent grade water from the laboratory. *Every shipping container (e.g., cooler) with aqueous VOC samples will contain a trip blank sample.*
- Field blanks are collected by pouring distilled water over sampling equipment and collecting the effluent in the proper containers. *Field blanks will be collected once per sampling area.*

**2. Laboratory Data Quality Determination Methodologies and Objectives:**

- Analysis of analytical spikes and/or reference standards, MS/MSD, LCS, surrogate compounds, or equivalent and the determination of percent recoveries.
- At a minimum, *one sample spike should be included in every set of 20 samples tested on each instrument, for each sample matrix* (e.g., groundwater, soil, etc.) to be tested.

## C. DQI – Representativeness

Representativeness is a qualitative term that expresses "the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition." (ANSI/ASQC 1995)[1]

**1. Field Data Quality Determination Methodologies and Objectives:**

- Ensure that sampling locations were properly selected to provide data representative of Site conditions.
- Follow all sampling and analysis protocols in the QAPP, other project specific work plans, and all pertinent SOPs. These will include the anal-

[1] American National Standards Institute/American Society for Quality Control S2-1995: Introduction to Attribute Sampling

ysis of trip blank and field blank data as well as calibration and documentation review of field instruments.

**2. Laboratory Data Quality Determination Methodologies and Objectives:**

- Following the proper analytical procedures and appropriate analytical methods, adhering to the appropriate sample holding times, and analyzing blanks and duplicates will ensure representativeness.
- The QA goal will be to have all laboratory measurements representative of the samples being analyzed.

## D. DQI – Completeness

Completeness is a measure of the amount of valid data needed to be obtained from a measurement system.

**1. Field Data Quality Determination Methodologies and Objectives:**

- The equation for completeness is presented in Section 5.3.1 of this QAPP.

**2. Laboratory Data Quality Determination Methodologies and Objectives:**

- The equation for completeness is presented in Section 5.3.1 of this QAPP.

## E. DQI – Comparability

Comparability is a qualitative term that expresses the measure of confidence that one data set can be compared to another and can be combined for the decision(s) to be made.

**1. Field Data Quality Determination Methodologies and Objectives:**

- Use standard sampling techniques and strict adherence to the project's SOPs.

**2. Laboratory Data Quality Determination Methodologies and Objectives:**

- Use of similar sampling, preservation, and analytical methods and reporting limits as documented in this QAPP.

- To the extent possible, the same laboratory will be used throughout a specific phase of the project, or for particular types of media to be analyzed.

## F. DQI – Sensitivity

Sensitivity is the capability of a method or instrument to discriminate between measurement responses representing different levels of the variable of interest.

### 1. Field Data Quality Determination Methodologies and Objectives:

- Ensure that the field instrument and/or equipment used is/are utilized within the manufacturer specified sensitivity ranges for the measurements being taken.

### 2. Laboratory Data Quality Determination Methodologies and Objectives:

- Method detection limit (MDL) is defined as the minimum concentration of a substance that can be identified, measured, and reported with a 99 percent confidence that the analyte concentration is greater than zero and is determined from repeated analysis of a sample in a given matrix containing the analyte. Laboratory MDLs have been determined as required in Title 40 of the Code of Federal Regulation (CFR) Part 136B. The reporting limit (RL) is greater than or equal to the lowest standard used to establish the calibration curve. Results greater than the MDL and less than the RL will be qualified estimated (J) by the laboratory. The laboratory analyte reporting parameters (MDLs, RLs and project sensitivity goals) are identified in Appendix I.

## G. DQI - Bias

Bias is the systematic or persistent distortion of a measurement process that causes errors in one direction.

1. **Field Data Quality Determination Methodologies and Objectives:**
   - Ensure that calibration standards have not expired and perform field instrument calibrations per manufacturer recommendations.
2. **Laboratory Data Quality Determination Methodologies and Objectives:**
   - Use reference materials or analyze spiked matrix samples to check for bias (see Accuracy DQI objectives).

## 2.0 PROJECT MANAGEMENT

### 2.1 Project Management Team

The Project Management Team will consist of the associated personnel as outlined in the RAWP. This will include:

- the Site Owner;
- the Site General Contractor;
- Site Owner's Environmental Council;
- Site Remedial Consultant (LBG Engineering Services, P.C. [LBGES]/Leggette, Brashears & Graham, Inc. [LBG]);
  - Principal In Charge;
  - Remedial Engineer;
  - Project Manager;
  - Project Field Supervisor;
  - Health and Safety Officer; and
  - Substitute field personnel.
- Construction Sub-Contractors; and,
- Analytical Laboratories.

#### 2.1.1 Field Sampling

Field sampling activities will consist of air, sediment, soil, sludge, groundwater, surface water and/or spent environmental treatment media sampling within or around the Site. Some sampling activities will require intrusive techniques, such as drilling and/or excavation in

order to obtain representative samples necessary to delineate impacts or to evaluate the adequacy or progress of a particular response action. As such, contractors and personnel completing these activities shall have sufficient knowledge and on-the-job training to follow the procedures required for the activities listed above. Sample collection techniques are included in Section 3.2, below.

### 2.1.2 Field Personnel

All field personnel involved in field observation, analyses and sample collection work will have completed the appropriate Occupational Safety and Health Administration (OSHA) and Hazardous Waste Operations and Emergency Response (HAZWOPER) health and safety training including annual refreshers of the same. Training and record retention requirements are included in the RAWP and Health and Safety Plan (HASP).

All contractors performing onsite work activities will comply with the HASP as well as maintain all insurance certificates as required by Gemini Arts Initiative, Inc. (GAII). Depending on the nature of the work, additional certifications and/or requirements may be required for Contractors. For example, excavation contractors shall comply with the Department of Transportation's (DOT) Operator Qualification (OQ) and applicable requirements.

### 2.1.3 Laboratories

Laboratories utilized for sample analyses associated with the project will be certified to perform the specific analyses using the specified methodologies by the State of New York. When required, all laboratories used will have a current National Environmental Laboratory Accreditation Conference (NELAC) certification. If additional certifications are required for specific analyses, the laboratory certifications will be verified prior to work.

Laboratory requirements for laboratory analysts are listed in the laboratory's QA Plan and/or Quality Systems Manual (QSM) and the laboratory has self-declared compliance with the listed requirements.

Soil, sediment, groundwater, surface water, soil vapor, air, investigation derived waste (IDW) and/or spent environmental treatment media samples will be collected during the project and submitted for laboratory analysis of a number of COCs.

The laboratories to be used for this project are listed below. The QA Plans, SOPs and certifications for each laboratory are presented in Appendix I.

| Laboratory | Address | Contact Person | Phone Number |
|---|---|---|---|
| AMRO Environmental Laboratories Corporation | 111 Herrick Street Merrimack, NH 03054 | Nancy Stewart | (603) 424-2022 |
| American Analytical Laboratories | 56 Toledo Street Farmingdale, NY 11735 | Lori Beyer | (631) 454-6100 |
| Eurofins Lancaster Laboratories, Inc. | 2425 New Holland Pike Lancaster, PA 17601 | Amek Carter | (717) 556-7252 |

Each of these labs is qualified to perform specific analyses required for the project, and is certified by the State of New York. When samples are collected the laboratory will be selected based on capability (qualification to analyze the specific media using the specified method for the parameters requested), available capacity and required turnaround time. To the extent practical, the same laboratory will be utilized to analyze similar sample types throughout the project life-cycle.

A summary of contaminated media expected at the Site as well as the COCs are provided in Section 1.1. A summary of analytical methods are provided in Section 3.4.2 and in detail on table 1.

### 2.1.4 Third Party Data Validator

A Third Party Data Validator will be an independent entity not otherwise involved with the project. Full data validation will be conducted on endpoint confirmation samples (and additional samples where required) in accordance with DER-10 and 6 NYCRR Part 375. Data Usability Summary Reports (DUSR) will be prepared for all selected samples and analytical methods. The Third Party Data Validator will communicate data issues and final validation reports (when required) to the Project Manager for evaluation of any potential corrective ac-

tions and for final reporting. The remaining analytical data will be reported by the laboratory and will be reviewed/validated by the Project Manager.

### 2.1.5 Certifications

All contractors conducting work activities for the project will be licensed and/or certified to complete the specific work activity as required in the State of New York. In addition, some work (such as engineering design, reporting, surveying) may require that individuals overseeing the work also be licensed in their respective field of expertise (e.g., professional engineer, professional land surveyor, professional geologist, etc.) by the State of New York. In these cases, only qualified individuals and/or entities shall conduct the work activities.

## 2.2 Field Data Management

### 2.2.1 Daily Field Sheets

All work completed in the field for the project will be recorded in field logbooks and additionally will be summarized in daily field sheets. Field logbooks will be bound field survey books or notebooks. Entries will be described in as much detail as possible so that a particular situation can be reconstructed without reliance on memory.

Each logbook used at the Site will be dedicated project-specific logbooks, not used on other project sites. The Project Field Supervisor or designee will be responsible for collecting and filing the completed books. The cover page of each logbook will include the Project name and the Project start date.

Entries into the logbook will be made in permanent ink and contain a variety of information, including, but not limited to, the following:

- date, start time, and weather conditions at the beginning of each entry;
- names and purpose of individuals and/or contractors present;
- summary of any critical project-related communications during the field work, including the time, subject matter, decisions or requests made, and personnel involved;
- summary of work being conducted and equipment being used;

- summary of any field calibrations completed or the date in which the instrument was last calibrated;
- records of measurements made and samples collected, including a detailed description of the location and depth (if applicable). Sample locations may include compass and distance measurements or latitude and longitude information obtained by using a global positioning system (GPS); and,
- summary of any photographs taken.

If an incorrect entry is made in the field logbook, the incorrect information will be crossed out with a single strike mark, and the change initialed and dated by the person making the change. At the end of each entry period (i.e., the end of the work shift for the individual making the entry) the time will be recorded.

### 2.2.2 Sample Collection Field Sheets (SCFSs)

Sample Collection Field Sheets (SCFSs) will also be completed for each sample collected. The SCFS will include information specific to the type of sample collected and the SOP required. Typical information entered on the SCFS may include, but not be limited to:

- sample date, time and weather conditions;
- signature or initials of personnel conducting sampling;
- equipment used;
- sample identification and matrix;
- sample type (i.e., grab or composite);
- sample description (i.e., color, odor, texture, appearance, etc.);
- sample depth (if applicable);
- sample volume;
- description of sample containers and preservatives used;
- sample location;
- sample procedure and/or stabilization data; and,

- summary of photographs of sample or sample location and direction photo was taken (if required).

The SCFSs will be turned in to the Project Manager at the end of each day. The Project Manager or his designee will crosscheck the SCFSs for completeness and accuracy. A SCFS template is included in Appendix II.

### 2.2.3 Sample Labeling

The sampling location, distribution and frequency is outlined in the RAWP. The samples will be successively numbered, taking into account previous sampling events and/or locations, and may also include a date and time number element to ensure a unique sample identification number. The following are typical sample location designation prefixes:

**Air/Vapor:**
- Emission Point = EP
- Indoor Air Sample = IAS
- Sub-Slab Vapor Point = SSV
- Vapor Monitoring Point = VMP

**Borings:**
- Geoprobe = GP
- Hand Auger = HA
- Test Boring = TB

**Excavation Limits/Soil, Sediment and Waste Sampling:**
- East Side Wall = ESW
- West Side Wall = WSW
- North Side Wall = NSW
- South Side Wall = SSW
- Excavation Bottom/Base = B
- Roll-off Container = RO
- Stockpile = SP
- Sediment = SED
- Test Pit = TP

**Water/Wells**
- City Well = CW
- Domestic Well = DW
- Extraction Well = EW
- Injection Well = IJW
- Irrigation Well = IRW
- Monitoring Well = MW
- Piezometer = PZ
- Recovery Well = RW
- Groundwater = GW
- Surface Water = SW
- Wastewater = WW

**Remediation:**
- Air Sparge Point = ASP
- Air Stripper = AS
- Bag Filter = BF
- Biosparge Point = BSP
- Carbon Vessel = CV
- Density Driven Convection = DDC
- Diffused Aeration Tank = DAT
- Dissolved Oxygen Injection = DOI
- Drum = DR
- Effluent = EFF
- Extraction Well = EW
- Free Product = FP
- Groundwater Treatment System = GWTS
- Influent = INF
- Injection Point = IP
- Injection Well = IJW
- Injection Trench = IT
- In-Situ Chemical Oxidation = ISCO
- Multi-Phase Extraction = MPE
- Oil-Water Separator = OWS
- Organo-Clay Filter = OCF
- Outfall = OF
- Oxidizer = OX
- Recovery Well = RW
- Roll-off Container = RO
- Soil Vapor Extraction = SVE
- Spent Carbon = SC
- Tank = TNK
- Zeolite Filter = ZF

**Miscellaneous:**
- Duplicate = DUP

All labels will be filled out with waterproof ink. The unique sample location number will be utilized throughout the project to record field documentation, sample result reporting, and final report presentation documentation. The sample label shall indicate:

- project name;
- unique sample location number;
- depth interval (if applicable);
- sample type (grab or composite);
- date;
- time; and,
- sampler name or initials, and company.

### 2.2.4 Electronic (Digital Data)

Electronic data collected in the field (such as digital photos, GPS coordinates, pressure transducer readings, etc.) and stored in memory devices will be downloaded onto computer files by the field staff and submitted to the Project Manager at the end of each day, or as required.

### 2.2.5 Chain-of-Custody Documentation

The purpose of the chain-of-custody procedure is to:

- summarize the samples collected and the analyses requested;
- provide an inventory of sample containers shipped;
- prevent misidentification of samples;
- prevent tampering of the samples during shipment and storage; and,
- allow for easy tracking of possession.

The chain-of-custody will include much of the same information listed in the SCFS for all samples included in the same shipping container, including signatures of the individuals relinquishing and receiving the samples, and the date and time the samples were relinquished and received. If an incorrect entry is made on the chain-of-custody, the error will be crossed out

with a single strike mark, and the change initialed and dated by the person making the chain-of-custody change. A copy will be kept by the sampling team and will be turned in to the Project Manager with the associated field logbooks and SCFSs at the end of the day.

If the chain-of-custody is broken at any time from sample collection through sample analysis, the Project Manager and the applicable laboratory will be notified. The Project Manager is responsible for implementing corrective action and responsible for ensuring that all necessary documentation is completed. Chain-of-custody record will be completely filled out for every shipment and every sample to trace sample possession including:

- sample number and/or identification;
- printed name and signature of sample collector;
- date and time of sample collection;
- place of sample collection;
- sample type (water, soil, etc.);
- sample preservatives;
- sample container;
- requested analysis;
- signature of person involved with sample possession;
- inclusive dates of sample possession; and,
- pertinent comments and/or notes.

The laboratory portion of the chain-of-custody form will be completed by the designated analytical laboratory person and contain the following information:

- inclusive dates of sample possession;
- pertinent comments and/or notes;
- name of person receiving the sample;
- laboratory sample number;
- date of sample receipt;
- analysis requested; and,
- sample condition and temperature.

The laboratory will compare the samples entered on the chain-of-custody forms with the sample containers received by the laboratory. If the laboratory finds any discrepancies, the laboratory will contact the Project Manager for resolution. The chain-of-custody forms will be the primary source of information for the laboratory to enter data into the laboratory's sample tracking system.

### 2.2.6 Laboratory Data Analytical Reports

Laboratory reports will include a raw data package and a QC summary package and will be submitted in hard copy and portable document format (PDF). An electronic data deliverable (EDD) will also be provided. This will be a Microsoft Excel format for inclusion by the Project Manager into a database. The file provided in Excel format will be prepared in accordance with the Environmental Information Management System (EIMS) implemented by the NYSDEC. The EIMS uses the database software application EQuIS™ (EQuIS) from EarthSoft® Inc. (EarthSoft). The use of the NYSDEC standardized EDD format (required for all data submitted) will allow for the incorporation of the analytical data into a comprehensive geospatial database.

The laboratory reports will also be submitted electronically to the Project Manager for verification, and to a third party data validator, as required. The contents of the QC summary package include:

- cover sheet;
- laboratory case narrative,
    - date of issuance;
    - laboratory analysis performed;
    - any deviations from intended analytical strategy;
    - laboratory batch number;
    - numbers of samples and respective matrices;
    - QC procedures utilized and also references to the acceptance criteria;
    - laboratory report contents;
    - project name and number;

  - condition of samples “as-received”;
  - discussion of whether or not sample holding times were met;
  - discussion of technical problems or other observations which may have created analytical difficulties; and,
  - discussion of any laboratory QC checks which failed to meet project criteria.
- cooler receipt forms;
- chain-of-custody copy;
- analytical results;
- surrogate summary forms;
- blank summary forms;
- laboratory control sample summary forms; and,
- matrix spike/matrix spike duplicate/laboratory duplicates summary forms.

Raw data packages will be provided in two different levels of QC documentation – Level II data packages and Level IV data packages (based on the former Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] classification scheme for analytical methods). Level II data packages are generally used for analyzing data in the field (data packages produced by mobile laboratories). This type of analytical data is limited mostly to volatiles and metals and is not considered accurate enough for public health risk assessments. Level II data packages are also referred to as Category A Deliverables. Level IV is laboratory analysis using United States Environmental Protection Agency’s (USEPA) contract laboratory program protocols and produces information needed for data validation by EPA national functional guidelines. Level IV data packages are also referred to as Category B Deliverables.

Both Level II and Level IV data packages will consist of the elements presented in the QC summary package but will additionally include the raw data, including, chromatograms, mass spectra, manual integration correction data, quantitation reports, calibration data, prepa-

ration logs, and analytical logs. Data in Level II and Level IV data packages will consist of the following information:

- case narrative for each analyzed batch of samples;
- summary page indicating dates of analyses for samples and laboratory QC checks;
- cross referencing of laboratory sample to project sample identification numbers;
- description of data qualifiers to be used;
- sample preparation and analyses for samples;
- sample results (analytical results will be reported as estimated J when detected above the MDL and below the RL);
- results of method reagent and preparation blanks; and,
- results of surrogate spiked LCSs, laboratory duplicates, and field QC samples.

Level IV data packages will include the Level II data package information plus the following additional information.

- raw data for sample results and laboratory QC samples (including LCS, MS/MSD, surrogates, serial dilutions, blanks, etc.);
- results of surrogate spiked LCSs, laboratory duplicates, and field QC samples;
- results of internal standards;
- results of (dated) initial and continuing calibration checks; and,
- gas chromatography and mass spectrometer (GC/MS) tuning results.

All samples will be submitted and analyzed by a New York State Department of Health (NYSDOH) Environmental Laboratory Accreditation Program (ELAP) certified laboratory. Laboratory analysis of soil and groundwater samples will consist of Category A (as defined in the Analytical Services Protocol [ASP]) or Category Spills laboratory data deliverables for all sampling performed at the Site with the exception of confirmatory (post remediation) samples and final delineation samples.

For all confirmatory (post remediation) samples and final delineation samples, Category B laboratory data deliverables as defined in the ASP will be submitted. In addition, for samples analyzed according to Category B laboratory data deliverables, a DUSR will be prepared by a party independent from the laboratory performing the analysis, when required by the NYSDEC.

For all soil gas and indoor air quality sampling, Category B laboratory data deliverables as defined in the ASP will be submitted.

In accordance with the DER-10 guidance document, analytical results without all QC documentation and raw data may be provided for all intermediate sampling events and for all long-term groundwater monitoring samples where the Site has Department of Environmental Remediation oversight, provided the following information is submitted:

- a cover page, including facility name and address, laboratory name and address, laboratory certification number, if applicable, date of analytical report preparation and signature of laboratory director;
- a listing of all field sample identification numbers and corresponding laboratory sample identification numbers;
- a listing of all analytical methods used, including matrix cleanup method;
- the method detection limit and practical quantitation level for each analyte for each sample analysis;
- all sample results including date of analysis;
- all method blank results; and,
- all chain-of-custody documentation.

### 2.2.7 Project Reports

Other project records used or generated for the project are summarized in the RAWP. These may include, but not be limited to:

- Site-specific workplans;
- HASP;
- required Site permits;

- project data summaries and databases;
- inspection, assessment, and corrective action reports;
- progress reports;
- technical memorandums, meeting notes and/or other written correspondences;
- model evaluation summaries;
- presentations;
- historical data documents, literature research/review files, weather data, and/or external database queries (such as State or county well indices);
- drawings, maps, tables and figures;
- photos;
- soil boring logs;
- subcontractor reports;
- QA reports (such as data review/validation and/or assessment reports), and,
- final reports.

These records (if applicable) will be incorporated in the Final Engineering Report (FER).

### 2.2.8 Use of Historic Data

Historical data, if available, will be utilized to help identify previous areas of environmental concern, and to estimate, approximate, or forecast the behavior, risks, fate and transport of COC before new data is obtained. The data may also be used to determine the types of analytical parameters, depths, location, and matrix to be sampled for subsequent field activities. Data may include, but not be limited to:

- maps, including Platte maps, topographic maps, utility maps, site maps, contaminant delineations, groundwater elevation contour maps, etc.;
- geological and hydrogeological information (i.e., previous boring logs, groundwater elevation data, etc.);
- soil, sediment, soil vapor, indoor air, surface water and/or groundwater analytical data generated via historical Site investigation activities;

- receptor survey information and/or State or County well indices/databases; and,
- survey data.

## 3.0 DATA GENERATION AND ACQUISITION

### 3.1 Sampling Process Design

The RAWP and/or supplemental sampling plan outline the following information:

- list samples required by type and number;
- State sample network design and rationale;
- identify sampling locations and sampling frequency; and,
- identify sample matrices.

Specific parameters critical to meeting the Remedial Action Objectives (RAOs) are indicated in the RAWP. If project-specific sampling activities are not addressed as part of this QAPP, further data will be provided as necessary in the RAWP.

### 3.2 Sampling Methods

Sampling methods to be used during the field activities will be consistent throughout the project, and will follow SOPs for the type of sample being collected. The SOPs for collection or measurement of each type of sample or field data are outlined in this Section. The SOPs describe the equipment required and the specific procedure to follow for collecting the sample and/or data. Sample methods, containers, preservatives, and holding time requirements for each sample parameter and matrix to be analyzed are presented in table 1.

Detailed field records for all site activities will be kept by the personnel performing or supervising the work. Recordkeeping will be completed in a field notebook, SCFSs and the daily field sheets. These documents will be used to record pertinent observations (odors, visual observation, matters of interest, weather), all field measurements (water levels, pH, specific conductance) and any irregularities or deviations from the prescribed sampling procedures. All entries into the field book and/or preprinted data sheets will be with waterproof ink

pen, initialed by the person completing the measurements/observations, and the pages of the field book numbered.

During sample collection, extreme care will be taken in order to ensure that high quality data are obtained. The sampling team will avoid fueling vehicles, using permanent marking pens or any other materials containing volatile organic compounds (VOCs) which can cause sample interference in the field. Field Blank will be prepared in the field by passing analyte-free water from the full bottle to the empty Field Blank container. The purpose of the Field Blank is to demonstrate ambient field conditions and/or equipment conditions that may potentially affect the quality of the samples. One field blank will be collected per every main sampling area. Additionally, one trip blank will be collected per shipping container of aqueous samples for VOCs in groundwater.

In general, most samples collected will be grab-type samples. Exceptions will include: samples collected for soil or sediment waste disposal characterization in which a composite sample will be collected; and indoor air samples which are extended-duration time-weighted samples. Sampling locations, including preliminary sampling locations used for screening and planning purposes, will be measured using GPS equipment with a real-time horizontal accuracy of less than one meter. Monitoring wells, staff gauges, select soil, sediment, and/or soil vapor sample locations, confirmatory sample locations, and/or other features will be professionally surveyed to within one foot horizontal and one inch vertical accuracy, traceable to an established system such as United States Geological Survey (USGS) datum. Sample depths will be directly measured in the field via measuring tape or other means and recorded in the field sampling documentation (field logbooks, SCFSs and daily field sheets).

In addition to sample locations and depths, the equipment used to collect samples will be noted, along with the time of sampling, sample description, volume, and number of containers in the field logbooks, SCFSs and daily field sheets. Sample identification numbers will be assigned prior to sample collection. Field duplicate samples, which will receive a unique sample identification number, will be noted in the field logbooks, SCFSs and daily field sheets.

In the event of any additional soil, groundwater and soil gas/indoor air sampling, latex gloves will be worn and changed between sampling locations. All of the samples will be preserved for holding time (if necessary) and properly labeled in the field as per Section 2.2.3.

### 3.2.1 Soil/Sediment Sampling

Soil samples may be collected in association with activities at the Site. As per the 2012 New York State (NYS) ELAP accreditation update, VOC soil/sediment samples submitted for low-level volatile analysis (less than 200 ug/kg) must be collected according to 5035 low-level specifications. As per the requirement, the soil/sediment sample must be identified on the laboratory report or associated chain-of-custody as collected in a water miscible solvent (such as methanol). The reporting limit for a field-preserved sample may vary depending on the dilution factors, percent moisture, and the range of the initial calibration curve. If 5035 low-level specifications have not been met, the lab must notify the client that the sample does not meet their sample acceptance criteria and provide the client an opportunity to re-collect the sample. If the client chooses not to re-collect and requests the samples to still be analyzed, the lab must qualify any reported sample concentrations that are below 200 ug/kg. The qualification statement will indicate that the results may be biased low due to the sample not being collected according to the 5035-L/5035A-L low-level specifications.

For any soil/sediment samples which were not collected in a water miscible solvent preservative, any reported concentrations less than 200 ug/kg must be qualified indicating they may be biased low due to the sample not being collected according to 5035/5035A low-level specifications. The 200 ug/kg concentration may not be reduced (even if supported by the low end of the initial calibration curve) as this concentration is the limit for high level sample collection – not the analytical procedure. The collection of samples without use of a chemical preservative is appropriate for those samples or wastes suspected of percent level contamination. Reporting levels must be supported by a limit of quantitation (LOQ) study that includes all sample processing steps.

Soil/sediment samples may be collected several ways: grab sample, hand auger, geoprobe macrocore and split-spoon sampling. These methods are summarized in sections below.

#### 3.2.1.1 Grab Sampling

Grab samples are collected from exposed surficial soil and from stockpiled soil. Collection of a grab sample will be performed with the field personnel using latex or nitrile sampling gloves. The soil sample(s) will be placed into laboratory prepared sampling containers and stored on ice. The sample will then be shipped to the laboratory under chain-of-custody procedures.

#### 3.2.1.2 Hand Auger Sampling

Pending access to the subsurface, the hand auger would be advanced from grade to the designated termination depth. Samples will be removed from the hand auger and placed on polyethylene liner for observation. During advancement of the hand auger, the samples obtained will be screened in the field for VOCs using a photoionization detector (PID). The soil samples will be handled by field personnel using new latex or nitrile sampling gloves for each sampling interval. Pending review of all samples collected, the previously collected soil samples will be stored in plastic Ziploc bags to prevent off-gassing of VOCs. The soil sample(s) selected for analysis will be placed into laboratory prepared sampling containers and stored on ice. The sample will then be shipped to the laboratory under chain-of-custody procedures.

Following completion of each individual boring, the hand auger sampling point and extension rods will be decontaminated using alconox and water.

#### 3.2.1.3 Geoprobe Macrocore Sampling

Soil samples may be collected from the Site using a Geoprobe drill rig. This rig uses direct push technology to recover 4-foot or 5-foot long macrocore samples. The samples are collected in dedicated polyethylene liners. The liners are then cut open to expose the soil cross-section. The soil is then characterized on a geologic log. The soil samples will be handled by field personnel using new latex or nitrile sampling gloves for each sampling interval. Pending review of all samples collected, the previously collected soil samples will be stored in plastic Ziploc bags to prevent off-gassing of

VOCs. The soil sample(s) selected for analysis will be placed into laboratory prepared sampling containers and stored on ice. The sample will then be shipped to the laboratory under chain-of-custody procedures.

Following completion of each macrocore sample, the macrocore will be decontaminated using alconox and water and a new dedicated polyethylene sleeve will be used.

#### 3.2.1.4 Split-Spoon Sampling

Soil samples may be collected from the Site using a stainless steel split-spoon sampler in association with a hollow-stem auger and/or mud-rotary drill rig. This technique involves sending a 2-foot sampling device to the termination depth of a drill boring and hammering the sampler through the soil. The samples are collected within the split-spoon sampler and prevented from falling out of the sampler with a plastic basket at the bottom. After the split-spoon sampler is advanced two feet, it is removed from the boring. The split-spoon sampler is then taken apart exposing the soil sample. The soil is then characterized on a geologic log. The soil samples will be handled by field personnel using new latex or nitrile sampling gloves for each sampling interval. Pending review of all samples collected, the previously collected soil samples will be stored in plastic Ziploc bags to prevent off-gassing of VOCs. The soil sample(s) selected for analysis will be placed into laboratory prepared sampling containers and stored on ice. The sample will then be shipped to the laboratory under chain-of-custody procedures.

Following completion of each split-spoon sample, the split-spoon sampler will be decontaminated using alconox and water.

### 3.2.2 Groundwater Sampling

In the interest of generating additional groundwater parameter information, a low-flow sample technique will be used. Groundwater will be sampled from onsite monitor wells using a peristaltic sampling pump. The pump intake will be placed at predetermined positions within

each well and, if necessary, lowered as pumping progresses. The pump intake position within each well was determined from geologic logs.

The low-flow purge and sample methodology will be utilized for the collection of groundwater samples. Prior to sampling, the depth to water with respect to the top of well casing and total depth of each well will be measured with an electric tape and/or weighted steel tape. Both measurements will be recorded in a field logbook. Dedicated polyethylene tubing will be set within each well at the predetermined well screen interval and connected to a variable speed peristaltic pump. The peristaltic pump will be operated at a discharge rate of 100-500 ml/min (milliliters per minute) and will discharge to a Flow-Through Cell. Geochemical parameters of the associated groundwater such as pH, conductivity, dissolved oxygen and temperature will be continuously monitored inside the Flow-Through Cell using a Horiba multi-parameter meter. Once all of the above geochemical parameters stabilize, a groundwater sample will be collected from the dedicated polyethylene tubing through an inline sampling port prior to the Flow-Through Cell. During the sampling, latex gloves will be worn and changed between sampling locations.

All of the samples will be preserved for holding time and properly labeled in the field. A chain-of-custody form will be filled out and the samples will be placed in a cooler with ice. The sample will then be shipped to the laboratory under chain-of-custody procedures.

### 3.2.3 Soil Gas, Indoor Air, Ambient Air and Effluent Vapor

The purpose of soil gas and indoor air sampling is to determine the following:

- potential for current human exposure;
- potential for future human exposure;
- necessary measures to be implemented for removal of vapors from the subsurface and/or indoor air;
- potential for offsite soil vapor contamination;
- determine any offsite preferential migration pathways;
- characterize the vapors in the vadose zone; and,
- investigate the relationship between contaminated groundwater and soil vapor.

#### 3.2.3.1 Soil Vapor

Soil vapor samples may be collected from both existing soil vapor sampling points and from soil vapor points yet to be installed. If additional soil vapor points are installed at the Site, they will be installed following the construction specifications as described in the New York State Department of Health Center for Environmental Health, Bureau of Environmental Exposure Investigation Guidance for Evaluating Soil Vapor Intrusion in the State of New York.

Soil vapor samples may be collected from the soil vapor sampling points using the following procedures.

- a soil vapor sample will be collected from a soil vapor sampling point after one to three volumes of the soil vapor sampling point and the tube are purged using a peristaltic pump;
- the flow rate for purging will not exceed 0.2 liters per minute; and,
- each sample will be collected using a Summa canister fitted with a flow regulator to collect a 1-liter soil vapor sample over a 2 to 8 hour period.

The soil vapor sample will then be sent to the laboratory via overnight courier service under chain-of-custody procedures. The soil vapor samples will be analyzed by EPA Method TO-15.

#### 3.2.3.2 Indoor Air

In the event that it is deemed necessary, indoor air samples may be collected from within the building. If this sampling is to constitute a soil vapor intrusion investigation, the indoor air samples will be collected concurrent with the soil vapor samples from similar building areas. The indoor air sampling would be used to characterize the indoor air quality and; if sampled concurrently with soil vapor samples, also to evaluate the relationship between the indoor air and the soil vapor concentrations the Site. A 6-liter Summa canister will be placed in the sample location at a slightly elevated height of approximately 3-4 feet above the ground surface. Each Summa canister used for

collecting indoor air samples will be fitted with a dedicated regulator calibrated to allow 1 liter of air flow over an 8-hour sampling period. The indoor air sample will then be sent to the laboratory via overnight courier service under chain-of-custody procedures. The indoor air sample will be analyzed by a NYSDOH ELAP certified laboratory by EPA Method TO-15.

#### 3.2.3.3 Outdoor Ambient Air

Outdoor ambient air samples (if collected) will be collected from predetermined locations at the perimeter of the building onsite. One location will be upwind of the Site and one location will be downwind of the Site. A 6-liter Summa canister will be placed in each sample location at a slightly elevated height. Each Summa canister used for collecting outdoor ambient air samples will be fitted with a dedicated regulator calibrated to allow 1 liter of air flow over an 8-hour sampling period. The outdoor ambient air samples will then be sent to the laboratory via overnight courier service under chain-of-custody procedures. The outdoor ambient air samples will be analyzed by a NYSDOH ELAP certified laboratory by EPA Method TO-15.

#### 3.2.3.4 (Remediation System) Sampling

Soil-Vapor Extraction (SVE) System, Sub-Slab Depressurization System (SSDS) and Groundwater Pump and Treat System (GWPT) sampling protocol for the remediation system will be conducted as described in the RAWP.

## 3.3 Sample Handling and Custody

Following the completion of field sample collection, custody protocols that will be followed are divided into three parts: sample handling, laboratory analysis and final evidence files. Sample containers, preservatives and holding times for each sample matrix and analytical methodology are summarized in table 1. Chain-of-custody documentation and procedures will be completed for all samples generated. Final evidence files including all original laboratory reports will be maintained under document control in a secure area. The following sec-

tions describe in detail the different aspects of sample handling and shipment, the sample identification system that will be used, and documentation.

When samples are released from the sampler's immediate control (i.e., shipment to laboratory), custody seals will be placed across the lid opening of the container. The custody seals will bear the collector's name and the date signed. The sample custody seal is used to ensure that the samples in the shipping container have not been tampered with, therefore ensuring sample integrity.

An analytical data control check will be established by utilizing trip blanks. Trip blanks will be prepared in the laboratory using organic free water. Trip blanks will accompany a batch of samples from the start of sampling to delivery of samples to the laboratory for analysis, remaining unopened. The purpose of the trip blank is to measure possible cross contamination of samples during the shipping and handling stages.

### 3.3.1 Documentation/Chain-of-Custody

Samples will be documented and maintained in custody continuously. The chain-of-custody process begins immediately after collection of the samples. The documentation will include field logbooks, SCFSs, daily field sheets, the chain-of-custody form, sample identification label, custody seal and any shipping documents. Details of the chain-of-custody procedures are outlined in Section 2.2.5, above.

The following scenarios describe when samples are considered to be in custody of the field personnel:

- samples are in actual possession of the field personnel;
- samples are still in the personnel's view after being in the personnel's possession; or
- samples are deposited by the personnel in a designated secured area.

### 3.3.2 Sample Handling

Packaging of sample coolers is an integral part of the field activities. The sample storage container will be secured to ensure that the samples are not disturbed during transport. A

sufficient amount of padding material (bubble wrap, packaging paper or similar material) will be used to ensure that glass sample containers are protected during shipping and to prevent sample containers from breaking during transport to the laboratory. Water, soil and sediment samples will be properly packaged on ice at 4 ±2 degree Celsius (°C) in coolers for shipment. Air samples will be properly packaged and shipped in coolers or boxes. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the chain-of-custody to document the transfer.

All sample containers to be shipped will be sent to the appropriate laboratory for analysis, with a separate signed chain-of-custody enclosed in and secured to the inside top of each container (sample box or cooler). Once the samples are properly packaged, the shipping containers will be closed and secured with strapping tape and custody seals for shipment to the laboratory. The custody seals will be signed and dated by the field team leader and attached across the lid opening of the box or lid opening and body of the cooler.

### 3.3.3 Laboratory Chain-of-Custody Procedures

The selected analytical laboratory will perform laboratory custody procedures in accordance with their SOPs for sample receiving and login, storage, and tracking during sample preparation, analysis, and storage of data. Specific laboratory SOPs are provided in Appendix I.

### 3.3.4 Final Evidence File Custody Procedure

All field documentation (such as field logbooks, SCFSs, daily field sheets, chain-of-custodies, etc.) completed by the field sampling technicians will be submitted to the Project Field Supervisor at the end of each day. The Project Field Supervisor will make copies of field logbook pages, and submit these copies and all original SCFSs and chain-of-custodies to the Project Manager. The original copy of any completed field logbook will also be submitted by the Project Field Supervisor to the Project Manager.

Electronic data/information collected in the field, such as GPS data, pressure transducer data, digital photos, etc. will be downloaded each day by the field technicians into electronic

files and e-mailed to, or saved on a portable storage device (e.g., flash drive) and submitted to the Project Manager. The Project Manager will evaluate the data and also file the data and archive.

The Project Field Supervisor will be responsible for the custody and filing of all field documentation and analytical reports. The Project Manager will maintain the final evidence file until the completion of the project. The final evidence file will be the main archive for all documents, which constitute evidence relevant to sampling and analysis activities as described in this QAPP.

## 3.4 Analytical Methods

### 3.4.1 Field Analytical Procedures

Various field measurements and/or analyses will be required during the project to generate data for field screening purposes, verifying sample representativeness, identifying sample locations, depths, and/or volume, evaluating sample quality (e.g., stabilization data measurements for groundwater samples), delineating impacts, measuring or calculating recovery rates, etc. Procedures for field measurements and analyses are presented in the RAWP. The RAWP will detail the aspects of the data acquisition for the investigation or mitigation activities.

Field instruments/equipment will be checked/inspected daily. Sections 3.6 and 3.7 describe general procedures for instrument/equipment checks, maintenance and calibration.

A list of common field measurements and/or analyses generally required is provided in the table below. The list includes an example(s) of the field instrument typically used to take the measurement or perform the analyses.

| Field Measurement/Analysis | Example Field Instrument |
|---|---|
| **Air** | |
| **Physical Property** | |
| - Pressure/Vacuum | Pressure/vacuum gauge, manometer, barometer |
| - Flow/velocity | Pitot tube, venturi meter, rotameter, anemometer |
| - Temperature | Temperature gauge |
| **Chemical Property** | |
| - Ammonia | Field test kit, Ammonia sensor/monitor |
| - Carbon Dioxide | Single or multi-gas meter |

| Field Measurement/Analysis | Example Field Instrument |
|---|---|
| - Carbon Monoxide | Single or multi-gas meter |
| - Hydrogen Sulfide | Single or multi-gas meter |
| - Lower Explosive Limit (LEL) | Explosimeter, multi-gas meter |
| - Methane | Single or multi-gas meter |
| - Organic Vapor Concentration | Photoionization detector (PID), flame ionization detector (FID) |
| - Oxygen | Single or multi-gas meter |
| **Soil/Sediment** | |
| - Weight | Scale |
| - Organic Vapor Concentration | Photoionization detector (PID), flame ionization detector (FID) |
| - Sheen tests | Glass jar and deionized water – visual observation |
| **Water** | |
| **Physical Property** | |
| - Pressure | Pressure gauge, pressure transducer |
| - Flow/velocity | Turbine, electromagnetic, nutating disc flow meters, flumes, weirs, |
| - Temperature | Temperature gauge |
| - Depth | Tape measure, staff gauge, water-level indicator |
| **Chemical Property** | |
| - Specific Conductance | Single parameter or multi-parameter probe |
| - Dissolved Oxygen (DO) | Dissolved oxygen sensor or probe, multi-parameter water probe |
| - pH | pH meter, multi-parameter probe |
| - Turbidity | Single parameter or multi-parameter probe |
| - Oxidation-Reduction Potential | Single parameter or multi-parameter probe |
| **Other** | |
| - Location | Global Positioning System (GPS), Transit and Stadia Rod |
| - Depth to Product/Product | Product interface probe |
| - Other (specify): | |

### 3.4.2 Laboratory Analytical Procedures

The laboratories utilized for the project will implement the appropriate project-required SOPs. Laboratory SOPs are based on analytical methods published by the USEPA (USEPA Test Method for Evaluating Solid Waste, Physical/Chemical Methods, Final Update IIIB, June 2005) or consistent with specific method requirements under the Safe Drinking Water Act (SWDA) and/or other applicable methods (such as American Society for Testing and Materials [ASTM]). The laboratory SOPs are provided in Appendix I.

Appropriate analytical methods will be used to provide adequate detection limits for COCs, and for the final intended data usage. A list of anticipated laboratory analytical methods is provided below and also presented in table 1. Of note, table 1 also includes additional analytical methods (not anticipated at the Site based on historical Site characterization activi-

ties), however, if required are available for analytical characterization. If different or additional contaminants of concern or analytical methods not presented in table 1 are determined to be required for the project, the pertinent information will be added to the QAPP as an addendum.

| Parameter | Water, Soil/Sediment Method | Air Method |
|---|---|---|
| Organic Analyses: | | |
| - Poly Chlorinated Biphenyls (PCBs) | SW 846 8082A | --- |
| - Polynuclear Aromatic Hydrocarbons (PAHs/SVOCs) | SW 846 8270C | --- |
| - Volatile Organic Compounds (VOCs) | SW 846 8260B | TO-15 |
| - Pesticides | SW 846 8081B | --- |
| - VOCs - TCLP | SW 846 1311, 8260B | --- |
| Metals Analyses: | | |
| - Metals – Target Analyte List | SW 846 6010B | --- |
| - Metals – TCLP | SW 846 1311, 6010B, | --- |
| - Mercury | SW 846 7470A, 7471A | --- |
| - Hexvalent Chromium | SW 846 9176A | --- |
| Other Analyses: | | |
| - Flashpoint | SW 846 1010A | --- |
| - pH | SW 846 9040C, 9045D | --- |

The analytical procedures will follow laboratory in-house limits; as appropriate. MDLs for the anticipated laboratory methods will comply with the regulatory limit requirements as outlined in DER-10 to ensure appropriate analytical sensitivity. The laboratory will report all detections at or above the MDL.

The RLs are typically three to five times the MDL and are presented in the laboratory analyte reporting parameters included in Appendix I for each analytical method. Values above the MDL and below the RL will be qualified as estimated (J). The laboratory will analyze a RL check sample for each parameter and an MDL check sample for organic parameters. In house limits will be used where no QSM limits exist.

## 3.5 Quality Control

The QC necessary to monitor the data quality process during the remedial project is described in this section for both the field and the laboratory environment. A summary of the general field and laboratory QA/QC sample collection/analysis frequency is included in table 2.

### 3.5.1 Field Quality Control Requirements

Replicate measurements, equipment calibration checks, and data verification by field personnel will be rigorously applied to provide the necessary QC checks on the data generated. Duplicate samples, field blanks, VOC trip blanks, and temperature blanks will be used to assess field sampling precision, data quality and integrity, and are described in more detail below:

- Duplicate samples are analyzed to check for sampling and analytical reproducibility, and to evaluate the precision and bias of the entire sampling and analyses process including homogeneity, handling, transportation, storage, and analyses. The selected laboratory will provide pre-cleaned sample containers with preservatives, as required, and as specified by the USEPA. *Field duplicate samples will be typically collected at a frequency of one duplicate sample during each representative sampling area for each media type*. Duplicate samples will be submitted as "blind" duplicates meaning the specific sample location will not be identified in the sample name on the chain-of-custody. The duplicate sample will be identified on the chain-of-custody with the suffix "DUP" followed by the number of the duplicate. Duplicate sample locations and identifications will be specifically noted on the daily field sheets and field logbooks for identification purposes. Duplicate samples will generally be analyzed for all target analytical parameters.
- Field blanks (also referred to as equipment blanks or rinse blanks), are used to assess decontamination of reusable sampling equipment, or to assess whether contamination has occurred during sampling or transportation. *Field blanks are*

*typically taken at a rate of one per day per sampling crew when using sampling equipment that requires decontamination between samples. However, when the daily sampling volume is low, field blanks will typically be taken at a rate of one during each representative sampling area for each media type. It should be noted that field blanks will not be collected when dedicated disposable sampling equipment is used.* Field blanks will generally be analyzed for all target analytical parameters.

- Trip blanks are generated in the laboratory and used to assess contamination resulting from shipping and handling. *A trip blank will be included in each shipment of aqueous VOC samples.* Trip blanks will be analyzed for VOCs.
- Temperature blanks are provided by the laboratory to ensure proper packaging and preservation at the prescribed temperature for certain sample types (e.g., samples for VOC analyses). *One temperature blank will be included for each shipping container (cooler) of samples requiring preservation at a particular temperature.*

### 3.5.2 Laboratory Quality Control Requirements

Each laboratory utilized for project has a QC program and SOPs in place to ensure the reliability and validity of the analysis performed at their laboratory. The Laboratory QA Manager will be responsible for assessing and assuring that the data precision and accuracy is maintained according to their specification.

Method blank, laboratory control and MS samples will be analyzed to assess the quality of the data resulting from the analytical programs.

- Method blank samples are generated within the laboratory and used to assess contamination resulting from laboratory procedures. A method blank will be analyzed by the laboratory with each analytical batch of samples for organic analyses and for metals analyses. Samples for organic analyses will be re-analyzed if common laboratory contaminants are detected above the RL or when non-laboratory contaminants are reported greater than one-half the RL. Samples

for metals analyses will be re-analyzed if the blank concentration is greater than the RL.

- LCSs provide information about the accuracy of the analytical system, independent of matrix. LCSs are laboratory-generated sample spikes with target analytes. Investigative samples and the associated LCS will be re-analyzed if more than 5 percent of the LCS recoveries are less than the lower limit or any one recovery is less than one-half the lower limit.
- MS/MSDs provide information about the effect of the sample matrix on the digestion and measurement methodology. MS/MSD samples are designated/collected for organic and metals analyses only.

*The general level of the QC effort will be one MS/MSD, LCS and blank for every 20 samples collected, or 1 for each batch of samples of similar method and matrix*. A summary of laboratory analyte reporting parameters (accuracy, precision and reporting limits) are provided in Appendix I.

In addition to the QC analyses identified above, the laboratory will perform additional QC checks as part of the analytical method. In general, these QC checks may include, but are not limited to the following:

- reagent/preparation/calibration blanks (applicable to inorganic analysis);
- instrument blanks;
- initial calibration (ICAL);
- initial calibration verification (ICV);
- continuing calibration verification (CCV);
- MDL verification;
- method RL verification;
- surrogate spikes;
- laboratory duplicates;
- laboratory control standards;
- internal standard areas for GC/MS analysis; and,

- mass tuning for GC/MS analysis.

*In general, QA samples will be collected at a frequency of 5% and will be analyzed by each respective laboratory*.

Laboratory QA/QC data will be properly recorded, allowing the recipients of data packages to reconstruct QC information and compare it to QC criteria. When analyses are not in conformance with the established QC criteria, the laboratory will reanalyze the samples if sufficient volume is available. It is expected that sufficient volumes/weights of samples will be collected to allow for reanalysis when necessary.

## 3.6 Instrument/Equipment Testing, Inspection, and Maintenance

### 3.6.1 Field Instrumentation

Field instrumentation and equipment may include (but not be limited to) the devices listed in Section 3.4.1. Field instrumentation and equipment will be inspected on a daily basis prior to use. Equipment will be maintained as required in the manufacturer's operation manuals. Preventive maintenance will be completed and documented by qualified project personnel.

Replacement batteries or, if possible, fully charged spares will be kept onsite to reduce downtime due to drained batteries. Equipment found to be in need of maintenance or repair will be replaced immediately with like or better equipment. Field technicians will be responsible for reporting any equipment issues to the Project Field Supervisor and/or the Project Manager.

### 3.6.2 Laboratory Instruments

Contracted laboratories will conduct a routine preventative maintenance program to minimize the occurrence of instrument failure and other system malfunctions. All maintenance that is performed is documented in the laboratory's operating record. All laboratory instruments are maintained in accordance with manufacturer's specifications. The frequency of laboratory preventive maintenance is identified in the laboratory's QA Plan (Appendix I).

## 3.7 Instrument/Equipment Calibration and Frequency

The instrument calibration and frequency for both field instruments and laboratory instrumentation are provided below.

### 3.7.1 Field Instrument/Equipment Calibration and Frequency

Field personnel will examine and calibrate field equipment prior to use in order to ensure proper operation and accuracy. The field instruments will be calibrated as described in the manufacturer's manual and procedures. *In general, instruments will be calibration checked at the beginning of each day and calibrated weekly unless otherwise directed in the instrument manuals*. If a piece of equipment or instrument cannot be properly calibrated, it will be noted in the field log and replaced.

All calibration procedures and maintenance performed will be documented on the daily field sheet and/or field logbook, and will include the date/time of calibration/maintenance, name of person performing the calibration/maintenance, reference standard used, temperature at which readings were taken, and the readings. Multiple readings on one sample or standard, as well as readings on replicate samples, will likewise be documented.

The Project Field Supervisor and/or the Project Health and Safety Officer will be responsible for ensuring that field instrument calibration records are maintained and adequate. The Project Manager and/or Remedial Engineer may conduct field inspections to ensure proper equipment handling, testing and calibration procedures are followed.

### 3.7.2 Laboratory Instrument/Equipment Calibration and Frequency

The specific Laboratory QA Manager will have the responsibility for assuring that the laboratory instrumentation is maintained and calibrated in accordance with specifications. Preventive maintenance and corrective actions for the laboratory instruments will follow the laboratory SOPs.

All laboratory instrumentation will be calibrated in accordance with the respective analytical method. In general, calibration procedures for a specific laboratory instrument will consist of initial calibrations (three or five points), initial calibration verifications, and contin-

uing calibration verification. The laboratory will maintain a sample logbook for each instrument which will contain the following information: instrument identification, serial number, date of calibration, analyst, calibration solutions run, and the samples associated with these calibrations.

### 3.8 Inspection/Acceptance of Supplies and Consumables

Field personnel will be responsible for inspecting supplies and consumables needed for the performance of field activities. The inspection shall insure that all materials and ancillary sampling equipment are free of defects, compatible with equipment used or elements sampled, within recommended use periods (i.e., reagents not expired), and/or adequate for its intended use. Results of the inspection will be recorded in the logbook. Any issues observed will be reported to and resolved by the Project Field Supervisor and/or the Project Manager.

Laboratory personnel, under management of the specific Laboratory QA Manager, will be responsible for inspection and either accepting or rejecting supplies and consumables in the laboratory.

### 3.9 Non-Direct Measurements

Historical data that may be used for the project is identified and discussed in Section 2.2.8. Use of historical data or any non-direct measurements (e.g., such as weather data from an online weather station) will be limited to identifying previous areas of environmental concern, forecasting fate and transport before new data is obtained, and providing a reference point for establishing the sampling plan.

### 3.10 Data Management

The Project Field Supervisor and/or the Project Health and Safety Officer will manage field data under the supervision of the Project Manager Quality Assurance Officer (QAO). The RAWP will specify the data to be collected.

Daily field sheets, the field logbook and SCFS will be used to record the appropriate raw data measured or recorded during field activities. As described in Section 4.4.1, copies of

field logbooks, daily field sheets, SCFSs and field copies of any chain-of-custodies will be turned in to the Project Manager, and will be distributed electronically to the Project Management Team on a daily basis. In addition, electronic data generated in the field will be downloaded and e-mailed or stored on portable storage devices (e.g., flash drives) and given to the Project Manager on a daily basis. The Project Manager or designee will electronically scan original field data and documentation to provide duplication of field data information, and originals will be filed in the permanent project files in document control. The Project Manager or designee will review the data, perform QA/QC checks, and compile the data on an ongoing basis.

The laboratory's internal data management QA/QC measures will be performed in accordance with the laboratory specific Quality Assurance Manual and SOPs. All analytical data will be transmitted both electronically and as hard copy to the Project Manager. The Project Manager and/or designee will be responsible for processing the data. The data will be summarized in tables and on figures for data analysis and presentation. Once the data has been reviewed and QC checks have been verified, both electronic and hard copy laboratory data reports will be archived in the electronic and permanent project files in document control.

## 4.0 ASSESSMENT AND OVERSIGHT

System and performance audits may be conducted to ensure compliance with the sampling and analytical mandates of this QAPP and RAWP. The audits will verify documentation and implementation of the QA program, assess the effectiveness of work plans, identify any non-conformances, and verify corrective action of identified deficiencies. Below summarizes the audit procedures for field and laboratory activities.

### 4.1 Technical System Audits

This section describes the details for technical system audits and performance evaluation audits. The technical system audits are for field data, report preparation, and laboratory data. The performance evaluation audits cover file and laboratory processes.

Repeated failure or gross irregularities in field duplicate, QA split, and calibration or quality control samples may warrant the need for an audit. Follow up audits may be required to correct deficiencies and to verify that QA procedures are maintained throughout the investigation. Nonconformance with performance criteria will be addressed and resolved by the Project Manager and/or designee.

### 4.1.1 Field Data

The Project Manager and/or designee will be in daily contact with the Field Manager(s) to ensure that the DQOs outlined in this QAPP, and the sampling protocol outlined in the RAWP are followed. The Project Field Supervisor and/or designee will report any modification or variance from SOPs to the Project Manager. Any anticipated changes or modifications to measurement or sampling procedures will be reported to the Project Manager and/or Remedial Engineer. Field personnel will document any modification or variance in the field logbooks and daily field sheets.

Collection and analysis of sample duplicates and equipment blanks will be used to assess sampling data precision. Copies of the field logbooks and daily field sheets will be transmitted or delivered to the Project Team on a daily basis. These data and records will allow the Project Manager and/or Remedial Engineer to assess the field data for completeness, comparability, accuracy and quality. The Project Manager and/or Remedial Engineer may also inspect field activities as needed during the project to observe progress, field procedures, and other aspects of the project.

### 4.1.2 Reports

Project reporting will be performed in accordance with the RAWP. Reports and technical correspondence will be reviewed by the Project Manager, Remedial Engineer and Principal in Charge prior to final submission to the NYSDEC.

### 4.1.3 Laboratory Data

The Laboratory QA Manager will review the laboratory results to ensure compliance with the DQO criteria and the laboratory specific Quality Assurance Manual. The internal system audits will include an examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody procedures, sample preparation and analysis, instrument operating records, etc.

## 4.2 Performance Evaluation Audits

This section outlines the field and laboratory audits required to ensure that the DQOs are met.

### 4.2.1 Field Performance Evaluation Audits

The Project Field Supervisor will oversee all investigation and mitigation field activities. Field personnel will document sample collection procedures, follow chain-of-custody protocol, and prepare samples for proper shipping to the laboratory. The Project Field Supervisor will verify with the laboratory that the sample numbers are correct, the proper analytical requests are on the chain-of-custody, dates and times are correct, and the sampler's signature is recorded on the form. A sample copy of a chain-of-custody form is included in Appendix III. Instrument calibrations, which are included in the field logbooks, will be submitted to the Project Manager on a daily basis for review.

An audit by the Project Manager will be conducted on the first day of field activities. The Project Manager, Remedial Engineer and/or designee may inspect field activities as needed during the project to observe progress, field procedures, and other aspects of the project.

### 4.2.2 Laboratory Performance Evaluation Audits

All analytical work for the project will be conducted by the laboratories following contractual protocol, laboratory specific Quality Assurance Manuals, and the associated SOPs.

The Laboratory QA Manager will be responsible for assuring that laboratory data QA/QC is maintained in accordance with specification and laboratory SOPs.

Internal laboratory performance audits (if performed) will involve preparing blind QC samples and submitting them, along with project samples, to the laboratory for analysis throughout the project. The Project Manager will evaluate the analytical results of these blind performance samples to ensure the laboratory maintains acceptable QC performance. If the laboratory fails the QC sample analysis, they will be given another opportunity for blind QC sample analysis. A second failure will be cause for termination of the laboratory from the project.

External laboratory performance audits may be conducted by the Project Manager prior to, during, or after sampling and analysis activities. These audits may or may not be announced. Repeated failure or gross irregularities in the field duplicate, QA split, and calibration or quality control samples may warrant the need for an audit. The external audit may include any or all of the following:

- review of laboratory analytical procedures;
- laboratory onsite visits to review:
  - sample receipt procedures;
  - custody and sample security log in procedures;
  - sample throughput tracking procedure;
  - instrument calibration records;
  - instrument logs and statistics;
  - QA procedures;
  - logbooks;
  - sample preparation procedures;
  - sample analytical SOP;
  - instrument integrity;
  - glassware preparation; and,
  - lab conditions and interview personnel.
- submission of performance evaluation samples to the laboratory for analysis.

The laboratory will be given one week to address any non-conformances to the satisfaction of the Project Manager, Remedial Engineer and/or designee. Failure to resolve any or all audit procedures chosen can lead to laboratory disqualification and the requirement that another suitable laboratory be chosen.

### 4.3 Audit Records

If an audit is conducted, the Project Manager or designee will prepare an audit report. Nonconformance issues will be addressed and resolved by the Project Manager. The audit report and original records generated for the audit will be retained within the main project archives. Records will include audit reports, written replies, the record of completion of corrective actions, and documents associated with the conduct of audits, which support audit findings and corrective actions as appropriate.

### 4.4 Reports to Management

#### 4.4.1 Progress Reports

Project reporting will be performed in accordance with the RAWP. Copies of the daily field sheets will be transmitted or delivered to the Project Manager, and distributed to the Project Management Team on a daily basis. These data and records will allow the Project Manager and/or Remedial Engineer to assess the field data for completeness, comparability, accuracy and quality. The Project Manager and/or Remedial Engineer may also inspect field activities as needed during the project to observe progress, field procedures, and other aspects of the project. The daily field sheets will be sent via e-mail by the Project Field Supervisor or designee. The purpose of these reports is to inform the NYSDEC of the progress of the project and pertinent interim findings. This information will allow issues to be evaluated and addressed as necessary. In addition to progress reports, appropriate reports will be completed according to State requirements.

### 4.4.2 QA Reports

QA Reports will include verbal and/or written assessments of fieldwork progress and quality, and data accuracy and precision to the project team. The Project Field Supervisor will report to the Project Manager on a daily basis regarding progress of the fieldwork and quality control issues associated with field activities. Any corrective actions necessary will be documented by the Project Manager.

Laboratory analytical reports will include QA/QC summary data as described in Sections 3.5, 3.6 and 3.7. If, during laboratory analyses, any QA problems are encountered, the Laboratory QA Manager will call the Project Manager immediately for corrective action and also issue a written report.

The laboratory will submit analytical reports to the Project Field Supervisor and the Project Manager. The Project Manager and/or designee(s) will review each data set for the accuracy and precision of the data.

After all activities associated with the project are complete and all data has been reviewed, verified and validated, a final QA assessment will be performed. The assessment will summarize the quality assurance and audit information (if completed), indicating any corrective actions taken and the overall results of QAPP compliance. The Project Manager, Remedial Engineer and/or designee(s) will prepare this final review. The final QA data assessment be utilized during the decision-making process to assess data validation prior to incorporation as part of the FER.

## 5.0 DATA VALIDATION AND USABILITY

This section describes QA activities that will be conducted to ensure that the collected data are scientifically defensible, properly documented, of known quality, and meet project objectives. As appropriate, analytical data collected for the project may be validated. The following steps will be followed to ensure that project data quality needs are met.

## 5.1 Data Review, Verification, and Validation

### 5.1.1 Data Review

Data will be presented in tables and figures to identify trends, relationships, and/or anomalies. Data review is an in-house examination to ensure that the data have been recorded, transmitted, and processed correctly. This includes checking for data entry, transcription, calculation, reduction, and transformation errors. It is also a completeness check to ensure all data is accounted for and all sample information, such as sample matrixes, blanks, duplicates, shipping dates, preservatives, holding times, etc., is available. The Project Manager will be responsible for data review.

### 5.1.2 Data Verification

Data verification is a process of evaluating the completeness, correctness, and contractual compliance of a data set against the method standard, SOP, or contract requirements. Field data verification will be performed by the Project Manager. Laboratory data verification will be performed internally by the laboratory generating the data. Data may also be checked by an external entity.

Data verification is generally done before data validation. Data verification may result in accepted, qualified, or rejected data.

### 5.1.3 Data Validation

Data validation is an analyte- and sample-specific process that extends the qualification of data beyond method, procedural, or contractual compliance (i.e., data verification) to determine the quality of specific data sets. Data validation criteria are based on the measurement performance criteria of the project QAPP.

A third party data validator not otherwise involved with the project will be responsible for performing data validation analysis. Data validation may occur both during and at the end of the project. Data validation may result in accepted, qualified, or rejected data.

One hundred percent (100%) of the data will undergo a data review by the Project Manager and/or designee(s). The data review will include the review of the QC parameters discussed in this QAPP.

Sample analyses for each matrix will be validated by a third party validator for all confirmatory (post remediation) samples and final delineation samples for which Level IV (Category B Deliverables) laboratory analysis was performed. Following the third party data validation, they will issue a DUSR outlining the results of the data validation. This data will be the primary source of data for risk and final cleanup evaluation. In the event the data are unacceptable, additional validation may be required.

### 5.1.4 Data Usability Assessment

A data usability assessment is the process of evaluating validated data to determine if the data can be used for the purpose of the project (i.e., to answer project-required questions or to make qualified environmental decisions). Data usability will include the following sequence of evaluation:

1. individual data sets will be evaluated to identify the measurement performance/usability issues or problems affecting the ultimate achievement of the project DQOs;
2. an overall evaluation of all data generated for the project will be conducted; and,
3. the project-specific measurement performance criteria and data validation criteria will be evaluated to determine if they were appropriate for meeting project DQOs.

In order to complete the data evaluation steps above, the reported data will be supported by complete data packages which will include sample receipt and tracking information, chain-of-custody records, tabulated data summary forms, and raw analytical data for all field samples, standards, QC checks and QC samples, and all other project-specific documents that are generated.

## 5.2 Verification and Validation Methods

This section describes the process that will be followed to verify and validate the project data.

### 5.2.1 Verification

The Project Manager will verify that sampling, sample handling and field screening procedures as described in the QAPP were met. The laboratory data will be verified with respect to the chain-of-custody, units of measure, and citation of analytical methods. The Project Manager will also verify the use of blanks and duplicates. All applicable reference and identification codes and numbers will be reviewed as part of the documentation.

### 5.2.2 Validation

All sampling, handling, field analytical data, and fixed laboratory data will be validated by entities external to the data generator. The validation procedure will specify the verification process of every quality control measure used in the field and laboratory. Each analytical report will be reviewed for compliance with the applicable method and for the quality of the data reported.

### 5.2.3 Validation and Verification Procedures

The following procedures will be implemented to verify and validate data collected during a project:

- Sampling Design – How closely a measurement represents the actual environment at a given time and location is a complex issue. Each sample will be checked for compliance with specific work plan requirements, including type and location. The Project Field Supervisor will note deviations from the work plan requirements, and discuss them with the Project Manager.
- Sample Collection Procedures – Sample collection procedures identified in the RAWP will be followed. If field conditions require deviations, they will be communicated to the Project Manager and reported in the FER.

- Field Data Reporting - Field data reporting will be conducted principally through the transmission of report sheets containing tabulated results of all measurements made in the field and documentation of all field calibration activities.
- Sample Handling and Custody – Deviations from the planned sample handling procedures will be noted on the chain-of-custody forms, field logbooks and field sheets. Data collection activities will indicate any events that may occur during sample handling that may affect the integrity of the samples. Field technical staff members will evaluate the sample containers and the preservation methods used to ensure that they are appropriate to the nature of the sample and the type of data generated from the sample. Checks on the identity of the sample will be made to ensure that the sample continues to be representative of its native environments as it progresses through the analytical process.
- Analytical Procedures – Each sample will be verified to ensure that the procedures used to generate the data were implemented as specified. Data validation activities will be used to determine how seriously a sample deviated beyond the acceptance limit so that the potential effects of the deviation can be evaluated.
- Quality Control – QC checks that are to be performed during sample collections, handling, and analysis are specified in an earlier section of this QAPP. For each specified QC check, the procedures, acceptance criteria, and corrective action should be specified. During data validation, any corrective actions taken, any samples affected, and the potential effect of the actions on the validity of the data will be documented.
- Calibration – Field and laboratory instrument calibrations will be documented to ensure that calibrations:
  - were performed within an acceptable time prior to measurement data;
  - were performed in proper sequence;
  - included the proper number of calibration points;

- were performed using a standard that bracketed the range of reported measurement results; and,
- had acceptable linearity checks and other checks to ensure that the measurement system was stable when calibration was performed.

When calibration problems are identified, any data produced between the suspect calibration event and any subsequent recalibration will be flagged to alert data users.

- Data Reduction and Processing – Checks on data integrity will be performed to evaluate the accuracy of raw data and include the comparison of important events and duplicate re-keying of data to identify data entry errors.
  - All data generated through field activities or by the laboratory operation will be reduced and validated internally (via remedial project team and analytical laboratory) prior to final reporting. The laboratory will not disseminate data until it has been subjected to these procedures. All third party data validation (when required) for data generated through field activities will be reduced and validated prior to final reporting.
  - Field Data: All field data will be written into field logbooks and daily field sheets immediately after measurements are taken. If errors are made, results will be legibly crossed out, initialed, and dated by the field member, and corrected in a space adjacent to the original (erroneous) entry. Periodically throughout the field sampling effort, the Project Field Supervisor and/or designee will review the logbooks and daily field sheets to determine whether any errors have been made.
  - Laboratory Data: Laboratory data reduction procedures are located in the laboratory Quality Programs.

### 5.2.4 Data Assessment

After all data have been reviewed and validated, the third party validator will prepare a DUSR. Within the DUSR, all data points observed as having either a high or low bias (qualified data) will be evaluated for determination of data usability.

All laboratory and field data obtained will be reviewed and both qualitatively and quantitatively assessed by the Project Manager and/or designee on a project-wide, matrix-specific, parameter-specific, and/or unit-specific basis to confirm that it complies with this QAPP. The results of this assessment will be presented and discussed in detail in the FER. In addition, the Principal in Charge will review all data generated during this project as a part of the process of preparing the FER. Data that does not meet QC objectives will be qualified and will be used for decision-making purposes in accordance with the qualifiers.

## 5.3 Data Requirement Compliance Evaluation

The quality and quantity of data generated for the project will be compared to the project specific DQO that was developed. This section describes the scientific and statistical procedures/methods that will be used to determine whether data are of the right type, quality, and quantity to support environmental decision making for the project.

The Data Quality Assessment (DQA) process is described in Guidance for the Data Quality Assessment Process: Practical Methods for Data Analysis, EPA QA/G9, July 1996[2]. EPA QA/G-9 will be used, as appropriate, to guide the data assessment on the projects. The DQA process consists of five steps:

1. review DQO and sampling design;
2. conduct preliminary data review;
3. select statistical test;
4. verify assumptions; and,
5. draw conclusions from the data.

[2] United States Environmental Protection Agency (USEPA). 1996. Guidance for the Data Quality Assessment Process: Practical Methods for Data Analysis, EPA QA/G9, July

### 5.3.1 Data Quality Indicators Evaluation Criteria Details

The DQOs for field measurements and laboratory data during this project will be addressed in terms of the DQIs summarized in Section 1.3, above. Assessment and interpretation of DQI results are described in more detail below.

#### 5.3.1.1 Precision Assessment

The methods outlined in Section 1.1 will be implemented to ensure that the data is precise. The RPD between the spike and matrix spike, or matrix spike and sample duplicate in the case of metals, and field duplicate pair or laboratory duplicate pair is calculated to assess data precision. The RPD is calculated according to the following formula.

$$RPD = \left[\frac{|Amount\ in\ Sample\ 1 - Amount\ in\ Sample\ 2|}{\frac{Amount\ in\ Sample\ 1 + Amount\ in\ Sample\ 2}{2}}\right] * 100$$

Poor overall precision may be the result of one or more of the following:

- field instrument variation;
- analytical measurement variation;
- poor sampling techniques;
- sample transport problems; and/or
- heterogeneous matrices.

In order to identify the cause of any identified imprecision, the field sampling design rationale and sampling techniques should be evaluated by the Project Manager and Remedial Engineer, and both field and analytical duplicate/replicate sample results should be reviewed. If poor precision is indicated in both the field and analytical duplicates/replicates, then the laboratory may be the source of error. If poor precision is limited to the field duplicate/replicate results, then the sampling technique, field instrument variation, sample transport, or heterogeneous sample matrices may be the source of error.

#### 5.3.1.2 Accuracy Assessment

The methods outlined in Section 1.1 will be implemented to ensure that the data is accurate. To ensure the accuracy of field procedures, field blanks and/or trip blanks will be collected and measured, and all sample handling, preservation, and holding time criteria will be adhered. Every shipping container (e.g., cooler) with aqueous VOC samples will contain a trip blank sample. Field blanks will be collected once per day of sampling.

In order to ensure the accuracy of the analytical procedures, analysis of analytical spikes and/or reference standards (MS/MSD, LCS, surrogate compounds, or equivalent) will be conducted as required, and percent recoveries will be determined.

Percent recovery for MS/MSD results is determined according to the following equation:

$$\%R = \left(\frac{Amount\ in\ Spiked\ Sample - Amount\ in\ Parent\ Sample}{Amount\ of\ Spike\ Added}\right) * 100$$

Percent recovery for LCS and surrogate compound results is determined according to the following equation:

$$\%R = \left(\frac{Amount\ Found\ in\ Spiked\ Sample}{Amount\ of\ Spike\ Added}\right) * 100$$

The accuracy limits are specific for each laboratory and analysis. Accuracy control limits are given in Appendix I.

#### 5.3.1.3 Sample Representativeness

The methods outlined in Section 1.1 will be implemented to ensure that sample data is representative of the samples collected. QC check and sample data will be reviewed to assess sample representativeness. If field duplicate precision checks indicate potential spatial variability, data usability will be evaluated by the Project Manager and

Remedial Engineer. Subsequent re-sampling may be required in order to collect data that are more representative of a non-homogeneous Site.

#### 5.3.1.4 Completeness Assessment

The methods outlined in Section 1.1 will be implemented to ensure that data is complete. Completeness is the ratio of the number of valid sample results to the total number of samples analyzed with a specific matrix and/or analysis. Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

$$Completeness = \left(\frac{Number\ of\ Valid\ Measurements}{Total\ Number\ of\ Measurements}\right) * 100$$

#### 5.3.1.5 Comparability Assessment

The methods outlined in Section 1.1 will be implemented to ensure that data is comparable. For long-term monitoring projects, data comparability is extremely important. Project data will be compared to previously generated data to determine the possibility of false positives and/or false negatives. Variations detected in the data may reflect a changing environment or indicate sampling and/or analytical error. Comparability criteria will be established to evaluate these data sets in order to identify statistical outliers.

#### 5.3.1.6 Sensitivity and Quantification Limits

The methods outlined in Section 1.1 will be implemented to ensure that data meets the measurement performance criteria for sensitivity as specified. Low point calibration standards should produce a signal at least ten times the background noise levels and should be part of a linear calibration curve. The procedures for calculating minimum MDLs and RLs will be documented. If Data Validation Reports indicate that sensitivity and/or RLs were not achieved, then the impact of that lack of sensitivity and/or higher RLs on data usability will be evaluated.

#### 5.3.1.7 Sample Bias Assessment

The methods outlined in Section 1.1 will be implemented to ensure that data is not biased. Bias is systematic error, an example of which is calibration drift - a non-random change in a measurement system over time. Field calibration checks and a variety of QC samples (such as reference standards, matrix spike samples, and matrix-specific QC samples) will be used to determine the degree of bias (see Accuracy Assessment in Section 5.3.2).

### 5.3.2 Data Limitations and Corrective Actions

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter out-of-QC performance that can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation, and data assessment. Sources of sampling and analytical error identified will be corrected as early as possible prior to the onset of subsequent sample collection activities. All corrective action proposed and implemented will be documented in regular QA reports to management. Corrective action will only be implemented after approval by the Project Manager, Remedial Engineer or designee.

An ongoing data assessment process will be incorporated during the project to facilitate the early detection and correction of problems, ensuring that project quality objectives are met. For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the Project Manager who will in turn relay the information to the Remedial Engineer. If the problem is analytical in nature, information on these problems will be promptly communicated to the analytical laboratory.

Any nonconformance with the established QC procedures in the QAPP will be identified and corrected in accordance with the QAPP. The Project Manager, Remedial Engineer or designee will issue a nonconformance report for each nonconformance condition.

#### 5.3.2.1 Field Corrective Action

Situations may occur in which corrective action in the field may be needed (i.e., when sampling procedures and/or field analytical procedures require modification due to unexpected conditions). The field staff in consultation with the Project Manager and/or the Remedial Engineer will recommend a corrective action. The Project Manager will approve the corrective measure (after consultation with and concurrence by the NYSDEC Project Manager) which will be implemented by the field team. It will be the responsibility of the Project Manager to ensure the corrective action has been implemented. All corrective actions implemented will be documented in the field logbooks.

#### 5.3.2.2 Laboratory Corrective Action

Situations may occur prior to, during, and/or after initial analyses in which corrective action in the laboratory may be needed (e.g., broken sample containers, multiple phases, low/high pH readings, potentially high concentration samples, QC criteria not met, etc.). Depending on the condition encountered, the Laboratory QA Manager may consult the Project Manager for input. All laboratory corrective actions (i.e., method-specific corrective actions) will be documented and also identified in the case narrative of the data packages.

The laboratory will reanalyze any samples analyzed in non-conformance with the QC criteria, if sufficient volume is available and holding times for samples have not been exceeded. It is expected that sufficient volumes/weights of samples will be collected to allow for possible reanalysis if necessary.

#### 5.3.2.3 Corrective Action During Data Review/Validation and Assessment

If the need for corrective action is discovered during either the data review/validation or data assessment process, the Project Field Supervisor and/or associated data evaluation personnel will report the situation to the Project Manager and/or the Remedial Engineer. The Project Manager will be responsible for approving the im-

plementation of corrective action. The Project Manager will be responsible for documenting the corrective action. Potential types of corrective action may include resampling by the field team or re-extraction/re-analysis of samples by the laboratory.

dmd
July 16, 2013
f:\reports\sive paget\gowanus\phase 3 - bcp alternatives analysis & remedial action work plan\rawp\appendix h - quality assurance project plan (qapp)\site-specific qapp.doc

**TABLES**

**TABLE 1**

**GOWANUS VILLAGE I, LLC**
**322 3rd AVENUE**
**BROOKLYN, KINGS COUNTY, NEW YORK**
**NYSDEC BCP SITE NO. C224099**
**INDEX NO. W2-1069-0506**

**Quality Assurance Project Plan**

**Sample Guidelines for Matrix, Parameter, Method, Containers, Preservative and Holding Time**

| Matrix | Parameter | Method | Container | Preservative | Holding Time |
|---|---|---|---|---|---|
| Aqueous Samples | VOC | SW846 8260B | Three (3) 40 mL VOA glass vials | 4 ±2 °C, HCl | 14 days to analysis |
| | PCBs | SW 846 8082A | Two (2) Liter Amber glass bottle | 4 ±2 °C | 7 days to extract, 40 days to analysis |
| | Pesticides | SW 846 8081B | Two (2) Liter Amber glass bottle | 4 ±2 °C | 7 days to extract, 40 days to analysis |
| | Metals | SW 846 6010B | One (1) 500 mL - Plastic bottle | 4 ±2 °C, $HNO_3$ | 28 days for Mercury, 180 days for all other metals |
| | Mercury | SW 846 7470A | One (1) 500 mL - Plastic bottle | 4 ±2 °C, $HNO_3$ | 28 days |
| | Hexvalent Chromium | SW 846 9176A | 500 mL - Plastic bottle (No Acid) | 4 ±2 °C, HCl | 24 hours |
| | PAHs (SVOCs) | SW 846 8270C | One (1) Liter Amber glass bottle | 4 ±2 °C | 7 days to extract, 40 days to analysis |
| | GRO | SW 846 8015B | Two (2) 40 mL VOA glass vials | 4 ±2 °C, HCl | 14 days to analysis |
| | DRO | SW 846 8015B | One (1) Liter Amber glass bottle | 4 ±2 °C, HCl | 7 days to extract, 40 days to analysis |
| | ORO | SW 846 8015B | One (1) Liter Amber glass bottle | 4 ±2 °C, HCl | 7 days to extract, 40 days to analysis |
| | Cyanide | SW 846 9012B | 250 mL - Plastic or glass bottle | 4 ±2 °C, NaOH to pH>12, Ascorbic Acid | 14 days to analysis |
| | Ethanol, Methanol | SW 846 8015B | Two (2) 40 mL VOA glass vials | 4 ±2 °C, HCl | 14 days to analysis |
| | Tetraethyl Lead | SW 846 8270C | One (1) Liter Amber glass bottle | 4 ±2 °C | 7 days to extract, 40 days to analysis |
| | Ammonia | SM 4500-NH3 | 250 mL - Plastic bottle | 4 ±2 °C, $H_2SO_4$ | 28 days |
| | Nitrate | SM 4500-NO3 | 150 mL - Plastic bottle | 4 ±2 °C | 28 days |
| | Nitrite | SM 4500-NO2 | 150 mL - Plastic bottle | 4 ±2 °C | 48 hours |
| | pH | SW 846 9040C | 100 mL - Plastic or Glass bottle | 4 ±2 °C | Immediately |
| Soil / Sediment Samples | VOC | SW 846 8260B | Encore device | 4 ±2 °C | 14 days to analysis |
| | | | 4-oz Glass jar w/ no headspace, | 4 ±2 °C | 14 days to analysis |
| | | | 2-oz weighed jar - 25 grams of soil | 4 ±2 °C, Methanol | 14 days to analysis |
| | PCBs | SW 846 8082A | 4-oz Glass jar | 4 ±2 °C | 14 days to analysis |
| | Pesticides | SW 846 8081B | 4-oz Glass jar | 4 ±2 °C | 14 days to analysis |
| | GRO | SW 846 8015B | Encore device | 4 ±2 °C | 14 days to analysis |
| | | | 4-oz Glass jar w/ no headspace | 4 ±2 °C | 14 days to analysis |
| | | | 2-oz weighed jar - 25 grams of soil | 4 ±2 °C, Methanol | 14 days to analysis |
| | DRO | SW 846 8015B | 8-oz Glass jar | 4 ±2 °C | 14 days to extract, 40 days to analysis |
| | ORO | SW 846 8015B | 8-oz Glass jar | 4 ±2 °C | 14 days to extract, 40 days to analysis |
| | PAHs (SVOCs) | SW 846 8270C | 8-oz Glass jar | 4 ±2 °C | 14 days to extract, 40 days to analysis |
| | Metals | SW 846 6010B | 4-oz Glass jar | 4 ±2 °C | 14 days to extract, 40 days to analysis |
| | Mercury | SW 846 7471A | 4-oz Glass jar | 4 ±2 °C | 28 days to analysis |
| | Hexvalent Chromium | SW 846 6010B | 4-oz Glass jar | 4 ±2 °C | 30 days to analysis |
| | Cyanide | SW 846 9012B | 8-oz Glass jar | 4 ±2 °C | 14 days to analysis |
| | TCLP Metals | SW 846 1311/6010B | 8-oz Glass jar | 4 ±2 °C | 28 days for Mercury, 180 days for all other metals |
| | TCLP VOCs | SW 846 1311/8260B | 4-oz Glass jar | 4 ±2 °C | 14 days to extract, 14 days to analysis |
| | Ethanol, Methanol | SW 846 8015B | 4-oz Glass jar | 4 ±2 °C | 14 days to analysis |
| | Tetraethyl Lead | SW 846 8270C | 8-oz Glass jar | 4 ±2 °C | 14 days to extract, 40 days to analysis |
| | Ammonia | SM 4500-NH3 | 4-oz Glass jar | 4 ±2 °C | 28 days |
| | Nitrate | EPA 353.2 | 4-oz Glass jar | 4 ±2 °C | 28 days |
| | Nitrite | EPA 353.2 | 4-oz Glass jar | 4 ±2 °C | 28 days |
| | Flashpoint | SW 846 1010A | 4-oz Glass jar | N/A | N/A |
| | pH | SW 846 9045D | 4-oz Glass jar | 4 ±2 °C | ASAP |
| Air Samples | VOC | TO-15 | Summa Canister | None | 30 days |
| | | TO-15 Modified | Tedlar Bag | None | 72 hours |
| | Butane | TO-15 | Summa Canister | None | 30 days |
| | Propane | TO-15 | Summa Canister | None | 30 days |
| | Ammonia | OSHA ID-188/164 | Sorbent Tube | None | 14 days |
| | Ethanol | TO-15 | Summa Canister | None | 30 days |
| | | TO-15 Modified | Tedlar Bag | None | 72 hours |
| | Methanol | TO-3 | Summa Canister | None | 30 days |
| | | TO-3 | Tedlar Bag | None | 72 hours |

Notes:
VOC = Volatile Organic Compound
GRO = Gasoline Range Organics
DRO = Diesel Range Organics
ORO = Oil Range Organics
PAHs = Polynuclear Aromatic Hydrocarbons
TCLP = Toxic Chemical Leaching Procedure
mL = milliliters
VOA = Volatile Organic Analysis
°C = degrees Celsius
HCl = Hydrochloric Acid
$HNO_3$ = Nitric Acid
$H_2SO_4$ = Sulfuric Acid

**TABLE 2**

**GOWANUS VILLAGE I, LLC**
**322 3rd AVENUE**
**BROOKLYN, KINGS COUNTY, NEW YORK**
**NYSDEC BCP SITE NO. C224099**
**INDEX NO. W2-1069-0506**

**Quality Assurance Project Plan**

**General Field and Laboratory QA/QC Sample Collection/Analysis Schedule**

| Quality Assurance/Quality Control Sample | Frequency |
|---|---|
| Field Sample Duplicate | 1 set per sampling area per media type |
| Field (Equipment) blank | 1 set per sampling area |
| Trip bank | 1 per shipping container of aqueous samples for VOC analysis |
| Temperature blank | 1 per shipping container of samples requiring cool temperature preservation |
| Laboratory Method Blank | 1 per 20 samples, or 1 for each batch of samples of similar method and matrix |
| Laboratory Control Sample | 1 per 20 samples, or 1 for each batch of samples of similar method and matrix |
| Laboratory Matrix Spike/Matrix Spike Duplicate | 1 per 20 samples, or 1 for each batch of samples of similar method and matrix |
| Surrogate Spike | 1 for every sample for organic analyses when required by method |

**APPENDIX I**

**Analytical Laboratories - QA Plans, SOPs and Certifications**

**AMRO Environmental Lab Corp.**

**NEW YORK STATE DEPARTMENT OF HEALTH**
**WADSWORTH CENTER**

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

## CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

*Issued in accordance with and pursuant to section 502 Public Health Law of New York State*

*MS. NANCY STEWART*
*AMRO ENVIRONMENTAL LAB CORP*
*111 HERRICK STREET*
*MERRIMACK, NH 03054*

*NY Lab Id No: 11278*

*is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER*
*All approved analytes are listed below:*

| | |
|---|---|
| **Acrylates** | |
| Acrolein (Propenal) | EPA 624 |
| | EPA 8260B |
| Acrylonitrile | EPA 624 |
| | EPA 8260B |
| **Amines** | |
| 2-Nitroaniline | EPA 8270C |
| 3-Nitroaniline | EPA 8270C |
| 4-Chloroaniline | EPA 8270C |
| 4-Nitroaniline | EPA 8270C |
| Aniline | EPA 8270C |
| Pyridine | EPA 8270C |
| **Benzidines** | |
| 3,3'-Dichlorobenzidine | EPA 625 |
| | EPA 8270C |
| Benzidine | EPA 625 |
| | EPA 8270C |
| **Chlorinated Hydrocarbon Pesticides** | |
| 4,4'-DDD | EPA 608 |
| | EPA 8081A |
| 4,4'-DDE | EPA 608 |
| | EPA 8081A |
| 4,4'-DDT | EPA 608 |
| | EPA 8081A |
| Aldrin | EPA 608 |

| | |
|---|---|
| **Chlorinated Hydrocarbon Pesticides** | |
| Aldrin | EPA 8081A |
| alpha-BHC | EPA 608 |
| | EPA 8081A |
| beta-BHC | EPA 608 |
| | EPA 8081A |
| Chlordane Total | EPA 608 |
| | EPA 8081A |
| delta-BHC | EPA 608 |
| | EPA 8081A |
| Dieldrin | EPA 608 |
| | EPA 8081A |
| Endosulfan I | EPA 608 |
| | EPA 8081A |
| Endosulfan II | EPA 608 |
| | EPA 8081A |
| Endosulfan sulfate | EPA 608 |
| | EPA 8081A |
| Endrin | EPA 608 |
| | EPA 8081A |
| Endrin aldehyde | EPA 608 |
| | EPA 8081A |
| Heptachlor | EPA 608 |
| | EPA 8081A |
| Heptachlor epoxide | EPA 608 |
| | EPA 8081A |
| Lindane | EPA 608 |

Serial No.: 48581

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

**NEW YORK STATE DEPARTMENT OF HEALTH**
**WADSWORTH CENTER**

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

## CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

*Issued in accordance with and pursuant to section 502 Public Health Law of New York State*

*MS. NANCY STEWART*
*AMRO ENVIRONMENTAL LAB CORP*
*111 HERRICK STREET*
*MERRIMACK, NH 03054*

*NY Lab Id No: 11278*

*is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER*
*All approved analytes are listed below:*

| | |
|---|---|
| **Chlorinated Hydrocarbon Pesticides** | |
| Lindane | EPA 8081A |
| Methoxychlor | EPA 608 |
| | EPA 8081A |
| Toxaphene | EPA 608 |
| | EPA 8081A |
| **Chlorinated Hydrocarbons** | |
| 1,2,4-Trichlorobenzene | EPA 625 |
| | EPA 8270C |
| 2-Chloronaphthalene | EPA 625 |
| | EPA 8270C |
| Hexachlorobenzene | EPA 625 |
| | EPA 8270C |
| Hexachlorobutadiene | EPA 625 |
| | EPA 8270C |
| Hexachlorocyclopentadiene | EPA 625 |
| | EPA 8270C |
| Hexachloroethane | EPA 625 |
| | EPA 8270C |
| **Demand** | |
| Biochemical Oxygen Demand | SM 18-21 5210B (01) |
| Carbonaceous BOD | SM 18-21 5210B (01) |
| Chemical Oxygen Demand | HACH 8000 |
| **Haloethers** | |
| 4-Bromophenylphenyl ether | EPA 625 |
| 4-Bromophenylphenyl ether | EPA 8270C |
| 4-Chlorophenylphenyl ether | EPA 625 |
| | EPA 8270C |
| Bis(2-chloroethoxy)methane | EPA 625 |
| | EPA 8270C |
| Bis(2-chloroethyl)ether | EPA 625 |
| | EPA 8270C |
| Bis(2-chloroisopropyl) ether | EPA 625 |
| | EPA 8270C |
| **Mineral** | |
| Alkalinity | SM 18-21 2320B (97) |
| Calcium Hardness | EPA 200.7 Rev. 4.4 |
| Chloride | EPA 300.0 Rev. 2.1 |
| | SM 18-20 4500-Cl- C |
| Fluoride, Total | EPA 300.0 Rev. 2.1 |
| Hardness, Total | EPA 200.7 Rev. 4.4 |
| Sulfate (as SO4) | ASTM D516-90 02 & 07 |
| | EPA 300.0 Rev. 2.1 |
| **Nitroaromatics and Isophorone** | |
| 2,4-Dinitrotoluene | EPA 625 |
| | EPA 8270C |
| 2,6-Dinitrotoluene | EPA 625 |
| | EPA 8270C |
| Isophorone | EPA 625 |
| | EPA 8270C |

Serial No.: 48581

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

**NEW YORK STATE DEPARTMENT OF HEALTH**
**WADSWORTH CENTER**

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

## CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

*Issued in accordance with and pursuant to section 502 Public Health Law of New York State*

*MS. NANCY STEWART*
*AMRO ENVIRONMENTAL LAB CORP*
*111 HERRICK STREET*
*MERRIMACK, NH 03054*

*NY Lab Id No: 11278*

*is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER*
*All approved analytes are listed below:*

| | |
|---|---|
| **Nitroaromatics and Isophorone** | |
| Nitrobenzene | EPA 625 |
| | EPA 8270C |
| **Nitrosoamines** | |
| N-Nitrosodi-n-propylamine | EPA 625 |
| | EPA 8270C |
| N-Nitrosodiphenylamine | EPA 625 |
| | EPA 8270C |
| **Nutrient** | |
| Ammonia (as N) | SM 19-21 4500 NH3-C (97) |
| Kjeldahl Nitrogen, Total | SM 19-21 4500 NH3-C (97) |
| Nitrate (as N) | EPA 300.0 Rev. 2.1 |
| Nitrite (as N) | EPA 300.0 Rev. 2.1 |
| Orthophosphate (as P) | SM 18-21 4500-P E |
| Phosphorus, Total | SM 18-21 4500-P E |
| **Phthalate Esters** | |
| Benzyl butyl phthalate | EPA 625 |
| | EPA 8270C |
| Bis(2-ethylhexyl) phthalate | EPA 625 |
| | EPA 8270C |
| Diethyl phthalate | EPA 625 |
| | EPA 8270C |
| Dimethyl phthalate | EPA 625 |
| | EPA 8270C |
| Di-n-butyl phthalate | EPA 625 |
| **Phthalate Esters** | |
| Di-n-butyl phthalate | EPA 8270C |
| Di-n-octyl phthalate | EPA 625 |
| | EPA 8270C |
| **Polychlorinated Biphenyls** | |
| PCB-1016 | EPA 608 |
| | EPA 8082 |
| PCB-1221 | EPA 608 |
| | EPA 8082 |
| PCB-1232 | EPA 608 |
| | EPA 8082 |
| PCB-1242 | EPA 608 |
| | EPA 8082 |
| PCB-1248 | EPA 608 |
| | EPA 8082 |
| PCB-1254 | EPA 608 |
| | EPA 8082 |
| PCB-1260 | EPA 608 |
| | EPA 8082 |
| **Polynuclear Aromatics** | |
| Acenaphthene | EPA 625 |
| | EPA 8270C |
| Acenaphthylene | EPA 625 |
| | EPA 8270C |
| Anthracene | EPA 625 |
| | EPA 8270C |

Serial No.: 48581

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

**NEW YORK STATE DEPARTMENT OF HEALTH**
**WADSWORTH CENTER**

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

## CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

*Issued in accordance with and pursuant to section 502 Public Health Law of New York State*

*MS. NANCY STEWART*
*AMRO ENVIRONMENTAL LAB CORP*
*111 HERRICK STREET*
*MERRIMACK, NH 03054*

*NY Lab Id No: 11278*

*is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER*
*All approved analytes are listed below:*

| Polynuclear Aromatics | | Priority Pollutant Phenols | |
|---|---|---|---|
| Benzo(a)anthracene | EPA 625 | 2,4,5-Trichlorophenol | EPA 625 |
| | EPA 8270C | | EPA 8270C |
| Benzo(a)pyrene | EPA 625 | 2,4,6-Trichlorophenol | EPA 625 |
| | EPA 8270C | | EPA 8270C |
| Benzo(b)fluoranthene | EPA 625 | 2,4-Dichlorophenol | EPA 625 |
| | EPA 8270C | | EPA 8270C |
| Benzo(ghi)perylene | EPA 625 | 2,4-Dimethylphenol | EPA 625 |
| | EPA 8270C | | EPA 8270C |
| Benzo(k)fluoranthene | EPA 625 | 2,4-Dinitrophenol | EPA 625 |
| | EPA 8270C | | EPA 8270C |
| Chrysene | EPA 625 | 2-Chlorophenol | EPA 625 |
| | EPA 8270C | | EPA 8270C |
| Dibenzo(a,h)anthracene | EPA 625 | 2-Methyl-4,6-dinitrophenol | EPA 625 |
| | EPA 8270C | | EPA 8270C |
| Fluoranthene | EPA 625 | 2-Methylphenol | EPA 8270C |
| | EPA 8270C | 2-Nitrophenol | EPA 625 |
| Fluorene | EPA 625 | | EPA 8270C |
| | EPA 8270C | 4-Chloro-3-methylphenol | EPA 625 |
| Indeno(1,2,3-cd)pyrene | EPA 625 | | EPA 8270C |
| | EPA 8270C | 4-Nitrophenol | EPA 625 |
| Naphthalene | EPA 625 | | EPA 8270C |
| | EPA 8270C | Cresols, Total | EPA 8270C |
| Phenanthrene | EPA 625 | Pentachlorophenol | EPA 625 |
| | EPA 8270C | | EPA 8270C |
| Pyrene | EPA 625 | Phenol | EPA 625 |
| | EPA 8270C | | EPA 8270C |

Serial No.: 48581

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

**NEW YORK STATE DEPARTMENT OF HEALTH**
**WADSWORTH CENTER**

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

## CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

*Issued in accordance with and pursuant to section 502 Public Health Law of New York State*

*MS. NANCY STEWART*
*AMRO ENVIRONMENTAL LAB CORP*
*111 HERRICK STREET*
*MERRIMACK, NH 03054*

*NY Lab Id No: 11278*

*is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER*
*All approved analytes are listed below:*

| | |
|---|---|
| **Residue** | |
| Solids, Total | SM 18-21 2540B (97) |
| Solids, Total Dissolved | SM 18-21 2540C (97) |
| Solids, Total Suspended | SM 18-21 2540D (97) |
| **Semi-Volatile Organics** | |
| Benzoic Acid | EPA 8270C |
| Benzyl alcohol | EPA 8270C |
| Dibenzofuran | EPA 8270C |
| **Volatile Aromatics** | |
| 1,2-Dichlorobenzene | EPA 624 |
| | EPA 8260B |
| 1,3-Dichlorobenzene | EPA 624 |
| | EPA 8260B |
| 1,4-Dichlorobenzene | EPA 624 |
| | EPA 8260B |
| Benzene | EPA 624 |
| | EPA 8260B |
| Chlorobenzene | EPA 624 |
| | EPA 8260B |
| Ethyl benzene | EPA 624 |
| | EPA 8260B |
| Styrene | EPA 624 |
| | EPA 8260B |
| Toluene | EPA 624 |
| | EPA 8260B |
| Total Xylenes | EPA 624 |
| **Volatile Aromatics** | |
| Total Xylenes | EPA 8260B |
| **Volatile Halocarbons** | |
| 1,1,1-Trichloroethane | EPA 624 |
| | EPA 8260B |
| 1,1,2,2-Tetrachloroethane | EPA 624 |
| | EPA 8260B |
| 1,1,2-Trichloroethane | EPA 624 |
| | EPA 8260B |
| 1,1-Dichloroethane | EPA 624 |
| | EPA 8260B |
| 1,1-Dichloroethene | EPA 624 |
| | EPA 8260B |
| 1,2-Dichloroethane | EPA 624 |
| | EPA 8260B |
| 1,2-Dichloropropane | EPA 624 |
| | EPA 8260B |
| 2-Chloroethylvinyl ether | EPA 624 |
| | EPA 8260B |
| Bromodichloromethane | EPA 624 |
| | EPA 8260B |
| Bromoform | EPA 624 |
| | EPA 8260B |
| Bromomethane | EPA 624 |
| | EPA 8260B |
| Carbon tetrachloride | EPA 624 |

Serial No.: 48581

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

**NEW YORK STATE DEPARTMENT OF HEALTH**
**WADSWORTH CENTER**

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

## CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

*Issued in accordance with and pursuant to section 502 Public Health Law of New York State*

*MS. NANCY STEWART*
*AMRO ENVIRONMENTAL LAB CORP*
*111 HERRICK STREET*
*MERRIMACK, NH 03054*

*NY Lab Id No: 11278*

*is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER*
*All approved analytes are listed below:*

| | |
|---|---|
| **Volatile Halocarbons** | |
| Carbon tetrachloride | EPA 8260B |
| Chloroethane | EPA 624 |
| | EPA 8260B |
| Chloroform | EPA 624 |
| | EPA 8260B |
| Chloromethane | EPA 624 |
| | EPA 8260B |
| cis-1,2-Dichloroethene | EPA 8260B |
| cis-1,3-Dichloropropene | EPA 624 |
| | EPA 8260B |
| Dibromochloromethane | EPA 624 |
| | EPA 8260B |
| Dichlorodifluoromethane | EPA 624 |
| | EPA 8260B |
| Methylene chloride | EPA 624 |
| | EPA 8260B |
| Tetrachloroethene | EPA 624 |
| | EPA 8260B |
| trans-1,2-Dichloroethene | EPA 624 |
| | EPA 8260B |
| trans-1,3-Dichloropropene | EPA 624 |
| | EPA 8260B |
| Trichloroethene | EPA 624 |
| | EPA 8260B |
| Trichlorofluoromethane | EPA 624 |
| | EPA 8260B |
| **Volatile Halocarbons** | |
| Vinyl chloride | EPA 624 |
| | EPA 8260B |
| **Volatiles Organics** | |
| 2-Butanone (Methylethyl ketone) | EPA 8260B |
| 2-Hexanone | EPA 8260B |
| 4-Methyl-2-Pentanone | EPA 8260B |
| Acetone | EPA 8260B |
| Carbon Disulfide | EPA 8260B |
| Vinyl acetate | EPA 8260B |
| **Wastewater Metals I** | |
| Barium, Total | EPA 200.7 Rev. 4.4 |
| | EPA 6010B |
| Cadmium, Total | EPA 200.7 Rev. 4.4 |
| | EPA 200.9 Rev. 2.2 |
| | EPA 6010B |
| Calcium, Total | EPA 200.7 Rev. 4.4 |
| | EPA 6010B |
| Chromium, Total | EPA 200.7 Rev. 4.4 |
| | EPA 6010B |
| Copper, Total | EPA 200.7 Rev. 4.4 |
| | EPA 6010B |
| Iron, Total | EPA 200.7 Rev. 4.4 |
| | EPA 6010B |
| Lead, Total | EPA 200.7 Rev. 4.4 |
| | EPA 200.9 Rev. 2.2 |

Serial No.: 48581

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

**NEW YORK STATE DEPARTMENT OF HEALTH**
**WADSWORTH CENTER**

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

## CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

*Issued in accordance with and pursuant to section 502 Public Health Law of New York State*

*MS. NANCY STEWART*
*AMRO ENVIRONMENTAL LAB CORP*
*111 HERRICK STREET*
*MERRIMACK, NH 03054*

*NY Lab Id No: 11278*

*is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER*
*All approved analytes are listed below:*

| | |
|---|---|
| **Wastewater Metals I** | |
| Lead, Total | EPA 6010B |
| Magnesium, Total | EPA 200.7 Rev. 4.4 |
| | EPA 6010B |
| Manganese, Total | EPA 200.7 Rev. 4.4 |
| | EPA 6010B |
| Nickel, Total | EPA 200.7 Rev. 4.4 |
| | EPA 6010B |
| Potassium, Total | EPA 200.7 Rev. 4.4 |
| | EPA 6010B |
| Silver, Total | EPA 200.7 Rev. 4.4 |
| | EPA 200.9 Rev. 2.2 |
| | EPA 6010B |
| Sodium, Total | EPA 200.7 Rev. 4.4 |
| | EPA 6010B |
| Strontium, Total | EPA 200.7 Rev. 4.4 |
| | EPA 6010B |
| **Wastewater Metals II** | |
| Aluminum, Total | EPA 200.7 Rev. 4.4 |
| | EPA 6010B |
| Antimony, Total | EPA 200.7 Rev. 4.4 |
| | EPA 200.9 Rev. 2.2 |
| | EPA 6010B |
| Arsenic, Total | EPA 200.7 Rev. 4.4 |
| | EPA 200.9 Rev. 2.2 |
| | EPA 6010B |

| | |
|---|---|
| **Wastewater Metals II** | |
| Arsenic, Total | EPA 7060A |
| Beryllium, Total | EPA 200.7 Rev. 4.4 |
| | EPA 6010B |
| Chromium VI | EPA 7196A |
| | SM 18-19 3500-Cr D |
| Mercury, Total | EPA 245.1 Rev. 3.0 |
| | EPA 7470A |
| Selenium, Total | EPA 200.7 Rev. 4.4 |
| | EPA 200.9 Rev. 2.2 |
| | EPA 6010B |
| Vanadium, Total | EPA 200.7 Rev. 4.4 |
| | EPA 6010B |
| Zinc, Total | EPA 200.7 Rev. 4.4 |
| | EPA 6010B |
| **Wastewater Metals III** | |
| Cobalt, Total | EPA 200.7 Rev. 4.4 |
| | EPA 6010B |
| Molybdenum, Total | EPA 200.7 Rev. 4.4 |
| | EPA 6010B |
| Thallium, Total | EPA 200.7 Rev. 4.4 |
| | EPA 200.9 Rev. 2.2 |
| | EPA 6010B |
| Tin, Total | EPA 200.7 Rev. 4.4 |
| | EPA 6010B |
| Titanium, Total | EPA 200.7 Rev. 4.4 |

Serial No.: 48581

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

**NEW YORK STATE DEPARTMENT OF HEALTH**
**WADSWORTH CENTER**

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

## CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

*Issued in accordance with and pursuant to section 502 Public Health Law of New York State*

*MS. NANCY STEWART*
*AMRO ENVIRONMENTAL LAB CORP*
*111 HERRICK STREET*
*MERRIMACK, NH 03054*

*NY Lab Id No: 11278*

*is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER*
*All approved analytes are listed below:*

| | |
|---|---|
| **Wastewater Metals III** | |
| Titanium, Total | EPA 6010B |
| **Wastewater Miscellaneous** | |
| Boron, Total | EPA 200.7 Rev. 4.4 |
| | EPA 6010B |
| Cyanide, Total | EPA 9014 |
| | SM 18-21 4500-CN E (99) |
| Oil and Grease Total Recoverable (HEM | EPA 1664A |
| Phenols | EPA 420.1 Rev. 1978 |
| Specific Conductance | EPA 120.1 Rev. 1982 |
| **Sample Preparation Methods** | |
| | EPA 200.2 |
| | EPA 3010A |
| | EPA 3510C |
| | EPA 5030B |
| | SM 18-20 4500-CN C |
| | SM 18-21 4500-N Org B or C (97) |
| | SM 18-21 4500-NH3 B (97) |

Serial No.: 48581

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

# CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

*Issued in accordance with and pursuant to section 502 Public Health Law of New York State*

MS. NANCY STEWART
AMRO ENVIRONMENTAL LAB CORP
111 HERRICK STREET
MERRIMACK, NH 03054

*NY Lab Id No: 11278*

*is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2009) for the category*
*ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE*
*All approved analytes are listed below:*

**Acrylates**

| | |
|---|---|
| Acrolein (Propenal) | EPA 8260B |
| Acrylonitrile | EPA 8260B |

**Amines**

| | |
|---|---|
| 2-Nitroaniline | EPA 8270C |
| 3-Nitroaniline | EPA 8270C |
| 4-Chloroaniline | EPA 8270C |
| 4-Nitroaniline | EPA 8270C |
| Aniline | EPA 8270C |
| Carbazole | EPA 8270C |

**Benzidines**

| | |
|---|---|
| 3,3'-Dichlorobenzidine | EPA 8270C |
| Benzidine | EPA 8270C |

**Characteristic Testing**

| | |
|---|---|
| Reactivity | SW-846 Ch7 Sec. 7.3 |
| TCLP | EPA 1311 |

**Chlorinated Hydrocarbon Pesticides**

| | |
|---|---|
| 4,4'-DDD | EPA 8081A |
| 4,4'-DDE | EPA 8081A |
| 4,4'-DDT | EPA 8081A |
| Aldrin | EPA 8081A |
| alpha-BHC | EPA 8081A |
| beta-BHC | EPA 8081A |
| Chlordane-Total | EPA 8081A |
| delta-BHC | EPA 8081A |

**Chlorinated Hydrocarbon Pesticides**

| | |
|---|---|
| Dieldrin | EPA 8081A |
| Endosulfan I | EPA 8081A |
| Endosulfan II | EPA 8081A |
| Endosulfan sulfate | EPA 8081A |
| Endrin | EPA 8081A |
| Endrin aldehyde | EPA 8081A |
| Heptachlor | EPA 8081A |
| Heptachlor epoxide | EPA 8081A |
| Lindane | EPA 8081A |
| Methoxychlor | EPA 8081A |
| Toxaphene | EPA 8081A |

**Chlorinated Hydrocarbons**

| | |
|---|---|
| 1,2,4-Trichlorobenzene | EPA 8270C |
| 2-Chloronaphthalene | EPA 8270C |
| Hexachlorobenzene | EPA 8270C |
| Hexachlorobutadiene | EPA 8270C |
| Hexachlorocyclopentadiene | EPA 8270C |
| Hexachloroethane | EPA 8270C |

**Haloethers**

| | |
|---|---|
| 4-Bromophenyl-phenyl ether | EPA 8270C |
| 4-Chlorophenyl-phenyl ether | EPA 8270C |
| Bis(2-chloroethoxy)methane | EPA 8270C |
| Bis(2-chloroethyl)ether | EPA 8270C |
| Bis(2-chloroisopropyl) ether | EPA 8270C |

Serial No.: 48582

Property of the New York State Department of Health. Certificate is valid only at the address listed. Must be conspicuously posted and available for review upon request. Current and scheduled analytes are available on request and/or at the Program Coordinators are urged to call (518) 485-2570 to verify the laboratory's accreditation status.

**NEW YORK STATE DEPARTMENT OF HEALTH**
**WADSWORTH CENTER**

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

## CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

*Issued in accordance with and pursuant to section 502 Public Health Law of New York State*

*MS. NANCY STEWART*
*AMRO ENVIRONMENTAL LAB CORP*
*111 HERRICK STREET*
*MERRIMACK, NH 03054*

*NY Lab Id No: 11278*

*is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE*
*All approved analytes are listed below:*

| | |
|---|---|
| **Metals I** | |
| Barium, Total | EPA 6010B |
| Cadmium, Total | EPA 6010B |
| Calcium, Total | EPA 6010B |
| Chromium, Total | EPA 6010B |
| Copper, Total | EPA 6010B |
| Iron, Total | EPA 6010B |
| Lead, Total | EPA 6010B |
| Magnesium, Total | EPA 6010B |
| Manganese, Total | EPA 6010B |
| Nickel, Total | EPA 6010B |
| Potassium, Total | EPA 6010B |
| Silver, Total | EPA 6010B |
| Sodium, Total | EPA 6010B |
| **Metals II** | |
| Aluminum, Total | EPA 6010B |
| Antimony, Total | EPA 6010B |
| Arsenic, Total | EPA 6010B |
| | EPA 7060A |
| Beryllium, Total | EPA 6010B |
| Chromium VI | EPA 7196A |
| Mercury, Total | EPA 7471A |
| Selenium, Total | EPA 6010B |
| Vanadium, Total | EPA 6010B |
| Zinc, Total | EPA 6010B |
| **Metals III** | |
| Cobalt, Total | EPA 6010B |
| Molybdenum, Total | EPA 6010B |
| Thallium, Total | EPA 6010B |
| Tin, Total | EPA 6010B |
| **Miscellaneous** | |
| Boron, Total | EPA 6010B |
| Cyanide, Total | EPA 9014 |
| **Nitroaromatics and Isophorone** | |
| 2,4-Dinitrotoluene | EPA 8270C |
| 2,6-Dinitrotoluene | EPA 8270C |
| Isophorone | EPA 8270C |
| Nitrobenzene | EPA 8270C |
| Pyridine | EPA 8270C |
| **Nitrosoamines** | |
| N-Nitrosodimethylamine | EPA 8270C |
| N-Nitrosodi-n-propylamine | EPA 8270C |
| N-Nitrosodiphenylamine | EPA 8270C |
| **Nutrients** | |
| Nitrite (as N) | EPA 9056A |
| **Phthalate Esters** | |
| Benzyl butyl phthalate | EPA 8270C |
| Bis(2-ethylhexyl) phthalate | EPA 8270C |
| Diethyl phthalate | EPA 8270C |

Serial No.: 48582

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

# CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

*Issued in accordance with and pursuant to section 502 Public Health Law of New York State*

*MS. NANCY STEWART*
*AMPO ENVIRONMENTAL LAB CORP*
*111 HERWICK STREET*
*MERRIMACK, NH 03054*

*NY Lab Id No: 11278*

*is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category*
*ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE*
*All approved analytes are listed below:*

**Phthalate Esters**

| | |
|---|---|
| Diethyl phthalate | EPA 8270C |
| Di-n-butyl phthalate | EPA 8270C |
| Di-n-octyl phthalate | EPA 8270C |

**Polychlorinated Biphenyls**

| | |
|---|---|
| PCB-1016 | EPA 8082 |
| PCB-1221 | EPA 8082 |
| PCB-1232 | EPA 8082 |
| PCB-1242 | EPA 8082 |
| PCB-1248 | EPA 8082 |
| PCB-1254 | EPA 8082 |
| PCB-1260 | EPA 8082 |

**Polynuclear Aromatic Hydrocarbons**

| | |
|---|---|
| Acenaphthene | EPA 8270C |
| Acenaphthylene | EPA 8270C |
| Anthracene | EPA 8270C |
| Benzo(a)anthracene | EPA 8270C |
| Benzo(a)pyrene | EPA 8270C |
| Benzo(b)fluoranthene | EPA 8270C |
| Benzo(ghi)perylene | EPA 8270C |
| Benzo(k)fluoranthene | EPA 8270C |
| Chrysene | EPA 8270C |
| Dibenz(a,h)anthracene | EPA 8270C |
| Fluoranthene | EPA 8270C |
| Fluorene | EPA 8270C |
| Indeno(1,2,3-cd)pyrene | EPA 8270C |

**Polynuclear Aromatic Hydrocarbons**

| | |
|---|---|
| Naphthalene | EPA 8270C |
| Phenanthrene | EPA 8270C |
| Pyrene | EPA 8270C |

**Priority Pollutant Phenols**

| | |
|---|---|
| 2,4,6-Trichlorophenol | EPA 8270C |
| 2,4-Trichlorophenol | EPA 8270C |
| 2,4-Dichlorophenol | EPA 8270C |
| 2,4-Dimethylphenol | EPA 8270C |
| 2,4-Dinitrophenol | EPA 8270C |
| 2-Chlorophenol | EPA 8270C |
| 2-Methyl-4,6-dinitrophenol | EPA 8270C |
| 2-Methylphenol | EPA 8270C |
| 2-Nitrophenol | EPA 8270C |
| 4-Chloro-3-methylphenol | EPA 8270C |
| 4-Nitrophenol | EPA 8270C |
| Pentachlorophenol | EPA 8270C |
| Phenol | EPA 8270C |

**Semi-Volatile Organics**

| | |
|---|---|
| 2-Methylnaphthalene | EPA 8270C |
| Acetophenone | EPA 8270C |
| Benzoic Acid | EPA 8270C |
| Benzyl alcohol | EPA 8270C |
| Dibenzofuran | EPA 8270C |

Serial No.: 48582

Property of the New York State Department of Health. Certificate not valid only at the address listed. Must be conspicuously posted, and be posted in latest date. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

## CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

*Issued in accordance with and pursuant to section 502 Public Health Law of New York State*

MS. NANCY STEWART
AMRO ENVIRONMENTAL LAB CORP
111 HERRICK STREET
MERRIMACK, NH 03054

*NY Lab ID No: 11278*

*is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2009) for the category*
*ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE*
*All approved analytes are listed below:*

| Volatile Aromatics | | Volatile Halocarbons | |
|---|---|---|---|
| 1,2,4-Trimethylbenzene | EPA 8260B | 1,2-Dichloroethane | EPA 8260B |
| 1,2-Dichlorobenzene | EPA 8260B | 1,3-Dichloropropane | EPA 8260B |
| 1,3,5-Trimethylbenzene | EPA 8260B | 2-Chloroethyl vinyl ether | EPA 8260B |
| 1,3-Dichlorobenzene | EPA 8260B | Bromochloromethane | EPA 8260B |
| 1,4-Dichlorobenzene | EPA 8260B | Bromoform | EPA 8260B |
| 2-Chlorotoluene | EPA 8260B | Bromomethane | EPA 8260B |
| 4-Chlorotoluene | EPA 8260B | Carbon tetrachloride | EPA 8260B |
| Benzene | EPA 8260B | Chloroethane | EPA 8260B |
| Bromobenzene | EPA 8260B | Chloroform | EPA 8260B |
| Chlorobenzene | EPA 8260B | Chloromethane | EPA 8260B |
| Ethyl benzene | EPA 8260B | cis-1,3-Dichloropropene | EPA 8260B |
| Isopropylbenzene | EPA 8260B | Dibromochloromethane | EPA 8260B |
| n-Butylbenzene | EPA 8260B | Dichlorodifluoromethane | EPA 8260B |
| sec-Butylbenzene | EPA 8260B | Tetrachloroethene | EPA 8260B |
| Styrene | EPA 8260B | trans-1,3-Dichloropropene | EPA 8260B |
| tert-Butylbenzene | EPA 8260B | Trichloroethene | EPA 8260B |
| Toluene | EPA 8260B | Trichlorofluoromethane | EPA 8260B |
| Total Xylenes | EPA 8260B | Vinyl chloride | EPA 8260B |

| Volatile Halocarbons | | Volatile Organics | |
|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | EPA 8260B | 1,4-Dioxane | EPA 8260B |
| 1,1,1-Trichloroethane | EPA 8260B | 2-Butanone (Methylethyl ketone) | EPA 8260B |
| 1,1,2,2-Tetrachloroethane | EPA 8260B | 2-Hexanone | EPA 8260B |
| 1,1,2-Trichloroethane | EPA 8260B | 4-Methyl-2-Pentanone | EPA 8260B |
| 1,1-Dichloroethene | EPA 8260B | Acetone | EPA 8260B |
| 1,1-Dichloroethane | EPA 8260B | Carbon Disulfide | EPA 8260B |

Serial No.: 40582

Property of the New York State Department of Health. Certificate is valid only at the address listed, must be conspicuously posted, and be placed on plain paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-2000 to verify the laboratory's accreditation status.

**NEW YORK STATE DEPARTMENT OF HEALTH**
**WADSWORTH CENTER**

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

## CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

*Issued in accordance with and pursuant to section 502 Public Health Law of New York State*

*MS. NANCY STEWART*
*AMRO ENVIRONMENTAL LAB CORP*
*111 HERRICK STREET*
*MERRIMACK, NH 03054*

*NY Lab Id No: 11278*

*is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE*
*All approved analytes are listed below:*

**Volatile Organics**

| | |
|---|---|
| Vinyl acetate | EPA 8260B |

**Sample Preparation Methods**

EPA 3010A
EPA 3050B
EPA 3051
EPA 3541

Serial No.: 48582

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

# QUALITY SYSTEMS MANUAL

**For**

# ENVIRONMENTAL ANALYSES POTABLE WATER, NON POTABLE WATER AND SOLID AND HAZARDOUS WASTE

## AMRO ENVIRONMENTAL LABORATORIES CORPORATION

**Revision No.: 14**

**JANUARY 2012**

Reviewed and Approved by

**Nancy Stewart/**
**Lead Technical Director & Quality Assurance Manager**

1-30-2012
**Date**

Prepared by: Nancy Stewart (01/12)

**Property of AMRO Environmental Laboratories Corporation**

# TABLE OF CONTENTS


| SECTION # | TOPIC | DATE | REVISION |
|---|---|---|---|
| 1 | **Policy Statement** | 06/08 | 6 |
| 2 | **Organizational Structure**<br>2.1 Organizational Structure | 01/12 | 10 |
| 3 | **Approved Signatories** | 03/11 | 9 |
| 4 | **Qualifications and Training**<br>4.1 Qualifications<br>4.2 Training | 09/09 | 8 |
| 5 | **Sample Collection and Receipt**<br>5.1 Bottle Preparation<br>5.2 Sampling and Preservation<br>5.3 Sample Receipt | 09/09 | 7 |
| 6 | **Incoming Work Review**<br>6.1 New Work<br>6.2 Existing Work<br>6.3 Current Work | 09/09 | 5 |
| 7 | **Analytical Procedures**<br>7.1 Analytical Procedures<br>7.2 Standard Operating Procedures | 03/11 | 12 |
| 8 | **Instrument/Equipment and Facilities**<br>8.1 AMRO Equipment/Instrumentation List<br>8.2 Facilities<br>8.3 Support Services used by AMRO | 13/11 | 8 |
| 9 | **Traceability**<br>9.1 Chemical Receipt<br>9.2 Standard Preparation<br>9.3 Standard Tracking<br>9.4 Solution Check Analysis<br>9.5 Solvent Check Analysis<br>9.6 Distilled Water Check Analysis | 01/10 | 7 |

| SECTION # | TOPIC | DATE | REVISION |
|---|---|---|---|
| 10 | **Calibration/Verification of Test Procedures** | 03/11 | 12 |
| | 10.1 Method Detection Limits (MDL) | | |
| | 10.2 Precision and Accuracy Studies | | |
| | 10.3 GC/MS (Volatile Organics) | | |
| | 10.4 GC/MS (Semivolatile Organics) | | |
| | 10.5 GC Pesticides | | |
| | 10.6 GC PCBs | | |
| | 10.7 GC Fingerprint | | |
| | 10.8 Instrumental Detection Limits (IDL) | | |
| | 10.9 Graphite Furnace (GFAA) | | |
| | 10.10 ICP | | |
| | 10.11 Mercury Analyzer System | | |
| | 10.12 Ion Chromatography | | |
| 11 | **Instrument Equipment Calibration** | 13/11 | 10 |
| | 11.1 Calibration Checks and Frequencies | | |
| | 11.2 Instrument Maintenance/Repair | | |
| 12 | **Quality Control Samples** | 01/08 | 5 |
| | 12.1 Quality Assurance | | |
| | 12.2 Accuracy | | |
| | 12.3 Precision | | |
| | 12.4 Completeness | | |
| | 12.5 Representativeness | | |
| | 12.6 Comparability | | |
| | 12.7 QC Sample Types | | |
| | 12.8 Proficiency Testing | | |
| | 12.9 Internal Verification | | |
| | 12.10 Control Charts | | |
| 13 | **Corrective Action** | 02/04 | 3 |
| | 13.1 General | | |
| | 13.2 Definition | | |
| | 13.3 Initiation of Action | | |
| | 13.4 Documentation of Corrective Action | | |
| | 13.5 Training | | |
| | 13.6 Non-Conforming Data Report | | |
| | 13.7 Documentation of Non-Conforming Report Data | | |
| | 13.8 Client Requested Investigation | | |
| | 13.9 Complaints | | |

| SECTION # | TOPIC | DATE | REVISION |
|---|---|---|---|
| 14 | **Departures From Documented Policies and Procedures** | 02/02 | 3 |
| 15 | **Data Handling and Reporting**<br>15.1 Gathering and Reporting Data<br>15.2 Data Review<br>15.3 Analytical Values<br>15.4 Data Reporting<br>15.5 Records Management<br>15.6 Records Transfer | 01/12 | 12 |
| 16 | **Confidentiality and Proprietary Rights** | 03/03 | 1 |
| 17 | **Audits and Certifications**<br>17.1 System Audits<br>17.2 Performance Evaluation Audits<br>17.3 Internal Audits<br>17.4 External Audits<br>17.5 Data Integrity Audits<br>17.6 Certifications | 01/12 | 11 |
| 18 | **Record Retention and Data Archiving**<br>18.1 Data Security/Archiving<br>18.2 Forms<br>18.3 Logbooks<br>18.4 SOP's<br>18.5 Certificates | 03/11 | 5 |
| 19 | **References** | 01/10 | 10 |

# ATTACHMENTS

Attachment 1 – AMRO Ethics and Data Integrity Agreement
Attachment 2 – AMRO Qualification Card
Attachment 3 – AMRO Bottle Preparation Preservation Requirements
Attachment 4 – AMRO Sample Container, Preservation and Holding Time Requirements
Attachment 5 – AMRO Chain-Of-Custody
Attachment 6– AMRO Project Number Assignment Log
Attachment 7a&b – AMRO Sample Receipt Checklist
Attachment 8 – AMRO Sample Receipt fax to clients
Attachment 9 – AMRO Internal Chain of Custody Form
Attachment 10 – AMRO Incoming Notice Form
Attachment 11 – AMRO GC/MS Method Information Form
Attachment12- AMRO Instrument List
Attachment 13 – AMRO Chemical Receiving Log Form
Attachment 14 – AMRO Inorganic Standard Log Form
Attachment 15 – AMRO Mercury Standard Log Form
Attachment 16– AMRO Optima ICP Standard Log Form
Attachment 17 – AMRO Graphite Furnace Standard Log Form
Attachment 18 – AMRO Inorganic Reagent Log Form
Attachment 19 – AMRO Organic Standard Log Index Form
Attachment 20 – AMRO Organic Stock Standard Log Form
Attachment 21 – AMRO Organic Working Standard Log Form
Attachment 22 – AMRO Method Detection Limit Checklist
Attachment 23 – AMRO Precision and Accuracy Checklist
Attachment 24 – AMRO Corrective Actions Report and Status
Attachment 25 – AMRO Surveillance Report
Attachment 26 – AMRO Non-Conforming Data Report
Attachment 27 – AMRO GC and GC/MS Data Review Checklist
Attachment 28 – AMRO ICP Data Review Checklist
Attachment 29 – AMRO GFAA and CVAA Data Review Checklist
Attachment 30 – AMRO Wet Chemistry Data Review Checklist
Attachment 31a&b – AMRO Data Review Checklist
Attachment 32 – AMRO Report Packages List
Attachment 33– AMRO Storage Boxes Tracking Log
Attachment 34– AMRO Sign Out Storage Boxes Log
Attachment 35 – AMRO Interim Change Notification Form

# SECTION 1. POLICY STATEMENT

**This policy statement serves to establish the top management's objectives and commitments to the laboratory**

AMRO Environmental Laboratories Corporation of Merrimack, New Hampshire was incorporated in 1987 to provide environmental testing services. AMRO's capabilities include volatile organics, semivolatile organics, pesticides, PCB's, petroleum hydrocarbon fingerprinting, EPH, VPH, industrial solvents, trace metals and inorganic analyses in wastewater, drinking water, soil, sediment, solid and hazardous wastes. AMRO also has the capability to perform the Toxicity Characteristics Leaching Procedure (TCLP) and Hazardous waste characteristics testing.

The owners of AMRO are committed to producing the highest quality results possible with the objective of continuously improving all areas of our operation. These objectives are accomplished through the quality systems that are in place throughout the laboratory. Management stresses to the staff that quality is considered to be the responsibility of all AMRO personnel. Laboratory personnel should be free from any undue internal or external commercial, financial or other pressure and influences that may adversely affect the quality of their work. Any personnel that experiences any such pressure should immediately inform one of the owners. All analysts are thoroughly trained, tested in each method and where applicable required to pass a precision and accuracy study before analyzing actual samples. All procedures require an initial startup check to demonstrate the ability to produce acceptable results prior to implementation. Experienced staff members review all results prior to data being released to clients. Employees are also required to sign an "Ethics and Data Integrity Agreement" upon starting employment at AMRO (Attachment 1). This statement helps to ensure employee awareness of the commitment the company has to produce quality data and the role of the employee in realizing this goal.

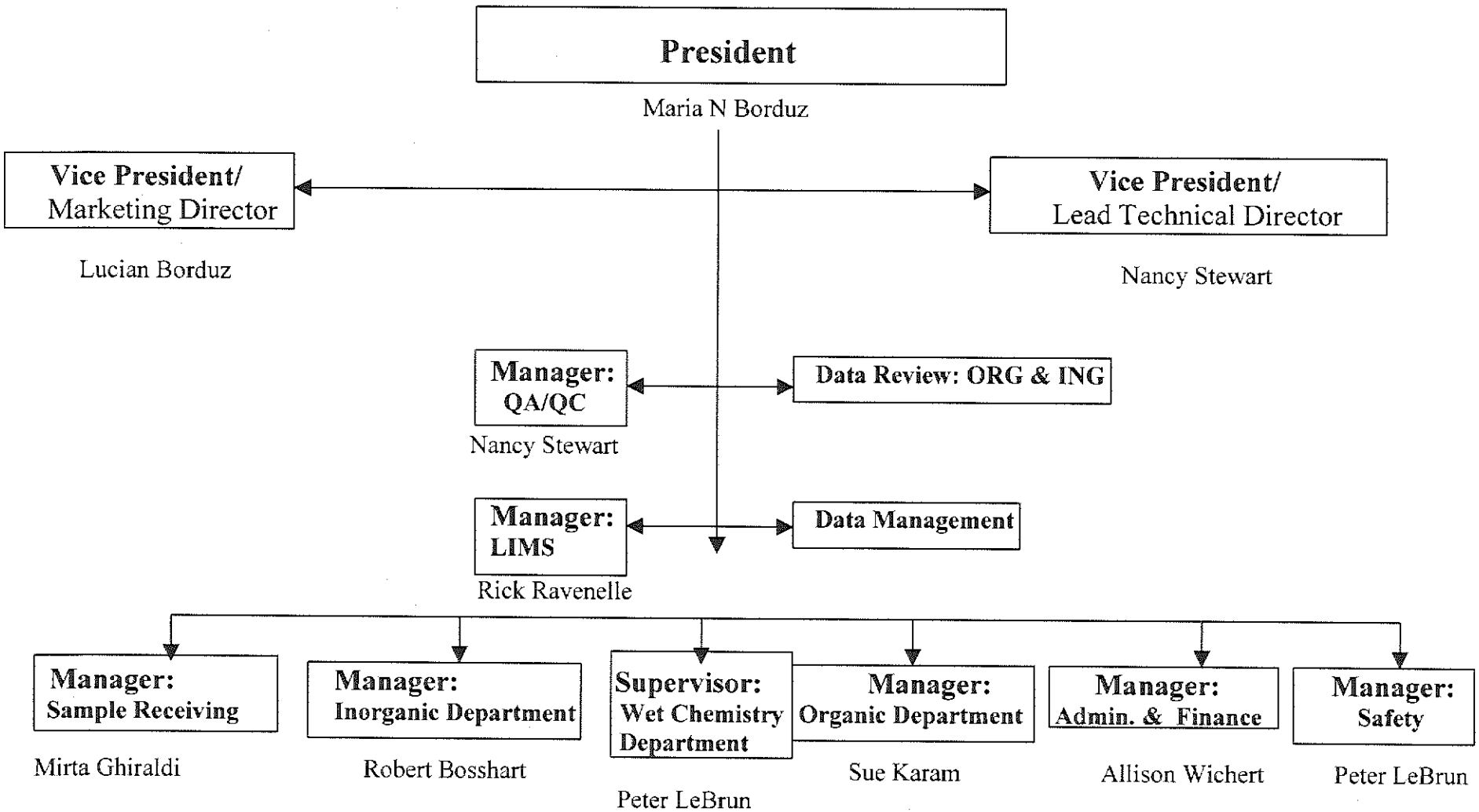
The Quality Systems Manual and all the laboratory Standard Operating Procedures (SOP's) meet the requirements of the National Environmental Laboratory Accreditation Conference (NELAC), Massachusetts Contingency Plan (MCP) and Department of Defense (DOD).

This Quality Systems Manual defines the quality assurance and quality control procedures that are employed here at AMRO to ensure the accuracy, precision, completeness, representatives and comparability of the analytical data generated in our laboratory. The Quality Assurance/Quality Control (QA/QC) Manager is responsible for controlling and updating the Quality Systems Manual as needed. It is reviewed and updated annually, at a minimum. All employees are required to read and sign the Quality Systems Manual the first day of employment and annually after Manual is updated.

# SECTION 2. ORGANIZATIONAL STRUCTURE

**2.1** The organizational structure of AMRO is outlined in Figure 1. and shows the different areas within the laboratory. AMRO is managed by Maria N. Borduz, President; Nancy Stewart, Vice President and Lead Technical Director; and Lucian Borduz, Vice President and Chief Operational Officer. All three hold degrees in chemistry and each has between 35 to 50 years of experience in analytical chemistry.

# AMRO Environmental Laboratories Corporation
## Corporate Organizational Structure



# SECTION 3. APPROVED SIGNATORIES

The following Personnel are considered approved signatories for the items indicated:

**President:** Maria N. Borduz- Approved signatory of the Quality Systems Manual, final data package, Corrective Actions Report, SOP's, Non-Conformance Reports, and purchasing.

**Vice President/Lead Technical Director:** Nancy Stewart – Approved signatory of the Quality Systems Manual, final data package, Corrective Actions Report, SOP's, Non-Conformance Reports, and purchasing.

**QA/QC Manager:** Nancy Stewart – Approved signatory of the Quality Systems Manual, final data packages, laboratory training, SOP's approval for the laboratory, Corrective Actions, and Non-Conformance Report.

**Organic Section Manager:** Sue Karam – Approved signatory of the final semivolatiles and volatiles report review, final data package, SOP's, Corrective Actions, Non-Conformance Report, organic section approval of training and organic section approval for purchasing.

**VOA Supervisor:** Sue Karam- Approved signatory of the final volatiles report review, SOP's, Corrective Actions, Non-Conformance Report, VOA section approval of training and organic section approval for purchasing.

**Inorganic Manager:** Robert Bosshart - Approved signatory of the final inorganic/metals report, final data package, SOP's, Corrective Actions, Non-Conformance Report, approval for the inorganic/metals section, inorganic/metals section approval of training and inorganic/metals section approval for purchasing.

**Wet Chemistry Supervisor:** Peter LeBrun - Approved signatory of the final wet chemistry report, SOP's, Corrective Actions, Non-Conformance Report, wet chemistry section approval of training and wet chemistry section approval for purchasing.

# SECTION 4. QUALIFICATIONS AND TRAINING

## 4.1 QUALIFICATIONS

### 4.1.1 Lead Technical Director

Responsibilities:

- To oversee the technical performance of the laboratory and is responsible for laboratory operations.
- The overall financial and technical performance of the Laboratory
- To review and approve chemical procedures
- To review reports to clients
- Designated as substitute for Organic Manager and QA/QC Manager

Qualifications - Education: B.S. or B.A. in chemistry or related science.

Experience:

- Minimum of 15 years experience in laboratory operation.
- Demonstrated proficiency in management of one or more laboratory departments.
- Demonstrated proficiency in program design and implementation, selection of equipment, procedure development, data evaluation and interpretation, report preparation, supervision of personnel and knowledgeable in necessary aspects of chemical measurement.
- Thoroughly familiar with functional and analytical aspects of current program.

### 4.1.2 Laboratory Information Management Systems (LIMS) Manager

Responsibilities:

- Ensure proper functionality of the LIMS.
- Perform routine network maintenance in regards to internet connection, electronic messaging services, virus protection and data backup and storage.
- Evaluate impact of upgrades to the LIMS
- Document procedures for LIMS use.
- Implement, training and troubleshooting the LIMS including instrument data acquisition to ensure optimal efficiency of laboratory data processing and data integrity.
- Implement system security.

Qualifications- Education: B.S. or B.A. in chemistry or computer science.

Experience:

- 6 months experience in design/implementation of Access97 database or equivalent.

4.1.3 Manager Organic Department

Responsibilities:

- Responsible for organic laboratory operations.
- To review reports to clients.
- To review and approve organic chemical procedures.
- To respond to client inquiries concerning analyses and results.
- Designated substitute for the Laboratory Director and QA/QC Manager.

Qualifications- Education: B.S. or B.A. in chemistry or related science.

Experience:

- Minimum 6 years experience in laboratory operations.
- Demonstrated proficiency in supervision of one or more laboratory departments.
- Thoroughly familiar with functional and analytical aspects of the organic department.

4.1.4 Supervisor Volatile Department

Responsibilities:

- Responsible for daily operations of the department.
- To prepare procedures and suggest modifications for improvement of quality systems in the volatiles laboratory.
- To review and approve volatile chemical procedures.
- To review volatile reports and results.
- To review specific QC procedures and implement corrective action where necessary.
- To respond to client inquiries concerning volatile analyses and results.
- Responsible for review of external Performance Evaluation sample results.
- Reports to the Laboratory Director.

Qualifications- Education: B.S. or B.A. in Chemistry or related science.

Experience:

- Minimum of 4 years experience in analytical chemistry.
- 2 years experience in volatile analysis.
- Thoroughly familiar with the laboratory analytical and QA/QC procedures of the VOA department.
- Capable of following complex procedures and instructing others to do the same.

4.1.5 Manager Inorganic Department

Responsibilities:

- Responsible for daily inorganic/metals laboratory operations.
- To prepare procedures and suggest modifications for improvement of quality systems in the inorganic/metals section of the laboratory.
- To review and approve inorganic/metals chemical procedures.
- To review inorganic/metals reports and results.
- To review specific QC procedures and implement corrective action where necessary.
- To respond to client inquiries concerning inorganic/metals analyses and results.
- Responsible for review of external Performance Evaluation sample results.
- Reports to the Laboratory Director.

Qualifications- Education: B.S. or B.A. in chemistry or related science.

Experience:

- Minimum 6 years experience in laboratory operations.
- Minimum of 4 years experience in analytical chemistry.
- Minimum of 2 years experience in metals analysis.
- Demonstrated proficiency in supervision of one or more laboratory departments.
- Thoroughly familiar with functional and analytical aspects of the department.
- Thoroughly familiar with the laboratory analytical and QA/QC procedures of the department.
- Capable of following complex procedures and instructing others to do the same.

4.1.6 Supervisor Wet Chemisty Department

Responsibilities:

- Responsible for daily operations of the Wet Chemistry Department
- Responsible for technical support of the Wet Chemistry Department.
- To prepare procedures and suggest modifications for improvement of quality systems in the wet chemistry section of the laboratory.
- To review and approve wet chemistry chemical procedures.
- To review wet chemistry reports and results.
- Review specific QC procedures and implement corrective action where necessary.
- Responsible for reviewing external Performance Evaluation results.
- Responds to client inquiries concerning wet chemistry analyses and results.
- Reports to the Laboratory Director.

Qualifications- Education: B.S. or B.A. in Chemistry or related science.

Experience:

- Minimum of 4 years experience in analytical chemistry.
- Thoroughly familiar with the laboratory analytical and QA/QC procedures of the department.
- Capable of following complex procedures and instructing others to do the same.

4.1.7 Quality Assurance/Quality Control (QA/QC) Manager

Responsibilities:

- To supervise the QA/QC program.
- To evaluate the result of internal and external quality control sample results.
- To perform internal audits.
- To audit specific QC procedures.
- To participate in external audits.
- To review and approve Case Narrative.
- To review report and QC results.
- To review and document analyst training.
- To review and document standard operating procedures for the laboratory.

- Reports to the President of the Company.

Qualifications- Education: B.S. or B.A. in Chemistry or related science

Experience:

- Minimum of 10 years experience in analytical chemistry.
- Thoroughly familiar with QA/QC aspects of current programs.
- Capable of following complex procedures and instructing others to do the same.

4.1.8 Customer Service Representative

Responsibilities:

- To receive customer inquiries for services and to ensure prompt response.
- To respond to customer inquiries regarding project status.
- To inform clients of any problems associated with projects.
- To receive customer complaints or other issues and to ensure prompt response.
- To inform the laboratory of concerns associated with projects communicated by the client.
- To inform the laboratory of incoming work.
- Reports to the Laboratory Director.

Qualifications - Education : B.S or B.A. in chemistry or related field or 5 years experience.

Experience:

- Demonstrated proficiency in performance of duties.
- Instructed in specific customer service, sample receiving and handling procedures.

4.1.9 Chemists

Preparation Chemists

Responsibilities:

- To prepare standards and samples in accordance with SOPs and the AMRO Quality Systems Manual.
- To maintain preparation logs.
- To maintain instrumentation.
- To be familiar with analysis methods and their requirements.
- To report data and all associated QC.
- To properly document all preparation procedures.
- To have knowledge of safety procedures.

- Reports to the appropriate section supervisor.

Qualifications - Education: B.S. or B.A. in chemistry or related science.

Experience:

- Instructed in specific laboratory procedures.
- Demonstrated proficiency in specific laboratory procedures.

Instrumentation Chemists
Responsibilities:

- To prepare standard and samples in accordance with SOPs and the AMRO Quality Systems Manual.
- To maintain preparation and instrument run logs.
- To maintain instrumentation.
- To be familiar with analysis methods and their requirements.
- To run instruments.
- To evaluate and report data and all associated QC.
- To maintain proper documentation.
- To have knowledge of safety procedures.
- Reports to the appropriate section supervisor.

Qualifications - Education: B.S. or B.A. in chemistry or related science.

Experience: 6 months experience in the laboratory section.

4.1.10 Data Review
Responsibilities:

- To be familiar with analysis methods and their requirements.
- To be familiar with project requirements.
- To evaluate data.
- To check for completeness of all data including logbooks, reports and Non-Conformance Data Reports.
- To report data and all associated QC.
- To verify and maintain proper documentation.
- Reports to the appropriate section supervisor.

Qualifications - Education: B.S. or B.A. in chemistry or related science.

Experience: Minimum of 5 years experience.

4.1.11 Sample Receiving Technician

Responsibilities:

- To receive samples from couriers, customers and delivery services.
- To assign project numbers for each sample set, schedule analyses, label bottles and properly store samples.
- To communicate with various sections of the laboratory about incoming samples.
- To prepare and send out bottle orders per client requests.
- To receive ordered supplies, standards and reagents for the laboratory.
- Reports to the Customer Service Representative.

Qualifications - Education: H.S. diploma, college chemistry courses preferred.

4.1.12 Lab Technician

Responsibilities:

- To prepare samples in accordance with SOPs and the AMRO Quality Systems Manual.
- To be instructed in sample preparation techniques.
- To be instructed in specific laboratory procedures such as dry weight determination, glassware and sample container preparation.
- To demonstrate proficiency in specific laboratory procedures.
- To have knowledge of safety procedures.
- Reports to the appropriate section supervisor.

Qualifications - Education: H. S. diploma, college chemistry courses preferred.

4.1.13 Mass Spectral Interpretation Specialist:

Qualifications - Education: B.S. in Chemistry, or Physical Sciences

Experience: Completed a specialized training course in mass spectral interpretation.

Two years of experience in mass spectral

interpretation.

4.1.14 Inductively Coupled Plasma (ICP) Specialist:

Qualifications - Education: B.S. in Chemistry, or Physical Sciences
Experience: Completed a specialized training course in ICP Spectroscopy.

Two years of experience in ICP analysis of Environmental samples.

## 4.2 TRAINING

4.2.1 Every analyst is required to read the Quality Systems Manual and the Safety Plan on their first day of employment.

4.2.2 Each employee is trained in those areas that are applicable to their particular laboratory position.

4.2.3 Employees are required to record all observations, calculations and results in black, ball point pen. Errors, if made, shall be crossed out with a single line, initialed and dated. If the reason for the correction is not obvious, a brief explanation should be provided in the data. **Under no circumstances will correction fluid (i.e. whiteout) be used.**

4.2.4 Employees are required to be familiar with the analytical procedures associated with the laboratory section they are working in and the laboratory equipment that is needed to perform the analyses.

4.2.5 The training for each procedure should follow the following steps:

4.2.5.1 Read the SOP and/or EPA Method for the procedure and discuss with a qualified trainer.

4.2.5.2 Become familiar with all reagents, equipment, and laboratory areas designated for the procedure.

4.2.5.3 Observe a qualified analyst perform the procedure while following along in the SOP. Any questions can be answered during this process.

4.2.5.4 Perform the procedure with a qualified analyst observing. The qualified analyst should offer any assistance and the trainee should clarify any outstanding questions associated with the analysis.

4.2.5.5 Repeat the procedure until the qualified analyst, trainee and the supervisor are satisfied with the performance of the method.

4.2.5.6 Analyze a QC sample and produce acceptable results.

4.2.5.7 The Qualification Card (Attachment 2) with the supporting document are submitted to the QA/QC department to be filed.

4.2.5.8 Periodic review may be necessary in the event of method changes or technique modifications.

4.2.5.9 At least once per year the qualified personnel shall be repeating the performance examination. The data sheets and any other documentation of the analysis shall be attached to a new Qualification Card.

4.2.5.10 At least once per year all personnel shall be trained on data integrity issues and record keeping. This training will include laboratory procedures, responsibilities, examples of unethical conduct, notification procedures, disciplinary action and confidential reporting procedures.

# SECTION 5. SAMPLE COLLECTION AND RECEIPT

## 5.1 Bottle Preparation

All glass sample bottles and vials are purchased pre-cleaned. Oldest bottles are used first to ensure inventory is rotated. Each lot of VOA vials is checked by adding DI water to a vial from the lot and analyzing for Volatile Organic compounds to ensure that no target analytes are present above ½ the RL. Protocols for cleaning are as follows:

### 5.1.1 Volatile Organic Containers:

Glass containers, Teflon/silicone septa and Teflon liners are washed in laboratory grade non-phosphate detergent and tap water.
They are rinsed with tap water and with ASTM Type 1 Organic-Free water.
They are dried at 105°C for one hour.
They are cooled to room temperature in an enclosed contaminant-free environment.
They are assembled in an organic-free environment.
They are labeled with a lot number on the exterior of each case.
They are stored in a contaminant-free storage area.

### 5.1.2 Organic Containers:

Glass containers and Teflon liners are washed in laboratory grade non-phosphate detergent and tap water.
They are rinsed with tap water and with ASTM Type 1 Organic-Free water.
They are dried at 105°C for one hour.
They are cooled to room temperature in an enclosed contaminate-free environment.
They are assembled in an organic-free environment.
They are labeled with a lot number on the exterior of each case.
They are stored in a contaminant-free storage area.

### 5.1.3 Plastic Containers:

The plastic sample collection bottles supplied by AMRO are also purchased and preserved if required prior to being provided to client. Blanks are analyzed monthly to monitor the bottles for contamination and ensure that no analytes are present above ½ the RL.

### 5.1.4 Bacteria:

All plastic bottles used for Bacteria samples are purchased pre-sterilized. (Bacteria containers are purchased for subcontract work.)

## 5.2 Sampling and Preservation

All samples analyzed at AMRO are collected by clients or by an environmental sampling firm. When sample bottles are provided by AMRO for specific analytical tests, they are preserved by the laboratory with the appropriate preservative for the particular tests that are going to be performed and labeled accordingly. Laboratory personnel use the preservation list to determine the correct preservative, volume of preservative and bottle type for each analysis (Attachment 3). Pre-preserved bottles are labeled to include the preservative and the analysis required. These bottles are packed into coolers with COCs, ice packs, custody seals if required, plastic bags if required, and any other items required for sampling that are provided by the laboratory. The bottles are then mailed out or delivered to the client by our couriers. A copy of the bottle and preservation checklist that also lists holding times (Attachment 4) is provided to clients with each set of bottles.

## 5.3 Sample Receipt

### 5.3.1 Chain-of-Custody

The Chain-of-Custody (COC) (Attachment 5) documents the transfer of custody of each sample from collection to receipt in the laboratory. Each person that has custody of the sample(s) must sign and date the COC before relinquishing it and when receiving it. Once a sample(s) is brought into the laboratory, it is turned over to the Sample Receiving Technician. The Sample Receiving Technician checks all of the information on the COC for accuracy and completeness.

### 5.3.2 Project Number Assignment

Upon receipt by the laboratory, each project has a 7 digit number assigned to it in the project number logbook (Attachment 6). The project numbers are sequential with the first numbers representing the year and month the project was received. Also documented are the date received, the time received, the client name and comments.

### 5.3.3 The Sample Receiving Checklist (SRC)

The Sample Receiving Checklist (Attachment 7a and 7b) (SRC) is used to document the condition of the samples that are received by the laboratory. This includes sample preservation, labeling, bottle type, amount of sample provided, temperature of samples upon receipt, and completeness of the COC. The temperature of the samples when received

is measured and documented on the COC and on the SRC as indicated in laboratory Standard Operating Procedure, GL-1004 " Temperature of Measurement" section 10.3. Any problems with the samples that require client input are communicated to the client via fax or email. The client is required to respond to the fax or email to resolve any issues prior to the beginning of analysis. The samples are labeled with the assigned AMRO project number. The pH of samples is adjusted if necessary with the appropriate reagent. The laboratory shall flag the sample results for any sample received improperly preserved. The information is recorded on the back of the SRC. The samples are stored in a refrigerator at 4°C ± 2°C.

### 5.3.4 Sample Condition Receipt Form

When samples are found to be unacceptable for one reason or another (for example, they are received broken or the labels are illegible), AMRO's policy is to send a FAX out to the client (Attachment 8)or an email. The Sample Receiving Technician lists the problems with the samples and the client is requested to let AMRO know, by FAX or email, what action should be taken with the samples and if they want us to continue with the analyses. The client is requested to sign and date the FAX form with any further instructions to the laboratory or and return to the laboratory to be included in the project folder. The FAX/email is kept with the project in the project folder.

### 5.3.5 Project Folder Organization, Preparation and Review

A project folder for each project is assembled after the samples have been logged in by the Sample Receiving Technician. Once all the information is verified, the original COC, the Sample Receiving Form, and the SRC are put into a manila folder labeled with the project number, date sampled, date received and date due to the client. Login is checked, the Preliminary Invoice and Work Order Summary forms which contain all the requested analyses are produced and put into the folder. If samples were delivered with a shipping receipt, such as a bill of lading, it is also included in the project folder. Any documentation from the client, including telephone logs and emails, are to be placed in the project folder.

### 5.3.6 Sample Storage/ Internal Chain of Custody Log

All samples are stored in a refrigerator at 4°C ± 2°C. Samples to be analyzed for volatile organic compounds (VOC's) are stored in a separate refrigerator from other samples. All Low–Level aqueous samples (e.g. drinking water and ground water samples) are segregated from potentially high level VOC soil samples (e.g. collected for UST work). An "Internal Chain of Custody Form" (Attachment 9) is maintained and anytime the sample is removed from the refrigerator the employee must sign and date this logbook. When the analyst is finished with the sample, it is returned to the refrigerator and the sample is signed back into the "Internal Chain of Custody Log". Tracking of custody between analysts while samples are signed out must be documented on the Internal Chain of Custody Log also. Custody is

continued for sample extracts and digestates in the form of logbook page custody areas on the extraction and digestion logbooks that are required to be completed.

### 5.3.7 Subcontracting Samples

Samples that require subcontracting to another laboratory are required to have the appropriate section completed on the SRC to indicate the analyses being subcontracted, where they are being sent, the date and who is sending the samples. A COC is completed and the subcontract laboratory is contacted to ensure they can perform the analyses in the required time frame. The samples are sent via courier or delivery service to the appropriate laboratory. A copy of the subcontract COC is included in the project folder. The client is always informed and permission is obtained prior to subcontracting any work. It is determined that the subcontract laboratory holds the appropriate certifications needed for any given test when applicable.

**5.3.7.1** When AMRO subcontracts work whether because of unforeseen reasons (e.g., workload, need for further expertise or temporary incapacity) or on a continuing basis (e.g., for tests not performed in-house), this work shall be placed with a laboratory accredited under NELAP for the tests to be performed or with a laboratory that meets applicable statutory and regulatory requirements for performing the tests and submitting the results of tests performed. The laboratory performing the subcontracted work shall be indicated in the final report and non-NELAP accredited work shall be clearly identified.

**Subcontractor Laboratories:**

- Subcontractor laboratories must have an established and documented laboratory quality system that complies with the requirements of the project being subcontracted.
- For USACOE or Navy projects the subcontractor laboratories must be approved by the specific DoD Component laboratory approval process.
- Subcontractor laboratories must demonstrate the ability to generate acceptable results from the analysis of proficiency testing (PT) samples, subject to availability, using each applicable method, in the specified matrix, and provide appropriate documentation to the client.
- Subcontractor laboratories must receive project-specific approval from the client before any samples are analyzed.
- Subcontractor laboratories are subject to project-specific, on-site assessments by the client or their designated representatives. These requirements apply to the use of any laboratory under the same corporate umbrella, but at a different physical facility.

**5.3.7.2** AMRO shall advise the client of the arrangement in writing and, when possible, gain the approval of the client, preferably in writing.

**5.3.7.3** AMRO is responsible to the client for the subcontractor's work, except in the case where the client or a regulatory authority specifies which subcontractor is to be used.

**5.3.7.4** AMRO shall maintain a register of all subcontractors that it uses for environmental tests and a record of the evidence of compliance with 4.5.1.

### 5.3.8 LIMS System

Every sample is assigned a unique sequential identification number. The sample information is entered into a computer program known as Omega ELIMS. This program is used to schedule samples for analyses, provide work lists, produce sample reports and invoice work. The Sample Receiving Technician or designee will enter sample ID, sample date and requested analyses into the Omega ELIMS database. Work lists are printed daily in order to schedule work. Samples are printed by order of holding time to ensure the analyses are performed according to method criteria.

### 5.3.9 Security

AMRO is equipped with an alarm system that is activated during non-work hours. The sample storage refrigerators are locked during non-business hours. All visitors are required to sign in and are escorted within the building.

### 5.3.10 Sample Disposal

Any unused sample volume and all sample extracts and metals digestates will be held for 30 days from the date the report was mailed or shipped unless the client requests the sample be held longer. All U.S. Army Corps of Engineers samples will be held for 60 days from the time the report is received. All samples are disposed of by assigned laboratory personnel into appropriate waste containers. Waste disposal containers are housed in an area designed for waste storage. All hazardous samples are handled as hazardous wastes and are disposed of appropriately. extremely hazardous samples (example: samples with high levels of cyanide, mercury, PCBs) must be marked to ensure they are disposed of in the proper waste stream containers. A waste disposal company is employed to remove the waste containers when full and within the applicable time frame.

### 5.3.11 Sample Bottle and Vial Disposal

All used glass and plastic sample bottles, when empty, are disposed of in broken glass containers or in the general trash. Sample bottles and vials containing samples, standards, or extracts are handled as hazardous waste and are disposed of according to the characteristics of the waste.

# SECTION 6. INCOMING WORK REVIEW

## 6.1 New Work

6.1.1 Bid work:

AMRO Environmental Laboratories has sales people responsible for seeking out new work projects for the laboratory. They accomplish this through business contacts, regulatory agencies, and current clients. They obtain bid proposals from various jobs and distribute them to appropriate laboratory personnel, QA/QC, and customer service for review and comment prior to placing any bids. Bid review includes evaluation of analyses requested, reporting limit requirements, QA/QC requirements and data deliverable requirements. AMRO will inform the client of this review if it indicates any potential conflict, deficiency, lack of appropriate accreditation status, or inability on the laboratory's part to complete the clients work. Based on input from the laboratory, prices are set and bids are submitted. The marketing personnel communicate to the laboratory the status of bids submitted. Jobs that are won by AMRO are scheduled based on the project seope of work. Any differences between the request or tender and the contract shall be resolved before any work commences. Each contract shall be acceptable both to the laboratory and the client. Copies of bids are kept in individual folders by customer service and are available for review as needed.

6.1.2 Non-bid work:

The marketing and sales personnel evaluate any work that does not have a bid associated with it. They complete the "Incoming Notice Form" (Attachment 10) to be evaluated by the appropriate laboratory personnel, QA/QC and customer service. This form contains pertinent information the laboratory personnel requires to determine it's ability to perform the job. Based on input from the laboratory, priees are set. Copies of the Incoming Work forms are kept in client folders by customer service and are available for review as needed.

## 6.2 Existing Work

6.2.1 AMRO has projects from customers that are required to be performed on a regular basis. Pertinent information concerning these projects is kept on file by customer service and is available for review as needed. Records of review, including any significant changes, shall be maintained. Records shall also be maintained of pertinent discussion with the client relating to the client's requirements or the results of the work during the period of execution of the contract. AMRO will inform the client of any deviation from the contract.

6.2.2 If a contract needs to be amended after work has commenced, the same contract review process shall be repeated and any amendments shall be communicated to all affected personnel. Suspension of accreditation, revocation of accreditation, or voluntary withdrawal of accreditation will be reported to the client.

## 6.3 Current Work

6.3.1 The status of projects currently at the laboratory for analysis is reviewed in daily production meetings. Topics reviewed in these meetings include the status of projects, incoming work, bid review, and QA/QC. The time frame of current project review is performed through to one day past the current day. Based on this information it is determined if there is a need to inform clients of any potential delays associated with their projects. The cause of any delays that result in late data is discussed. Any incoming projects are discussed as well as any QA/QC issues concerning data and general laboratory operations.

# SECTION 7 - ANALYTICAL PROCEDURES

## 7.1 Analytical Procedures

The analytical procedures used at AMRO are listed below under the Method Reference column. The actual methodologies are outlined in great detail in the Standard Operating Procedures Manual (SOPs) available in the laboratory.

AMRO ANALYTICAL CAPABILITIES LIST

| PARAMETERS | METHOD NUMBER | |
|---|---|---|
| **WET CHEMISTRY** | **AQUEOUS** | **SOIL / WASTE** |
| Alkalinity | 2320-B SM19th | N/A |
| Hydroxide Alkalinity | 4500-CO2D SM19th | N/A |
| Carbonate Alkalinity | 4500-CO2D/2320-B SM19th | N/A |
| Bicarbonate Alkalinity | 4500-CO2D SM19th | N/A |
| Ammonia as N | 4500-NH3B,C SM19th | 4500-NH3B,C SM19th Mod. |
| Biochemical Oxygen Demand (BOD) | 5210B SM19th | N/A |
| Carbonaceous Biochemical Oxygen Demand (CBOD) | 5210B SM19th | N/A |
| Bromide | 300.0 | 9056 |
| Chemical Oxygen Demand (COD) | Hach 8000/5220D SM19th | N/A |
| Chloride | 300.0/4500-Cl- C SM19th | 9056/4500-Cl C Mod. SM19th |
| Chlorine, Total Residual | SM 4500-Cl G Mod. SM19th | N/A |
| Corrosivity as pH | N/A | 9045C |
| Color | 110.2 | N/A |
| Cyanide (Amenable to chlorine) | 335.1/SM19th 4500-CN C,E 9010C/9014 | 9010C/9014 |
| Cyanide, Total | 4500-CN C,E SM19th 9010C/9014 | 9010C/9014 |
| Fluoride | 300.0 | N/A |
| Hardness | 6010B/2340B SM19th | N/A |
| Hexavalent Chromium | 7196A/3500-Cr D SM19th | 3060A/7196A |
| Nitrate as N | 300.0 | 9056 |
| Nitrite | 300.0 | 9056 |
| Oil & Grease, Gravimetric | 1664A | 1664A Mod |
| Ortho-phosphate as p | 300.0/4500-P E SM19th | 9056 |
| Paint Filter Test | N/A | 9095B |
| pH | 9040B/4500-H+B SM19th | 9045D |
| Phenolics (4 AAP) | 420.1 | 9065 |
| Phosphorus, Total | 4500-P B.5,E SM19th | 4500-P B.5,E SM19th Mod. |

| PARAMETERS | METHOD NUMBER | |
|---|---|---|
| **WET CHEMISTRY** | **AQUEOUS** | **SOIL / WASTE** |
| Sulfite | 4500-$SO3^{2}$ –B SM19th | N/A |
| Sulfate | 300.0/D516-90,02 | 9038/9056 |
| Sulfide | 4500-$S^{2}$ –F SM19th | N/A |
| Specific Conductivity | 120.1 | 9050A Mod. |
| Total Kjeldahl Nitrogen (TKN) | 4500-NorgC/4500-NH3C SM19th | 4500-NorgC/4500-NH3C SM19th Mod. |
| Total Organic Carbon (TOC) | (subcontracted) | CFAS18 |
| Total Solids (TS) | 2540B SM19th | 2540G SM19th |
| Total Dissolved Solids (TDS) | 2540C SM19th | N/A |
| Total Suspended Solids (TSS) | 2540D SM19th | N/A |
| Total Volatile Solids (TVS) | 2540E SM 19th | SM2540G SM 19th |
| Settleable Solids | 2540F SM19th | N/A |
| Total Petroleum Hydrocarbons, Grav. | 1664A-SGT | 1664A-SGT Mod |
| Turbidity | 180.1 | N/A |

| PARAMETERS | METHOD NUMBER | |
|---|---|---|
| **TRACE METALS** | **AQUEOUS** | **SOIL / WASTE** |
| Analyzed by Furnace | 200.9,7000 series | 7000 series |
| Analyzed by ICP | 200.7/6010B/6010C | 6010B/6010C |
| Mercury by Cold Vapor AA | 245.1/7470A | 7471A |
| Lead in paint | N/A | 6010B |
| Digestion (Prep) – Aqueous | 200 series/3010A/3015 | N/A |
| Digestion (Prep) – Solid | N/A | 3050B/3051 |

| PARAMETERS | METHOD NUMBER | |
|---|---|---|
| **ORGANIC TESTS** | **AQUEOUS** | **SOIL / WASTE** |
| Volatile Organics (VOA by GC/MS) | 624/8260B/OLM4.0 | 8260B |
| Volatile Organics (VOA by GC/MS) | 524.2 | N/A |
| Volatile Organics (Halogenated List) | 624/8260B | 8260B |
| Volatile Organics (Aromatics List) | 624/8260B | 8260B |
| Volatile Petroleum Hydrocarbons (VPH) | MADEP 1.1 | MADEP 1.1 |
| Extractions | 3510C | 5035/3541/3540 |
| Semivolatile Organics ( BNA ) | 625/8270C/8270D | 8270C/8270D |
| Semivolatile Organics (B/N only) | 625/8270C/8270D | 8270C/8270D |
| Semivolatile Organics (Acid only) | 625/8270C/8270D | 8270C/8270D |
| Petroleum Hydrocarbon Fingerprinting (GC/FID) | 8015B Mod. | 8015B Mod. |
| Petroleum Hydrocarbon fingerprinting (P&T) | 8260B Mod. | 8260B Mod |
| Extractable Petroleum Hydrocarbons (EPH) | MADEP 1.1 | MADEP 1.1 |
| Pesticides | 608/8081A/8081B | 8081A/8081B |
| PCB's | 608/8082/8082A | 8082/8082A |
| PCB's in Oil | N/A | 8082 Mod. |
| Polynuclear Aromatics (Low Level) | 8270C SIM | 8270C SIM |
| Herbicides | (subcontracted) | (subcontracted) |
| Diesel Range Organics (DRO) | 8015B Mod. | 8015B Mod. |
| Diesel Range Organics (DRO)- Maine | 4.1.25 (9/06/25) | 4.1.125 (9/06/95) |
| Gasoline Range Organics (GRO) | 8015B Mod. | 8015B Mod. |
| Gasoline Range Organics (GRO)-Maine | 4.2.17 (9/06/95) | 4.2.17 (9/06/95) |
| Extractable Total Petroleum Hydrocarbons (ETPH) | ETPH (CT Method) | ETPH (CT Method) |

| PARAMETERS | METHOD NUMBER | |
|---|---|---|
| **WASTE CHARACTERISTICS** | **AQUEOUS** | **SOIL / WASTE** |
| Ignitability | 1010 | 1010/ASTM D92-90 |
| Reactive Cyanide | SW846 ch 7.3.3.2 | SW846 ch 7.3.3.2 |
| Reactive Sulfide | SW846 ch 7.3.4.2 | SW846 ch 7.3.4.2 |
| Corrosivity by pH | 9040C | 9045D |
| Total Organic Halides (TOX) | (subcontracted) | (subcontracted) |

| PARAMETERS | METHOD NUMBER | |
|---|---|---|
| TOXICITY CHARACTERISTICS LEACHING PROCEDURE (TCLP) | AQUEOUS | SOIL / WASTE |
| Extraction Semivolatiles | 1311 | 1311 |
| Extraction Metals | 1311 | 1311 |
| Extraction Pesticides/Herbicides | 1311 | 1311 |
| ZHE Volatiles | 1311 | 1311 |
| 8 RCRA Metals Analysis | 6010B/6010C/7470A | 6010B/6010C/7470A |
| Volatiles analysis | 8260B | 8260B |
| Semivolatiles analysis | 8270C/8270D | 8270C/8270D |
| Pesticide analysis | 8081A/8081B | 8081A/8081B |
| Herbicide analysis | 8151A(subcontracted) | 8151A(subcontracted) |

| PARAMETERS | METHOD NUMBER | |
|---|---|---|
| SP LEACHING PROCEDURE (SPLP) | AQUEOUS | SOIL / WASTE |
| Extraction Metals | 1312 | 1312 |
| Extraction Cyanide and Volatiles | 1312 | 1312 |
| Extraction Semivolatiles | 1312 | 1312 |

NOTE: Some GC volatiles type work is performed by GC/MS. Attachment 11 is the documentation sent to clients to inform them of AMRO's procedures.

## 7.2 Standard Operating Procedures (SOP)

All procedures performed at AMRO are documented through Standard Operating Procedures (SOPs). The SOPs are based on referenced methods from the EPA, Standard Methods, NELAC, and other regulatory agencies. They document the actual steps performed by analysts to perform a specific task. Detailed information is documented in the SOP concerning instrumentation, reagents, standards, and procedures specific to AMRO Environmental Laboratories Corp. The process by which a standard operating procedure is accepted by the laboratory is as follows:

7.2.1 An analyst familiar with the procedure or a qualified designee writes the original draft of the SOP. The draft SOP is written based on the EPA format for SOPs and the appropriate method.

7.2.2 The draft is reviewed for accuracy and completeness and edited as necessary by an analyst knowledgeable in the procedure or the Section Manager.

7.2.3 An analyst familiar with the procedure as technical review, the appropriate Section manager or supervisor, the Laboratory Director and the QA/QC Manager reviews the final draft. Any final edits, corrections or clarifications are made at this time. A final draft is signed by a technical review designate, a section review designate, the Laboratory Director, and QA/QC Manager.

7.2.4 Copies of the laboratory's final SOPs are made and distributed to each appropriate section as Control Copies. Control Copies will be updated with each update to the SOPs. Original SOPs are kept on file with the QA/QC Manager.

7.2.5 Analysts are required to read the SOP and sign off on the appropriate form indicating they have read and understood the procedure prior to performing the analysis. The SOPs are available for referral when a procedure is being performed.

7.2.6 SOPs are reviewed on an annual basis unless procedural changes or method updates occur. Updates to SOPs are made as needed or occasionally an interim change notification form (Attachment 35) is used to notify the laboratory of procedural changes that will not be incorporated into the SOP until the next scheduled SOP review date. The interim change notification form is signed by all personnel in the section and is kept with the current SOP. A copy of the interim change notification form is also kept with the control copy of the SOP.

# SECTION 8. INSTRUMENT/EQUIPMENT AND FACILITIES

## 8.1 AMRO Equipment/Instrumentation List

The following section lists the major equipment of AMRO Environmental Laboratories Corporation, also refer to Attachment 12 "Instrument List", this new tracking system was implemented as of August 2000:

| AMRO EQUIPMENT / INSTRUMENT LIST | PURCHASE DATE |
|---|---|
| ANALYTICAL BALANCE - Sartorius Research (R 160 P) | 1987 |
| - O'Haus Explorer (E01240) | 1998 |
| - Mettler (BB300) | 1998 |
| - A&D (HF400) | 1999 |
| ASTM Class I Weight set – 1 mg to 100 g (Serial No. 98-J112277-3) | 1998 |
| ASTM Class I - 200 gram Weight (Serial No. 98-J38238-8) | 1998 |
| ASTM Traceable Thermometer -1 to 151°C – Serial No. B95-122) | 1995 |
| TURBIDIMETER - Hach-2100AN | 1996 |
| SPECTROPHOTOMETER - HACH DR2010 Spectrophotometer | 1999 |
| CLOSED CUP FLASH TESTER - CLEVELAND- PRECISION SCIENTIFIC BE-2 | 1994 |
| LACHAT - QUIKCHEM 8000 AUTOMATED ION ANALYZER | 1996 |
| OXYGEN METER (YSI Model 59 and D.O. probe) | 1996 |
| MIDI REFLUX DISTILLATION APPARATUS for cyanides | 1994 |
| DIGESTION APPARATUS (Tecator Digestion System 6, 1007 Digestor, Serial #11947) | 1991 |
| HOT BLOCK DIGESTOR Mercury Prep. - Environmental Express | 1998 |
| DigiBLOC3000 SCP Science for metals digestions | 1998 |
| MERCURY ANALYZER SYSTEM and RECORDER - Perkin Elmer FIMS100 Mercury Analyzer with AS90 Autosampler | 1999 |
| SPECTROFLAME MODULA ICP, Model FTP-08 Spectro Analytical Instruments | 1995 |
| PE-3300 DV OPTIMA ICP, Model 3300, Serial #DV069N806302 Perkin Elmer | 1998 |

| AMRO EQUIPMENT / INSTRUMENT LIST | PURCHASE DATE |
|---|---|
| ZEEMAN ATOMIC ABSORPTION SPECTROPHOTOMETER / GRAPHITE FURNACE - PE4100 ZL | 1993 |
| AUTOMATIC SOXHLET EXTRACTORS: | |
| OI Analytical Soxtherm (4 with 6 units) (Serial #'s: 473343, 480005, 480007, 480009) | 1997 |
| OI Analytical Controllers (4 with 6 units) (Serial #'s: 473338, 480015, 480017, 480019) | 1997 |
| (2) ULTRASONIC PROCESSOR SONICATOR (Misonix Systems) | 1993 & 1998 |
| (4) ZYMARK TURBOVAP II TURBOVAPS | 1998 |
| N-EVAP ANALYTICAL EVAPORATOR 112 (Serial #: 82c1) | 1997 |
| GC / MS - Hewlett Packard 5972 Series Mass Selective Detector and 5890 GC with Tekmar LSC 2000/ Dynatech PTA - 30 W/S (MS Serial # 3341A01057) (V1a) | 1997 |
| GC / MS - Hewlett Packard 5971 Series Mass Selective Detector and 5890 GC with Tekmar LSC 2000/ Archon 5100A Purge &Trap (MS Serial # 33188A03542) (V2) | 1991 |
| GC / MS - Hewlett Packard 5971A Series Mass Selective Detector and 5890 GC with Dynatrap Purge and Trap / Autosampler System (MS Serial #3188A02799) (V3) | 1994 |
| GC / MS – Hewlett Packard 5973 Mass Selective Detector and 6890 GC with OI 4560 Purge and Trap/Archon 4552 Autosampler System (MS Serial #US81211039) (V4) | 1998 |
| GC / MS - Hewlett Packard 5972A Series Mass Selective Detector with HP 5890 Series II GC and Autosampler (MS Serial # 3501A02576) (SV2) | 1996 |
| GC / MS - Hewlett Packard 5972A Series Mass Selective Detector with HP 5890 Series II Plus GC and Autosampler (MS Serial # 3501A02436) (SV3) | 1996 |
| GC / MS – Hewlett Packard 5973 Series Mass Selective Detector with HP 6890 Series GC and Autosampler (MS Serial #US81210085) (SV4) | 1998 |

| AMRO EQUIPMENT / INSTRUMENT LIST | PURCHASE DATE |
|---|---|
| GC - Hewlett Packard 5890 with Autosampler and dual ECD (Serial # 2919A28651) (TRENT) | 1991 |
| GC - Hewlett Packard 5890 with Autosampler and dual ECD (Serial # 2843A20867) (ELVIS) | 1997 |
| GC – Hewlett Packard 5890 with Autosampler and dual ECD (Serial # 2919A22601) Purchased 1998 (DALI) | 1998 |
| GC - Hewlett Packard 5890 Series II Plus with Autosampler and FID (Serial # 3310A52905) (FING1) | 1994 |
| Culligan Deionized Water System (Aqua-Summa) | 1990 |
| Activated Charcoal/Reverse Osmosis Culligan Deionized Water System (Volatiles) | 1999 |
| MUFFLE FURNACE - Thermolyne Type 1400 | 1988 |
| TCLP EXTRACTOR with 6 zero-head space extraction units | 1990 |
| TCLP Extractor with 8 spaces | 1990 |
| MICROSCOPE (Swift) | 1993 |
| DRYING OVENS (4) | 1989-1997 |
| INCUBATORS (2) | 1991 |
| REFRIGERATORS (13 of various brand names) | 1989-1999 |
| UNIVERSAL POWER SYSTEMS - POWER SUPPLY | 1996 |
| 36 PC-IBM COMPATIBLE COMPUTERS | 1989-2004 |
| (2) SAG Electronics PII Xeon 450 Network Servers, (2) 9GB Hard Drives | 1999 |

Software Packages Available: Windows; Excel; Word; Analytical Auto Spec., Omega II E-LIMS (1999), D-Base IV; HP Chem-Station and Enviroquant; Perkin Elmer AA Laboratory Software; FIMS software version 2.5, and PE Optima WinLab (ICP)

## 8.2 Facilities

AMRO operates in a modern 7,000 square foot laboratory located in Merrimack, New Hampshire. Working space at AMRO includes 142 linear feet of bench area with formica tops, formica and concrete flooring, three sinks, hot and cold water, and temperature control.

## 8.3 Support Services Used by AMRO

8.3.1 Caley and Whitemore located in Somerville, MA is used for annual balance calibration and service. They are also used for the spectrophotometer service and support.

8.3.2 Cal-Tek Co. Inc., North Billerica, MA is used for weight calibration checks.

8.3.3 Agilent and CompCo is used for support of the GC and GC/MS equipment.

8.3.4 Perkin Elmer is used for support of the Optima ICP, the PE4100ZL Graphite Furnace, the AAnalyst600 Graphite Furnace and the FIMS Mercury Analyzer. Optima and PE-6000.

8.3.5 LIMS – Khemia Co., Broomfield CO – Omega II E-LIMS

8.3.6 Waste Removal – EnPro Environmental Services

8.3.7 Bottles – H&L Distribution

8.3.8 Reagents – Fisher, VWR

8.3.9 Standards – AccuStandard, Supelco, Spex, Restek, VHG, Inorganic Ventures, HACH, ERA, APG are some of the vendors used for standards. Others are used if quality is acceptable for analysis.

# SECTION 9. TRACEABILITY

## 9.1 Chemical Receipt

The receipt of all standards, neat compounds and reagents from commercial sources is documented in the "Chemical Receiving Log" by sample receiving personnel or designate (Attachment 13). Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a five digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and AMRO employees complete the disposal dates when standards are used up or disposed.

## 9.2 Standards Preparation

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

9.2.1 AMRO purchases pesticide residue grade solvents and purge and trap grade Methanol for organic standard preparation and organic sample extractions.

9.2.2 Activated carbon cleaned water is generated for use with volatile sample and standard preparation.

9.2.3 ACS reagent grade chemicals are used when the method warrants.

9.2.4 A certificate of analysis accompanies any stock standards that are purchased from the manufacturer.

9.2.5 Class A volumetric glassware is used to prepare standards.

## 9.3 Standard Tracking

It is important to be able to track all analytical standards back to their sources. The following procedure is used by AMRO personnel to accomplish this:

9.3.1 Wet Chemistry and Mercury Standards - Working Standards and LCS solutions made from stock standards listed in the Chemical Receiving Log are documented in the Inorganic Standard Log. The corresponding analysis, preparation date, standard name, AMRO ID, amount used, initial concentration of standard, amount used, final volume, final concentration, Standard ID, expiration date, storage location, and analyst initials are recorded. The initial concentration of the standard is obtained from the certificates received from the manufacturer. The Standard ID is written as an "S" followed by a five digit sequential number. The expiration of working standards varies depending on the use. Standards should be used in accordance with method specifications and manufacturer's instructions. See (Attachments 14 and 15).

9.3.2 Metals Standards

9.3.2.1 Axial Standards Log (Optima) - Preparation and Standard ID's are listed in the Standard Log. Standards include: S1 (Calibration #1 & CCV), S2 (Calibration #2 & IPC), RL1 (Reporting Limit), RL2 (two times the Reporting Limit), ICSA &ICSAB (Interference Check Standards), ICV (Independent Source QC Standards), and Stock Solutions for Matrix/LCS spike additions. The Solution ID is written as the ID followed by the date prepared (example: S1042798 is standard S1 prepared on 042798). After a conformational analysis to verify the new standard and just prior to its use, the new ID is entered into the Optima software. Until updated, this will be the ID printed on every run log and standard page for hardcopy tracking. An example of the Metals Standard Tracking information for Optima is included as (Attachment 16).

9.3.2.2 Graphite Furnace Standard Logs (GFAA): Preparation and Standard ID's listed in this log include: Purchased Stock Certificates: Intermediate Calibration, CCV, ICV, LCS/MS Solutions: and final Calibration Solutions, final ICV final CCV and final reporting limit. These standards are prepared from the same stock solution as those used for the ICP. The nomenclature is essentially the same, but there are more dilutions needed, which necessitate Intermediate Solutions. Nomenclature for intermediate solutions includes "INT", the type of solution, and the date prepared. After a conformational analysis to verify the new standard and just prior to its use, the new ID is entered into the PE-4100ZL and/or AAnalyst600

software. Until updated, this will be the ID printed on every run log and standard page for hardcopy training. An example of the Metals Standard Tracking information for the Graphite Furnace is included as (Attachment 17).

9.3.4 Wet Chemistry and Metals Reagent Log - Working reagents are made from reagents listed in the Chemical Receiving Log and are documented in the Inorganic Reagent Log (Attachment 18). The corresponding analysis, preparation date, reagent name, AMRO ID, initial concentration, amount used, final volume, final concentration, Solution ID, expiration date, storage location, and analyst initials are recorded. The initial concentration is obtained from the certificate received from the manufacturer. The Solution ID is written as an "R" followed by a five digit sequential number. The expiration of prepared reagents varies. Reagents should be used in accordance with method specifications and manufacturer's instructions.

9.3.5 Organic Standard Tracking - The Organic Standards Tracking Log consists of Stock Standard Log, Working Standard Log and Standard ID Index (Attachment 19). The ID index assures that no two standards are assigned the same ID number.

9.3.5.1.1 Stock Section - Whenever a stock standard solution is opened or is prepared from a neat compound, this information is recorded in the Stock Standard Logbook section of the standard tracking log (Attachment 20). The stock solution is assigned a new ID number consisting of the date of preparation plus a letter suffix starting with the letter "A". This ID along with the compound name, concentration and expiration date is included on the label. Stock standards are good one year from the date prepared or the date provided by manufacturer, whichever is shorter. Example - The fourth volatile standard prepared on April 15, 2000 would have the standard ID A041500D. This number will be recorded in the logbook and written on the container.

9.3.5.1.2 Working Section - Whenever a working standard solution opened or is prepared, whether from AMRO stocks or commercially obtained stocks, the information is recorded in the Working Standard section of the standard tracking log (Attachment 21). The solution is assigned a new ID number based on the date it is prepared plus a letter suffix. This number along with a descriptive name, concentration (or conc. varied) and the initials of the person preparing the solution are included on the label. The expiration of working standards varies depending on the use. Standards should be

used in accordance with method specifications and manufacturer's instructions.

9.3.6 Standard Storage - Standards and reagents are stored per method specifications and manufacturer's instructions. Volatile standards are stored in a freezer at minus 10°C to 20°C with no other standards or reagents. Semivolatile, Pesticide, PCB and Petroleum standards are stored in refrigerators at 4°C± 2°C, freezers at minus 10°C, and ambient temperature depending upon the method and manufacturer requirements. Metals standards are stored in a dark, cool area of the lab in a labeled box. Wet Chemistry standards are stored at ambient temperature and in refrigerators at 4°C± 2°C depending upon the method and manufacturers requirements.

## 9.4 Solution Check Analysis

All solutions must be verified to contain the correct analytes and the desired concentrations prior to use with samples. Verification includes checking the accompanying documentation and information on the containers to ensure content, concentration, and expiration are correct. Verification consists of analysis of the solutions on the appropriate instrument. Single solutions used without dilution are confirmed with first use using analysis results. Prepared solutions are checked prior to use with samples. Result of these solution checks are reviewed by a trained analyst who will ensure that all analytes are present and the solution is within ±10% of the expected concentration or within acceptable limits as defined by the appropriate SOP. The solution checks are to be kept on file in each department and available for reference.

## 9.5 Reagents and Consumables Check Analysis

9.5.1 All extraction procedures are performed using pesticide residue grade solvents and a method or procedural blank analysis is performed to verify the absence of target analytes.

9.5.2 Procedural or method blanks are performed with every procedure to ensure that the quality of reagents and consumables used in the test do not adversely affect the quality of the results.

## 9.6 Distilled Water Check Analysis

9.6.1 The quality of the distilled water is monitored for Total Residual Chlorine, Specific Conductance and pH on a monthly basis.

9.6.2 Analysis for Trace Metals (Cd, Cr, Cu, Ni, Pb and Zn) is monitored monthly.

9.6.3 Listed below are the acceptable limits for reagent water:

| ANALYSIS | ACCEPTABLE RANGE |
|---|---|
| pH | 5.5-7.5 pH Units |
| Spec. Cond. | <2 µmhos/cm; 25°C |
| Total Residual Chlorine | <0.2mg/L |
| Pb, Cd, Cr, Cu, Ni, Zn | <0.05mg/L |

# SECTION 10. CALIBRATION/VERIFICATION OF TEST PROCEDURES

## 10.1 Method Detection Limit (MDL) Studies

The method detection limit is defined in 40 CFR 136 Appendix B. The MDL is determined annually for each analysis, for each preparation method, on each instrument performing the analysis. This is accomplished by the analysis of a minimum of seven replicate samples, all containing an analyte(s) of the same low-level concentration equaling 1 to 5 times the estimated MDL. These replicate samples are put through all the preparation steps that a sample is put through. The standard deviation of the results of these analyses is multiplied by the appropriate student T-test value depending on the number of replicates and the resulting value is deemed the method detection limit for that specific analyte. AMRO's internal criteria for MDLs are as follows:

A. ***The lowest standard or low level calibration verification standard (which is also the Reporting Limit) must be at least three times the MDL or greater.***

B. ***The ratio of the spiking concentrations to calculated MDLs must be between 1 to 10.***

If any of the acceptance criteria is not met the MDL must be repeated. See (Attachment 22) for a copy of the evaluation sheet completed by the analyst for each MDL study.

If multiple instruments with identical configurations are used in the laboratory, then the laboratory shall conduct an MDL study on at least one of the instruments and confirm the attainability of that MDL on all instruments by using an MDL verification check sample. The MDL verification check shall be performed quarterly on every instrument.

If multiple MDL results are generated from multiple instruments with identical configurations, then the highest MDL among those may be used in reporting data from all of those instruments. If a lower MDL is reported for specific samples, then the samples must have been run on that specific instrument on which the lower MDL was generated.

An MDL verification check shall always be performed immediately following an MDL study.

If an annual MDL study is not performed, MDL verification checks shall be performed **quarterly**. If the quarterly MDL verification check fails, additional MDL verification checks shall be performed at a higher level to set a higher MDL, or the MDL study shall be re-conducted.

Department of Defense (DOD) projects require that the MDL verification check sample be spiked at **approximately 2 times** the current reported MDL. The MDL verification check sample shall be acceptable if the laboratory can reliably detect and identify by method-specified criteria all analytes in the check sample. If the method has no confirmation, the check sample must produce a signal that is at least 3 times the instrument's noise level.

The matrix of MDL samples associated with solid samples must be a solid material. For metals teflon chips or glass beads may be used. For other analyses a clean sand (for example, Ottawa sand) may be used.

## 10.2 Limits of Detection (LOD) and Limits of Quantitation (LOQ)

The Limit of Detection (LOD) is defined as the estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect. Analysis of a low level standard at the detection limit , can be used to check this minimum amount.

The Limit of Quantitation (LOQ) is defined as the lowest concentration of a target analyte that can be reported with a high degree of confidence. The LOQ check sample is carried through the same preparation procedures as all samples and QC. The LOQ check sample should be analyzed at a level that is one to two times the reporting limit. The recoveries should be + / -50%. The LOQ will always be greater than the LOD.

## 10.3 Precision and Accuracy Studies

Accuracy is a measure of the degree to which the analytical result approaches the "true" value of the concentration of the analyte being determined. Precision in the laboratory is determined by the comparison of duplicates, where duplicate samples result from an original sample that has been split for identical analyses. Precision and Accuracy in the laboratory is assessed initially by the analyses of a minimum of 4 replicate samples at a mid-level point of the expected range. The percent recoveries and Relative Standard Deviations (%RSD) are evaluated and compared to method specifications or default limits where applicable.

If any of the acceptance criteria is not met the Precision and Accuracy Study must be repeated. See (Attachment 23) for a copy of the evaluation sheet completed by the analyst for each study.

The regular analysis of known standards such as the Laboratory Control Samples (LCS), and matrix and analytical spikes also assess accuracy. Accuracy within the laboratory is expressed in terms of percent recovery.

The precision of data is regularly evaluated by determining the Relative Percent Difference (%RPD) of duplicate (replicate) analyses.

## 10.3 GC/MS (Volatile Organics)

### 10.3.1 Initial Calibration Procedure

A multi-level calibration consisting of 0.5, 1, 2, 5, 10, 25, 50, 100, 200 and 300µg/L is performed using standards obtained commercially, according to the procedures outlined in Methods 624, 524.2 and 8260B. The three internal standards that are used: Fluorobenzene, Chlorobenzene-d5, and 1,4 Dichlorobenzene-d4 at a level of 25.0µg/L (10µg/L for 524.2). A separate calibration curve is analyzed for soils using 2mL of surrogate spiked Methanol/50 ml water to make up the standards. A separate calibration curve is analyzed for low level soils preserved with sodium bisulfate using 5 grams sand, 5mL sodium bisulfate solution, 5mL of calibration standard and a 40°C VOA vial purge temperature.

10.3.1.1 The average RRF (response factor) must be calculated for each compound using the 5-9 RF values calculated for each compound from the initial (5-9 point's) calibration curve. The RRF is calculated as follows:

$$RRF = \frac{(Ax \times Cis)}{(Ais \times Cx)}$$

where: Ax = Area of the characteristic ion for the compound being measured.
Ais = Area of the characteristic ion for the specific internal standard.
Cis = Concentration of the specific internal standard.
Cx = Concentration of the compound being measured.

If the % RSD of any compound is 15% or less, then the relative response factor is assumed to be constant over the calibration range, and the average relative response factor may be used for quantitation.

**EPA Method 624 requires the %RSD must be less than 35% and SW-846 Method 8260B Method requires the %RSD must be less than 15% for the average response factor for each analyte. EPA Method 524.2 requires the %RSD for any compound is less than or equal to 20%. If it is exceeded linear regression or a quadratic equations must be used with a minimum correlation coefficient of 0.990.**

10.3.1.2 If the % RSD of any compound is 15% or greater, construct calibration curves of area ratio (A / Ais) versus concentration ratio (Cx/ Cis) using first order (Linear Regression) or second order (Quadratic Regression) regression fit of the initial calibration points. The requirement for Linear Regression correlation coefficient is greater than 0.99. If the Linear Regression criteria are not met, then Quadratic equation (second order) may be used with a minimum of 6 data points. In either case, the curve must be printed and stored in the file with the initial calibration to document evaluation. The analyst should select the regression order, which introduces the least calibration error into the quantitation and minimizes the y-intercept value (constant term).

Linear and Quadratic Regressions each have several options available in the software. The analyst must chose which order will be used. Options available are equal weighting, inverse of conc., and inverse square of conc., and force (0,0). Do not force zero **or** use the (0,0) as a quantitation point because this option is not allowed by Method 8000B. The analyst should choose the curve order and weighting which gives the best coefficient of the determination (COD) and a y-intercept nearest to the origin, given the calibration blank is clean.

10.3.2 A system performance check should be made before this calibration curve is used. Five compounds (the System Performance Check Compounds, or SPCCs) are checked for a minimum average relative response factor. These compounds are:

Chloromethane
1,1-Dichloroethane
Bromoform
1,1,2,2-Tetrachloroethane
Chlorobenzene

These compounds typically have RFs of 0.100 - 0.400 and are used to check compound stability and to check degradation caused by contaminated lines or active sites in the system. See the Table for summary of the acceptance limits.

10.3.3. Using the RFs from the initial calibration, calculate and record the percent relative standard deviation (% RSD) for all compounds. The % RSD is calculated as follows:

$$\% \text{ RSD} = \frac{SD}{RF} \times 100$$

where:
RSD = relative standard deviation
RF = mean of 7 initial RFs for a compound
SD = standard deviation of average RFs for a compound

10.3.4 The percent relative standard deviation ***should*** be less than 15% for each compound. However, the % RSD for each individual calibration check compound (CCC) ***must*** be less than 30%. Late-eluting compounds usually have much better agreement. The CCCs are:

1,1-Dichloroethene
Chloroform
1,2-Dichloropropane
Toluene
Ethylbenzene
Vinyl chloride

10.3.5 If a % RSD greater than 30% is measured for any CCC, then corrective action to eliminate a system leak and/or column reactive sites is required before attempting another calibration.

## Criteria for Initial and Continuing Calibration for 624 and 8260B

| Volatile Compound | Initial and Continuing Calibration Minimum RRF | Initial Calibration Maximum % RSD | | Continuing Calibration Maximum % Drift (8260) Daily Check LCS (624) | |
|---|---|---|---|---|---|
| | 8260 | 624 | 8260 | 624 | 8260 |
| Chloromethane (SPCC) | (0.100) | 35 | | 0-40.80 | |
| Bromomethane | | 35 | | 2.80-37.20 | |
| Vinyl chloride (CCC) | | 35 | (30%) | 0.80-39.20 | (20%) |
| 1,1-Dichlororethane (SPCC) | (0.100) | 35 | | 14.50-25.25.50 | |
| 1-1-Dichloroethene (CCC) | | 35 | (30%) | 10.10-26.10 | (20%) |
| Chloroform (CCC) | | 35 | (30%) | 13.50-26.50 | (20%) |
| 1,2-Dichloroethane | | 35 | | 13.60-26.40 | |
| 1,1,1-Trichlororethane | | 35 | | 15-25 | |
| Carbon tetrachloride | | 35 | | 14.60-25.40 | |
| Bromodichloromethane | | 35 | | 13.10-26.90 | |
| cis-1,3-Dichloropropene | | 35 | | 4.80-35.20 | |
| Trichloroethene | | 35 | | 13.30-26.70 | |
| Dibromochloromethane | | 35 | | 13.50-26.50 | |
| 1,1,2-Trichloroethane | | 35 | | 14.20-25.80 | |
| Benzene | | 35 | | 12.80-27.20 | |
| trans-1,3-Dichloropropene | | 35 | | 10-30 | |
| Bromoform (SPCC) | (0.100) | 35 | | 14.20-25.80 | |
| Tetrachloroethene | | 35 | | 14.70-25.30 | |
| 1,1,2,2-Tetrachloroethane (SPCC) | (0.300) | 35 | | 12.10-27.90 | |
| Toluene (CCC) | | 35 | (30%) | 14.90-25.10 | (20%) |
| Chlorobenzene (SPCC) | (0.300) | 35 | | 13.20-26.80 | |
| Ethylbenzene (CCC) | | 35 | (30%) | 11.80-28.20 | (20%) |
| Styrene | | 35 | | | |
| Xylenes (total) | | 35 | | | |
| Bromofluorobenzene | | 35 | | | |
| 1,2 Dichloropropane (CCC) | | | (30%) | 3.80-36.20 | (20%) |

10.3.6 GC/MS Daily Calibration Procedure

GC/MS calibration consists of verifying that the mass spectrometer is in tune, has adequate sensitivity, is standardizing for the compounds of interest, and is demonstrating that the system is free of interferences. Calibration begins with the analysis of Bromofluorobenzene (BFB). This performance test must be passed before any samples, blanks, or standards are analyzed. The calibration is good for twelve hours from the injection time of the BFB for SW-846 Method 8260B, EPA 524.2 and 24 hours for EPA Method 624. The laboratory shall use the BFB criteria as listed below as tuning acceptance criteria. Alternatively, other documented tuning criteria may be used

10.3.6.1 **Tuning** - 50 ng of BFB (40 µL of a 25ng/µL solution) is added to 100 mL of VOA free water. 5 mL is purged for 11 minutes and desorbed onto the chromatographic column. The analysis is performed at 100° C to 150° C. A scan delay of two to five minutes is used. After the scan delay, data is acquired for five to ten minutes. The expected elution time of the BFB is six to eight minutes from the start of data acquisition. The background corrected average of three scans at the apex or of the entire peak of the peak is checked against the tuning requirements in the SW-846 Method 8260B (Table 3). One simple subtraction of background is required within twenty scans of the left side of the peak. There is a procedure file program in the software that will **locate** and check the BFB for a passing spectrum in the manner explained above. This procedure will be used routinely to eliminate any subjectivity from the tuning process. If this procedure fails to produce ion abundances that meet the criteria, it will display the message "no passing spectrum found in data file: xxxxx" on the printer. If this occurs the BFB must be re-analyzed. If repeated analyses fail to produce acceptable results, then the instrument must be manually tuned according to the Hewlett-Packard reference manual. A single scan option can also be used but should not be required on a regular basis. Once an acceptable tune is obtained, the following items are documented in the analyzed log:

- The scan number(s) of the good tune and background corrections used to achieve it.
- The time of injection.
- Once a good spectrum is found a hardcopy of the following information is filed in the daily calibration file.

The following is the BFB tune criteria:

**BFB Mass - Intensity Specifications**

**SW-846 Method 8260B and EPA Methods 624, 524.2:**

| Mass | Intensity Required (relative abundance) |
|---|---|
| 50 | 15-40% of mass 95 |
| 75 | 30-60% of mass 95 |
| 95 | Base peak, 100% relative abundance |
| 96 | 5 to 9% of Mass 95 |
| 173 | <2% of Mass 174 |
| 174 | >50% of Mass 95 |
| 175 | 5 to 9% of mass 174 |
| 176 | >95% but < 101% of Mass 174 |
| 177 | 5 to 9% of Mass 176 |

10.3.6.2 Daily Calibration Check:

10.3.6.2.1 The average response factor or calibration curve of the initial calibration is verified daily using the continuing calibration standard, the concentration of this standard is varied periodically. The acceptable criteria of CCC's <20% drift.

$$\% \text{ Drift} = \quad c1 - c2/c2 \times 100$$

where: c1 is the measured analyte concentration
c2 is the theoretical analyte concentration

10.3.6.2.2 The five SPCC compounds are checked for a minimum average relative response factors. The acceptance criteria is listed above.

10.3.6.2.3 All internal standards must be monitored for retention time and area of response. The internal standard areas may not vary more than a factor of 2 (i.e.- 50% to + 100%) and their retention times by ±30 seconds from the comparable standard in the initial calibration.

10.3.6.2.4 If a standard does not pass it may be should be checked for problems and corrected. Common causes of SPCC failure are: (1) purge flow too slow which will depress the RRFs of the poor purgers like bromoform and 1,1,2,2-tetrachloroethane, (2) purge flow too fast which will depress the RRFs of the gas analytes like chloromethane, (3) contamination in the autosampler/purge&trap system trap, valves, or lines which can degrade 1,1-dichloroethane and 1,1,2,2-tetrachloroethane.
New initial calibrations are always analyzed after major system changes such as replacing the column, cleaning the source, significant retuning of the mass spectrometer, significant changes in purge&trap conditions, etc.

EPA Method 624

10.3.6.2.5 The average response factor or calibration curve of the initial calibration is verified daily using a 20ug/L LCS and must meet the criteria for 624 which printed daily as a demonstration of compliance. LCS is from a source other that the standards used to calibrate the instrument.

10.3.6.2.6 If any of the compounds of the LCS do not meet the acceptance criteria for the QC check standard page5, then the system should be checked for possible problems, and the LCS

re-analyzed. If it does not pass 624 samples should not be analyzed.

EPA Method 524.2

10.3.6.2.7 The 524.2 standard (continuing calibration at 10ppb but varied periodically) must pass 524.2 criteria to continue. To meet 524.2 criteria, all target analytes must be within 30% of the true value in the daily standard analyzed at beginning of each 12- hour shift.

## 10.4 GC/MS Semivolatile Organics

10.4.1 Hardware Tuning - The GC/MS system must be hardware-tuned using a 50 ng injection of DFTPP. Analyses must not begin until the tuning criteria are met. The tuning procedure is required for SW-846 Method 8270C every 12 hours and for EPA Method 625 every 24 hours of sample analysis for as long as the calibration is valid, and prior to an initial calibration.

10.4.1.1 Under the HP ChemStation drop down menu item, select Tune. In the drop down menu select Autofind DFTPP to screen or printer. Alternately, the whole peak average spectrum and a single scan background correction may be evaluated. In either case, a hard copy showing the passing spectrum and passing criteria must be printed, dated and initialed by the analyst. A single scan option can also be used.

**DFTPP Mass - Intensity Specifications**

| MASS | ION ABUNDANCE CRITERIA 8270C(1) | ION ABUNDANCE CRITERIA 625 |
|---|---|---|
| 51 | 10.0-80.0 % of mass 198 | 30.0-60.0 % of mass 198 |
| 68 | < 2.0% of mass 69 | < 2.0% of mass 69 |
| 70 | < 2.0% of mass 69 | < 2.0% of mass 69 |
| 127 | 10.0-80.0 % of mass 198 | 40.0-60.0 % of mass 198 |
| 197 | < 2.0% of mass 198 | < 1.0% of mass 198 |
| 198 | Base peak, or >50% of Mass 442 | Base peak, 100% relative abundance(2) |
| 199 | 5.0-9.0 % of mass 198 | 5.0-9.0 % of mass 198 |
| 275 | 10.0-60.0 % of mass 198 | 10.0-30.0 % of mass 198 |
| 365 | > 1.0% of mass 198 | > 1.0% of mass 198 |
| 441 | Present but less than 24% of mass 442 | Present but less than mass 443 |
| 442 | Base peak, or >50.0 % of mass 198 | > 40.0 % of mass 198 |
| 443 | 15.0-24.0 % of mass 442 | 17.0-23.0 % of mass 442 |

Notes: 1. The criteria allowed by SW-846 Method 8270D

10.4.1.2 Use the DFTPP mass intensity criteria as tuning acceptance criteria.

NOTE: All subsequent standards, samples, MS/MSDs and blanks associated with a DFTPP analysis must use the identical mass spectrometer instrument conditions.

10.4.2 Initial Calibration

10.4.2.1 Using the HP 7673 autosampler, inject 1µl of each calibration standard (containing internal standards). Seven calibration levels are injected: 5.0 ng/µl, 10 ng/µl, 20 ng/µl, 50 ng/µl, 80 ng/µl, 120 ng/µl, and 160 ng/µl.
An injection volume of 1µl is used for all standards and sample extracts.
A set of at least 5 calibration standards is required. Additional higher level Standards may be used for analytes with large linear response ranges.

The data system software calculates relative response factors (RRFs) for each target analyte relative to one of the internal standards as follows:

$$RRF = \frac{A_s \times C_{is}}{A_{is} \times C_s}$$

where:

$A_s$ = Peak area of the analyte's quantitation ion
$A_{is}$ = Peak area of the internal standard's quantitation ion
$C_s$ = Mass of analyte injected in nanograms (ng)
$C_{is}$ = Mass of internal standard injected in nanograms (ng)

For EPA 625 analyses a minimum of 3 point initial calibration for all 625 target analytes is required and all must have RSD < 35% to allow use of the mean RF (Response Factor) for calibration. For analytes with RSD > 35% a linear regression or quadratic equation must be used.

10.4.2.2 System performance check compounds (SPCCs)

System Performance Check Compounds (SPCCs) are: N-nitroso-di-n-propylamine; hexachlorocyclopentadiene; 2,4-dinitrophenol; and 4-nitrophenol. The minimum acceptable average RRF for these compounds is 0.050 in the initial calibration curve. If the minimum response factors are not met, the system must be evaluated, and corrective action must be taken before sample analysis begins. Possible problems include standard mixture degradation, injection port inlet contamination, contamination at the front end of the analytical column, and active sites in the column or chromatographic system. This check must be met before sample analysis begins.

10.4.2.3 Calibration check compounds (CCCs) are as follows:

| Base/Neutral Fraction | Acid Fraction |
|---|---|

| | |
|---|---|
| Acenaphthene | 4-Chloro-3-Methylphenol |
| 1,4-Dichlorobenzene | 2,4-Dichlorophenol |
| Hexachlorobutadiene | 2-Nitrophenol |
| N-Nitrosodiphenylamine | Phenol |
| Di-n-octyl phthalate | Pentachlorophenol |
| Fluoranthene | 2,4,6-Trichlorophenol |
| Benzo(a)pyrene | |

10.4.2.4 The data system calculates the mean response factor and the relative standard deviation (RSD) of the response factors for each target analyte. The RSD should be less than or equal to 15% for each target analyte. However, the RSD for each individual CCC must be less than or equal to 30%.

$$RSD = \frac{SD}{RF} * 100$$

Where: SD = Standard Deviation
RF = Relative Response Factor

10.4.2.5 If the RSD of any CCC is greater than 30%, then the chromatographic system is too reactive for analysis to begin. Evaluate possible causes of the problems, perform additional maintenance whieh may include replacing the injector liner, clipping 2 to 3 inches off the front of the capillary, or replacing the capillary column, then repeat the calibration procedure.

10.4.2.6 Evaluation of retention times - The relative retention time (RRT) of each target analyte in each calibration standard must agree within 0.06 RRT units.

10.4.2.7 Linearity of target analytes - If the RSD of any target analyte is 15% or less, then the relative response factor is assumed to be constant over the calibration range, and the average relative response factor is used for quantitation.

10.4.2.8 If the RSD of any target analyte is greater than 15%, linear regression or quadratic equation may be used but the

Coefficient of Determination (COD) must be greater than 0.99 for the calibration to be valid for the analyte.

10.4.2.9 Several compounds may not exhibit sufficient response at the lower calibration levels due to their chemical properties. These compounds have a Reporting Limit of 20µg/L in water. If the %RSD criteria cannot be met for any of these compounds with all seven data points then point(s), then one of the following actions should be taken:

10.4.2.9.1 linear regression or quadratic equation may be used but the Coefficient of Determination (COD) must be greater than or equal to 0.99 for the calibration to be valid for the analyte.

10.4.2.9.2 Dropping of standard point should be performed ONLY on either the high or the low standard. Any point dropping should be documented for the reason of dropping on the initial calibration form. The Section Supervisor must sign and date the initial calibration form.

10.4.3 GC/MS calibration verification - Calibration verification consists of five evaluation steps that are performed prior to sample extract analysis at the beginning of each 12 hour shift.

10.4.3.1 Prior to the analysis of samples or calibration standards, inject 50 ng of the tune standard into the GC/MS system. The resultant mass spectrum for DFTPP must meet the criteria given in 10.4.11 before sample analysis begins. Using the Enviroquant "Tailing" macro in QEDIT, evaluate and hardcopy the tailing factor for pentachlorophenol and benzidine. The tailing factors must be less than 5 and 3, respectively. Evaluate the DDT degradation using the following formula: ((DDD+DDE) / (DDT+DDD+DDE))*100 = %degradation. DDT degradation must be less than 20%. These criteria must be demonstrated each 12-hour shift during which samples are analyzed.

10.4.3.2 The initial calibration for each compound of interest is verified once every 12 hours prior to sample analysis, using the introduction technique and conditions used for samples. This

is accomplished by analyzing the 80 ng/µl calibration standard and verifying that the following criteria are met. All analytical queues containing USACE project samples must be followed by a closing CCV. CCV criteria do not apply to the closing standard and the results do not need to be reported, but the data must be available to USACE inspection if requested.

10.4.3.3 System performance check compounds (SPCCs) - A system performance check must be made during every 12-hour analytical shift. Each SPCC in the calibration verification standard must meet a minimum response factor of 0.050. This is the same check that is applied during the initial calibration.

If the minimum response factors are not met, the system must be evaluated, and corrective action must be taken before sample analysis begins. Possible problems include standard mixture degradation, injection port inlet contamination, contamination at the front end of the analytical column, and active sites in the column or chromatographic system. This check must be met before sample analysis begins.

10.4.3.4 Calibration check compounds (CCC's) - After the system performance check is met, the CCC's listed previously are used to check the validity of the initial calibration. Use percent difference when performing the average response factor model calibration. Use percent drift when calibrating using a regression or quadratic fit model. If the percent difference or drift for each CCC is less than or equal to 20%, then the initial calibration is assumed to be valid. If the criterion is not met (i.e., greater than 20% difference or drift) for any one CCC, then corrective action must be taken prior to the analysis of samples. If the CCCs are not included in the list of analytes for a project, then all analytes, which will be reported, must meet the 20% difference or drift criterion. Problems similar to those listed under SPCCs could affect the CCCs. If the problem cannot be corrected by other measures, a new initial calibration must be generated. The CCC criteria must be met before sample analysis begins.

10.4.3.5 Peak tailing will be evaluated by using the Enviroquant "Tailing" macro in QEDIT for each tune mix standard run and

printed. Tailing factor is calcluated by the software and must be <5 for Pentachlorophenol and <3 for Benzidine.

## 10.5 GC Pesticides

10.5.1 Retention Time Windows

10.5.1.1 Before establishing retention time windows, make sure that the chromatographic system is operating reliably and that the system conditions have been optimized for the target analytes and surrogates in the sample matrix to be analyzed.

10.5.1.2 Make three injections of all single and all multi-component analytes over the course of a 72 hours period. Serial injections or injections over a period of less than 72 hours may result in retention time windows that are too tight.

10.5.1.3 Record the retention times for all single analytes and three to five major peaks for multi-component analytes. Calculate the mean and standard deviation of the three absolute retention times of each single analyte and those peaks.

10.5.1.4 If the standard deviation of the retention times for a target compound is 0.000, then the laboratory uses a default standard of 0.01 minutes. Recording retention times to three decimal places rather than two should minimize the instances in which the standard deviation is calculated as 0.000.

10.5.1.5 The width of the retention time window for the single analytes, each major constituent in multi-component analytes and surrogates is defined as ±3 times the standard deviation of the mean absolute retention time established during a 72-hour period. If the default standard deviation is employed, the width of the window will be 0.03 minutes.

10.5.1.6 The absolute retention time windows must be calculated for each analyte and surrogate on each chromatographic column and instrument. New retention time windows must be established when a new GC column is installed.

10.5.1.7 Establish the center of the window for each analyte and surrogate by using the absolute retention time for each analyte and

surrogate from the calibration verification standard at the beginning of the analytical shift. For samples run during the same shift as an initial calibration, use the retention time of the mid-point standard of the initial calibration.

10.5.1.8 If the daily CCV falls outside the window, the analyst will evaluate the instrument and will recalibrate if necessary. For samples run during the same analytical shift as the Initial Calibration, use the RT of the midpoint standard. However, the experience of the GC analyst should weigh heavily in the interpretation of the chromatograms. The analyst may therefore qualify an analyte as present outside the RT window by using pattern recognition.

10.5.2 Initial Calibration.

10.5.2.1 Must contain a minimum of a 5-point curve for all surrogates & analytes of interest with %RSD's less than 20%.

10.5.2.2 In those instances where the RSD exceeds 20% for any analyte, then the quadratic equation which requires a six-point initial calibration curve may be used but the Coefficient of Determination (COD) must be greater than or equal to 0.990 for the calibration to be valid for the analyte.

10.5.2.3 The analysis of the multi-component analytes employs a single point calibration at the midpoint of the expected calibration range of each multi-component analyte. It is included with the initial calibration of the single component analytes and is used for pattern recognition and RT's.

10.5.2.4 A second source mid-point standard is injected and compared to the initial calibration curve. The percent recovery of each analyte should be ±15%. For USACOE and Navy projects, all analytes must be within ±20% of the expected value.

10.5.2.5 In reporting multi-component analytes, two processes are used: qualitative and quantitative. The first is qualitative, which is done matching the unknown sample to the multi-component standards evaluated during the initial calibration. In this case the pattern in the sample is compared to patterns of the standards. If a match is found, it is determined at what concentration the multi-component analyte is in the unknown, or its quantitative value. Three to five of the major peaks in the multi-component analyte pattern are chosen to measure the concentration of the positive hit.

10.5.3 Calibration Techniques. There are two calibration techniques used by AMRO acceptable for quantitation: average response factor calibration and linear calibration curve. This is the order of preference.

10.5.3.1 This is the Average Response Factor Calibration. For each analyte calculate the response factor of each compound using the equation:

$$\text{Response Factor (RF)} = \frac{\text{Peak Area of analyte}}{\text{Conc. of Analyte in standard}}$$

Calculate the Average of the Response Factors (Rfa) and the Standard Deviation (STD). Using the Rfa and STD, calculate the percent relative standard deviation (%RSD). When the RSD of Analytes are less than 20%, linearity through the origin can be assumed.

$$\%\ \text{RSD} = \frac{\text{Standard Deviation}}{\text{Average Response factor}} \times 100\%$$

Providing the % RSD for each analyte is less than 20%, the Average Response Factor (Rfa) can be using to calculate the sample results. If the %RSD is greater than 20% then a Linear Calibration Curve may be used providing the acceptance criteria is met.

10.5.3.2 Linear Calibration Curve. In order to use this technique, the data system must plot and evaluate a calibration curve by calculating the correlation coefficient against the first order equation:

$$Y = mX + b$$

The software option "Curve Fit" must be selected and the computer will evaluate the calibration based on the above equation.

The acceptance criteria for this equation is the correlation coefficient must be at least 0.990 and documented on the calibration data with analyst initials and the date. The curve must be printed for visual verification and stored with the calibration records.

If the %RSD is greater than 20% and the correlation coefficient is less than 0.990, the instrument must be re-calibrated.

10.5.4 Continuing Calibration Verification (CCV)

10.5.4.1 Verify calibration each 12 hours shift by injecting CCV's (Continuing Calibration Verification sample, a midpoint concentration standard) prior to any sample analysis. A CCV must also be injected at intervals not less than once every 20 client samples (or at the end of a 12 hour interval, whichever comes first). USACOE samples will be analyzed at intervals of no greater than 10 injections between CCV's.

10.5.4.2 The 12 hours shift begins with the injection of the first CCV. The shift ends after the completion of the analysis of the last sample or standard that can be injected within 12 hours of the beginning of the shift. A closing standard **MUST** be injected at the end of the 12 hours window. However, in continuous analysis, the closing CCV of one shift may also serve as the CCV of the next 12 hours shift. The concentration of the last CCV in the analytical batch should be different than the beginning CCV.

10.5.4.3 The CCV Std response must be within ± 15% of the initial calibration curve. If the percent Difference (%D) of an analyte is > 15%, but the average %D for all the analytes are within 15%, then the calibration has been verified.

$$\%\ D = \frac{\text{Calculated Concentration - Theoretical Conc.}}{\text{Theoretical conc.}} \times 100\%$$

$$\text{Ave. \%D} = \frac{\text{\%D of Each Analyte}}{\text{Total \# of Analytes}}$$

No sample results can be reported associated with CCV > 15% for that analyte unless it is qualified as estimated. Reanalysis is recommended in these cases.

10.5.4.4 The initial CCV retention times must be compared to the RT windows established vs. the mid-concentration standard of the initial calibration.

10.5.4.4.1 If any analyte is outside the window, the chromatographic system must either be adjusted so re-analysis of the CCV falls within RT windows, or a new initial calibration must be performed and new retention time windows established.

10.5.4.5 Subsequent CCV retention times should be compared to the initial CCV of the 12-hour shift.

10.5.4.6 If the standard analyzed after a group of samples exhibits high response (>15%), and the analyte was not detected in the samples, it is okay to report. In contrast, if the response in the standard is low (by 15%), the sample must be reanalyzed per analyst discretion.

10.5.4.7 The CCV standards should include a PEM (pesticide evaluation mixture) which is used to determine the breakdown of Endrin and DDT. This standard should be analyzed before samples are analyzed, every 12-hour shift. Breakdown should be less than 15% for each compound. Results should be written on the raw data with analyst initials and date.

$$\% \text{ DDT Breakdown} = \frac{\text{Sum of DDE \& DDD areas}}{\text{Sum of DDT,DDE,DDD areas}} \times 100\%$$

$$\% \text{ Endrin Breakdown} = \frac{\text{Sum of Endrin Aldehyde + Endrin Ketone Areas}}{\text{Sum of Endrin, End. Alde, + Endrin Ketone Areas}} \times 100\%$$

## 10.6 GC PCBs

10.6.1 Retention Time Windows

10.6.1.1 Before establishing retention time windows, make sure that the chromatographic system is operating reliably and that the system conditions have been optimized for the target analytes and surrogates in the sample matrix to be analyzed.

10.6.1.2 Make three injections of all multi-component analytes over the course of a 72 hours period. Serial injections or injections over a period of less than 72 hours may result in retention time windows that are too tight.

10.6.1.3 Record the retention times for three to five major peaks for multi-component analytes. Calculate the mean and standard deviation of the three absolute retention times of those peaks.

10.6.1.4 If the standard deviation of the retention times for a target compound is 0.000, then the laboratory uses a default standard of 0.01 minutes. Recording retention times to three decimal places rather than two should minimize the instances in which the standard deviation is calculated as 0.000.

10.6.1.5 The width of the retention time window for each major constituent in multi-component analytes and surrogates is defined as ±3 times the standard deviation of the mean absolute retention time established during a 72 hours period. If the default standard deviation is employed, the width of the window will be 0.03 minutes.

10.6.1.6 The absolute retention time windows must be calculated for each analyte and surrogate on each chromatographic column and instrument. New retention time windows must be established when a new GC column is installed.

10.6.1.7 Establish the center of the window for each analyte and surrogate by using the absolute retention time for each analyte and surrogate from the calibration verification standard at the beginning of the analytical shift. For samples run during the same shift as an initial calibration, use the retention time of the mid-point standard of the initial calibration.

10.6.1.8 If the daily CCV falls outside the window, the analyst will evaluate the instrument and will recalibrate if necessary. For samples run during the same analytical shift as the Initial Calibration, use the RT of the midpoint standard. However, the experience of the GC analyst should weigh heavily in the interpretation of the chromatograms. The analyst may therefore qualify an analyte as present outside the RT window by using pattern recognition.

10.6.2 Initial Calibration.

10.6.2.1 Must contain a minimum of 5-point curve of Aroclor 1660 (this is a mixture of PCB's 1016 and 1260), along with the midpoint standards for the remaining 1221, 1232, 1242, 1248, 1254 Aroclors. These midpoints are to be used for pattern recognition and one-point calibration (the standards are used to determine the response factor appropriate for each individual PCB using the linear curve of the combination of PCB 1016 and PCB 1260). The %RSD of the 1660 curve must be ≤ to 20%. See Section 7.4.2.1 for action when the %RSD exceeds 20%.

10.6.2.2 A minimum of 3 peaks must be chosen for quantitation but preferably 5 peaks should be used especially with 1016 and 1260. The chosen peaks should be within 25% of the height of the largest Aroclor peak and should try to include at least one peak that is unique to each Aroclor.

10.6.2.3 In reporting, PCBs two processes are used: qualitative and quantitative. The first is qualitative, which is done matching the unknown sample to the Aroclor standards evaluated during the initial calibration. In this case the pattern in the sample is compared to patterns of the standards. If a match is found, it is determined at what concentration the Aroclor is in the unknown, or its quantitative value. Three to five of the major peaks in the Aroclor pattern are chosen to measure the concentration of the positive hit. Of the seven commercial Aroclors on the 8082 target list, 1016, 1242, and 1232 have similar major peaks, the difference being the ratio of these peaks to one another. Although the same peaks are used to quantitate a PCB hit, the same average response factors are not used.

10.6.3 Calibration Techniques. There are two calibration techniques used by AMRO acceptable for quantitation: average response factor calibration and linear calibration curve. This is the order of preference.

10.6.3.1 This is the Average Response Factor Calibration. For each analyte calculate the response factor of each compound using the equation:

$$\text{Response Factor (RF)} = \frac{\text{Peak Area of analyte}}{\text{Conc. of Analyte in standard}}$$

Calculate the Average of the Response Factors (Rfa) and the Standard Deviation (STD). Using the Rfa and STD, calculate the percent relative standard deviation (%RSD). When the RSD of Analytes are less than 20%, linearity through the origin can be assumed.

$$\%\ \text{RSD} = \frac{\text{Standard Deviation}}{\text{Average Response factor}} \times 100\%$$

Providing the % RSD for each analyte is less than 20%, the Average Response Factor (Rfa) can be using to calculate the sample results. If the %RSD is greater than 20% then a Linear Calibration Curve may be used providing the acceptance criteria is met.

10.6.3.2 Linear Calibration Curve. In order to use this technique, the data system must plot and evaluate a calibration curve by calculating the correlation coefficient against the first order equation:

$$Y = mX + b$$

The software option "Curve Fit" must be selected and the computer will evaluate the calibration based on the above equation.

The acceptance criteria for this equation is the correlation coefficient must be at least 0.99 and documented on the calibration data with analyst initials and the date. The curve must be printed for visual verification and stored with the calibration records.

10.6.3.3 If the %RSD is greater than 20% and the correlation coefficient is less than 0.99, the instrument must be re-calibrated.

10.6.4 Continuing Calibration Verification (CCV)

10.6.4.1 Verify calibration each 12-hour shift by injecting the mid pt 1660 std prior to any sample analyses. A CCV must also be injected at intervals not less than once every 20 client samples plus batch QC (or at the end of a 12- hour interval, whichever comes first). USACOE (U. S. Army Corp. of Engineers) samples will be analyzed at intervals of no greater than 10 injections between CCVs. The calibration verification process does **not** require reanalysis of the other Aroclor standards used for pattern recognition. .

10.6.4.2 The CCV Std response must be within ± 15% of the initial calibration curve.

$$\%\ D = \frac{\text{Calculated Concentration - Theoretical Conc.}}{\text{Theoretical conc.}} \times 100\%$$

10.6.4.3 The initial CCV retention times must be compared to the RT windows established vs. the mid-concentration standard of the initial calibration.

10.6.4.4 If any analyte is outside the window, the chromatographic system must either be adjusted so re-analysis of the CCV falls within RT windows, or a new initial calibration must be performed and new retention time windows established.

10.6.4.5 Subsequent CCV retention times should be compared to the initial CCV of the 12-hour shift.

10.6.4.6 The RTs of the CCV's must fall within the daily RT windows, otherwise the instrument is considered out of control.

10.6.4.7 If the standard analyzed after a group of samples exhibits high response (>15%), and the analyte was not detected in the samples, it is acceptable to report as is. In contrast, if the response in the standard is low (by <15%), the sample must be reanalyzed.

## 10.7 GC Fingerprints

10.7.1 Initial Calibration:

A minimum of five points are used for the initial calibration curve. The following components and their corresponding concentrations are listed in the reagent section of this document. The average response factor (RF) for each component is calculated.

$$\frac{\text{Conc. of standard}}{\text{Area of component}} = \text{RF}$$

The average RF is calculated by averaging the RF's from each calibration level. The average RF's must be less than or equal to 20% for each component. Any that are over 20% must be evaluated using linear regression. The criteria for linear regression is the correlation coefficient must be 0.990 or greater. If this criteria cannot be met a quadratic equation must be used. The criteria is a coefficient of determination of 0.990 or greater. If none of these criteria are met the instrument must be recalibrated. A $6^{th}$ point must be added to use a quadratic regression. Do not force zero, and do not use 0,0 as a point. If linear regression or quadratic regression are used, a calibration factor (CF) must be calculated for each component:

$$\frac{\text{Total Area within the Retention Time (RT) range}}{} = \text{CF}$$

Mass injected in ng

10.7.2 The 50 ng/µl O-Terphenyl (OTP) Daily standard is run on the instrument. This standard must be within 20% of the initial curve. This standard is analyzed as the first standard of the day. If the 20% criteria is not met, a new OTP daily standard is prepared. If this OTP daily standard does not meet criteria and preventative maintenance does not correct the problem then a new initial calibration curve must be analyzed. If the standard is acceptable, analysis may continue.

10.7.3 After an acceptable daily standard is obtained, a daily reference standard containing the following components is analyzed:

| | |
|---|---|
| Gas/Motor Oil: | 1000 ng/µl |
| Fuel Oil#2: | 2500 ng/ µl |

These standards must be within 15% of the initial curve. If criteria is not met the daily reference standard is rerun. If it is still unacceptable a fresh daily standard is prepared and analyzed. If this is unacceptable and preventative maintenance does not solve the problem, a new calibration curve must be analyzed. Standards must be analyzed at least every 12 hours. Additional standards such as Fuel Oil#4, JP-4, JP-5, Gasoline, Mineral spirits, etc. are run as needed if any components are seen in the samples.

10.7.4 A retention time (RT) standard, working Florida TRPH standard, consisting of n-alkanes from C8 to C40, is then analyzed and evaluated for RT drift and confirmation of the DRO range boundaries if DRO will be reported.

10.7.4.1 The calibration curves consists of an ortho-Terphenyl (OTP) standard curve, a diesel standard curve and a gas/motor oil standard curve at 5 levels. An average RF (Response Factor) of 20% or less must be achieved or a linear regression with an acceptable limit for the correlation coefficient of 0.99 or greater is used.

10.7.4.2 The daily calibration check procedure for the GC/FID is as follows:

(a) Two solvent blanks consisting of Methylene Chloride are analyzed. The blanks are acceptable if there are no analytes detected.

(b) The ortho-Terphenyl (OTP) daily standard is analyzed and the recovery of the OTP must be within ± 15%.
(c) A diesel/#2 Fuel oil standard is analyzed next. The acceptance criteria for this standard is ± 15% compared to the initial calibration curve.
(d) A gas/motor oil standard is analyzed next. The acceptance criteria for this standard is ± 15% compared to the initial calibration curve.

## 10.8 Instrumental Detection Limits (IDL)

The Instrumental Detection Limit is calculated for metals on the ICP, GFAA and CVAA as part of initial startup and repeated if there is a significant change to the instrument. It is defined as the concentration equivalent to a signal due to the analyte which is equal to three times the standard deviation of a series of 7 replicate measurements of a standard solution at a concentration of 3 to 5 times the estimated instrument detection limit. The IDL is rounded upward and reported to three significant figures. The IDL must be less than or equal to the MDL.

## 10.9 Graphite Furnace (GFAA)

10.9.1 The instruments are calibrated starting with a calibration blank and four standards defining the range of the metal being analyzed, to establish the calibration curve. One of the standards is at the laboratory reporting limit. An acceptable correlation coefficient is ≥ 0.995.

10.9.2 If the peaks look clean and proportionally correct, an ICV or QCS (initial calibration verification or quality control sample) check sample is run. The ICV is prepared from a different source than the standards used for the calibration curve. The ICV check sample must be within 90-110 % recovery for SW846 and for EPA Method 200.9. If the acceptance criteria are not met the instrument will be re-calibrated.

10.9.3 An IPC (Instrument Performance Check) solution is analyzed for 200 series methods and must be within ±5% of the true value. This solution is the same as the CCV.

10.9.4 An ICB is analyzed and must be within ± one half the reporting limit of the analyte(s) being analyzed. If the acceptance limit is not met the analysis is stopped and the instrument is re-calibrated.

10.9.5 Next a reporting limit standard is run for the metal being analyzed. Internal warning limits are set at ± 30%.

10.9.6 To assure calibration accuracy throughout the analysis, a Continuing Calibration Verification (CCV) check standard is run at a frequency of 10% and at the end of the analytical run. If the CCV is outside the control limits of 90-110% for EPA Methods 200.9 and SW846 the analysis is stopped and the instrument is re-calibrated.

10.9.7 A Continuing Calibration Blank (CCB) check standard is run at a frequency of 10% and at the end of an analytical run with the CCV. The acceptance criteria for the CCB is ± one half the reporting limit. If acceptance limits are not met the analysis is stopped and the instrument is re-calibrated. For USACOE and Navy projects no analyte can be detected at > 2x the MDL.

**10.10 ICP**

10.10.1 The instrument is calibrated daily using a blank and between two and six standards containing the metals that are going to be analyzed. One of the standards is at the laboratory reporting limit. An acceptable correlation coefficient is ≥ 0.995.

10.10.2 Immediately after running the calibration curve an Initial Calibration Verification (ICV) is run and it is prepared at the mid-range of the calibration curve. The ICV is prepared from a different source than the standards for the calibration curve. The control limits for the ICV are 90 - 110% for SW846 and 95 - 105% for EPA Method 200.7. If outside of acceptance limits the instrument must be re-calibrated.

10.10.3 A Quality Control Sample (QCS) is prepared daily as required by EPA Method 200.7. The QCS is prepared from an independent source from the calibration standards and is run in duplicate. The average must be within 95 - 105% of the true value or the QCS must be remade. AMRO's QCS is the ICV.

10.10.4 An IPC (Instrument Performance Check) is run daily per Method 200.7, this is a mid-level QC standard prepared from the same stock as the calibration standards. The criteria are ±5%. The same solution is analyzed every ten samples, proceeding the CCB, as the CCV with an acceptance criteria of ±10%.

10.10.5 An Initial Calibration Verification Blank (ICB) is run next and it must be ± one half the reporting limit. A continuing calibration blank (CCB) is also run after every 10 samples and at the end of the run. For USACOE and Navy projects no analyte can be detected at > 2x the MDL.

10.10.6 A reporting limit standard is the next QC check. The reporting limit standard are analyzed at three concentrations (RL1, RL2 & RL4) at the beginning and end of the run. Internal warning limits are set at ± 30% for R1 and RL2. In addition, the RL 2 standard is the lowest standard for the Optima ICP.

10.10.7 An Interference Check Sample (ICS) is run next and at the end of each run batch. The control limits for the ICSA are ± two times the reporting limit and the acceptance limits for ICSAB are 80-120%. If the ICSAB is outside of acceptance limits but the ICSA is acceptable the data is reportable but the instrument channel must be monitored for potential problems. If the ICSA results are outside the ± two times the reporting limit the Interference Correction Factor must be checked and the samples must be evaluated to determine if re-analysis is required.

10.10.8 On an semi-annual basis all Inter-element Correction Factors (IEC's) and linear ranges are verified and updated as needed. This is done by analyzing single-element solutions of each element currently determined by ICP at the highest reported value for the element and verifying the apparent concentrations for the remaining elements are within the ± two times the Reporting limit criteria.

10.10.9 Once all these QC checks are acceptable, the instrument is considered calibrated and samples can be run.

10.10.10 A Continuing Calibration Verification (CCV) check is run after every 10 samples to assure the ICP is still in calibration. The acceptable limits for

the CCV check are 90-110% and it is always followed by a CCB (Continuing Calibration Blank). If the CCV or CCB results are not within acceptance limits it can be re-analyzed once more per EPA Method 200.7. If it is still not within acceptance limits a Non Conformance Report must be completed investigating the problem. If the CCV and/or CCBs continue to be outside of acceptance criteria the problem must be corrected and the samples re-analyzed.

**Metals QC Requirements**

| **Instrument QC** | **QC requirements for 200.7/200.9 GFAA** | **ICP** |
|---|---|---|
| Calibration | Per Manufacturer | Per Manufacturer |
| IPC | 95 - 105% | 95 - 105 % |
| ICV/QCS - Ind Source* | 90 - 110 % | 95 - 105 % |
| ICB | ± Reporting Limit (RL) | ± Reporting Limit (RL) |
| RL | In the Calibration Curve | ±30 % (Internal Warning Limits) |
| ICSA (SIC) | N/A | ± Reporting Limit (RL) |
| ICSAB (SIC) | N/A | 80 - 120 % |
| CCV (IPC) | 90 - 110 % | 90 - 110 % |
| CCB | ± Reporting Limit (RL) | ± Reporting Limit (RL) |

| **Instrument QC** | **QC requirements for SW-846 GFAA** | **ICP** |
|---|---|---|
| Calibration | Per Manufaeturer | Per Manufacturer |
| ICV - Ind Source | 90 - 110 % | 90 - 110 % |
| ICB | ± Reporting Limit (RL) | ± Reporting Limit (RL) |
| RL | In the Calibration Curve | ±30 % (Internal Warning Limits) |
| ICSA | N/A | ± Reporting Limit (RL) |
| ICSAB | N/A | 80 - 120 % |
| CCV | 80 - 120 % | 90 - 110 % |
| CCB | ± Reporting Limit (RL) | ± Reporting Limit (RL) |

* - Verify QCS Quarterly or run daily

## 10.11 Mercury Analyzer System

10.11.1 The instruments are calibrated starting with a calibration blank and five standards defining the range of the metal being analyzed, to establish the calibration curve. One of the standards is at the laboratory reporting limit. An acceptable correlation coefficient is ≥ 0.995.

10.11.2 An ICV or QCS (initial calibration verification or quality control sample) check sample is run. The ICV is prepared from a different source than the standards used for the calibration curve. The ICV check sample must be within (90-110 %) recovery for SW846 and for EPA Method 245.1. If the acceptance criteria are not met the instrument will be re-calibrated.

10.11.3 An IPC (Instrument Performance Check) solution is analyzed for 200 series methods and must be within ±5% of the true value. This solution is the same as the CCV.

10.11.4 An ICB is analyzed and must be within ± one half the reporting limit of the analyte(s) being analyzed. If the acceptance limit is not met the analysis is stopped and the instrument is re-calibrated.

10.11.5 To assure calibration accuracy throughout the analysis, a Continuing Calibration Verification (CCV) check standard is run at a frequency of 10% and at the end of the analytical run. If the CCV is outside the control limits of (90-110%) for EPA Method 245.1 and (80-120%) for SW846 the analysis is stopped and the instrument is re-calibrated.

10.11.6 A reporting limit standard is the next QC check. Internal warning limits are set at ± 30%.

10.11.7 A Continuing Calibration Blank (CCB) check standard is run at a frequency of 10% and at the end of an analytical run with the CCV. The acceptance criteria for the CCB is ± one half the reporting limit. If acceptance limits are not met the analysis is stopped and the instrument is re-calibrated.

10.11.8

| QC Sample | Frequency | Hg Action Level | Hg Action | Analyst Response |
|---|---|---|---|---|
| ICV | Once, after calibration | ±5% of True Value for 245.1; ±10% of True Value for EPA Method 7470A | Stop | Correct problem and recalibrate |
| IPC | Once, after Calibration | ±5% of True Value for EPA Method 245.1, Not applicable for Method 7470A | Stop | Correct problem and recalibrate |
| ICB | Once, after ICV | ±2 X MDL (MDL Check) | Stop | Correct problem and recalibrate |
| CCV | 10% of analytical samples | ±10% of True Value for 245.1; ±20% of True Value for EPA Method 7470A | Stop | Correct problem and reanalyze affected samples |
| CCB | Following each CCV | ±2 X MDL (MDL Check) | Stop | Correct problem and reanalyze affected samples |

## 10.12 Ion Chromatography

10.12.1 The instrument is calibrated starting with a calibration blank and a minimum of six standards defining the range for each Anion of interest being analyzed, to establish the calibration curve. One of the standards is at the laboratory reporting limit. An acceptable correlation coefficient is $\geq 0.995$.

10.12.2 The calibration curve must be verified on each working day, or whenever the Anion eluent is change, and after every 10 samples. The response for any analyte must be within ±10% from the excepted value. If the results more than ±10% use a fresh calibration standers. If the results are still more than ±10%, a new curve must be prepared for that analyte.

# SECTION 11. INSTRUMENT/EQUIPMENT CALIBRATION

## 11.1 Calibration checks and frequencies

### 11.1.1 Analytical Balance - Sartorius Research R160P, Ohaus Explorer E02140

The analytical balance has a sensitivity of 0.01mg. It is checked using ASTM Class I weights at weights that bracket the target weight(s) on a daily basis and the actual weights are recorded in the Daily Balance Check Logbook. The balance is kept on a marble slab on a heavy table and is checked regularly to be sure it is level. The balance is calibrated annually by a certified service representative.

### 11.1.2 Top Loader Balance(s) - Mettler BB300, AND HF400

The top loader balances are checked daily using ASTM Class I weights at weights bracketing routinely measured weights on a daily basis and they are recorded in individual Quality Control logbooks. The top loader balances have a sensitivity of 0.01 g. The balances are calibrated annually by a certified service representative.

### 11.1.3 pH Meters – VWR SympHony SB20 and Thermo Electron Corp. Orion 3 Star

Since most of the samples received in the laboratory have a pH between 4 and 10, the pH meter is calibrated on a daily basis using three standard buffer solutions: pH of 4, pH of 7 and pH of 10. The calibration is carried out according to the 3-Buffer Calibration/ Automatic Mode outlined in the pH meter manual. The slope is read and it must be 92-102 mv or appropriate actions are taken. A standard 6 Buffer is read as the Lab QC Check sample. All standards are at room temperature and stirred during measurement. pH buffers at 2.0 and 12 are available to check samples outside the calibration range.

### 11.1.4 Conductivity Meter with Platinum Electrode – Fisher, Model 09-328

The conductivity meter has a range of 0 - 200,000 µmhos/cm and is calibrated daily by using a 1413 µmhos/cm standard. The deionized water system is checked daily to make sure the laboratory water has a very low specific conductance (<1 µmhos/cm).

11.1.5 Turbidimeters - Hach 2100AN

The Hach 2100AN is calibrated quarterly per manufacturers instructions. The Hach 2100AN turbidimeter is checked before use with a blank and standards of 1.0 and 20.0 NTU.

11.1.6 Spectrophotometer - HACH –DR2010

The Spectrophotometer is also calibrated annually by a certified service representative.

11.1.7 Drying Ovens (2)

All ovens have a selectable temperature control ranging from room temperature to 200°C. A long stem thermometer which is calibrated annually against a certified thermometer is inserted through a center ceiling port with the bulb of the thermometer located inside a cylinder filled with sand. A record of the temperature of the drying ovens is maintained for each day on which the drying ovens are in use. The temperature is recorded both before and after use. Records of the oven temperatures are found in the analytical logbooks associated with temperature dependent analyses.

11.1.8 Incubators

11.1.8.1 The temperature of the BOD incubator is recorded twice daily and the temperature is monitored using a calibrated thermometer immersed in glycerol that is stored in the incubator.

11.1.9 Refrigerators

The temperature of each refrigerator is recorded twice daily to be sure they maintain a temperature of 4°C±2°C. The thermometers used are calibrated against an NIST traceable thermometer on an annual basis. The thermometers are labeled with the date, thermometer ID and conversion factor and documented in the thermometer calibration logbook. Each thermometer is immersed in glycerol and placed on one of the shelves being used for sample storage. Refrigerators containing samples or sample extracts are monitored on non-working days with digital max/min thermometers.

11.1.10 Freezers

The temperature of each freezer is recorded daily to be sure they maintain a temperature of <-10°C. The thermometers used are calibrated against an NIST traceable thermometer on an annual basis. The thermometers are labeled with the date, thermometer ID and conversion factor and documented in the thermometer calibration logbook. Each thermometer is immersed in glycerol and placed on one of the shelves being used for sample storage. Freezers are monitored on non-working days with digital max/min thermometers.

11.1.11 Water Baths

11.1.11.1 Mercury Hot Block

The temperature of the mercury hot block is recorded daily when in use. It is monitored using a non-mercury thermometer that has been calibrated against a certified thermometer annually.

11.1.11.2 Oil and Grease Water Bath

The temperature of the oil and grease water bath is recorded when in use. It is monitored using a thermometer that has been calibrated against a certified thermometer annually.

11.1.11.3 Organic Water Baths

The temperature of the organic water baths is recorded daily when in use. It is monitored using thermometers that has been calibrated against a certified thermometer annually.

11.1.12 Thermometers

Thermometers are calibrated against a certified thermometer annually or quarterly (dial or digital). The certified thermometer is checked for accuracy at the ice point with each use. It is sent to an outside vendor for verification once every three years.

11.1.13 Weights

AMRO used Class I weights to check the calibration of the balances daily each day of use. The weights are inspected periodically for cleanliness. They are sent to an outside vendor for verification once every five years.

11.1.14 Pipette

All variable-volume pipettes are checked the day of use or weekly at two volumes that brackets the range of use. Fixed volume pipettes are checked quarterly.

## 11.2 Instrument Maintenance/Repair

Preventive maintenance is performed on all instruments to minimize instrument downtime. Spare parts are maintained for each instrument to replace worn out parts to further minimize downtime. Instrument maintenance and repair records are kept throughout the lab to document satisfactory instrument performance. The operator is responsible to see that records are well kept. Records of major maintenance and repair are kept in instrument maintenance logs.

### 11.2.1 GC/MS (Volatile Organics) Preventive Maintenance and Repair

11.2.1.1 Daily maintenance proecdures. The following items should be checked on every day that an instrument is used for analysis.

- Trap and column performance. This is monitored by checking the response factor of key compounds which indicate trap and column degradation and observing column bleed. Change trap or column if necessary.

- Check that gases have adequate supply to last until the following day. Change tanks if necessary.

- Check data file space on the data system.

11.2.1.2 Biweekly maintenance procedures. The following items should

be done every two weeks.

- Check purge gas flow on the purge and trap systems. Adjust if necessary.
- Check Teflon ferrules on the purge and trap systems for wear. Replace if necessary.

- Check Teflon block on the autolab systems for wear. Replace if necessary.

11.2.1.3 Six month maintenance procedure.

- Every six months the vacuum pump oil and the adsorbent trap packing should be changed.

11.2.1.4 "As needed" maintenance.

The following service should be performed when system performance indicates.

- Clean the analyzer source. This will become necessary if a high background becomes apparent which is not attributable to column degradation or the system cannot meet BFB criteria.

- Replace the electron multiplier when the maximum gain no longer provides the required sensitivity.

- Replace the ion source filament as needed.

### 11.2.2 GC/MS (Semivolatile Organics) Preventive Maintenance and Repair

11.2.2.1 Daily maintenance procedures. The following procedures are performed each day an instrument is used for analysis.

- The GC septum and glass liner are removed and replaced if judged necessary by the analyst.

- Column performance is monitored by checking the response factor of key compounds which indicate column degradation and/or column bleed. Clip two or more inches from the head of the column if necessary.

- Check that gases have adequate supply to last until the following day. Change tanks if necessary.

- Check data file space and quant space on the MS Chem Station system.

11.2.2.2 Weekly maintenance procedures, or as needed.

- Clip column

- Swab shell weldment with methylene chloride or other appropriate solvent.

- Clean or replace gold seal

11.2.2.3 Six month maintenance procedure. Every six months the vacuum pump oil and the adsorbent trap packing should be changed.

11.2.2.4 "As needed" maintenance. The following services should be done when system performance indicates:

- Clean the analyzer source. This will become necessary if a high background becomes apparent which is not attributable to column degradation or the system cannot meet DFTPP criteria.

- Replace the electron multiplier when the maximum gain no longer provides the required sensitivity.

- Replace the ion source filament as needed.

### 11.2.3 GC Pesticide/PCB Preventative Maintenance and Repair

11.2.3.1 Daily maintenance procedures. The following procedures are performed each day an instrument is used for analysis if in the analyst's judgement, system performance requires them.

- The GC septum and glass liner are removed and replaced if judged necessary by the analyst.

- Column performance is monitored by checking the response factor of key compounds which indicate column degradation and/or column bleed. Clip two or more inches from the head of the column if necessary.

- Check that gases have adequate supply to last until the following day. Change tanks if necessary.

- Check data file space and quant space on the MS Chem Station system.

11.2.3.2 Weekly maintenance procedures, or as needed.

- Clip column

- Swab shell weldment with hexane or other appropriate solvent.

- Clean or replace inlet seal

**11.2.4 GC Fingerprint Preventative Maintenance and Repair**

11.2.4.1 Daily maintenance procedures. The following procedures are performed each day an instrument is used for analysis if in the analyst's judgement, system performance requires them.

- The GC septum and glass liner are removed and replaced if judged necessary by the analyst.

- Column performance is monitored by checking the response factor of key compounds which indicate column degradation and/or column bleed. Clip two or more inches from the head of the column if necessary.

- Check that gases have adequate supply to last until the following day. Change tanks if necessary.

- Check data file space and quant space on the MS Chem Station system.

11.2.4.2 Weekly maintenance procedures, or as needed.

- Clip column

- Swab shell weldment with methylene chloride or other appropriate solvent.

- Clean or replace inlet seal

### 11.2.5 Zeeman PE-4100 and AAnalyst 600 Atomic Absorption Spectrometer Maintenance and Repair

The following is a brief list of maintenance/checks that are done on the Atomic Absorption/Graphite Furnace Spectrometer when needed. Maintenance logs are located by each instrument.

11.2.5.1 Autosampler

- The autosampler waste bottle is emptied regularly; not allowed to overflow, nor is the liquid allowed to reach the end of the drain tube.

- The rinsing liquid bottle is kept filled with 2% Nitric Acid + 2% Hydrochloric Acid Solution in order to prevent cross contamination on the autosampler tip.

- The autosampler tubing and connections are checked regularly. If the tip of the sampling capillary appears damaged, it is trimmed back.

11.2.5.2 Cooling System

- The water level in the cooling system is checked regularly and filled up when necessary with deionized water.

11.2.5.3 Furnace

- The operator regularly checks the condition of the contact cylinders and if they are pitted or cracked they are replaced.

- The operator checks that the furnace windows are clean.

- The operator checks the gas connections and makes sure that the gas supply is delivering the correct pressure.

- The graphite tubes are checked for contamination and if they can't be cleaned, they are replaced.

11.2.5.4 Spectrometer

- The air filter is changed monthly or when it shows signs of becoming clogged with dust.

- A stock of replacement lamps should be on hand for all elements routinely used.

- Do not leave the EDL's lit longer than is necessary. However, Care should be taken to avoid lighting them an excessive number of times.

- The air filter should be cleaned monthly in order to keep dust out of the electronics compartment.

- Be careful not to hit the IEEE cable on the rear of the instrument when cleaning the bench. This could cause communication problems

11.2.5.5 The Graphite tube and platform must be changed when:

- When the portion of tube visible from the sample introduction port is rough.

- The instrument re-calibrates excessively without running samples.

- Blanks are contaminated after "burning out" the tube

There are anomalies visible inside the tube.

11.2.5.6 The following must be done when replacing the tube and platform:

- Clean the contact rings with a cotton swab and 1.0 % nitric acid.

- Clean both the left and right windows with Methanol and wipe with lens paper before replacing.

- When handling any of the graphite parts wear gloves to prevent skin oils from contaminating the graphite. Fingerprints shorten tube life.

- After replacing all parts, condition the furnace with the element file "cond_hga".

- Clean the tip of the autosampler with Methanol and 1.0 % Nitric Acid to remove any residual organics. These may cause imprecise placement of the samples in the furnace.

### 11.2.6 Optima ICP Maintenance and Repair

To keep the ICP running optimally the following maintenance procedures are performed as indicated and recorded in the maintenance logbooks located beside each instrument:

11.2.6.1 Daily

- Check acid waste, pump tubing, argon pressure.

- Verify that intensity counts for first standard are in a range that indicates efficient sample introduction.

- Change pump tubing. The tygon tubing is checked daily before use and replaced, depending on usage. The capillary tubing is changed when it becomes frayed or is too short.

11.2.6.2 Weekly

- Drain acid waste.

- Check coolant level and top off with tap water.

- Make any standards that are low and verify concentration prior to use.

- Check Nebulizer and Spray Chamber and clean if necessary.

11.2.6.3 Bi-Weekly

- Clean torch by heating in dilute AquaRegia.

11.2.6.4 Monthly

- Change filters. The filters on the back of the power unit and monochromator are checked and cleaned on a regular basis.
- Wipe off Rail on Autosampler and oil lightly.
- Dust off instrument.
- Clean external optics.

11.2.6.5 Semiannual

- Drain chiller and flush with Acetic Acid (15 ml added to coolant) for 10-15 minutes. Refill with 50% tap water and 50% deionized water.
- Repairs/Service - Record any problems and resolutions.

### 11.2.7 Perkin Elmer FIMS 100 Automated Mercury Analyzer Maintenance

11.2.7.1 Daily

- Check acid waste, pump tubing, and argon pressure.
- Verify Peak Height for first standard is in a range that indicates efficient sample introduction.

11.2.7.2 Weekly

- Change Two-Stop pump tubing position every week. Tubing should last two weeks.

- Drain acid waste

- Clean Gas/Liquid separator - see manual pg 2-11. Replace filter as needed to keep water out of cell (can dry and reuse). Try adding Anti-Foaming agent to rinse to keep water off filter.

- Archive result files for the past week.

- Clean racks with DI and dust off instrument. Make any standards that are low and verify concentration prior to use.

11.2.7.3 Monthly

- FIMS-cell maintenance - see manual pages 2-7.

- Dust off instrument.

11.2.7.4 As Needed

- Replace the mercury lamp.

- Record problems, service calls, and their resolution.

### 11.2.8 Ion Chromatography DX-120 and Ion Chromatography ICS-2000 Maintenance and Repair

11.2.8.1 Monthly

- Once a month clean the column with 0.1M oxalic acid.

11.2.8.2 As Needed

- Check column and tubing for visible leaks. Replace if necessary.

- Disconnect the ionpac AS14a analytical column from the ASRS–ULTRA part and reverse the guard column from the analytical column, so that the guard column is the last part flowing to a waste container flush for 15 min., with D.I water pump for 60 min. with the clean up solution at 1.0mL/min rinse the column for 15min with D.I. water. Equilibrate the columns with eluent for 30min. Re-connect the analytical column to the ASRS-ULTRA and place the guard column back in line between the injection valve and analytical column.

# SECTION 12. QUALITY CONTROL SAMPLES

## 12.1 Quality Assurance

Quality assurance is the system whereby the laboratory can assure its clients and other outside agencies that the laboratory is generating data of proven and known quality. By the same token, a Quality Assurance program helps within the laboratory, by letting the analysts know the quality of their results and giving them the data to prove those results if necessary.

AMRO's QA program is designed with the following objectives:

1. to demonstrate that the quality control operations are in fact being carried out in the laboratory,

2. to assure that the data reported is for the sample that it is reported on

3. to assure complete traceability and defensibility of reported data.

Quality control is defined as the operations undertaken in the laboratory to ensure that the data produced is generated within known probability limits of accuracy and precision.

## 12.2 Accuracy

Accuracy is a measure of the degree to which the analytical result approaches the "true" value of the concentration of the analyte being determined. Accuracy in the laboratory is assessed by the regular analysis of known standards such as the Laboratory Control Samples (LCS), and matrix and analytical spikes. Accuracy within the laboratory is expressed in terms of percent recovery.

## 12.3 Precision

Precision in the laboratory is determined by the comparison of duplicates, where duplicate samples result from an original sample that has been split for identical analyses. The precision of data is commonly determined by calculating the relative percent difference (RPD) of these duplicate (replicate) analyses and then using these values to determine confidence limits for subsequent analysis.

## 12.4 Completeness

The completeness of a project is measured as a percentage of the amount of acceptable data that is generated within the time frame requested, to the expected amount of total data multiplied by 100. This completeness includes the completion and acceptability of all the QC check analyses (ex. duplicates, spikes) for all the analyses requested. AMRO strives to provide 100% data completeness for all samples received.

## 12.5 Representativeness

In order to preserve the representativeness of the samples received in the laboratory, they are preserved and stored in accordance with EPA regulations. Documentation is kept to assure that protocols have been followed and that sample identification and integrity have been maintained. The analysts in the laboratory are also very careful about making sure the sample aliquots that are used for analysis are representative of the total sample.

## 12.6 Comparability

Comparability is a measure of how closely sample data generated by AMRO compares with sample data generated by other laboratories. Comparability is assured through the use of established and approved analytical methodologies. AMRO participates in EPA and State administered proficiency test programs to provide assurance of the comparability of our data.

## 12.7 Quality Control Samples

On a daily basis several types of Quality Control (QC) samples are analyzed to document the validity of data generated in the laboratory. The following is a description of the different quality control samples run in the laboratory.

### 12.7.1 Blank Samples

All analytical tests performed in the laboratory, including organics, metals and wet chemistry, are required to run blanks.

12.7.1.1 Trip Blank: "Trip blanks" are sent out when samples are going to be analyzed for volatile organics. A trip blank is a vial of VOA carbon filtered water or purge and trap methanol which is sent to the client, along with empty preserved VOA vials or VOA vials containing Methanol for sampling, and is returned with the other

samples to the lab for analysis. The purpose of the trip blank is to determine if there is any contamination during sample transport. Frequency is one trip blank per project per matrix type.

12.7.1.2 Field Blank: "Field blanks" are run when the client has run DI water through their collection proceedings. A field blank is used to detect any contamination that may occur during sampling. Frequency is one field blank per project per matrix type depending upon the sampling event requirements.

12.7.1.3 Method Blank: A laboratory DI water sample/or solvent that is carried through the entire analytical procedure with a batch of samples, whether it is a digestion or an extraction procedure, is referred to as a "method blank". Method blanks are important in identifying contamination that may occur during the analytical process. They are analyzed 1 for every batch of 20 samples for organics, metals and total petroleum hydrocarbons and 1 for every batch of 20 samples for wet chemistry.

12.7.1.4 Calibration Blank: The "calibration blank" is used to determine the "zero" concentration point for that particular instrument. The calibration blank consists of a sample of laboratory deionized water or solvent which has the same reagents added to it as the calibration standards, and it is used to "zero" in the instrument.

12.7.1.5 The Daily Blank: This is used to determine an instrument is free from contamination each day it is run. The Method Blank can be used as a Daily Blank for volatile analysis.

**12.7.2 Spiked Samples**

The following "spiked" samples are useful in determining the accuracy of a method throughout the entire procedure.

12.7.2.1 Blank Spike: A "blank spike" is a known volume of deionized water or clean sand into which a known amount of a particular analyte is added. The blank spike is taken through the entire analytical procedure, and the percent recovery of the spiked analyte(s) is calculated in order to assess the efficiency of the extraction/ digestion procedures and the final analyses. Blank spikes are referred to as Laboratory Control Sample (LCS). They are analyzed 1 for every batch of 20 samples of a similar matrix for organics, metals and total petroleum hydrocarbons and 1 for every

batch of 20 samples of a similar matrix for wet chemistry. The Laboratory Control Sample Duplicate (LCSD) shall be extracted/digested with every batch of samples of similar matrix when insufficient sample volume is provided to perform MS/MSD. This will ensure that each batch samples of a similar matrix will have both precision and accuracy.

12.7.2.2 Surrogate Spike: The "surrogate spike" is used in the analysis of organic compounds. These surrogate spikes are added to every blank, sample, matrix spike, duplicate and standard to evaluate the analytical efficiency of the method in individual sample matrices. The compounds used in the surrogate spikes are chemically similar to the target compounds.

12.7.2.3 Analytical Spike: The "analytical spike" is a specific aliquot of digested sample into which a known amount of compound is added. The analytical spike is analyzed immediately and the percent recovery is calculated in order to assess the matrix effect of the sample on the analytical system.

12.7.2.4 Matrix Spike: The "Matrix Spike" is a specific aliquot of sample (aqueous, soil or waste) into which a known amount of compounds are added. Like the blank spike, the matrix spike is also subjected to the entire extraction and analytical procedures. The percent recovery of the spiked compounds is calculated in order to assess the appropriateness of the method for that sample matrix. They are analyzed Matrix Spike (MS) and Matrix Spike Duplicate (MSD) for every batch of 20 samples for organic, with the exception of EPH and VPH, and for inorganic. Samples should be chosen for spiking randomly and rotated among clients and sites from batch to batch. In some cases, the client may specify which sample is to be used for MS/MSD; if not, the laboratory shall pick a representative sample based on the following:

12.7.2.4.1 Method of extraction or digestion
12.7.2.4.2 MS/MSD shall not be performed on Trip Blank, Rinsate Blank or Field Blank
12.7.2.4.3 Adequate sample weight/volume

### 12.7.3 Duplicate Samples

12.7.3.1 Duplicate samples are two aliquots of a sample which are carried through the same sample preparation and analysis procedures to verify the precision of the specific analytical method for that sample matrix. They are analyzed at a frequency of 1 per ten samples for inorganic analysis, EPH and VPH analysis require duplicates one every twenty samples. The %RPD is calculated from the original and the duplicate sample. If one sample result is above the reporting limit and one is less than four times the reporting limit the data is considered acceptable for metals analyses. Organic, metals and total petroleum hydrocarbon analyses requires duplicate spike samples per batch of 20 samples of a similar matrix. The %RPD is calculated from the Matrix Spike (MS) and Matrix Spike Duplicate (MSD) results. Metals for 200.7 and wet chemistry analyses require duplicates 1 every batch of 10 samples of a similar matrix. EPH and VPH analyses require 1 sample duplicate per batch of 20 samples of a similar matrix.
Samples should be chosen for either spiking randomly or duplicate rotated among clients and sites from batch to batch. In some cases, In some cases, the client may specify which sample is to be used for MS/MSD or Sample Duplicate; if not, the laboratory shall pick a representative sample based on the following:

12.7.3.1.1 Method of extraction or digestion
12.7.3.1.2 Duplicate shall not be performed on Trip Blank, Rinsate Blank or Field Blank
12.7.3.1.3 Adequate sample weight/volume

### 12.7.4 Internal Standards (IS) (Organic)

Internal Standards of a known concentration are added to every organic blank, sample, matrix spike, duplicate and standard vial prior to analysis on the GC/MS. Although these standards do not include the target compounds, they are used as the basis for quantifying the target compounds.

12.7.4.1 The retention times of the internal standards in the calibration verification standard must be evaluated immediately after or during data acquisition. If the retention time for any internal standard changes by more than 30 seconds from that of the mid-point standard of the initial calibration curve, then the

chromatographic system must be inspected for malfunctions and corrections must be made, as required. When corrections are made, reanalysis of samples analyzed while the system was malfunctioning is required.

12.7.4.2 Internal Standard Response - If the Extracted Ion Current Profile (EICP) area for any of the internal standards in the calibration verification standard changes by a factor of two (-50% to + 100%) from that in the mid-point standard of the initial calibration curve, the mass spectrometer must be inspected for malfunctions and corrections must be made, as required. When corrections are made, reanalysis of samples analyzed while the system was malfunctioning is required.

**12.7.5 Surrogates (Organic)**

Surrogates of a known concentration are added to every organic blank, sample, matrix spike, duplicate and standard vial prior to analysis by GC/MS and GC. They are used to evaluate extraction efficiency and to assist in the determination of matrix interference. They are known amounts of non-target analytes that response the same as target analytes during extraction and analysis.

**12.7.6 Laboratory QC Check Samples**

12.7.6.1 Tbe Laboratory QC Check Samples (or independent calibration verifieations) are prepared in the laboratory from a different source than the calibration standards are made from. This Lab. QC check sample is prepared at a concentration that is reproducible for the particular method. The check sample is run after the calibration of the instrument to verify the integrity for the initial calibration.

12.7.6.2 A continuing calibration check from the same source as the calibration curve and is analyzed every ten samples and at the end of the run for inorganic analyses to ensure instrument performance throughout the analyses. The frequency of continuing calibration for organics is specified per the methods.

### 12.7.7 Standard Reference Solutions (Wet Chemistry)

These standard reference solutions are from the same source as the initial calibration curve. They are required if a calibration curve is not performed daily to ensure the acceptability of the initial calibration.

### 12.7.8 Reporting Limit Standard (RL)

The reporting limit standard is a low level QC check that is analyzed at the beginning and end of ICP runs, distilled and un-distilled for Cyanides. It is the lowest standard of a calibration curve for organic, GFAA, CVAA and wet chemistry analyses. The results are used to verify the reporting limit for the given analyses.

### 12.7.9 Interference Check Standard Solutions (ICS) (Metals)

The interference check standard solutions are run on the ICP at the beginning and end of all runs. They are run to verify that these analytes do not interfere at the particular wavelengths at which the samples are being analyzed.

### 12.7.10 Serial Dilutions (Metals)

An aliquot of sample is diluted 1:4 with a matrix blank solution then analyzed to determine if there is any matrix effects present.

## 12.8 Proficiency Testing

AMRO participates in semi-annual proficiency testing studies for drinking water, wastewater and solid/hazardous waste parameters. The results of the studies are evaluated by the provider and returned to the laboratory. The laboratory reviews the scores and investigates any results that are outside of acceptance limits. The results of these studies with a summary of the investigations are distributed to State agencies from which laboratory certifications are obtained. The results are used as part of the evaluation of the ability of the laboratory to produce accurate results. Results are also provided to clients upon request.

## 12.9 Internal Verification

AMRO occasionally obtains known PE samples to submit to the laboratory as checks to the analytical system. Double Blind PE samples may be obtained as another way of verifying the analytical system.

## 12.10 Control Charts

Control charts are basic tools for quality assurance/quality control. They provide a graphical means to demonstrate statistical control, monitor a measurement process, diagnose measurement uncertainty, monitor trending and aid in methodology development and troubleshooting. Each analytical department of the laboratory shall be required to keep specific QC Charts, which pertain to the analyses performed within that department as determined by the QA Manager in consultation with the Laboratory Director. The QA Manager shall ensure that QC Charts are being utilized and updated.

# SECTION 13. CORRECTIVE ACTION

## 13.1 General

Corrective action will be required whenever the measurement system generating the data is found to be out of control. The determination of whether a system is out of control will be based on the correlation between predetermined limits and the actual analytical values. The corrective action is intended to be initiated by the person closest to the actual problem or the first person to determine a problem exists. Ideally the analyst should initiate the action; however, supervisors also share the responsibility for determining if the analytical system is out of control. Corrective action involves investigation into the root cause, resolution of the problem and implementation of the solution. The Quality Assurance Manager shall be responsible for monitoring laboratory results to insure that measurements are in control. At anytime where an out of control measurement is found, appropriate laboratory personnel will be notified so as to take proper corrective action.

## 13.2 Definition

Corrective Action is the measures taken to rectify and/or prevent recurrence of a quality failure.

Preventive Action is a pro-active process to identify opportunities for improvement rather than a reaction to the identification of problems or complaints.

## 13.3 Initiation of Action

Corrective action may be initiated as a result of the following activities:

a. Daily quality control system failure.
b. Response to external or internal audits findings and performance evaluations.
c. Written follow-up to client and/or revision to client reports impacted by non-conforming analytical events discovered through audits, client complaints, or instrument malfunction.

## 13.4 Documentation of Corrective Action

The QA Manager shall document all corrective actions using the Corrective Action Report and Status Form (CARS) (Attachment 24). The corrective action shall be signed by the person responsible for completing the action to indicate acceptance of responsibility. The QA Manager shall verify and document completion and effectiveness of the corrective action by performing surveillance, using Surveillance Form (Attachment 25). The Laboratory Director and QA Manager shall sign and date the completed corrective action.

## 13.5 Training

Employees are trained in the proper procedures to perform their tasks. Included in this training is the identification of acceptable results versus not acceptable results. The employee is required to acknowledge and document any instance that is not acceptable for the task. This includes safety, analysis, sample receiving, data review, quality control, waste disposal, report preparation and data reporting. Documentation must be clearly stated and visible to all personnel reviewing the information.

## 13.6 Non-Conforming Data Report

The Non-Conforming Data Report (NCD) will be initiated as a result of the following:

a. Quality control criteria being "out of range".
b. Audit findings indicating systematic problems.
c. As a result of client inquiries.
d. Parameters (s) which failed in Performance Evaluation Samples (PE).
e. Holding times violations.
f. Calibration criteria not met.
g. Tune unacceptable.

## 13.7 Documentation of Non-Conforming Data

When a significant problem has occurred as mentioned above, a Non-Conforming Data Report (NCD)(Attachment 26) will be initiated. The person who discover the Non-Conforming Data shall complete the top portion of the NCD Report which consists of the following information:

a. NCD Number
b. Lab Order
c. Client's Name
d. Section
e. Sample(s) Affected
f. Date of Occurrence
g. Date Discovered
h. Discovered by
i. Description of the NCD

The responsible person(s) will correct the data report or investigate the cause for the PE failure. The responsible person shall then sign and date the NCD. The resolution of the NCD is reviewed, signed and dated by both the Section Supervisor and QA Manager. After the completion of the review, entering the closing date in the NCD tracking system shall close the NCD. The original NCD Form is placed in the project folder.

## 13.8 Client Requested Investigation

In cases of client requested data investigations the NCD is completed as instructed above. The corrective action will be initiated. A copy of the completed CARS will be sent to the client. The original copy is placed in the project folder.

## 13.9 Complaints

Customer complaints are often presented to various levels of personnel at AMRO. The statement is usually verbal, although occasionally they are written. They may be received by an AMRO courier, sample receiving technician, business development personnel, owners, managers, customer service and chemists.

If a member of the management, customer service or QA/QC received a telephone call, which requires further action, then the conversation is documented in the individual's communications log. The information recorded in the log includes the caller, the company, the date and time of the call, and a description of the discussion. Customer complaints are reviewed during daily production meetings during the "customer issues" agenda item. A copy of the telephone call log page is provided to the individual responding to the item. The resolution of the issue is documented in the original telephone call log along with the data and initials of the responder. The issue is discussed and a course of action is planned to resolve the issue or complaint.

# SECTION 14. DEPARTURES FROM DOCUMENTED POLICIES AND PROCEDURES

14.1 In the event that it is required to deviate from documented policies and procedures established by the laboratory, the situation is brought to the attention of the appropriate section head.

14.2 The section head reviews the situation and options are discussed.

14.3 The options are presented to the QA/QC Manager, Director of Business Development and upper management and an acceptable decision is reached.

14.4 The decision is documented and analysis continues.

# SECTION 15. DATA HANDLING AND REPORTING

To obtain meaningful data on sample analyses, the analyst must perform the proper analysis in the prescribed fashion according to AMRO Standard Operating Procedures, complete calculations, and convert results to final form for permanent recording of the analytical data in meaningful exact terms. These results are reported for future interpretation and use.

## 15.1 Gathering and Reporting Data

When an analysis of a sample is complete, the analysis for that sample should be checked and the data calculated as soon as possible to identify any problems while still within the holding time for the analysis. The following steps should be taken by the analyst to ensure that a good analysis has been obtained.

15.1.1 All the QC data collected during a specific calibration run must be within the predetermined QC acceptance ranges.

15.1.2 Any dilution factors, blank correction factors or dry weights are taken into consideration when making final calculations.

15.1.3 All data log sheets are checked to be sure they are completed and signed by the analyst.

15.1.4 Verify that no compounds exceeded the calibration range.

15.1.5 Check for cross contamination between samples and blank contamination.

15.1.6 For organic analyses check the chromatography, verify that any "unknown" peaks are not target analytes.

## 15.2 Data Review

### 15.2.1 Analyst Review:

When an analysis of a sample is complete, the analysis for that sample should be checked and the data calculated as soon as possible to identify any problems while still within the holding time for the analysis or sample preparation. The following steps should be taken to ensure that the analysis has met the method, SOP QC criteria as well as project requirements.

A. CALIBRATION: Date and initial all initial and continuing calibration data. Check that all initial and continuing calibration runs associated with the sample meet criteria. Check most current SOP and project specific documentation for acceptance criteria.
B. BLANKS: Date and initial all initial, continuing calibration and procedural blanks data. Check that all initial, continuing calibration and procedural blank runs associated with the sample meet criteria. Check most current SOP and project specific documentation for acceptance criteria.
C. LCS: Date and initial all LCS data. Check that all LCS runs associated with the sample meet criteria. Check most current SOP and project specific documentation for acceptance criteria.
D. Check that no compounds exceed the calibration range. For METALS check all elements (not just project required elements due to interference concerns) to see if they exceed calibration range. If any element exceeds its linear range the sample MUST be diluted. Consult section head to determine if there are any problems associated with client requirements.
E. Check to see if there are any other runs of the sample. If so, check to see if the data agrees. Provide all runs used or not for each project.
F. Verify that ALL project requirements have been met. If any project requirements are not met, they must be documented.
G. Ensure the holding time has been met for every sample.
H. Make sure any method required checks have been properly recorded in the appropriate logbook (i.e. pH checks, residual chlorine checks, etc.)
I. Note any observances associated with each sample. (i.e.- sample was wet, sample foamed, any color changes occurring during prep., formation of emulsions, etc.)
J. Note any dilutions on the quant output page or data page and the reason for the dilutions for each sample.
K. Check the run for carryover or contamination.
L. Note if there was not sufficient sample to perform required QC.
M. Make sure the frequency of QC was performed as required (i.e. 1 spike and 1 spike duplicate per twenty samples)

N. Make sure acceptance limits were met for QC: MS, MSD, Duplicates, Surrogates, serial dilutions, interference checks, internal standards. Any outside of acceptance limits must be noted and reported in the narrative or non-conformance summary where applicable.
O. Make sure all preparation sheets and run logs are completed and signed off by the analysts.
P. Make sure the logbooks are filled out correctly and completely including standard and reagent traceability information.
Q. Accurately complete the narrative form for each project.
R. Make sure all non-conformance summaries are provided and filled out completely and accurately. Make sure all signatures are present.
S. Perform the final calculations on any positively identified compound in the correct units, taking into consideration dilution factors, dry weights, blank corrections (WET CHEM), etc.
T. (METALS) Check that interference checks, ICVs, serial dilutions, LCS, IPC (200 series), MS, MSD, duplicates, and post spikes met criteria.
U. (ORG) Check the internal standard areas. They should be -50 to + 100% of the I.S. areas in the initial calibration.
V. (ORG) Compare the surrogate recoveries to the AMRO limits. Check the LCS surrogate recoveries for acceptability to determine if sample surrogates are out due to matrix effects or possibly spike solution problems.
W. (ORG) Check the chromatography. (Good peak shape, baseline not noisy, good sensitivity)
X. (ORG) Check that the amount of sample analyzed is correctly recorded in the chromatogram header along with client and extraction date information.
Y. (ORG) Check spectrum, area, and retention time of any positive hits on the quant output page.

Z. (ORG) Check the chromatogram for target peaks not picked up by the automated quantitation. If any suspicious peaks are present, check the spectrum to be sure it is not a target compound. If not a target compound, make a note on the chromatogram that the peak is an unknown. Print library search results for the unknown.

All problems discovered during this preliminary data check should be documented on the checklist. Problems may necessitate re-prep or re-analysis. A non-conformance data report (NCD) may be required in addition to the narrative form in writing with an explanation of why the data is being used.

All calculations should be written in black ball-point pen ink. All cross-outs must be a single line and should be initialed and dated. Analyst review is documented on the following Checklists:

1. GC and GC/MS Data Review Checklist (Attachment 27)
2. ICP Data Review Checklist (Attachment 28)
3. GFAA and CVAA Data Review Checklist (Attachment 29)
4. Wet Chemistry Data Review Checklist (Attachment 30)

The analyst shall sign and date the Data Review checklist.

15.2.2 Peer Review:

When all samples for a given project have been analyzed and the results have been calculated, the project goes through the following data review procedure. The Section Supervisor or Data Review Specialist performs the peer review. The function of this review is to provide an independent, complete peer review of the analytical batch data package. The final review of the data shall be performed by the "Data Review Specialist" using the Data Review Checklist (Attachments 31a&b). The following items must be verified and documented as part of data review. Level of review should be appropriate to the package level being produced.

A. The reviewer reads over all associated paperwork (C-O-C's, faxes, notes on folders, and sample receipt checklists) to become familiar with the requirements of the project.
B. CALIBRATION: Check that all initial and continuing calibration runs associated with the sample meet criteria. Verify acceptance criteria using with the most current SOP and project specific documentation.

C. BLANKS: Check that all initial, continuing calibration and procedural blank runs associated with the sample met criteria. Verify acceptance criteria using with the most current SOP and project specific documentation.
D. LCS: Check that all LCS runs associated with the sample meet criteria. Verify acceptance criteria using with the most current SOP and project specific documentation.
E. Check that no compounds exceed the calibration range. For METALS check all elements (not just project required elements due to interference concerns) to see if they exceed calibration range. If any element exceeds its linear range the sample MUST be diluted. Consult section head to determine if there are any problems associated with client requirements.
F. Spot check the final calculations on any positively identified compound in the appropriate units, taking into consideration dilution factors, dry weights, blank corrections (WET CHEM), etc.
G. Check to see if there are any other runs of the sample. If so, check to see if the data agrees. File any runs not reported in the project folder.
H. Verify that ALL project requirements have been met. If any project requirements are not met, they must be documented. Consult with QC or customer service if project requirements are not known.
I. Ensure the holding time has been met for every sample.
J. Make sure any method required checks have been properly recorded in the appropriate logbook (i.e. pH checks, residual chlorine checks, etc.)
K. Verify any observances associated with each sample were noted. (i.e. – sample was wet, sample foamed, any color changes occurring during prep., formation of emulsions, etc.)
L. Check the dilution factor and make sure it is written on the quant output page or data page.
M. Check the run for carryover or contamination.
N. Verify if there was not sufficient sample to perform required QC.
O. Make sure the frequency of QC was performed as required (i.e. one spike and one spike duplicate per twenty samples)
P. Make sure acceptance limits were met for QC: MS, MSD, Sample Duplicates, Surrogates, serial dilutions, interference checks, internal standards. Any outside of acceptance limits must be noted and reported in on the case narrative.
Q. Make sure all preparation sheets and run logs are completed and signed off by the analysts.
R. Make sure the logbooks are filled out correctly and completely including standard and reagent traceability information.
S. Accurately complete the narrative form for each project.
T. Make sure all Non-Conformance Data Reports are provided and filled out completely and accurately. Make sure all signatures are present.

U. Provide the QC data in the format required by the client for each project. Consult the AMRO Report Packages summary, the QC Reports summary, any project specific summaries provided, the QA/QC Manager or the Customer Service Manager for Package levels and any other project specific requirements.

V. (METALS) Check that interference checks, ICV's, serial dilutions, LCS, IPC (200 series), and post spikes met criteria.

W. (ORG) Check the internal standard areas of samples and QC. They should be -50 to + 100% of the I.S. areas in the initial calibration.

X. (ORG) Compare the surrogate recoveries to the AMRO limits. Check the LCS surrogate recoveries for acceptability to determine if sample surrogates are out due to matrix effects or possibly spike solution problems.

Y. (ORG) Check the chromatography. (Good peak shape, baseline not noisy, good sensitivity)

Z. (ORG) Check that the amount of sample analyzed is correctly recorded in the chromatogram header along with client and extraction date information.

AA. (ORG) Check spectrum, area, and retention time of any positive hits on the quant output page.

BB. (ORG) Verify the chromatogram for target peaks not picked up by quant. If any suspicious peaks are present, verify the spectrum to be sure it is not a target compound with the analyst. If not a target compound, make sure a note is on the chromatogram that the peak is an unknown. Verify a library search results for the unknown was printed.

Any problems encountered by the reviewer should be brought to the attention of the analyst for resolution. Once resolution is achieved, both the analyst and the reviewer must sign off on the data. If resolution between the reviewer and the analyst is not obtained, a third party must be consulted. All involved must sign off on the data once a decision is reached.

15.2.3 QA Review:

QA review is performed by the QA Officer. This review shall provide a total overview of the data package including sample receipt, to ensure its consistency and compliance with project-specific requirements. Review of the case narrative. This review is documented on the Data Review Checklist (Attachment 31b) with signature and date of the reviewer.

## 15.3 Analytical Values

Once the data is recorded and collected, it is put into reporting form through the use of significant figures and rounding off numbers.

15.3.1 Significant Figures

The proper use of significant figures gives an indication of the reliability of the analytical method used. A significant figure is a number that denotes the amount of the quantity in the particular decimal place in which it stands. Reported analytical values should contain only significant figures. A value is made up of significant figures when it contains all digits known to be true and one last digit in doubt. AMRO reports data in two significant figures where appropriate with the exception of Proficiency Samples and QC data, which are reported in three significant figures.

15.3.2 Rounding Off Data

Rounding off of numbers is a necessary operation in all analytical areas. It is automatically applied by the limits of measurement of every instrument and all glassware. Rounding off should be applied only as described below:

15.3.2.1 If the figure following those to be retained is less than 5, the figure is dropped, and the retained figures are kept unchanged.

15.3.2.2 If the figure following those to be retained is greater than 5, the figure is dropped, and the last retained figure is raised by 1.

15.3.2.3 If the figure following those to be retained is 5, and if there are no figures other than zeros beyond the five, the figure is dropped, and the last-place figure retained is increased by one if it is an odd number or it is kept unchanged if an even number.

## 15.4 Data Reporting

15.4.1 Many report options are available to clients of AMRO. It is AMRO policy to discuss with all clients their reporting requirements soon after receipt of the samples. Attachment 32 is a list of the QC report levels and the requirements for each level. It must be determined prior to sample receipt or shortly after the reporting requirements in order for the analysts to provide the required documentation. The data reviewers also require the QC level information in order to prepare the report package. The cover letter for the data reports will address any quality control problems, either with the condition of the samples upon receipt or with the analyses, or contain a statement that no quality control problems were encountered. This letter is an integral part of the data report and a statement indicating this is incorporated in the text of the letter.

15.4.2 Even though there is some customizing of reports, all reports contain the following information:

15.4.2.1 Date(s) of sampling, date sample was received in the laboratory, date sample was prepared, and date(s) which analysis(es) was performed.

15.4.2.2 A copy of the Chain of Custody for the project

15.4.2.3 The client's ID given to the samples and AMRO's ID numbers.

15.4.2.4 Which analyses were performed on the sample(s).

15.4.2.5 The results are listed on the report with the units of measure used.

15.4.2.6 The EPA method number is also included on the final report. An "M" after the method code indicates the laboratory uses a modified version of the method. Modifications are available upon request.

15.4.3 Listed below is the default reporting limits used by AMRO with units. These reporting limits are based on optimum sample size and typical sample matrix. ***All analytes listed below are not reported on all AMRO reports for all methods. Consult the laboratory to determine the exact analyte lists for particular methods. Reporting limits are subject to change. Do not include these lists in QAPP's without consulting the laboratory for current reporting lists and limits.***

# AMRO Environmental Laboratories Corp. Reporting Limits
## Organic Reporting Limits

**Volatile Organics (GC/MS)**

| Analyte | Reporting Limit (µg/L) Aqueous | Reporting Limit (µg/L) Low Level Aqueous | Reporting Limit (µg/Kg) Low Level Soils/Solids * | Reporting Limit (µg/Kg) Medium Level Soils/Solids * |
|---|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | 2 | 1 | 5 | 25 |
| 1,1,1-Trichloroethane | 2 | 1 | 5 | 25 |
| 1,1,2,2-Tetrachloroethane | 2 | 1 | 5 | 25 |
| 1,1,2-Trichloroethane | 2 | 1 | 5 | 25 |
| 1,1-Dichloroethane | 2 | 1 | 5 | 25 |
| 1,1-Dichloroethene | 1 | 1 | 5 | 25 |
| 1,1-Dichloropropene | 2 | 1 | 5 | 25 |
| 1,2,3-Trichlorobenzene | 2 | 1 | 5 | 25 |
| 1,2,3-Trichloropropane | 2 | 1 | 5 | 25 |
| 1,2,4-Trichlorobenzene | 2 | 1 | 5 | 25 |
| 1,2,4-Trimethylbenzene | 2 | 1 | 5 | 25 |
| 1,2-Dibromo-3-chloropropane | 5 | 2 | 5 | 125 |
| 1,2-Dibromoethane (EDB) | 2 | 1 | 5 | 25 |
| 1,2-Dichlorobenzene | 2 | 1 | 5 | 25 |
| 1,2-Dichloroethane | 2 | 1 | 5 | 25 |
| 1,2-Dichloroethene (cis) | 2 | 1 | 5 | 25 |
| 1,2-Dichloroethene (trans) | 2 | 1 | 5 | 25 |
| 1,2-Dichloropropane | 2 | 1 | 5 | 25 |
| 1,3,5-Trichlorobenzene | 2 | 1 | 5 | 25 |
| 1,3,5-Trimethylbenzene | 2 | 1 | 5 | 25 |
| 1,3-Dichloropropane | 2 | 1 | 5 | 25 |
| 1,3-Dichlorobenzene | 2 | 1 | 5 | 25 |
| 1,4-Dichlorobenzene | 2 | 1 | 5 | 25 |
| 1.4-Dioxane | 50 | 50 | 250 | 250 |
| 2,2-Dichloropropane | 2 | 1 | 5 | 25 |
| 2-Butanone (MEK) | 10 | 5 | 25 | 250 |
| 2-Chloroethylvinylether | 10 | 5 | N/A | N/A |
| 2-Chlorotoluene | 2 | 1 | 5 | 25 |
| 2-Hexanone | 10 | 5 | 25 | 250 |
| 4-Chlorotoluene | 2 | 1 | 5 | 25 |
| 4-Isopropyltoluene | 2 | 1 | 5 | 25 |
| 4-Methyl-2-Pentanone (MIBK) | 10 | 5 | 25 | 250 |
| Acetone | 10 | 25 | 50 | 250 |

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

** Analyte available only in limited methods.

## Volatile Organics (GC/MS)

| Analyte | Reporting Limit (µg/L) Aqueous | Reporting Limit (µg/L) Low Level Aqueous | Reporting Limit (µg/Kg) Low Level Soils/Solids * | Reporting Limit (µg/Kg) Medium Level Soils/Solids * |
|---|---|---|---|---|
| Acrolein** | 75 | N/A | N/A | N/A |
| Acrylonitrile** | 10 | N/A | N/A | N/A |
| Benzene | 1 | 1 | 5 | 25 |
| Bromobenzene | 2 | 1 | 5 | 25 |
| Bromochloromethane | 2 | 1 | 5 | 25 |
| Bromodichloromethane | 2 | 1 | 5 | 25 |
| Bromoform | 2 | 1 | 5 | 50 |
| Bromomethane | 2 | 1 | 5 | 50 |
| Chloroethane | 5 | 2 | 5 | 50 |
| Carbon Disulfide | 2 | 1 | 5 | 50 |
| Carbon tetrachloride | 2 | 1 | 5 | 50 |
| Chlorobenzene | 2 | 1 | 5 | 50 |
| Chloroform | 2 | 1 | 5 | 25 |
| Chloromethane | 5 | 2 | 5 | 50 |
| cis-1,2-Dichloroethene | 2 | 1 | 5 | 25 |
| cis-1,3-Dichloropropene | 1 | 1 | 5 | 25 |
| Dibromochloromethane | 2 | 1 | 5 | 25 |
| Dibromomethane | 2 | 1 | 5 | 25 |
| Dichlorodifluoromethane | 5 | 2 | 5 | 50 |
| Diethyl Ether** | 5 | 5 | 5 | 250 |
| Diisopropyl ether** | 2 | 1 | 5 | 25 |
| Ethylbenzene | 2 | 1 | 5 | 25 |
| Ethyl tertiary butyl ether** | 2 | 1 | 5 | 25 |
| Hexachlorobutadiene | 2 | 1 | 5 | 50 |
| Isopropylbenzene | 2 | 1 | 5 | 25 |
| Methyl-tert-butyl ether (MTBE) | 2 | 1 | 5 | 25 |
| Methylene Chloride | 5 | 2 | 25 | 50 |
| n-Butylbenzene | 2 | 1 | 5 | 25 |
| n-Propylbenzene | 2 | 1 | 5 | 25 |
| Naphthalene | 5 | 1 | 5 | 50 |
| sec-Butylbenzene | 2 | 1 | 5 | 25 |
| Styrene | 2 | 1 | 5 | 25 |
| tert-Butylbenzene | 2 | 1 | 5 | 25 |
| Tetrachloroethene | 2 | 1 | 5 | 25 |

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

** Analyte available only in limited methods.

## Volatile Organics (GC/MS)

| Analyte | Reporting Limit (µg/L) Aqueous | Reporting Limit (µg/L) Low Level Aqueous | Reporting Limit (µg/Kg) Low Level Soils/Solids * | Reporting Limit (µg/Kg) Medium Level Soils/Solids * |
|---|---|---|---|---|
| Tetrahydrofuran** | 10 | 10 | 5 | 250 |
| Tertiary amyl methyl ether** | 2 | 1 | 5 | 25 |
| Tertiary Butanol | 20 | 20 | 100 | 2,500 |
| Toluene | 2 | 1 | 5 | 25 |
| trans-1,3-Dichloropropene | 1 | 1 | 5 | 25 |
| trans-1,4-Dichloro-2-butene | 2 | 2 | 5 | 50 |
| Trichloroethene | 2 | 1 | 5 | 25 |
| Trichlorofluoromethane | 2 | 1 | 5 | 50 |
| Vinyl Acetate** | 10 | N/A | N/A | N/A |
| Vinyl Chloride | 2 | 1 | 5 | 25 |
| Xylene (o) | 2 | 1 | 5 | 25 |
| Xylene (m&p) | 2 | 1 | 5 | 25 |

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

** Analyte available only in limited methods.

## Volatile Organics (GC/MS)
## EPA Method 524.2

| Analyte | Reporting Limit (µg/L) Aqueous |
|---|---|
| 1,1,2-Tetrachloroethane | 0.5 |
| 1,1,1-Trichloroethane | 0.5 |
| 1,1,2,2-Tetrachloroethane | 0.5 |
| 1,1,2-Trichloroethane | 0.5 |
| 1,1-Dichloroethane | 0.5 |
| 1,1-Dichloroethene | 0.5 |
| 1,1-Dichloropropene | 0.5 |
| 1,2,3-Trichlorobenzene | 0.5 |
| 1,2,3-Trichloropropane | 0.5 |
| 1,2,4-Trichlorobenzene | 0.5 |
| 1,2,4-Trimethylbenzene | 0.5 |
| 1,2-Dibromo-3-chloropropane | 2 |
| 1,2-Dibromoethane | 0.5 |
| 1,2-Dichlorobenzene | 0.5 |
| 1,2-Dichloroethane | 0.5 |
| 1,2-Dichloropropane | 0.5 |
| 1,3,5-Trimethylbenzene | 0.5 |
| 1,3-Dichlorobenzene | 0.5 |
| 1,3-Dichloropropane | 0.5 |
| 1,4-Dichlorobenzene | 0.5 |
| 2,2-Dichloropropane | 0.5 |
| 2-Chlorotoluene | 0.5 |
| 4-Chlorotoluene | 0.5 |
| 4-Isopropyltoluene | 0.5 |
| Acrylonitrile | 0.5 |
| Benzene | 0.5 |
| Bromobenzene | 0.5 |
| Bromochloromethane | 0.5 |
| Bromodichloromethane | 0.5 |
| Bromoform | 0.5 |
| Carbon disulfide | 1 |
| Carbon tetrachloride | 0.5 |
| Chlorobenzene | 0.5 |
| Chloroethane | 0.5 |
| Chloroform | 0.5 |
| Chloromethane | 0.5 |

## Volatile Organics (GC/MS)
## EPA Method 524.2

| Analyte | Reporting Limit (µg/L) Aqueous |
|---|---|
| cis-1,2-Dichloroethene | 0.5 |
| cis-1,3-Dichloropropene | 0.5 |
| Dibromochloromethane | 0.5 |
| Dibromomethane | 0.5 |
| Dichlorodifluoromethane | 0.5 |
| Ethylbenzene | 0.5 |
| Hexachlorobutadiene | 0.5 |
| Isopropylbenzene | 0.5 |
| m,p-Xylene | 0.5 |
| Methyl tert-butyl ether | 0.5 |
| Methylene chloride | 0.5 |
| n-Butylbenzene | 0.5 |
| n-Propylbenzene | 0.5 |
| Naphthalene | 0.5 |
| o-Xylene | 0.5 |
| sec-Butylbenzene | 0.5 |
| Styrene | 0.5 |
| tert-Butylbenzene | 0.5 |
| Tetrachloroethene | 0.5 |
| Toluene | 0.5 |
| trans-1,2-Dichloroethene | 0.5 |
| trans-1,3-Dichloropropene | 0.5 |
| Trichloroethene | 0.5 |
| Trichlorofluoromethane | 0.5 |
| Vinyl chloride | 0.5 |
| Acetone | 10 |
| 2-Butanone | 10 |
| 2-Hexanone | 10 |
| 4-Methyl-2-pentanone | 10 |
| Tetrahydrofuran | 5 |
| Tertiary butanol | 10 |
| Diisopropylether | 1 |
| Diethyl ether | 1 |

## Semivolatile Organics (GC/MS)

| Analyte | Reporting Limit (µg/L) Aqueous | Reporting Limit (µg/Kg) Soils/Solids * |
|---|---|---|
| 1,2,4-Trichlorobenzene | 10 | 250 |
| 1,2-Dichlorobenzene | 10 | 250 |
| 1,3-Dichlorobenzene | 10 | 250 |
| 1,4-Dichlorobenzene | 10 | 250 |
| 2,4,5-Trichlorophenol | 10 | 250 |
| 2,4,6-Trichlorophenol | 10 | 250 |
| 2,4-Dichlorophenol | 10 | 250 |
| 2,4-Dimethylphenol | 10 | 250 |
| 2,4-Dinitrophenol | 20 | 500 |
| 2,4-Dinitrotoluene | 10 | 250 |
| 2,6-Dinitrotoluene | 10 | 250 |
| 2-Chloronaphthalene | 10 | 250 |
| 2-Chlorophenol | 10 | 250 |
| 2-Methylnaphthalene | 10 | 250 |
| 2-Methylphenol | 10 | 250 |
| 2-Nitroaniline | 20 | 500 |
| 2-Nitrophenol | 10 | 250 |
| 3,3'-Dichlorobenzidine | 10 | 250 |
| 3-Nitroaniline | 20 | 500 |
| 4,6-Dinitro-2-Methylphenol | 20 | 500 |
| 4-Bromophenylphenyl Ether | 10 | 250 |
| 4-Chloro-3-Methylphenol | 20 | 500 |
| 4-Chloroaniline | 10 | 250 |
| 4-Chlorophenyl-Phenylether | 10 | 250 |
| 4-Methylphenol | 10 | 250 |
| 4-Nitroaniline | 20 | 500 |
| 4-Nitrophenol | 20 | 500 |
| Acenaphthene | 10 | 250 |
| Acetophenone | 10 | 250 |
| Aniline | 10 | 250 |
| Acenaphthylene | 10 | 250 |
| Anthracene | 10 | 250 |

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

## Semivolatile Organics (GC/MS)

| Analyte | Reporting Limit (µg/L) Aqueous | Reporting Limit (µg/Kg) Soils/Solids * |
|---|---|---|
| Azobenzene | 10 | 250 |
| Benzidine | 20 | 500 |
| Benzo(a)Anthracene | 10 | 250 |
| Benzo(a)Pyrene | 10 | 250 |
| Benzo(b)Fluoranthene | 10 | 250 |
| Benzo(g,h,i)Perylene | 10 | 250 |
| Benzo(k)Fluoranthene | 10 | 250 |
| Benzoic Acid | 20 | 500 |
| Benzyl Alcohol | 20 | 500 |
| Bis(2-Chloroethoxy)Methane | 10 | 250 |
| Bis(2-Chloroethyl)Ether | 10 | 250 |
| Bis(2-Chloroisopropyl)Ether | 10 | 250 |
| Bis(2-Ethylhexyl)Phthalate | 10 | 250 |
| Butylbenzylphthalate | 10 | 250 |
| Carbazole | 10 | 250 |
| Chrysene | 10 | 250 |
| Di-n-Butylphthalate | 10 | 250 |
| Di-n-Octyl Phthalate | 10 | 250 |
| Dibenzo(a,h)Anthracene | 10 | 250 |
| Dibenzofuran | 10 | 250 |
| Diethylphthalate | 10 | 250 |
| Dimethyl Phthalate | 10 | 250 |
| Fluoranthene | 10 | 250 |
| Fluorene | 10 | 250 |
| Hexachlorobenzene | 10 | 250 |
| Hexachlorobutadiene | 10 | 250 |
| Hexachlorocyclopentadiene | 10 | 250 |
| Hexachloroethane | 10 | 250 |
| Indeno(1,2,3-c,d)Pyrene | 10 | 250 |
| Isophorone | 10 | 250 |
| N-Nitroso-Di-n-Propylamine | 10 | 250 |
| N-Nitrosodimethylamine** | 20 | 500 |
| N-Nitrosodiphenylamine | 10 | 250 |
| Naphthalene | 10 | 250 |
| Nitrobenzene | 10 | 250 |

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

** Analyte available only in limited methods.

## Semivolatile Organics (GC/MS)

| Analyte | Reporting Limit (µg/L) Aqueous | Reporting Limit (µg/Kg) Soils/Solids * |
|---|---|---|
| Pentachlorophenol | 20 | 500 |
| Phenanthrene | 10 | 250 |
| Phenol | 10 | 250 |
| Pyrene | 10 | 250 |
| Pyridine** | 20 | 500 |

## Polynuclear Aromatic Hydrocarbons (GC/MS – 8270)

| Analyte | Reporting Limit (µg/L) Aqueous | Reporting Limit (µg/L) Aqueous 8270 SIM Only | Reporting Limit (µg/L) Soils/Solids* 8270 SIM Only |
|---|---|---|---|
| Naphthalene | 10 | 0.1 | 10 |
| 2-Methylnaphthalene | 10 | 0.1 | 10 |
| Acenaphthylene | 10 | 0.1 | 10 |
| Acenaphthene | 10 | 0.1 | 10 |
| Fluorene | 10 | 0.1 | 10 |
| Phenanthrene | 10 | 0.1 | 10 |
| Anthracene | 10 | 0.1 | 10 |
| Fluoranthene | 10 | 0.1 | 10 |
| Pyrene | 10 | 0.1 | 10 |
| Benzo[a]anthracene | 10 | 0.1 | 10 |
| Chrysene | 10 | 0.1 | 10 |
| Benzo[b]fluoranthene | 10 | 0.1 | 10 |
| Benzo[k]fluoranthene | 10 | 0.1 | 10 |
| Benzo[a]pyrene | 10 | 0.1 | 10 |
| Dibenzo[a,h]anthracene | 10 | 0.1 | 10 |
| Benzo[g,h,i]perylene | 10 | 0.1 | 10 |
| Indeno[1,2,3-cd]pyrene | 10 | 0.1 | 10 |

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

** Analyte available only in limited methods.

**Organochlorine Pesticides (GC/ECD)**

| Analyte | Reporting Limit (µg/L) Aqueous | Reporting Limit (µg/Kg) Soils/Solids * |
|---|---|---|
| 4,4´-DDD | 0.0128 | 1.6 |
| 4,4´-DDE | 0.0128 | 1.6 |
| 4,4´-DDT | 0.0128 | 1.6 |
| Aldrin | 0.0064 | 0.8 |
| alpha-BHC | 0.0064 | 0.8 |
| alpha-Chlordane | 0.0064 | 0.8 |
| beta-BHC | 0.0064 | 0.8 |
| delta-BHC | 0.0064 | 0.8 |
| Dieldrin | 0.0128 | 1.6 |
| Endosulfan I | 0.0064 | 0.8 |
| Endosulfan II | 0.0128 | 1.6 |
| Endosulfan sulfate | 0.0128 | 1.6 |
| Endrin | 0.0128 | 1.6 |
| Endrin aldehyde | 0.0128 | 1.6 |
| Endrin ketone | 0.0128 | 1.6 |
| gamma-BHC | 0.0064 | 0.8 |
| gamma-Chlordane | 0.0064 | 0.8 |
| Heptachlor | 0.0064 | 0.8 |
| Heptachlor epoxide | 0.0064 | 0.8 |
| Methoxychlor | 0.064 | 8 |
| Technical Chlordane | 0.2 | 25 |
| Toxaphene | 0.2 | 25 |

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

**Polychlorinated Biphenyls (GC/ECD)**

| Analyte | Reporting Limit (µg/L) Aqueous | Reporting Limit (µg/Kg) Soils/Solids * | Reporting Limit (µg/Wipe) Wipe | Reporting Limit (mg/Kg) Oils |
|---|---|---|---|---|
| PCB-1016 | 0.2 | 25 | 1.0 | 5 |
| PCB-1211 | 0.2 | 25 | 1.0 | 5 |
| PCB-1232 | 0.2 | 25 | 1.0 | 5 |
| PCB-1242 | 0.2 | 25 | 1.0 | 5 |
| PCB-1248 | 0.2 | 25 | 1.0 | 5 |
| PCB-1254 | 0.2 | 25 | 1.0 | 5 |
| PCB-1260 | 0.2 | 25 | 1.0 | 5 |
| PCB-1262 | 0.2 | 25 | 1.0 | 5 |
| PCB-1268 | 0.2 | 25 | 1.0 | 5 |

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

**Hydrocarbon Fingerprinting (GC/FID)**

| Analyte | Reporting Limit (mg/L) Aqueous | Reporting Limit (µg/Kg) Soils/Solids * |
|---|---|---|
| Gasoline | 0.05 | 50 |
| Kerosene | 0.05 | 50 |
| Mineral Spirits | 0.05 | 50 |
| Fuel Oil #2/Diesel | 0.05 | 50 |
| Motor Oil/Hydraulic Oil | 0.1 | 100 |
| Unidentified Hydrocarbons | 0.2 | 100 |

**DIESEL RANGE ORGANICS (GC/FID)**

| Analyte | Reporting Limit (mg/L) Aqueous | Reporting Limit (µg/Kg) Soils/Solids * |
|---|---|---|
| Fuel Oil #2/Diesel | 0.05 | 50 |

**DIESEL RANGE ORGANICS (GC/FID) Maine**

| Analyte | Reporting Limit (mg/L) Aqueous | Reporting Limit (mg/Kg) Soils/Solids * |
|---|---|---|
| Fuel Oil #2/Diesel | 0.05 | 5 |

**Extractable Total Petroleum Hydrocarbons (ETPH) (GC/FID) -Connecticut**

| Analyte | Reporting Limit (mg/L) Aqueous | Reporting Limit (µg/Kg) Soils/Solids * |
|---|---|---|
| Extractable TPH (C9 - C36) | 0.10 | 50 |

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

**Hydrocarbon Fingerprinting (P&T/GCMS)**

| Analyte | Reporting Limit (mg/L) Aqueous | Reporting Limit (mg/Kg) Soils/Solids * |
|---|---|---|
| Gasoline | 0.1 | 2.5 |
| Mineral Spirits | 0.1 | 1.2 |

**GASOLINE RANGE ORGANICS (GC/FID) Maine**

| Analyte | Reporting Limit (mg/L) Aqueous | Reporting Limit (mg/Kg) Soils/Solids * |
|---|---|---|
| Gasoline | 0.01 | 0.25 |

**Volatile Petroleum Hydrocarbon (VPH) Analysis**
**MA-DEP September 2004 Method 1.1**

| Analyte | Reporting Limit (µg/L) Aqueous | Reporting Limit (mg/Kg) Soils/Solids * |
|---|---|---|
| C5-C8 Aliphatics | 100 | 100 |
| C9-C12 Aliphatics | 100 | 100 |
| C9-C10 Aromatics | 100 | 100 |
| Methyl-tert-butylether | 1 | 2 |
| Benzene | 1 | 2 |
| Toluene | 1 | 2 |
| Ethylbenzene | 1 | 2 |
| M,P- Xylene | 1 | 2 |
| o- Xylene | 1 | 2 |
| Naphthalene | 2 | 2 |

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

**Extractable Petroleum Hydrocarbon (EPH) Analysis**
**MADEP September, 2004 Method 1.1**

| Test Parameter | Reporting Limit (µg/L) Aqueous | Reporting Limit (µg/L) Aqueous SIM Only** | Reporting Limit (mg/Kg) Soils/Solids * | Reporting Limit (mg/Kg) Soils/Solids * SIM Only** |
|---|---|---|---|---|
| C9-C18 Aliphatics | 100 | N/A | 10 | N/A |
| C19-C36 Aliphatics | 100 | N/A | 10 | N/A |
| C11-C22 Aromatics* | 100 | N/A | 10 | N/A |
| Acenaphthene | 2 | 0.1 | 0.1 | 0.025 |
| Acenaphthylene | 2 | 0.1 | 0.1 | 0.025 |
| Anthracene | 2 | 0.1 | 0.1 | 0.025 |
| Benzo(a)Anthracene | 2 | 0.1 | 0.1 | 0.025 |
| Benzo(a)Pyrene | 2 | 0.1 | 0.1 | 0.025 |
| Benzo(b)Fluoranthene | 2 | 0.1 | 0.1 | 0.025 |
| Benzo(g,h,i)Perylene | 2 | 0.1 | 0.1 | 0.025 |
| Benzo(k)Fluoranthene | 2 | 0.1 | 0.1 | 0.025 |
| Chrysene | 2 | 0.1 | 0.1 | 0.025 |
| Dibenzo(a,h)Anthracene | 2 | 0.1 | 0.1 | 0.025 |
| Fluoranthene | 2 | 0.1 | 0.1 | 0.025 |
| Fluorene | 2 | 0.1 | 0.1 | 0.025 |
| Indeno(1,2,3-cd)Pyrene | 2 | 0.1 | 0.1 | 0.025 |
| Naphthalene | 2 | 0.1 | 0.1 | 0.025 |
| Phenanthrene | 2 | 0.1 | 0.1 | 0.025 |
| Pyrene | 2 | 0.1 | 0.1 | 0.025 |
| 2-Methylnaphthalene | 2 | 0.1 | 0.1 | 0.025 |

N/A= Not Applicable

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

** Analyte available only in limited methods.

## Metal's Reporting Limits

| Element | AQUEOUS 200.7 6010B/3010A ICP µg/L | SOIL 6010B/3050 ICP mg/kg * | SOIL 6010B/3051 ICP mg/kg * | AQUEOUS 200 Series 7000 Series /3010A GFAA µg/L | SOIL 7000 Series/ 3050/ 3051 GFAA mg/kg * | AQUEOUS 245.1/7470 Mercury µg/L | SOIL 7471 Mercury mg/kg * |
|---|---|---|---|---|---|---|---|
| Aluminum | 200 | 25 | 25 | | | | |
| Antimony | 20 | 5 | 5 | 5 | 1 | | |
| Arsenic | 50 | 6.3 | 6.3 | 5 (2)** | 1 | | |
| Barium | 200 | 25 | 25 | | | | |
| Beryllium | 4 | 0.63 | 0.63 | | | | |
| Boron | 250 | 31 | 31 | | | | |
| Cadmium | 4 | 0.5 | 0.5 | 2(1)** | 0.25 | | |
| Calcium | 2500 | 310 | 310 | | | | |
| Chromium | 10 | 1.3 | 1.3 | | | | |
| Cobalt | 50 | 6.3 | 6.3 | | | | |
| Copper | 25 | 3.2 | 3.2 | | | | |
| Iron | 100 | 13 | 13 | | | | |
| Lead | 25 (12)** | 6.3 | 6.3 | 5 (1)** | 1 | | |
| Lithium | 100 | 13 | 13 | | | | |
| Magnesium | 2500 | 310 | 310 | | | | |
| Manganese | 15 | 1.9 | 1.9 | | | | |
| Molybdenum | 25 | 3.2 | 3.2 | | | | |
| Nickel | 40 | 5 | 5 | | | | |
| Potassium | 2500 | 310 | 310 | | | | |
| Selenium | 80 | 15 | 15 | 5 | 1 | | |
| Silver | 7 | 1.8 | 1.8 | 1 | 0.1 | | |
| Sodium | 2500 | 310 | 310 | | | | |
| Strontium | 10 | 1.3 | 1.3 | | | | |
| Thallium | 50 | 6.3 | 6.3 | 2 | 1 | | |
| Tin | 250 | 31 | 31 | | | | |
| Titanium | 100 | 13 | 13 | | | | |
| Vanadium | 50 | 6.3 | 6.3 | | | | |
| Zinc | 20 | 5 | 5 | | | | |
| Mercury | | | | | | 0.2 | 0.05 |

* Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

** These reporting limits are available for special projects or if requested by the client.

## Wet Chemistry Reporting Limits

| ANALYSES | METHOD NUMBER Aqueous | METHOD NUMBER Soil | REPORTING LIMIT Aqueous mg/L | REPORTING LIMIT ** Soil mg/Kg |
|---|---|---|---|---|
| Alkalinity | SM2320B | N/A | 5 | -- |
| Alkalinity | 310.2 | N/A | 10 | -- |
| Ammonia | SM4500-NH3, C | SM4500-NH3 M | 1 | 50 |
| BOD | SM-5210B | N/A | 2 | -- |
| CBOD | SM-5210B | N/A | 2 | -- |
| Bromide | 300 | 9056 | 04 | 20 |
| COD (low) | Hach 8000/5220D | N/A | 20 | -- |
| COD (high) | Hach 8000/5220D | N/A | 50 | -- |
| Chloride | SM 4500-Cl, C | 9252A | 5 | 250 |
| Chloride | 300 | 9056 | 0.5 | 25 |
| Chlorine, Total Residual | SM 4500-Cl G | N/A | 0.2 | -- |
| Cyanide, Total | SM 4500-CN C,E/9010/9014 | 9010B/9014 | 0.01 | 0.5 |
| Cyanide, Amenable | SM 4500-CN C,E9010/9014 | 9010B/9014 | 0.01 | 0.5 |
| Fluoride | 340.2/4500 F C/300 | 9056 | 0.1 | 5 |
| Flashpoint/Ignitability | 1010 | 1010 M | 200° F | 200° F |
| Hardness | 6010/SM 2340B* | N/A | 33 | -- |
| Hexavalent Chromium | 3500-CR D | N/A | 0.01 | -- |
| Kjeldahl Nitrogen, Total | SM4500-NH3, C | SM4500-NH3 M | 1 | 50 |
| Nitrate | 300 | 9056 | 0.2 | 10 |
| Nitrite | 300 | 9056 | 0.2 | 10 |
| Nitrite | 354.1 | 354.1 M | 0.01 | 0.5 |
| Oil & Grease, Grav. | 413.1M/1664A | N/A | 5 | -- |
| Oil & Grease, IR | 413.2 M | 5520C SM | 0.5 | 35 |
| Orthophosphate | 300 | 9056 | 0.5 | 25 |
| Orthophosphate | SM 4500-P E | SM 4500-P E M | 0.01 | 0.5 |
| Paint Filter Test | N/A | 9095A | -- | -- |
| Petroleum Hydrocarbon, Total IR | 418.1 M | 5520C SM/418.1M | 0.5 | 35 |
| PH/Corrosivity | SM4500-H,B | 9045C | -- | -- |
| Phosphorus | SM 4500-P E | 365.2 M | 0.01 | 0.5 |
| Phenol | 420.1 | 9065 | 0.05 | 2.5 |
| Reactive Cyanide | SW-846 7.3.3.2 | SW-846 7.3.3.2 | 20 | 20 |
| Reactive Sulfide | SW-846 7.3.4.2 | SW-846 7.3.4.2 | 100 | 100 |
| Settleable Solids | 160.5 | N/A | 0.10 mL/L/hr | -- |
| Silica | 4500-Si E M | N/A | 1 | -- |
| Specific Conductivity | 120.1 | 9050A M | 1 | 1 |
| Sulfate | ASTM D516-02 | 9030A | 5 | 250 |

* Hardness by ICP

** Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

## Wet Chemistry Reporting Limits

| ANALYSES | METHOD NUMBER Aqueous | METHOD NUMBER Soil | REPORTING LIMIT Aqueous mg/L | REPORTING LIMIT ** Soil mg/Kg |
|---|---|---|---|---|
| Sulfate | 300 | 9056 | 1 | 50 |
| Sulfide | 376.1 | N/A | 1 | -- |
| Sulfite | 377.1 | N/A | 2 | -- |
| Total Dissolved Solids | 2540 C | N/A | 10 | -- |
| Total Solids | 160.3 | 2540G | 10 | -- |
| Total Suspended Solids | 2540 D | N/A | 4 | -- |
| Turbidity | 180.1 | N/A | 1 | -- |

* Hardness by ICP

** Soil/Solid reporting limits are based on 100% dry weight. Actual sample reporting limits will vary based on sample moisture content.

## 15.5 Records Management

15.5.1 Permanent Records:

15.5.1.1 Permanent Records are identified as records that meet one or more of the following criteria:

- Are of significant value for demonstrating safe operation; for determining the cause of accidents or malfunctions; and for maintaining, reworking, repairing, or modifying structures, items, systems or equipment;
- Pertain to environment, hazardous systems, or material disposal (waste management and environmental monitoring);
- Provide required baseline data for in-service maintenance, monitoring, inspection, or reconstruction of facilities or equipment;
- Are required by local, state, or federal statutes;
- Are identified by the client as a quality-related document.

15.5.1.2 Permanent records shall be retained for the life of the activity.

15.5.2 Non-Permanent Records:

15.5.2.1 Non-permanent records are those that are required to be maintained for a set time period. The records provide objective evidence that an activity was performed in accordance with specified requirements that may not be designated in the lifetime records.

15.5.3 Storage:

15.5.3.1. Records shall be stored in a manner that precludes deterioration, larceny and vandalism. The QA Manager shall assure that all records are stored in a location constructed and maintained in a manner which minimizes the risk of damage or destruction from natural disasters, such as winds, floods, or fires; environmental conditions, such as high and low temperatures and humidity; and infestation of insects, mold or rodents. Prevention of damage to special records (e.g., radiographs, photographs, negatives, microfilm, and magnetic media) from excessive light, dust, stacking and electromagnetic fields shall be of prime consideration when placing these special records in long-term storage facilities.

15.5.3.2 All records (including those pertaining to calibration and test Equipment), certificates and reports shall be stored and held secure and in confidence to the client. AMRO shall retain these records for a minimum of 5 years.

15.5.3.3 Records needed for reference on a routine basis may be stored in office files. Official records of the projects that are not needed on a routine basis shall be retired and stored. These activities shall be documented and include a complete listing of all records (Attachments 33 and 34).

## 15.6 Records Transfer

15.6.1 In the event that AMRO Environmental Laboratories Corporation transfers ownership or goes out of business the following steps will be in effect:

15.6.1.1 The owners of AMRO will agree in writing, before the transfer of ownership takes place to be accountable and liable for analyses, data and reports generated up to the time of legal transfer of ownership.

15.6.1.2 The buyer must agree in writing to be accountable and liable for any analyses, data and reports generated after the legal transfer of ownership occurs.

15.6.1.3 All records and analyses performed pertaining to accreditation will be kept for a minimum of 10 years.

15.6.1.4 The owners of AMRO will send an official notification to all clients announcing either the change of ownership or going out of business. The letter of notification will be mailed at least thirty days in advance.

# SECTION 16. CONFIDENTIALITY AND PROPRIETARY RIGHTS

AMRO has a strict policy in place for protecting a client's right to confidentiality and any proprietary information that AMRO may learn in the course of performing analyses for a client. Results for any analysis are only released to the client of record who has submitted the samples, authorized the testing or is responsible for the payment of the services rendered. Any request for information from any other party is refused until AMRO has obtained written permission from the client of record to release data to another party. In addition, AMRO personnel will not discuss the nature of a client's samples with anyone except the client of record. AMRO personnel are informed of this policy upon employment at AMRO. Any intentional infraction of this policy would be considered cause for immediate dismissal.

# SECTION 17. AUDITS AND CERTIFICATIONS

## 17.1 System Audits

A system audit is an on-site review of the laboratory's quality assurance practices and operating procedures. AMRO has agreed to audits by various government agencies and clients when requested.

## 17.2 Performance Evaluation Audits

Performance audits provide a systematic check of the quality of the laboratory data and of the measurement systems. AMRO participates in blind laboratory performance evaluations for the analytes in Potable and Non-Potable Water as well as Solid and Hazardous Waste. These studies are obtained from the State of New York and other approved proficiency test providers twice per year. Results are evaluated and sent to appropriate regulatory agencies.

## 17.3 Internal Audits

Internal audits for each analysis include checking, verification and documentation of all aspects of each analysis. Internal audits are performed annually or as needed in the event an out-of-control situation are discovered. Corrective Action Report and Status (CARS) are initiated and completed as a result of any audit findings. Follow up of out-of-control situations is performed until the analysis is determined to be in-control. The QA Manager keeps internal audits on file.

The items checked include the following:

17.3.1 Initial Demonstration of Lab Performance

17.3.1.1 Method Detection Limit studies of each analyte must be reported annually for each instrument, column, matrix, and extraction method. They are verified for completeness, proper documentation and accuracy.

17.3.1.2 Precision and Accuracy in the laboratory is assessed initially by the analyses of a minimum of 4 replicate samples at a mid-level point of the expected range. The percent recoveries and Relative Standard Deviations (RSD) are evaluated and compared to method specifications or default limits where applicable. They are verified for completeness, proper documentation and accuracy

17.3.2 Initial Calibration – verify all criteria met per method requirements.

17.3.3 Continuing Calibration – verify all method criteria met.

17.3.4 Blanks – verify all analytes below the MDL check (approximately 2 time the MDL) or method specified criteria or flagged if not.

17.3.5 Laboratory Control Samples – verify all recoveries acceptable and that the correct limits are applied.

17.3.6 Matrix Spike/Matrix Spike Duplicates - verify all recoveries acceptable and that the correct limits are applied.

17.3.7 Duplicates – verify all RPDs within acceptance limits.

17.3.8 Surrogates - verify all recoveries acceptable and that the correct limits are applied.

17.3.9 Internal Standards - verify all recoveries acceptable and that the correct limits are applied.

17.3.10 Control Limits – verify that correct limits are in use.

17.3.11 Maintenance – verify that maintenance documented and frequency is correct.

17.3.12 Training – verify training is on file and current for each analyst for the analyses performed.

17.3.13 Logbooks – verify they are filled out correctly and completely.

## 17.4 External Audits

The State of New Hampshire audits AMRO every two years to NELAC July 2003 Standards. Certifying authorities and clients also conduct audits per their requirements. All areas of the laboratory participate in these audits. Any deviations observed during any audit are investigated and corrected as needed.

## 17.5 Data Integrity Audits

Data Integrity Audits are performed in conjunction with the Internal Audits. Selected samples and QC data are subjected to more in depth scrutiny which includes examining raw data and ensuring that any manual manipulation of the data was done appropriately. Approximately 5% of the data throughout the lab is reviewed in depth. If any problem is encountered during this audit an investigation is started to determine if there is an on-going problem or an isolated incident. Corrective Action Report and Status (CARS) are initiated and completed as a result of any audit findings. Any employee found to be manipulating data inappropriately is subject to disciplinary action ineluding dismissal.

## 17.6 Certifications

AMRO is currently certified to perform analyses in the following states for the following categories:

| State/Program | Category |
|---|---|
| Connecticut (PH-0758) | Drinking Water/Wastewater<br>Soil |
| Maine (NH-012) | Drinking Water/Wastewater |
| Massachusetts (M-NH-012) | Drinking Water/Wastewater |
| New Hampshire (1001) | Drinking Water/Non-potable water/<br>Solid and Hazardous Waste |
| New Jersey (NH005) | Solid and Hazardous Waste |
| New York (11278) | Non-potable water/<br>Solid and Hazardous Waste |
| Pennsylvania (68-01257) | Non-potable water/<br>Solid and Hazardous Waste |

*A copy of each of the certificates and/or approved analytes lists is available upon request.*

# SECTION 18. RECORD RETENTION AND DATA ARCHIVING

## 18.1 Data Security and Archiving

Once the data is reported, a copy of the final report and invoice are kept on file at our laboratory for at least 3 months. After 3 months, reports may be moved to an offsite storage facility.

## 18.2 Forms

All Master Forms are stored under the qc directory. The QA/QC Manager controls these forms. All forms are identified by name, date and revision number. Edits are submitted to the QA/QC Manager, completed, reviewed by the appropriate section head and updated in the Master Control Logbook.

## 18.3 Logbooks

All Logbooks are inventoried by the QA/QC Manager. Only one logbook is opened for any specific purpose at a time. Edits to logbooks are made using the procedure indicated in 18.2.

## 18.4 SOP's

SOP's are controlled by the QA/QC Manager. They are identified by title, revision number and revision date. Control copies are distributed to the appropriate section heads. Non-control copies are available upon request from the QA/QC Manager. SOP's are considered proprietary and are provided to outside sources only if necessary. Distribution is tracked and documented with the master copy of each SOP.

## 18.5 Certificates

Original Certificates provided from state agencies are displayed in the front lobby area of the laboratory. They are updated as provided.

# SECTION 19. REFERENCES

1. Code of Federal Regulations; (40 CFR) Part 136, Appendix A and Appendix B.

2. Method for Chemical Analysis of Water and Wastes; U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, OH, 1983; EPA-600/4/79-020.

3. Standard Methods for the Examination of Water and Wastewater; 19th Edition; American Public Health Association, Washington, DC, 1995.

4. Methods for the Determination of Metals in Environmental Samples; EPA-600/4-91-010, June 1991.

5. Methods for the Determination of Metals in Environmental Samples – Supplement I; EPA-600/R-94/I1I, May 1994.

6. Technical Notes on Drinking Water Methods, EPA/600/R94-173, October 1994.

7. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods; Third Edition and its Updates; U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response, Washington, DC, 1996; SW-846.

8. Good Automated Laboratory Practices, August 1995.

9. NELAC Quality Systems Manual, July, 2003.

10. EPA, "Methods for Determination of Organic Compounds in Drinking Water", Supplement III, August 1995.

11. Department of Defense Quality Systems Manual For Environmental Laboratories, Version 4.1, 4/22/2009.

12. Massachusetts Contingency Plan (MCP), September 10, 2004.

13. Method for Determining Diesel Range Organics-Maine, 4.1.25, 09/06/95.

14. Method for Determining Gasoline Range Organics-Maine, 4.1.17, 09/06/95.

15. MA Department of Environmental Protection 310CMR 42.08.

# AMRO ENVIRONMENTAL LABORATORIES CORPORATION

## ETHICS AND DATA INTEGRITY AGREEMENT

I. I,_____, state that I understand the high standards of integrity required of me with regard to the duties I perform and the data I report in connection with my employment at AMRO Environmental Laboratories Corporation.

II. I agree that in the performance of my duties at AMRO Environmental Laboratories Corporation

a. I shall not intentionally report data values that are not the actual values. obtained;

b. I shall not intentionally report the dates and times of data analyses that are not the actual dates and times of data analyses; and

c. I shall not intentionally represent another individual's work as my own.

III. I agree to inform AMRO Environmental Laboratories Corporation of any accidental reporting of non-authentic data by myself in a timely manner.

IV. I agree to inform AMRO Environmental Laboratories Corporation of any accidental or intentional reporting of non-authentic data by other employees.

V. I understand that disciplinary action and criminal penalties can result from unethical behavior. I understand that ethical behavior is a requirement of continued employment.

_____
(Signature)

_____
(Date)

**AMRO Environmental Laboratories Corporation**
111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

# QUALIFICATION CARD

Trainee: _____ Signature: _____

Trainer: _____ Signature: _____

**I. Knowledge Factors:**

SOP Title: _____ Revision Number/Date: _____

1. Did the Trainee read and understand the above SOP? Yes☐ No☐ NA☐
2. Was the Trainee instructed on how to properly fill out the documentation? Yes☐ No☐ NA☐
3. Has the Trainee been instructed on the proper procedures for addressing potential problems? Yes☐ No☐ NA☐

**II. Practical Factors:**

1. Has the Trainee completed a Precision and Accuracy Study? Yes☐ No☐ NA☐
2. Has the Trainee completed an acceptable Performance Evaluation sample? Yes☐ No☐ NA☐
3. Did the Trainee completed an acceptable Laboratory Control Sample (LCS)? Yes☐ No☐ NA☐

Completion Date: _____ Trainer's Signature: _____

I_____have read, understood and follow the above method/SOP, which is in use at AMRO Laboratories for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

Section Manager/ Supervisor: _____ Date: _____

QA Manager: _____ Date: _____

Preservation reagent requirements and volumes for bottle preparation.
1.0 ml disposable pipettes are used.

| TYPE OF ANALYSIS | CONTAINER WATER | PRESERVATION WATER | CONTAINER SOIL/SEDIMENTS/ SLUDGES |
|---|---|---|---|
| 524.2 | 2 x 40 mL VOA vials | 10 drops (3 mg) Sodium Thiosulfate, sample, then 5 drops HCl to pH<2 | - |
| 524.2/w/ vinyl chloride | 2 x 40 mL VOA vials | 1 scoop (25 mg) ascorbic acid, sample, then 5 drops HCl to pH<2 | - |
| 624/8260 | 2 x 40 mL VOA vials | 5 drops HCl to pH <2, | 2x40 mL VOA vials with Methanol/ Teflon lid |
| 624/8260 w/ Residual Chloride | 2 x 40 mL VOA vials | 10 drops (3 mg) Sodium Thiosulfate, sample then 5 drops HCl to pH <2, | – |
| TCLP/SPLP Volatiles | 3 x 40 mL VOA vials | None | 2 oz glass w/ Teflon lid |
| VPH 1.1 | 2 x 40 mL VOA vials | 5 drops HCl to pH <2 | 2x40 mL VOA vials with Methanol/ Teflon lid |
| 8015 GRO | 2 x 40 mL VOA vials | 5 drops HCl to pH <2 | 2x40 mL VOA vials with Methanol/ Teflon lid |
| 504.1 | 3 x 40 mL VOA vials | 10 drops (3 mg) Sodium Thiosulfate | - |
| 608 Pest/PCB | 2x1 liter amber glass ** | None | - |
| 8081/Pest./8082/PCB | 2x1 liter amber glass ** | None | 4 oz glass jar |
| TCLP Pesticide | 1 liter amber glass | None | 8 oz glass jar |
| 625/8270BNA/Acid/BN | 2x1 liter amber glass ** | None | 4 oz glass jar |
| 8270 PAH | 2x1 liter amber glass ** | None | 4 oz glass jar |
| TCLP Semivolatiles | 1 liter amber glass | None | 8 oz glass jar |
| EPH 1.1 | 2x1 liter amber glass ** | H2SO4 or HCl to pH <2; 3mL | 4 oz amber glass jar * |
| TPH-GC/8015 DRO | 2x1 liter amber glass ** | H2SO4 or HCl to pH <2; 3mL | 4 oz glass jar |
| ETPH- CT | 2x1 liter amber glass** | None | 250 ml widemouth glass jar with Teflon lined lid |
| Mercury | 250 mL Poly * | 1 pipettes (4 mL) HNO3 to pH<2 | 4 oz glass jar * |
| Metals except Mercury | 250 mL Poly * | 4 pipettes (3 mL) HNO3 to pH<2 | 4 oz glass jar * |
| TCLP/SPLP Metals | 1 Liter Poly * | None | 8 oz glass jar * |

* = In some cases multiple analyses can be taken from the same jar. Consult the lab for further instructions.
** = Additional bottles needed for QC.

| TYPE OF ANALYSIS | CONTAINER WATER | PRESERVATION WATER | CONTAINER SOIL/SEDIMENTS / SLUDGES |
|---|---|---|---|
| Hexavalent Chromium | 500 mL Poly - NO ACID! | None | - |
| pH | 100 mL Poly bottle | None | 4 oz glass jar |
| Acidity/Alkalinity | 250 mL Poly Bottle | None | - |
| Ammonia | 500 mL Poly Bottle | 1 mL H2SO4 to pH <2 | 4 oz glass jar |
| BOD and CBOD | 1000 mL Poly or Glass jar | None | - |
| COD | 100 mL Poly or glass jar | 5 drops H2SO4 to pH <2 | - |
| Color | 100ml | None | - |
| Chloride | 250 mL Poly Bottle | None | 4 oz glass jar |
| Chlorine, Total Residual | 250 mL Poly Bottle | None | 8 oz glass jar |
| Cyanide, Total and Amenable. | 250 mL amber glass jar | ½ pipette (0.5 mL) NaOH to pH>12 & large scoop (0.5 grams) Ascorbic Acid | 4 oz amber glass jar |
| Flash point/ Ignitability | 250 mL glass jar/separate | None | 8 oz glass jar/separate |
| Fluoride | 250 mL Poly Bottle | None | - |
| Formaldehyde*** | 500 mL glass | None | - |
| Hardness | 250 mL Poly or glass jar | 1 pipette (4 mL) HNO3 to pH<2 | 4 oz glass jar |
| Total Kjeldahl Nitrogen | 500 mL Poly Bottle | ½ pipette (0.5 mL) H2SO4 to pH <2 | 4 oz glass jar |
| Nitrate | 250 mL Poly bottle | None | 4 oz glass jar |
| Nitrate/Nitrite | 250 mL Poly Bottle | 1 drop H2SO4 to pH <2 | 4 oz glass jar |
| Nitrite | 250 mL Poly bottle | None | 4 oz glass jar |
| Oil and Grease – Grav. | 2x 1 Liter Glass jar ** | 1 pipette (4 mL) H2SO4 to pH<2 | 4 oz glass jar (IR only) |
| TPH –Grav. | 2x 1 Liter Glass jar** | 1 pipette (4 mL) H2SO4 to pH<2 | 4 oz glass jar |
| Total Organic Carbon*** | 40 mL VOA vial | 5 drops HCl to pH <2 | 4 oz Glass jar |
| Orthophosphate | 250 mL Poly Bottle | None | 4 oz glass jar |
| Dissolved Oxygen | BOD bottle/1 Liter glass | None/1 mL H2SO4 | - |
| Phenol | 1 Liter Glass Bottle | 1 mL H2SO4 to pH <2 | 4 oz glass jar |
| Total Phosphorus | 250 mL Poly bottle | ¼ pipette (0.25 mL) H2SO4 to pH<2 | 4 oz glass jar |
| Total Residue | 250 mL Poly Bottle | None | 4 oz glass jar |
| Filterable Residue | 250 mL Poly Bottle | None | - |
| Non-Filterable Residue (TSS) | 250 mL Poly Bottle | None | - |
| Settleable Residue | 1 Liter Poly Bottle | None | - |
| Volatile Residue | 500 mL Poly Bottle | None | 4 oz glass jar |
| Silica | 250 mL Poly Bottle | None | - |
| Specific Conductivity | 250 mL Poly Bottle | None | 4 oz glass jar |
| Sulfate | 250 mL Poly bottle | None | 4 oz glass jar |
| Sulfide | 500 mL Poly bottle | 4 drops 2N Zn acetate/ 100 mL & (1.0 mL) NaOH to pH>9 | - |

* = In some cases multiple analyses can be taken from the same jar. Consult the lab for further instructions.
** = Additional bottles needed for QC.
***= subcontracted

| TYPE OF ANALYSIS | CONTAINER WATER | PRESERVATION WATER | CONTAINER SOIL/SEDIMENTS / SLUDGES |
|---|---|---|---|
| Sulfite | 250 mL Poly Bottle | None | 4 oz glass jar |
| Surfactants*** | 250 mL Poly Bottle | None | - |
| Turbidity | 250 mL Poly bottle | None | - |

* = In some cases multiple analyses can be taken from the same jar. Consult the lab for further instructions.
** = Additional bottles needed for QC.
***= subcontracted

## AMRO TABLE OF CONTAINERS, PRESERVATIVES AND HOLDING TIMES

| TYPE OF ANALYSIS | CONTAINER WATER | PRESERVATION WATER | CONTAINER SOIL/SEDIMENTS/ SLUDGES | PRES SOIL | HOLDING TIME WATER/SOIL |
|---|---|---|---|---|---|
| 624/8260/524.2/8021 | 2 - 40 mL VOA vials | HCl to pH <2, 4°C | 2 x 40 mL VOA vials/Methanol w/ Teflon lid | 4°C | 14 Days/14 Days |
| TCLP/SPLP Volatiles | 3 - 40 mL VOA vials | - | 2 oz glass w/ Teflon lid | | 14 Days/14 Days |
| VPH 1.1 | 2 - 40 mL VOA vials | HCl to pH <2, 4°C | 2 x 40 mL VOA vials/Methanol w/ Teflon lid | 4°C | 14 Days/28 Days |
| 8015/GRO/GRO Maine | 2 - 40 mL VOA vials | HCl to pH <2, 4°C | 2 x 40 mL VOA vials/Methanol w/ Teflon lid | 4°C | 14 Days/14 Days |
| 504.1 | 3 - 40 mL VOA vials | 3 mg Na2S2O3 | - | - | 14 Days |
| 608 Pest/PCB | 2x1 liter amber glass ** | pH 5 -9 , 4°C | - | - | 7 Days |
| 8081/Pest. | 2x1 liter amber glass ** | 4°C | 4 oz glass jar | 4°C | 7 Days/14 Days |
| 8082/PCB | 2x1 liter amber glass ** | 4°C | 4 oz glass jar | 4°C | 7 Days/14 Days |
| TCLP Pesticide | 1 liter amber glass | 4°C | 8 oz glass jar | 4°C | 7 Days/14 Days |
| 625/8270BNA/Acid/BN | 2x1 liter amber glass ** | 4°C | 4 oz glass jar | 4°C | 7 Days/14 Days |
| 8270 PAH | 2x1 liter amber glass ** | 4°C | 4 oz glass jar | 4°C | 7 Days/14 Days |
| TCLP Semivolatiles | 1 liter amber glass | 4°C | 8 oz glass jar | 4°C | 14 Days/14 Days |
| EPH 1.1 | 2x1 liter amber glass ** | H2SO4 or HCl to pH <2, 4°C | 4 oz amber glass jar* | 4°C | 14 Days/7 Days |
| TPH-GC/8015B DRO/DRO Maine | 2x1 liter amber glass ** | H2SO4 or HCl to pH <2, 4°C | 4 oz glass jar | 4°C | 7 Days/14 Days |
| ETPH -CT | 2x1 liter amber glass ** | 4°C | 250 mL widemouth glass jar with Teflon lined lid | 4°C | 7 Days/14 Days |
| Mercury/TCLP Mercury | 250 mL Poly * | HNO3 to pH<2 | 4 oz glass jar * | 4°C | 28 Days |
| Metals except Mercury | 500 mL Poly * | HNO3 to pH<2 | 4 oz glass jar * | - | 180 Days |
| TCLP/SPLP Metals | 1 Liter Poly * | 4°C | 8 oz glass jar * | 4°C | 180 Days |
| Hexavalent Chromium | 500 mL Poly - NO ACID! | 4°C | 4 oz glass jar | 4°C | 24 hours / 30 days |
| pH | 250 mL Poly bottle | (4°C) | 4 oz glass jar | (4°C) | ASAP water/(soil) |
| Acidity/Alkalinity | 250 mL Poly Bottle | 4°C | - | - | 14 Days |
| Ammonia | 500 mL Poly Bottle | H2SO4 to pH <2, 4°C | 4 oz glass jar | 4°C | 28 Days |
| BOD | 1 Liter Poly or Glass jar | 4°C | - | - | 48 Hours |
| COD | 120 mL Poly or glass jar | H2SO4 to pH <2, 4°C | - | - | 28 days |
| Color | 100ml | 4°C | - | - | 48 Hours |
| Chloride | 250 mL Poly Bottle | - | 4 oz glass jar | - | 28 Days |
| Chlorine, Total Residual | 250 mL Poly Bottle | (4°C) | 8 oz glass jar | 4°C | ASAP water/(soil) |
| Cyanide, Total and Amenable And Free | 250 mL Poly or glass jar | NaOH to pH>12, Ascorbic Acid, 4°C | 4 oz amber glass jar | 4°C | 14 Days |
| Flash point/Ignitability | 8 oz glass jar/separate | 4°C | 8 oz glass jar/separate | 4°C | None Specified |
| Fluoride (DW) | 250 mL Poly Bottle | (4°C) | - | - | 28 Days |
| Fluoride (WW) | 1 Liter Poly Bottle | (4°C) | - | - | 28 Days |
| Formaldehyde*** | 500 mL glass | 4°C | - | - | 72 hours |
| Hardness | 250 mL Poly or glass jar | HNO3 to pH<2 | 4 oz glass jar | 4°C | 6 months |
| Total Kjeldahl Nitrogen | 500 mL Poly Bottle | H2SO4 to pH <2, 4°C | 4 oz glass jar | 4°C | 28 Days |
| Nitrate | 250 mL Poly bottle | 4°C | 4 oz glass jar | 4°C | 48 Hours |
| Nitrate/Nitrite | 250 mL Poly Bottle | H2SO4 to pH <2, 4°C | 4 oz glass jar | 4°C | 28 Days |
| Nitrite | 250 mL Poly bottle | 4°C | 4 oz glass jar | 4°C | 48 hours |
| Oil and Grease - Grav. | 2x 1 Liter Glass jar ** | H2SO4 to pH<2, 4°C | 4 oz glass jar (IR only) | 4°C | 28 Days |
| TPH – Grav. | 1 Liter Glass jar | H2SO4 to pH<2, 4°C | 4 oz glass jar | 4°C | 28 Days |
| Total Organic Carbon*** | 40 mL VOA vial | H2SO4 to pH <2, 4°C | 4 oz glass jar | 4°C | 28 Days |
| Orthophosphate | 250 mL Poly Bottle | 4°C | 4 oz glass jar | 4°C | 48 hours |
| Dissolved Oxygen | BOD Bottle/1 liter glass jar | (4°C) / 1mL H2SO4 | - | - | IMMEDIATELY/ 8 Hours |
| Phenol | 1 Liter Glass Bottle | H2SO4 to pH <2, 4°C | 4 oz glass jar | 4°C | 28 Days |
| Total Phosphorus | 250 mL Poly bottle | H2SO4 to pH <2, 4°C | 4 oz glass jar | 4°C | 28 Days |
| Total Residue (TS) | 250 mL Poly Bottle | 4°C | 4 oz glass jar | 4°C | 7 Days/(7 Days) |
| Filterable Residue (TDS) | 250 mL Poly Bottle | 4°C | - | - | 7 Days |
| Nonfilterable Residue (TSS) | 250 mL Poly Bottle | 4°C | - | - | 7 Days |
| Settleable Residue | 1 Liter Poly Bottle | 4°C | - | - | 48 Hours |
| Volatile Residue (TVS) | 500 mL Poly Bottle | 4°C | 4 oz glass jar | 4°C | 7 Days |
| Silica | 250 mL Poly Bottle | 4°C | - | -- | 28 Days |
| Specific Conductivity | 250 mL Poly Bottle | 4°C | 4 oz glass jar | 4°C | 28 Days |
| Sulfide | 500 mL Poly bottle | 4 drops 2N Zn acetate/100mL, NaOH (1.0mL) to pH>9, 4°C | - | - | 7 Days |
| Sulfate | 250 mL Poly bottle | 4°C | 4 oz glass jar | 4°C | 28 Days |
| Sulfite | 250 mL Poly Bottle | 4°C | 4 oz glass jar | 4°C | IMMEDIATELY |
| Surfactants *** | 250 mL Poly Bottle | 4°C | - | - | 48 Hours |
| Turbidity | 250 mL Poly Bottle | 4°C | - | - | 48 Hours |

* = In some cases multiple analyses can be taken from the same jar. Consult the lab for further instructions.
** = Additional bottles needed for QC. ***= Subcontracted ( ) indicates AMRO internal criteria.

**AMRO Environmental Laboratories Corp. Sample Acceptance Policy**

This sample acceptance policy outlines the circumstances when samples shall be accepted or rejected by the Lab. Data from any samples which do not meet the following criteria will be flagged. An explanation of all flagged data will be in a case narrative included with the final report. This policy is available to sample collection personnel and includes, but is not limited to, the following areas of concern:

a) full, and complete documentation (Chain of Custody), which shall include the client's name, address, turnaround time, sample identification, the location, date and time of collection, container's description, requested analyses, collector's name, preservation type, sample type and any special remarks concerning the sample;

b) proper sample labeling to include unique identification using durable labels (water resistant) and the use of indelible ink. Special instructions for sampling Methanol and Sodium Bisulfate vials is provided, (see Sampling Instructions Memo)

c) Use of appropriate sample containers, with proper preservation, temperature of samples upon receipt, (see Table of containers, preservatives and holding times)

d) Adherence to specified holding times (see Table of containers, preservatives and holding times)

e) Adequate sample volume. Sufficient sample volume must be available to perform the necessary tests;

f) When samples are found to be unacceptable for any reason an email or fax will be sent to the client. The Sample Receiving Technician will list the problems with the samples and the client is requested to let AMRO know, by email or fax, what action should be taken with the samples and if the laboratory should continue with the analyses. The client must answer by email or sign and date this form with any further instructions to the laboratory and return to the laboratory.

g) AMRO can not proceed with any analyses until all issues are resolved and the laboratory receives proper written authorization.

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054

# CHAIN-OF-CUSTODY RECORD

59407

Office: (603) 424-2022
Fax: (603) 429-8496
web: www.amrolabs.com

| Project No.: | Project Name: | Project State: | Project Manager: | Samplers (Signature): | AMRO Project No.: |
|---|---|---|---|---|---|
| | | | | | |

| P.O.#: | Results Needed by: | Matrix | Total # of Cont. & Size | Comp. | Grab | REQUESTED ANALYSES | Remarks |
|---|---|---|---|---|---|---|---|
| QUOTE #: | Seal Intact? Yes No N/A | | | | | | |
| Sample ID.: | Date/Time Sampled | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Preservative: Cl-HCl, MeOH, N-HN03, S-H2SO4, Na-NaOH, O- Other | | | | | | | |

Send Results To:

PRIORITY TURNAROUND TIME AUTHORIZATION
Before submitting samples for expedited TAT, you must *have a coded AUTHORIZATION NUMBER*
AUTHORIZATION No.: BY:

METALS 8 RCRA ☐ 13 PP ☐ 23 TAL ☐ 14 MCP ☐
Method: 6010 ☐ 200.7 ☐ Other Metals:
Dissolved Metals Field Filtered? YES ☐ NO ☐

PHONE #: FAX #:
E-mail:

MCP Presumptive Certainty Required? YES ☐ NO ☐

MCP Methods Needed: YES ☐ NO ☐

Required Reporting Limits:
S-1 ☐ GW-1 ☐
S-2 ☐ GW-2 ☐
S-3 ☐ GW-3 ☐
Other:

| Relinquished By: | Date/Time | Received By |
|---|---|---|
| | | |
| | | |
| | | |

AMRO report package level needed:

EDD required:

Please print clearly, legibly and completely. Samples can not be logged in and the turnaround time clock will not start until any ambiguities are resolved.

*Samples arriving after 12:00 noon will be tracked and billed as received on the following day.*

*AMRO policy requires notification in writing to the laboratory in cases where the samples were collected from highly contaminated sites.*

KNOWN SITE CONTAMINATION:

White: Lab Copy Yellow: Client Copy

SHEET OF

AMROCOC2004, Rev.3 08/18/04

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054

## Project Number Assignment Log

| AMRO Project Number | Date Received | Time Received | Client Name | Comment |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

AMRO Environmental
Laboratories Corporation

# SAMPLE RECEIPT CHECKLIST

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

Client: _____ AMRO ID: _____
Project Name: _____ Date Rec.: _____
Ship via: (circle one) Fed Ex., UPS , AMRO Courier, Date Due: _____
Hand Del., Other Courier, Other:

| Items to be Checked Upon Receipt | Yes | No | NA | Comments |
|---|---|---|---|---|
| 1. Army Samples received in individual plastic bags? | | | | |
| 2. Custody Seals present? | | | | |
| 3. Custody Seals Intact? | | | | |
| 4. Air Bill included in folder if received? | | | | |
| 5. Is COC included with samples? | | | | |
| 6. Is COC signed and dated by client? | | | | |
| 7. Laboratory receipt temperature. TEMP = | | | | |
| Samples rec. with ice___ ice packs___ neither____ | | | | |
| 8. Were samples received the same day they were sampled? | | | | |
| Is client temperature = or <6°C ? | | | | |
| **If no obtain authorization from the client for the analyses.** | | | | |
| **Client authorization from: Date: Obtained by:** | | | | |
| 9. Is the COC filled out correctly and completely? | | | | |
| 10. Does the info on the COC match the samples? | | | | |
| 11. Were samples rec. within holding time? | | | | |
| 12. Were all samples properly labeled? | | | | |
| 13. Were all samples properly preserved? | | | | |
| 14. Were proper sample containers used? | | | | |
| 15. Were all samples received intact? (none broken or leaking) | | | | |
| 16. Were VOA vials rec. with no air bubbles? | | | | |
| 17. Were the sample volumes sufficient for requested analysis? | | | | |
| 18. Were all samples received? | | | | |
| 19. VPH and VOA Soils only: | | | | |
| Sampling Method VPH (circle one): M=Methanol, E=EnCore (air-tight container) | | | | |
| Sampling Method VOA (circle one): M=Methanol, SB=Sodium Bisulfate, E=EnCore, B=Bulk | | | | |
| If M or SB: | | | | |
| Does preservative cover the soil? | | | | |
| **If NO then client must be faxed.** | | | | |
| Does preservation level come close to the fill line on the vial? | | | | |
| **If NO then client must be faxed.** | | | | |
| Were vials provided by AMRO? | | | | |
| **If NO then weights MUST be obtained from client** | | | | |
| Was dry weight aliquot provided? | | | | |
| **If NO then fax client and inform the VOA lab ASAP.** | | | | |
| 20. Subcontracted Samples: | | | | |
| What samples sent: | | | | |
| Where sent: | | | | |
| Date: | | | | |
| Analysis: | | | | |
| TAT: | | | | |
| 21. Information entered into: | | | | |
| Internal Tracking Log? | | | | |
| Dry Weight Log? | | | | |
| Client Log? | | | | |
| Composite Log? | | | | |
| Filtration Log? | | | | |

Received By: Date: Logged in By: Date:
Labeled By: Date: Checked By: Date:

NA= Not Applicable

AMRO Environmental
Laboratories Corporation

111 Hellick Street
Merrimack, NH 03054
(603) 424-2022

Please Circle if:
Sample= Soil
Sample= Waste

AMRO ID: _____

| Sample ID | Analysis | Volume Sample | Preserv. Listed | Initial pH* | Acceptable? Y or N | List Preserv. Added by AMRO | Solution ID # of Preserv. | Volume Preservative Added | Final adjusted pH | Final adjusted pH (after 16 or 24 hours) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054
Phone: 603-424-2022
Fax: 603-429-8496

**DATE:**_____

**TO:** _____

_____

**RE: SAMPLES RECEIVED** **AMRO #:** _____

**DATE RECEIVED:**_____ **CHAIN OF CUSTODY #:**_____

**PROJECT NAME:**_____

**THE FOLLOWING SAMPLES WERE NOT RECEIVED IN ACCEPTABLE CONDITION AS PER THE ANALYTICAL METHOD (S) REQUESTED:**

| **SAMPLE ID** | **PROBLEM** |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |

**SIGNATURE OF SAMPLE TECHNICIAN:** _____

**IF YOU WISH US TO CONTINUE WITH THE REQUESTED ANALYSES FOR THIS/THESE SAMPLE (S), PLEASE SIGN, DATE AND FAX THIS FORM BACK TO US. WE WILL HOLD THIS/THESE SAMPLE (S) PENDING YOUR RESPONSE. THANK YOU.**

| _____ | _____ | _____ |
|---|---|---|
| **DATE** | **COMPANY NAME** | **SIGNATURE PROJECT MANAGER** |

# AMRO Internal Chain of Custody Form

**1201056**

Client: AMRO Environmental Lab. Corp. Project Name: DI Water

Date Received: 1/25/2012 Date Due: 2/1/2012

| Sample ID | Stored | Bottles | Bottle Type | Test | MS | Comments | Date / Time Out | By | Date / Time In |
|---|---|---|---|---|---|---|---|---|---|
| 1201056-01B | | 1 | 500PHNO3 | 200.9_AS | ☐ | | | | |
| | | | | | ☐ | | | | |
| 1201056-01B | | 1 | 500PHNO3 | 200.9_PB | ☐ | | | | |
| | | | | | ☐ | | | | |
| 1201056-01B | | 1 | 500PHNO3 | 200.9_SE | ☐ | | | | |
| | | | | | ☐ | | | | |
| 1201056-01B | | 1 | 500PHNO3 | 200_PREP, 200.7 | ☐ | | | | |
| | | | | | ☐ | | | | |
| 1201056-01A | | 1 | 500PU | E120.1 COND | ☐ | | | | |
| | | | | | ☐ | | | | |
| 1201056-01B | | 1 | 500PHNO3 | HG_245.1 PREP, HG_245.1 | ☐ | | | | |
| | | | | | ☐ | | | | |
| 1201056-01A | | 1 | 500PU | SM4500 PH | ☐ | | | | |
| | | | | | ☐ | | | | |
| 1201056-01A | | 1 | 500PU | SM4500-CL RES | ☐ | | | | |

Comments:



1201056

AMRO Environmental
Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054



# Incoming Notice Form

Client Name: _____

Project ID: _____

Contact Person: _____

Number samples to be rec.: _____

Matrix: _____

Analyses: _____

Expected Date to be Rec.: _____

Turn Around Time: _____

QC Deliverable Requirements: _____

Other Information:

Information Rec. by: _____ Date: _____

Date Samples Received: _____

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054
Phone: (603) 424-2022
Fax: (603) 429-8496

Customer/Contact

Project

Chain-of custody #

Fax Number Date

In response to customer requests and state regulations. AMRO is informing you that the following methods are being substituted with the GC/MS method which covers the same analyte list.

1. EPA Method 601 analyte list will be analyzed as EPA Method 624.
2. EPA Method 602 analyte list will be analyzed as EPA Method 624.
3. SW-846 Method 8010 analyte list will be analyzed as SW-846 Method 8260B.
4. SW-846 Method 8020 analyte list will be analyzed as SW-846 Method 8260B.
5. SW-846 Method 8021 analyte list will be analyzed as SW-846 Method 8260B
6. SW-846 Method 8240 analyte list will be analyzed as SW-846 Method 8260B.
7. SW-846 Method 8100PAH analyte list will be analyzed as SW-846 Method 8270CPAH.
8. SW-846 Method 8100TPH analyte list will be analyzed as SW-846 Method 8015BMod.

AMRO feels that the GC/MS provides more reliable and accurate data.

The price billed for the analysis is for the method requested on the chain-of-custody, not for the method that AMRO is using.

If you feel that the substitutions do not suit your purposes, please contact us to provide you with alternative services.

Please sign and return this fax if the substitution for your project is acceptable.

Signature Date:

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054



# AMRO EQUIPMENT/INSTRUMENT LIST

| Instrument Name | Manufacturer's Name | Serial Number | Purchase Date | Date Placed In Service | Location | Condition |
|---|---|---|---|---|---|---|
| Ion Chromatography DX-120 | Dionex Corporation | 901099 | 9/26/2000 | 9/26/2000 | Wet Chemistry | New |
| pH Meter | VWR Scientific | SympHony SB20 | 7/1/2001 | 7/1/2001 | Wet Chemistry | New |
| Muffle Furnace F62700 | Barnstead International | 120031 | 5/28/2002 | 6/4/2002 | Organic Extraction | New |
| Conductivity Meter | Fisher | 022241 | 7/1/2002 | 7/5/2002 | Wet Chemistry | New |
| 3D Floor Shaker | Glas-Col | VS5504 | 5/20/2003 | 6/13/2003 | Organic Extraction | New |
| Purge &Trap 6890 GC FID/PID (V6) | Agilent | VS10404045 | 2/17/2004 | 3/1/2004 | VOA Section | New |
| Model 8000-DSE Autoclave | NAPCO | 34002704 | 1/27/2005 | 2/4/2005 | Micro Section | New |
| Swift Microscope | Swift | SM-80 | 1/20/1995 | 2/15/1995 | Micro Section | Used |
| Vapodest 20 Distilling Unit | Gerhardt | VAP 003967 | 10/1/2003 | 10/9/2003 | Wet Chemistry | New |
| Ion Chromatography ICS-2000 | Dionex Corporation | 5041158 | 5/11/2005 | 5/11/2005 | Wet Chemistry | New |
| Colony Counter | Reichert | 01004-1205 | 2/3/2006 | 2/3/2006 | Micro Section | New |
| Isotemp Water Bath | Fisher | 1597051107865.00 | 2/3/2006 | 2/3/2006 | Micro Section | New |
| Microwave Digestion System | CEM | 600122 Mars | 3/15/2006 | 3/17/2006 | Metals | New |
| pH Meter | Thermo Electron Corp. | 10527 | 12/12/2006 | 12/12/2006 | Wet Chemistry | New |
| Dell PowerEdge T610 Server | Dell | | 7/1/2008 | 7/1/2008 | Computer Room | New |
| Tecator Digestion System 20 1015 | Tecator | 5244 | 10/1/2009 | 10/1/2009 | Wet Chemistry | Used |
| Perkin Elmer AAnalyst600 | Perkin Elmer | 600S9120301 | 12/15/2009 | 1/5/2010 | Metals | New |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054



# CHEMICAL RECEIVING LOG

| DATE REC. | AMRO ID | CHEMICAL | MFG. | LOT # | AMOUNT | STORAGE | EXP. DATE | DISP. DATE |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054



# INORGANIC STANDARD LOG

| Analysis | Prep. Date | Prep. By | Standard | AMRO ID ("A" Number) | Amount Used (mLs or g) | Final Vol. (mLs) | Reagent used/ ID Number | Final Conc. (mg/L) | Stardard/LCS ID ("S" Number) | Exp. Date | Storage |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

# Mercury Standard Log

**Storage**: Hg Hood

| Standard ID | Manufacturer | Lot No. | Expiration Date | Stock Conc. | Analyst |
|---|---|---|---|---|---|
| Hg Calib. Stock ID | | | | 5000 µg/L | |
| Hg ICV Stock ID | | | | 20,000 µg/L | |
| Hg Calib. Stock ID | | | | 5000 µg/L | |
| Hg ICV Stock ID | | | | 20,000 µg/L | |
| Hg Calib. Stock ID | | | | 5000 µg/L | |
| Hg ICV Stock ID | | | | 20,000 µg/L | |
| Hg Calib. Stock ID | | | | 5000 µg/L | |
| Hg ICV Stock ID | | | | 20,000 µg/L | |
| Hg Calib. Stock ID | | | | 5000 µg/L | |
| Hg ICV Stock ID | | | | 20,000 µg/L | |
| Hg Calib. Stock ID | | | | 5000 µg/L | |
| Hg ICV Stock ID | | | | 20,000 µg/L | |
| Hg Calib. Stock ID | | | | 5000 µg/L | |
| Hg ICV Stock ID | | | | 20,000 µg/L | |
| Hg Calib. Stock ID | | | | 5000 µg/L | |
| Hg ICV Stock ID | | | | 20,000 µg/L | |
| Hg Calib. Stock ID | | | | 5000 µg/L | |
| Hg ICV Stock ID | | | | 20,000 µg/L | |
| Hg Calib. Stock ID | | | | 5000 µg/L | |
| Hg ICV Stock ID | | | | 20,000 µg/L | |
| Hg Calib. Stock ID | | | | 5000 µg/L | |
| Hg ICV Stock ID | | | | 20,000 µg/L | |
| Hg Calib. Stock ID | | | | 5000 µg/L | |
| Hg ICV Stock ID | | | | 20,000 µg/L | |
| Hg Calib. Stock ID | | | | 5000 µg/L | |
| Hg ICV Stock ID | | | | 20,000 µg/L | |
| Hg Calib. Stock ID | | | | 5000 µg/L | |
| Hg ICV Stock ID | | | | 20,000 µg/L | |
| Hg Calib. Stock ID | | | | 5000 µg/L | |
| Hg ICV Stock ID | | | | 20,000 µg/L | |

ICP Calibration Standard S1 = S1-mmddyy.

This standard is also the Continuing Calibration Verification Standard (CCV) = CV-mmddyy and the Initial Performance Check
(IPC) = IPC-mmddyy.

To a presoaked 1,000-ml volumetric flask, add 50 mL of HCL and 10 mL of HNO3. Then add 5.0 ml of AMRO CAL/CCV 1 (A02446), 5.0 ml of AMRO CAL/CCV 2 (A02447), and 5.0 mL of AMRO CAL/CCV 3 (A02448). Dilute to volume with DI and transfer to a polyethylene bottle for storage. This solution is stable for up to six months following preparation.

| Date | Analyst | ID | Exp. Date | HNO3 ID | HCl ID |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

Daily Calibration Standard at 25.0µg/L = S25mmddyy.

To a 100-mL volumetric flask, add 2 mL of HCl and 2 mL of HNO3. Then pipette 0.50 mL of Intermediate Calibration Standard and dilute to volume. This standard is prepared weekly or daily for Army Corp work.

| Prep Date | Analyst | ID | Expiration Date | INTCAL ID |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054



# INORGANIC REAGENT LOG

| Analysis | Prep. Date | Reagent | AMRO ID ("A" Number) | Amount Used (mLs or g) | Final Vol. (mLs) | Final Conc. (mg/L) | Reagent ID ("R" Number) | Exp. Date | Storage | Prep. By |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

# STANDARD I.D. INDEX

| Standard I.D. | Section of Log | Brief Description |
|---|---|---|
| | | |
| | | |
| | | |

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054



# STANDARD LOG - STOCK SOLUTIONS
## ORGANIC SECTION

| Date Opened/Prep'd | Open/Prep'd by | Compound Name | Receipt/Stock ID | Source | Conc. or Purity | Amt g or µl | Final Vol. (ml) | Solvent ID/ number | Final Conc. | Units µg/µl or µg/ml | Solution ID | Storage Loc. | Exp. Date |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

NOTE: 1) AMRO Stock ID is "V" or "S", date prepared plus a letter suffix (110498B is the second stock prepared on 11/04/98).
2) Vials must be labeled with compound name, conc., and AMRO stock ID, and exp. date.

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054



# STANDARD LOG - WORKING STANDARDS
## ORGANIC SECTION

| Date Opened/Prep'd | Open/Prep'd by | Compound Name | Receipt/Stock ID | Source | Conc. or Purity | Amt. (µl) | Final volume (ml) | Solvent ID/ number | Final Conc. | Units ng/µl or µg/ml | Sol'n ID | Storage Loc. | Exp. Date |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

Notes: 1) AMRO working Std. ID is "V" or "S", date prepped, letter suffix(110498C is the third working std prepared on 11/04/98)

2) Vials must be labeled with the compound name, conc., AMRO ID, and exp. Date

**MDL (Method Detection Limit) Checklist**
**Start-up (yes / no), Start up new analyst? (yes or no), Start up new instrument? (yes or no)?**
**Start-up on a new instrument must be approved by QA Manager before client data is released.**
**Start-up on a new analyst must be approved by Section manager before analyzing independently.**

***(Reviewer's )*Name:_____On: ___/___/___**

**Information required on MDL data sheet (fill in appropriate information or verify completed):**

Instrument ID:_____
Analysis Method #:_____
Matrix(Aqueous/Soil/Methanol):_____
Prep Method/Prepped by/ Prep date:_____/_____/_____
File Name(s):_____
Analyst name:_____
Analysis date(s) – must be analyzed within holding time_____
Analytes (circle one: full list/subset – ID subset)_____

Student t-test value used – must be correct for number of replicates used to calc. MDL. Formula for SD is "n-1" t value 3.143 for 7 QC's / 2.998 for 8 QC's _____
Minimum 7 replicates – report all replicates unless documented assignable cause for not using data_____
All values in at least 3 significant figures _____
Data - with units – explain if not in proper units for the matrix_____
Mean – with units_____
Standard deviation _____
MDL – with units, must be in proper units for the matrix_____
Percent Recovery_____

Complete one: Method required concentration used per Sect. _____ of Method _____ or
MDL conc. = 1-5x est. MDL

***The Laboratory Reporting Limit must be at least three times the MDL or greater***

MDL meets method criteria per Sect._____ of Method _____ where applicable
Outliers? If yes, assignable cause(s)?_____
Math Spot Check(s) & Transcription (cite analyte(s) & file/ ID's):_____
(100% check required where spreadsheet is not used..)
Explanations/ support for anomalies/deviations:_____
Limitations of this MDL/ Plans for next MDL: _____

**STORAGE:** Orig. review and report sheets, copies of prep & analysis logs, & original raw data to instrument/Method MDL file.

**Review of this MDL Study by Section Manager_____ on ___/___/___**

**Review of this MDL Study by QA Manager _____ on ___/___/___**

**P&A (Precision & Accuracy Checklist**

**Start-up (yes / no), Start up new analyst? (yes or no), Start up new instrument? (yes or no)?**
**Start-up on a new instrument must be approved by QA Manager before client data is released.**
**Start-up on a new analyst must be approved by Section manager before analyzing independently.**

***(Reviewer's )*Name:_____ On: ___/___/___**

**Information required on P &A data sheet (fill in appropriate information or verify completed):**

Instrument ID_____
Analysis Method #_____
Matrix(Aqueous/Soil/Methanol)_____
Prep Method/Prepped by/ Prep date_____/_____/_____
File Name(s)_____
Analyst name_____
Analysis date(s) – must be analyzed within holding time_____
Analytes (circle one: full list/subset – ID subset)_____

Minimum 4 replicates – report all replicates unless documented assignable cause for not using data_____
All values in at least 3 significant figures _____
Data - with units – explain if not in proper units for the matrix_____
Mean – with units_____
Standard deviation _____
MDL – with units, must be in proper units for the matrix_____
Percent Recovery_____
%RSD_____

Complete one: Method required concentration used per Sect. _____ of Method _____ or 10-50xMDL_____

Circle one: %Rec. meets method criteria per Sect._____ of Method _____ or meets Sensibility check *(ID ones out)*

Circle one: SD(or %RSD) meets method criteria per Sect._____of Method _____ or sensibility check <50% RSD *(ID ones out)*_____

Outliers? If yes, assignable cause(s)?_____

Math Spot Check(s) & Transcription (cite analyte(s) & file/ ID's):_____
(100% check required where spreadsheet is not used.)
Explanation of/support for Deviations/ Anomalies **&/or** qualifications for use:_____

**STORAGE: originals to instrument/method P&A File; CC: Analyst(s) training file(s)**
**Review of this P&A Study by Section Manager _____ on ___/___/___**

**Review of this P&A Study by QA Manager _____ on ___/___/___**

AMRO Environmental
Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054
(603) 424-2022



# Corrective Actions Report and Status

| | | |
|---|---|---|
| Date Generated: | Finding | ☐ |
| CARS No.: | Recommendation | ☐ |
| Source No.: | Observation | ☐ |

## Description

## Corrective Action

Responsible Person: Scheduled Completion Date:

## Status

## Corrective Action Completed

Responsible Person: Date:

Laboratory Director: Date:

Quality Assurance: Date:

AMRO Environmental
Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054
(603) 424-2022



## Surveillance Report

Surveillance Leader: Surveillance No.:

Section: Surveillance Date:

Source No.:

| Requirements or Activities to be verified | Compliance | | Observations |
|---|---|---|---|
| | Yes | No | |
| | | | |

Passed ☐

Failed ☐

Additional Surveillance Required Yes ☐ No ☐

## Approvals

Quality Assurance: Date:

**AMRO Environmental Laboratories Corporation**
111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

# Non-Conforming Data Report

| | |
|---|---|
| NCD :<br>Lab Order: :<br>Client(s) :<br>Section:<br>Sample(s) Affected: | Date of Occurrence:<br>Date Discovered:<br>Discovered by: |

Description of Non-Conforming Data

Resolution

Resolution Completed by: _____ Date: _____

Approvals

_____ Date: _____
Section Supervisor

_____ Date: _____
QA Manager

**AMRO Environmental**
**Laboratories Corporation**

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

## GC AND GC/MS DATA REVIEW CHECKLIST

**LAB ORDER:** _____ **CLIENT:** _____

| | | |
|---|---|---|
| **Method:** | | **Sample(s) No.:** |
| **Analysis:** | **Matrix:** | **LIMS Batch ID:** |
| **Date of Extraction/Preparation:** | | **Date of Analysis** |

| | | | | |
|---|---|---|---|---|
| **A.** | **GENERAL** | | | |
| 1. | Copy of Prep/Extraction Log? | Y | N | NA |
| 2. | Copy of Instrument Run Log or Tune List? | Y | N | NA |
| 3. | Copy of dry weight log present? | Y | N | NA |
| 4. | Are all sample checked for preservation after VOA analysis? | Y | N | NA |
| 5. | Are all VPH Soil sample received with mL Methanol/g soil 1:1 ±25% ? | Y | N | NA |
| 6. | All samples met extraction and/or analysis holding time criteria? | Y | N | NA |
| 7. | Did the Tune pass and DFTPP or BFB injected every 12 / 24 hours? | Y | N | NA |
| 8. | Are the surrogate recoveries for each sample within the QC limits? | Y | N | NA |
| 9. | Method Blank- contaminant free(<½RL)? | Y | N | NA |
| 10. | Initial Calibration meets method criteria for all compounds reported? | Y | N | NA |
| 11. | Continuing Calibration meets method criteria for all compounds reported? | Y | N | NA |
| 12. | Are all reported results within calibration range? | Y | N | NA |
| 13. | LCS % Recovery criteria met for all compounds? | Y | N | NA |
| 14. | MS/MSD %R's and %RPD's are met for all compounds? | Y | N | NA |
| 15. | %RPD criteria met between sample and duplicate? | Y | N | NA |
| 16. | Samples checked for carry over from sample to sample due to target or nontarget overload? | Y | N | NA |
| 17. | Were manual integrations performed properly? | Y | N | NA |
| 18. | Are all data exported to LIMS, calculated and verified? | Y | N | NA |

**COMMENTS**

Analyst (s)_____ DATE: _____

REVIEWER: _____ DATE OF REVIEW: _____

# ICP DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

Method:

**Analysis:**

| | | | | |
|---|---|---|---|---|
| **A.** | **GENERAL** | | | |
| 1. | Copy of Digestion Log? | Y | N | NA |
| 2. | Copy of ICP Checklist? | Y | N | NA |
| 3. | Copy of LIMS Checklist? | Y | N | NA |
| 4. | All samples met digestion and/or analysis holding time criteria? | Y | N | NA |
| 5. | Initial Calibration Verification (ICV) meets method 6010 criteria: ±10%? | Y | N | NA |
| 6. | Initial Calibration Verification (ICV) meets method 200.7 criteria: ±5%? | Y | N | NA |
| 7. | Is the RL1 check QC at ±20%? | Y | N | NA |
| 8. | Initial Calibration Blank (ICB) free of contamination?(<½RL) | Y | N | NA |
| 9. | Continuing Calibration Verification(CCV) meets method 6010 criteria: ±10% ? | Y | N | NA |
| 10. | Initial Performance Calibration(IPC) meets method 200.7 criteria: ±5% ? | Y | N | NA |
| 11. | Continuing Calibration Blank(CCB) free of contamination?(<½RL) | Y | N | NA |
| 12. | Are CCV and CCB analyzed after every 10 samples ? | Y | N | NA |
| 13. | Is the Interference Check Solution %R between 80-120%? | Y | N | NA |
| 14. | Was the serial dilution performed? If yes was %R= 90-110? | Y | N | NA |
| 15. | Was post digestion performed? If yes was %R=75-125? | Y | N | NA |
| 16. | Was the MSA performed? | Y | N | NA |
| 17. | Method Blank- contaminant free(<½RL)? | Y | N | NA |
| 18. | Are all reported results within linear range? | Y | N | NA |
| 19. | LCS % Recovery criteria met for all compounds? | Y | N | NA |
| 20. | MS/MSD %R's and %RPD's are met for all compounds? | Y | N | NA |
| 21. | %RPD criteria met between sample and duplicate? | Y | N | NA |
| 22. | Are all data exported to LIMS, calculated and verified? | Y | N | NA |

**COMMENTS**

Analyst (s)_____ DATE: _____

REVIEWER: _____ DATE OF REVIEW: _____

# GFAA and CVAA DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

Method:

**Analysis:**

| | | | | |
|---|---|---|---|---|
| **A.** | **GENERAL** | | | |
| 1. | Copy of Digestion Log? | Y | N | NA |
| 2. | Copy of Instrument Run Log? | Y | N | NA |
| 3. | All samples met digestion and/or analysis holding time criteria? | Y | N | NA |
| 4. | Initial Calibration meets method criteria for GFAA, min. 3 std plus a blank? R >0.995 | Y | N | NA |
| 5. | Initial Calibration meets method criteria for CVAA, min. 5 std plus a blank? R >0.995 | Y | N | NA |
| 6. | Initial Calibration Verification (ICV) meets method criteria: ±10%? | Y | N | NA |
| 7. | Is the RL1 check QC at ±20%? | Y | N | NA |
| 8. | Initial Calibration Blank (ICB) free of contamination?(<½RL) | Y | N | NA |
| 9. | Initial Performance Calibration(IPC) meets criteria: ±5% ? | Y | N | NA |
| 10. | Continuing Calibration Verification(CCV) meets method criteria: ±10% ? | Y | N | NA |
| 11. | Continuing Calibration Blank(CCB) free of contamination?(<½RL) | Y | N | NA |
| 12. | Are CCV and CCB analyzed after every 10 samples ? | Y | N | NA |
| 13. | Was post digestion performed? If yes was %R=85-115? | Y | N | NA |
| 14. | Was the serial dilution performed? If yes was %R= 90-110? | Y | N | NA |
| 15. | Method Blank- contaminant free(<½RL)? | Y | N | NA |
| 16. | Are all reported results within calibration range? | Y | N | NA |
| 17. | LCS % Recovery criteria met for all compounds? | Y | N | NA |
| 18. | MS/MSD %R's and %RPD's are met for all compounds? | Y | N | NA |
| 19. | %RPD criteria met between sample and duplicate? | Y | N | NA |

**COMMENTS**

Analyst (s) _____ DATE: _____

REVIEWER: _____ DATE OF REVIEW: _____

# WET CHEMISTRY DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

Method:

**Analysis:**

| | **A. GENERAL** | | | |
|---|---|---|---|---|
| 1. | Copy of Digestion Log? | Y | N | NA |
| 2. | Copy of Instrument Run Log? | Y | N | NA |
| 3. | All samples met digestion and/or analysis holding time criteria? | Y | N | NA |
| 4. | Initial Calibration meets method criteria? | Y | N | NA |
| 5. | Initial Calibration Verification (ICV) meets method or laboratory criteria? | Y | N | NA |
| 6. | Continuing Calibration Verification(CCV) meets method criteria? | Y | N | NA |
| 7. | Continuing Calibration Verification analyzed after every 10 samples ? | Y | N | NA |
| 8. | Method Blank- contaminant free (½RL)? | Y | N | NA |
| 9. | Are all reported results within calibration range? | Y | N | NA |
| 10. | LCS % Recovery criteria met for all compounds? | Y | N | NA |
| 11. | MS/MSD %R's and %RPD's are met for all compounds? | Y | N | NA |
| 12. | %RPD criteria met between sample and duplicate? | Y | N | NA |

**COMMENTS**

Analyst (s) _____ DATE: _____

REVIEWER: _____ DATE OF REVIEW: _____

# DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

## Section: VOA, VPH, SVO, EPH, GC, ICP, GFAA, CVAA, Gen. Chem.

**Analysis:**

| | | | | |
|---|---|---|---|---|
| **A.** | **GENERAL** | | | |
| 1. | Is the QC checklist initialed by the Analyst(s) ? | Y | N | NA |
| 2. | Are all forms present? | Y | N | NA |
| 3. | Are the case narrative and log-book pages enclosed? | Y | N | NA |
| 4. | Is the correct method used? | Y | N | NA |
| **B.** | **CASE NARRATIVE** | | | |
| 1. | Does the case narrative contain problems as documented on the section checklist(s)? | Y | N | NA |

**OBSERVATIONS**

# DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

## OBSERVATIONS

## RECOMMENDATIONS

OK AS IS ☐ OK WITH MODIFICATIONS (RESUBMIT) ☐ REJECT ☐ LAB MANAGER APPROVAL REQ'D ☐

REVIEWER: _____ DATE OF REVIEW: _____
REVIEWER: _____ DATE OF REVIEW: _____
REVIEWER: _____ DATE OF REVIEW: _____
QA Manager: _____ DATE OF REVIEW: _____

## LAB. MANAGER'S APPROVAL

LAB MANGER: _____ DATE: _____

# AMRO Report Packages

**Level 1:**

1. Cover Letter
2. Work Order Sample Summary
3. Dates Report
4. Chain-Of- Custody
5. Sample Receipt Checklist
6. LIMS Case Narrative (If Applicable)
7. State Certificate (If required)
8. Data Comment Page
9. Sample Results
10. Invoice

**Level 2:**

1. Cover Letter
2. Work Order Sample Summary
3. Dates Report
4. Chain-Of- Custody
5. Sample Receipt Checklist
6. State Certificate (If required)
7. Case Narrative
8. MCP Report (If Applicable)
9. Data Comment Page
10. Sample Results and Surrogates*
11. Method Blank (s)
12. Sample Matrix Spike/Matrix Spike Duplicate
13. Sample Duplicate ( If Applicable)
14. Laboratory Control Sample
15. Invoice

**Level 3:**

1. Cover Letter
2. Work Order Sample Summary
3. Dates Report
4. Chain-Of- Custody
5. Sample Receipt Checklist
6. State Certificate (If required)
8. Case Narrative
9. MCP Report (If applicable)
10. Data Comment Page
11. Sample Results and Surrogates*
12. Method Blank (s) and Raw Data (Organic Only)
13. Sample Matrix Spike/Matrix Spike Duplicate
14. Sample Duplicate ( If Applicable)
15. Laboratory Control Sample

* *Use flag if required by client ( i.e. J, B, etc.)*

16. Initial and Continuing calibration Summaries
17. Internal Standard Summaries (GC/MS Only)
18. Raw Sample Data (If Required)
19. Miscellaneous Data:
    - 19.1 Dry Weight Sheet
    - 19.2 Extraction/Digestion logbook pages
20. Invoice

**Level 4:**

1. Cover Letter
2. Table Of Content
3. Work Order Sample Summary
4. Dates Report
5. Chain-Of- Custody
6. Sample Receipt Checklist
7. State Certificate (If required)
8. Case Narrative
9. MCP Report (If Applicable)
10. Data Comment Page
11. Sample Results and Surrogates*
12. Method Blank Summary
13. Method Blank (s) and Raw Data
14. Sample Matrix Spike/Matrix Spike Duplicate
15. Sample Duplicate ( If Applicable)
16. Laboratory Control Sample
17. Tune (GC/MS Only)
18. T-List/Injection Log/ Sequence List
19. Initial and Continuing calibration Summaries
20. Internal Standard Summaries (GC/MS Only)
21. Serial Dilutions (Inorganic Only)
22. Interference Check Sample (Inorganic Only)
23. Raw Sample Data
24. Miscellaneous Data:
    - 24.1 Dry Weight Sheet
    - 24.2 Extraction/Digestion logbook pages
25. Invoice

* *Use flag if required by client ( i.e. J, B, etc.)*

**Level 4 NJ:**

1. Cover Letter
2. Table Of Content
3. Work Order Sample Summary
4. Dates Report
5. Chain-Of-Custody
6. Sample Receipt Checklist
7. State Certificate (If required)
8. Case Narrative
9. Data Comment Page
10. Sample Results and Surrogates*
11. TIC Results after each sample results including method blank(s) (VOA and SVO Only)
12. Method Blank Summary
13. Method Blank (s) and Raw Data
14. Sample Matrix Spike/Matrix Spike Duplicate and Raw Data
15. Sample Duplicate ( If Applicable) and Raw Data
16. Laboratory Control Sample and Raw Data
17. Tune (GC/MS Only)
18. T-List/Injection Log/ Sequence List (Organic Only)
19. Initial and Continuing calibration Summaries
20. Internal Standard Summaries (GC/MS Only)
21. Interference Check Sample (Inorganic Only)
22. Serial Dilutions (Inorganic Only)
23. Raw Sample Data
24. Miscellaneous Data:
    - 24.1 Dry Weight Sheet
    - 24.2 Extraction/Digestion logbook pages
    - 24.3 Analysis logbook pages
    - 24.4 Internal Chain-Of-Custody
25. Invoice

* *Use flag if required by client ( i.e. J, B, etc.)*

**Level 5:** CLP/ CLP-like

1. Cover Letter
2. Table Of Content
3. Work Order Sample Summary
4. Dates Report
5. Chain-Of-Custody
6. Sample Receipt Checklist
7. State Certificate (If required)
8. Case Narrative
9. MCP Report (If Applicable)
10. Data Comment Page
11. Sample Results and Surrogates*
12. TIC Results after each sample results including method blank(s) (VOA and SVO Only)
13. Method Blank Summary
14. Method Blank (s) and Raw Data
15. Sample Matrix Spike/Matrix Spike Duplicate and Raw Data
16. Sample Duplicate ( If Applicable) and Raw Data
17. Laboratory Control Sample and Raw Data
18. Tune (GC/MS Only) and Raw Data
19. T-List/Injection Log/ Sequence List
20. Initial and Continuing calibration Summaries and Raw Data
21. Internal Standard Summaries (GC/MS Only)
22. Pesticide Identification Summary for Single Component and Multicomponent analytes (Form 10)
23. Interference Check Sample (Inorganic Only)
24. Serial Dilutions (Inorganic Only)
25. Method Detection Limit (Inorganic Only)
26. Raw Sample Data
27. Miscellaneous Data:
    - 27.1 Dry Weight Sheet
    - 27.2 Extraction/Digestion logbook pages
    - 27.3 Analysis logbook pages
    - 27.4 Internal Chain-Of-Custody
28. Invoice

* *Use flag if required by client ( i.e. J, B, etc.)*

*Notes: All reports are paginated*

# STORAGE BOXES TRACKING LOG

| BOX # | BOX CONTENTS | DATE SENT OUT | TAKEN BY | STORAGE LOCATION | COMMENTS |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

# SIGN OUT STORAGE BOXES LOG

| BOX # | ITEM/FOLDER | REQUESTED BY | DATE OUT | TAKEN BY | DATE BACK | STORAGE LOCATION | COMMENTS |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**AMRO Environmental**
**Laboratories Corporation**

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

# INTERIM CHANGE NOTIFICATION

SOP Number:
SOP Tittle:

Revision Number:
Revision Date:

Approvals

Section Supervisor/ Manager

Date: _____

Samir A. Naguib
QA Manager

Date: _____

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

# TOTAL PETROLEUM HYDROCARBONS BY GAS CHROMATOGRAPHY

# AND

# DIESEL RANGE ORGANICS (DROs)

## SW-846 Method 8015B Modified

Procedure Number: OL-2009

Revision No.: 5

Revision Date: 02/04/2010

Review Date: N/A

Prepared By: Kristin Albert Date: 2/4/10

Approved By: Sue Kerr Date: 2/4/10
Organic Manager

Approved By: [signature] Date: 2/4/10
Laboratory Director

Approved By: Paula Benham Date: 2/4/10
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

# TABLE OF CONTENTS


| | | Page |
|---|---|---|
| 1.0 | SCOPE AND APPLICATION | 3 |
| 2.0 | METHOD SUMMARY | 4 |
| 3.0 | DEFINITIONS | 4 |
| 4.0 | SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE | 5 |
| 5.0 | POTENTIAL PROBLEMS AND INTERFERENCES | 6 |
| 6.0 | HEALTH AND SAFETY | 7 |
| 7.0 | INSTRUMENTS AND EQUIPMENT | 8 |
| 8.0 | INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR | 8 |
| 9.0 | REAGENTS AND STANDARDS | 9 |
| 10.0 | PROCEDURE | 15 |
| 11.0 | CALCULATIONS | 24 |
| 12.0 | QUALITY CONTROL | 25 |
| 13.0 | DATA REVIEW AND STORAGE | 28 |
| 14.0 | REFERENCES | 29 |
| Attachment 1 | Standard I.D. Index | 30 |
| Attachment 2 | Stock and Working Standards | 31 |
| Attachment 3 | GC and GC/MS Data Review Checklist | 32 |
| Attachment 4 | SW-846 Method 8015M Qualification Card | 33 |
| Attachment 5A-E | Chromatograms of Standards | 34-38 |

## 1.0 SCOPE and APPLICATION

This method is used to analyze Total Petroleum Hydrocarbons with qualitative "fingerprint" identification, diesel range organics (DRO), the Connecticut DEP Extractable Total Petoleum Hydrocarbons (CT ETPH), and the Maine Health and Environmental Testing Method 4.1.25 ( Maine DRO), and the Oklahoma Department of Environmental Quality's method for Diesel Range Organics Revision 4.1( OK DRO) from extracts of waters, solids, soils and sludges, for purposes of identification and quantification. In general diesel range organics cover the range of nC10-nC28 alkanes and covers a boiling point range of approximately 170°C to 430°C. AMRO extends this method to include lubricating oil range organics (LRO) up to C36+. The CT ETPH range extends from nC9 to nC36. The identification of specific fuel types may be accomplished but may be complicated by environmental processes such as evaporation, biodegradation, or when more than one fuel type is present.

1.1 This SOP is for Method 8015B Modified, used to determine the concentrations of various hydrocarbons present in extracts from solid, aqueous, and other matrices.

1.2 Analytes and Reporting Limits:

| ANALYTE | REPORTING LIMIT Aqueous (µg/L) (1) | REPORTING LIMIT Soil (mg/kg) (2) |
|---|---|---|
| Diesel Range Organics | 50 | 50 |
| Diesel Fuel | 50 | 50 |
| Gasoline | 50 | 50 |
| Motor Oil | 100 | 100 |
| Kerosene | 50 | 50 |
| Mineral Spirits | 50 | 50 |
| Oklahoma DRO | 100 | 10 |
| Maine DRO | 50 | 5 |
| CT ETPH | 100 | 50 |
| Unidentified Hydrocarbons | 200 | 100 |

***Notes:*** 1. Aqueous based on 1000mL sample/1mL final volume.
2. Soil based on 20.0g/10mL final volume (Diesel Range Organics).
3. Soil based on 20.0g/20mL final volume (Fingerprint Analysis).
4. Soil Reporting Limits based on 100% dry weight.

## 2.0 METHOD SUMMARY

2.1 This method describes chromatographic procedures for the detection of various hydrocarbons using a Flame Ionization detector (FID). Prior to the use of this method, appropriate extraction procedures must be used. Refer to the following SOP's: OL-2003 (Separatory Funnel Liquid-Liquid Extraction, OL-2016 (Microscale Solvent Extraction (MSE) and OL-2004 (automated Soxhlet Extraction for Soil) for sample extraction. The identification of petroleum products is accomplished by comparison with reference oil standards, and quantitation of identified products using the appropriate calibration curve(s).

## 3.0 DEFINITIONS

3.1 **Diesel range organics:** All chromatographic material eluting from C-10 (decane) and C-28 (octacosane) inclusive.

3.2 **Fingerprint Analysis:** Analysis of samples for specific hydrocarbon products such as fuels and lubricating oils.

3.3 **Unknown Hydrocarbons** are defined as the collective concentration of all compounds eluting from n-nonane to n-hexatriacontane inclusive.

3.4 **Analytical Batch:** is defined as a group of field samples with similar matrices which are processed as a unit. For Quality Control purposes, if the number of samples in such a group is greater than 20, then each group of 20 samples or less are defined as separate analytical batches.

3.5 **Calibration Check Standard** or **Calibration Verification Standard (CCV)** is defined as a calibration standard used to periodically check the calibration state of an instrument. The calibration check standard is prepared from the same stock standard solution as calibration standards, and is generally one of the mid-level range calibration standard dilutions.

3.6 **Calibration Standards** are defined as a series of standard solutions prepared from dilutions of a stock standard solution, containing known concentrations of each analyte, surrogate or petroleum product of interest.

3.7 **Method Blank** is defined as an aliquot of reagent water or clean sand spiked with a surrogate standard. The laboratory method blank is treated exactly as a sample, exposed to all glassware, solvents, reagents, and equipment. A laboratory method blank is analyzed with every batch of samples, to

determine if method analytes or other interferences are present in the laboratory environment, reagents, or equipment.

3.8 **Surrogate Standards** are compounds spiked into all samples, blanks, and matrix spikes to monitor the efficiency of sample extraction, chromatographic, and calibration systems.

3.9 **Matrix Spike Samples** are separate aliquots of field samples spiked with #2 fuel oil to monitor the efficacy of sample extraction, chromatographic, and calibration systems.

3.10 **Laboratory Control Samples** are aliquots of analyte free water or soil spiked with #2 fuel oil to monitor the efficacy of sample extraction, chromatographic, and calibration systems. Maine and Oklahoma DRO methods also require an LCS/LCSD spike pair using the Diesel Component Standard spike of even carbon n-alkanes from nC10 to nC28.

3.11 **Unresolved Complex Mixture (UCM)** is the "hump" in the chromatogram caused by a complex mixture of unresolved hydrocarbon peaks.

## 4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 Water samples are collected in 1L glass bottles. Samples to be analyzed by Maine DRO and OK DRO are preserved with 5 ml of 1:1 HCl (check sample pH when received, preserve any samples with pH >2 and note this fact on the sample receiving checklist). Soil, sludge and oil samples are collected in 8 oz. wide mouth jars or other suitable containers.

4.2 Extract must be stored under refrigeration in the dark and analyzed within 40 days of extraction.

4.3 Sample extracts are custody transferred from the Extraction analyst to the GC analyst via signature in the extraction logbook, or they are transferred to cold storage by the Extraction analyst. The extracts are either loaded directly on to GC instrument for analysis or they are stored at 4°C for future use. Extracts are kept for a minimum of two months after extraction and are then properly disposed of.

## 5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 The success of these methods frequently depends on the levels of interference rather than on instrumental limitations. If interferences prevent identification or detection of analytes, the analyst must evaluate the interferences and perform the proper corrective action.

5.2 Sources of interferences can be grouped into three categories:

5.2.1 Contaminated solvents, reagents, or glassware

5.2.1.1 Method Extraction Blanks and Instrument Blanks are used to determine possible contamination of solvents, reagents, glassware, and GC equipment.

5.2.1.2 If samples are found to be contaminated from the extraction process, scrupulous cleaning of the glassware and re-extraction of the samples may be required.

5.2.2 Contaminated carrier gas or GC equipment, i.e. columns, injection port liners, & syringes.

5.2.2.1 If the GC equipment is found to be the source of contamination, proper cleaning and solvent rinsing of affected parts may be required or replacement with new ones.

5.2.3 Most organic compounds will show some response on the FID. Naturally occurring long chain alcohols and fatty acids are frequently found in waste sludges that are analyzed for the presence of TPH's. These will respond as large tailing peaks that are not part of the TPH response.

5.2.4 Contamination by carryover can occur whenever high concentration and low concentration samples are analyzed in sequence. Whenever an unusually high sample is encountered, it should be followed by injection of solvent blanks until the system is demonstrated to be free of carryover.

5.2.5 Other sources of interferences could occur from phthalate esters which can be minimized by avoiding sample contact with any plastic materials Phthalates are easily leached from plastic materials during laboratory operations or even sampling including equipment rinsing.

## 6.0 HEALTH AND SAFETY

6.1 AMRO has a laboratory safety program in place that applies to all employees. There is a safety officer as well as employees with 40 hours of OSHA training. The air quality of the laboratory has been monitored and employees are sent for physicals. All employees receive fire and safety training upon employment.

6.2 Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place.

6.3 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean laboratory coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place.

6.4 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eyewash stations and an emergency shower.

6.5 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.7 Waste control – AMRO takes whatever steps possible to minimize waste. This includes volume reduction where appropriate. AMRO also properly segregates wastes according to contaminants and a commercial vendor is utilized for waste disposal.

## 7.0 INSTRUMENTS AND EQUIPMENT

7.1 Gas Chromatograph: Analytical system complete with gas chromatograph suitable for on column and split-splitless injections. The system includes all the required accessories such as syringes, analytical columns, gases, flame ionization detectors (FIDs) and a data system.

7.2 AMRO has one complete GC/FID system: GC-FING 1. It is a Hewlett Packard Model 5890 Series II gas chromatographs equipped with electronic pressure control (EPC) and a Model 7673 autosamplers. Helium is the carrier and auxiliary make up gas. UHP hydrogen and ultra zero air are the detector gases. The GC is equipped with the following analytical column.

7.2.1 HP-5ms capillary column, 30m x 0.32mm from Agilent or comparable

7.3 The data systems for all instruments are run by Enviroquant software which is used to acquire and process all data.

7.4 Volumetric flasks, 10-mL to 100-mL, for preparation of standards.

## 8.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

8.1 Daily Maintenance:

The following procedures are performed each day an instrument is used for analysis if, in the analyst's judgement, system performance requires them:

8.1.1 The GC septum and glass liner are removed and replaced if judged necessary by the analyst.

8.1.2 Column performance is monitored by checking the response factor of key compounds which indicate column degradation and/or column bleed. Clip two or more inches from the head of the column if necessary.

8.1.3 Check that gases have adequate supply to last until the following day. Change tanks if necessary.

8.1.4 Check data file space and quant space on the MS Chem Station system.

8.2 Weekly Maintenance, or as needed:

8.2.1 Clip column

8.2.2 Swab shell weldment with methylene chloride or other appropriate solvent.

8.2.3 Clean or replace inlet seal

## 9.0 REAGENTS AND STANDARDS

9.1 The following solvents are used for sample dilutions, preparation of standards or solvent rinsing of equipment:

9.1.1 Methylene chloride, Reagent Grade and Pesticide Residue Grade chemicals or equivalent.

9.1.2 Acetone, Reagent Grade and Pesticide Residue Grade chemicals or equivalent.

9.1.3 Methanol, Reagent Grade and Pesticide Residue Grade chemicals or equivalent.

9.2 Commercially prepared stock standard solutions and solutions prepared from pure reference materials are used in this analysis.

9.3 Stock calibration standards

| | Concentration µg/ml | Vendor | Catalog Number |
|---|---|---|---|
| Diesel fuel | 50,000 | Restek | 31259 |
| o-Terphenyl | 10,000 | Restek | 31097 |
| Gasoline | 50,000 | Restek | 30206 |
| Motor Oil | 50,000 | Restek | 31464 |
| Kerosene | 50,000 | Restek | 31257 |
| Mineral Spirits | 50,000 | Restek | 31261 |
| DRO mix | 2,000 | Restek | 31064 |
| CT ETPH Mix | 1,000 | Restek | 31614 |

9.4 Preparation of calibration standards.

Diesel Fuel, Kerosene, Mineral Spirits, Gasoline and Motor Oil are all prepared in methylene chloride as described below (all stock at 50,000 µg/ml)

| Calibration Point (ng/µL) | Amount of Stock (µL) | Final Volume (mL) |
|---|---|---|
| 50* | 10 | 10 |
| 250 | 50 | 10 |
| 1000 | 200 | 10 |
| 2500 | 500 | 10 |
| 5000 | 200 | 2 |
| 10000 | 400 | 2 |
| 20000 | 800 | 2 |

* note this fuel oil #2 standard is also used as the resolution check mix for Maine DRO

The o-Terphenyl (Surrogate) calibration curve is prepared in methylene chloride as described below (Stock solution at 10,000 ug/ml).

| Calibration Point (ng/(µL) | Amount Of Stock (µL) | Final Volume (mL) |
|---|---|---|
| 2.0 | 2.0 | 10 |
| 10 | 10 | 10 |
| 25 | 25 | 10 |
| 50 | 50 | 10 |
| 100 | 100 | 10 |
| 150 | 150 | 10 |
| 250 | 250 | 10 |

9.5 The CT ETPH standard contains 15 n-alkanes ranging from C-9 to C-36 at 1000µg/mL each. This is used as a retention time marker for the range analytes. It is also used to prepare a calibration curve for methods using the response factors of a specified set of alkanes for quantitation. The Maine and OK DRO required Diesel Component Standard contains all the even carbon number normal alkanes (10 of them) from nC10 to nC28

9.5.1 Preparation of retention time marker standard. 100µL of the n-alkane stock is brought to 10 ml final volume with methylene chloride. Final concentration is 10 ng/µL for each alkane.

9.5.2 Preparation of n-alkane calibration curve.

| Calibration point (ng/µL) | Conc. of stock (µg/mL) | Amount of stock (µL) | Final volume (mL) |
|---|---|---|---|
| 1 | 1000 | 5 | 5.0 |
| 5* | 1000 | 5 | 1.0 |
| 20 | 1000 | 20 | 1.0 |
| 50* | 1000 | 50 | 1.0# |
| 100 | 1000 | 100 | 1.0 |
| 200 | 1000 | 200 | 1.0 |
| 500* | 1000 | 500 | 1.0 |
| # 50 ng/µL standard also used as CCV | * minimum 3 points for ME and OK DRO | | |

9.6 Surrogate, matrix spike and second source standards.

| | Concentration | Vendor | Catalog Number |
|---|---|---|---|
| Fuel Oil #2 | neat | Rochette Oil | N/A |
| Diesel component mix | 2,000 ug/mL | Restek | 31064 |
| n-Nonane | neat | Chem Service | F1099 |
| o-Terphenyl | neat | Chem service | F1054 |

9.6.1 Preparation of standard mixes from neat material.

| | Amount (g) | Final volume (mL) | Concentration (µg/mL) | Solvent |
|---|---|---|---|---|
| Fuel Oil #2 | 2.0 | 100 | 20,000 | Acetone |
| n-Nonane | 1.0 | 5.0 | 20,000 | MeCl2 |
| o-Terphenyl | 0.25 | 5.0 | 50,000 | Acetone |

9.6.2 Preparation of second source, initial calibration verification working standards.

| | Amount (µL) | Final volume (mL) in methylene chloride | Concentration (µg/mlL |
|---|---|---|---|
| Fuel Oil #2 (20,000 µg/ml) | 250 | 10.0 | 500 |
| n-Nonane (20,000 ug/mL) | 12.5 | 5.0 | 50 |
| o-Terphenyl (50,000 µg/ml) | 10 | 10.0 | 50 |

9.6.3 Preparation of surrogate and matrix spike solutions.

The #2 fuel oil standard (see sec 9.6.1) prepared in acetone from neat material is used as is to spike laboratory control samples and matrix spike samples.

The o-terphenyl standard (see sec 9.6.1) prepared in acetone from neat material is diluted 5X with acetone to prepare the working solution with a final concentration of 1,000 µg/ml and 20ug/mL (for Maine DRO)

Diesel component spike mix (for Maine and OK DRO): Prepared from a certified solution containing the 10 alkanes listed in Table 1 of the Maine DRO Method 4.1.25 and Table 1 of the OK DRO method. The stock solution at 2,000ug/mL is dilulted in acetone to make a working solution at 50 ug/mL per component.

## 9.7 TRACKING OF ANALYTICAL STANDARDS

9.7.1 Chemical Receipt:

9.7.1.1 The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a four digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and the disposal dates are completed by AMRO employees when standards are used up or disposed. Refer to SOP " Sample Management" GL-1006.

9.7.2 Standards Preparation: Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

9.7.2.1 AMRO purchases pesticide residue grade solvents for organic standard preparation and organic sample extractions.

9.7.2.2 All stock standards that are purchased must include a certificate of analysis from the manufacturer.

9.7.3 Standard Tracking: It is important to be able to track all analytical standards back to their sources. The following procedure is used by AMRO personnel to accomplish this:

9.7.3.1 Organic Standard Tracking: The Organic Standards Tracking System consists of three logbooks. One Standard ID Index logbook (Attachment 1) , one for Stock Standards, and one for Working Standards (Attachment 2).

9.7.3.2 Stock Standard: Whenever a stock standard solution is opened or is prepared from a neat compound, this information is recorded in the Stock Standard Logbook section of the standard tracking log. The stock solution is assigned a new ID number consisting of the letter "V" or "S", the date of preparation plus a letter suffix starting with the letter "A". This ID along with the compound name, concentration and initials of the person making the stock are included on the label. Stock standards are good one year from the date prepared or the date provided by manufacturer, whichever is shorter. Example - The fourth volatile standard prepared on April 15, 1989 would have the

standard ID V041589D. This number will be recorded in the log book and written on the container.

9.7.3.3 Working Section: Whenever a working standard solution opened or is prepared, whether from AMRO stocks or commercially obtained stocks, the information is recorded in the Working Standard section of the standard tracking log. The solution is assigned a new ID number based on the section "V" or "S", the date it is prepared plus a letter suffix. This number along with a descriptive name, concentration (or conc. varied) and the initials of the person preparing the solution are included on the label. The expiration of working standards vary depending on the use. Standards should be used in accordance with method specifications and manufacturer's instructions.

9.7.3.4 Standard Storage: Standards and reagents are stored per method specifications and manufacturer's instructions. Semivolatile, Pesticide, PCB, Petroleum standards are stored in refrigerators at 4±2°C, freezers at minus 10 °C, and ambient temperature depending upon the method and manufacturer requirements.

9.7.3.5 Solvent Check Analysis

All extraction procedures are performed using pesticide residue grade solvents and the first method or procedural blank analysis is used when a new lot number is received to verify the absence of target analytes. Also, Before a new vendor's solvent is used for sample extraction a special check of the concentrated solvent (not a method blank) is required.

## 10.0 PROCEDURE

10.1 AMRO currently has one GC-FID instrument: FING 1.

10.2 GC Operating Conditions: all analysis:

10.2.1 Injection volume: 2 µL

10.2.2 FID Temperature: 320°C

10.2.3 Injection Port Temperature: 300°C

10.2.4 Initial Temperature: 50°C

10.2.5 Initial time: 2.0minutes

10.2.6 Rate 1: 35°C/minute

10.2.7 Final Temperature 1: 100°C

10.2.8 Final Time 1: hold 0.0 minutes

10.2.9 Rate 2: 25°C/minute

10.2.10 Final Temperature 2: 320°C

10.2.11 Final Time 2: hold 15.77 minutes

10.2.12 Total Run Time 28 min

10.3 Injection Run Log:

10.3.1 All injections must be recorded in the injection runlog created by the macro inject.mac and stored in the Excel/InjLogs directory on each instrument. The runlog must indicate the appropriate sample, standard, and the instrument. Each page in the hardcopy logbook must be signed by the analyst who is responsible for its accuracy.

10.4 Retention Time Windows:

10.4.1 Before establishing retention time windows, make sure that the chromatographic system is operating reliably and that the system conditions have been optimized for the target analytes and surrogates in the sample matrix to be analyzed.

10.4.2 Make three injections of all single and all multi-component analytes over the course of a 72-hour period. Serial injections or injections over a period of less than 72 hours may result in retention time windows that are too tight.

10.4.3 Record the retention times for all single analytes and three to five major peaks for multi-component analytes. Calculate the mean and standard deviation of the three absolute retention times of each single analyte and those peaks.

10.4.4 If the standard deviation of the retention times for a target compound is 0.000, then the laboratory uses a default standard of 0.01 minutes. Recording retention times to three decimal places rather than two should minimize the instances in which the standard deviation is calculated as 0.000.

10.4.5 The width of the retention time window for the single analytes, each major constituent in multi-component analytes and surrogates is defined as ±3 times the standard deviation of the mean absolute retention time established during a 72-hour period. Determination of the retention time windows for the DRO range marker analytes and surrogates are required . If the default standard deviation is employed, ½ the width of the window will be 0.07 minutes.

10.4.6 The absolute retention time windows must be calculated for each analyte and surrogate on each chromatographic column and instrument. New retention time windows must be established when a new GC column is installed.

10.4.7 Establish the center of the window for each analyte and surrogate by using the absolute retention time for each analyte and surrogate from the calibration verification standard at the beginning of the analytical shift. For samples run during the same shift as an initial calibration, use the retention time of the mid-point standard of the initial calibration.

10.4.8 If the daily CCV falls outside the window, the analyst will evaluate the instrument and will recalibrate if necessary. For samples run during the same analytical shift as the Initial Calibration, use the RT of the midpoint standard. However, the experience of the GC analyst should weigh heavily in the interpretation of the chromatograms. The analyst may therefore qualify an analyte as present outside the RT window by using pattern recognition.

10.5 Initial Calibration

10.5.1 A minimum of a five point curve is used for the initial calibration curve ( *three points minimum for Maine DRO Method 4.1.25 and the Oklahoma DRO method Rev.4.1*). The following components and their corresponding concentrations are listed in the reagent section of this document. The response factor (RF) for each component is calculated.

$$\frac{\text{Area of component}}{\text{ng injected}} = \text{RF}$$

10.5.2 The average RF is calculated by averaging the RF's from each calibration Level. The %RSD must be less than or equal to 20%. Any curve that is over 20% must be evaluated using linear regression. The criteria for linear regression is the coefficient of determination must be 0.99 or greater. If this criteria cannot be met a quadratic equation must be used. The criteria is a coefficient of determination of 0.99 or greater. If none of these criteria are met the instrument must be recalibrated. A $6^{th}$ point must be added to use a quadratic regression. Do not force the origin, and do not use (0,0) as a calibration point.

10.5.3 The response factors for the Connecticut EPTH method are calculated by summing the areas of the 15 components listed in the CT ETPH Mix and dividing by the total amount injected for each calibration level.

10.5.4 The response factors for the Maine DRO method 4.1.25 and OK DRO Rev.4.1 are calculated by summing the integrated area, baseline to baseline, of the 10 alkane components in the Diesel Component Mix and dividing this area by the total amount injected for each calibration level.

10.6 Continuing Calibration Verification (CCV)

10.6.1 Baseline subtraction is performed at the instrument level by electronic subtraction of a stored "blank run". This "column compensation data" needs to be updated periodically as column bleed and length change. Do not update the column compensation to compensate for an elevated baseline due to contamination of the GC system with high boiling material. This will result in a negative baseline once the system has cleared itself of this material.

10.6.2 Updating the column compensation data.

10.6.2.1 Close the data acquisition software (Chemstation) for the instrument.

10.6.2.2 On the GC keypad press col comp 1 (or 2) and enter.

10.6.2.3 The GC will go through the normal EPC and oven program.

10.6.2.4 Check the result by running a solvent blank.

10.6.3 Verify calibration at the start of each analytical sequence by injecting a #2 fuel oil standard at 2500 ng/ul and an o-terphenyl standard at 50 ng/ul. The #2 fuel oil standard response must be ± 15% of the true value, the o-terphenyl standard response must be ± 15% of the true value. A closing or continuing standard is required every 12 hours and is evaluated by the same criteria. The closing CCV concentration should not be the same as the initial CCV. If two or more initial CCVs fail in a row, then after corrective action to fix the problem, two passing CCVs in succession must be analyzed to demonstrate calibration verification before continuing with sample analyses.

10.6.4 Verify calibration for the CT ETPH method at the start of each analytical sequence containing CT ETPH samples by injecting the n-alkane CCV mix and o-terphenyl standard ( 50ug/mL). If the response is within 30% of the true value then the calibration is verified and CT ETPH samples can be analyzed. A passing continuing or closing standard is required every 12 hours. A discrimination check must be performed on the CCV at the beginning of each sequence and pass the requirement that the RFs for each alkane must be within 20% of the average response factor. This discrimination check requirement does not apply to the closing CCV.

10.6.5 Verify calibration for the Maine DRO method and OK DRO methods at the start of each sequences containing Maine or OK DRO samples by injecting the n-alkane CCV mix and o-terphenyl standard ( 50ug/mL). If the response is within 20% of the true value then the calibration is verified and Maine DRO / OK DRO samples can be analyzed. A passing continuing standard is required every 20 samples and at the end of each sequence. A resolution check should be performed at the beginning and end of each analytical batch if Maine DRO samples are present in the queue. Pristane should resolve from n-C17 and phytane should resolve from n-C18 in the resolution check mix (50ug/mL fuel oil #2 standard). The peaks are considered resolved

when the smallest peak height to valley difference is greater than 60% of the smaller peak height. If this criteria is not met then all the associated data must be rerun or flagged. The recovery of the resolution check standard should be between 60% and 140%.

10.6.6 The verification of calibration curves for other products such as gasoline, kerosene, and mineral spirits is only done at the start of an analytical sequence. The standard response must be ± 15% of the true value. A closing CCV is required only for fuel oil#2 and o-terphenyl because fuel oil #2 is representative of all analyte fuel types. Samples can be analyzed for all these products for 24 hours as long as the #2 fuel and o-terphenyl CCV's continue to pass.

10.6.7 Retention time marker standard (sec 9.5.1). This standard is run before and after each analytical sequence but need not be injected within the 12 hour window. If a #2 fuel oil standard and an o-terphenyl standard are serving as continuing calibration standards (marking the end of one analytical sequence and the start of another) the retention time marker standard may be run either before or after the continuing calibration standards. The n-alkane CCV can also serve as the retention time marker.

10.6.8 An instrument blank is run after the opening or continuing standards. This may be an extraction blank or a methylene chloride blank. The o-terphenyl standard can also serve as the instrument blank.

10.6.9 If the standard analyzed after a group of samples exhibits high response (over the applicable limit), and the analyte was not detected in the samples, it is acceptable to report ND results without qualification. If Department of Defense (DOD) samples are present in the queue then two terminal CCVs must be analyzed at the end of the sequence to demonstrate a consistent high bias. In contrast, if the response in the standard is low (below the applicable limit), the sample must be reanalyzed.

10.6.10 Note the OK DRO method requires an instrument or method blank analysis after every 10 samples to check for target analyte carryover.

10.7 Data Interpretation

10.7.1 Begin to examine the sample chromatograms. Check the baseline integration and compare it to the baseline for the sample blank. The baseline should be about the same as the sample blank. In the case of poor chromatography or matrix interferences, this baseline may be difficult to determine. The technical judgement and experience of the analyst must be used in making accurate baseline determinations. Baseline determinations must be verified by a supervisor or data reviewer to confirm analyst interpretation of the baseline. In some cases adjustment to the GC may be required.

10.7.2 Locate the Surrogate Standard peak (OTP) and quantify it. The computer will automatically calculate the recovery. If the % recovery of OTP in the sample is off by more than the current limits, re-extraction may be necessary. The analyst may re-analyze the samples to determine if a bad injection was made.

10.7.3 Check to determine if the surrogate is identified correctly by matching retention times with the daily standard. If any interferences are observed associated with the surrogate the data should be flagged and noted in the narrative. The analyst should consult a supervisor if retention time shifts occur.

10.8 Petroleum Product Identification in 'Fingerprint Analysis'

10.8.1 Use a current hard copy of the daily standard to compare to the samples for identification purposes. Look for the presence of a gaussian shaped window of un-resolved peaks in the chromatogram, the presence of such an envelope is indicative of a possible petroleum product and should be examined for a positive match with reference materials.

10.8.2 Light-weight products such as gasoline, kerosene, jet fuel or mineral spirits may not show any un-resolved hydrocarbon window at low concentrations. If there is a group(s) of early eluting peaks in the sample chromatogram check them against the reference standards for the aforementioned products for retention time matches. Please note that these low boiling point products are particularly susceptible to weathering effects, so differences in the relative amounts of the peaks should be expected. Samples showing a reasonable degree of match with the reference material patterns should be quantitated as the matching petroleum product with the notation that it is weathered. If

there is no identifiable match to a calibrated petroleum product then report the results as an unidentified hydrocarbon (nC9-nC36 range).

10.8.3 Gasoline is more appropriately analyzed by purge and trap (8015B GRO Mod) and should be reported as an estimated value by this method.

10.8.4 To identify which petroleum product is present in an extract, a detailed evaluation must be made. Listed below is guidance information to use in identifying components.

10.8.4.1 Shape, width and elution time of the UCM 'hump'.

10.8.4.2 Range and relative ratios of n-alkane components.

10.8.5 Characteristics of typical petroleum products:

10.8.5.1 Unleaded Gasoline - Asymmetrical, C8-C12 no unresolved area

10.8.5.2 Mineral Spirits - symmetrical, C8 - C14

10.8.5.3 Kerosene - symmetrical, C8-C18

10.8.5.4 Fuel Oil #2 - symmetrical, C9 - C24

10.8.5.5 Motor Oil - symmetrical, C18 - C36+

10.8.6 Sample chromatograms that do match any of the calibration standards are quantitated as 'unknown hydrocarbons' using the #2 fuel oil response factor. Integration is done by projecting a horizontal baseline from nC-9 to nC-36.

10.8.7 Sample chromatograms that are to be reported as Diesel Range Organics (DRO) are Integrated by projecting a horizontal baseline from C-10 to C-28. These samples are quantitated using a response factor generated by integrating the #2 fuel oil curve using the same criteria, or in the case of Maine and OK DRO analyses using the Diesel Component Standard response factor.

10.8.8 Sample chromatograms that are to be reported as CT ETPH are integrated by projecting a horizontal baseline from nC9 to nC36 and quantified using the initial calibration specified in Sec.10.5.3.

10.8.9 Sample chromatograms that are to be reported as Maine DRO or OK DRO are integrated by projecting a horizontal baseline from nC10 to nC28 and quantified using the initial calibration specified in Sec. 10.5.4. Note the individual calibrated n-alkanes in the DRO window should also be reported for OK DRO.

10.8.10 Note the presence of any extraneous peaks in the sample that are not present in the reference standards used for qualitative identification. Report the possible presence of gasoline or significant UCM area outside the DRO window for Maine DRO reports.

10.8.11 Note additional evidence of weathering, including degradation of low boiling point components and degradation of the low boiling point end of the unresolved complex mixture.

10.8.12 All sample responses must fall within the calibration range. Re-analysis at a dilution must occur if the sample response exceeds the maximum calibration range.

10.8.13 Identification based on the guidelines in ASTM Method 3328 is recommended. Four possible levels of identification are given.

10.8.13.1 MATCH - This level of identification indicates an exact or near exact match between the sample and reference standard Indicate the name of the component.(i.e. "Fuel Oil #2", conc. = 500 mg/kg, reporting limit (50 mg/kg.).

10.8.13.2 PROBABLE MATCH - This indicates a nearly exact match, with the exception of small differences that can be specifically attributed to the presence of extraneous components or moderate weathering effects. Indicate the name of the component same as above but flag that the sample is weathered.

10.8.13.3 INDETERMINATE - This level indicates that the sample is too different from any reference standard to make a definitive identification. Include a carbon range and quantify as an unknown hydrocarbon against a known standard in the same range. Indicate unidentified hydrocarbon, concentration, and reporting limit with a flag on the results to indicate what the result was quantitated as.

10.8.13.4 MISMATCH - This level of identification should only be used when a client has submitted a possible source standard for comparison with the sample and the source does not match the sample. Use this level in conjunction with one of the other 3 levels of identification for both the sample and the suspected source.

10.8.13.5 If there is no indication of the presence of a petroleum product report "No Petroleum Product Detected" (N.D.) and the reporting limit. All samples and blanks that are reported as ND are integrated either as diesel range organics or as unidentified hydrocarbons (C-9 to C-36). This is done to confirm the response is below the reporting limit.

10.8.13.6 The integration of compounds for standards and samples should be performed to be in the same manner as the initial calibration integration. Cases where the initial calibration is in question should be investigated to ensure it is not related to poor maintenance, damaged or defective column, or other issues which should be solved before further analysis.

10.8.13.7 The initial calibration curve must be printed and stored with the calibration records to document passing the required QC criteria.

10.8.14 Each sample analysis must be bracketed with an acceptable continuing calibration check CCV's (each 12-hr. shift or interspersed every 20 samples, whichever comes first). DOD samples will be analyzed at intervals of no greater than 10 injections between CCV's.

## 11.0 CALCULATIONS

11.1 Necessary calculations and formulas can be found throughout the text as applicable to each section.

11.2 Average Response Factor Calibration. Use the following equation to calculate the concentration of analytes in aqueous samples:

$$\text{Concentration (mg/L)} = \frac{(As)\,(Vf)\,(Df)}{(Rfa)\,(Vs)\,(Vi)}$$

Where:
**As** = Area counts for the analyte in the sample.
**Vs** = Initial volume of the sample extracted in mL.
**Vf** = Final volume of sample extract in mL.
**Df** = Dilution factor.
**Vi** = Volume of extract injected in ul. The injection volume for samples and standards must be the same
**Rfa** = Average response factor from the initial calibration curve (area per ng injected).

11.3 Average Response Factor Calibration. Use the following equation to Calculate the concentration of analytes in non aqueous samples:

$$\text{Concentration (mg/KG)} = \frac{(As)\,(Vf)\,(Df)}{(Rfa)\,[(W)(\%S)]\,(Vi)}$$

Where:
**As** = Area counts for the analyte in the sample.
**W** = Initial weight of the sample in grams.
**%S** = Percent solids expressed in decibel form (91% = 0.91). If not applicable set at 1.0.
**Vf** = Final volume of sample extract in mL.
**Df** = Dilution factor.
**Vi** = Volume of extract injected in ul. The injection volume for samples and standards must be the same
**Rfa** = Average response factor from the initial calibration curve (area per ng injected).

## 12.0 QUALITY CONTROL

12.1 Initial Demonstration of Proficiency:

12.1.1 The ability of AMRO to produce accurate and precise data is demonstrated per instrument/per analyst for each method. It consists of a Method Detection Limit Study (MDL) and Precision and Accuracy Study (P&A) for each instrument and each matrix on an annual basis. The laboratory demonstrates initial proficiency with each combination of sample preparation and determinative methods that it utilizes by generating data of acceptable precision and accuracy for a reference sample containing the target analytes in a clean matrix. The reference samples are prepared from a spiking solution containing each analyte of interest at a concentration that is 10-50 times the MDL for each analyte in that matrix, or at the routine concentration of LCS's (Laboratory Control Samples). P & A Studies are required to be updated annually by evaluating a minimum of 4 LCS's.

12.2 Method Detection Limit (MDL) Study:

12.2.1 The method detection limit is defined in 40 CFR 136 Appendix B. The purpose of an MDL is to establish the minimum concentration of each analyte greater than zero that can be reported with 99% confidence. An MDL study consists of at least 7 replicates of spiked deionized water (ideally standard set at ½ RL or lower), which are extracted and analyzed as normal samples. The standard deviation of the results of these analyses is multiplied by the appropriate student T-test value and the resulting value is deemed the method detection limit for that specific analyte.

12.2.2 MDL studies of each analyte must be reported annually for each instrument, column, matrix, and extraction method. To ensure that reasonable MDL values are determined, an MDL check sample is analyzed by spiking an interference free matrix with all target analytes at about two times the determined MDL. The MDL check sample is taken through the same process as the MDL. If any of the target analytes are not detected, the MDL study is modified and repeated until the MDL check sample is detectable. The MDL check will be analyzed quarterly and after major instrument maintenance or changes in the instrumentation or instrumental conditions to verify sensitivity of the method.

12.3 Precision &Accuracy:

12.3.1 Accuracy is a measure of the degree to which the analytical result approaches the "true" value of the concentration of the analyte being determined. Precision in the laboratory is determined by the comparison of duplicates, where duplicate samples result from an original sample that has been split for identical analyses. Precision and Accuracy in the laboratory is assessed initially by the analyses of a minimum of 4 replicate samples at a mid-level point of the expected range. The percent recoveries and Relative Standard Deviations (RSD) are evaluated and compared to method specifications or default limits where applicable.

12.3.2 Accuracy is also assessed by the regular analysis of known standards such as the Laboratory Control Samples (LCS), and matrix and analytical spikes. Accuracy within the laboratory is expressed in terms of percent recovery.

12.3.3 The precision of data is regularly evaluated by determining the relative percent difference (RPD) of duplicate (replicate) analyses.

12.4 Method Blanks are prepared at a frequency of one for every batch of up to 20 samples of the same matrix, prepared at the same time, by the same procedures. When sample extracts are subjected to cleanup procedures, the associated method blank must also be subjected to the same procedures.

12.4.1 The results for the method blank should be < the RL for all analytes and ½ the RL if DoD project samples are in the batch. If the method blank results do not meet the acceptance criteria, then corrective action is taken to locate and reduce the source of the contamination and the associated sample extracts are reanalyzed or re-extracted if necessary.

12.5 Matrix spike (MS) and Matrix Spike Duplicate (MSD) are prepared at a frequency of one for every batch of up to 20 samples of the same matrix, prepared at the same time, by the same procedures.

12.5.1 Samples must be selected for spiking at random and rotated among clients and sites from batch to batch. In some cases, the client may specify which sample is to used for MS/MSD; if not , the laboratory shall pick a representative sample based on the following:

12.5.1.1 MS/MSD shall not be performed on Trip Blank, Rinsate Blank or Field Blank.

12.5.1.2 Adequate sample weight/volume.

12.5.1.3 Client requested QC deliverables.

12.6 Laboratory Control Samples are prepared at a frequency of one for everybatch of up to 20 samples of the same matrix, prepared at the same time, by the same procedures. The LCS consists of an aliquot of clean matrix similar to the sample matrix and of the same weight or volume. The LCS is spiked with the same compounds at the same concentrations as the MS and MSD. When the results of the MS and MSD analysis indicates a potential problem due to the sample matrix itself, the LCS results are used to verify that the lab can perform the analysis in a clean matrix. Note the OK DRO method requires an LCSD per batch and a maximum batch size of 10 samples.

12.7 Analysis of the MS, MSD, and LCS require the same procedures employed for the original sample and the concentration of each analyte spiked is calculated.

12.8 Calculation of Recovery: Accuracy is estimated from the recovery of spiked analytes from the matrix of interest. The recovery of each spiked analyte is calculated using the following formula:

$$\text{Recovery} = \%R = \frac{Cs - Cu}{Cn} \times 100\%$$

Where:
Cs = Measured concentration of the spike sample aliquot
Cu = Measured concentration of the unspike sample aliquot (use 0 for LCS)
Cn= Nominal (theoretical) concentration increase that results from spiking the sample, or the nominal concentration of the spike aliquot (for LCS).

12.9 Calculation of Precision: Precision is estimated from the relative percent difference (RPD) of the concentrations (not the recoveries) measured for the MS/MSD. To calculated the RPD, use the following formula:

$$RPD = \frac{|Conc.\ 1 - Conc.\ 2|}{((Conc.\ 1 + Conc.\ 2)/\ 2)} \times 100$$

Where:
Conc. 1 = Measured concentration of the first sample aliquot
Conc. 2 = Measured concentration of the second sample aliquot

12.10 Unless specifically excepted below, all recoveries control limits for surrogates, matrix spikes and laboratory control sample control are based on the laboratory control charts. The control charts are updated annually.

12.11 For all batches containing DOD project samples the default acceptance criteria for LCS recoveries is 60% to 140%.

12.12 Maine DRO LCS and MS spike recovery contorl limits are 60% to 140% and the RPD for LCS/LCSD or MS/MSD results should be less than 20%.

12.13 OK DRO LCS/LCSD pairs must demonstrate accuracy and precision within 20% for waters and 40% for soils.

12.14 If the surrogate recovery for a Maine DRO sample is less than 50% then repeat the analysis and flag the results if it fails this criteria in the rerun.

## 13.0 DATA REVIEW AND STORAGE

13.1 All cross-outs must be a single line and should be initialed and dated. Analyst review is documented on the GC and GC/MS Data Review Checklist (Attachment 3).

## 14.0 REFERENCES

14.1 40 CFR Part 136 Appendix B, 1984.

14.2 USEPA Office of Solid and Hazardous Waste - SW-846 Method Chapter 1, Rev. 1 7/92.

14.3 Method 8000B Revision 2, December 1996. SW846, Update III, USEPA.

14.4 Method 8015B Revision 2, December 1996. SW846, Update III, USEPA.

14.5 Shell for Analytical Chemistry Requirements, Version EM 200-1-3, 02/01/01.

14.6 Separatory Funnel, Liquid-Liquid Extraction, OL-2003.

14.7 Microscale Solvent Extraction (MSE), OL-2016.

14.8 Automated Soxhlet Extraction for Soil, OL-2004.

14.9 Department of Defense Quality Systems Manual For Environmental Laboratories, Version 3, January 2006.

14.10 Method For Determining Diesel Range Organics, Maine, Method 4.1.25, 09/06/95.

14.11 Analysis of Extractable Total Petroleum Hydrocarbons (ETPH) using Methylene Chloride Gas Chromatograph/Flame Ionization Detection , CT DEP , March 1999

14.12 Oklahoma Department of Environmental Quality, Methods 8000/8100 (modified) Diesel Range Organics, Revision 4.1, 10/22/97

# Attachment 1

AMRO Environmental Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

## STANDARD I.D. INDEX

| Standard I.D. | Standard Logbook ( Stock or Working) | Brief Description |
|---|---|---|
| | | |
| | | |
| | | |

# Attachment 2

AMRO Environmental Laboratories Corporation
111 Hertick Street
Merrimack, NH 03054

STANDARD LOG - STOCK SOLUTIONS
ORGANIC SECTION

| Date Opened/Prepared | Opened/Prepared by | Compound Name | Reagent/Stock ID | Source | Conc. or Purity | Amt (g) or (µl) | Final Vol. (ml) | Solvent ID# Number | Final Conc. | Units (g/kg) or (µg/ml) | Solution ID | Storage Loc. | Exp. Date |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

Notes: 1) AMRO stock Std ID is "V" or "S", date prepared, letter suffix(110498B is the second stock std prepared on 11/04/98)

2) Vials must be labeled with the compound name, conc., AMRO stock ID, and exp. Date

qa/qc-reviews/standardslog.wpd Rev. 4 05/00

AMRO Environmental Laboratories Corporation

111 Hertick Street
Merrimack, NH 03054
(603) 424-03054

STANDARD LOG - WORKING STANDARDS
ORGANIC SECTION

| Date Opened/Prepared | Prepd/Opened by | Compound Name | Reagent/Stock ID | Source | Conc. or Purity | Amt. (ml) | Final volume (ml) | Solvent ID# number | Final Conc. | Units (g/kg) or (µg/ml) | Soln ID | Storage Loc. | Exp. Date |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

Notes: 1) AMRO working Std ID is "V" or "S", date prepared, letter suffix(110498C is the third working std prepared on 11/04/98)

2) Vials must be labeled with the compound name, conc., AMRO ID, and exp. Date

qa/qc-reviews/standardslog.wpd Rev. 3 08/13/01

# Attachment 3

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

## GC AND GC/MS DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

| | |
|---|---|
| Method: | Sample(s) No.: |
| Analysis: | Matrix: |

| | | | | |
|---|---|---|---|---|
| A. | GENERAL | | | |
| 1. | Copy of Prep/Extraction Log? | Y | N | NA |
| 2. | Copy of Instrument Run Log or Tune List? | Y | N | NA |
| 3. | Copy of dry weight log present? | Y | N | NA |
| 4. | Are all sample checked for preservation after VOA analysis? | Y | N | NA |
| 5. | All samples met extraction and/or analysis holding time criteria? | Y | N | NA |
| 6. | Did the Tune pass and DFTPP or BFB injected every 12 hours? | Y | N | NA |
| 7. | Are the surrogate recoveries for each sample within the QC limits? | Y | N | NA |
| 8. | Method Blank - contaminant free( < ½ RL)? | Y | N | NA |
| 9. | Initial Calibration meets method criteria for all compounds reported? | Y | N | NA |
| 10. | Continuing Calibration meets method criteria for all compounds reported? | Y | N | NA |
| 11. | Are all reported results within calibration range? | Y | N | NA |
| 12. | LCS % Recovery criteria met for all compounds? | Y | N | NA |
| 13. | MS/MSD %R's and %RPD's are met for all compounds? | Y | N | NA |
| 14. | %RPD criteria met between sample and duplicate? | Y | N | NA |
| 15. | Samples checked for carry over from sample to sample due to target or nontarget overload? | Y | N | NA |
| 16. | Are all data exported to LIMS, calculated and verified? | Y | N | NA |

COMMENTS:

Analyst (s) _____ DATE: _____

REVIEWER _____ DATE OF REVIEW: _____

qc/qcmemos/Forms/gcmschecklist Rev. 2 08/13/01

Property of AMRO Environmental Laboratories Corporation

Attachment 4

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

## QUALIFICATION CARD FOR TPH/DRO SW-846 METHOD 8015Mod.

Trainee: _____ Signature: _____

Trainer: _____ Signature: _____

I. Knowledge Factors:

SOP Title: _____ Revision Number/Date: _____

| | | | |
|---|---|---|---|
| 1. Did the Trainee read and understand the above SOP? | Yes ☐ | No ☐ | NA ☐ |
| 2. Was the Trainee instructed on how to properly fill out the documentation? | Yes ☐ | No ☐ | NA ☐ |
| 3. Has the Trainee been instructed on the proper procedures for addressing potential problems? | Yes ☐ | No ☐ | NA ☐ |

II. Practical Factors:

| | | | |
|---|---|---|---|
| 1. Has the Trainee completed a Precision and Accuracy Study? | Yes ☐ | No ☐ | NA ☐ |
| 2. Has the Trainee completed an acceptable Performance Evaluation sample? | Yes ☐ | No ☐ | NA ☐ |
| 3. Did the Trainee completed an acceptable Laboratory Control Sample (LCS)? or PT study* | Yes ☐ | No ☐ | NA ☐ |
| 4. Has the Trainee performed manual integration as indicated in the SOP? | Yes ☐ | No ☐ | NA ☐ |

Completion Date: _____ Trainer's Signature: _____

I _____ have read, understood and follow the above method/SOP, which is in use at AMRO Laboratories for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

Section Manager/ Supervisor: _____ Date: _____

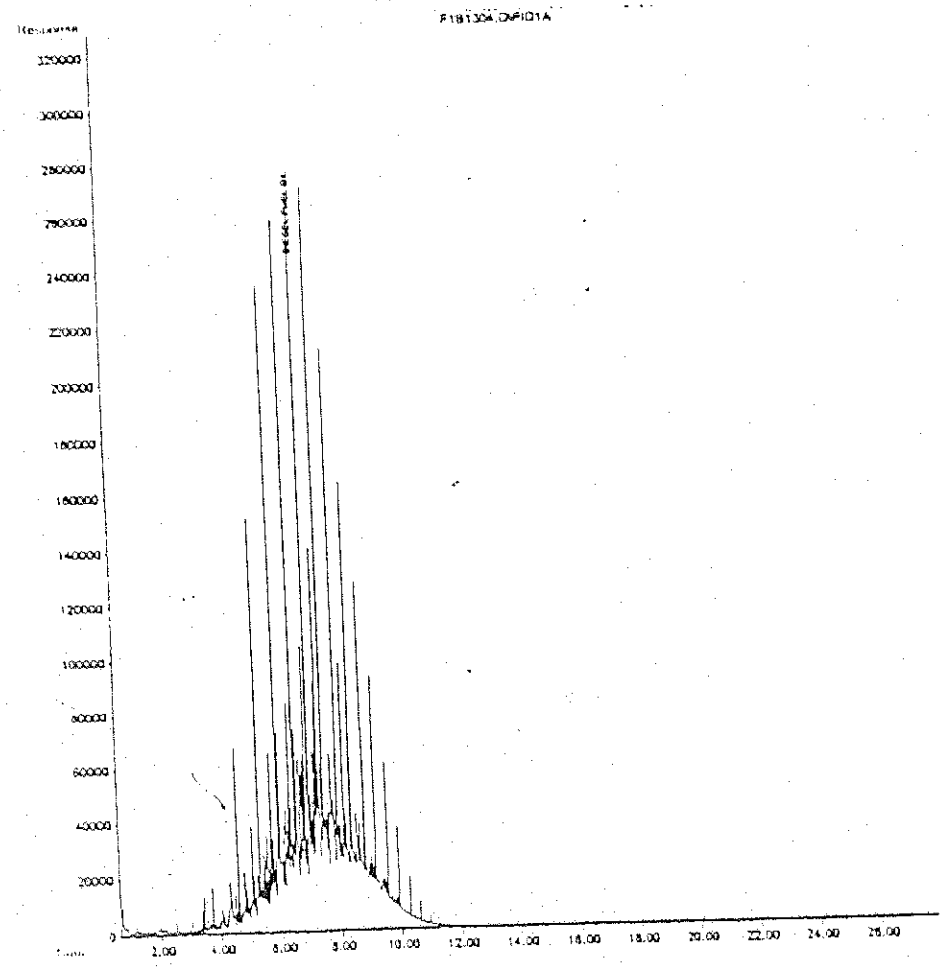
QA Manager: _____ Date: _____

qc/qcmemos/forms/TPH/DRO8015Mod.qualcard Rev. 0 08/13/01

Property of AMRO Environmental Laboratories Corporation

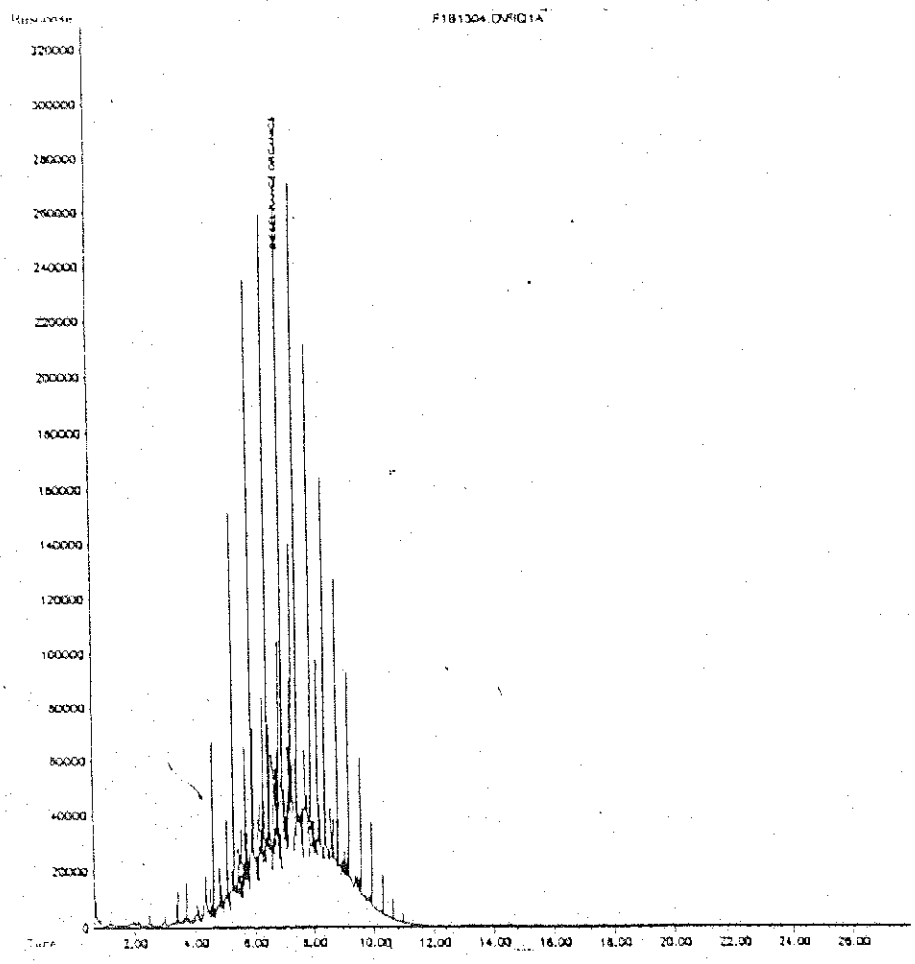
# Attachment 5A

```
File       : C:\HPCHEM\1\DATA\082703\F1B1304.D
Operator   : KD
Acquired   : 27 Aug 2003   2:18 pm using AcqMethod FING1_32.M
Instrument :   Fing1
Sample Name: (#2 FUEL OIL 2500 NG/UL) DF-1 (FING_S)
Misc Info  : $0701031
Vial Number: 6
```



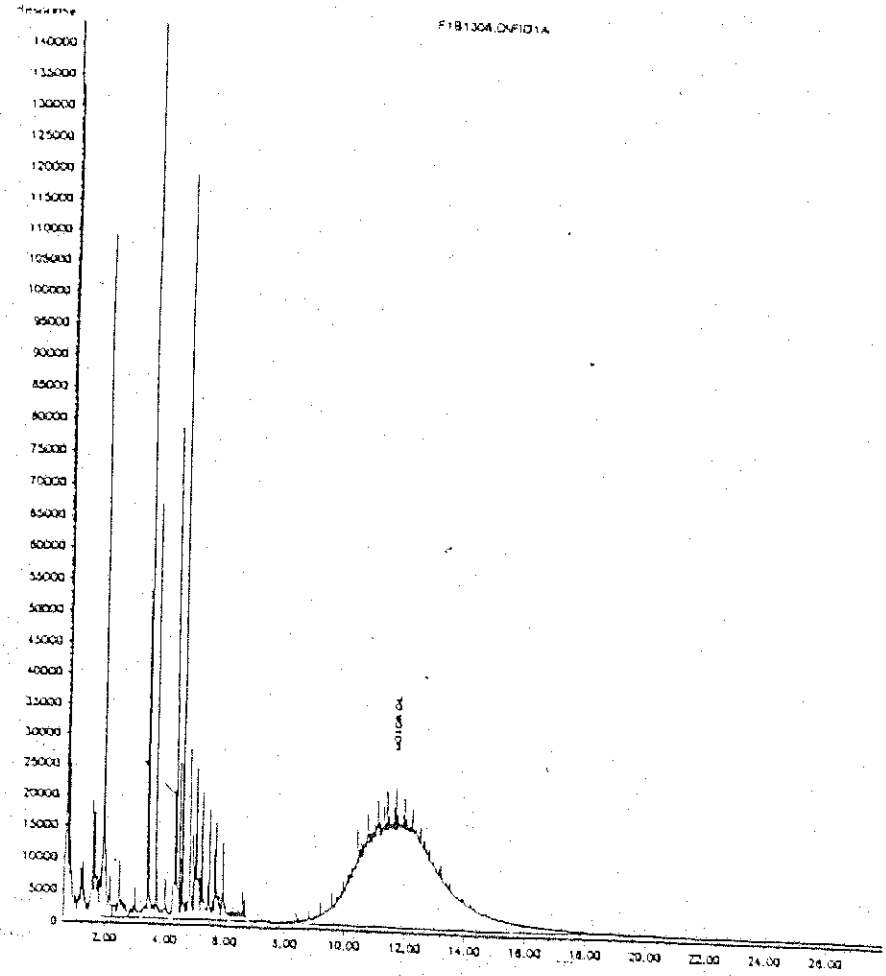
# Attachment 5B

```
File        : C:\HPCHEM\1\DATA\082703\F1B1304.D
Operator    : KD
Acquired    : 27 Aug 2003   2:18 pm using AcqMethod FING1_32.M
Instrument :
  Fing1
Sample Name: (#2 FUEL OIL 2500 NG/UL) DF=1 (FING_5)
Misc Info   : S0701031
Vial Number: 6
```



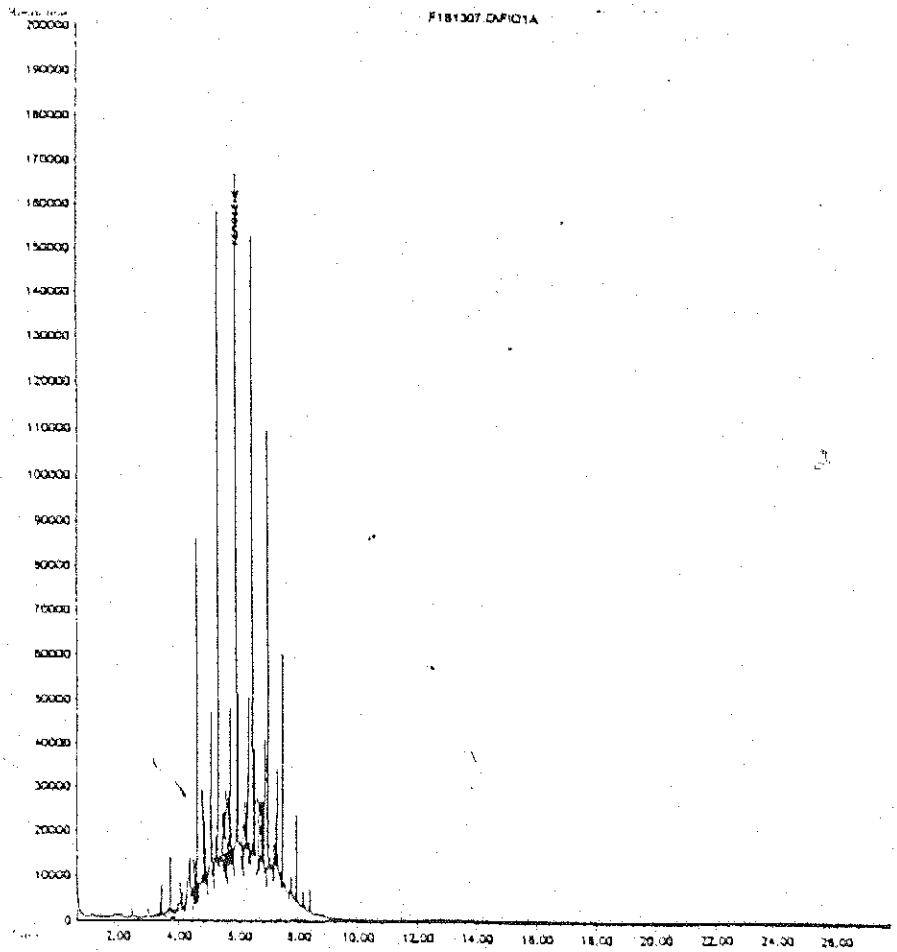
# Attachment 5C

```
File        : C:\HPCHEM\1\DATA\082703\F1B1306.D
Operator    : KD
Acquired    : 27 Aug 2003   3:31 pm using AcqMethod FING1_32.M
Instrument :   Fing1
Sample Name: (GASOLINE/MOTOR OIL 1000 NG/UL) DF=1 (FING_S)
Misc Info   : S070103K
Vial Number: 8
```



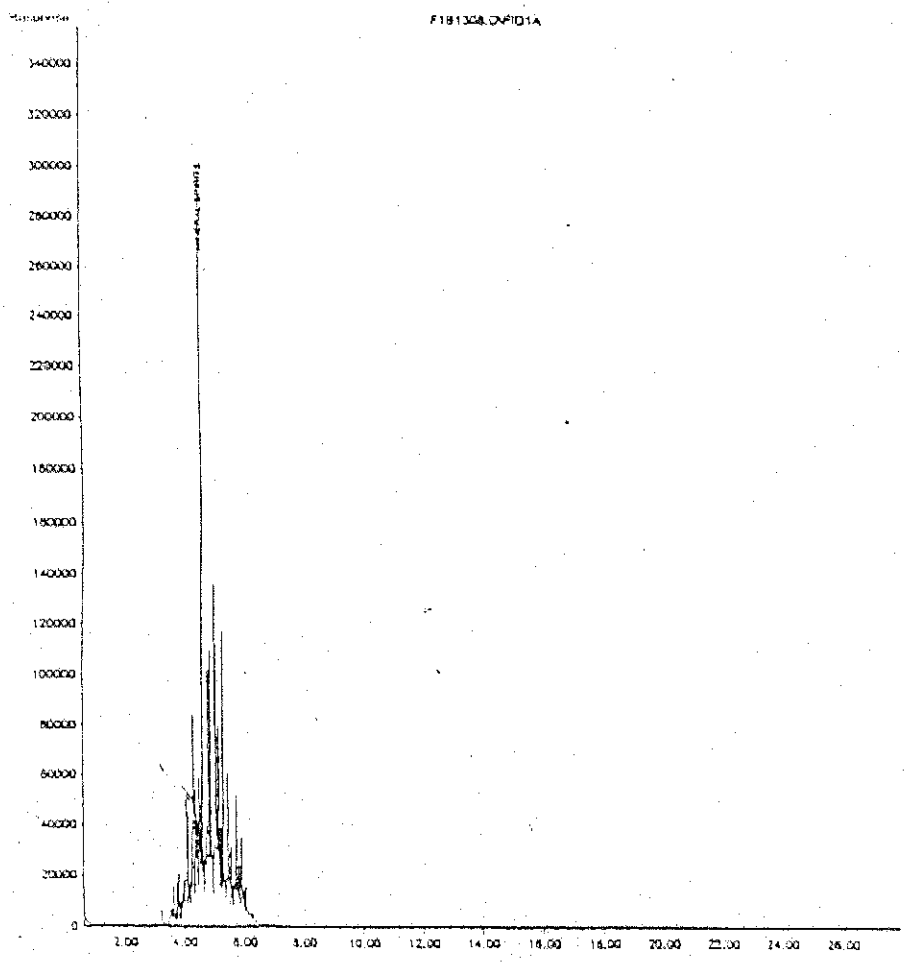
# Attachment 5D

```
File        : C:\HPCHEM\1\DATA\082703\F1B1307.D
Operator    : KD
Acquired    : 27 Aug 2003   4:08 pm using AcqMethod FING1_32.M
Instrument :   Fing1
Sample Name: (KEROSENE 1000 NG/UL) DF=1 (FING_S)
Misc Info   : S070103L
Vial Number: 9
```



# Attachment 5E

```
File        : C:\HPCHEM\1\DATA\082703\F181308.D
Operator    : KD
Acquired    : 27 Aug 2003    4:44 pm using AcqMethod FING1_32.M
Instrument  :   Fing1
Sample Name: (MINERAL SPIRITS 1000 NG/UL) DF=1 (FING_S)
Misc Info   : S070103M
Vial Number: 10
```



AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

# SEMIVOLATILE ORGANIC COMPOUNDS BY GAS CHROMATOGRAPH/MASS SPECTROMETRY

By

**SW-846 METHOD 8270C**

Procedure Number: OL-2008

Revision No.: 8

Revised Date: 02/02/2010

Review Date: N/A

Prepared By: _____ Date: 2/3/10

Approved By: _____ Date: 2/4/10
Organic Manager

Approved By: _____ Date: 2/3/10
Laboratory Director

Approved By: Paula Bentam Date: 2/3/10
Quality Assurance Manager

# TABLE OF CONTENTS


| | | Page |
|---|---|---|
| 1.0 | SCOPE AND APPLICATION | 2 |
| 2.0 | METHOD SUMMARY | 5 |
| 3.0 | DEFINITIONS | 5 |
| 4.0 | SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE | 6 |
| 5.0 | POTENTIAL PROBLEMS AND INTERFERENCES | 6 |
| 6.0 | HEALTH AND SAFETY | 6 |
| 7.0 | INSTRUMENTS AND EQUIPMENT | 7 |
| 8.0 | REAGENTS AND STANDARDS | 8 |
| 9.0 | GC/MS PROCEDURE | 18 |
| 10.0 | INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR | 28 |
| 11.0 | CALCULATIONS | 29 |
| 12.0 | QUALITY CONTROL | 30 |
| 13.0 | DATA REVIEW AND STORAGE | 34 |
| 14.0 | REFERENCES | 36 |

| | | |
|---|---|---|
| Attachment 1A,B,C | Internal Standards with Corresponding target and surrogates Assigned for Quantitation | 38 |
| Attachment 2 | Surrogate Recovery Control Limits | 41 |
| Attachment 3A,B,C | DoD LCS and MS Control Limits for Water Matrix | 42 |
| Attachment 4A,B,C | DoD LCS and MS Control Limits for Soil Matrix | 45 |
| Attachment 5 | Instrument Operating Conditions | 48 |
| Attachment 6 | GC and GC/MS Data Review Checklist | 49 |
| Attachment 7 | SW-846 Method 8270C Qualification Card | 50 |

## 1.0 SCOPE and APPLICATION

1.1 This Standard Operating Procedure (SOP) describes the analysis of semivolatile organic compounds in Methylene Chloride extracts prepared from many types of solid waste matrices, soils, and water samples. The compounds analyzed by AMRO and their typical reporting limits are listed in Table 1.

**Table 1**

| Compound Name | CAS number | Reporting Limits | |
|---|---|---|---|
| | | Water (µg/L) | Soil (mg/kg) |
| 1,2,4-TRICHLOROBENZENE | 120-82-1 | 10 | 0.25 |
| 1,2-Dichlorobenzene | 95-50-1 | 10 | 0.25 |
| 1,2-Diphenylhydrazine (as Azobenzene) | 122-66-7 | 10 | 0.25 |
| 1,3-Dichlorobenzene | 541-73-1 | 10 | 0.25 |
| 1,4-Dichlorobenzene | 106-46-7 | 10 | 0.25 |
| 2,4,5-Trichlorophenol | 95-95-4 | 10 | 0.25 |
| 2,4,6-Trichlorophenol | 88-06-2 | 10 | 0.25 |
| 2,4-Dichlorophenol | 120-83-2 | 10 | 0.25 |
| 2,4-Dimethylphenol | 105-67-9 | 10 | 0.25 |
| 2,4-Dinitrophenol | 121-14-2 | 20 | 0.5 |
| 2,4-Dinitrotoluene | 606-20-2 | 10 | 0.25 |
| 2,6-Dinitrotoluene | 53-96-3 | 10 | 0.25 |
| 2-Chloronaphthalene | 321-60-8 | 10 | 0.25 |
| 2-Chlorophenol | 95-57-8 | 10 | 0.25 |
| 2-Methylnaphthalene | 95-48-7 | 10 | 0.25 |
| 2-Methylphenol | 91-59-8 | 10 | 0.25 |
| 2-Nitroaniline | 88-75-5 | 20 | 0.5 |
| 2-Nitrophenol | 119-93-7 | 10 | 0.25 |
| 3,3'-Dichlorobenzidine | 56-49-5 | 10 | 0.25 |
| 3-Nitroaniline | 534-52-1 | 20 | 0.5 |
| 4,6-Dinitro-2-Methylphenol | 92-67-1 | 20 | 0.5 |
| 4-Bromophenylphenyl Ether | 101-55-3 | 10 | 0.25 |
| 4-Chloro-3-Methylphenol | 59-50-7 | 20 | 0.5 |
| 4-Chloroaniline | 106-47-8 | 10 | 0.25 |
| 4-Chlorophenyl-Phenylether | 7005-72-3 | 10 | 0.25 |
| 4-Methylphenol | 106-44-5 | 10 | 0.25 |
| 4-Nitroaniline | 57-97-6 | 20 | 0.5 |
| 4-Nitrophenol | 3855-82-1 | 20 | 0.5 |
| Acenaphthene | 83-32-9 | 10 | 0.25 |
| Acenaphthylene | 208-96-8 | 10 | 0.25 |
| Acetophenone | 98-86-2 | 10 | 0.25 |

**Table 1 (cont)**

| Compound Name | CAS number | Reporting Limits | |
|---|---|---|---|
| | | Water (µg/L) | Soil (mg/kg) |
| ANILINE | 120-12-7 | 10 | 0.25 |
| Anthracene | 140-57-8 | 10 | 0.25 |
| Benz(a)Anthracene | 56-55-3 | 10 | 0.25 |
| Benzidine | 92-87-5 | 20 | 0.5 |
| Benzo(a)Pyrene | 50-32-8 | 10 | 0.25 |
| Benzo(b)Fluoranthene | 205-99-2 | 10 | 0.25 |
| Benzo(g,h,i)Perylene | 191-24-2 | 10 | 0.25 |
| Benzo(k)Fluoranthene | 207-08-9 | 10 | 0.25 |
| Benzoic Acid | 65-85-0 | 20 | 0.5 |
| Benzyl Alcohol | 100-51-6 | 20 | 0.5 |
| Bis(2-Chloroethoxy)Methane | 111-91-1 | 10 | 0.25 |
| Bis(2-Chloroethyl)Ether | 111-44-4 | 10 | 0.25 |
| Bis(2-Chloroisopropyl)Ether | 108-60-1 | 10 | 0.25 |
| Bis(2-Ethylhexyl)Phthalate | 117-81-7 | 10 | 0.25 |
| Butylbenzylphthalate | 85-68-7 | 10 | 0.25 |
| Carbazole | 86-74-8 | 10 | 0.25 |
| Chrysene | 218-01-9 | 10 | 0.25 |
| Dibenzo(a,h)Anthracene | 53-70-3 | 10 | 0.25 |
| Dibenzofuran | 132-64-9 | 10 | 0.25 |
| Diethylphthalate | 84-66-2 | 10 | 0.25 |
| Dimethyl Phthalate | 131-11-3 | 10 | 0.25 |
| Di-n-Butylphthalate | 84-74-2 | 10 | 0.25 |
| Di-n-Octyl Phthalate | 117-84-0 | 10 | 0.25 |
| Fluoranthene | 62-50-0 | 10 | 0.25 |
| Fluorene | 206-44-0 | 10 | 0.25 |
| Hexachlorobenzene | 118-74-1 | 10 | 0.25 |
| Hexachlorobutadiene | 87-68-3 | 10 | 0.25 |
| Hexachlorocyclopentadiene | 77-47-4 | 10 | 0.25 |
| Hexachloroethane | 67-72-1 | 10 | 0.25 |
| Indeno(1,2,3-c,d)Pyrene | 193-39-5 | 10 | 0.25 |
| Isophorone | 78-59-1 | 10 | 0.25 |
| Naphthalene | 621-64-7 | 10 | 0.25 |
| Nitrobenzene | 62-75-9 | 10 | 0.25 |
| N-Nitrosodimethylamine | 86-30-6 | 20 | 0.5 |
| N-Nitroso-di-n-propylamine | 91-20-3 | 10 | 0.25 |

## Table 1 (cont)

| Compound Name | CAS number | Reporting Limits | |
|---|---|---|---|
| | | Water (µg/L) | Soil (mg/kg) |
| N-Nitrosodiphenylamine | 98-95-3 | 10 | 0.25 |
| Pentachlorophenol | 87-86-5 | 20 | 0.5 |
| Phenanthrene | 85-01-8 | 10 | 0.25 |
| Phenol | 108-95-2 | 10 | 0.25 |
| Pyrene | 129-00-0 | 10 | 0.25 |
| Pyridine | 110-86-1 | 20 | 0.5 |

## 2.0 SUMMARY OF METHOD

2.1 Soil and solid samples are prepared by SW-846 Method 3541, Automated Sohxlet Extraction. Water samples are prepared by SW-846 Method 3510, Separatory Funnel Extraction.

2.2 The semivolatile compounds are introduced into the GC/MS by injecting the sample extract into a gas chromatograph (GC) with a narrow-bore fused-silica capillary column. The GC column is temperature-programmed to separate the analytes, which are then detected with a mass spectrometer (MS) connected to the gas chromatograph.

2.3 Analytes eluted from the capillary column are introduced into the mass spectrometer via a direct connection. Identification of target analytes is accomplished by comparing their mass spectra with the electron impact spectra of authentic standards. Quantitation is accomplished by comparing the response of a major (quantitation) ion relative to an internal standard using a calibration curve with a minimum of five contiguous data points.

## 3.0 DEFINITIONS

3.1 **Method Blank:** An aliquot of reagent water, which is carried through the entire analytical procedure with the samples, its purpose is to determine whether contamination is present during the analysis. A method blank is analyzed 1 for every analytical batch of samples.

3.2 **Laboratory Control Sample:** An aliquot of reagent water which known quantities of the method analyte are added in the laboratory. The LCS is analyzed exactly like a sample, and its purpose is to determine the degree to which the analytical result approaches the "true value" of the concentration of the analyte being determined. The percentage recovery is calculated in order to assess the efficiency of the analysis. One (1) LCS is analyzed for every analytical batch of samples.

3.3 **Matrix Spike:** A specific aliquot of sample into which a known amount of analyte is added. The analytical spike is analyzed with the sample batch and the percent recovery is calculated in order to assess the matrix effect on the analytical system.

3.4 **Batch:** A group of 20 or fewer samples extracted (prepared) at the same time, in the same location, using the same method. Associated with each batch is a set of QC samples, including: Duplicate Samples, Matrix Spike(MS), Matrix Spike Duplicate (MSD), Laboratory Control Sample (LCS), and a Method Blank.

## 4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 Store the sample extracts at 4°C ±2°C, protected from light, in sealed vials (e.g. screw-cap vials or crimp-capped vials) equipped with unpierced PTFE-lined septa. Analysis: 40 days after extraction.

## 5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 Contamination by carryover can occur whenever high-concentration and low-concentration samples are sequentially analyzed. To reduce carryover, the sample syringe is rinsed with solvent between sample injections. Whenever an unusually concentrated sample is encountered, the analysis immediately following it is evaluated for cross-contamination.

5.2 The following compound specific problems are noteworthy.

5.2.1 Benzidine may be subject to oxidative losses during solvent concentration and its chromatographic behavior is poor.

5.2.2 Hexachlorocyclopentadiene is subject to thermal decomposition in the inlet of the gas chromatograph, chemical reaction in acetone solution, and photochemical decomposition.

5.2.3 N-nitrosodimethylamine and Pyridine elute very early and become more difficult to separate from the solvent front as the column is shortened through maintenance clipping.

5.2.4 N-nitrosodiphenylamine decomposes in the gas chromatographic inlet and cannot be separated from diphenylamine.

5.2.3 Pentachlorophenol, 2,4-dinitrophenol, 4-nitrophenol, benzoic acid, 4,6-dinitro-2-methylphenol, 4-chloro-3-methylphenol, 2-nitroaniline, 3-nitroaniline, 4-chloroaniline, and benzyl alcohol are subject to erratic chromatographic behavior, especially if the GC system is contaminated with high boiling material.

## 6.0 HEALTH AND SAFETY

6.1 AMRO has a laboratory safety program in place that applies to all employees. There is a safety officer as well as employees with 40 hours of OSHA training. The air quality of the laboratory has been monitored and employees are sent for physicals. All employees receive fire and safety training upon employment.

6.2 Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place.

6.3 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean laboratory coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.4 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eyewash stations and an emergency shower.

6.5 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention: The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.7 Waste control, AMRO takes whatever steps possible to minimize waste. This includes volume reduction where appropriate. AMRO also properly segregates wastes according to contaminants and a commercial vendor is utilized for waste disposal.

## 7.0 INSTRUMENTS AND EQUIPMENT

7.1 Gas Chromatograph/Mass Spectrometer Systems

7.1.1 Hewlett-Packard (HP) Model 5890 Series II (SV-2, SV-3) -temperature-programmable gas chromatographs equipped with Electronic Pressure Control (EPC), splitless injection, capillary-direct interface, and Model 7673 Autosampler/Injector. Hewlett-Packard (HP) Model 6890 (SV-4) - temperature-programmable gas chromatograph equipped with Electronic Pressure Control (EPC), split injection, capillary-direct Interface and Model 7683 Autosampler/injector.

7.1.2 Column - 30 m x 0.25 mm ID, 0.25 um film thickness 5% phenyl methyl silicone-coated fused-silica capillary column (J&W Scientific DB-5MS, Catalog No. 122-5532 or equivalent).

7.1.3 Hewlett-Packard (HP) Model 5972 Mass Selective Detector (MSD) , SV-2 and SV-3. Hewlett-Packard (HP) Model 5973 Mass Selective Detector (MSD) SV-4. Note SV-2 and SV-3 are backup instruments only for the SW-846 Method 8270 and do not routinely perform full BNA analyses.

7.1.4 Hewlett-Packard Chemstation PC Data system - Computer system interfaced to the GC/MSD.

The following system identifiers have the listed software versions:

| | |
|---|---|
| SV-2 | G1034C Version C.02.05 |
| SV-3 | G1701AA Version A.03.00 |
| SV-4 | G1701BA Version B.00.00 |

The system allows the continuous acquisition and storage on machine-readable media of all mass spectra obtained throughout the duration of the chromatographic program. The computer has software that can search any GC/MS data file for ions of a specific mass and that can plot such ion abundances versus time or scan number. This type of plot is defined as an Extracted Ion Current Profile (EICP). The software allows integrating the abundances in any EICP between specified time or scan-number limits. The most recent version of the EPA/NIST Mass Spectral Library is also available.

7.2 Syringe - 10 µL, 25µl - 1.0 mL varying sizes

7.3 Volumetric flasks: Class A - Appropriate sizes with ground-glass stoppers.

7.4 Bottles - 1.5 to 2.0mL amber and clear glass with polytetrafluoroethylene (PTFE)-lined screw caps or crimp tops for standard storage.

7.5 5.0mL amber vials with PFTE-lined screw caps.

7.6 Compressed Helium - Ultra High Purity (UHP) grade.

## 8.0 REAGENTS AND STANDARDS

8.1 The stock standard solutions are purchased from commercial suppliers as certified solutions. Transfer the stock standard solutions into 2mL amber vials with PTFE-lined screw caps using a pasteur pipet. Label vial with content information, standard ID and expiration date. Store, protected from light, at $4^{\circ}C \pm 2^{\circ}C$. Stock standard solutions must be replaced after one year from the opening date of the vial, or on the manufacturer expiration date, whichever is shorter.

8.1.1 Stock Calibration Standards

Restek:

Semivolatiles Calibration Standards
Contain1mL of each of the following products at:
8270 Mega Mix (Catalog No.: 31850) 500-1000 µg/ml
Benzoic Acid Mix (Catalog No.: 31879) 2000 µg/ml
Benzidines Mix (Catalog No.: 31852) 2000 µg/ml
Custom Acetophenone (2,000 µg/ml) Catalog No. 558859

8.1.2 Calibration Standards: Second Source Verification Standards

Ultra Scientific, Inc.:

| | | |
|---|---|---|
| Pyridines Mixture | 2000 µg/ml | Catalog No. US-120AN |
| Benzidines Mixture | 2000 µg/ml | Catalog No. US-105N |
| SVOA Mix 1 | 1000 µg/ml | Catalog No. SVM-8270 |
| SVOA Mix 2 | 1000 µg/ml | Catalog No. SVM-8271 |

8.1.3 Surrogate Solutions: The surrogates are Phenol-$d_6$, 2-Fluorophenol, 2,4,6-Tribromophenol, Nitrobenzene-$d_5$, 2-Fluorobiphenyl, and p-Terphenyl-$d_{14}$.

Restek, Inc.:

Base/Neutral Surrogates, 5,000 µg/mL (Catalog No. 31086)
Nitrobenzene-d5
Fluorobiphenyl
P-Terphenyl-d14

Acid Surrogates, 10,000µg/mL (Catalog No. 31063)
Phenol-d5
2-Fluorophenol
2,4,6-Tribromophenol

8.1.4 Internal Standard Solutions: The internal standards are 1,4-Dichlorobenzene-$d_4$, Naphthalene-$d_8$, Acenaphthene-$d_{10}$, Phenanthrene-$d_{10}$, Chrysene-$d_{12}$, and Perylene-$d_{12}$. Restek Catalog No.: 31206 is purchased and used as is directly from manufacturer.

8.1.4.1 The solution contains each compound at a concentration of 2,000 ng/µL. Each 1mL sample extract undergoing analysis should be spiked with 20µL of the internal standard solution, resulting in a concentration of 40ng/ µL of each internal standard. Store at 4°C±2°C when not in use.

8.1.5 GC/MS Tuning Standard: A mix of Decafluorotriphenylphosphine (DFTPP), Pentachlorophenol, Benzidine, and DDT is commercially available stock solution from Restek, Catalog No.: 31615 (1,000µg/mL).

8.1.6 Laboratory Control Sample spike stock solutions: Restek

| | | |
|---|---|---|
| Mega Mix | 500-100 µg/ml | Catalog No.: 31850 |
| Benzidines Mix | 2000 µg/ml | Catalog No: 31852 |
| Benzoic acid | 2000 µg/ml | Catalog No.: 31879 |
| CAL Mix 1 | 2000 µg/ml | Catalog No.: 31618 |
| Custom Acetophenone | 2000 µg/ml | Catalog No.: 558859 |

8.2 Intermediate Solutions

8.2.1 Preparation of Intermediate Calibration stock at 250µg/ml Using Primary Source Standards

Prepare each individual commercial calibration stock solutions according to the manufacturers instructions. Transfer each of the calibration stock solutions into 1.5mL amber vials with teflon lined screw caps using pasteur pipets. Label each vial with contents, standard ID and expiration date. Clean a 5mL volumetric flask and stopper with methylene chloride. Do not add any methylene chloride to the flask until all solutions have been added. Using a clean 500µl syringe, transfer 625µl of each 2,000 µg/mL calibration stock solution and 1250µl of the Mega Mix calibration stock solution (500-1000 µg/ml) into the volumetric flask. Rinse the syringe between each aliquot with clean methylene chloride and replace the stopper. Using a clean syringe, transfer 250µl of the Base Neutral Surrogate (5,000 µg/mL) to the volumetric flask and replace the stopper. Using a clean syringe, transfer 125µl of the acid surrogate (10,000 µg/mL) to the volumetric flask and replace the stopper. Using clean methylene chloride carefully bring the meniscus to the mark on the flask. Use extreme caution to ensure proper volume. Transfer contents of the volumetric to a clean 5mL amber vial with a PFTE-lined screw cap using a pasteur pipet. Label vial with contents, standard ID and expiration date. Using a Sharpee, mark the meniscus with a line to ensure no evaporation has taken place when not in use, store protected from light at 10°C-20°C.

8.2.2 Preparation of Intermediate Calibration Standard Stock at 250µg/mL - Secondary Source Verification

Prepare each individual commercial calibration stock solutions according to the manufactures instructions. Transfer each of the calibration stock solutions into 1.5mL amber vials with teflon lined screw caps using pasteur pipets. Label each vial with contents, standard ID and expiration date. Clean a 5mL volumetric flask and stopper with methylene chloride. Do not add any methylene chloride to the flask until all solutions have been added. Using a clean syringe, transfer 625µl of each 2,000 µg/mL calibration stock solution and 1250µl of each 1000 µg/mL calibration stock solution into the volumetric flask. Rinse the syringe between each aliquot with clean methylene chloride and replace the stopper. Using a clean syringe, transfer 250µl of the Base Neutral Surrogate (5,000 µg/mL) to the volumetric flask and replace the stopper. Using a clean syringe, transfer 125µl of the acid surrogate (10,000 µg/mL) to the volumetric flask and replace the stopper. Using clean methylene chloride carefully bring the meniscus to the mark on the flask. Use extreme caution to ensure proper volume. Transfer contents of the volumetric to a clean 5mL amber vial with a PFTE-lined screw cap using a pasteur pipet. Label vial with contents, standard ID and expiration date. Using a Sharpee mark the meniscus with a line to ensure no evaporation has taken place. When not using, store protected from light at -10 to -20C.

8.3 Working Standard Solution

8.3.1 Calibration standards - Eight calibration standards are prepared at eight different concentrations using the 250µg/mL intermediate standard, including 5.0, 10, 20, 50, 80, 120, 160 and 250µg/mL. Each point is prepared in a 1.5mL amber vial with a solid teflon-lined screw cap. Label each point with standard ID, concentration, expiration date and initials. Using a Sharpee mark the meniscus with a line to ensure no evaporation when not in use.

8.3.1.1 All working calibration standards are stored at -10 to -20°C and are freshly prepared if the calibration verification standard indicates a problem. The CCV working standard is stored at 4 ±2 °C.

8.3.1.2 A eight point curve is prepared by diluting the above stock with clean methylene chloride according to the chart below:

| Calibration Point | Amt. of stock (µL) | Final Volume | Amt. of Internal Std |
|---|---|---|---|
| 250ng/µl | 500 | 0.5mL | 10µl |
| 160ng/µl | 640 | 1.0mL | 20µl |
| 120ng/µl | 480 | 1.0mL | 20µl |
| 80ng/µl also CCV | 320 | 1.0mL | 20µl |
| 50ng/µl | 200 | 1.0mL | 20µl |
| 20ng/µl | 80 | 1.0mL | 20µl |
| 10ng/µl | 40 | 1.0mL | 20µl |
| 5.0ng/µl | 20 | 1.0mL | 20µl |

8.3.1.3 Low limit check standard.

A 1.0ng/µl standard is analyzed to check the lower limit of the system. This point is not used in the calibration curve.

8.3.2 Secondary Source Working Stock Calibration point using 225µg/mL Intermediate Calibration Stock

A single point 80µg/mL is prepared by diluting the secondary source stock with clean methylene chloride. Fill a clean 2mL volumetric frask with 500µl of clean methylene chloride. Using a clean 1mL syringe, transfer 640µl of the above stock into the 2mL volumetric and carefully bring to volume. Add 40µl of semivolatile internal standard to the volumetric and transfer to a clean 5mL amber screw cap vial, label with standard ID, concentration and expiration date. Using a Sharpee, mark the meniscus with a line to ensure proper volume.

8.3.3 Surrogate Standard Check: Dilute the working surrogate standard solution by a factor of two in methylene chloride. Inject this into the GC/MS to determine recovery of surrogate standards. Recovery of all surrogates must be between 95 - 110 % of true value before use in samples.

True values of the surrogates are as follows:

| | |
|---|---|
| Base/Neutral Surrogates | 50µg/mL on column |
| Nitrobenzene-d5 | |
| Fluorobiphenyl | |
| p-Terphenyl-d14 | |
| | |
| Acid Surrogates | 75 µg/mL on column |
| Phenol-d5 | |
| 2-Fluorphenol | |
| 2,4,6-Tribromophenol | |

8.3.4 Laboratory Control Sample spike working solution:

Prepare each individual commercial LCS stock solutions according to the manufactures instructions. Transfer each of the calibration stock solutions into 1.5mL amber vials with teflon lined screw caps using pasteur pipets. Label each vial with contents, standard ID and expiration date. Clean a 10mL volumetric flask and stopper with methylene chloride. Do not add any methanol to the flask until all solutions have been added. Using a clean 500µL syringe, transfer 1.0mL of the CLP mix, 250µL of the phenols mix, 500µL of the benzidines mix, 200uL of the NNDMA stock, 500µL of the benzoic acid stock, 500µL of the benzyl alcohol stock, and 500uL of the pyridine stock into the volumetric flask. Rinse the syringe between each aliquot with clean

methylene chloride and replace the stopper. Using clean methanol carefully bring the meniscus to the mark on the flask. Use extreme caution to ensure proper volume. Transfer contents of the volumetric to a clean 5mL amber vial with a PFTE-lined screw cap using a pasteur pipet. Label vial with contents, standard ID and expiration date. Using a Sharpee mark the meniscus with a line to ensure no evaporation has taken place. When not using, store protected from light at -10 to -20°C.

8.3.5 GC/MS tuning standard:

Containing decafluorotriphenylphosphine (DFTPP), pentachlorophenol, benzidine, and DDT is prepared by diluting the stock solution with methylene chloride to form a solution containing 50 ng/µL. Clean a 2mL volumetric flask and stopper with methylene chloride. Add a small amount of clean methylene chloride to the flask and replace the stopper. Using a clean syringe transfer 100µL of DFTPP stock into the 2mL volumetric flask. Using clean methylene chloride slowly bring meniscus up to the mark on the volumetric flask. Transfer the contents of volumetric flask to a clean 5 mL amber PFTE-lined screw cap vial. Label vial with concentration, standard ID and expiration date. Using a Sharpee, mark the meniscus with a line to ensure no evaporation has occurred when not in use. Store at 4°C±2°C (per vendors recommendation) when not in use.

8.3.6 Matrix Spike Check:

Dilute the working matrix spike standard solution by a factor of two in Methylene Chloride. Inject this into the GC/MS to determine recovery of matrix spike compounds. Recovery of all matrix spike compounds must be between 95 -110 % of true value before use in samples. True values of the spiking solution are as follows:

| BASE/NEUTRAL SPIKES | µg/mL on column |
|---|---|
| 1,4-Dichlorobenzene | 50 |
| n-Nitroso-di-N-propylamine | 50 |
| 1,2,4-Trichlorobenzene | 50 |
| Acenaphthene | 50 |
| 2,4-Dinitrotoluene | 50 |
| Pyrene | 50 |

| ACID SPIKES | µg/mL on column |
|---|---|
| Phenol | 75 |
| 2-Chlorophenol | 75 |
| 4-Chloro-3-Methylphenol | 75 |
| 4-Nitrophenol | 75 |
| Pentachlorophenol | 75 |

8.3.6.1 Some projects may require the spiking of the specific compounds of interest. When this occurs, the matrix and LCS spiking standards should be prepared in methanol, with each compound present at a concentration appropriate for the project.

8.4 Acetone, pesticide residue quality or equivalent.

8.5 Hexane, pesticide residue quality or equivalent.

8.6 Methanol, pesticide residue quality or equivalent.

8.7 Methylene chloride, pesticide residue quality or equivalent.

8.8 TRACKING OF ANALYTICAL STANDARDS

8.8.1 Chemical Receipt

The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a four digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded.

8.9 Standards Preparation:

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

8.9.1 AMRO purchases pesticide residue grade solvents and purge and trap grade Methanol for organic standard preparation and organic sample extractions.

8.9.2 ACS reagent grade chemicals are used when the method warrants.

8.9.3 Any stock standards that are purchased are accompanied by a certificate of analysis from the manufacturer.

8.9.4 Class A volumetric glassware is used to prepare standards.

8.10 Standard Tracking:

It is important to be able to track all analytical standards back to their sources. The following procedure is used by AMRO personnel to accomplish this:

8.10.1 Standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, which consists of the letter "A" and a four digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and the disposal dates are completed by AMRO employees when standards are used up or disposed. Refer to the Certificate of Analysis Logbook for standard concentration information. The Certificates are kept on file in the GC/MS department.

8.10.2 Standards Preparation

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

AMRO purchases pesticide residue grade solvents and purge and trap grade Methanol for organic standard preparation and organic sample extractions.

Any stock standards that are purchased are accompanied by a certificate of analysis from the manufacturer.

Class A volumetric glassware is used to prepare standards.

8.10.3 Organic Standards:The Organic Standards Tracking Log consists of three sections, an Index, a Stock section and a Working section. Stock Standards are defined as any solution that requires a dilution or addition to multiple solutions and are used to make Working Standards. Working Standards are defined as anything that is added directly to a sample or analyzed directly on an instrument.

8.10.3.1 The ID index assures that no two standards are assigned the same ID number. The Index requires the Standard ID, the section of the Standard Log (Stock or Working) the Standard information is located, and a brief description of the standard.

8.10.3.2 Stock Section: Whenever a stock standard solution is opened or prepared, this information is recorded in the Stock Standard Logbook section of the standard tracking log.

8.10.3.2.1 Date prepared and Prepared by are the first two items to be completed. The next is the compound name, which should be the name of the solution being used. Do not use vendor catalog numbers alone.

8.10.3.2.2 The Receipt/Stock ID is the ID of the solution being used. This can be the "A" number or a Stock ID number. The Source of the solution is the manufacturer. The concentration or purity of the solution is the next item.

8.10.3.2.3 The amount in grams (g) or microliters (μL) of the solution used and the final volume of the solution made is documented. The final concentration of the new solution and the units is recorded.

The stock solution is assigned a new ID number consisting of the letter "S" for semivolatile, the date of preparation plus a letter suffix starting with the letter "A". This ID along with the compound name, concentration and initials of the person making the stock are included on the label. Example - The fourth semivolatile standard prepared on April 15, 1989 would have the standard ID S041589D. This number will be recorded in the logbook and written on the container along with expiration date and analyst initials.

The storage location is recorded in the logbook.

The expiration date is the last item recorded. Stock standards are good one year from the date opened or the date provided by manufacturer, whichever is shorter. The analyst must verify that 1 year from the date opened is within the manufacturers expiration date window. If it is not, then the manufacturer's expiration date must be used for the AMRO expiration date.

8.10.4 Working Section - Whenever a working standard solution opened or is prepared, whether from AMRO stocks or commercially obtained stocks, the information is recorded in the Working Standard section of the standard tracking log.

- Date opened/prepared and Opened/Prepared by are the first two items to be completed.

The next is the compound name, which should be the name of the solution being used. Do not use vendor catalog numbers alone.
The Receipt/Stock ID is the ID of the solution being used. This can be the "A" number or a Stock ID number. If a stock ID number was previously assigned, use the stock ID number rather than the "A" number for traceability.
The Source of the solution is the manufacturer.
The concentration or purity of the solution is the next item.
The amount in microliters (uL) of the solution used and the final volume of the solution made is documented.
The final concentration of the new solution and the units is recorded.
The stock solution is assigned a new ID number consisting of the letter "S" for semivolatile, the date of preparation plus a letter suffix starting with the letter "A". This ID along with the compound name, concentration and initials of the person making the stock are included on the label. Example - The fourth semivolatile standard prepared on April 15, 1989 would have the standard ID S041589D. This number will be recorded in the logbook and written on the container along with expiration date and analyst initials.
The storage location is recorded in the logbook.
The expiration date is the last item recorded. Working standards are good one year from the date opened or the oldest date prepared of any compound stock standard or the date provided by manufacturer, whichever is shorter. The daily CCV standards are good for one week only. The analyst must verify that 1 year from the date opened is within the manufacturers expiration date window. If it is not than the manufacturer date must be used for the expiration date.

8.11 Standard Storage - Standards and reagents are stored per method specifications or manufacturer's instructions. Semivolatile standards are stored in refrigerators at 4 +/- 2°C, or in freezers at below minus 10 °C, and/or ambient temperature depending upon the method and manufacturer requirements.

8.12 Solvent Check Analysis

All extraction procedures are performed using pesticide residue grade solvents and a method or procedural blank analysis is performed when a new lot number is received to verify the absence of target analytes.

## 9.0 PROCEDURE

### 9.1 Sample Preparation

9.1.1 All Samples are normally prepared by one of the following Methods prior to GC/MS analysis

| Matrix | SW-846 Methods | AMRO SOP |
|---|---|---|
| Water | 3510 | OL-2003 |
| Soil/Solids | 3541 | OL-2004 |
| Waste | See supervisor | |

9.1.2 Sample extracts are prepared by adding 2µl of internal standard solution per 100µl of extract (or diluted extract) that is dispensed into a 2mL crimp vial.

9.1.3 AMRO does not routinely perform any cleanups of extracts for semivolatile analyses, however if significant non-target analyte interference exists for aniline and aniline derivatives, or phthalate esters, or nitrosamines, or nitroaromatics and cyclic ketones, or haloethers, or chlorinated hydrocarbons, then the Florisil cleanup (OL-2018, SW-846 Method 3620B) may be used to remove interferences.

### 9.2 GC/MS Conditions

Attachment 7 contains the specific instrument operating conditions. These parameters are contained in method file *BNAmmdd.m;* where mm = the month, and dd=the day of calibration, or any similar format incorporating the date of calibration. Method calibration files should be archived with the data files at the time of back-up on the file server

9.3 Hardware Tuning - The GC/MS system must be hardware-tuned using a 50 ng injection of DFTPP. Analyses must not begin until the tuning criteria are met.

9.3.1 Under the HP ChemStation drop down menu item, select Tune. In the drop down menu select Autofind DFTPP to screen or printer. This macro selects the peak apex plus or minus one scan average mass spectrum and does an automatic background correction. Alternately, the whole peak average spectrum and a single scan background correction may be evaluated. Another alternative is the use of a single passing scan near

the TIC peak apex after the background scan correction. All background correction scans must be before the DFTPP peak but not more than 20 scans before the DFTPP apex. In either case, a hard copy showing the passing spectrum and passing criteria must be printed, dated and initialed by the analyst.

9.3.2 Use the DFTPP mass intensity criteria as tuning acceptance criteria.

| MASS | ION ABUNDANCE CRITERIA 8270 |
|---|---|
| 51 | 30-60 % of mass 198 |
| 69 | present |
| 68 | < 2% of mass 69 |
| 70 | < 2% of mass 69 |
| 127 | 40-60 % of mass 198 |
| 197 | < 1% of mass 198 |
| 198 | Base peak, 100% relative abundance |
| 199 | 5-9 % of mass 198 |
| 275 | 10-30 % of mass 198 |
| 365 | > 1% of mass 198 |
| 441 | Present but less than mass 443 |
| 442 | > 40% of mass 198, |
| 443 | 17-23 % of mass 442 |

NOTE: All subsequent standards, sample, MS/MSDs, and blanks associated with a DFTPP analysis must use the identical mass spectrometer instrument conditions.

9.4 Initial Calibration

9.4.1 Using the HP 7673 autosampler, inject 1µl of each calibration standard (containing internal standards). Seven calibration levels are injected: 5.0 ng/µl, 10 ng/µl, 20 ng/µl, 50 ng/µl, 80 ng/µl, 120 ng/µl, and 160 ng/µl. An injection volume of 1µl is used for all standards and sample extracts. A set of at least 5 calibration standards is required. The default quantitation ions and association of target analytes and internal standards is listed in Attachments 1A, 1B, and 1C.

The data system software calculates relative response factors (RRFs) for each target analyte relative to one of the internal standards as follows:

$$RRF = \frac{A_s \times C_{is}}{A_{is} \times C_s}$$

where:

$A_s$ = Peak area of the analyte's quantitation ion
$A_{is}$ = Peak area of the internal standard's quantitation ion
$C_s$ = Mass of analyte injected in nanograms (ng)
$C_{is}$ = Mass of internal standard injected in nanograms (ng)

9.4.2 System performance check compounds (SPCCs)

9.4.2.1 System Performance Check Compounds (SPCCs) are: N-nitroso-d-n-propylamine; hexachlorocyclopentadiene; 2,4-dinitrophenol; and 4-nitrophenol. The minimum acceptable average RRF for these compounds is 0.050 in the initial calibration curve. If the minimum response factors are not met, the system must be evaluated, and corrective action must be taken before sample analysis begins. Possible problems include standard mixture degradation, injection port inlet contamination, contamination at the front end of the analytical column, and active sites in the column or chromatographic system. This check must be met before sample analysis begins.

9.4.3 Calibration check compounds (CCCs) are as follows:

| Base/Neutral Fraction | Acid Fraction |
|---|---|
| Acenaphthene | 4-Chloro-3-Methylphenol |
| 1,4-Dichlorobenzene | 2,4-Dichlorophenol |
| Hexachlorobutadiene | 2-Nitrophenol |
| N-Nitrosodiphenylamine | Phenol |
| Di-n-octyl phthalate | Pentachlorophenol |
| Fluoranthene | 2,4,6-Trichlorophenol |
| Benzo(a)pyrene | |

9.4.3.1 The data system calculates the mean response factor and the relative standard deviation (RSD) of the response factors for each target analyte. The RSD should be less than or equal to 15% for each target analyte. However, the RSD for each individual CCC must be less than or equal to 30%.

$$RSD = \frac{SD}{RF} * 100$$

Where: SD = Standard Deviation
RF = Relative Response Factor

9.4.3.2 If the RSD of any CCC is greater than 30%, then the chromatographic system is too reactive for analysis to begin. Evaluate possible causes of the problems, perform additional maintenance which may include replacing the injector liner, clipping 2 to 3 inches off the front of the capillary, or replacing the capillary column, then repeat the calibration procedure.

9.4.4 Evaluation of retention times - The relative retention time (RRT) of each target analyte in each calibration standard must agree within 0.06 RRT units.

9.4.5 Linearity of target analytes - If the RSD of any target analyte is 15% or less, then the relative response factor is assumed to be constant over the calibration range, and the average relative response factor can be used for quantitation.

9.4.5.1 If the RSD of any target analyte is greater than 15%, linear regression or quadratic equation may be used but the Coefficient of Determination (COD) ($r^2$) must be greater than 0.99 for the calibration to be valid for the analyte.

9.4.5.2 Several compounds may not exhibit sufficient response at the lower calibration levels due to their chemical properties. These compounds are indicated in Table 1 by a Reporting Limit of 20 ug/L in water. If the %RSD criteria cannot be met for any of these compounds with all seven data points then up to the two lowest points (i.e. the 5.0 and 10 ug/ml calibration points) may be excluded from the calibration curve to meet the criteria. If the criteria cannot be met in this manner then further investigation into the problem must be initiated. If there is a subset of compounds to be reported, then the curve may be used for those which meet the criteria; e.g PAHs only.

9.4.6 A second source initial calibration verification standard (ICV) is analyzed after the initial calibration. All analytes must be within 25% of the expected value.

9.5 GC/MS calibration verification - Calibration verification consists of five evaluation steps that are performed prior to sample extract analysis at the beginning of each 12 hour shift.

9.5.1 Prior to the analysis of samples or calibration standards, inject 50 ng of the tune standard into the GC/MS system. The resultant mass spectrum for DFTPP must meet the criteria given in section 9.3.2 before sample analysis begins. Using the Enviroquant "Tailing" macro in QEDIT, evaluate and

hardcopy the tailing factor for pentachlorophenol and benzidine. See Section 9.5.2.3 for the formula used. The tailing factors must be less than 5 and 3, respectively. Evaluate the DDT degradation using the following formula: ((DDD+DDE) / (DDT+DDD+DDE) )*100 = %degradation. DDT degradation must be less than 20%. These criteria must be demonstrated before each 12-hour shift during which samples are analyzed.

9.5.2 The initial calibration for each compound of interest is verified once every 12 hours prior to sample analysis, using the introduction technique and conditions used for samples. This is accomplished by analyzing the 80 ng/µl calibration standard and verifying that the following criteria are met. All analytical queues containing USACE project samples must be followed by a closing CCV. CCV criteria do not apply to the closing standard and the results do not need to be reported, but the data must be available to USACE inspection if requested.

9.5.2.1 System performance check compounds (SPCCs) - A system performance check must be made during every 12-hour analytical shift. Each SPCC in the calibration verification standard must meet a minimum response factor of 0.050. This is the same check that is applied during the initial calibration.

If the minimum response factors are not met, the system must be evaluated, and corrective action must be taken before sample analysis begins. Possible problems include standard mixture degradation, injection port inlet contamination, contamination at the front end of the analytical column, and active sites in the column or chromatographic system. This check must be met before sample analysis begins.

9.5.2.2 Calibration check compounds (CCCs) - After the system performance check is met, the CCCs listed in Section 7.4.3 are used to check the validity of the initial calibration. Use percent difference when performing the average response factor model calibration. Use percent drift when calibrating using a regression or quadratic fit model. If the percent difference or drift for each CCC is less than or equal to 20%, then the initial calibration is assumed to be valid. If the criterion is not met (i.e., greater than 20% difference or drift) for any one CCC, then corrective action must be taken prior to the analysis of samples. If the CCCs are not included in the list of analytes for a project, then all analytes which will be reported must meet the 20% difference or drift criterion. Problems similar to those listed under SPCCs could affect the CCCs. If the problem cannot be corrected by other measures, a new initial

calibration must be generated. The CCC criteria must be met before sample analysis begins.

9.5.2.3 Peak tailing will be evaluated by using the Enviroquant "Tailing" macro in QEDIT for each tune mix standard run and printed. Tailing factor is calcluated by the software and must be <5 for Pentachlorophenol and <3 for Benzidine. The formula is as follows:

$$\text{Peak Tailing} = \frac{B*C}{A*B}$$

9.5.3 A method or solvent blank must be analyzed after the calibration standard, or at any other time during the anlytical shift, to ensure that the total system (introduction device, transfer lines and GC/MS system) is free of contaminants. If the sample extracts in the 12 hour analysis shift are being analyzed solely for dilution of target analytes exceeding calibration range, and the method blank analyzed with the sample extract was previously demonstrated to be free of contaminants, then a method or solvent blank is not required to be analyzed with the reanalysis for dilution. See the following for method blank performance criteria.

9.5.3.1 Less than half of the Reporting Limit for the matrix for the specific analyte.

9.5.3.2 Less than a level specified in a quality assurance project plan specific to the associated samples.

9.5.3.3 Less than the MDL check sample concentration for all batches containing USACE project samples. See Section 9.1.1.

If the method blank exceeds these criteria then an investigation will be initiated.

9.5.4 Internal standard retention time - The retention times of the internal standards in the calibration verification standard must be evaluated immediately after data acquisition. If the retention time for any internal standard changes by more than 30 seconds from that in the mid-point standard level of the most recent initial calibration sequence, then the chromatographic system must be inspected for malfunctions and corrections must made, as required. When corrections are made, reanalysis of samples analyzed while the system was malfunctioning is required. AMRO also evaluates all samples and batch QC against the daily CCV using the same

criteria. The decision to re-analyze samples due to internal standards falling outside of the windows is based on analysts' judgement of data impact.

- If examination of the total ion chromatogram shows no evidence of matrix interference or elevated baseline, the extract should be reanalyzed to determine if there is some other matrix effect behavior or that the added internal standard solution is no longer acceptable for use. If reanalysis exhibits the same behavior then the analyst will report the data and indicate the problem on the Data Review Checklist with some assessment of data impact.

- If examination of the total ion chromatogram shows evidence of matrix interference or elevated baseline, the analyst should evaluate whether a dilution is warranted due to peak distortion. If there are no chromatographic anomalies, the data is reported as is since the internal standard is designed to allow for some matrix effects or inlet discrimination.

9.5.5 Internal standard response - if the EICP area for any of the internal standards in the calibration verification standard changes by a factor of two (-50% to +100%) from that in the mid-point standard level of the most recent initial calibration sequence, the mass spectrometer must be inspected for malfunctions and corrections must made, as required. When corrections are made, reanalysis of sample analyzed while the system was malfunctioning is required. AMRO also evaluates all samples and batch QC against the daily CCV using the same criteria. The decision to re-analyze samples due to internal standards falling outside of the windows are based on analysts' judgement of data impact.

- If examination of the total ion chromatogram shows no evidence of matrix interference or elevated baseline, the extract should be reanalyzed to determine if there is some other matrix effect behavior or that the added internal standard solution is no longer acceptable for use. If reanalysis exhibits the same behavior then the analyst will report the data and indicate the problem on the Data Review Checklist report with some assessment of data impact.

- If examination of the total ion chromatogram shows evidence of matrix interference or elevated baseline, the analyst should evaluate whether a dilution is warranted due to peak distortion. If there are no chromatographic anomalies, the data is reported as is since the internal standard is designed to allow for some matrix effects or inlet discrimination.

9.6 GC/MS analysis of samples

9.6.1 Allow the sample extract to warm to room temperature. Add 2 µL of the internal standard per 100 µL of concentrated sample extract or diluted extract obtained from sample preparation.

9.6.2 Inject a 1µL aliquot of the sample extract into the GC/MS system, using the same operating conditions that were used for the calibration.

9.6.3 If the response for any quantitation ion exceeds the initial calibration range of the GC/MS system, the sample extract must be diluted and reanalyzed.

9.6.4 Monitor internal standard retention times and responses (area counts) in all samples, spikes, blanks, and standards to effectively check drifting method performance, poor injection execution, and anticipate the need for system inspection and/or maintenance.

9.6.5 The use of Selected Ion Monitoring (SIM) is acceptable for applications requiring detection limits below the normal range of electron impact mass spectrometry. However, SIM provides a lesser degree of confidence in compound identification.

9.7 Qualitative analysis

9.7.1 The qualitative identification of compounds determined by this method is based on retention time and on comparison of the sample mass spectrum, after background correction, with characteristic ions in a reference mass spectrum. The reference mass spectrum must be generated by using the conditions of this method. The characteristic ions from the reference mass spectrum are defined as the three ions of greatest relative intensity, or any ions over 30% relative intensity, if less than three such ions occur in the reference spectrum. Compounds are identified when the following criteria are met.

9.7.1.1 The intensities of the characteristic ions of a compound must maximize in the same scan or within one scan of each other. Selection of a peak by the HP data system target compound search routine where the search is based on the presence of a target chromatographic peak containing ions specific for the target compound at a compound-specific retention time will be accepted as meeting this criterion.

9.7.1.2 The RRT of the sample component is within +/- 0.06 RRT units of the RRT of the standard component.

9.7.1.3 The relative intensities of the characteristic ions agree within 30% of the relative intensities of these ions in the reference spectrum. (Example: For an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%).

Isometric pairs are resolved >90% to baseline except in the case of Benzo(b)fluoranthene and Benzo(k)fluoranthene. In this case, manual integration is performed by drawing parallel to the baseline and then stopping at the baseline point where the valley between the two isomers is deepest. This integration is performed on all calibration standards. Samples are integrated in the same way as the standards.

9.7.1.4 Identification is hampered when sample components are not resolved chromatographically and produce mass spectra containing ions contributed by more than one analyte. When gas chromatographic peaks obviously represent more than one sample component, i.e. a broadened peak with shoulder(s) or a valley between two or more maxima, appropriate selection of analyte spectra and background spectra is important.

9.7.1.5 Examination of extracted ion current profiles of appropriate ions can aid in the selection of spectra and in qualitative identification of compounds. When analytes co-elute (i.e. only one chromatographic peak is apparent), the identification criteria may be met, but each analyte spectrum will contain extraneous ions contributed by the co-eluting compound.

9.8 Quantitative analysis

9.8.1 Once a compound has been identified, the quantitation of that compound will be based on the integrated abundance of the primary characteristic ion from the EICP.

9.8.2 Isomeric pairs will be reported as individual compounds by performing integration in the same manner that the standards were integrated.

9.8.3 The integration of compounds for standards and samples should be performed to be in the same manner as the initial calibration integration. Cases where the initial calibration is in question should be investigated to

ensure it is not related to poor maintenance, damaged or defective column, or other issues which should be solved before further analysis.

9.8.4 The following must be checked for each compound present in standards and samples to ensure proper integration has been performed.

9.8.4.1 The peak shape of the calibration compound must be maintained for standards and samples. This should take into account any shouldering, peak tailing, and peak co-elution.

9.8.4.2 The retention time windows for each compound of the calibration must be applied to standards and samples. If there is a retention time shift confirmed by comparison of the Internal Standards and Surrogates then pattern recognition can be utilized for identification of multi-component analytes or known isomer relative retention time patterns, e.g., benzo(b) and benzo(k) fluoranthene, dibenz(a,h)anthracene and indeno(1,2,3,cd)pyrene. If the retention time shifts are serious enough to cause potential false negatives or quantitation errors for many compounds, then re-calbration is required.

9.8.4.3 The baseline integration techniques for each compound of the calibration must be maintained for the standards and the samples. This should take into account elevated baselines, column compensation corrections and negative peaks in samples.

9.8.4.4 Make sure that positive identification of compounds has been established thru EICP's. Pay special attention to the isomer pairs commonly misidentified by the data system, i.e. phenanthrene + anthracene, benzo(a)anthracene +chrysene, benzo(b)fluroanthene + benzo(k)fluoranthene, indeno(1,2,3,cd)pyrene + dibenz(a,h)anthracene, the trichlorophenol isomers, the dichlorobenzene isomers, the dueterated dichlorobenzene isomers, the methylphenol isomers, and benzyl alcohol.

9.8.4.5 Ensure any positive results are within the lower and upper levels of the calibration curve and above the reporting limits for each compound.

9.8.4.6 If there are any cases where the integration of a compound is questionable after ensuring the above steps have been followed then consult another qualified analyst. Chromatograms should be printed out in these cases, dated and initialed by the analyst and the qualified consultant.

## 10.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

Instrument maintenance and repair records are maintained to document satisfactory instrument performance. The operator is generally responsible to see that records are well kept. Records of major maintenance and repair are kept in the instrument maintenance log per instrument. Routine maintenance procedures such as changing the GC septum need only be recorded in the instrument analysis log.

10.1 Daily maintenance procedures:

10.1.1 The following procedures are performed each day an instrument is used for analysis.

10.1.1.1 The GC septum and glass liner are removed and replaced if judged necessary by the analyst.

10.1.1.2 Column performance is monitored by checking the response factor of key compounds which indicate column degradation and/or column bleed. Clip two or more inches from the head of the column if necessary.

10.1.1.3 Check that gases have adequate supply to last until the following day. Change tanks if necessary.

10.1.1.4 Check for sufficient data file space on the data system hardrive.

10.2 Weekly maintenance procedures:

10.2.1 Clip column at the inlet end.

10.2.2 Swab shell weldment with methylene chloride or other appropriate solvent.

10.2.3 Clean or replace gold seal.

10.3 Six month maintenance procedure:

10.3.1 Six month maintenance procedure. Every six months the vacuum pump oil and the adsorbent trap packing should be changed.

10.4 Maintenance "As needed":
The following service should be performed when system performance Indicates:

10.4.1 Clean the analyzer source. This will become necessary if a high background becomes apparent which is not attributable to column degradation or the system cannot meet DFTPP criteria.

10.4.2 Replace the electron multiplier when the maximum gain no longer provides the required sensitivity.

10.4.3 Replace the ion source filament as needed.

## 11.0 CALCULATIONS

11.1 Sample results are calculated automatically using a Microsoft EXCEL spreadsheet macro called *calcmul2*. The macro requires that specific information be included in the Sample and Miscellaneous fields in the HP Chemstation quantitation report. Provided that the information has been entered correctly, the results are provided as direct read-out in units of ug/liter for water samples and mg/kg for soil samples. The information and format of the sample information is as follows:

Sample : [AMRO ID#] DF= {8270-SX}
Misc : Matrix FV= Samp= S= X

Where: [AMRO ID#] = AMRO # in square brackets
DF = dilution factor
{8270-SX} = LIMS test code in curly brackets
FV = Final volume of sample extract in mLs
Samp = sample weight in grams for soils, sample volume in mLs for water
S = Dry weight % (i.e. % Solids)
X = Extraction date of sample

Example follows for a soil sample:

Sample : [20152-03] DF=1 {8270_SX}

Misc : Soil FV=1ML SAMP=20.10G S=94.5 X083198

## 12.0 QUALITY CONTROL

12.1 Initial Demonstration of Lab Performance

The ability of AMRO to produce accurate and precise data is demonstrated per instrument/per analyst for each method. This information was entered on an Excel® spreadsheet and is kept on file with the QC department along with the associated chromatograms and quantitation output pages. It consists of a Method Detection Limit Study (MDL) and Precision and Accuracy Study (P&A) for each instrument and each matrix on an annual basis.

12.1.1 The method detection limit is defined in 40 CFR 136 Appendix B. The MDL is determined annually by the analysis of a minimum of seven replicate samples, all containing an analyte(s) of the same low-level concentration. These replicate samples are put through all the preparation steps that a sample is put through. The standard deviation of the results of these analyses is multiplied by the appropriate student T-test value and the resulting value is deemed the method detection limit for that specifie analyte.

This is performed annually for each method, each instrument and each matrix analyzed by AMRO. Quarterly preparation and analysis of MDL check samples are performed and the results compared to the USACE and Navy requirements. MDL check sample concentrations should be about twice the target analyte MDL values. MDL values must be less than about 1/3 of the RL value for each analyte.

12.1.2 Precision &Accuracy

Accuracy is a measure of the degree to which the analytical result approaches the "true" value of the concentration of the analyte being determined. Precision in the laboratory is determined by the comparison of duplicates, where duplicate samples result from an original sample that has been split for identical analyses. Precision and Accuracy in the laboratory is assessed initially by the analyses of a minimum of 4 replicate samples at a mid-level point of the expected range. The percent recoveries and Relative Standard Deviations (RSD) are evaluated and compared to method specifications or default limits where applicable.

Accuracy is also assessed by the regular analysis of known standards such as the Laboratory Control Samples (LCS), and matrix and analytical spikes. Accuracy within the laboratory is expressed in terms of percent recovery.

The precision of data is regularly evaluated by determining the relative percent difference (RPD) of duplicate (replicate) analyses.

12.2 The GC/MS system must be tuned to meet the DFTPP criteria listed in Section 9.3.2.

12.3 There must be an initial calibration of the GC/MS system as described in Section 9.4.

12.4 The GC/MS system must meet the calibration verification acceptance criteria in Section 9.5, each 12 hours.

12.5 Sample Quality Control for Preparation and Analysis - The laboratory analyzes QC samples for every analytical batch of up to 20 samples or each day, whichever is more frequent. QC samples include a method blank, matrix spike, matrix spike duplicate, and a laboratory control sample (LCS) in each analytical batch and the addition of surrogates to each field sample and QC sample.

12.5.1 Method blanks are evaluated for every extraction batch. See Section 9.5.3 for method blank performance criteria.

12.5.2 Full list Matrix spike (MS)/matrix spike duplicate (MSD) pairs are prepared with every extraction batch if sufficient sample was provided. The MS/MSD are evaluated for % Recovery and Relative Percent Difference (RPD). Quality Control limits are updated annually for the water and soil matrices (non-soil solid samples follow the rules for soil samples). Note the special USACE acceptance criteria limits for the LCS apply to all USACE or Navy project sample matrix spikes by default.

12.5.2.1 If all analytes are within QC limits then accuracy and precision objectives have been met for the matrix.

12.5.2.2 If any analyte exceeds QC limits then an investigation of possible causes begins. This may include, but is not limited to, the following:

12.5.2.2.1 Review of the preparation worksheet to see if any problems were encountered by the technicians during sample preparation such as emulsions, unusually high or low initial pH, observations or descriptions of a

strange physical appearance of the sample, extract losses during handling, etc;

12.5.2.2.2 review of the chain-of-custody to see if any descriptions or notations were provided by client;

12.5.2.2.3

12.5.2.2.4 previous knowledge of the history of the particular matrix;

12.5.2.2.5 evaluation of the total ion chromatogram (TIC) for interferences in the region of interest.

12.5.3. A Full List Laboratory Control Sample (LCS) is included with each extraction batch. If sufficient sample was not provided for an MS/MSD, then a LCS Duplicate is also extracted. The LCS consists of an aliquot of a clean (control) matrix similar to the sample matrix and of the same weight or volume. The LCS is spiked with a full analyte list at the same relative concentrations (acid and base) as the matrix spike. When the results of the matrix spike analyses indicate a potential problem due to the sample matrix itself, the LCS results are evaluated to verify that the laboratory extraction systems are in control. Note the special default USACE acceptance criteria limits for LCS samples are described in the Attachments 3A, 3B, 3C and 4A, 4B, and 4C and these apply to all USACE and Navy project sample LCS reports. Note that 3 Sporadic Marginal Exceedances of the criteria below are allowed for each full list LCS.

12.5.4 Surrogate recoveries - The laboratory must evaluate surrogate recovery data from individual samples versus the surrogate control limits developed by the laboratory. The same evaluation criteria for sections 12.5.2.1 through 12.5.2.3 are applied to the surrogates.

12.5.3 Special surrogate recovery limits apply to all USACE and Navy project samples and associated QC samples. These limits are listed in Attachment 2 and the USACE test codes: Note that Sporadic Marginal Exceedances of surrogate recoveries is not allowed. All surrogate failures must be discussed in the narrative and results flagged. Samples must be re-extracted and re-analyzed if sufficient volume remains.

12.5.4 Samples must be selected for spiking at random and rotated among clients and sites from batch to batch. In some cases, the client may specify which sample is to used for MS/MSD; if not , the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall not be performed on Trip Blank, Rinsate Blank or Field Blank.
B. Adequate sample weight/volume.
C. Client requested QC deliverables.

12.6 The following additional Quality Control criteria should be met for all Massachusetts Contingency Plan (MCP) projects where MCP methods are requested:

12.6.1 MS/MSD: Must contain all target compounds. Recoveries should be between 40-140% for base-neutral targets and between 30-130% for acids. RPDs should be≤20% for waters and ≤30% for soils. Document exceedance in narrative with laboratory statistical control limits if recoveries are *within* AMRO statistical limits.

12.6.2 LCS- Must contain all target compounds.Recoveries must be between 40-140% for base-neutral targets and between 30-130% for acids. Re-extract if >20% of all analytes fall outside the criteria or if >15% or either fraction fall outside the criteria. Document exceedance in narrative with laboratory statistical control limits if recoveries are *within* AMRO statistical limits.

12.6.3 Surrogates- Recoveries must be between 30-130% for all surrogates in soils. Recoveries must be between 30-130% for all base-neutral surrogates in water and between 15-110% for acids in water. Document exceedance in narrative with laboratory statistical control limits if recoveries are *within* AMRO statistical limits.

12.7 USACOE and Navy Projects:

12.7.1 For all project submitted from the USACOE and Navy follow the specific requirements as indicated in Attachment 2, 3A, 3B, 3C, 4A, 4B, 4C. LCS failure occurs if: (1) a project specific analyte exceeds the control limits; or (2) if more than the allowable number of Sporadic Marginal Exceedances occur; or (3) if any single analyte exceeds the SME limits. Corrective action must be applied to all analytes that exceed the primary control limits used as acceptance criteria. If the problem appears to be isolated to the LCS then a new LCS may be prepared and run with the original batch reruns. If the problem appears to affect all the samples in the batch, indicated by similar problems in the surrogates and matrix spikes, then the entire batch must be reprepared and reanalyzed. If the new LCS has similar problems then all the associated data must be flagged in the results and discussed in the

narrative. If the new LCS passes, report both LCS results and discuss the problem analytes in the narrative.

## 13.0 DATA REVIEW AND STORAGE

AMRO's goal for completeness is 100%. The following data calculating, reviewing and reporting procedures are followed to obtain that goal.

13.1 Data Review - performed by the analyst:

When an analysis of a sample is complete, the analysis for that sample should be checked and the data calculated as soon as possible to identify any problems while still within the holding time for the analysis. The following steps should be taken to ensure that a good analysis has been obtained.

13.1.1 Check that all calibration analyses associated with the sample meet criteria to ensure acceptance criteria is met.

13.1.2 Check the internal standard areas. They should be -50 to +200% in comparison to the I.S. areas in the Initial Calibration standard.

13.1.3 Compare the surrogate recoveries to the AMRO limits. The default SVO surrogate recovery limits are as follows and are used until in house limits are generated.

13.1.4 Check the LCS to be sure the results are inside the limits, as well as the matrix spike and matrix spike duplicate results.

13.1.5 Check the analyzed times to be sure the tuning requirements are met.

13.1.6 Check that no compounds exceed the calibration range. If there are, these samples must be reanalyzed at a dilution.

13.1.7 Check the chromatography (good peak shape, baseline not noisy, good sensitivity).

13.1.8 Check the analysis for carryover or contamination. If any carryover is evident, these samples must be reanalyzed.

13.1.9 Check that the amount of sample analyzed is correctly recorded in the chromatogram header.

13.1.10 Check spectrum, area, and retention time of any positive hit on the quant output page.

13.1.11 Perform the final calculations on any positively identified compound in µg/L, taking into account dilution factors, etc.

13.1.12 Check the chromatogram for very large peaks not picked up by quant. If any are present, check the spectrum to be sure it is not a target compound that is over the calibration range or outside the normal retention time window. If not a target compound, make a note on the chromatogram that the peak is an unknown and use the library to identify if possible.

13.1.13 Check to see if there are any other analyses of the sample. If so, check to see if the data agrees.

13.1.14 Any problems discovered during this preliminary data check will necessitate re-analysis unless the lab manager authorizes use of the data in writing with an explanation of why the data is being used.

13.1.15 All calculations should be written in black ballpoint pen ink. All cross-outs should be a single line and should be initialed. The person performing these data calculations and checks should sign and date the bottom of the quant page.

13.2 Data Review - performed by the department supervisor or designate.

When all samples for a given project have been analyzed and the results have been calculated, the project goes through the following data review procedure:

13.2.1 The reviewer reads over all associated paperwork to become familiar with the requirements of the project.

13.2.2 The project is checked for completeness.

13.2.3 Data sheets are checked for accuracy.

13.2.4 The data calculations are spot-checked. If any problems are encountered then the whole package should be checked.

13.2.5 The QC data sheets are checked. Any problems encountered by the reviewer are brought to the attention of the lab manager.

13.2.6 All cross-outs must be a single line and should be initialed and dated. Analyst review is documented on the GC and GC/MS Data Review Checklist (Attachment 8).

13.3 Data Reporting

Many report options are available to clients of AMRO. It is AMRO policy to discuss with all clients their reporting requirements soon after receipt of the samples. The cover letter for the data reports will address any quality control problems, either with the condition of the samples upon receipt or with the analyses, or contain a statement that no quality control problems were encountered. The letter will also contain a statement that it is an integral part of the data report.

13.4 Data Archival

13.4.1 GC/MS Data Files:
All raw GC/MS data files are archived through the Network and are backed up on a tape drive through the server.

13.4.2 Data Reports:

Final data and QC reports are input into Excel and spreadsheet files. Template files exist on the Network for final data reports, daily QC check reports, sample spike reports, initial precision and accuracy data, wastewater method accuracy data, surrogate recovery data, and MDL data. When data is input template files are renamed as follows:

Data reports: XXX#####

Where X 's are the first three characters of the AMRO client code and #'s are the AMRO project and sample number.

## 14.0 REFERENCES

14.1 USEPA Office of Solid and Hazardous Waste - SW-846 Method Chapter 1, Rev. 1 7/92.

14.2 USEPA Method 3500. Physical and Chemical Methods for the Determination of Soild/Hazardous Waste, SW 846, Update III, Revision 2, 12/96

14.3 USEPA Method 8000B. Physical and Chemical Methods for the Determination of Soild/Hazardous Waste, SW 846, Update III, Revision 2, 12/96.

14.4 USEPA Method 8270C. Physical and Chemical Methods for the Determination of Soild/Hazardous Waste, SW 846, Update III, Revision 3, 12/96.

14.5 40 CFR Part 136 Appendix B, 1984

14.6 USACE Shell for Analytical Chemistry Requirements, EM 200-1-3, Feb 01, 2001.

14.7 Massachusetts Department of Environmental Protection, Massachusetts Contingency Plan (MCP) Method BWSC – CAM IIB , Revision 3, May 22, 2003.

14.8 USEPA Superfund Contract Laboratory Program Statement of Work for Organics Analysis OLM04.2 , May 1999.

14.9 Department of Defense Quality Systems Manual For Environmental Laboratories, Final Version 3, January 2006.

# Attachment 1A

## Semi-Volatile Internal Standards With Corresponding Target Compounds and Surrogates Assigned For Quantitation

| | Compound | Quant ion | Qual #1 | Qual #2 | Qual#3 |
|---|---|---|---|---|---|
| Internal Standard | 1,4-DICHLOROBENZENE-d4 | 152 | 115 | | |
| | N-NITROSODIMETHYLAMINE | 74 | 42 | | |
| | PYRIDINE | 79 | 52 | 50 | 73 |
| Surrogate | 2-FLUOROPHENOL | 112 | 64 | | |
| Surrogate | PHENOL-d5 | 99 | 42 | 71 | |
| | PHENOL | 94 | 65 | 66 | |
| | ANILINE | 93 | 65 | 66 | |
| | bis (2-CHLOROETHYL) ETHER | 93 | 63 | 95 | |
| | 2-CHLOROPHENOL | 128 | 64 | 130 | |
| | 1,3-DICHLOROBENZENE | 146 | 148 | 113 | |
| | 1,4-DICHLOROBENZENE | 146 | 148 | 113 | |
| | BENZYL ALCOHOL | 108 | 79 | 77 | |
| | 2-METHYLPHENOL | 108 | 107 | | |
| | 1,2-DICHLOROBENZENE | 146 | 148 | 113 | |
| | bis(2-CHLOROISOPROPYL) ETHER | 45 | 77 | | |
| | ACETOPHENONE | 105 | 77 | 120 | 51 |
| | 4-METHYLPHENOL | 108 | 107 | | |
| | n-NITROSO-DI-N-PROPYLAMINE | 70 | 42 | 130 | |
| | HEXACHLOROETHANE | 117 | 201 | 199 | |
| Internal Standard | NAPHTHALENE-d8 | 136 | 68 | | |
| Surrogate | NITROBENZENE-d5 | 82 | 128 | 54 | |
| | NITROBENZENE | 77 | 123 | 65 | |
| | ISOPHORONE | 82 | 138 | | |
| | 2,4-DIMETHYLPHENOL | 107 | 121 | 122 | |
| | BENZOIC ACID | 122 | 105 | 77 | |
| | 2-NITROPHENOL | 139 | 65 | 109 | |
| | bis(2-CHLOROETHOXY) METHANE | 93 | 95 | 123 | |
| | 2,4-DICHLOROPHENOL | 162 | 164 | 98 | |
| | 1,2,4-TRICHLOROBENZENE | 180 | 182 | 145 | |
| | NAPHTHALENE | 128 | 129 | 127 | |
| | 4-CHLOROANILINE | 127 | 129 | | |
| | HEXACHLOROBUTADIENE | 225 | 223 | 227 | |
| | 4-CHLORO-3-METHYLPHENOL | 107 | 144 | 142 | |
| | 2-METHYLNAPHTHALENE | 142 | 141 | | |

Attachment 1B

Semi-Volatile Internal Standards With Corresponding Target Compounds and Surrogates Assigned For Quantitation

| | Compound | Quant ion | Qual #1 | Qual #2 | Qual#3 |
|---|---|---|---|---|---|
| Internal Standard | ACENAPHTHENE-d10 | 164 | 162 | 160 | |
| | HEXACHLOROCYCLOPENTADIENE | 237 | 235 | 272 | |
| | 2,4,6-TRICHLOROPHENOL | 196 | 198 | 200 | |
| | 2,4,5-TRICHLOROPHENOL | 196 | 198 | 200 | |
| Surrogate | 2-FLUOROBIPHENYL | 172 | 171 | | |
| | 2-CHLORONAPHTHALENE | 162 | 164 | 127 | |
| | 2-NITROANILINE | 65 | 92 | 138 | |
| | DIMETHYLPHTHALATE | 163 | 194 | 164 | |
| | 2,6-DINITROTOLUENE | 165 | 89 | 121 | |
| | ACENAPHTHYLENE | 152 | 151 | 153 | |
| | 3-NITROANILINE | 138 | 108 | 92 | |
| | 4-NITROPHENOL | 109 | 139 | 65 | |
| | 2,4-DINITROPHENOL | 184 | 63 | 154 | |
| | ACENAPHTHENE | 153 | 152 | 154 | |
| | 2,4-DINITROTOLUENE | 165 | 63 | 182 | |
| | DIBENZOFURAN | 168 | 139 | | |
| | DIETHYLPHTHALATE | 149 | 177 | 150 | |
| | 4-CHLOROPHENYL-PHENYLETHER | 204 | 206 | 141 | |
| | FLUORENE | 166 | 165 | 167 | |
| | 4-NITROANILINE | 138 | 92 | 108 | |
| Internal Standard | PHENANTHRENE-d10 | 188 | 94 | | |
| | 4,6-DINITRO-2-METHYLPHENOL | 198 | 51 | 121 | |
| | n-NITROSODIPHENYLAMINE | 169 | 168 | 167 | |
| | AZOBENZENE | 77 | 51 | 182 | |
| Surrogate | 2,4,6-TRIBROMOPHENOL | 330 | 332 | 141 | |
| | 4-BROMOPHENYL-PHENYL-ETHER | 248 | 250 | 141 | |
| | HEXACHLOROBENZENE | 284 | 142 | 249 | |
| | PENTACHLOROPHENOL | 266 | 264 | 268 | |
| | PHENANTHRENE | 178 | 179 | 176 | |
| | ANTHRACENE | 178 | 179 | 176 | |
| | CARBAZOLE | 167 | 166 | 139 | |
| | DI-N-BUTYL-PHTHALATE | 149 | 150 | 104 | |
| | FLUORANTHENE | 202 | 101 | | |

# Attachment 1C

## Semi-Volatile Internal Standards With Corresponding Target Compounds and Surrogates Assigned For Quantitation

| | Compound | Quant ion | Qual #1 | Qual #2 | Qual#3 |
|---|---|---|---|---|---|
| Internal Standard | CHRYSENE-d12 | 240 | 120 | 236 | |
| | BENZIDINE | 184 | 185 | 92 | |
| | PYRENE | 202 | 101 | 100 | |
| Surrogate | TERPHENYL-d14 | 244 | 122 | 212 | |
| | BUTYLBENYLPHTHALATE | 149 | 91 | 206 | |
| | BIS(2-ETHYLHEXYL)PHTHALATE | 149 | 167 | 279 | |
| | 3,3'-DICHLOROBENZIDINE | 252 | 254 | 126 | |
| | BENZO(A)ANTHRACENE | 228 | 229 | 226 | |
| | CHRYSENE | 228 | 226 | 229 | |
| | DI-N-OCTYL PHTHALATE | 149 | 150 | | |
| Internal Standard | PERYLENE-d12 | 264 | 260 | 265 | |
| | BENZO(B)FLUORANTHENE | 252 | 253 | 125 | |
| | BENZO(K)FLUORANTHENE | 252 | 253 | 125 | |
| | BENZO(A)PYRENE | 252 | 126 | 253 | |
| | DIBENZO(A,H,)ANTHRACENE | 278 | 139 | 279 | |
| | INDENO[1,2,3-CD]PYRENE | 276 | 138 | | |
| | BENZO[G,H,I]PERYLENE | 276 | 138 | 277 | |

Attachment 2

## SURROGATE RECOVERY CONTROL LIMITS FOR USACOE AND NAVY PROJECTS

| | 8270C Water | | 8270C Solid | |
|---|---|---|---|---|
| **Analyte** | **Lower** | **Upper** | **Lower** | **Upper** |
| | **Control Limit** | **Control Limit** | **Control Limit** | **Control Limit** |
| 2-Fluorobiphenyl | 50 | 110 | 45 | 105 |
| Terphenyl-d14 | 50 | 135 | 30 | 125 |
| 2,4,6-Tribromophenol | 40 | 125 | 35 | 125 |
| 2-Fluorophenol | 20 | 110 | 35 | 105 |
| Phenol-d5/d6 | 10 | 115 | 40 | 100 |
| Nitrobenzene-d5 | 40 | 110 | 35 | 100 |

Attachment 3A

**LCS and MS Control Limits For Semi-volatile Organic Compounds SW-846 Method 8270C**

**Water Matrix**

| Analyte | Lower Control Limit | Upper Control Limit | Lower ME | Upper ME |
|---|---|---|---|---|
| 1,2,4-Trichlorobenzene | 35 | 105 | 25 | 120 |
| 1,2-Dichlorobenzene | 35 | 100 | 20 | 115 |
| 1,2-Diphenylhydrazine (as Azobenzene) | 55 | 115 | 45 | 120 |
| 1,3-Dichlorobenzene | 30 | 100 | 20 | 110 |
| 1,4-Dichlorobenzene | 30 | 100 | 20 | 110 |
| 2,4,5-Trichlorophenol | 50 | 110 | 40 | 120 |
| 2,4,6-Trichlorophenol | 50 | 115 | 40 | 125 |
| 2,4-Dichlorophenol | 50 | 105 | 40 | 115 |
| 2,4-Dimethylphenol | 30 | 110 | 15 | 125 |
| 2,4-Dinitrophenol | 15 | 140 | 10 | 160 |
| 2,4-Dinitrotoluene | 50 | 120 | 40 | 130 |
| 2,6-Dinitrotoluene | 50 | 115 | 35 | 130 |
| 2-Chloronaphthalene | 50 | 105 | 40 | 115 |
| 2-Chlorophenol | 35 | 105 | 25 | 115 |
| 2-Methylnaphthalene | 45 | 105 | 35 | 115 |
| 2-Methylphenol | 40 | 110 | 25 | 120 |
| 2-Nitroaniline | 50 | 115 | 35 | 125 |
| 2-Nitrophenol | 40 | 115 | 25 | 125 |
| 3,3´-Dichlorobenzidine | 20 | 110 | 10 | 125 |
| **3,3´-Dimethylbenzidine** | 20 | 150 | | |
| 3-Nitroaniline | 20 | 125 | 10 | 145 |
| 4,6-Dinitro-2-methylphenol | 40 | 130 | 25 | 145 |
| 4-Bromophenyl phenyl ether | 50 | 115 | 40 | 125 |
| 4-Chloro-3-methylphenol | 45 | 110 | 35 | 120 |
| 4-Chloroaniline | 15 | 110 | 10 | 125 |
| 4-Chlorophenyl phenyl ether | 50 | 110 | 40 | 120 |
| 4-Methylphenol | 30 | 110 | 20 | 125 |
| 4-Nitroaniline | 35 | 120 | 20 | 130 |
| *4-Nitrophenol*[3] | *0* | *125* | *0* | *145* |
| Acenaphthene | 45 | 110 | 35 | 120 |
| Acenaphthylene | 50 | 105 | 40 | 115 |
| **Acetophenone** | 45 | 135 | | |
| **Aniline*** | 10 | 150 | | |

Notes:

1. All **bold** analytes do not have DoD QSM acceptance criteria and "Shell" criteria are used.
2. **Bold*** analytes are designated Poor Performing Analytes (PPA) in the "Shell"
3. PPA DoD Table D-2 analytes are designated poor performers in the DoD QSM.

Attachment 3B

**LCS and MS Control Limits For Semi-volatile Organic Compounds SW-846 Method 8270C**
**Water Matrix**

| Analyte | Lower Control Limit | Upper Control Limit | Lower ME | Upper ME |
|---|---|---|---|---|
| Anthracene | 55 | 110 | 45 | 120 |
| Benz(a)anthracene | 55 | 110 | 45 | 120 |
| **Benzidine*** | 10 | 150 | | |
| Benzo(a)pyrene | 55 | 110 | 45 | 120 |
| Benzo(b)fluoranthene | 45 | 120 | 35 | 130 |
| Benzo(g,h,i)perylene | 40 | 125 | 25 | 135 |
| Benzo(k)fluoranthene | 45 | 125 | 30 | 135 |
| *Benzoic acid*[3] | *0* | *125* | *0* | *150* |
| Benzyl alcohol | 30 | 110 | 15 | 125 |
| Bis(2-chloroethoxy)methane | 45 | 105 | 35 | 115 |
| Bis(2-chloroethyl)ether | 35 | 110 | 25 | 120 |
| Bis(2-chloroisopropyl)ether | 25 | 130 | 10 | 150 |
| Bis(2-ethylhexyl)phthalate | 40 | 125 | 30 | 140 |
| Butyl benzyl phthalate | 45 | 115 | 35 | 130 |
| Carbazole | 50 | 115 | 35 | 130 |
| Chrysene | 55 | 110 | 45 | 120 |
| Dibenz(a,h)anthracene | 40 | 125 | 30 | 140 |
| Dibenzofuran | 55 | 105 | 45 | 115 |
| Diethyl phthalate | 40 | 120 | 30 | 130 |
| Dimethyl phthalate | 25 | 125 | 10 | 145 |
| Di-n-butyl phthalate | 55 | 115 | 45 | 125 |
| Di-n-octyl phthalate | 35 | 135 | 20 | 155 |
| Fluoranthene | 55 | 115 | 45 | 125 |
| Fluorene | 50 | 110 | 40 | 120 |
| Hexachlorobenzene | 50 | 110 | 40 | 120 |
| Hexachlorobutadiene | 25 | 105 | 15 | 115 |

Notes:

1. All **bold** analytes do not have DoD QSM acceptance criteria and "Shell" criteria are used.
2. **Bold*** analytes are designated Poor Performing Analytes (PPA) in the "Shell"
3. PPA DoD Table D-2 analytes are designated poor performers in the DoD QSM. Batch acceptance should not be evaluated based on these control limits.

Attachment 3C

**LCS and MS Control Limits For Semi-volatile Organic Compounds SW-846 Method 8270C**
**Water Matrix**

| Analyte | Lower Control Limit | Upper Control Limit | Lower ME | Upper ME |
|---|---|---|---|---|
| **Hexachlorocyclopentadiene** | 20 | 150 | | |
| Hexachloroethane | 30 | 95 | 15 | 105 |
| Indeno(1,2,3-cd)pyrene | 45 | 125 | 30 | 140 |
| Isophorone | 50 | 110 | 40 | 125 |
| Naphthalene | 40 | 100 | 30 | 115 |
| Nitrobenzene | 45 | 110 | 35 | 120 |
| N-Nitrosodimethylamine | 25 | 110 | 10 | 125 |
| N-Nitrosodi-n-propylamine | 35 | 130 | 20 | 145 |
| N-Nitrosodiphenylamine | 50 | 110 | 35 | 120 |
| Pentachlorophenol | 40 | 115 | 25 | 130 |
| Phenanthrene | 50 | 115 | 40 | 130 |
| *Phenol*[3] | 0 | 115 | 0 | 135 |
| Pyrene | 50 | 130 | 35 | 140 |
| **Pyridine** | NA | NA | | |

Notes:

1. All **bold** analytes do not have DoD QSM acceptance criteria and "Shell" criteria are used.
2. **Bold*** analytes are designated Poor Performing Analytes (PPA) in the "Shell"
3. PPA DoD Table D-2 analytes are designated poor performers in the DoD QSM.

Attachment 4A

## LCS and MS Control Limits For Semi-volatile Organic Compounds SW-846 Method 8270C Soil Matrix

| Analyte | Lower Control Limit | Upper Control Limit | Lower ME | Upper ME |
|---|---|---|---|---|
| 1,2,4-Trichlorobenzene | 45 | 110 | 30 | 120 |
| 1,2-Dichlorobenzene | 45 | 95 | 35 | 105 |
| **1,2-Diphenylhydrazine (as Azobenzene)** | 45 | 135 | | |
| 1,3-Dichlorobenzene | 40 | 100 | 30 | 110 |
| 1,4-Dichlorobenzene | 35 | 105 | 25 | 115 |
| 2,4,5-Trichlorophenol | 50 | 110 | 40 | 120 |
| 2,4,6-Trichlorophenol | 45 | 110 | 30 | 120 |
| 2,4-Dichlorophenol | 45 | 110 | 35 | 120 |
| 2,4-Dimethylphenol | 30 | 105 | 20 | 115 |
| 2,4-Dinitrophenol | 15 | 130 | 10 | 150 |
| 2,4-Dinitrotoluene | 50 | 115 | 35 | 130 |
| 2,6-Dinitrotoluene | 50 | 110 | 35 | 125 |
| 2-Chloronaphthalene | 45 | 105 | 35 | 115 |
| 2-Chlorophenol | 145 | 105 | 35 | 115 |
| 2-Methylnaphthalene | 45 | 105 | 35 | 115 |
| 2-Methylphenol | 40 | 105 | 30 | 115 |
| 2-Nitroaniline | 45 | 120 | 30 | 130 |
| 2-Nitrophenol | 40 | 110 | 30 | 120 |
| *3,3'-Dichlorobenzidine*[3] | 10 | 130 | 0 | 145 |
| 3-Nitroaniline | 25 | 110 | 15 | 125 |
| 4,6-Dinitro-2-methylphenol | 30 | 135 | 10 | 155 |
| 4-Bromophenyl phenyl ether | 45 | 115 | 35 | 130 |
| 4-Chloro-3-methylphenol | 45 | 115 | 35 | 125 |
| *4-Chloroaniline*[3] | 10 | 95 | 0 | 110 |
| 4-Chlorophenyl phenyl ether | 45 | 110 | 35 | 120 |
| 4-Methylphenol | 40 | 105 | 30 | 120 |
| 4-Nitroaniline | 35 | 115 | 20 | 125 |
| 4-Nitrophenol | 15 | 140 | 10 | 160 |
| Acenaphthene | 45 | 110 | 35 | 120 |
| Acenaphthylene | 45 | 105 | 35 | 115 |
| **Acetophenone** | 45 | 135 | | |
| **Aniline** | 10 | 150 | | |

Notes:

1. All **bold** analytes do not have DoD QSM acceptance criteria and "Shell" criteria are used.
2. **Bold*** analytes are designated Poor Performing Analytes (PPA) in the "Shell"
3. PPA DoD Table D-2 analytes are designated poor performers in the DoD QSM.

Attachment 4B

**LCS and MS Control Limits For Semi-volatile Organic Compounds SW-846 Method 8270C**
**Soil Matrix**

| Analyte | Lower Control Limit | Upper Control Limit | Lower ME | Upper ME |
|---|---|---|---|---|
| Anthracene | 55 | 105 | 45 | 115 |
| Benz(a)anthracene | 50 | 110 | 40 | 120 |
| **Benzidine** | 10 | 150 | | |
| Benzo(a)pyrene | 50 | 110 | 40 | 120 |
| Benzo(b)fluoranthene | 45 | 115 | 35 | 125 |
| Benzo(g,h,i)perylene | 40 | 125 | 25 | 140 |
| Benzo(k)fluoranthene | 45 | 125 | 30 | 135 |
| *Benzoic acid*[3] | 0 | 110 | 0 | 130 |
| Benzyl alcohol | 20 | 125 | 10 | 140 |
| Bis(2-chloroethoxy)methane | 45 | 110 | 30 | 120 |
| Bis(2-chloroethyl)ether | 40 | 105 | 25 | 115 |
| Bis(2-chloroisopropyl)ether | 20 | 115 | 10 | 130 |
| Bis(2-ethylhexyl)phthalate | 45 | 125 | 35 | 140 |
| Butyl benzyl phthalate | 50 | 125 | 35 | 135 |
| Carbazole | 45 | 115 | 30 | 130 |
| Chrysene | 55 | 110 | 45 | 120 |
| Dibenz(a,h)anthracene | 40 | 125 | 25 | 140 |
| Dibenzofuran | 50 | 105 | 40 | 110 |
| Diethyl phthalate | 50 | 115 | 40 | 125 |
| Dimethyl phthalate | 50 | 110 | 40 | 120 |
| Di-n-butyl phthalate | 55 | 110 | 45 | 120 |
| Di-n-octyl phthalate | 40 | 130 | 25 | 145 |
| Fluoranthene | 55 | 115 | 45 | 125 |
| Fluorene | 50 | 110 | 40 | 115 |
| Hexachlorobenzene | 45 | 120 | 35 | 130 |
| Hexachlorobutadiene | 40 | 115 | 25 | 130 |

Notes:

1. All **bold** analytes do not have DoD QSM acceptance criteria and "Shell" criteria are used.
2. **Bold*** analytes are designated Poor Performing Analytes (PPA) in the "Shell"
3. PPA DoD Table D-2 analytes are designated poor performers in the DoD QSM.

Attachment 4C

**LCS and MS Control Limits For Semi-volatile Organic Compounds SW-846 Method 8270C**
**Soil Matrix**

| Analyte | Lower Control Limit | Upper Control Limit | Lower ME | Upper ME |
|---|---|---|---|---|
| **Hexachlorocyclopentadiene** | NA | NA | | |
| Hexachloroethane | 35 | 110 | 20 | 120 |
| Indeno(1,2,3-cd)pyrene | 40 | 120 | 35 | 135 |
| Isophorone | 45 | 110 | 30 | 125 |
| Naphthalene | 40 | 105 | 30 | 120 |
| Nitrobenzene | 40 | 115 | 30 | 125 |
| N-Nitrosodimethylamine | 20 | 115 | 10 | 130 |
| N-Nitrosodi-n-propylamine | 40 | 115 | 30 | 125 |
| N-Nitrosodiphenylamine | 50 | 115 | 40 | 125 |
| Pentachlorophenol | 25 | 120 | 10 | 135 |
| Phenanthrene | 50 | 110 | 40 | 120 |
| Phenol | 40 | 100 | 30 | 110 |
| Pyrene | 45 | 125 | 35 | 135 |
| **Pyridine** | NA | NA | | |

Notes:

1. All **bold** analytes do not have DoD QSM acceptance criteria and "Shell" criteria are used.
2. **Bold*** analytes are designated Poor Performing Analytes (PPA) in the "Shell".
3. PPA DoD Table D-2 analytes are designated poor performers in the DoD QSM.

# Attachment 5

## INSTRUMENT CONTROL PARAMETERS

Sample Inlet: GC
Injection Source: GC ALS
Mass Spectrometer: Enabled

### HP GC Injector

Front Injector:
No parameters specified

Back Injector:

| | |
|---|---|
| Sample Washes | 1 |
| Sample Pumps | 1 |
| Injection Volume | 1.0 microliters |
| Syringe Size | 10.0 microliters |
| On Column | Off |
| Monolithed Adapter | Off |
| Post-Inj Solvent A Washes | 1 |
| Post-Inj Solvent B Washes | 1 |
| Viscosity Delay | 0 seconds |
| Plunger Speed | Fast |

### HP5890 Temperature Parameters

| Zone Temperatures: | State | Setpoint |
|---|---|---|
| Inlet A: | Off | 50 C |
| Inlet B: | On | 280 C |
| Detector A: | Off | 50 C |
| Detector B: | On | 280 C |
| Auxiliary: | Off | 50 C |

Oven Parameters:

| | |
|---|---|
| Oven Equib Time: | 0.30 minutes |
| Oven Max: | 325 C |
| Oven State: | On |
| Cryo State: | Off |
| Cryo Blast: | Off |
| Ambient: | 25 C |

Oven Program:

| | |
|---|---|
| Initial Temperature: | 50 C |
| Initial Time: | 1.50 minutes |

| | | | |
|---|---|---|---|
| d: BMASV1.M | Mon Jul 21 12:56:29 2001 | Page: 1 | |

| | | | | |
|---|---|---|---|---|
| | Valve 1: Off | Valve 2: Off | Valve 3: Off | Valve 4: Off |
| 19405 Valves: | | | | |
| | Valve 5: Off | Valve 6: Off | Valve 7: Off | Valve 8: Off |
| 19405 Relays: | | | | |
| | Relay 1: Off | Relay 2: Off | Relay 3: Off | Relay 4: Off |

### HP5890 Detector Information

| Detector | Type | State |
|---|---|---|
| A | --- | Off |
| B | --- | Off |

### HP5890 Signal Information

Not saving signal data.

| Signal | Source | Peak Width | Data Rate | Start Data | Stop Data |
|---|---|---|---|---|---|
| 1 | Tecplot | 0.053 | 5.000 | 0.00 | 1.00 |
| 2 | Tecplot | 0.053 | 5.000 | 0.00 | 1.00 |

### MS ACQUISITION PARAMETERS

General Information

Tune File : dfcpp.u
Acquisition Mode : Scan

MS Information

Solvent Delay : 1.00 min

EM Absolute : False
EM Offset : 0
Resulting EM Voltage : 1317.6

(Scan Parameters)

Low Mass : 35
High Mass : 500
Threshold : 500
Sample # : 2 A/D Samples 4

END OF MS ACQUISITION PARAMETERS

END OF INSTRUMENT CONTROL PARAMETERS

| Level | Rate (C/minute) | Final Temperature (C) | Final Time (minutes) |
|---|---|---|---|
| 1 | 10.0 | 100 | 0.00 |
| 2(A) | 15.0 | 240 | 0.00 |
| 3(B) | 3.0 | 320 | 1.50 |

Next Run Time: 24.00 minutes

### HP5890 Inlet Pressure Programs

GC Pressure Units: psi

Inlet A:

| | |
|---|---|
| Constant Flow: | Off |
| Constant Flow Pressure: | 0.0 psi |
| Constant Flow Temperature: | 50 C |
| Initial Pressure: | 0.0 psi |
| Initial Time: | 650.00 minutes |

| Level | Rate (psi/minute) | Final Pressure (psi) | Final Time (minutes) |
|---|---|---|---|
| 1 | 0.00 | 0.0 | 0.00 |
| 2(A) | 0.00 | 0.0 | 0.00 |
| 3(B) | 0.00 | 0.0 | 0.00 |

Total Program Time: 650.00 minutes

| | |
|---|---|
| Column Length: | 30.00 m |
| Column Diameter: | 0.530 mm |
| Gas: | He |
| Vacuum Compensation: | Off |

Inlet B:

| | |
|---|---|
| Constant Flow: | Off |
| Constant Flow Pressure: | 0.0 psi |
| Constant Flow Temperature: | 50 C |
| Initial Pressure: | 7.7 psi |
| Initial Time: | 0.00 minutes |

| Level | Rate (psi/minute) | Final Pressure (psi) | Final Time (minutes) |
|---|---|---|---|
| 1 | 99.00 | 50.0 | 0.15 |
| 2(A) | 99.00 | 7.7 | 0.00 |
| 3(B) | 0.00 | 0.0 | 0.00 |

Total Program Time: 1.00 minutes

| | |
|---|---|
| Column Length: | 30.00 m |
| Column Diameter: | 0.250 mm |
| Gas: | He |
| Vacuum Compensation: | On |

### HP5890 Packed Column Flow Control

Inlet A not used to control packed column flow.

Inlet B not used to control packed column flow.

### HP5890 Purge Valve Settings

| Inlet Purge | Init Value | On Time | Off Time | Splitless Injection |
|---|---|---|---|---|
| A | Off | 0.00 | 0.00 | No |
| B | Off | 0.52 | 0.00 | Yes |

### HP5890 Valve and Relay Information

Initial Sequence:
5890 Valves:

| | | |
|---|---|---|
| Method: BMASV1.M | Mon Jul 21 12:54:19 2001 | Page: 1 |

Property of AMRO Environmental Laboratories Corporation

# Attachment 6

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

## GC AND GC/MS DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

Method: | Sample(s) No.:

Analysis: | Matrix:

| | | | | |
|---|---|---|---|---|
| A. | GENERAL | | | |
| 1. | Copy of Prep/Extraction Log? | Y | N | NA |
| 2. | Copy of Instrument Run Log or Tune List? | Y | N | NA |
| 3. | Copy of dry weight log present? | Y | N | NA |
| 4. | Are all sample checked for preservation after VOA analysis? | Y | N | NA |
| 5. | All samples met extraction and/or analysis holding time criteria? | Y | N | NA |
| 6. | Did the Tune pass and DFTPP or BFB injected every 12 hours? | Y | N | NA |
| 7. | Are the surrogate recoveries for each sample within the QC limits? | Y | N | NA |
| 8. | Method Blank- contaminant free( < ½RL)? | Y | N | NA |
| 9. | Initial Calibration meets method criteria for all compounds reported? | Y | N | NA |
| 10. | Continuing Calibration meets method criteria for all compounds reported? | Y | N | NA |
| 11. | Are all reported results within calibration range? | Y | N | NA |
| 12. | LCS % Recovery criteria met for all compounds? | Y | N | NA |
| 13. | MS/MSD %R's and %RPD's are met for all compounds? | Y | N | NA |
| 14. | %RPD criteria met between sample and duplicate? | Y | N | NA |
| 15. | Samples checked for carry over from sample to sample due to target or nontarget overload? | Y | N | NA |
| 16 | Are all data exported to LIMS: calculated and verified? | Y | N | NA |

COMMENTS:

Analyst (s) _____ DATE: _____

REVIEWER: _____ DATE OF REVIEW: _____

qc/qcmemos/Forms/gcmschecklist Rev. 2 08/13/01

Property of AMRO Environmental Laboratories Corporation

Attachment 7

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

# QUALIFICATION CARD FOR SW-846 METHOD 8270C

Trainee: _____ Signature: _____

Trainer: _____ Signature: _____

I. Knowledge Factors:

SOP Title: _____ Revision Number/Date: _____

| | | | |
|---|---|---|---|
| 1. Did the Trainee read and understand the above SOP? | Yes ☐ | No ☐ | NA ☐ |
| 2. Was the Trainee instructed on how to properly fill out the documentation? | Yes ☐ | No ☐ | NA ☐ |
| 3. Has the Trainee been instructed on the proper procedures for addressing potential problems? | Yes ☐ | No ☐ | NA ☐ |

II. Practical Factors:

| | | | |
|---|---|---|---|
| 1. Has the Trainee completed a Precision and Accuracy Study? | Yes ☐ | No ☐ | NA ☐ |
| 2. Has the Trainee completed an acceptable Performance Evaluation sample? | Yes ☐ | No ☐ | NA ☐ |
| 3. Did the Trainee completed an acceptable Laboratory Control Sample (LCS)? or PT study | Yes ☐ | No ☐ | NA ☐ |
| 4. Has the Trainee performed manual integration as indicated in the SOP? | Yes ☐ | No ☐ | NA ☐ |

Completion Date: _____ Trainer's Signature: _____

I _____ have read, understood and follow the above method/SOP, which is in use at AMRO Laboratories for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

Section Manager/ Supervisor: _____ Date: _____

QA Manager: _____ Date: _____

qc/qcmemos/forms/8270Cqualcard Rev. 0 08/24/01

Property of AMRO Environmental Laboratories Corporation

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

# POLYCHLORINATED BIPHENYLS (PCB's) BY GAS CHROMATOGRAPHY

## SW-846 Method 8082

Procedure Number: OL-2006

Revision No.: 10

Revision Date: 03/07/13

Review Data: N/A

Prepared By: Kristen Morin Date: 3/18/13

Approved By: Sue Karam Date: 3/18/13
Organic Manager

Approved By: Nancy Sargent Date: 3/18/13
Laboratory Director

Approved By: Nancy Sargent Date: 3/18/13
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

# TABLE OF CONTENTS


| | | Page |
|---|---|---|
| 1.0 | SCOPE AND APPLICATION | 3 |
| 2.0 | METHOD SUMMARY | 3 |
| 3.0 | DEFINITIONS | 3 |
| 4.0 | SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE | 4 |
| 5.0 | POTENTIAL PROBLEMS AND INTERFERENCES | 4 |
| 6.0 | HEALTH AND SAFETY | 5 |
| 7.0 | INSTRUMENTS AND EQUIPMENT | 6 |
| 8.0 | INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR | 7 |
| 9.0 | REAGENTS AND STANDARDS | 7 |
| 10.0 | PROCEDURE | 11 |
| 11.0 | CALCULATIONS | 22 |
| 12.0 | QUALITY CONTROL | 22 |
| 13.0 | DATA REVIEW AND STORAGE | 27 |
| 14.0 | REFERENCES | 27 |

## 1.0 SCOPE and APPLICATION

1.1 This SOP is for Method 8082 to determine the concentrations of various Polychlorinated Biphenyls (PCBs) in extracts from solid, aqueous, and other matrices.

1.2 Analytes and Reporting Limits:

| ANALYTE | RL (Reporting Limit)* | | | |
|---|---|---|---|---|
| | Aqueous (µg/L) | Soil (µg/kg) | Oil (mg/kg) | Wipes (µg/wipe) |
| +PCB-1016 | 0.20 | 25 | 5.0 | 1.0 |
| +PCB-1221 | 0.20 | 25 | 5.0 | 1.0 |
| +PCB-1232 | 0.20 | 25 | 5.0 | 1.0 |
| +PCB-1242 | 0.20 | 25 | 5.0 | 1.0 |
| +PCB-1248 | 0.20 | 25 | 5.0 | 1.0 |
| +PCB-1254 | 0.20 | 25 | 5.0 | 1.0 |
| +PCB-1260 | 0.20 | 25 | 5.0 | 1.0 |

+= Designates multi-component analytes.
* = Aqueous based on 1000mL sample /4mL final volume
Soil based on 20.00g/10mL final volume
Oil based on 0.10g/10mL final volume
Wipe based on 10mL final volume per wipe

## 2.0 METHOD SUMMARY

2.1 This method describes chromatographic procedures for the detection of specific PCB's at ppb (µg/L and µg/kg) levels. Prior to the use of this method, appropriate extraction procedures must be used. Please refer to OL-2003 and OL-2004 for sample extraction. An aliquot of the sample extract is injected into a gas chromatograph (GC) equipped with dual columns and dual electron capture detectors (ECD). This allows for quantitation and confirmation to occur at the same time.

## 3.0 DEFINITIONS

3.1 **Multi-component Analyte and Single component Analyte:** Throughout this SOP, the terms "single component and multi-component analyte" are used. Multi-component analyte chromatograms contain a pattern of many peaks for one target analyte while a single component analyte chromatogram contains only a single peak for each target analyte.

3.2 **Aroclor:** Aroclor is the trade name for mixtures containing PCB's. Since each Aroclor is a mixture, they must be described as multi-component analytes. Aroclors may contain compounds in addition to PCB's, but the terms "PCB" and "Aroclor" are commonly used interchangeably. The names of the Aroclor mixtures such as 1260 refer to the 12-member biphenyl ring and the percent Chlorination by weight with the exception of 1016. Aroclor 1260 is a mixture of isomers composed of 12-member (carbon) biphenyl rings with 60% chlorination by weight. Chromatograms of Aroclors contain a pattern of multiple peaks due to different PCB compounds called congeners.

## 4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 Extract must be stored under refrigeration in the dark and analyzed within 40 days of extraction.

4.2 Sample extracts are custody transferred from the Extraction analyst to the GC analyst via signature in the extraction logbook, or the sample extracts are transferred to cold storage by the Extraction analyst. The extracts are either loaded directly on to GC instrument for analysis or they are stored at 4°C for future use. Extracts are kept for a minimum of two months after extraction and are then properly disposed of.

## 5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 The success of these methods frequently depends on the levels of interference rather than on instrumental limitations. If sample or matrix interference's prevent identification or detection of analytes, the analyst must evaluate the interference's and perform the proper corrective action.

5.2 Sources of interference's can be grouped into three categories:

5.2.1 Contaminated solvents, reagents, or glassware

5.2.1.1 Method Extraction Blanks and Instrument Blanks are used to determine possible contamination of solvents, reagents, glassware, and GC equipment.

5.2.1.2 If contamination is found from the extraction process, review of methodology, scrupulous cleaning of the glassware, and re-extraction of the samples may be required.

5.2.2 Contaminated carrier gas or GC equipment, i.e. columns, injection port liners, detectors and syringes.

5.2.2.1 If the GC equipment is found to be the source of contamination, proper cleaning and solvent rinsing of affected parts may be required or replacement with new ones.

5.2.3 Compounds extracted from the sample matrix to which the detectors respond.

5.2.3.1 If sample matrix is determined to be the cause of interference in the extract, the analyst should evaluate whether extract cleanup procedures are needed. All PCB extracts are sulfuric acid cleaned prior to analysis. Additional cleanups may be needed.

5.2.3.2 Such interference may include the presence of elemental sulfur, which results in broad peaks that interfere with the detection target compounds. (Analyst should refer to SOP OL-2020 for sulfur removal.).

5.2.3.3 Other sources of interference could occur from phthalate esters, which can be minimized by avoiding sample contact with any plastic materials. Phthalates are easily leached from plastic materials during laboratory operations or even sampling including equipment rinsing.

## 6.0 HEALTH AND SAFETY

6.1 AMRO has a laboratory safety program in place that applies to all employees. There is a safety officer as well as employees with 40 hours of OSHA training. The air quality of the laboratory and the extraction hood velocities are monitored. All employees receive fire and safety training upon employment.

6.2 Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place. Fire drills are held on an annual basis or "as needed" with building or personnel changes.

6.3 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean laboratory coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place.

Property of AMRO Environmental Laboratories Corporation

6.4 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eyewash stations and an emergency shower.

6.5 Material Safety Data Sheets (MSDS's) are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.7 Waste control – AMRO takes whatever steps possible to minimize waste. This includes sample and solvent volume minimization where appropriate. There is a Waste Coordinator officer designated with 40 hours of OSHA training. AMRO also properly segregates wastes based upon waste characterization (i.e. flammability, chlorination, acidity, etc.) and a commercial vendor is utilized for waste disposal.

## 7.0 INSTRUMENTS AND EQUIPMENT

7.1 Gas Chromatograph: Analytical system complete with gas chromatograph suitable for on column and split-splitless injections. The system includes all the required accessories such as syringes/autosampler systems, analytical columns, gases, electron capture detectors (ECDs) and a data system.

7.2 AMRO has two complete GC/ECD systems: GC-ELVIS and GC-TRENT. Both are Hewlett Packard Model 5890s capable of dual column analysis. Helium is the carrier gas and P5 (95% Argon/5% Methane) is the auxiliary make-up gas. Each GC is equipped with one of two equivalent capillary column pairs, either:

7.2.1 ELVIS:
RXI-50 (Restek), 30m x 0.53mm I.D. 0.83µmdf
RTX50 (Restek), 30m x 0.53mm I.D. 1.5µmdf

or

7.2.2 TRENT:
RTX-CL PesticideII (Restek), 30m x 0.32mmID, 0.25µmdf.
RTX-CL PesticideI (Restek), 30m x 0.32mmID, 0.5µmdf

7.3 The data systems for all instruments are Hewlett-Packard Chemstation-Enviroquant software which is used to acquire and process all GC-ECD data.

GC Elvis is the primary PCB analysis instrument. GC Trent is a back-up instrument for PCB analysis but not used routinely.

7.4 Volumetric flasks, 10 and 25mL, and Gas-Tight syringes for preparation of standards.

## 8.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

8.1 Daily Maintenance:

The following procedures are performed each day an instrument is used for analysis if in the analyst's judgement, system performance requires them:

8.1.1 Column performance is monitored by checking the response factor of key compounds, which indicates column degradation, column bleed, or appropriate peak resolution. Clip two or more inches from the head of the column if necessary.

8.1.2 Check that carrier and make-up gases have adequate supply sufficient for the analytical sequence. Visual inspection of color indicating inline gas filters (hydrocarbon and moisture). Change tanks if necessary.

8.1.3 Check to ensure the hard drive memory capacity is sufficient for data acquisition using the HP Chemstation-EnviroQuant software.

8.2 Weekly Maintenance, or as needed:

8.2.1 Clipping column

8.2.2 Swab inlet weldment and injection port with hexane or other appropriate solvent(s).

8.2.3 Clean or replace single taper injection liners and glass wool, gold inlet seal, ferrules, and septa.

## 9.0 REAGENTS AND STANDARDS

9.1 The following solvents are used for sample dilutions, preparation of standards or solvent rinsing of equipment:

9.1.1 Hexane, Reagent Grade and Pesticide Residue Grade chemicals or equivalent.

9.1.2 Acetone, Reagent Grade and Pesticide Residue Grade chemicals or equivalent.

9.1.3 Methanol, Reagent Grade and Pesticide Residue Grade chemicals or equivalent.

9.2 Commercially prepared stock standard solutions that are certified by the manufacturer are used in this analysis. All PCBs standards are purchased from Restek (e.g. cat. #32039 for 1000µg/mL Aroclor 1660) or an equivalent vendor. Second source standards can be purchased from another supplier or can be a different lot number than used to calibrate. Calibration standards for the special Aroclors 1262 and 1268 can be purchased from Ultra Scientific or Restek. The source of the surrogate, LCS, and MS/MSD spike solutions used in sample preparation is Restek.

9.3 Working standard solutions are made from stock standard solutions. All multi-component PCBs are purchased individually and surrogates are then added. Serial dilutions are made to create a seven point curve for "AR1660 (a mixture of PCB 1016 and PCB 1260). The remaining PCBs only require a single point analysis at the midpoint of the AR1660 curve, to be used to create a response factor appropriate for the individual Aroclor. Note for DoD projects all reportable quantitation of non-AR1660 PCBs must be preceded by at least a five point initial calibration so bracketing standards must be prepared as needed. All standards are brought to final volume with Hexane.

| Calibration Stds | Vol. Of Stock | Final Vol. | Concentration (µg/mL) |
|---|---|---|---|
| AR1660*/TCX/DCB | 0.05mL (2.0µg/mL) | 2mL | 0.05/0.001 |
| AR1660*/TCX/DCB | 0.1mL (2.0µg/mL) | 2mL | 0.10/0.002 |
| AR1660*/TCX/DCB | 0.2mL (2.0µg/mL) | 2mL | 0.20/0.004 |
| AR1660*/TCX/DCB | 0.4mL (2.0µg/mL) | 2mL | 0.40/0.008 |
| AR1660*/TCX/DCB | 0.6mL (2.0µg/mL) | 2mL | 0.60/0.012 |
| AR1660*/TCX/DCB | 0.8mL (2.0µg/mL) | 2mL | 0.80/0.016 |
| AR1660*/TCX/DCB | 1.0mL | 2mL | 1.00/0.02 |

| | | |
|---|---|---|
| | (2.0µg/mL) | |
| AR1660*/TCX/DCB | 0.05mL (1660 stock) 25mL<br>5µL TCX/DCB Stock | 2.00/0.04 |
| AR1221/TCX/DCB | 25µL of Stock 25mL<br>2.5 µL of TXC/DCB Stock | 1.0/0.02 |
| AR1232/TCX/DCB | 25 µL of Stock 25mL<br>2.5 µL of TCX/DCB Stock | 1.0/0.02 |
| AR1242/TCX/DCB | 25 µL of Stock 25mL<br>2.5 µL of TCX/DCB Stock | 1.0/0.02 |
| AR1248/TCX/DCB | 25 µL of Stock 25mL<br>2.5 µL of TCX/DCB Stock | 1.0/0.02 |
| AR1254/TCX/DCB | 25 µL of Stock 25mL<br>2.5 µL of TCX/DCB Stock | 1.0/0.02 |

*Please note AR1660 contains both AR1016 & AR1260.

## 9.4 TRACKING OF ANALYTICAL STANDARDS

### 9.4.1 Chemical Receipt:

The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a 5 digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and the disposal dates are completed by AMRO employees when standards are used up or disposed. Refer to SOP " Sample Management" GL-1006.

### 9.4.2 Standards Preparation:

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

9.4.2.1 AMRO purchases pesticide residue grade solvents and purge and trap grade Methanol for organic standard preparation and organic sample extractions.

9.4.2.2 All stock standards that are purchased must include a certificate of analysis from the manufacturer.

9.5.3 Standard Tracking:

It is important to be able to track all analytical standards back to their sources. The following procedure is used by AMRO personnel to accomplish this:

9.5.3.1 Organic Standard Tracking: The Organic Standards Tracking System consists of three logbooks. One Standard ID Index logbook, one for Stock Standards, and one for Working Standards.

9.5.3.2 Stock Standard: Whenever a stock standard solution is opened or is prepared from a neat compound, this information is recorded in the Stock Standard Logbook section of the standard tracking log. The standard chemical receipt I.D. is used for the stock solution. This ID along with the compound name, concentration and initials of the person making the stock are included on the label. Stock standards are good one year from the date prepared or the date provided by manufacturer, whichever is shorter. Example - The fourth volatile standard prepared on April 15, 1989 would have the standard ID V041589D. This number will be recorded in the logbook and written on the container.

9.5.3.3 Working Section: Whenever a working standard solution opened or is prepared, whether from AMRO stocks or commercially obtained stocks, the information is recorded in the Working Standard section of the standard tracking log. The solution is assigned a new ID number based on the section "V" or "S", the date it is prepared plus a letter suffix. This number along with a descriptive name, concentration (or conc. varied) and the initials of the person preparing the solution are included on the label. The expiration of working standards vary depending on the use. Standards should be used in accordance with method specifications and manufacturer's instructions. Stock standards must be replaced no more than one year after opening or sooner if routine QC tests indicates a problem. Working standard expiration dates are derived from

Property of AMRO Environmental Laboratories Corporation

the assigned stock solution's expiration date or sooner if routine QC tests indicates a problem.

9.5.3.4 Standard Storage: Standards and reagents are stored per method specifications and manufacturer's instructions. Semivolatile, Pesticide, PCB, Petroleum standards are stored in refrigerators at 4±2°C, freezers at minus 10 °C, and ambient temperature depending upon the method and manufacturer requirements.

9.5.3.5 Solvent Check Analysis

All extraction procedures are performed using pesticide residue grade solvents. The first method blank is used to verify the absence of target analytes when a new lot number is received. Also, Before a new vendor's solvent is used for sample extraction a special check of the concentrated solvent (not a method blank) is suggested.

## 10.0 PROCEDURE

10.1 AMRO currently has two GC instruments: TRENT and ELVIS.

10.2 GC Operating Conditions:

**PCB ANALYSIS** (using Sec.7.2.1 columns on GC Elvis)
Injection volume: 1 µL
ECD Temperature: 310°C
Injection Port Temperature: 280°C
Initial Temperature: 150°C
Initial time: 0.5minutes
Rate: 1: 12°C/minute
Final Temperature 1: 270°C
Final Time hold: 15 minutes
Total Run Time: 25.5 min

* A signed hard copy of this acquisition method is stored in the Instrument run logbook.

10.3 Injection port maintenance:

10.3.1 Due to the low concentrations injected in this method, every attempt must be made to ensure that the analyte path in the GC is free from sites of absorption or activity by performing injection port maintenance. Such maintenance may include replacing septa, inlet

liners, and the inlet seal. All maintenance must be recorded in the maintenance logbook.

10.4 Injection Runlog:

10.4.1 All injections are recorded with the EnviroQuant software and a signed hard copy of the sequence list (brief and full listing) is stored in the Instrument logbook.

10.5 Dual Column Analysis:

10.5.1 This method uses the dual column/dual detector approach. It involves the use of two 30m X 0.53mm ID fused- silica open tubular columns of different polarities, thus different selectivities towards the target compounds. The columns are connected to two separate injection ports with dual auto sampling towers. Each column is then connected to its individual ECD detector.

10.6 Retention Time Windows (sections 10.6.1 through 10.6.5 refer to a setting up new instrument and determining analyte RT and elution orders):

10.6.1 Before establishing retention time windows, make sure that the chromatographic system is operating reliably and that the system conditions have been optimized for the target analytes and surrogates in the sample matrix to be analyzed.

10.6.2 Make three injections of all single and all multi-component analytes over the course of a 72-hour period. Serial injections or injections over a period of less than 72 hours may result in retention time windows that are too tight.

10.6.3 Record the retention times for all single analytes and three to five major peaks for multi-component analytes. Calculate the mean and standard deviation of the three absolute retention times of each single analyte and those peaks.

10.6.4 If the standard deviation of the retention times for a target compound is 0.000, then the laboratory uses a default standard of 0.01 minutes. Recording retention times to three decimal places rather than two should minimize the instances in which the standard deviation is calculated as 0.000.

10.6.5 The width of the retention time window for the single analytes, each major constituent in multi-component analytes and surrogates is defined as ±3 times the standard deviation of the mean absolute

retention time established during a 72-hour period. If the default standard deviation is employed, ½ the width of the window will be 0.07 minutes.

10.6.6 The absolute retention time windows must be calculated for each analyte and surrogate on each chromatographic column and instrument. New retention time windows and/or analyte elution order must be established when a new GC column is installed.

10.6.7 Establish the center of the window for each analyte and surrogate by using the absolute retention time for each analyte and surrogate from the calibration verification standard at the beginning of the analytical shift. For samples run during the same shift as an initial calibration, use the retention time of the mid-point standard of the initial calibration.

10.6.8 If the daily CCV falls outside the window, the analyst will evaluate the instrument and will recalibrate if necessary. For samples run during the same analytical shift as the Initial Calibration, use the RT of the midpoint standard. However, the experience of the GC analyst should weigh heavily in the interpretation of the chromatograms. The analyst may therefore qualify an analyte as present outside the RT window by using pattern recognition.

10.7 Initial Calibration:

10.7.1 Must contain a minimum 5-point curve of AR1660 (this is a mixture of Aroclors 1016 and 1260) to establish linearity for PCBs over the range of quanitifed Aroclors, along with the midpoint standards for the remaining 1221, 1232, 1242, 1248, 1254 Aroclors. These midpoints are to be used for pattern recognition and one-point calibration (the standards are used to determine the response factor appropriate for each individual Aroclor). The %RSD of the 1660 curve must be ≤20%. See Section 10.9.1 for action when the %RSD exceeds 20%. Note for DoD projects all reportable quantitation of Aroclors that are not 1016 or 1260 must be preceded by at least a five point initial calibration. Bracketing standards must be prepared as needed and the sample re-run after the special initial calibration.

10.7.2 A minimum of 3 peaks must be chosen for quantitation but preferably 5 peaks should be used especially with 1016 and 1260. The chosen peaks should be within 25% of the height of the largest Aroclor peak and/or represent a unique peak height ratio. Peak selection should include at least one peak that is unique to each Aroclor.

10.7.3 When reporting PCBs two processes are used: qualitative and quantitative. The first is qualitative, which is done matching the unknown sample to the Aroclor standards evaluated during the initial calibration. In this case the pattern in the sample is compared to patterns of the standards. If a match is found, it is determined at what concentration the Aroclor is in the unknown, or its quantitative value. Three to five of the major peaks in the Aroclor pattern are chosen to measure the concentration of the positive hit. Of the seven commercial Aroclors on the 8082 target list, 1016, 1242, and 1232 have similar major peaks, the difference being the ratio of these peaks to one another. Although the same peaks may be used to quantitate a PCB hit, the same average response factors are not used. These are derived from that additional Aroclor's initial calibration.

10.8 Calibration Techniques:

There are two calibration techniques used by AMRO acceptable for quantitation: average response factor calibration and linear regression calibration curve. This is the order of preference:

10.8.1 The Average Response Factor Calibration:

10.8.1.1 Calculate the response factor of each compound using the equation:

$$\text{Response Factor (RF)} = \frac{\text{Peak Area of analyte}}{\text{Conc. of Analyte in standard}}$$

10.8.1.2 Calculate the Average of the Response Factors (Rfa) and the Standard Deviation (STD). Using the Rfa and STD, calculate the percent relative standard deviation (%RSD). When the RSD of Analytes are less than 20%, linearity through the origin can be assumed.

$$\%\ \text{RSD} = \frac{\text{Standard Deviation}}{\text{Average Response factor}} \times 100\%$$

10.8.1.3 Providing the % RSD for each analyte is less than 20%, the Average Response Factor (Rfa) can be using to calculate the sample results. If the %RSD is greater than 20% then a Linear Calibration Curve may he used providing the acceptance criteria is met.

Property of AMRO Environmental Laboratories Corporation

10.8.2 Linear Calibration Curve:

10.8.2.1 In order to use this technique, the data system must plot and evaluate a calibration curve by calculating the correlation coefficient against the first order equation:

$$Y = mX + b$$

10.8.2.2 The software option Linear Regression must be selected and the computer will evaluate the calibration based on the above equation. Forcing the origin of the linear regression is not acceptable. The acceptance criteria for this equation is the coefficient of determination must be at least 0.990 and documented with a signed/dated graphics plot stored with the calibration.

10.8.2.3 Dropping of standard point should be performed ONLY on either the high or the low standard. Any point dropping should be documented for the reason of dropping on the initial calibration form. The analyst must sign and date the initial calibration form and will be reviewed by the appropriate data reviewer. The curve must be printed for visual verification and stored with the calibration records.

10.8.2.3.1 If the %RSD is greater than 20% and the coefficient of determination is less than 0.99 even after the adjustments in 10.8.2.3 are made , then the instrument must be re-calibrated.

10.9 Continuing Calibration Verification (CCV)

10.9.1 Verify calibration each 12 hour shift by injecting CCV's (Continuing Calibration Verification sample, a midpoint concentration standard) prior to any sample analysis. A CCV must also be injected at intervals not less than once every 20 samples, including QC (MB, LCS, MS, etc) (or at the end of a 12 hour interval, whichever comes first). DoD samples will be analyzed at intervals of no greater than 10 field samples between CCV's.

10.9.2 A12-hour sequence begins with the injection of the first CCV. The shift ends after the completion of the analysis of the last sample or standard that can be injected within 12-hours of the beginning of the sequence. A closing standard **MUST** be injected at the end of the 12-hour window. However, in

continuous analysis, the closing CCV of one shift may also serve as the CCV of the next 12-hour shift.

10.9.3 The CCV Standard response must be within ± 15% of the initial calibration curve. If the percent Difference (%D) of an analyte peak is > 15%, but the average %D for all the analyte peaks within any one Aroclor is within 15%, then the calibration has been verified.

$$\% \text{ Drift} = \frac{\text{Calculated Concentration - Theoretical Conc.}}{\text{Theoretical conc.}} \times 100\%$$

$$\text{Ave. \%Drift per Aroclor} = \frac{\text{\%Drift of Each Analyte Peak}}{\text{Total \# of Analyte Peaks}}$$

No sample results can be reported associated with a verified CCV > 15% for that analyte unless it is qualified as estimated. Reanalysis is recommended in these cases. If a CCV fails and correction action fails to produce a passing CCV, i.e. two CCVs fail in a row, then a new initial calibration is required *or* two consecutive CCVs must pass the method criteria described above in order for sample analysis to proceed.

10.9.4 CCV retention times must be compared to the RT windows established vs. starting CCV (RT updated and verified) of the analytical sequence.

10.9.4.1 If any analyte is outside the window, the chromatographic system must either be adjusted so re-analysis of the CCV falls within RT windows, or a new initial calibration must be performed and new retention time windows established.

10.9.4.2 Subsequent CCV retention times should be compared to the initial CCV of the 12-hour shift.

10.9.5 If the standard analyzed after a group of samples exhibits high response (>15%), and the analyte was not detected in the samples, it is acceptable to report ND results without qualification. The high bias must be demonstrated by one or both terminal CCVs. In contrast, if the response in the standard is low (by 15%), the sample must be reanalyzed.

Property of AMRO Environmental Laboratories Corporation

10.10 Data Interpretation

10.10.1 The integration of compounds for standards and samples should be performed to be in the same manner as the initial calibration integration. Cases where the initial calibration is in question should be investigated to ensure it is not related to poor maintenance, damaged or defective column, or other issues which should be solved before further analysis.
The following must be checked for each compound present in standards and samples to ensure proper integration has been performed:

10.10.1.1 The peak shape of the calibration compound must be maintained for standards and samples. This should take into account any shouldering, peak tailing, and peak co-elution. See Sec.10.11.2.1 for specific information associated with PCBs.

10.10.1.2 The retention time windows for each compound of the calibration must be applied to standards and samples. If there is a retention time shift confirmed by comparison of the Continuing Calibration Standards and Surrogates then pattern recognition can be utilized for identification of multi-component analytes only. Otherwise re-calibration is required. Generally re-calibration is required whenever the column is significantly shortened during maintenance.

10.10.1.3 The baseline integration techniques for each compound of the calibration must be consistent for the standards and the samples. This should take into account elevated baselines, coelution, peak shape ands peak splitting, and negative peaks in samples.

10.10.1.4 Make sure that positive identification and confirmation of compounds has been established. This is done using comparison between two columns.

10.10.1.5 Ensure any positive results are within the lower and upper levels of the calibration curve and above the reporting limits for each compound.

Property of AMRO Environmental Laboratories Corporation

10.11.2 Data interpretation consists of two steps, qualitative interpretation and quantitative interpretation. Qualitative interpretation involves identifying the analytes that are present. Analytes are identified and confirmed according to their retention times on two different columns. Quantitative interpretation involves determining the concentrations of the analytes that are present. All analytes are calculated by using the initial calibration curve:

10.11.2.1 Qualitative Analysis:

10.11.2.1.1 Qualitative interpretation involves identifying the analytes that are present. Analytes are identified and confirmed according to their retention times on two different columns which is done matching the unknown sample to the Aroclor standards evaluated during the initial calibration. In this case the pattern in the sample is compared to patterns of the standards. If a match is found, it is determined at what concentration the Aroclor is in the unknown, or its quantitative value. Quantitative interpretation involves determining the concentrations of the analytes that are present. All analytes are calculated by using the initial calibration curve. Three to five of the major peaks in the Aroclor pattern are chosen to measure the concentration of the positive hit. Of the seven commercial Aroclors on the 8082 target list, 1016, 1242, and 1232 have similar major peaks, the difference being the ratio of these peaks to one another. Although the same peaks are used to quantitate a PCB hit, the same average response factors are not used.

10.11.2.1.2 The first step in evaluating the data is qualitative analysis. Tentative identification of an analyte occurs when a peak from a sample falls within the established daily RT window for a specific target analyte. Confirmation is required on a second GC column of different characteristics. For multi-component analytes (Aroclors), identifications is based upon pattern recognition,

Property of AMRO Environmental Laboratories Corporation

but retention time windows are used to supplement this process.

10.11.2.1.3 Pattern recognition of multi-component analytes. Each multi-component analyte shows a distinctive chromatographic pattern which is used to identify that compound in a sample. To determine if a multi-component analyte is present, compare the sample chromatogram to the initial calibration standard. If the multi-component analyte is present in the sample, the relative response of the peaks in the standard should be similar in selected peak height ratios in standards. In addition, most major peaks observed in the standard should also appear in the sample. Be aware that degradation can alter the appearance and peak ratios of an Aroclor pattern. All Aroclors are mixes of congeners and may vary with the original manufacturer's raw materials.

10.11.2.1.4 When dual column analysis is being performed, the results for at least one column must meet the calibration acceptance criteria. The other column may be used for qualitative verification. Use of the designated qualitative verification column for quantitation is only acceptable if the initial and terminal CCVs on the verification column are in control and interference is suspected on the primary quantitation column. The maximum RPD between the final concentrations generated from the two columns is 40%. For DoD samples both columns must meet the acceptance criteria.

**10.11.2.1.5** If compound identification is precluded due to interference, cleanup of the extract may be warranted. Refer to method 3600 for cleanup procedures. Analyst judgement must consider options available vs. expected improvement in chromatography.

10.11.2.2 Quantitative Analysis:

The second step in evaluating data is quantitative analysis. This step can only take place after the qualitative techniques in Section 10.11.2.1 have been used to confirm a positive result. For all multi-component analytes, a minimum of three distinct peaks must be used for quantitative analysis.

10.11.2.2.1 Sample results are quantitated from the initial calibration based on the three techniques discussed in Section 10.9, following this order of preference.

10.11.2.2.2 Average Response Factor Calibration. Use the following equation to calculate the concentration of analytes:

$$\text{Concentration } (\mu g/L) = \frac{(Ax)\,(Vf)\,(Df)}{(Rfa)\,(Vi)}$$

Where:
**Ax** = Area counts for the analyte in the sample.
**Vi** = Initial volume of the sample extracted in mL.
**Vf** = Final volume of sample extract in mL.
**Df** = Dilution factor.
**Rfa** = Average response factor from the initial calibration curve.

10.11.2.2.3 Linear Fit Calibration. Use the following equation to calculate the concentration of analytes:

$$\text{Concentration } (\mu g/L) = \frac{([m]\,[Ax] + b)\,(Vf)\,(Df)}{(Vi)}$$

Where:
**([m] [Ax] + b)** = Concentration of analyte in sample extract, calculated by data system or integrator (ug/L).
**Vi** = Initial volume of sample extracted in mL.
**Vf** = Final volume of sample extract in mL
**Df** = Dilution factor.

The curve must be printed and stored with the calibration records to document visual evaluation.

10.11.3 To quantitate multi-component analytes, discern at least three to five distinctive, unobstructed, peaks in the sample chromatogram that correspond to characteristic peaks in the standard chromatogram used for initial calibration. The data system will calculate the average concentration of the selected characteristic peaks. The average response factors of the characteristic peaks or the calibration curve is used to calculate sample concentrations. Alternatively, the total area from each curve standard can be used to produce a linear or quadratic calibration curve.

10.11.4 Each sample analysis must be bracketed with an acceptable Initial Calibration, CCV's (each 12-hr. shift or interspersed every 20 samples, whichever comes first). DoD samples will be analyzed at intervals of no greater than 10 field samples between CCV's.

10.11.5 When a CCV fails to meet acceptance criteria, all the samples injected after the last acceptable CCV must be re-injected.

10.11.6 All sample responses must fall within the calibration range. Re-analysis at a dilution must occur if the sample response exceeds the calibration range.

10.11.7 Sample results are confirmed by using two dissimilar columns. The column used for reporting results depends upon acceptable daily quality control including CCVs, MS, MSD, and LCS criteria being met. In general, report data from the column with the best overall QC data. This is the designated quantitation column and should be indicated on the Data Review Checklist in the project folder and marked on the CCV Summary Form. For DoD samples both columns must be in control. Report the higher of two confirmed results unless overlapping peaks are causing erroneously high results, then report the non-affected result and document in the case narrative.

10.11.8 For DoD samples any sample which is not confirmed must be reported with a "Q" flag.

10.11.9 When sample results are confirmed , the difference between the two columns is measured by calculating the Relative Percent Difference (RPD) between the two concentrations:

$$RPD = \frac{|R1-R2|}{((R1+R2)/2)} \times 100\%$$

*R1 & R2 are the results on 2 columns.

This data is calculated by the macro PCB_RT.mac when the information is required in a data deliverables package.

If the result from one column is significantly higher than the other column result, check the chromatogram for overlapping peaks causing erroneously high results. If no overlapping peaks are noted, examine the baseline parameters established during integration. If no abnormalities are noted, report the result from the designated primary quantitation column (except as noted in section 10.11.7 for DoD samples). If the results from the designated quantitation column appear to be in error due to interference's, and the CCV data is acceptable from the designated qualitative confirmation column, then use the confirmation column result for reporting. If the RPD exceeds 40% and the difference is not clearly attributable to matrix interference then report the RPD criteria exceedance in the case narrative and flag the result with a "J".

## 11.0 CALCULATIONS

11.1 All necessary calculations and formulas can be found throughout the text as applicable to each section.

## 12.0 QUALITY CONTROL

12.1 Initial Demonstration of Proficiency:

12.1.1 The ability of AMRO to produce accurate and precise data is demonstrated per instrument/per analyst for each method. It consists of a Method Detection Limit Study (MDL) and Precision and Accuracy Study (P&A) for each instrument and each matrix. The laboratory demonstrates initial proficiency with each combination of sample preparation and determinative methods that it utilizes by generating data of acceptable precision and accuracy for a reference sample containing the target analytes in a clean matrix. The reference samples are prepared from a spiking solution containing each analyte of interest at a concentration that is 10-50 times the MDL for each analyte in that matrix, or at the routine concentration of LCS's (Laboratory Control Samples). P & A Studies are required to be reviewed annually by evaluating a minimum of 4 LCS's and corrective action taken if necessary.

12.2 MDL and LOQ/LOD Studies:

12.2.1 The method detection limit (MDL) is defined in 40 CFR 136 Appendix B. The purpose of an MDL is to establish the minimum concentration of each analyte greater than zero that can be reported with 99% confidence. An MDL study consists of at least 7 replicates of spiked deionized water (ideally standard set at RL or lower), which are extracted and analyzed as normal samples. The standard deviation of the results of these analyses is multiplied by the appropriate student T-test value. The resulting value is deemed the method detection limit for that specific analyte.

MDL studies of each analyte must be reported initially for each instrument, column, matrix, and extraction method. To ensure that reasonable MDL values are determined, an MDL check sample may be analyzed by spiking an interference free matrix with all target analytes at about two times the determined MDL. The MDL check sample is taken through the same process as the MDL. If any of the target analytes are not detected, or the characteristic Aroclor peak pattern cannot be identified, then the MDL study is modified and repeated until the MDL check sample is detectable. The MDL check is recommended on a quarterly basis and after major instrument maintenance or changes in the instrumentation or instrumental conditions to verify sensitivity of the method.

12.2.2 LOQ/LOD

The LOD (limit of detection) is an estimate of the lowest amount of an analyte that can be detected. This estimate would be derived from MDL studies and calibration curves (the low-level standards).

To determine the LOQ (limit of quantation), low level standards are prepped and analyzed as normal samples. The level should be at one to two times the reporting limit. The percent recoveries are calculated and criteria established for expected recoveries. For 8082 analysis, the LOQ/LOD is spiked into blank water/soil, brought through the normal extraction and cleanup process, and then analyzed. The acceptance criteria will be 50-150%. The LOQ studies must be done annually.

12.3 Precision &Accuracy:

12.3.1 Accuracy is a measure of the degree to which the analytical result approaches the "true" value of the concentration of the analyte being determined. Precision in the laboratory is determined by the

comparison of duplicates, where duplicate samples result from an original sample that has been split for identical analyses. Precision and Accuracy in the laboratory is assessed initially by the analyses of a minimum of 4 replicate samples at a mid-level point of the expected calibration range. The percent recoveries and Relative Standard Deviations (RSD) are evaluated and compared to method specifications or default limits where applicable.

12.3.2 Accuracy is also assessed by the regular analysis of known standards such as the Laboratory Control Samples (LCS), and matrix and analytical spikes. Accuracy within the laboratory is expressed in terms of percent recovery.

12.3.3 The precision of data is regularly evaluated by determining the relative percent difference (RPD) of duplicate (replicate) analyses.

12.4 Method Blanks are prepared at a frequency of one for every batch of up to 20 samples of the same matrix, prepared at the same time, by the same procedures. When sample extracts are subjected to cleanup procedures, the associated method blank must also be subjected to the same procedures.

12.4.1 The results for the method blank should be < RL for all analytes for all sample batches and < ½ RL for batches containing DoD project samples (DoD samples can have common lab contaminants up to the RL). If the method blank results do not meet these acceptance criteria, then corrective action is taken to locate and reduce the source of the contamination and the associated sample extracts are reanalyzed or re-extracted if necessary. If all the samples in the batch are non-detects then re-extraction is not necessary. If insufficient sample volume remains for re-extraction then all the samples will be reported with the appropriate data qualifiers.

12.5 Matrix spike (MS) and Matrix Spike Duplicate (MSD) are prepared at a frequency of one for every batch of up to 20 samples of the same matrix, prepared at the same time, by the same procedures (unless otherwise specified, i.e. MCP requires an LCS/LCSD).

12.5.1 Samples must be selected for spiking at random and rotated among clients and sites from batch to batch. In some cases, the client may specify which sample is to used for MS/MSD; if not , the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall not be performed on Trip Blank, Rinsate Blank or Field Blank.
B. Adequate sample weight/volume.

C. Client requested QC deliverables.

12.6 Laboratory Control Samples are prepared at a frequency of one for every batch of up to 20 samples of the same matrix, prepared at the same time, by the same procedures. The LCS consists of an aliquot of clean matrix similar to the sample matrix and of the same weight or volume. The LCS is spiked with the same compounds at the same concentrations as the MS and MSD. When the results of the MS and MSD analysis indicates a potential problem due to the sample matrix itself, the LCS results are used to verify that the lab can perform the analysis in a clean matrix.

12.7 Analysis of the MS, MSD, and LCS require the same procedures employed for the original sample and the concentration of each analyte spiked is calculated.

12.8 Calculation of Recovery:

Accuracy is estimated from the recovery of spiked analytes from a sample matrix. The recovery of each spiked analyte is calculated using the following formula:

$$\text{Recovery} = \%R = \frac{Cs - Cu}{Cn} \times 100\%$$

Where:
Cs = Measured concentration of the spike sample aliquot
Cu = Measured concentration of the unspiked sample aliquot (use 0 for LCS)
Cn= Nominal (theoretical) concentration increase that results from spiking the sample, or the nominal concentration of the spike aliquot (for LCS).

12.9 Calculation of Precision:

Precision is estimated from the relative percent difference (RPD) of the concentrations (not the recoveries) measured for the MS/MSD. To calculated the RPD, use the following formula:

$$RPD = \frac{|\text{Conc. 1} - \text{Conc. 2}|}{((\text{Conc. 1} + \text{Conc. 2})/ 2)} \times 100$$

Where:
Conc. 1 = Measured concentration of the first sample aliquot
Conc. 2 = Measured concentration of the second sample aliquot

12.10 All recoveries control limits for surrogates, matrix spikes and laboratory control sample control are based on the laboratory control charts. The control charts are updated annually.

12.11 The following additional Quality Control rules should be followed for all Massachusetts Contingency Plan (MCP) projects where MCP CAM methods are specifically requested:

12.11.1 MS/MSD: %REC's should be between 40-140%. RPD's should be <50% for all Aroclors.

12.11.2 LCS/LCSD: %REC's must be between 40-140%.

12.11.3 Surrogates: %REC's must be between 30-150% for both surrogates on both columns.

12.11.4 Confirmation: All QC parameters must meet on both columns. Report the higher of the two columns results unless the highest result is attributable to interference.

12.11.5 Reporting: Report both sets if one is extracted inside the holding time and other outside the holding time. Provide chromatograms if the Quality Control problems are attributed to matrix effects. Report any exceedances of the above requirements in the narrative. Note if recoveries are outside the CAM acceptance criteria but inside AMRO's statistical control limits.

12.12 The following special default batch QC acceptance limit criteria apply to all DOD project samples unless superceded by a project specific QAPP, :

12.12.4 The LCS recovery acceptance limits are as follows:
Soils: AR1016= 25-145%, AR1260= 30-145%
Waters: AR1016= 40-140%, AR1260= 60-130%.

12.12.5 The MS/ MSD recovery acceptance limits are the same as for the LCS.

12.12.6 The maximum RPD allowed for MS/MSD pairs is 30%.

12.12.7 Surrogate recovery for Decachlorobiphenyl in water samples is 40-135%. Surrogate recovery for Decachlorobiphenyl in solid samples is 60-125%.

12.12.8 Corrective action must be taken if the MB or LCS surrogates or LCS target analyte spike recoveries are outside the acceptance criteria. If

reanalysis does not fix the problem, or investigation does not prove the problem is confined to the MB and/or LCS, then re-extraction of the entire batch may be necessary. All data associated with failed MB or LCS QC must be flagged in the case narrative.

## 13.0 DATA REVIEW AND STORAGE

13.1 All cross-outs must be a single line and should be initialed and dated. Analyst review is documented on the GC and GC/MS Data Review Checklist.

## 14.0 REFERENCES

14.1 40 CFR Part 136 Appendix B, 1984.

14.2 USEPA Office of Solid and Hazardous Waste - SW-846 Method Chapter 1, Rev. 1 7/92.

14.3 Method 8000B Revision 2, December 1996. SW846, Update III, USEPA.

14.4 Method 8082 Revision 1, December 1996. SW846, Update III, USEPA.

14.5 Shell for Analytical Chemistry Requirements, Version EM 200-1-3, 02/01/01.

14.6 OL-2003, Separatory Funnel Liquid-Liquid Extraction.

14.7 OL-2004, Automated Soxhlet Extraction.

14.8 OL-2019, Sulfur Cleanup.

14.9 Massachusetts Department of Environmental Protection, WSC-CAM V-A Method, Revision 1, July 1, 2010

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

# ORGANOCHLORINE PESTICIDES BY GAS CHROMATOGRAPHY

## SW-846 Method 8081A

Procedure Number: OL-2005

Revision No.: 9

Revision Date: 03/04/13

Review Date: n/a

Prepared By: Kristen Morin Date: 3/18/13

Approved By: Sue Kamm Date: 3/18/13
Organic Manager

Approved By: [signature] Date: 3-18-13
Laboratory Director

Approved By: [signature] Date: 3-18-13
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

# TABLE OF CONTENTS


| | | Page |
|---|---|---|
| 1.0 | SCOPE AND APPLICATION | 3 |
| 2.0 | METHOD SUMMARY | 3 |
| 3.0 | DEFINITIONS | 4 |
| 4.0 | SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE | 4 |
| 5.0 | POTENTIAL PROBLEMS AND INTERFERENCE'S | 4 |
| 6.0 | HEALTH AND SAFETY | 5 |
| 7.0 | INSTRUMENTS AND EQUIPMENT | 6 |
| 8.0 | INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR | 7 |
| 9.0 | REAGENTS AND STANDARDS | 8 |
| 10.0 | PROCEDURE | 13 |
| 11.0 | CALCULATIONS | 25 |
| 12.0 | QUALITY CONTROL | 25 |
| 13.0 | DATA REVIEW AND STORAGE | 29 |
| 14.0 | REFERENCES | 30 |
| | Attachment 1 DoD requirements for Method 8081 | 31 |

## 1.0 SCOPE and APPLICATION

1.1 This SOP is for Method 8081A to determine the concentrations of various Organochlorine Pesticides in extracts from solid, aqueous, and other matrices.

1.2 Analytes and Reporting Limits:

| ANALYTE | RL (Reporting Limit) | |
|---|---|---|
| | Aqueous * (µg/L) | Soil ** (µg/kg) |
| Aldrin | 0.0064 | 0.80 |
| Alpha-BHC | 0.0064 | 0.80 |
| Beta-BHC | 0.0064 | 0.80 |
| Delta-BHC | 0.0064 | 0.80 |
| Gamma-BHC | 0.0064 | 0.80 |
| Alpha-Chlordane | 0.0064 | 0.80 |
| Gamma-Chlordane | 0.0064 | 0.80 |
| 4,4'-DDD | 0.0128 | 1.6 |
| 4,4'-DDE | 0.0128 | 1.6 |
| 4,4'-DDT | 0.0128 | 1.6 |
| Dieldrin | 0.0128 | 1.6 |
| Endosulfan I | 0.0064 | 0.80 |
| Endosulfan II | 0.0128 | 1.6 |
| Endosulfan Sulfate | 0.0128 | 1.6 |
| Endrin | 0.0128 | 1.6 |
| Endrin Aldehyde | 0.0128 | 1.6 |
| Endrin Ketone | 0.0128 | 1.6 |
| Heptachlor | 0.0064 | 0.80 |
| Heptachlor Epoxide | 0.0064 | 0.80 |
| Methoxychlor | 0.064 | 8.0 |
| +Technical Chlordane | 0.20 | 25 |
| +Toxaphene | 0.20 | 25 |

+ Designates multi-component analytes.
* Nominal value where aqueous initial volume 1000mL, final volume 4mL
** Nominal value where soil initial mass 20g, final volume 10mL, and 0%moisture.

## 2.0 METHOD SUMMARY

2.1 This method describes chromatographic procedures for the detection of specific organochlorine pesticides at ppb (µg/L and µg/kg) levels. Prior to the use of this method, appropriate extraction procedures must be used. Please refer to OL-2003 "Separatory Funnel Liquid-Liquid Extraction" and OL-2004, "Automated Soxhlet Extraction" for sample extraction. An aliquot of the sample extract is injected into a gas chromatograph (GC) equipped with dual columns and dual electron capture detectors (ECD). This allows for quantitation and confirmation to occur at the same time.

## 3.0 DEFINITIONS

3.1 Multi-component Analyte and Single component Analyte: Throughout this SOP, the terms "single component and multi-component analyte" are used. Multi-component analyte chromatograms contain a pattern of many peaks for one target analyte while a single component analyte chromatogram contains only a single peak for each target analyte.

## 4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 Extract must be stored under refrigeration in the dark and analyzed within 40 days of extraction.

4.2 Sample extracts are custody transferred from the Extraction analyst to the GC analyst via signature in the extraction logbook, or the Extraction analyst transfers them to cold storage. The extracts are either loaded directly on to GC instrument for analysis or they are stored at 4°C for future use. Extracts are kept for a minimum of two months after extraction and are then properly disposed of.

## 5.0 POTENTIAL PROBLEMS AND INTERFERENCE'S

5.1 The success of these methods frequently depends on the levels of interference rather than on instrumental limitations. If interferences prevent identification or detection of analytes, the analyst must evaluate the interferences and perform the proper corrective action.

5.2 Sources of interference's can be grouped into three categories:

5.2.1 Contaminated solvents, reagents, or glassware

5.2.1.1 Method Extraction Blanks and Instrument Blanks are used to determine possible contamination of solvents, reagents, glassware, and GC equipment.

5.2.1.2 Any blank value > ½ of the Reporting Limit (RL) is suspect. Sample values above the reporting limit must be evaluated for lab contamination.

5.2.1.3 If samples are found to be contaminated from the extraction process, scrupulous cleaning of the glassware and re-extraction of the samples may be required.

5.2.2 Contaminated carrier gas or GC equipment, i.e. columns, injection port liners, detectors, and syringes.

5.2.2.1 If the GC equipment is found to be the source of contamination, proper cleaning and solvent rinsing of affected parts may be required or replacement with new ones.

5.2.3 Compounds extracted from the sample matrix to which the detectors respond.

5.2.3.1 If sample matrix is determined to be the cause of interferences in the extract, the analyst should evaluate whether extract cleanup procedures should be employed.

5.2.3.2 Such interferences may include the presence of elemental sulfur, which results in broad peaks that interfere with the detection compounds and breakdown of certain pesticides. (The analyst should refer to SOP OL-2019 for sulfur removal).

5.2.3.3 Matrix interference's such as oxygen and sulfur containing compounds, elemental sulfur, and undetected hydrocarbons which cause retention time shifting or ECD response suppression. Some of these interferences may be removed by Florisil cleanup (The analyst should refer to SOP OL-2018 for the Florisil procedure).

5.2.3.4 Other sources of interferences could occur from phthalate esters, which can be minimized by avoiding sample contact with any plastic materials. Phthalates are easily leached from plastic materials during laboratory operations or even sampling including equipment rinsing.

## 6.0 HEALTH AND SAFETY

6.1 AMRO has a laboratory safety program in place that applies to all employees. There is a safety officer as well as employees with 40 hours of OSHA training. The air quality of the laboratory and the extraction hood velocities are monitored. All employees receive fire and safety training upon employment.

6.2 Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place. Fire drills are held on an annual basis or "as needed" with building or personnel changes.

6.3 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab,

clean laboratory coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place.

6.4 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eyewash stations and an emergency shower.

6.5 Material Safety Data Sheets (MSDS's) are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.7 Waste control – AMRO takes whatever steps possible to minimize waste. This includes sample and solvent volume minimization where appropriate. There is a Waste Coordinator officer designated with 40 hours of OSHA training. AMRO also properly segregates wastes based upon waste characterization (i.e. flammability, chlorination, acidity, etc.) and a commercial vendor is utilized for waste disposal.

## 7.0 INSTRUMENTS AND EQUIPMENT

7.1 Gas Chromatograph: Analytical system complete with gas chromatograph suitable for on column and split-splitless injections. The system includes all the required accessories such as syringes/autosampler systems, analytical columns, gases, electron capture detectors (ECDs) and a data system.

7.2 AMRO has two complete GC/ECD systems: GC-Trent (7.2.1) and GC-Priscilla (7.2.2). All are Hewlett Packard Model 5890s capable of dual column analysis. Helium is the carrier gas and P5 (95% Argon/5% Methane) is the auxiliary make-up gas. GC-Priscilla is the primary Pesticide analysis instrument and uses column configuration (7.2.2). Each GC is equipped with one of two equivalent capillary column pairs, either:

7.2.1 RXI-50 (Restek), 30m x 0.53mm I.D. 0.83µmdf
RTX50 (Restek), 30m x 0.53mm I.D. 1.5µmdf

7.2.2 J&W Scientific DB-608, 30m x 0.45mmID, 0.7µmdf
Agilent DB-1701, 30m x 0.45mmID, 0.85µmdf

7.3 The data systems for all instruments are Hewlett-Packard Chemstation-EnviroQuant software which is used to acquire and process all GC-ECD data.

7.4 Volumetric flasks, 10 and 25mL, and Gas-Tight syringes for preparation of standards.

## 8.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

8.1 Daily maintenance:

The following procedures are performed each day an instrument is used for analysis if in the analyst's judgement, system performance requires them:

8.1.1 The GC septum and glass liner are removed and replaced if judged necessary by the analyst.

8.1.2 Column performance is monitored by checking the response factor of key compounds, which indicate column degradation, column bleed, or appropriate peak resolution. Clip two or more inches from the head of the column if necessary.

8.1.3 Check that carrier and make-up gases have adequate supply sufficient for the analytical sequence. Visual inspection of color indicating inline gas filters (hydrocarbon and moisture). Change tanks if necessary.

8.1.4 Check to ensure the hard drive memory capacity is sufficient for data acquisition using the HP Chemstation-EnviroQuant software.

8.2 Weekly Maintenance, or as needed:

8.2.1 Clipping column

8.2.2 Swab inlet weldment and injection port with hexane or other appropriate solvent(s).

8.2.3 Clean or replace single taper injection liner and glass wool, gold inlet seal, ferrules, and septa.

## 9.0 REAGENTS AND STANDARDS

9.1 The following solvents are used for sample dilutions, preparation of standards or solvent rinsing of equipment:

9.1.1 Hexane, Reagent Grade and Pesticide Residue Grade chemicals or equivalent.

9.1.2 Acetone, Reagent Grade and Pesticide Residue Grade chemicals or equivalent.

9.1.3 Methanol, Reagent Grade and Pesticide Residue Grade chemicals or equivalent.

9.2 Commercially prepared stock standard solutions that are certified by the manufacturer are used in this analysis. All Pesticide standards are purchased from Restek or an equivalent vendor. Second source standards are purchased from Ultra or are a different lot number than that used to calibrate.

9.3 All single component pesticide compounds can be found in Pesticide Standard Mixture A (Ind. A) and Pesticide Standard Mixture B (Ind. B). Both Ind. A & B contain surrogates Tetrachloro-m-xylene (TCX) and Decachlorobiphenyl (DCB) so no additional surrogates need to be added. **Table 1** below lists the analytes and concentrations in the stock mixes:

**Table 1**

| Ind. A | Concentration µg/mL |
|---|---|
| alpha-BHC | 8.0 |
| gamma-BHC (Lindane) | 8.0 |
| 4,4'-DDD | 16 |
| 4,4'-DDT | 16 |
| Dieldrin | 16 |
| Endosulfan I | 8.0 |
| Endrin | 16 |
| Heptachlor | 8.0 |
| Methoxychlor | 80 |

| Ind. B | Concentration µg/mL |
|---|---|
| Hexachlorobenzene | 8.0 |
| Aldrin | 8.0 |
| beta-BHC | 8.0 |
| delta-BHC | 8.0 |
| alpha-chlordane | 8.0 |
| gamma-chlordane | 8.0 |
| 4,4'-DDE | 16 |
| Endosulfan II | 16 |
| Endosulfan Sulfate | 16 |
| Endrin Aldehyde | 16 |
| Endrin Ketone | 16 |
| Heptachlor Epoxide | 8.0 |

9.4 Working Calibration Standards: Seven serial dilutions are then made from the stock standards as specified in the Table 2 below for the calibration curve

9.4.1 Single component pesticide calibration standards and concentration:
NOTE: Methoxychlor is 10 times the lowest target concentration in each standard.
NOTE: To meet the analyte list requirements of the MADEP CAM V B Method, hexachlorobenzene (HCB) is added from a stock of 8ug/mL to the L7B standard and then is carried in all the serial dilutions of the L7B mix.

| Table 2 | | | |
|---|---|---|---|
| **Calibration Std's** | **Vol. Of Stock** | **Final Vol.** | **Concentration*** |
| IndA Level 1 (L1A) | 1.25mL Level 7 | 25mL | $2 \times 10^{-4}$ |
| IndB Level 1 (L1B) | 1.25mL Level 7 | 25mL | $2 \times 10^{-4}$ |
| IndA Level 2 (L2A) | 2.5mL Level 7 | 25mL | $4 \times 10^{-4}$ |
| IndB Level 2 (L2B) | 2.5mL Level 7 | 25mL | $4 \times 10^{-4}$ |
| IndA Level 3 (L3A) | 3.75mL Level 7 | 25mL | $6 \times 10^{-4}$ |
| IndB Level 3 (L3B) | 3.75mL Level 7 | 25mL | $6 \times 10^{-4}$ |
| IndA Level 4 (L4A) | 20mL Level 7 | 100mL | $8 \times 10^{-4}$ |
| IndB Level 4 (L4B) | 20mL Level 7 | 100mL | $8 \times 10^{-4}$ |
| IndA Level 5 (L5A) | 6.25mL Level 7 | 25mL | $1 \times 10^{-3}$ |
| IndB Level 5 (L5B) | 6.25mL Level 7 | 25mL | $1 \times 10^{-3}$ |
| IndA Level 6 (L6A) | 12.5mL Level 7 | 25mL | $2 \times 10^{-3}$ |
| IndB Level 6 (L6B) | 12.5mL Level 7 | 25mL | $2 \times 10^{-3}$ |
| IndA Level 7 (L7A) | 1.0mL stock A mix | 250mL | $4 \times 10^{-3}$ |
| IndB Level 7 (L7B) | 1.0 mL stock B mix plus 0.008mL of HCB stock | 250mL | $4 \times 10^{-3}$ |

* true concentrations = multiplier times stock solution concentrations in Table 1

9.4.2 All multi-component pesticides are purchased individually and surrogates are then added. Serial dilutions are made from 1,000µg/mL stock to create five point curves for Toxaphene and Technical Chlordane when a multi-point calibration is required.

Multi-component pesticide calibration standards and concentration

| Calibration Std's | Vol. Of Stock | Final Vol. | Concentration (µg/mL) |
|---|---|---|---|
| Toxaphene Level 4 | 50µL | 50mL | 1.0 |
| Tech. Chlordane Level 4 | 50µL | 50mL | 1.0 |

9.4.3 Initial Calibration Verification Standard: 2.5mL of Matrix Spike Solution (0.20µg/mL) is brought to 25mL final volume with Hexane for a final concentration of 0.020µg/mL.

## 9.5 TRACKING OF ANALYTICAL STANDARDS

9.5.1 Chemical Receipt:

The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a five digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and the disposal dates are completed by AMRO employees when standards are used up or disposed. Refer to the laboratory SOP "Sample Management" GL-1006.

9.5.2 Standards Preparation:

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

9.5.2.1 AMRO purchases pesticide residue grade solvents and purge and trap grade Methanol for organic standard preparation and organic sample extractions.

9.5.2.2 Any stock standards that are purchased are accompanied by a certificate of analysis from the manufacturer.

9.5.3 Standard Tracking:

It is important to be able to track all analytical standards back to their sources. The following procedure is used by AMRO personnel to accomplish this:

9.5.3.1 Organic Standard Tracking: The Organic Standards Tracking System consists of three logbooks. One logbook for The ID index logbook one for Stock Standards and one for Working Standards.

9.5.3.1 Stock Standard: Whenever a stock standard solution is opened or is prepared from a neat compound, this information is recorded in the Stock Standard Logbook section of the standard tracking log. The standard chemical receipt I.D. is used for the stock solution. This ID along with the compound name, concentration and initials of the person making the stock are included on the label. Stock standards are good one year from the date prepared or the date provided by manufacturer, whichever is shorter. Example - The fourth volatile standard prepared on April 15, 1989 would have the standard ID V041589D. This number will be recorded in the logbook and written on the container.

9.5.3.2 Working Section: Whenever a working standard solution opened or is prepared, whether from AMRO stocks or commercially obtained stocks, the information is recorded in the Working Standard section of the standard tracking log. The solution is assigned a new ID number based on the section "V" or "S", the date it is prepared plus a letter suffix. This number along with a descriptive name, concentration (or conc. varied) and the initials of the person preparing the solution are included on the label. The expiration of working standards vary depending on the use. Standards should be used in accordance with method specifications and manufacturer's instructions. Stock standards must be replaced no more than one year after opening or sooner if routine QC tests indicates a problem. Working standard expiration dates are derived from the assigned stock solution's expiration date or sooner if routine QC tests indicates a problem.

9.5.3.3 Standard Storage: Standards and reagents are stored per method specifications and manufacturer's instructions. Semivolatile, Pesticide, PCB, Petroleum standards are stored in

refrigerators at 4±2°C, freezers at minus 10 °C, and ambient temperature depending upon the method and manufacturer requirements.

9.5.3.4 Solvent Check Analysis

All extraction procedures are performed using pesticide residue grade solvents and the first method blank analysis is used when a new lot number is received to verify the absence of target analytes. Also, Before a new vendor's solvent is used for sample extraction a special check of the concentrated solvent (not a method blank) is suggested.

## 10.0 PROCEDURE

10.1 AMRO currently has two GC instruments: TRENT and PRISCILLA.

10.2 GC Operating Conditions for PRISCILLA:

**PESTICIDE ANALYSIS**
Injection volume: 2 µL
ECD Temperatures: 300°C
Injection Port Temperature: 150°C
Initial Temperature: 150°C
Initial time: 0.5minutes
Rate 1: 15°C/minute
Final Temperature: 280°C
Final Time: 6 minutes
Run Time: 15.17 minutes

* A signed hard copy of this acquisition method is stored in the Instrument run logbook.

10.3 Injection port maintenance:

10.3.1 Due to the low concentrations injected in this method, every attempt must be made to ensure that the analyte path in the GC is free from sites of absorption or activity by performing injection port maintenance. Routine daily maintenance may include replacing septa, inlet liners, cleaning the injection port and clipping the injector end of the guard column. All non-routine maintenance such as column replacement or detector replacement must be recorded in the maintenance logbook.

10.4 Column Priming:

10.4.1 Because of the low concentration of pesticide standards injected on a GC/ECD, column absorption may be a problem. The GC column may be primed or deactivated by injecting 1.0 µL of a high standard solution.

10.5 Injection Run Log:

10.5.1 All injections are recorded with the EnviroQuant software and a signed hard copy of the sequence list is stored in the Instrument logbook.

10.6 Dual Column Analysis:

10.6.1 This method uses the dual column/dual detector approach. It involves the use of two 30m X 0.45mm ID fused- silica open tubular columns of different polarities, thus different selection towards the target compounds. The columns are connected by a "Y" connector to a guard column, which is connected to one injection port with one auto-sampling tower. Both columns are then connected to two different ECD detectors. (A guard column maybe used at the analysts documented discretion.)

10.7 Retention Time Windows (sections 10.7.1 through 10.7.5 refer to a setting up new instrument and determining analyte RT and elution orders):

10.7.1 Before establishing retention time windows, make sure that the chromatographic system is operating reliably and that the system conditions have been optimized for the target analytes and surrogates in the sample matrix to be analyzed.

10.7.2 Make three injections of all single and all multi-component analytes over the course of a 72-hour period. Serial injections or injections over a period of less than 72 hours may result in retention time windows that are too tight.

10.7.3 Record the retention times for all single analytes and three to five major peaks for multi-component analytes. Calculate the mean and standard deviation of the three absolute retention times of each single analyte and those peaks.

10.7.4 If the standard deviation of the retention times for a target compound is 0.000, then the laboratory uses a default standard of 0.01 minutes. Recording retention times to three decimal places rather than two should minimize the instances in which the standard deviation is calculated as 0.000.

10.7.5 The width of the retention time window for the single analytes, each major constituent in multi-component analytes and surrogates is defined as ±3 times the standard deviation of the mean absolute retention time established during a 72-hour period. If the default standard deviation is employed, the width of the window will be 0.03 minutes.

10.7.6 The absolute retention time windows must be calculated for each analyte and surrogate on each chromatographic column and instrument. New retention time windows and/or analyte elution order must be established when a new GC column is installed.

10.7.7 Establish the center of the window for each analyte and surrogate by using the absolute retention time for each analyte and surrogate from the calibration verification standard at the beginning of the analytical shift. For samples run during the same shift as an initial calibration, use the retention time of the mid-point standard of the initial calibration.

10.7.8 If the daily CCV falls outside the window, the analyst will evaluate the instrument and will recalibrate if necessary. For samples run during the same analytical shift as the Initial Calibration, use the RT of the midpoint standard. However, the experience of the GC analyst should weigh heavily in the interpretation of the chromatograms. The analyst may therefore qualify an analyte as present outside the RT window by using pattern recognition.

10.8 Initial Calibration:

10.8.1 The initial calibration curve must contain a minimum 5-point curve for all surrogates and analytes of interest with %RSD's less than 20%. Normally 7 standard levels are used for the single pesticides as indicated in 9.5.1.

10.8.2 The analysis of the multi-component analytes chlordane and toxaphene employs a single point calibration at the midpoint of the expected calibration range of each multi-component analyte. It is included with the initial calibration of the single component analytes and is used for pattern recognition and RTs. If the analytes are detected in the sample,

and the sample is from a DoD project, then a 5 point curve needs to be analyzed and the sample should be reanalyzed against this curve.

10.8.3 A second source mid-point standard is injected and compared to the initial calibration curve. The recovery of each analyte must be ±15% of the true value.

10.8.4 In reporting multi-component analytes, two processes are used: qualitative and quantitative. The first is qualitative, which is done matching the unknown sample to the multi-component standards evaluated during the initial calibration. In this case the pattern in the sample is compared to patterns of the standards. If a match is found, it is determined at what concentration the multi-component analyte is in the unknown, or its quantitative value. Three to five of the major peaks in the multi-component analyte pattern are chosen to measure the concentration of the positive hit.

10.9 Calibration Techniques:

There are two calibration techniques used by AMRO acceptable for quantitation: average response factor calibration and linear regression calibration curve. This is the order of preference:

10.9.1 The Average Response Factor Calibration:

10.9.1.1 Calculate the response factor of each compound using the equation:

$$\text{Response Factor (RF)} = \frac{\text{Peak Area of analyte}}{\text{Conc. of Analyte in standard}}$$

10.9.1.2 Calculate the Average of the Response Factors (Rfa) and the Standard Deviation (STD). Using the Rfa and STD, calculate the percent relative standard deviation (%RSD). When the RSD of Analytes are less than 20%, linearity through the origin can be assumed.

$$\%\ \text{RSD} = \frac{\text{Standard Deviation}}{\text{Average Response factor}} \times 100\%$$

10.9.1.3 Providing the % RSD for each analyte is less than 20%, the Average Response Factor (Rfa) can be using to calculate the sample results. If the %RSD is greater than 20% then a Linear Calibration Curve may be used providing the acceptance criteria is met.

10.9.2 Linear Calibration Curve:

10.9.2.1 In order to use this technique, the data system must plot and evaluate a calibration curve by calculating the correlation coefficient against the first order equation:

$$Y = mX + b$$

10.9.2.2 The software option "Curve Fit" must be selected and the computer will evaluate the calibration based on the above equation. The acceptance criteria for this equation is the coefficient of determination must be at least 0.990 and documented with a signed/dated graphics plot stored with the calibration.

10.9.2.3 Dropping of standard point should be performed ONLY on either the high or the low standard. Any point dropping should be documented for the reason of dropping on the initial calibration form. The analyst must sign and date the initial calibration form and will be reviewed by the appropriate data reviewer. The curve must be printed for visual verification and stored with the calibration records.

10.9.3 If the %RSD is greater than 20% and the correlation coefficient is less than 0.99, the instrument must be re-calibrated.

10.10 Continuing Calibration Verification (CCV)

10.10.1 Verify calibration each 12 hour shift by injecting CCV's (Continuing Calibration Verification sample, a midpoint concentration standard) prior to any sample analysis. A CCV must also be injected at intervals not less than once every 20 samples including QC (or at the end of a 12 hour interval, whichever comes first). For DoD samples the CCV must be analyzed after every 10 field samples and at the end of the analysis sequence.

10.10.2 A12-hour sequence begins with the injection of the first CCV. The shift ends after the completion of the analysis of the last sample or standard that can be injected within 12-hours of the beginning of the sequence. A closing standard **MUST** be injected at the end of the 12-hour window. However, in

continuous analysis, the closing CCV of one shift may also serve as the CCV of the next 12-hour shift.

10.10.3 The CCV Standard response must be within ± 15% of the expected value based on the initial calibration curve. If the percent Drift (%D) of any analyte is > 15%, but the average %Drift for all the analytes are within 15% and the %D for an individual analyte < 25%, then the calibration has been verified.

$$\% \text{ Drift} = \frac{\text{Calculated Concentration - Theoretical Conc.}}{\text{Theoretical conc.}} \times 100\%$$

$$\text{Ave. \%Drift} = \frac{\text{\%Drift of Each Analyte}}{\text{Total \# of Analytes}}$$

No sample results can be reported associated with a verified CCV > ±15% drift for that analyte unless it is qualified in the associated narrative report. Reanalysis is required in these cases. If a CCV fails and correction action fails to produce a passing CCV, i.e. two CCVs fail in a row, then a new initial calibration is required *or* two consecutive CCVs must pass the method criteria described above in order for sample analysis to proceed.

For DoD samples all analytes must be within ± 20% of the expected value from the Initial Calibration.

10.10.4 CCV retention times must be compared to the RT windows established vs. starting CCV (RT updated and verified) of the analytical sequence.

10.10.4.1 If any analyte is outside the window, the chromatographic system must either be adjusted so re-analysis of the CCV falls within RT windows, or the data system method copy can be updated to adjust the RT window position, otherwise a new initial calibration must be performed and new retention time windows established.

10.10.4.2 Subsequent ongoing CCV retention times should be compared to the initial CCV of the 12-hour shift. Any shifts outside the initial CCV verified windows must be investigated for

possible reanalysis of the samples in the analytical sequence.

10.10.5 If the standard analyzed after a group of samples exhibits high response (>15%), and the analyte was not detected in the specific samples analyzed during the analytical shift, then the extracts for those samples do not need to be reanalyzed, as the verification standard has demonstrated that the analyte would have been detected were it present. A second terminal CCV should be performed for all queues containing DOD project samples to demonstrate the consistency of bias, if any, in the terminal CCV result. If the response in the terminal CCV standard is low (by >15%), the sample must be re-injected in a separate analytical queue after preventive maintenance to correct the instrument problem causing the terminal QC failure. If all samples were analyzed twice in separate analytical queues with the same failing results on the closing CCV, then the laboratory will submit the initial sample results and the reanalysis of the samples will be indicated in the laboratory case narrative with the indication of which compounds failed the closing CCVs.

10.10.6 The initial daily CCV standards should include a PEM (pesticide evaluation mixture) which is used to determine the breakdown of Endrin and DDT. This standard should be analyzed *before* samples are analyzed, every 12-hour shift. Breakdown should be less than 15% for each compound. Results of the macro BREAKDWN.mac must be included with the raw data with analyst initials and date.

$$\%\ \text{DDT Breakdown} = \frac{\text{Sum of DDE \& DDD areas x 100\%}}{\text{Sum of DDT,DDE,DDD areas}}$$

$$\%\ \text{Endrin Breakdown} = \frac{\text{Sum of Endrin Aldehyde + Endrin Ketone Areas x 100\%}}{\text{Sum of Endrin, End. Aldehyde, + Endrin Ketone Areas}}$$

10.11 Data Interpretation

10.11.1 The integration of compounds for standards and samples should be performed to be in the same manner as the initial calibration integration. Cases where the initial calibration is in question should be investigated to ensure it is not related to poor maintenance, damaged or defective column, or other issues which should be solved before further analysis.

The following must be checked for each compound present in standards and samples to ensure proper integration has been performed.

10.11.2 The peak shape of the calibration compound must be maintained for standards and samples. This should take into account any shouldering, peak tailing and peak co-elution. The following pesticide pairs may nearly co-elute, although when the columns are new the resolution should be sufficient to quantify them adequately if both are present in a standard or sample: heptachlor and delta-BHC; gamma-BHC and beta-BHC; 4,4'-DDE and dieldrin; endosulfan sulfate and 4,4'-DDT; endosulfan I and DDE (column 1); alpha-chlordane and endosulfan I (column 2). These analytes are in different standard mixes to allow for proper evaluation in the standards. Analyst experience is an important tool in differentiating co-eluting analytes.

10.11.3 The retention time windows for each compound of the daily initial calibration verification must be applied to standards and samples. If there is a retention time shift confirmed by comparison of the Continuing Calibration Standards and Surrogates then pattern recognition can be utilized for identification of multi-component analytes only. Otherwise re-calibration is required.

10.11.4 The baseline integration technique for each compound of the calibration must be maintained for the standards and the samples. This should take into account elevated baselines, column compensation corrections, and negative peaks in samples. The preferred integration of multicomponent analytes should be baseline-baseline along a common baseline established by the beginning and end of the pattern. Use of valley-valley integration for toxaphene or technical chlordane should be avoided.

10.11.5 Make sure that positive identification of compounds has been established. This is done using comparison between two columns and evaluating the presence, shape, and position of the peaks within the RT windows. The peak apex of the target peak should be very near the center of the window, which is marked with a "+" in the data system display. Some slight shifting due the matrix effects may occur but the shift should be in the same direction on both columns, usually to later RTs. Qdelete the unconfirmed and false positive hits.

10.11.6 Ensure any positive results are within the lower and upper levels of the calibration curve and above the reporting limits for each compound.

10.11.7 Data interpretation consists of two steps, qualitative interpretation and quantitative interpretation. Qualitative interpretation involves identifying the analytes that are present. Analytes are identified and confirmed according to their retention times on two different columns. Quantitative interpretation involves determining the concentrations of the analytes that are present. All analytes are calculated by using the initial calibration curve:

10.11.7.1 Qualitative Analysis:

10.11.7.1.1 The first step in evaluating the data is qualitative analysis. Tentative identification of an analyte occurs when a peak from a sample falls within the established daily RT window for a specific target analyte. Confirmation is required on a second GC column of different characteristics.. For multi-component analytes (Toxaphene, Technical Chlordane), identifications are based mostly on pattern recognition, but retention time windows are used to supplement this process.

10.11.7.1.2 Pattern recognition of multi-component analytes. Each multi-component analyte shows a distinctive chromatographic pattern, which is used to identify that compound in a sample. To determine if a multi-component analyte is present, compare the sample chromatogram to the initial calibration standard. If the multi-component analyte is present in the sample, the relative response of the peaks in the standard should be similar to the response of the corresponding peaks in the sample. In addition, most major peaks observed in the standard should also appear in the sample. Be aware that degradation can alter the appearance of a sample pattern, making it harder to recognize.

10.11.7.1.3 When dual column analysis is being performed, the results for at least one column

must meet the calibration acceptance criteria. The other column may be used for qualitative verification. Use of the designated qualitative verification column for quantitation is only acceptable if the initial and terminal CCVs on the verification column are in control and interference is suspected on the primary quantitation column. For DoD samples both columns must meet the acceptance criteria.

10.11.7.2 Quantitative Analysis:

10.11.7.2.1 The second step in evaluating data is quantitative analysis. This step can only take place after the qualitative techniques in Section 10.11.7.1 have been used to confirm a positive result. For all multi-component analytes, a minimum of three distinct peaks must be used for quantitative analysis.

10.11.7.2.2 Sample results are quantitated from the initial calibration based on the three techniques discussed in Section 10.9, following this order of preference.

10.11.7.2.3 Average Response Factor Calibration. Use the following equation to calculate the concentration of analytes:

$$\text{Concentration (ug/L)} = \frac{(Ax)\,(Vf)\,(Df)}{(Rfa)\,(Vi)}$$

Where:
**Ax** = Area counts for the analyte in the sample.
**Vi** = Initial volume of the sample extracted in mL.
**Vf** = Final volume of sample extract in mL.
**Df** = Dilution factor.
**Rfa** = Average response factor from the initial calibration curve.

10.11.7.2.4 Linear Fit Calibration. Use the following equation to calculate the concentration of analytes:

$$\text{Concentration (ug/L)} = \frac{([m]\,[Ax] + b)\,(Vf)\,(Df)}{(Vi)}$$

Where:
**([m] [Ax] + b)** = Concentration of analyte in sample extract, calculated by data system or integrator (ug/L).
**Vi** = Initial volume of sample extracted in mL.
**Vf** = Final volume of sample extract in mL
**Df** = Dilution factor.

The curve must be printed and stored with the calibration records to document visual evaluation.

10.11.7.2.5 If it is determined that Toxaphene and/or Technical Chlordane are present, a valid calibration curve for that analyte must be performed before quantitation of that analyte can proceed if multi point calibration is required. The sample must then be re-analyzed and quantitated against the curve.

10.11.8 To quantitate multi-component analytes, discern at least three to five distinctive, unobstructed, peaks in the sample chromatogram that correspond to peaks in the standard chromatogram. Total the area of these peaks in the sample. For each standard used in the curve, total the area of the corresponding peaks. If the average response factor calibration technique is being used, calculate standard response factors for each curve standard from the total area. Then from the standard response factors calculate an average response factor. Alternatively, the total area from each curve standard can be used to produce a linear or quadratic calibration curve. Finally, the average response factor or the calibration curve is used to calculate sample concentrations.

10.11.9 Each sample analysis must be bracketed with an acceptable Initial Calibration, CCV's (each 12-hr. shift or interspersed every 20 samples including QC, whichever comes first). DoD samples will be analyzed at intervals of no greater than 10 field samples between CCV's.

10.11.10 When a CCV fails to meet acceptance criteria, all the samples injected after the last acceptable CCV must be reinjected.

10.11.11 All sample responses must fall within the calibration range. Re-analysis at a dilution must occur if the sample response exceeds the calibration range.

10.11.12 Sample results are confirmed by using two dissimilar columns. The column used for reporting results depends upon acceptable daily quality control including CCVs, MS, MSD, and LCS criteria being met. In general, report data from the column with the best overall QC data. This is the designated quantitation column and should be indicated on the Data Review Checklist in the project folder and marked on the CCV Summary Form. For DoD samples both columns must be in control. Report the higher of two confirmed results unless overlapping peaks are causing erroneously high results, then report the non-affected result and document in the case narrative.

10.11.13 For DoD samples any sample which is not confirmed must be reported with a "Q" flag.

10.11.14 When sample results are confirmed , the difference between the two columns is measured by calculating the Relative Percent Difference (RPD) between the two results:

$$RPD = \frac{|R1-R2|}{((R1+R2)/2)} \times 100\%$$

Where R1 & R2 are the results on 2 columns.

If the result from one column is significantly higher than the other, check the chromatogram for overlapping peaks which may cause erroneously high results. If no overlapping peaks are noted, examine the baseline parameters established during integration. If no abnormalities are noted, report the result from the designated primary quantitation column (except as noted in section 10.11.12 for DOD samples). If the results from the designated quantitation column appear to be in error due to interference's, and the CCV data is acceptable from the designated qualitative confirmation column, then use the confirmation column result for reporting. If the RPD exceeds 40% and the difference is not clearly attributable to matrix interference then report the RPD criteria outlier in the case narrative and flag the result with a "J".

## 11.0 CALCULATIONS

11.1 All necessary calculations and formulas can be found throughout the text as applicable to each section.

## 12.0 QUALITY CONTROL

12.1 Initial Demonstration of Proficiency:

12.1.1 The ability of AMRO to produce accurate and precise data is demonstrated per instrument/per analyst for each method. It consists of a Method Detection Limit Study (MDL) and Precision and Accuracy Study (P&A) for each instrument and each matrix. The laboratory demonstrates initial proficiency with each combination of sample preparation and determinative methods that it utilizes by generating data of acceptable precision and accuracy for a reference sample containing the target analytes in a clean matrix. The reference samples are prepared from a spiking solution containing each analyte of interest at a concentration that is 10-50 times the MDL for each analyte in that matrix, or at the routine concentration of LCS's (Laboratory Control Samples). P & A Studies are required to be reviewed annually by evaluating a minimum of 4 LCS's and corrective action taken if necessary.

12.2 MDL and LOQ/LOD Studies:

12.2.1 The method detection limit (MDL) is defined in 40 CFR 136 Appendix B. The purpose of an MDL is to establish the minimum concentration of each analyte greater than zero that can be reported with 99% confidence. An MDL study consists of at least 7 replicates of spiked soil/deionized water (ideally standard set at ½ RL or lower), which are extracted and analyzed as normal samples. The standard deviation of the results of these analyses is multiplied by the appropriate student T-test value. The resulting value is deemed the method detection limit for that specific analyte.

MDL studies of each analyte must be reported initially for each instrument, column, matrix, and extraction method. To ensure that reasonable MDL values are determined, an MDL check sample may be analyzed by spiking an interference free matrix with all target analytes at about two times the determined MDL. The MDL check sample is taken through the same process as the MDL. If any of the target analytes are not detected, or the characteristic Aroclor peak

pattern cannot be identified, then the MDL study is modified and repeated until the MDL check sample is detectable. The MDL check is recommended on a quarterly basis and after major instrument maintenance or changes in the instrumentation or instrumental conditions to verify sensitivity of the method.

12.2.2 LOQ/LOD

The LOD (limit of detection) is an estimate of the lowest amount of an analyte that can be detected. This estimate would be derived from MDL studies and calibration curves (the low-level standards).

To determine the LOQ (limit of quantation), low level standards are prepped and analyzed as normal samples. The level should be at one to two times the reporting limit. The percent recoveries are calculated and criteria established for expected recoveries. For 8081 analysis, the LOQ/LOD is spiked into blank water/soil, brought through the normal extraction and cleanup process, and then analyzed. The acceptance criteria will be 50-150%. The LOQ studies are be done annually.

12.3 Precision &Accuracy:

12.3.1 Accuracy is a measure of the degree to which the analytical result approaches the "true" value of the concentration of the analyte being determined. Precision in the laboratory is determined by the comparison of duplicates, where duplicate samples result from an original sample that has been split for identical analyses. Precision and Accuracy in the laboratory is assessed initially by the analyses of a minimum of 4 replicate samples at a mid-level point of the expected range. The percent recoveries and Relative Standard Deviations (RSD) are evaluated and compared to method specifications or default limits where applicable.

12.3.2 Accuracy is also assessed by the regular analysis of known standards such as the Laboratory Control Samples (LCS), and matrix and analytical spikes. Accuracy within the laboratory is expressed in terms of percent recovery.

12.3.3 The precision of data is regularly evaluated by determining the relative percent difference (RPD) of duplicate (replicate) analyses.

12.4 Method Blanks are prepared at a frequency of one for every batch of up to 20 samples of the same matrix, prepared at the same time, by the same procedures. When sample extracts are subjected to cleanup procedures, the associated method blank must also be subjected to the same procedures.

Property of AMRO Environmental Laboratories Corporation

12.4.1 The results for the method blank should be < RL for all analytes for all sample batches and < ½ RL for batches containing DoD project samples (DoD samples can have common lab contaminants up to the RL). If the method blank results do not meet these acceptance criteria, then corrective action is taken to locate and reduce the source of the contamination and the associated sample extracts are reanalyzed or re-extracted if necessary. If all the samples in the batch are non-detects then re-extraction is not necessary. If insufficient sample volume remains for re-extraction then all the samples will be reported with the appropriate data qualifiers.

12.5 Matrix spike (MS) and Matrix Spike Duplicate (MSD) are prepared at a frequency of one for every batch of up to 20 samples of the same matrix, prepared at the same time, by the same procedures (unless otherwise specified).

12.5.1 Samples must be selected for spiking at random and rotated among clients and sites from batch to batch. In some cases, the client may specify which sample is to used for MS/MSD; if not , the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall not be performed on Trip Blank, Rinsate Blank or Field Blank.
B. Adequate sample weight/volume.
C. Client requested QC deliverables.

12.6 Laboratory Control Samples are prepared at a frequency of one for every batch of up to 20 samples of the same matrix, prepared at the same time, by the same procedures. The LCS consists of an aliquot of clean matrix similar to the sample matrix and of the same weight or volume. The LCS is spiked with the same compounds at the same concentrations as the MS and MSD. When the results of the MS and MSD analysis indicates a potential problem due to the sample matrix itself, the LCS results are used to verify that the lab can perform the analysis in a clean matrix.

12.7 Analysis of the MS, MSD, and LCS require the same procedures employed for the original sample and the concentration of each analyte spiked is calculated.

12.8 Calculation of Recovery:
Accuracy is estimated from the recovery of spiked analytes from the matrix of interest. The recovery of each spiked analyte is calculated using the following formula:

$$\text{Recovery} = \%R = \frac{Cs - Cu}{Cn} \times 100\%$$

Where:
Cs = Measured concentration of the spike sample aliquot
Cu = Measured concentration of the unspiked sample aliquot (use 0 for LCS)
Cn= Nominal (theoretical) concentration increase that results from spiking the sample, or the nominal concentration of the spike aliquot (for LCS).

12.9 Calculation of Precision:
Precision is estimated from the relative percent difference (RPD) of the concentrations (not the recoveries) measured for the MS/MSD. To calculated the RPD, use the following formula:

$$RPD = \frac{|Conc.\ 1 - Conc.\ 2|}{((Conc.\ 1 + Conc.\ 2)/\ 2)} \times 100$$

Where:
Conc. 1 = Measured concentration of the first sample aliquot
Conc. 2 = Measured concentration of the second sample aliquot

12.10 All recoveries control limits for surrogates, matrix spikes and laboratory control sample control are based on the laboratory control charts unless specifically excepted below. The control charts are updated annually.

12.11 The following additional Quality Control criteria apply for all Massachusetts Contingency Plan (MCP) projects where the CAM Method V B is requested:

12.11.1 MS/MSD: Must contain all target compounds. %REC's should be between 30-150%. RPD's should be <30% for soils, <20% for waters.

12.11.2 LCS/LCSD: %REC's must be between 40-140%.

12.11.3 Surrogates: %REC's must be between 30-150% for both surrogates on both columns.

12.11.4 Confirmation: All QC parameters must meet on both columns. Report the higher of the two columns results unless the highest result is attributable to interference.

12.11.5 Reporting: Report both sets if one is extracted inside the holding time and other outside the holding time. Provide chromatograms if the Quality Control problems are attributed to matrix effects. Report all exceedances of the above criteria in the narrative and

indicate if the recoveries ,although out side the acceptance criteria, are inside the AMRO statistical control limits.

12.12 The following special default batch QC acceptance limit criteria apply to all DOD project samples unless superceded by a project specific QAPP.

12.12.1 The LCS recovery acceptance limits for water and soil are found in Attachment 1. One target sporadic marginal failure for full list spikes is allowed outside these limits. The marginal exceedance limits are also found in Attachment 1.

12.12.2 The MS/ MSD recovery acceptance limit rules are the same as for the LCS.

12.12.3 The maximum RPD allowed for MS/MSD pairs is 30%.

12.12.4 The surrogate recovery limit for TCMX is 25-140% for water samples and 70-125% for solid samples. The surrogate recovery limit for Decachlorobiphenyl is 30-135% for water samples and 55-130% for solid samples.

12.12.5 Corrective action must be taken if the MB or LCS surrogates or LCS target analyte spike recoveries are outside the acceptance criteria. If reanalysis does not fix the problem, or investigation does not prove the problem is confined to the MB and/or LCS, then re-extraction of the entire batch may be necessary. All data associated with failed MB or LCS QC must be "Q" flagged.

## 13.0 DATA REVIEW AND STORAGE

13.1 All cross-outs must be a single line and should be initialed and dated. Analyst data review is documented on the GC and GC/MS Data Review Checklist.

## 14.0 REFERENCES

14.1 40 CFR Part 136 Appendix B, 1984.

14.2 USEPA Office of Solid and Hazardous Waste - SW-846 Method Chapter 1, Rev. 1 7/92.

14.3 Method 8000B Revision 2, December 1996. SW846, Update III, USEPA.

14.4 Method 8081A Revision 1, December 1996. SW846, Update III, USEPA.

14.5 Shell for Analytical Chemistry Requirements, Version EM 200-1-3, 02/01/01.

14.6 OL-2003, Separatory Funnel Liquid-Liquid Extraction.

14.7 OL-2004, Automated Soxhlet Extraction.

14.8 OL-2018, Florisil Cleanup.

14.9 OL-2019, Sulfur Cleanup.

14.10 Massachusetts Department of Environmental Protection, WSC CAM V B , Revision 1, July 1, 2010.

14.11 Department of Defense Quality Systems Manual for Environmental Laboratories, Final Version 3, January 2006

# Attachment 1



TABLE D-14. LCS CONTROL LIMITS FOR ORGANOCHLORINE PESTICIDES SW-846 METHOD 8081 WATER MATRIX[24]

| Analyte | Mean | Standard Deviation | Lower Control Limit | Upper Control Limit | Lower ME Limit | Upper ME Limit |
|---|---|---|---|---|---|---|
| 4,4'-DDD | 88 | 20 | 25 | 150 | 10 | 170 |
| 4,4'-DDE | 87 | 18 | 35 | 140 | 15 | 160 |
| 4,4'-DDT | 92 | 15 | 45 | 140 | 30 | 155 |
| Aldrin | 83 | 19 | 25 | 140 | 10 | 155 |
| alpha-BHC | 94 | 11 | 60 | 130 | 50 | 140 |
| alpha-Chlordane | 93 | 10 | 65 | 125 | 55 | 135 |
| beta-BHC | 96 | 10 | 65 | 125 | 55 | 135 |
| delta-BHC | 91 | 15 | 45 | 135 | 30 | 150 |
| Dieldrin | 95 | 11 | 60 | 130 | 50 | 140 |
| Endosulfan I[25] | 80 | 10 | 50 | 110 | 40 | 120 |
| Endosulfan II | 79 | 17 | 30 | 130 | 10 | 150 |
| Endosulfan sulfate | 96 | 14 | 55 | 135 | 40 | 150 |
| Endrin | 95 | 13 | 55 | 135 | 45 | 145 |
| Endrin aldehyde | 96 | 14 | 55 | 135 | 40 | 150 |
| Endrin ketone | 102 | 8 | 75 | 125 | 70 | 135 |
| gamma-BHC | 82 | 18 | 25 | 135 | 10 | 155 |
| gamma-Chlordane | 94 | 11 | 60 | 125 | 50 | 135 |
| Heptachlor | 87 | 15 | 40 | 130 | 30 | 145 |
| Heptachlor epoxide | 96 | 11 | 60 | 130 | 50 | 140 |
| Methoxychlor | 103 | 16 | 55 | 150 | 40 | 165 |

TABLE D-15. LCS CONTROL LIMITS FOR ORGANOCHLORINE PESTICIDES SW-846 METHOD 8081 SOLID MATRIX[26]

| Analyte | Mean | Standard Deviation | Lower Control Limit | Upper Control Limit | Lower ME Limit | Upper ME Limit |
|---|---|---|---|---|---|---|
| 4,4'-DDD | 81 | 18 | 30 | 135 | 10 | 155 |
| 4,4'-DDE | 97 | 10 | 70 | 125 | 60 | 135 |
| 4,4'-DDT | 92 | 16 | 45 | 140 | 30 | 155 |
| Aldrin | 93 | 16 | 45 | 140 | 30 | 155 |
| alpha-BHC | 93 | 10 | 60 | 125 | 50 | 135 |
| alpha-Chlordane | 92 | 10 | 65 | 120 | 55 | 130 |
| beta-BHC | 95 | 11 | 60 | 125 | 50 | 135 |
| delta-BHC | 94 | 12 | 55 | 130 | 45 | 145 |
| Dieldrin | 96 | 10 | 65 | 125 | 55 | 135 |
| Endosulfan I | 74 | 20 | 15 | 135 | 10 | 155 |
| Endosulfan II | 89 | 17 | 35 | 140 | 20 | 160 |
| Endosulfan sulfate | 99 | 12 | 60 | 135 | 50 | 145 |
| Endrin | 97 | 12 | 60 | 135 | 50 | 145 |
| Endrin aldehyde | 92 | 18 | 35 | 145 | 20 | 165 |
| Endrin ketone | 100 | 11 | 65 | 135 | 55 | 145 |
| gamma-BHC | 91 | 11 | 60 | 125 | 50 | 135 |
| gamma-Chlordane | 96 | 10 | 65 | 125 | 55 | 135 |
| Heptachlor | 96 | 15 | 50 | 140 | 35 | 155 |
| Heptachlor epoxide | 98 | 11 | 65 | 130 | 55 | 140 |
| Methoxychlor | 100 | 14 | 55 | 145 | 45 | 155 |

[24] A number of sporadic marginal exceedances of the control limits are allowed, depending on the number of analytes spiked in the LCS. Refer to section D.2 and Table D-1 for guidance on the appropriate application of control and ME limits. LCS control limits are not available for Hexachlorobenzene and Toxaphene, although those compounds do appear on the target analyte list for method 8081 (Table C-8 in Appendix DoD-C). Sufficient data to perform statistically significant analyses were not received for those analytes during the LCS study. Additional limits for surrogate compounds can be found in section D.6.

[25] Provisional limits – outlier analyses during the LCS study resulted in LCS-CLs generated with data from fewer than four laboratories. Limits may be adjusted in the future as additional data becomes available.

[26] A number of sporadic marginal exceedances of the control limits are allowed, depending on the number of analytes spiked in the LCS. Refer to section D.2 and Table D-1 for guidance on the appropriate application of control and ME limits. LCS control limits are not available for Hexachlorobenzene, Hexachlorocyclopentadiene, and Toxaphene, although these compounds do appear on the target analyte list for method 8081 (Table C-8 in Appendix DoD-C). Sufficient data were not received for those analytes during the LCS study to perform statistically significant analyses. Additional limits for surrogate compounds can be found in section D.6.

Property of AMRO Environmental Laboratories Corporation

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

# AUTOMATED SOXHLET EXTRACTION
## EPA Method 3541

Procedure Number: OL-2004

Revision No.: 6

Revision Date: 12/23/2009

Review Date: N/A

Prepared By: Kristen Albert Date: 12/23/09

Approved By: Kristen Albert Date: 1/21/10
Extraction Section Supervisor

Approved By: [signature] Date: 1/21/10
Laboratory Director

Approved By: Paula Benham Date: 1/21/10
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

# TABLE OF CONTENTS


| | | Page |
|---|---|---|
| 1.0 | SCOPE AND APPLICATION | 3 |
| 2.0 | METHOD SUMMARY | 3 |
| 3.0 | SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE | 3 |
| 4.0 | POTENTIAL PROBLEMS AND INTERFERENCES | 4 |
| 5.0 | HEALTH AND SAFETY | 5 |
| 6.0 | INSTRUMENTS AND EQUIPMENT | 5 |
| 7.0 | REAGENTS AND STANDARDS | 6 |
| 8.0 | PROCEDURE | 13 |
| 9.0 | CALCULATIONS | 21 |
| 10.0 | QUALITY CONTROL | 22 |
| 11.0 | DATA REVIEW AND STORAGE | 23 |
| 12.0 | REFERENCES | 23 |
| | Attachment 1 Semivolatile Organic Extraction Worksheet | 24 |
| | Attachment 2 Pesticides/PCBs Extraction Worksheet | 25 |
| | Attachment 3 EPH Extraction Worksheet | 26 |
| | Attachment 4 Automated Soxhlet Extraction Qualification Card | 27 |
| | Attachment 5 Extraction Information Summary | 28 |
| | Attachment 6 Preparation of Surrogates, Matrix Spike and Internal Standards | 29 |
| | Attachment 7 Surrogate and Spike Checks | 30 |
| | Attachment 8 Dilution Chart | 31 |
| | Attachment 9 DRO/TPH-GCFID Extraction Worksheet | 32 |

## 1.0 SCOPE and APPLICATION

1.1 This Standard Operating Procedure describes the extraction of organic analytes from soil, sediment, sludges, and waste solids.

## 2.0 METHOD SUMMARY

2.1 20 grams of sample is weighed, dried, and recorded in the appropriate prep logbook. The surrogates and spikes for the type of test to be run are added with the corresponding solvents and placed on the automated soxhlet unit.

2.2 This procedure uses 20 grams of sample to a 2mL final volume for EPH, 10mL for PCB/Pest and DRO, and 1mL for BNAs. Nominal default reporting limits are predicated on these values and assume 100% solids. The solvent volume is increased from 70mL to 140mL to cover the sample per method requirements.

2.3 Sample aliquots are measured prior to the addition of the drying agent. Samples are not ground but mixed to a homogeneous consistency.

2.4 Extraction temperatures are based on the boiling point of the solvents used plus 80°C. Manufacturer and method recommends 100 to 120°C above the solvent boiling point. Precision and Accuracy studies performed by the laboratory have produced acceptable results using the lower temperature.

## 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

3.1 It is not necessary for samples to be chemically preserved. They should be collected in 8-ounce glass sealable container and shipped in a cooler with cold packs, temperature 4°C. upon arrival at the laboratory, the soil samples must be refrigerated at 4°C.

3.2 Sample extraction must occur within 14 days of sampling for all, counting time from the date of sampling to the date the extraction begins. Store extracts at 4°C, separate from standards and samples.

## 4.0 POTENTIAL PROBLEMS AND INTERFERENCES

4.1 Water leaks, low or empty air tank, incorrect solvent amounts added, incorrect surrogate or spike added, contaminated glass wool, dirty glassware, wrong program selection may all cause problems.

4.2 Interferences by phthalate esters or other plasticizers introduced in sampling, login, or preparation can pose a major problem.

4.2.1 Avoid plastic/vinyl gloves. Use gloves made from nitrile, Viton, or similar solvent resistant polymers without plasticizers.

4.2.2 Avoid allowing the samples, pipettes, solvent bottles, and solvent pump tubing, or other apparatus or materials to contact plastics (unless PTFE coated) or contaminated surfaces.

4.3 Clean glassware immediately after use by rinsing with the last solvent used, then setting glassware in hot soapy water until washing steps can occur.

4.4 Follow the glassware cleaning SOP. Note that soap residue left on glassware may result in high (basic) pH on glassware surfaces, whieh may cause degradation of analytes including Aldrin, Heptachlor, most organophosphorus pesticides, and acid fraction SVOCs.

4.5 When the volume of solvent is reduced below 1mL during extract concentration, semivolatile analytes may be lost. Document problem and cause in extractions log, then notify supervisor or analyst. Attempt re-extraction ASAP.

4.6 Any observations associated with samples such as precipitate formation, non-homogeneous samples, clay samples, loss of sample, double spiking, etc. MUST be noted in the extraction logbook. This information is vital to the evaluation of the data.

## 5.0 HEALTH AND SAFETY

5.1 AMRO places a high value on laboratory safety. The air quality of the laboratory has been monitored. Fire extinguishers are located in various areas of the lab. The laboratory evacuation plan is posted in every room, with a designated meeting place.

5.2 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean lab coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. A leak detector is used to check for any gas leaks.

5.3 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eye-wash stations and an emergency shower.

5.4 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

5.5 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

## 6.0 INSTRUMENTS AND EQUIPMENT

6.1 Soxtherm Automated Extraction System

| | | |
|---|---|---|
| 6.1.1 Control Box- | Unit A # 473338 | Unit B # 480015 |
| | Unit C # 480019 | Unit D # 480019 |
| 6.1.2 Soxtherm- | Unit A # 473343 | Unit B # 480005 |
| | Unit C # 480007 | Unit D # 480009 |

6.2 Balance, analytical

6.3 Syringes: 100µL, 500µL and 1000µL, and 5 mL.

6.4 Micropipette: Finnpipette Fixed volume pipettors: 500µL and 1000µL

6.5 Graduated Cylinder: 100mL

6.6 Spatula

6.7 Extraction cups: Glass, 180 mL

6.8 Clips for thimbles

6.9 Boiling chips- Solvent-extracted, approximately 10/40 mesh (silicon carbide, PTFE ,or equivalent).

6.10 Vials-2mL, 5mL, 10 mL glass with PTFE-lined screw-caps or crimp tops.

6.11 Turbovap II Concentrator

6.11.1 200ml Turbovap Tubes

6.11.2 10mL graduated cylinder

6.11.3 5ml Syringe

6.11.4 500µL Syringe

6.11.5 1.0ml Syringe

6.12 Glass wool Pyrex WV-34552-01 purchased from Cole-Palmer. Baked at 200° C for four hours.

## 7.0 REAGENTS AND STANDARDS

7.1 Compressed air

7.2 Methylene Chloride, pesticide grade – for rinsing, EPH extractions and BNA, PAH, DRO.

7.3 Acetone, pesticide grade – for BNA and PAH extractions with Methylene Chloride.

7.4 Hexane, Pesticide Grade – for solvent exchange of EPH1.1, PCB, Pest and extraction of PCB and Pesticides with Acetone.

7.5 DI water – AMRO reagent water – Deionized and activated carbon cleaned water from a Culligan System that is checked monthly for Residual Chlorine, Conductivity, Heterotrophic Plate count, pH, Arsenic, Barium, Cadmium, Chromium, Copper, Iron, Lead, Nickel, Selenium, Silver, Zinc and Mercury. Resistivity and pH are monitored daily. Instrument and Procedural Blanks are also used to monitor contaminant levels through out the laboratory.

7.6 Nitrogen – UHP Ultra High Purity – Maine Oxy.

7.7 Methanol, pesticide grade.

7.8 Diatomaceous Earth

7.9 Sodium sulfate: Baker, anhydrous, reagent grade, heated at 400°C for 4 hours, cooled, and stored in a glass bottle.

7.10 Stock standard solutions: Stock standards should be stored in Teflon sealed crimp or screw-cap vials at 4 degrees Celsius and should be protected from the light. Stock standards should also be checked frequently for signs of degradation.

7.10.1 TPH-GCFID Surrogate stock solution -O-terphenyl at 10,000µg/mL from Restek # 31097.

7.10.2 TPH-GCFID Matrix Spike stock solution - used for LCS and Spikes - fuel oil #2, pure, obtained from Rochette Oil Co. This is a different lot number from the Calibration Stock Standard.

7.10.3 BNA LCS Stock Solution Components

8270 Mega Mix - 500-1000µg/mL obtained from Restek #31850
8270 Benzidines - 2000µg/mL obtained from Restek #31852
Custom Acetophenone - 2000µg/mL obtained from Restek #558859
8270 Cal. Mix # 1 - 2000µg/mL obtained from Restek #31618
Benzoic Acid - 2000µg/mL obtained from Restek #31879

7.10.4 BN/A Surrogate in Tinted Methanol 100:150µg/Ml obtained from Environmental Express (#M0014)

7.10.5 BN Matrix Spike Mix - 5000µg/mL obtained from Restek (#31074)

7.10.6 Acid Matrix Spike Mix - 7500µg/mL obtained from Restek (#31075)

7.10.7 TCLP BN Matrix Spike – 2,000µg/mL obtained from Restek (#31028)

7.10.8 TCLP Acid Matrix Spike – 2,000µg/mL obtained from Restek (#31027)

7.10.9 EPH Surrogate – 4,000µg/mL obtained from Restek #31479

7.10.10 EPH Matrix Spike - 1,000µg/mL Aliphatic Hydrocarbon obtained from Restek #21459, 1,000µg/mL Aromatic Hydrocarbon obtained from Restek # 31458.

7.10.11 EPH Fractionation surrogate 4,000µg/mL obtained from Restek # 31480

7.10.12 Pesticide/PCB Surrogate – 200µg/mL obtained from Restek #32000

7.10.13 Pest Full List Matrix Spike: 2000µg/mL organochlorine Pest Mix A&B obtained from Restek #32415, 1000µg/mL Hexachlorobenzene obtained from Restek # 32231

7.10.14 PCB Spike - Aroclor 1016/1260 Mix - 1,000µg/mL obtained from Restek # 32039.

7.10.15 BNA or PAH Internal Standard – 2,000µg/mL obtained from Restek # 31206.

7.10.16 EPH Internal Standard : 5 -alpha-Androstane - 2,000µg/mL obtained from Restek # 31065

7.11 Working standards:

7.11.1 Working TPH-GCFID (OTP) surrogate standard - 1000µL of surrogate standard is brought to a 10mL final volume in acetone. Final concentration is 1,000 ng/µL.

7.11.2 TPH-GCFID Matrix Spike working standard - 1gram of neat fuel oil brought to 100 mL final volume with acetone. Final concentration is 10,000 ng/µL.

7.11.3 BNA Full list Matrix Spike:
8270 Mega Mix - 1,000µl
8270 Benzidines - 500µl
Custom Acetophenone - 500µl
8270 Cal. Mix # 1 - 250µl
Benzoic Acid - 250µl
10mL final volume in Methanol.

Final concentrations are as follows:
8270 Mega Mix - 50-100µg/ml
8270 Benzidines - 100µg/ml
Custom Acetophenone - 100µg/ml
8270 Cal. Mix # 1 - 50µg/ml
Benzoic Acid - 50µg/ml

7.11.4 BN and Acid Surrogate – Prepared by Environmental Express; 30mL 100:150 BN:A Surrogate in Tinted Methanol. See 7.10.4

7.11.5 BN Matrix Spike Mix - 500µL of Stock to 25mL with Methanol for a final concentration of 100ng/µL.

7.11.6 Acid Matrix Spike Mix - 500µL of Stock to 25mL with Methanol for a final concentration of 15ng/µL.

7.11.7 TCLP BNA Matrix Spike – 500µL of the stock TCLP BN and Acid Matrix Spike solutions to 10mL with methanol for a final concentration of 100µg/mL for each analyte.

7.11.8 EPH Surrogate – 1mL of stock to 100mL with Acetone for a final concentration of 40ng/µL.

7.11.9 EPH Matrix Spike – 1,250µL of EPH Aliphatic Hydrocarbon and 1,250µL of EPH Aromatic Hydrocarbon to 25mL with Acetone for a final concentration of 50ng/µL.

7.11.10 Pesticide/PCB Surrogate – 400µL of stock to a final volume of 250mL with Acetone for a final concentration of 0.32ng/µL.

7.11.11 Pesticide Full List Spike – 10µL of Organochlorine mix and 20µL of Hexahlorobenzene to 50mL final volume with Acetone for a final concentration 0.4ng/µL.

7.11.12 PCB Matrix Spike – 1mL of Aroclor 1660 mix (1016/1260) stock to 100 mL final volume with Acetone for a final concentration of 10ng/µL.

7.11.13 BNA or PAH Internal Standard – 2000ug/mL obtained from Restek #31206

7.11.14 PAH-SIM Internal Standard Solution – 100uL of the BNA/PAH IS Stock to 1mL final volume with methylene chloride for a final concentration of 200ug/mL for each analyte.

7.11.15 EPH Internal Standard – 2000ug/mL of 5-alpha-androstane in methylene chloride obtained from Restek #31065

7.11.16 EPH Fractionation Surrogate Spike Solution – 4000ug/mL obtained from Restek #31480

**See Table below for surrogate and spike mix concentrations and volumes.**

**Table of Surrogate and Matrix Spikes for Soils**

| Method #'s | Based in | Solution | Concentration | Amount |
|---|---|---|---|---|
| 8270 | Methanol | BNA Tinted Surrogate | 100 and 150ng/µL | 500µL in all samples |
| | Methanol | BNA Full List | 100 and 150 ng/µL | 500µL in LCS, MS, MSD |
| 8270-PAH SIM | Methanol | BNA surrogate | 100 and 150ng/µL | 50µL in all samples |
| | Methanol | BNA Full List | 100 and 150ng/µL | 50µL in LCS, MS, MSD |
| 8270 PAH | Methanol | BNA Tinted surrogate | 100 and 150ng/µL | 500µL in all samples |

| | | | | |
|---|---|---|---|---|
| | Methanol | BNA Full List | 100 and 150ng/µL | 500µL in LCS, MS, MSD |
| EPH | Acetone | EPH surrogate | 40ng/µL | 1.0mL in all samples |
| EPH | Acetone | EPH Matrix Spike | 50ng/µL | 1.0mL in LCS, MS |
| Pesticide | Acetone | PCB/Pest surrogate | 0.32µg/mL | 500µL in all samples |
| Pesticide | Acetone | Pest Full List | 0.4ug/mL | 500µL LCS, MS, MSD |
| PCB | Acetone | PCB/Pest surrogate | 0.32µg/L | 500µL in all samples |
| PCB | Acetone | PCB spike | 10µg/mL | 1.0mL in LCS, MS, MSD |
| DRO/TPH-GCFID | Acetone | OTP | 1,000µg/mL | 100µL in all samples |
| DRO/TPH-GCFID | Acetone | #2 Fuel Oil | 10,000µg/mL | 400µL in LCS, MS |

Note: Surrogate and spike amounts are based on the assumption of nominal final volume for the extract. If it is known a different final volume will be required see the section supervisor for instructions before proceeding.

7.12 Tracking of Reagents and Standards

It is important to be able to track all analytical reagents and standards back to their sources. The following procedures are used by AMRO personnel to accomplish this:

7.12.1 Standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a five digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and the disposal dates are completed by AMRO employees when standards are used up or disposed. Refer to the Certificate of Analysis Logbook for standard concentration information.

7.12.2 Tracking of Reagents and Standards

It is important to be able to track all analytical reagents and standards back to their sources. The following procedures are used by AMRO personnel to accomplish this:

7.12.2.1 Standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample

receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, which consists of the letter "A" and a five digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and the disposal dates are completed by AMRO employees when standards are used up or disposed. Refer to the Certificate of Analysis Logbook for standard concentration information. The Certificates are kept on file in the QA/QC department. They are in numerical order and grouped as Organic Standards, Inorganic Standards and Solvents.

7.12.2.2 Standards Preparation: -

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

- AMRO purchases pesticide residue grade solvents and purge and trap grade Methanol for organic standard preparation and organic sample extractions.
- Any stock standards that are purchased are accompanied by a certificate of analysis from the manufacturer.
- Class A volumetric glassware is used to prepare standards.

7.12.2.3 Organic Standards - The Organic Standards Tracking Log System consists of three books, an Index Logbook, a Stock Standards Logbook and a Working Standards Logbook. Stock Standards are defined as any solution that requires a dilution or addition to multiple solutions and are used to make Working Standards. Working Standards are defined as anything that is added directly to a sample or analyzed directly on an instrument.

- The ID index assures that no two standards are assigned the same ID number. The Index requires the Standard ID, the section of the Standard Log (Stock or Working) the Standard information is located, and a brief description of the standard.

- Stock Standards Logbook - Whenever a stock standard solution is opened or prepared, this information is recorded in the Stock Standard Logbook .

  - Date prepared and Prepared by are the first two items to be completed.

- The next is the compound name, which should be the name of the solution being used. Do not use vendor catalog numbers alone.
- The Receipt/Stock ID is the ID of the solution being used. This can be the "A" number or a Stock ID number.
- The Source of the solution is the manufacturer.
- The concentration or purity of the solution is the next item.
- The amount in grams (g) or microliters (µL) of the solution used and the final volume of the solution made is documented.
- The Solvent ID is documented for traceability.
- The final concentration of the new solution and the units is recorded.

- The stock solution is assigned a new ID number consisting of the letter "S" for semivolatile, the date of preparation plus a letter suffix starting with the letter "A". This ID along with the compound name, concentration and initials of the person making the stock are included on the label. Example - The fourth semivolatile standard prepared on April 15, 1989 would have the standard ID S041589D. This number will be recorded in the logbook and written on the container along with expiration date and analyst initials.
- The storage location is recorded in the logbook.
- The expiration date is the last item recorded. Stock standards are good one year from the date opened or the date provided by manufacturer, whichever is shorter. The analyst must verify that 1 year from the date opened is within the manufacturers expiration date window. If it is not, then the manufacturer's expiration date must be used for the AMRO expiration date.

- Working Standards Logbook: Whenever a working standard solution opened or is prepared, whether from AMRO stocks or commercially obtained stocks, the information is recorded in the Working Standard Log.
  - Date opened/prepared and Opened/Prepared by are the first two items to be completed.
  - The next is the compound name, which should be the name of the solution being used. Do not use vendor catalog numbers alone.
  - The Receipt/Stock ID is the ID of the solution being used. This can be the "A" number or a Stock ID number. If a stock ID number was previously assigned, use the stock ID number rather than the "A" number for traceability.
  - The Source of the solution is the manufacturer.
  - The concentration or purity of the solution is the next item.

- The amount in microliters (µL) of the solution used and the final volume of the solution made is documented.
- The final concentration of the new solution and the units is recorded.
- The solvent ID is recorded for traceability.
- The stock solution is assigned a new ID number consisting of the letter "S" for semivolatile, the date of preparation plus a letter suffix starting with the letter "A". This ID along with the compound name, concentration and initials of the person making the stock are included on the label. Example - The fourth semivolatile standard prepared on April 15, 1989 would have the standard ID S041589D. This number will be recorded in the logbook and written on the container along with expiration date and analyst initials.
- The storage location is recorded in the logbook.
- The expiration date is the last item recorded. Working standards are good one year from the date opened or the oldest date prepared of any compound stock standard or the date provided by manufacturer, whichever is shorter. The analyst must verify that 1 year from the date opened is within the manufacturers expiration date window. If it is not than the manufacturer date must be used for the expiration date.

7.12.3 Standard Storage:

Standards and reagents are stored per method specifications and manufacturer's instructions. Semivolatile, DRO, Pesticide, PCB, Petroleum standards are stored in refrigerators at 4±2°C, in freezers at minus 10°C, and/or ambient temperature depending upon the method and manufacturer requirements.

7.12.4 Solvent Check Analysis:

All extraction procedures are performed using pesticide residue grade solvents and a method or procedural blank analysis is performed when a new lot number is received to verify the absence of target analytes.

## 8.0 PROCEDURE

8.1 All glassware is air-dried, oven dried, or dried with Acetone, then rinsed twice with Methylene Chloride. (See Glassware Washing SOP GL-1009.)

8.2 Boiling Stones are added to soxhlet beakers and glass wool is placed in each thimble to block the holes in thimble.

8.3 Weigh 20.00g of homogenized sample (remove foreign matter e.g. twigs and

leaves before weighing) into cleaned and rinsed beaker which has been labeled with the sample # and record exact mass in corresponding logbook. Refer to Homogenization SOP for proper procedures for sample homogenization. Take care when homogenizing samples. If mixed too much or too vigorously, target analytes may be lost. If samples cannot be homogenized it must be noted in the extraction log. Take a representative aliquot of the sample. This procedure uses approximately 20 grams of sample to a 2mL final volume for EPH, 10mL for PCB/Pest, DRO and 1mL for BNAs.

8.3.1 One sample per 20 should be chosen for a Matrix Spike (MS) and Matrix Spike Duplicate (MSD), for non-MCP requirements.

8.3.2 Approximately 20g are weighed out into each of 3 beakers and labeled sample number, sample number MS, and sample number MSD.

8.3.3 Method Blank and Laboratory Control Sample (LCS) are also weighed (20g each) and recorded in logbook.

8.3.4 If lack of sample volume or amount limits the ability to extract a matrix spike, or matrix spike duplicate, perform an LCSD instead. Notify the section head or appropriate analyst for further instructions. Samples that have MCP requirements do not need an MS/MSD, rather an LCS and LCSD, unless otherwise specified by client.

8.4 Drying agent (Anhydrous Sodium Sulfate or Diatomaceous Earth for Pest/PCB only) is mixed with samples until free flowing powder consistency is obtained. Avoid excessive and/or vigorous mixing as target analytes may be lost. Sample aliquots are measured prior to the addition of the drying agent. Samples are not ground but mixed to a homogeneous consistency.

8.4.1 For Pesticides/PCB's **ONLY**, diatomaceous earth may be used as the drying agent (Reference Method 3545).

8.5 Samples are transferred to extraction thimbles using metal spatulas. Spatulas are rinsed with Methylene Chloride between samples.

8.6 Surrogates and spikes are added. (See Surrogates/Spikes Table, Section 7.14).

8.7 Add respective solvents to extraction beakers which have been labeled with the sample #: The solvent volume is increased from the 70mL indicated in the method to 140mL due to the increased sample used for this procedure. The method requires the samples to be covered with solvent.

Extraction Solvents/ Volume:

8.7.1 PCB/Pesticides-70mL Hexane and 70mL Acetone
8.7.2 BNA- 70mL Methylene Chloride ($CH_2Cl_2$) and 70mL Acetone

8.7.3 EPH/ DRO - 140mL Methylene Chloride($CH_2Cl_2$)

8.8 Beakers with thimbles containing sample, surrogate, spike (where applicable), and solvent are placed on instrument and program is selected and started. (See Programs, Section 8.9)

8.9 Programs:

8.9.1 Programs used depend on solvent/test being performed. Maximum temperature switch is set on 200°C, shutdown will occur if it is exceeded. Extraction temperatures are based on the boiling point of the solvents used plus 80°C. Manufacturer and method recommends 100 to 120°C above the solvent boiling point. Precision and Accuracy studies performed by the laboratory have produced acceptable results using the lower temperature.

8.9.2 PCB/Pesticides and BNA
Extraction temperature 140 degrees Celsius
Boiling time 1 hour
Solvent reduction A- 5×15mL
Extraction time - 1 hour
Solvent reduction B - 2 ×15mL
Cooling 30 minutes

8.9.3 EPH and DRO
Extraction temperature 110 degrees Celsius
Boiling time 1 hour
Solvent reduction A - 5×15mL
Extraction time- 1 hour
Solvent reduction B - 2×15mL
Cooling - 30 minutes

8.9.4 If final reduction of extracts is <20mL, notify department manager or supervisor to adjust program to ensure samples do not go dry (<1mL) during soxhlet extraction.

8.10 Collection of Extract

8.10.1 When all but 20-50mL of solvent have been concentrated, open the system and remove the cups.

8.10.2 Transfer the contents of the cups to 200mL turbovap tubes, which have been labeled with the sample ID #. Rinse the cups using the proper solvent (see 8.12.1) and add the rinsates to the glass tubes. Concentrate the extracts to 1mL - 10mL (see 8.12). Transfer a portion to a GC vial and store at 4° C until analyses are performed.

8.11 Shut down

8.11.1 Turn off instrument and water.

8.11.2 Ensure all condensers are free of solvent.

8.12 Concentration - Extract is ready to be concentrated using Turbovap Concentration Technique.

8.12.1 Samples are removed from Soxhlet apparatus and rinsed (<5mL) through thimble and on exterior of thimble with respective solvent:

| Analysis | Solvent |
|---|---|
| EPH, DRO<br>BN ONLY , PAH ONLY and<br>Full BNA 8270 HSL, | Methylene Chloride |
| Pesticide/PCB<br>PCB only | Hexane |

8.12.2 After solvent is no longer dripping through soil, thimble may be removed and soil sample may be discarded in solid waste container for waste contaminated with Methylene Chloride/Hexane.

8.12.3 Turbovap concentrator tubes must be cleaned thoroughly with soap and water, rinsed with tap water and then further rinsed with deionized water. Tubes must be oven dried before use. After tubes are certain to be clean and dried, all tubes for any test are rinsed with Methylene Chloride and solvent discarded into waste solvent container.

8.12.4 Each tube must be clearly marked with sample number, test and extraction date before transfer of sample from Soxhlet beaker/Erlenmeyer flask to Turbovap tube. **Double check the match of all labels each time before transferring the sample or solvent to prevent mix-ups.**

8.12.5 Sodium Sulfate (NaSo4) may be used to remove water from sample extracts, to prevent water from being transferred into tube. Funnels are prepared for transfer of sample into tube. Funnels must be cleaned and dried as described above. A piece of silane treated glass wool should be placed in stem of funnel to allow flow of liquid but not allow Sodium Sulfate to get through wool and into tube. Sodium Sulfate ($Na_2So_4$) is used to remove water from sample extracts, to prevent water

from being transferred into tube. Once Sodium Sulfate is placed in funnel (approximately 1 inch deep), Sodium Sulfate is rinsed (~10mL) with methylene chloride for all tests. For Pesticides/PCB or PCB only test, funnel is further rinsed with hexane (~10mL).

8.12.6 Sample may be poured through sodium sulfate prepared funnel into tube. After contents of beaker are poured, beaker is rinsed 2 times (<5mL each) with respective solvent as described in step 1, and then poured into tube. If, as in the case of water extraction, entire volume of flask does not fit into tube, fill tube to "fill line" and keep funnel with respective flasks until the volume of sample is concentrated enough to fit rest of sample into tube.

8.12.7 Place tubes with extracts into warmed Turbovap bath (water should be ~ 41°C). Be certain nitrogen gas pressure is at 0psi before placing tubes in bath. The higher the volume of liquid in tube, the lower the gas pressure should be. A full tube should be ~5 to 7psi. Pressure of gas can be increased as volume in tube decreases, however pressure should never exceed 18psi. Pay close attention to be sure that gas pressure isn't so high that sample is splashing out of the tube against the glass top, and that the solvent liquid is in a controlled spinning motion (vortex).

8.12.8 Once liquid reaches the desired volume in tube, the Turbovap tube is removed from bath carefully, so as to not get water in other samples. The internal wall of the tube must be rinsed several times with appropriate solvent during the operation. During evaporation, the tube must be positioned to avoid water condensation (i.e. the solvent level should be below the level the water bath). The extract must not be allowed to become dry or concentrate significantly below 0.8mL to avoid analyte loss.

8.13 **SOLVENT EXCHANGE:** The extract must not be allowed to become dry or concentrate significantly below 0.8mL to avoid analyte loss. Appropriate solvents as described below:

8.13.1 BNA: Is exchanged twice with DCM, to remove the acetone, which can degrade some of the analytes with time, by aldol condensation. The level to initiate the exchange is between one and three ml. The volume to add is 20-30 ml. Final volume is 1ml.

8.13.2 PCB/PESTICIDE: Is exchanged twice with hexane to remove the acetone, which reacts exothermically or explosively with the H2SO4 cleanup. The level to initiate the exchange is between two and five ml. The volume to add is 20-30 ml. Final volume is 10ml.

8.13.3 EPH1.1: Is exchanged three times with hexane to remove all traces of polar solvent (DCM), which will cause breakthrough at the fractionation step and invalidate the test. The level to initiate the exchange is between one and four ml. The volume to add each time is 20-30 ml. Final volume is 2 ml.

8.13.4 DRO: Do not need solvent exchange. They can be directly concentrated to final volume (10 mL).

8.13.5 Solvents used for rinsing extract and bringing to final volume:

| |
|---|
| BNA: DCM. |
| EPH: Hexane |
| Pest/PCB: Hexane |
| DRO : DCM |

After rinsing step is complete, extracts can be concentrated to final volumes. If the extract evaporation rate slows down significantly during concentration and the extract becomes viscous, **DO NOT CONTINUE TO CONCENTRATE THE SAMPLE.** Ask the supervisor to examine the extract and dilute it to a higher volume if appropriate.

CAUTION: When the volume of solvent is reduced below 1mL, semivolatile analytes may be lost.

CAUTION: If sample will not concentrate to its optimal final volume to nearest whole number with addition of clean solvent with respect to test type, a note must be recorded into logbook about said sample and analyst must be notified. See 8.14 for final volumes.

8.14 All 1.0 mL final volumes are to be measured using a class A "TC" volumetric flask and are placed in a 2.0 mL screw top vial. If final volume of extract is less than desired final volume, volume may be achieved through use of clean solvent as described below.

8.15 All 2.0mL and 10.0 mL final volumes are measured by comparison to the proper reference vial, matching up the meniscus.

**NOTE:** Reference vials are made each time a new lot of vials are received. Using a syringe, 2 mL of Hexane are transferred into a 5 mL screw top

vial and the meniscus is marked with a permanent marker. For 10 mL vials, a syringe is used to transfer 10 mL of solvent to a 12 mL vial. A DCM and Hexane 10 mL reference vial are made [DRO (DCM) and Pest/PCB (Hexane)]. A record is kept of the new vial lot numbers and the date of preparation.

8.16 Final volume caution: Because acetone absorbs water, and DCM and Hexane do not, some times water will appear in the final volumes of BNA, or P/P samples. BNA may be dried through a small pasteur pipette containing a small quantity of Na2SO4 directly into the volumetric flask. In the case of PCB (or pest) samples, either carefully draw the water from the bottom with a pipette, or draw the hexane from the top, or both. Water will react exothermically with H2SO4, and alter the true volume.

8.16.1 BN only (8270 PAH), BNA (8270 HSL): Final volume (see 8.14)- store 1.0mL in screw cap vial. If volume is not less than 0.75mL, clean Methylene Chloride can be used to bring final volume to 1.0mL. If volume is <0.75mL, volume may be brought up to 1.0mL with clean Methylene Chloride and a note must be written in logbook about the lowest volume reached during concentration.

8.16.2 EPH1.1: Final volume(see 8.15)- 2.0ml in 5.0mL screw cap vial. If final volume is <2.0mL, clean hexane may be used to bring final volume to2.0mL.

8.16.3 Pesticide/PCB &PCB soil: Final volume(see 8.15)- store 10.0mL in 19X65 (12mL) vial. Clean hexane can be added to bring final volume to 10.0mL. A note must be recorded in logbook if volume before hexane addition <3.0mL.

8.16.4 DRO: Final volume (see 8.15)- 10mL in 19X65 (12mL) vial. Clean DCM can be used to bring to final volume.

8.17 The final volumes vary from the method requirements of 1-2mL final volumes. This procedure uses 20g of sample to a 2mL final volume for EPH, 10mL for PCB/Pest, DRO and 1mL for BNAs. This is done in order to achieve nominal reporting limits for the given parameters.

8.18 All final volumes must be recorded in respective logbooks along with initials and date. Once entire batch for day is complete, a photocopy of the page is given to analyst and samples are signed over to analyst. If analyst is not present, samples are placed in refrigerator and copy of batch placed on analyst desk.

8.19 Acid wash the PCB portion of the extract using 2mL of concentrated Sulfuric Acid. If the sample is lightly colored use 2mL of acid, if the sample is darkly

colored use 2 mL of acid and then repeat the cleanup if the hexane layer is colored or turbid until the acid layer is waxy white.

8.20 Preparation of Samples for Analysis

8.20.1 PAH/BNA Samples:

8.20.1.1 Using a clean 500µL syringe rinsed with Methylene Chloride take 300µL of the extract and place into a prelabeled crimp top vial. Double check the label match before transfer.

8.20.1.2 Add 6µL of BNA Internal Standard Solution (I.S.) to the extract and crimp vial with cap. Make sure to check the level of BNA I.S. to be sure the solution has not evaporated. Minimize the amount of time when the I.S. vial is open to reduce evaporation.

8.20.1.3 Mark the level of the I.S. when all extracts are prepared.

8.20.1.4 Make sure all crimp vials caps will not twist and are legibly and properly labeled.

8.20.2 EPH Samples:

8.20.2.1 Add 10µL of fractionation surrogate per 2.0mL final volume of EPH sample and thoroughly mix the sample. The fractionation surrogate is much less dense than the extract and will not mix well unless shaken.

8.20.2.2 Fractionate the sample ( see SOP OL-2026)

8.20.2.3 Using a clean 500µL syringe rinsed with Methylene Chloride take 300µL of the extract and place into a crimp top vial.

8.20.2.4 Add 3µL of EPH Internal Standard Solution (I.S.) to the extract and crimp vial with cap. Make sure to check the level of EPH I.S. to be sure the solution has not evaporated. Minimize the amount of time when the I.S. vial is open to reduce evaporation.

8.20.2.5 Mark the meniscus levels of the I.S. and fractionation surrogate when all extracts are prepared.

8.20.2.6 Make sure all crimp vials are properly labeled.

8.20.3 PCB Samples:

8.20.3.1 After acid washing (see SOP OL-2019) and copper cleanup (see SOP OL-2020), use Pasteur pipettes to place approximately 1mL of each extract from the top solvent layer into properly labeled crimp top vials. If the top layer appears cloudy allow it to settle longer or centrifuge the supernatant.

CAUTION: Transferring any sulfuric acid into the autosampler vial will destroy the GC column and damage the detector if the sample is injected. Be very careful that ONLY the clear hexane layer is transferred to the crimp top vial.

8.20.3.2 Crimp the tops of the vials and mark the meniscus level on each vial.

8.20.4 Pesticide Samples:

8.20.4.1 After Florisil cleanup ( see SOP OL-2018) and copper cleanup (see SOP OL-2020) use Pasteur pipettes to place approximately 1mL of each extract from the top of the extract into properly labeled crimp top vials.

8.20.4.2 Crimp the tops of the vials and mark the meniscus level on each vial.

8.20.5 DRO samples:

8.20.5.1 Use Pasteur pipettes to transfer approx. 1mL of extract into properly labeled crimp top vials.

8.20.5.2 Crimp the tops of the vials and mark meniscus level.

## 9.0 CALCULATIONS

Not Applicable

## 10.0 QUALITY CONTROL

10.1 The Method Blank (MB), Laboratory Control Sample (LCS), Matrix Spike (MS) and Matrix Spike Duplicate (MSD) must be rotated at various location between the soxtherm units.

10.2 One Method Blank (MB) must be extracted with each batch of samples. The method blank is used to determine if the extraction procedure was successful and if there is any contamination associated with the extraction.

10.3 The surrogate is used to determine the efficiency of the extraction and must be added to each sample, blank, LCS, MS/MSD, and sample duplicate prior to extraction.

10.4 The MS/MSD is used to determine the effects of the matrix on the analytes of interest in the analysis. They are extracted with every twenty samples.

10.5 In some cases, the client may specify which sample is to used for MS/MSD; if not, the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall **NOT** be performed on Rinsate Blank or Field Blank. Watch for client sample IDs containing codes like FB, EB, RB, etc. that might indicate a field blank sample.
B. Adequate sample weight.
C. Client requested QC deliverables.

10.6 If there is not adequate sample to have a Matrix Spike, then a Laboratory Control Sample (LCS) and Laboratory Control Sample Duplicate (LCSD) are extracted and analyst/department manger is notified.

10.7 The LCS is used to evaluate the laboratory performance in a clean matrix. The LCS confirms the extraction/analysis was properly performed when matrix effects cause the MS/MSD recoveries to be unacceptable. The acceptable LCS proves the extraction did not affect the recovery of the analytes, therefore it is extremely important to be careful when extracting, concentrating, and transferring the LCS.

*Failure of the LCS may necessitate re-extraction of the entire batch.*

10.8 In case of concentration <1mL, analytes may be lost. Contact the supervisor or initiate re-extraction before holding time has expired. In any case, documentation of the lowest extract volume in the prep logbook is required.

10.9 Be sure to enter all pertinent data in the extraction logbook. Carefully document any problems or unusual conditions in the comment section. This information is necessary for a non-conformance summary if QC sample or surrogate recovery problems occur.

## 11.0 DATA REVIEW AND STORAGE

11.1 All related preparation information and observations will be noted in the appropriate extraction worksheet.

11.2 All cross-outs must be a single line and should be initialed and dated.

## 12.0 REFERENCES

12.1 USEPA SW846-Update III, Rev 0, Dec. 1994, Automated Soxhlet Extraction Method 3541

12.2 USEPA SW846-Update III, Rev.2, Dec. 1996, Organic Extraction and Sample Preparation Method 3500B

# Attachment 1

AMRO Environmental Laboratories Corporation

## SEMIVOLATILE ORGANIC EXTRACTION WORKSHEET

111 Merrick Street
Merrimack, NH 03054
(603) 424-2022

Concentration Method: Turbovap; K-D (Circle One)

/Rev. No.: OL-2003: 5 Matrix: Water No./Rev. No.: OL-2004: 5 Matrix: Soil/Sludge Other Matrix:

CTION DATE
(S)(S)
DS Released by
ed By
CTION SOLVENT / LOT #
WED BY

SURR. AMT.:
MS AMT.:
SURROGATE/
SPIKE WITNESS
INTERNAL STANDARD ID
LIMS BATCH ID:

(SW-846 Method 3270C: Initial extraction pH <2 and Secondary extraction pH>11; EPA 625: Initial extraction pH <11 and Secondary extraction pH <2)

| Sample Number | Sample Amount Used (mL or g) | Sample pH | Initial Extraction pH | Secondary Extraction pH* | Conc. Date & Analyst | Final Volume (mL) | Int. Std. Added By/Date | Comments (Ext Appearance and Color) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

# Attachment 2

MO Environmental
boratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

## PESTICIDES/PCBs EXTRACTION WORKSHEET

Concentration Method: Turbovap, K-D (Circle One)

No./Rev. No.:OL-2003;5 Matrix: Water SOP No./Rev. No.: OL-2004;5 Matrix: Soil/Sludge Other Matrix:

EXTRACTION DATE
LYST(S)
TODY Released by
ved By
RACTION SOLVENT(s) / LOT #s
HANGE SOLVENT / LOT #

SURR. AMT.
MS AMT.
SURROGATE/
SPIKE WITNESS
LIMS BATCH ID
*REVIEWED BY:*

| Lab Sample Number | Sample Amount Used (mL or g) | Sample pH * | Adjusted pH * | Solvent Added (mL) | Conc. Date & Analyst | Final Volume (mL) | Cu Clean up: Date/Init | H2SO4Clean up: Date/Init | Comments ( Ext Appearance and Color) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

# Attachment 3

AMRO Environmental Laboratories Corporation

## EXTRACTABLE PETROLEUM HYDROCARBONS (EPH) EXTRACTION WORKSHEET

111 Hermit Street
Merrimack, NH 03054
(603) 424-2022

Concentration Method: Turbovap; K-D

SOP No./Rev. No.: OL-2003 Matrix: Water SOP No./Rev. No.: OL-2004 Matrix: Soil/Sludge Other Matrix:

EXTRACTION DATE
ANALYST(s)
CUSTODY/Released by
Received By
EXTRACTION SOLVENT / LOT #:
LIMS BATCH ID:

SURR. AMT.:
MS AMT.:
SURROGATE/
SPIKE WITNESS:
INTERNAL STANDARD ID:
FRACTIONATION STANDARD ID:

| Lab Sample Number | Sample Amount Used (mL or g) | Sample pH | Extraction pH <2 | Conc. Date & Analyst | Final Volume (mL) | Fractionation Added By/Date | Int. Std. Added By/ Date | Comments (Ext. Appearance and color) |
|---|---|---|---|---|---|---|---|---|
| MB: | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
|

Attachment 4

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

## QUALIFICATION CARD FOR AUTOMATED SOXHLET EXTRACTION

Trainee: _____ Signature: _____

Trainer: _____ Signature: _____

I. Knowledge Factors:

SOP Title: _____ Revision Number/Date: _____

| | | | |
|---|---|---|---|
| 1. Did the Trainee read and understand the above SOP? | Yes ☐ | No ☐ | NA ☐ |
| 2. Was the Trainee instructed on how to properly fill out the documentation? | Yes ☐ | No ☐ | NA ☐ |
| 3. Has the Trainee been instructed on the proper procedures for addressing potential problems? | Yes ☐ | No ☐ | NA ☐ |

II. Practical Factors:

| | | | |
|---|---|---|---|
| 1. Has the Trainee completed a Precision and Accuracy Study? | Yes ☐ | No ☐ | NA ☐ |
| 2. Has the Trainee completed an acceptable Performance Evaluation sample? | Yes ☐ | No ☐ | NA ☐ |
| 3. Did the Trainee completed an acceptable Laboratory Control Sample (LCS)? | Yes ☐ | No ☐ | NA ☐ |
| 4. Has the Trainee performed manual integration as indicated in the SOP? | Yes ☐ | No ☐ | NA ☐ |

Completion Date: _____ Trainer's Signature: _____

I _____ have read, understood and follow the above method/SOP, which is in use at AMRO Laboratories for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

Section Manager/ Supervisor: _____ Date: _____

QA Manager: _____ Date: _____

qc/qcmemos/forms/qualcardAutosoxhletex Rev. 0 11/00

Property of AMRO Environmental Laboratories Corporation

# Attachment 5

## EXTRACTION INFORMATION SUMMARY

| Analysis | QC | Matrix | Drying Agent | Type of Surr. | Surr. Amt. | Type of Spike | Spike Amt | Acid / Base First | Extraction Solvent | Solvent Amt(mL) | Final Vol |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 8270 PAH SIM | MB, LCS | A | N / A | BNA Tinted | 50µL | BNA Full List Spike | 50µL | N / A | CH2CL2 | 3 x 60mL | 1mL |
| | MS, MSD | S | Sodium Sulfate | Surrogate | | | | N / A | CH2CL2/Acetone | 70 / 70 | |
| 8270 PAH ONLY | MB, LCS | A | N / A | BNA Tinted | 500µL | BNA Full List Spike | 500µL | N / A | CH2CL2 | 3x60mL | 1mL |
| | MS, MSD | S | Sodium Sulfate | Surrogate | | | | N / A | CH2CL2/Acetone | 70 / 70 | |
| 8270 | MB, LCS | A | N / A | BNA Tinted | 500µL | BNA Full List Spike | 500µL | 1 H2SO4 2 NaOH | CH2CL2 | 6x60mL | 1mL |
| | MS, MSD | S | Sodium Sulfate | Surrogate | | | | N / A | CH2CL2/Acetone | 70 / 70 | |
| 625 | MB, LCS | A | N / A | BNA Tinted | 500µL | BNA Full List Spike | 500µL | 1 NaOH 2 H2SO4 | CH2CL2 | 6x60mL | 1mL |
| | MS, MSD | S | Sodium Sulfate | Surrogate | | | | N / A | CH2CL2/Acetone | N/A | |
| BNA TCLP | MB LCS, MS,MSD | S | N / A | BNA TintedSurrogate | 500µL | BNA TCLP Spike | 500µL | 1 H2SO4 2 NaOH | CH2CL2 | 6X60mL | 1mL |
| EPH Rev. 1.1 | MB,LCS,LCSD, | A | N/A | EPH | 1000µL | EPH Matrix Spike = | 1000µL | HCL to controls | CH2CL2 | 3x60mL | 2mL |
| | LCSD | S | Sodium Sulfate | Surrogate | | LCS+LCSD | | N/A | CH2CL2 | 140mL | 2mL |
| PCB ONLY | MB, LCS | A | N / A | PEST/PCB | 200µL | PCB Matrix Spike= | 400µL | N / A | CH2CL2 | 3x60mL | 4mL |
| | MS, MSD | S | Sodium Sulfate | Surrogate | 500µL | LCS + MS + MSD | 1000µL | N / A | Hexane/Acetone | 70 / 70 | 10mL |
| Pest ONLY | MB, LCS | A | N / A | PEST/PCB | 200µL | Full List Spike | 200µL | N / A | CH2CL2 | 3x60mL | 4mL |
| | MS, MSD | S | Sodium Sulfate | Surrogate | 500µL | LCS + MS + MSD | 500µL | N / A | Hexane/Acetone | 70 / 70 | 10mL |
| PEST/ PCB | P/P MB,PCB LCS, Pest LCS, PCB MS&MSD, Pest MS&MSD | A | N / A | PEST / PCB Surrogate | 200µL | Pest Full List Spike= Pest LCS,MS,MSD PCB spike=PCB LCS, MS,MSD | 200µL Pest 400µLPCB 500µL Pest 1000µL PCB | N / A | CH2CL2 | 3x60mL | 4mL |
| | | S | Sodium Sulfate | | 500µL | | | N / A | Hexane/Acetone | 70 / 70 | 10mL |
| PEST TCLP | MB, LCS, MS, MSD | S | N / A | Pest/PCB Surrogate | 200µL | PEST TCLP Matrix Spike | 200µL | N / A | CH2CL2 | 3x60mL | 4mL |
| PCB OIL | MB,MS & MSD | OIL | N / A | P/P Surr. | 500µL | PCB Spike | 1000µL | N / A | Hexane | 9.5/8.5mL | 10mL |
| PCB Wipes | MB,LCS, MS,MSD | Wipe | N / A | P/P Surr. | 1000µL | PCB Spike | 2000µL | N / A | Hexane | 19/17mL | 20mL |
| Fuog | MB,LCS, | A | N / A | O-terphenyl | 100µL | #2 Fuel Oil Matrix | 200µL | N / A | CH2CL2 | 3x60mL | 1mL |
| | MS,MSD | S | Sodium Sulfate | Surrogate 1000mg/µL | 100µL | Spike 10000 ng/µL | 400µL | N / A | CH2CL2 | 20mL | 20mL |
| DRO | MB LCS, | A | N / A | O-terphenyl | 100µL | #2 Fuel Oil Matrix | 200µL | N / A | CH2CL2 | 3x60mL | 1mL |
| | MS,MSD | S | Sodium Sulfate | Surrogate 1000mg/µL | 100µL | Spike 10000 ng/µL | 400µL | N / A | CH2CL2 | 140mL | 10mL |
| MEDRO | MB,LCS LCSD, | A | N / A | O-terphenyl | 1000µL | LCS=DRO MS 50 | 1000µL/ | N / A | CH2CL2 | 3x60mL | 1mL |
| | LCS II | S | Sodium Sulfate | Surrogate 20mg/µL | 1000µL | LCS II=#2 Fuel Oil MS | 100µL | N / A | CH2CL2 | 140mL | 1mL |
| ETPH | MB,LCS, | A | N / A | O-terphenyl | 100µL | #2 Fuel Oil Matrix | 200µL | N / A | CH2CL2 | 3x60mL | 1mL |
| | MS MSD | S | Sodium Sulfate | Surrogate 500mg/µL | 100µL | Spike 10000 ng/µL | 200µL | N / A | CH2CL2 | 140mL | 5mL |

qc/qcmemos/forms/extractionlist2009 Rev7 09/11/2009

Property of AMRO Environmental Laboratories Corporation

Attachment 6

# PREPARATION OF SURROGATES, MATRIX SPIKES AND INTERNAL STANTARDS

| Surrogate/Spike name | Compound name | Compound Amount (µL) | Solvent type | Final Volume * |
|---|---|---|---|---|
| BNA FULL LIST SPIKE Attachment 12 | 8270 Mega Mix | 1000µL | METHANOL | 10mL |
| | BENZIDINES | 500µL | | |
| | ACETOPHENONE | 500µL | | |
| | BENZOIC ACID | 500µL | | |
| | 8270 Cal Mix | 250µL | | |
| | BENZOIC ACID | 250µL | | |
| TCLP BNA SPIKE Attachment 13 | TCLP BN SPIKE MIX | 250µL | METHANOL | 5mL |
| | TCLP ACID SPIKE MIX | 250µL | | |
| EPH SURROGATE Attachment 14 | EPH SURROGATE MIX | 1000µL | ACETONE | 100mL |
| EPH SPIKE Attachment 14 | ALIPHATIC | 1250µL | ACETONE | 25mL |
| | AROMATIC | 1250µL | ACETONE | 25mL |
| PEST/PCB SURROGATE Attachment 15 | PEST/PCB SURROGATE MIX | 400µL | ACETONE | 250mL |
| PEST SPIKE | ORGANOCHLORINE MIX | 10µL | ACETONE | 50mL |
| | HEXACHLOROBENZENE | 20µL | ACETONE | 50mL |
| PCB SPIKE | AROCLOR 1016/1260 Mix | 1000uL | ACETONE | 100mL |
| TCLP PEST SPIKE Attachment 16 | TCLP PEST SPIKE MIX | 10µL | ACETONE | 50mL |
| BNA IS Attachment 17 | SEMIVOLATILE INTERNAL STANDARD | ALL | NOT APLLICABLE | ALL |
| EPH IS | 5-ALPHA ANDROSTANE | ALL | NOT APPLICABLE | ALL |
| EPH FRACTIONATION SURROGATE Attachment 18 | CUSTOM FRACTIONATION SURROGATE | ALL | NOT APPLICABLE | ALL |
| SIM IS | BNA IS | 100µL | METHYLENE CHLORIDE | 1000µL |
| DRO/TPH-GCFID SURROGATE Attachment 19 | O-TERPHENYL | 1000µL | ACETONE | 10mL |
| DRO/TPH-GCFID MATRIX SPIKE Attachment 19 | #2 FUEL OIL | 1g | ACETONE | 100mL |

*Amount is subject to change- check with analyst before making it up.
EPH Spike needs to be warmed up before use due to crystalization at room temperautre.

Attachment 7

SURROGATE AND SPIKE CHECKS

| SOLUTION | DILUTION | SOLVENT |
|---|---|---|
| QQ PAH SURROGATE | 5X | CH2CL2 |
| QQ PAH MARTIX SPIKE | 5X | CH2CL2 |
| QQ PCB SURROGATE | 10X | HEXANE |
| QQ PCB MATRIX SPIKE | 5X | HEXANE |
| EPH SURROGATE | 5X | CH2CL2 |
| EPH MATRIX SPIKE | 5X | CH2CL2 |
| BNA SURROGATE | 2X | CH2CL2 |
| BN MATRIX SPIKE | 2X | CH2CL2 |
| ACID MARTIX SPIKE | 2X | CH2CL2 |
| BNA FULL LIST SPIKE | 2X | CH2CL2 |
| BNA TCLP SPIKE | 2X | CH2CL2 |
| PEST/PCB SURROGATE | 20X | HEXANE |
| PCB MATRIX SPIKE | 10X | HEXANE |
| PEST MATRIX SPIKE | 20X | HEXANE |
| PEST TCLP SPIKE | 10X | HEXANE |

Property of AMRO Environmental Laboratories Corporation

Attachment 8

DILUTION CHART

| EPH-A / S Dilutions | AMOUNT SAMPLE | AMOUNT CH2CL2 | AMOUNT 5 ALPHA IS | FINAL VOLUME |
|---|---|---|---|---|
| 1X | 300µL | N / A | 3µL | 300µL |
| 2X | 200µL | 200µL | 4µL | 400µL |
| 5X | 100µL | 400µL | 5µL | 500µL |
| 10X | 100µL | 900µL | 10µL | 1000µL |
| 20X | 50µL | 950µL | 10µL | 1000µL |
| 50X | 20µL | 980µL | 10µL | 1000µL |
| 100X | 10µL | 990µL | 10µL | 1000µL |
| 200X | 5µL | 995µL | 10µL | 1000µL |

| EPH-A SIM Dilution | AMOUNT SAMPLE | AMOUNT CH2CL2 | AMOUNT SIM IS | FINAL VOLUME |
|---|---|---|---|---|
| 1X | 300µL | N / A | 3µL | 300µL |

| BNA-A/S Dilutions | AMOUNT SAMPLE | AMOUNT CH2CL2 | AMOUNT BNA IS | FINAL VOLUME |
|---|---|---|---|---|
| 1X | 300µL | N / A | 6µL | 300µL |
| 2X | 200µL | 200µL | 8µL | 400µL |
| 5X | 100µL | 400µL | 10µL | 500µL |
| 10X | 100µL | 900µL | 20µL | 1000µL |
| 20X | 50µL | 950µL | 20µL | 1000µL |
| 50X | 20µL | 980µL | 20µL | 1000µL |
| 100X | 10µL | 990µL | 20µL | 1000µL |
| 200X | 5µL | 995µL | 20µL | 1000µL |

A = Aqueous
S = Soil

BNA IS = Semivolatile Internal Standard

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

# SEPARATORY FUNNEL LIQUID-LIQUID EXTRACTION METHOD 3510C

Procedure Number: OL-2003

Revision No.: 6

Revision Date: 12/23/2009

Review Date: N/A

Prepared By: Kristen Albert Date: 12/23/09

Approved By: Kristen Albert Date: 1/22/10
Extraction Section Supervisor

Approved By: Mary Edwards Date: 1/22/10
Laboratory Director

Approved By: Paula Benham Date: 1/22/10
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

# TABLE OF CONTENTS


| | | Page |
|---|---|---|
| 1.0 | SCOPE AND APPLICATION | 3 |
| 2.0 | METHOD SUMMARY | 3 |
| 3.0 | SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE | 3 |
| 4.0 | POTENTIAL PROBLEMS AND INTERFERENCES | 4 |
| 5.0 | HEALTH AND SAFETY | 6 |
| 6.0 | INSTRUMENTS AND EQUIPMENT | 6 |
| 7.0 | REAGENTS AND STANDARDS | 8 |
| 8.0 | PROCEDURE | 14 |
| 9.0 | CALCULATIONS | 21 |
| 10.0 | QUALITY CONTROL | 22 |
| 11.0 | DATA REVIEW AND STORAGE | 23 |
| 12.0 | REFERENCES | 23 |
| | Attachment 1 Semivolatile Organic Extraction Worksheet | 24 |
| | Attachment 2 Pesticides/PCBs Extraction Worksheet | 25 |
| | Attachment 3 EPH Extraction Worksheet | 26 |
| | Attachment 4 Separatory Funnel Liquid-Liquid Extraction Qualification Card | 27 |
| | Attachment 5 Extraction Information Summary | 28 |
| | Attachment 6 Preparation of Surrogates, Matrix Spike and Internal Standards | 29 |
| | Attachment 7 Surrogate and Spike Checks | 30 |
| | Attachment 8 Dilution Chart | 31 |
| | Attachment 9 Fingerprint/DRO Extraction Worksheet | 32 |

## 1.0 SCOPE and APPLICATION

1.1 This method describes a procedure for isolating organic compounds from aqueous samples. This method also describes concentration techniques suitable for preparing the extract for the appropriate determinative methods.

## 2.0 METHOD SUMMARY

2.1 A measured volume of sample, usually 1.0 liter, at a specified pH, is serially extracted with methylene chloride using a separatory funnel.

2.2 The extract is dried, concentrated and, as necessary, exchanged into a solvent compatible with the cleanup or determinative method.

2.3 The extract is dried using sodium sulfate in a glass powder funnel rather than a drying column due to availability and cost.

2.4 Method modification – If emulsions are observed, the emulsion is removed into a test tube. The test tube is centrifuged, then the solvent is removed and placed in the Erlenmeyer flask used to collect the solvent layer. If an emulsion still exists, the centrifuge step is repeated. Alternatively, emulsions may be manually broken up using a clean glass pipette and gently mixing the emulsion. If it is not possible to break an emulsion then continuous liquid-liquid extraction must be used.

2.5 The extract is concentrated to between 2 and 10ml in a Kuderna-Danish flask fitted with a three ball snyder column On a heated water bath. In the Case of EPH1.1, 50 ml of hexane for solvent exchange are added to the top of the snyder column when the DCM volume in the KD has reduced to between 10-20ml.

## 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

3.1 Samples should be received and stored in 1-liter amber glass jars at 4°C.

3.2 Pesticide/PCB samples received for EPA Method 608 must be checked upon receipt to be within pH range 5-9. If not, they must be pH adjusted or extracted within 72hrs.of sampling. Use 10N Sodium Hydroxide solution, or 50% Sulfuric Acid Solution to adjust the pH. Record the volume of acid or base used.

3.3 Store extracts separate from standards at 4°C.

3.4 Holding time is measured from date of collection to date the extraction solvent first touches the sample.

3.5 The Sample Holding Times:

| Analysis | Sample Matrix | Holding Time |
|---|---|---|
| Semivolatile Organics | Aqueous | Samples extracted within 7 days and extracts analyzed within 40 days following extraction |
| Organochlorine Pesticides and PCB's | Aqueous | Samples extracted within 7 days and extracts analyzed within 40 days following extraction |
| EPH, EPH Rev 1.1 | Aqueous | Samples extracted within 14 days and extracts analyzed within 40 days following extraction |
| TPH, ETPH, DRO, DRO(ME) | Aqueous | Samples extracted within 7 days and extracts analyzed within 40 days following extraction |

## 4.0 POTENTIAL PROBLEMS AND INTERFERENCES

4.1 Soap residue, which results in a basic pH on the glassware surfaces, may cause degradation of certain analytes. Specifically, Aldrin, Heptachlor, and most organophosphorus pesticides will degrade in this situation. This problem is especially pronounced with glassware that may be difficult to rinse. These items should be hand-rinsed very carefully to avoid this problem.

4.2 Emulsions – If an emulsion occurs, slowly drain as much methylene chloride into flask as possible without allowing emulsions to drain. Then slowly drain the emulsion into disposable test tubes. Centrifuge.

4.2.1 After the sample has been centrifuged, there should be a layer of water on the top and the methylene chloride on the bottom.

4.2.2 Pipette the water layer back into the separatory funnel and pipette the methylene chloride into the Erlenmeyer flask.

4.2.3 If very little methylene chloride is recovered after centrifuging, remove the solvent then centrifuge again.

4.2.4 Make sure to document the presence of the emulsion on the extraction log.

4.2.5 Alternatively, a clean glass pipette can be used to manually break up emulsions. This method is not effective if heavy emulsions are present.

4.2.6 If all the above techniques fail to break the emulsion, then continuous liquid-liquid extraction (EPA 3520) should be employed in lieu of separatory funnel extraction.

4.3 Problems with the pH:

4.3.1 EPH samples should all be preserved with HCl at the time of sampling. If a sample pH is found to be greater than pH=2 upon receipt, notify the supervisor. The supervisor may have extraction personnel preserve the sample. DO NOT PRESERVE UNLESS APPROVED BY A SUPERVISOR. Record the pH in the extraction log, and proceed with the extraction.

4.3.2 The volume of acid or base should not exceed 1% of the total initial sample volume being extracted (i.e. 1000mL of sample – no more that 10mL acid or base can be added for pH adjustment.)

4.3.3 Care must be taken to ensure the proper extraction pH is reached for BNA extraction. EPA Method 625 requires basic then acidic order for extraction. SW-846 Method 3510C allows acidic, then basic extraction. Make sure to carefully adjust sample pH and properly document it. If pH is not properly adjusted, the procedure may not fully extract all analytes of interest. PAH/PAHSIM samples may be extracted at neutral pH.

4.4 Pre-extraction Sample Dilutions:

4.4.1 Before a dilution is performed on the "water" sample, determine if the sample is water-soluble. First place Deionized Water in a vial, then pipette a small amount of the sample in the water, gently swirl. The sample should mix evenly with the water, no layers should form. If layers do occur, the sample is not water-soluble. Notify the supervisor before proceeding.

4.4.2 If it is determined that a dilution is needed and can be done, then use deionized water to obtain desired dilution.

4.4.3 When any sample is received which is a darkly colored liquid, viscous liquid, or liquid with pH>11, contact the supervisor for instructions before proceeding. The sample may need to be diluted or an emulsion test performed before extraction.

4.5 If normal final volume is not achieved due to nature of sample, make a notation on the appropriate extraction worksheet; Semivolatile (Attachment1); Pesticides/PCB (Attachment 2), EPH (Attachment 3), and Fingerprint (Attachment 9) so the analyst will be aware adjustment in calculation is needed.

4.6 If at any point extract volume is reduced to <0.75mL then analytes may be lost. Indicate problem and cause on extractions log, and notify supervisor or analyst. Attempt re-extraction within holding time ASAP.

4.7 If sample will not concentrate to final volume, see supervisor for instruction.

## 5.0 HEALTH AND SAFETY

5.1 AMRO places a high value on laboratory safety. The air quality of the laboratory has been monitored. Fire extinguishers are located in various areas of the lab. The laboratory evacuation plan is posted in every room, with a designated meeting place.

5.2 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean lab coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. A leak detector is used to check for any gas leaks.

5.3 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eye-wash stations and an emergency shower.

5.4 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

5.5 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

## 6.0 INSTRUMENTS AND EQUIPMENT

6.1 Shaker-Floor Model 8 position orbital shaker

6.2 Separatory funnel-2.0 Liter, with stopper

6.3 Erlenmeyer Flask, 250mL and 1000mL

6.4 pH paper

6.5 Aluminum foil and white Labeling tape

6.6 Test tubes 16X125mm

6.7 Centrifuge

6.8 Pipettes and bulbs

6.9 Separatory funnel stand

6.10 Sonicator

6.11 Kuderna-Danish (K-D) apparatus. (Alternatively, in the case of PCB/Pesticide aqueous samples, use Zymark Turbovap II apparatus.):

6.11.1 Concentrator tube- 10mL, graduated (Kontes K-570050-1025 or equivalent). A ground-glass stopper is used to prevent evaporation of extracts.

6.11.2 Evaporation flask-500mL (Kontes K-570001-500 or equivalent). Attach to concentrator tube with springs, plastic clips, clamps, or equivalent.

6.11.3 Snyder column-Three ball macro (Kontes K-503000-0121 or equivalent).

6.11.4 Snyder column-Two ball micro (Kontes K-569001-0219 or equivalent).

6.11.5 Springs-1/2 inch (Kontes K-662750 or equivalent).

6.12 Boiling chips- Solvent-extracted, approximately 10/40 mesh (PTFE or equivalent).

6.13 Six position Water Baths

6.14 Vials-2mL,5ml, glass with PTFE-lined screw-caps or crimp tops.

6.15 Zymark Turbovap II concentration apparatus

6.16 N-evap Nitrogen Blowdown Apparatus

## 7.0 REAGENTS AND STANDARDS

7.1 Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

7.2 DI water- AMRO reagent water – Deionized and activated carbon cleaned water from a Culligan System that is checked monthly for Residual Chlorine, Conductivity, Heterotrophic Plate count, pH, Arsenic, Barium, Cadmium, Chromium, Copper, Iron, Lead, Nickel, Selenium, Silver, Zinc and Mercury. Resistivity and pH are monitored daily. Instrument and Procedural Blanks are also used to monitor contaminant levels through out the laboratory and demonstrate water is organic free.

7.3 Sodium sulfate (granular, anhydrous), $Na_2SO_4$. Purify by heating to 400°C for 4 hours in a shallow tray.

7.4 Sodium hydroxide solution (10N), NaOH. Dissolve 40g NaOH in Organic-free water and dilute to 100 mL. Other concentrations of hydroxide solutions may be used to adjust the sample pH, provided that the volume added does not appreciably change (e.g.<1%) the total sample volume.

7.5 Sulfuric acid solution (1:1 v/v), $H_2SO_4$. Slowly add 250mL of $H_2SO_4$ to 250mL of organic-free reagent water.

7.6 Hydrochloric acid solution (1:1 v/v), HCl.

7.7 Acetone. Pesticide residue grade or purer.

7.8 Extraction/exchange solvents:

7.8.1 Methylene chloride, boiling point 39°C. Pesticide residue grade or purer.

7.8.2 Hexane, boiling point 68°C. Pesticide residue grade or purer.

7.9 pH test strips with 1 pH unit increments.

7.10 Stock standard solutions: Stock standards should be stored in Teflon sealed crimp or screw-cap vials at 4 degrees Celsius and should be protected from the light. Stock standards should also be checked frequently for signs of degradation.

7.10.1 TPH-GCFID Surrogate stock solution -O-terphenyl from Restek #31097

7.10.2 TPH-GCFID Matrix Spike stock solution - used for LCS and Spikes - fuel oil #2, pure, obtained from Rochette Oil Co. This is a different lot number from the Calibration Stock Standard.

7.10.3 BNA LCS Stock Solution Components
8270 Mega Mix - 500-1000µg/mL obtained from Restek #31850
8270 Benzidines - 2000µg/mL obtained from Restek #31852
Custom Acetophenone - 2000µg/mL obtained from Restek #558859
8270 Cal. Mix # 1 - 2000µg/mL obtained from Restek #31618
Benzoic Acid - 2000µg/mL obtained from Restek #31879

7.10.4 BNA Surrogate in Tinted Methanol 100:150µg/mL obtained from Environmental Express (#M0014)

7.10.5 BN Surrogate- 5000 µg/mL from Restek (#31062)

7.10.6 Acid Surrogate - 10000µg/mL from Restek (#31063)

7.10.7 BN Matrix Spike Mix - 5000µg/mL obtained from Restek (#31074)

7.10.8 Acid Matrix Spike Mix - 7500µg/mL obtained from Restek (#31075)

7.10.9 TCLP BN Matrix Spike – 2,000µg/mL obtained from Restek (#31028)

7.10.10 TCLP Acid Matrix Spike – 2,000µg/mL obtained from Restek (#31027)

7.10.11 EPH Surrogate – 4,000µg/mL obtained from Restek #31479

7.10.12 EPH Aromatic Hydrocarbon Standard – 1000µg/mL from Restek (#31458)

7.10.13 EPH Aliphatic Hydrocarbon Standard - 1000µg/mL from Restek (#31459)

7.10.14 Pesticide/PCB Surrogate – 200µg/mL obtained from Restek #3200

7.10.15 Pest Full List Matrix Spike – Organochlorine 2,000µg/mL from Restek (#32415), HCB 1,000µg/mL from Restek (#32231).

7.10.16 PCB Spike – Aroclor 1016/1260 mix - 1,000µg/mL obtained from Restek (#32039).

7.10.17 BNA or PAH Internal Standard – 2000µg/mL obtained from Restek (#31206).

7.10.18 EPH Internal Standard – 5 alpha Androstane - 2000µg/mL obtained from Restek (#31065)

7.11 Working standards:

7.11.1 Working TPH-GCFID surrogate standard – 1mL of surrogate stock is brought to a 10mL final volume in acetone. Final concentration is 1,000µg/mL.

7.11.2 TPH-GCFID Matrix Spike working standard - 1gram of stock brought to 100 mL final volume with acetone. Final concentration is 10,000 ng/µL.

7.11.3 BNA LCS Mix – 10mL final volume in Methanol with the addition of each of the following:

8270 Mega Mix - 1,000µl
8270 Benzidines - 500µl
Custom Acetophenone - 500µl
8270 Cal. Mix # 1 - 250µl
Benzoic Acid - 250µl

Final concentrations are as follows:
8270 Mega Mix - 50-100µg/ml
8270 Benzidines - 100µg/ml
Custom Acetophenone - 100µg/ml
8270 Cal. Mix # 1 - 50µg/ml
Benzoic Acid - 50µg/ml

7.11.4 BN and Acid Surrogate – Prepared by Environmental Express; 30mL 100:150 BN:A Surrogate in Tinted Methanol. See 7.10.5

7.11.5 BN Matrix Spike Mix - 500µL of Stock to 25mL with Methanol for a final concentration of 100ng/µL.

7.11.6 Acid Matrix Spike Mix - 500µL of Stock to 25mL with Methanol for a final concentration of 15ng/µL.

7.11.7 TCLP BNA Matrix Spike – 500µL of the stock TCLP BN and Acid Matrix Spike solutions to 10mL with methanol for a final concentration of 100µg/mL for each analyte.

7.11.8 EPH Surrogate – 1mL of stock to 100mL with Acetone for a final concentration of 40ng/µL.

7.11.9 EPH Matrix Spike – 1,250µL Aliphatic, 1,250µL aromatic to 25mL with Acetone for a final concentration of 50µg/ml .

7.11.10 Pesticide/PCB Surrogate – 400µL of stock to a final volume of 250mL with Acetone for a final concentration of 0.32ng/µL.

7.11.11 Pesticide Full List Spike – 10µL of Organochlorine and 20µL of HCB to 50mL final volume with Acetone for a final concentration 0.40µg/ml

7.11.12 PCB Matrix Spike – 1mL of Aroclor 1016/1260 mix stock to 100 mL final volume with Acetone for a final concentration of 10ng/µL.

7.11.13 BNA or PAH Internal Standard – 2000ug/mL obtained from Restek (#31206)

7.11.14 PAH-SIM Internal Standard Solution – 100uL of the BNA/PAH IS Stock to 1mL final volume with methylene chloride for a final concentration of 200ug/mL for each analyte.

7.11.15 EPH Internal Standard – 2000ug/mL of 5-alpha-androstane in methylene chloride obtained from Restek (#31065)

7.11.16 EPH Fractionation Surrogate Spike Solution – 4000ug/mL obtained from Restek (#31480)

7.12 Tracking of Reagents and Standards

It is important to be able to track all analytical reagents and standards back to their sources. AMRO personnel to accomplish this use the following procedures:

7.12.1 Standards, neat compounds and reagents from commercial sources are documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, which consists of the letter "A" and a five digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and AMRO employees complete the disposal dates when standards are used up or disposed. Refer to the Certificate of Analysis Logbook for standard concentration information. The Certificates are kept on file in the Extraction Section.

7.12.2 Organic Standard Tracking - The Organic Standards Tracking Log System consists of a Standard ID Index Logbook, a Stock Standards Logbook, and a Working Standards Logbook. The ID index assures that no two standards are assigned the same ID number.

7.12.3 Stock Standards Logbook:

Whenever a stock standard solution is opened or is prepared from a neat compound, this information is recorded in the Stock Standard Logbook. The stock solution is assigned a new ID number consisting of the letter "S", the date of preparation plus a letter suffix starting with the letter "A". This ID along with the compound name, concentration and initials of the person making the stock are included on the label. Stock standards are good one year from the date prepared or the date provided by manufacturer, whichever is shorter. Example - The fourth semivolatile standard prepared on April 15, 1989 would have the standard ID S041589D. This number will be recorded in the logbook and written on the container.

7.12.4 Working Standards Logbook:

Whenever a working standard solution opened or is prepared, whether from AMRO stocks or commercially obtained stocks, the information is recorded in the Working Standard Logbook. The solution is assigned a new ID number consisting of the letter "S", the date it is prepared plus a letter suffix. This number along with a descriptive name, concentration (or conc. varied) and the initials of the person preparing the solution are included on the label. The expiration of working standards varies depending on the use. Standards should be used in accordance with method specifications and manufacturer's instructions.

7.12.5 Standard Storage:

Standards and reagents are stored per method specifications and manufacturer's instructions. Semivolatile, Pesticide, PCB, Petroleum standards are stored in refrigerators at 4°C± 2°C, freezers at -10 °C, and ambient temperature depending upon the method and manufacturer requirements.

7.12.6 Solvent Check Analysis

All extraction procedures are performed using pesticide residue grade solvents and a method or procedural blank analysis is performed when a new lot number is received to verify the absence of target analytes.

7.13 Surrogates and Spikes

**Table of Surrogates and Spikes-Water**

| Method #'s | Based in | Solution | Concentration | Amount |
|---|---|---|---|---|
| 8270 | Methanol | BNA Tinted Surrogate | 100 and 150ng/µL | 500µL in all samples |
| | Methanol | BNA Full List | 100 and 150ng/µL | 500µL in LCS, LCSD |
| 8270 PAH | Methanol | BNA Tinted Surrogate | 100 and 150ng/µL | 500µL in all samples |
| | Methanol | PAH MS | 100 and 150ng/µL | 500µL in LCS, LCSD |
| 8270 PAH-SIM | Methanol | BNA Surrogate | 100 and 150ng/µL | 50µL in all samples |
| | Methanol | BNA Full List Or PAH MS | 100 and 150ng/µL | 50µL in LCS, LCSD |
| EPH1.1 | Acetone | EPH Surrogate | 40ng/µL | 1.0mL in all samples |
| | Acetone | EPH Matrix Spike | 50ng/µL | 1.0mL in LCS, LCSD |
| Pesticide | Acetone | PCB/Pest Surrogate | 0.32µg/mL | 200µL in all samples |
| | Acetone | Pest Full List Spike | 0.4µg/mL | 200µL LCS, LCSD |
| PCB | Acetone | PCB/Pest Surrogate | 0.32µg/mL | 200µL in all samples |
| | Acetone | PCB Matrix Spike | 10µg/mL | 400µL in LCS, LCSD |
| FING/DRO | Acetone | O-terphenyl surrogate | 1000ng/µL | 100µL in all samples |
| | Acetone | #2 Fuel Oil | 10000ng/µL | 200µL in LCS, LCSD |

*Note: Surrogate and spike amounts are based on the assumption of nominal final volume for the extract. If it is known a different final volume will be required see the section supervisor for instructions before proceeding.*

## 8.0 PROCEDURE

8.1 All funnels and stoppers, and necessary glassware are dried with acetone, or air dried and rinsed with methylene chloride. An Erlenmeyer flask for each sample must also be dried with acetone and rinsed with methylene chloride.

8.2 The meniscus of the sample container is marked prior to transfer to the separatory funnel.

8.3 The samples are transferred to the separatory funnels that have been labeled with the corresponding sample number. The entire contents of the sample container should be transferred including small amounts of sediment if present. If large amounts of sediment are present in the sample bottle then contact the supervisor immediately before proceeding. Excluding the sediment is allowable only with client permission and must be documented in the logbook.

8.4 If there is an adequate amount of sample or sample duplicate available, a sample is chosen for the Matrix Spike and Matrix Spike Duplicate. The aliquot size should be about the same for the native sample and the QC samples. Be certain that Chain-Of-Custody is checked to allow for all other tests to be done on the sample. The funnels must be clearly labeled with the sample #, sample #MS, and sample #MSD.

8.4.1 If there is only enough sample to have a matrix spike, notify analyst and department manager so client can be contacted.

8.4.2 In some cases, the client may specify which sample is to used for MS/MSD; if not , the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall **NOT** be performed on Rinsate Blank or Field Blank. Watch for client sample IDs containing codes like FB, EB, RB, etc. that might indicate a field blank sample.
B. Adequate sample weight/volume.
C. Client requested QC deliverables.

8.4.3 If there is not adequate sample to have a Matrix Spike, then a Laboratory Control Sample (LCS) and Laboratory Control Sample Duplicate (LCSD) are extracted and analyst/department manager is notified.

8.4.4 For every 20 client samples prepare the following QC samples per method: Method Blank (MB), Laboratory Control Sample (LCS), and LCS Duplicate (LCSD). Unless the client requests a MS/MSD which is usually communicated in the chain of custody.

8.5 One liter of filtered drinking water for each the blank and a Laboratory Control Sample (LCS) are extracted for every 20 samples.

8.6 Test the initial pH of the sample and document it on the extractions log.

8.6.1 pH of EPH waters should be ~ 2.0

8.6.2 pH of waters for pesticide analysis should be between 5.0-9.0

8.7 pH is adjusted with 1:1 (v/v) Sulfuric Acid or 10N Sodium Hydroxide, or as indicated, according to the test being performed. Document any adjustments on the extraction log. To test the pH of aqueous samples, use a disposable pasteur pipette. Remove a few drops of sample and place them onto a strip of pH paper. Record the pH of the sample in the extraction logbook. Only use a pipette once for each sample. Dispose of each pipette after use.

8.7.1 Pesticides/PCB-pH should be between 5.0-9.0, or adjust.

8.7.2 EPH waters are preserved in HCl (1:1 v/v), pH~2.0. The blank and the LCS/LCSD need to be preserved with ~2.0 mL of HCl (1:1 v/v) before surrogates and spikes are added.

8.7.3 8270 PAH (or BN only)-initial pH should be between 5.0-9.0. For full BN analysis add a measured amount of 10N NaOH to the sample to reach a final pH of ~ 11.0. It is not necessary to adjust the pH of PAH only samples before extraction.

8.7.4 8270 (ABN)-initial pH should be between 5.0-9.0 on receipt. This is a two part extraction - First samples are acidified with a measured amount of 1:1 $H_2SO_4$ to a pH of <2. If the sample is alkaline or highly buffered then thoroughly mix the sample and allow sufficient time for the pH to stabilize below 2 before extracting. Improper acid fraction pH will significantly reduce analyte recovery. In the second part the samples are made alkaline with a measured amount of 10N NaOH to pH ~ 11.

8.7.5 625 (BNA)-initial pH should be between 5.0-9.0. This is a two part extraction - First the samples are made alkaline with a measured amount of 10N NaOH to pH ~ 11. Next the samples are acidified with a measured amount of 1:1 $H_2SO_4$ to pH <2. If the sample is alkaline or highly buffered then thoroughly mix the sample and allow sufficient time for the pH to stabilize below 2 before extracting. Improper acid fraction pH will significantly reduce analyte recovery.

8.8 Spikes and Surrogates

8.8.1 See Table of Spikes and Surrogates-Water for the correct surrogate and spike amounts.

8.8.2 All syringes used must be rinsed clean in the correct solvent before and after use.

8.8.3 All spikes and surrogates must be added to the sample before the pH is changed or solvent is added.

8.8.4 One person should be responsible for adding the spikes and surrogates to the samples.

8.8.5 A witness must be present while surrogates and spikes are being added to the samples. The witness is to make sure that the correct surrogates and spikes are being added and in the correct amount to each sample. The person who is the witness is also responsible for signing off that they did witness the samples being spiked and surrogated in the correct extraction logbook.

8.9 Add 60mL of Methylene Chloride to the sample bottle, seal, and shake for 30s to rinse the inner surface. Transfer the solvent to the separatory funnel. If sediment in the bottle, avoid formation of emulsions by gently turning the bottle to rinse the inner surface and avoid disturbing the sediment.

8.10 Each funnel is then shaken vigorously for two minutes using 8 position Floor Model Shaker for 2L separatory funnels. **Be certain to vent the funnels into a hood periodically while shaking.** If the funnel is not vented properly, it could explode. Venting should be done immediately after separatory funnel has been sealed and shaken once.

8.11 After each shake, the Methylene Chloride is drained into Erlenmeyer flasks that have been labeled with the sample number, date and test being performed. **Double check the match of funnel and flask labels each time before draining the solvent to prevent mix-ups.**

8.12 The number of times 60mL of Methylene Chloride is added and shaken depends on the test being performed. The first three 60mL aliquots must be used to rinse the sample bottle before transfer to the separatory funnel.

8.12.1 8270 (ABN): 6 shakes: First three shakes are done while samples are acidic. Three more shakes are done while the samples are basic (see Section 8.7.5) Final solvent volume = 360mL.

8.12.2 625 (BNA): 6 shakes:First three shakes are done while samples are basic. Three more shakes are done while samples are acidic (see Section 8.7.6) Final solvent volume = 360mL.

8.12.3 All other tests are three shakes. Final volume = 180mL.

After each shake, allow the solvent and sample layers to separate for a minimum of 10 minutes before being drained. If the emulsion interface between layers is more than one-third the size of the solvent layer, the analyst must employ mechanical techniques to complete the phase separation. The optimum technique depends upon the sample and may include stirring, filtration of the emulsion through glass wool, centrifugation, or other physical methods.

If the emulsion cannot be broken by stirring or filtration (recovery of < 80% of the methylene chloride, corrected for the water solubility of methylene chloride), then transfer the emulsion into a clean centrifuge tube and centrifuge for 2 minutes. Using a Pasteur pipette carefully remove the bottom solvent layer and transfer it to the extract solvent flask. If emulsion still exists repeat centrifuge step. Transfer any separated solvent to the solvent flask. Note the presence of emulsions and difficulty in separations in the extraction logbook comments column. See Sec. 4.2.6 if the emulsion is very bad and cannot be broken.

8.13 The Erlenmeyer flasks should be covered with aluminum foil between shakes to prevent contamination and evaporation. After the last shake is drained, an Elastic should be placed over the foil to hold it in place.

8.14 Measure initial volume of sample by refilling the original bottle to the mark made in Section 8.2 with water then measure the volume of the sample that was in the bottle by transferring it to a 1L graduated cylinder. Document actual volumes in the extraction log. If extracts are not to be concentrated immediately, they must be placed in refrigeration until concentration can be completed.

8.15 K-D technique for Concentrating Extract

8.15.1 Assemble a Kuderna-Danish (K-D) concentrator (Section 6.11) by attaching a 10mL concentrator tube to a 500mL evaporation flask, fixed in place with a blue plastic spring clip, and a white sample # label.

8.15.2 Dry the extract by passing it through a powder funnel containing a plug of clean glass wool in the stem about ½ full of anhydrous sodium sulfate. Do not use the same funnel to dry the BN fraction extract and then the ACID fraction extract, especially if any traces of water or emulsion are present in the flask. This can cause a loss of acid fraction analytes. Always use a new funnel or filter the acid fraction first. Collect the dried extract in a K-D concentrator. Both fractions should be combined before concentration unless special requirements make it clear the extracts must be concentrated separately. Rinse the Erlenmeyer flask, which contained the solvent extract, with 20 – 30mL of Methylene Chloride and add it to the column to complete the quantitative transfer.

8.15.3 Attach a three-ball Snyder column to the K-D after having disposed of the used NA2SO4 funnels. Pre-wet the Snyder column by adding about 1mL of Methylene Chloride to the top of the column. Place the K-D apparatus on a hot water bath (15°C -20°C above the boiling point of the solvent) so that the concentrator tube is partially immersed in the hot water and the entire lower rounded surface of the flask is bathed with hot vapor. Adjust the vertical position of the apparatus and the water temperature as required to complete the concentration in 10–20 minutes. At the proper rate of distillation, the balls of the Snyder column will actively chatter, but the chambers will not flood. When the apparent volume of liquid reaches 5mL, remove the K-D apparatus from the water bath and allow it to drain and cool for at least 10 minutes. If the concentration rate slows significantly or stops during concentration, remove the K-D from the water bath and notify the supervisor immediately. Continued application of heat after most of the solvent has evaporated from a high boiling residue can cause the loss of target analytes.

8.15.3.1 For EPH samples, exchange 2 times with 25 mLs Hexane at ~10mL

8.15.4 Remove the Snyder column and rinse the flask and its lower joints into the concentrator tube with 1-2mL of Methylene Chloride (or exchange solvent for methods using exchange solvent, i.e., use last solvent to rinse). If sulfur crystals are a problem, proceed to Method 3660 for cleanup. The extract may be further concentrated by using the Nitrogen blow-down technique outlined in Sec 8.20 or adjusted to the correct nominal final volume with the solvent last used.

8.16 Turbovap II Techniques for Concentrating Extract

8.16.1 See SOP # OL-2004 **Automated Soxhlet Extraction for details of turbovap procedures. Only PCB/Pest waters are concentrated in Turbovap tubes, with two hexane exhcanges to a final volume of 4mL.**

8.17 All 1.0 mL final volumes are to be measured using a clean class A volumetric flask marked "TC" and placed in 2.0 mL screw top vial. If final volume of extract is less than desired final volume, volume may be achieved through use of clean solvent as described below.

8.18 All 2.0 mL and 4.0 mL final volumes are measured by comparison to the proper reference vial, matching up the meniscus.

**NOTE**: Reference vials are made each time a new lot of vials are received. Using a syringe, 2mL of Hexane are transferred into a 5 mL screw top vial and the meniscus is marked with a permanent marker. The same is done for 4.0mL, using 4.0mLs of Hexane. A record is kept of the new vial lot numbers and date of preparation.

8.19 Final volumes are as follows:

8.19.1 PAH, BNA (8270 & 625)( see 8.17):1.0mL in screw cap vial. If the volume is not less than 0.75mL, Methylene Chloride can be used to bring final volume to 1.0mL. If volume is <0.75mL, volume may be brought up to 1.0mL with clean Methylene Chloride and a note must be written in logbook about the lowest concentration volume.

8.19.2 EPH1.1(see 8.18):2.0 mL in screw cap vial. If final volume is <1.0mL Hexane may be used to bring final volume to 1.0mL. A note must be recorded in logbook if volume before Hexane addition is < 0.75mL.

8.19.3 FING/DRO (see 8.17): 1.0 mL in screw cap vial. If final volume is <1.0mL, Methylene Chloride may be used to bring final volume to 1.0mL. A note must be recorded in logbook if volume before Methylene Chloride addition is < 0.75mL.

8.19.4 Pesticide/PCB &PCB (see 8.18): 4.0mL in 40mL vial. Hexane can be added to bring final volume to 4.0mL. A note must be recorded in logbook if volume before hexane addition <3.0mL.

8.19.5 All final volumes must be recorded in respective logbooks along with initials and date. Once entire batch for day is complete, a photocopy of the page is given to analyst and samples are signed over to analyst. If analyst is not present, samples are placed in refrigerator and copy of batch placed on analyst desk.

8.20 Nitrogen blow-down technique

8.20.1 Place the concentrator tube in a warm bath (35°C) and evaporate the solvent to the final volume indicated, using a gentle stream of clean, dry nitrogen. Carefully adjust the gas flow with the knob at the top of each gas tube. A dimple should form on the solvent surface and small ripples should reach the tube walls. Do not apply so much gas flow or move the gas tube tip so close that the solvent splashes.

CAUTION: New plastic tubing must **NOT** be used between the carbon trap and the sample, since it may introduce contaminants.

8.20.2 CAUTION: When the volume of solvent is reduced significantly below 1mL, Semivolatile analytes may be lost.

8.20.3 CAUTION: If sample will not concentrate to its optimal final volume then adjust the solvent to nearest whole number with addition of clean solvent with respect to test type. Do not over concentrate a viscous sample. If the rate of solvent reduction

slows significantly or stops then immediately remove the sample tube from the water bath and proceed as above. A note must be recorded into logbook to indicate the problem encountered.

8.21 Preparation of Samples for Analysis: note: This step no longer takes place in the extraction lab. For reference only.

8.21.1 BNA Samples:

8.21.1.1 Using a clean 500µL syringe rinsed with Methylene Chloride take 300µL of the extract and place into a pre-labeled crimp top vial. Double check the label match before transfer.

8.21.1.2 Add 6µL of BNA Internal Standard Solution (I.S.) to the extract and crimp vial with cap. Make sure to check the level of BNA I.S. to be sure the solution has not evaporated. Minimize the amount of time when the I.S. vial is open to reduce evaporation.

8.21.1.3 Mark the level of the I.S. when all extracts are prepared.

8.21.1.4 Make sure all crimp vials caps will not twist and are legibly and properly labeled.

8.21.2 EPH1.1 Samples:

8.21.2.1 Add 10µL of fractionation surrogate per 2.0mL final volume of EPH sample and thoroughly mix the sample. The fractionation surrogate is much less dense than the extract and will not mix well unless shaken.

8.21.2.2 Using a clean 500µL syringe rinsed with Methylene Chloride take 300µL of the extract and place into a crimp top vial.

8.21.2.3 Add 3µL of EPH Internal Standard Solution (I.S.) to the extract and crimp vial with cap. Make sure to check the level of EPH I.S. to be sure the solution has not evaporated. Minimize the amount of time when the I.S. vial is open to reduce evaporation.

8.21.2.4 Mark the meniscus levels of the I.S. and fractionation surrogate when all extracts are prepared.

8.21.2.5 Make sure all crimp vials are properly labeled.

8.21.3 PCB Samples:

8.21.3.1 After acid washing (see SOP OL-2019) and copper cleanup (see SOP OL-2020), use Pasteur pipettes to place approximately 1mL of each extract from the top solvent layer into properly labeled crimp top vials. If the top layer appears cloudy allow it to settle longer or centrifuge the supernatant.

CAUTION: Transferring any sulfuric acid into the Auto-sampler vial will destroy the GC column and damage the detector if the sample is injected. Be very careful that ONLY the clear hexane layer is transferred to the crimp top vial.

8.21.3.2 Crimp the tops of the vials and mark the meniscus level on each vial.

8.21.4 Pesticide Samples:

8.21.4.1 After Florisil cleanup (see SOP OL-2018) and copper cleanup (see SOP OL-2020) use Pasteur pipettes to place approximately 1mL of each extract from the top of the extract into properly labeled crimp top vials.

8.21.4.2 Crimp the tops of the vials and mark the meniscus level on each vial.

8.21.5 FING/DRO Samples:

8.21.5.1 Use Pasteur pipettes to place approximately 500uL of each extract from the top of the extract into properly labeled crimp top vials.

8.21.5.2 Crimp the tops of the vials and mark the meniscus level on each vial.

## 9.0 CALCULATIONS

Not Applicable.

## 10.0 QUALITY CONTROL

10.1 Any reagent blanks, Matrix Spikes (MS), Matrix Spike Duplicate (MSD) and or Sample Duplicate (DUP) should be subject to exactly the same analytical procedure as those used on the actual samples.

10.2 The same amounts of sample must be extracted for QC samples as for routine client samples to assure the same extraction efficiency.

10.3 One method blank must be extracted with each batch of samples. The method blank is used to determine if the extraction procedure was successful and if there is any contamination associated with the extraction.

10.4 The surrogate is used to determine the efficiency of the extraction and must be added to each sample, blank, LCS, MS/MSD, and sample duplicate prior to extraction.

10.5 The MS/MSD is used to determine the effects of the matrix on the analytes of interest in the analysis. They are extracted with every twenty client samples unless otherwise specified by the client.

10.6 In some cases, the client may specify which sample is to be used for MS/MSD; if not, the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall **NOT** be performed on Rinsate Blank or Field Blank. Watch for client sample IDs containing codes like FB, EB, RB, etc. that might indicate a field blank sample.

B. Adequate sample weight.

C. Client requested QC deliverables.

10.7 If there is not adequate sample to have a Matrix Spike, then a Laboratory Control Sample (LCS) and Laboratory Control Sample Duplicate (LCSD) are extracted and analyst/department manger is notified.

10.8 The LCS used to evaluate the laboratory performance in a clean matrix. The LCS confirms the extraction/analysis was properly performed when matrix effects cause the MS/MSD recoveries to be unacceptable. The acceptable LCS proves the extraction did not affect the recovery of the analytes, therefore it is extremely important to be careful when extracting, concentrating, and transferring the LCS.

*Failure of the LCS may necessitate re-extraction of the entire batch*

10.9 In case of concentration <1mL, analytes may be lost. Contact the supervisor or initiate re-extraction before holding time has expired. In any case, documentation of the lowest extract volume in the prep logbook is required

10.10 When a sample or a portion of a sample is lost during extraction or concentration, see the supervisor immediately for corrective action plan.

10.11 Any potential or suspected mix-ups in sample IDs, matrix spikes, or surrogate spikes must be communicated to the supervisor immediately so proper corrective action can be started as soon as possible. All possible errors and corrective action must be noted in the logbook. Carefully document any problems or unusual conditions in the comment section. This information is necessary for a non-conformance summary if QC sample or surrogate recovery problems occur. Record all observations about unusual sample color, odor, the presence of sediment or product phases or oily sheens, etc. Note any differences in the MS or MSD or DUP aliquots used for QC or obvious differences in the final extracts. This information is very important in explaining QC analytical result discrepancies.

## 11.0 DATA REVIEW AND STORAGE

11.1 All related preparation information and observations will be noted in the appropriate extraction worksheets

11.2 All cross-outs must be a single line and should be initialed and dated.

## 12.0 REFERENCES

12.1 USEPA SW846-Update III, Method 3510C, Rev 3, 12/96.

12.2 USEPA SW846-Update III, Method 3500B, Rev 2, 12/96.

12.3 USEPA SW846-Update III, Chapter 1, 7/94.

12.4 EPA Method 625, 40 CFR Part 136, Appendix A. 1996

12.5 EPA Method 608, 40 CFR Part 136, Appendix A Section 9.2 of Method 608.

# Attachment 1

AMRO Environmental Laboratories Corporation

111 Hedrick Street
Manchester, NH 03054
(603) 424-2022

## SEMIVOLATILE ORGANIC EXTRACTION WORKSHEET

Concentration Method: Turbovap, K-D (Circle One)

Rev. No.: OL-2003: 5 Matrix: Water Na/Rev. No.: OL-2003: 5 Matrix: Soil/Sludge Other Matrix:

TRON DATE:
Test
BY Released by
By
TRON SOLVENT LOT #
EQ BY

SURR AMT:
MS AMT:
SURROGATE/
SPIKE WITNESS:
INTERNAL STANDARD ID:
LIMS BATCH ID:

*SW-846 Method 8270C: Initial extraction pH <2 and Secondary extraction pH >11 and Secondary extraction pH <2

| Sample Number | Sample Amount Used (mL or g) | Sample pH | Initial Extraction pH* | Secondary Extraction pH* | Conc. Date & Analyst | Final Volume (mL) | Int. Std. Added By/Date | Comments (Est. Appearance and Color) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

# Attachment 2

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

## PESTICIDES/PCBs EXTRACTION WORKSHEET

Concentration Method: Turbovap, K-D (Circle One)

o./Rev. No.:OL-2003;5 Matrix: Water SOP No./Rev. No.: OL-2003;5 Matrix: Soil/Sludge Other Matrix:

| | | | |
|---|---|---|---|
| XTION DATE: | | SURR. AMT: | |
| VNTs): | | MS AMT: | |
| DY: Released by: | | SURROGATE: | |
| ed By: | | SPIKE WITNESS: | |
| XTION SOLVENT(S) / LOT #s: | | LIMS BATCH ID: | |
| ANGE SOLVENT / LOT #: | | *REVIEWED BY:* | |

| ab Sample Number | Sample Amount Used (mL or g) | Sample pH * | Adjusted pH * | Solvent Added (mL) | Conc. Date & Analyst | Final Volume (mL) | Cu Clean up: Date/ Init | H2SO4 Clean up: Date/Init | Comments ( Ext. Appearance and Color) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

# Attachment 3

AMRO Environmental Laboratories Corporation

## EXTRACTABLE PETROLEUM HYDROCARBONS (EPH) EXTRACTION WORKSHEET

111 Hermit Street
Manchester, NH 03054
(603) 424-4022

Concentration Method: Turbovap; K-D

SOP No./Rev. No.: OL-1003 Matrix: Water SOP No./Rev. No.: OL-1004 Matrix: Soil/Sludge Other Matrix:

EXTRACTION DATE:
ANALYST(S):
CUSTODY/Released by
Received By
EXTRACTION SOLVENT / LOT #:
LIMS BATCH ID:

SURR. AMT
MS AMT
SURROGATE/
SPIKE WITNESS:
INTERNAL STANDARD ID:
FRACTIONATION STANDARD ID:

| Lab Sample Number | Sample Aliquot Used (mL or g) | Sample pH | Extraction pH #2 | Conc. Due to Analyte | Final Volume (mL) | Preservative Added (Yes/No) | Inc. Std. Added By/ Date | Comments (Est. Appearance and color) |
|---|---|---|---|---|---|---|---|---|
| MB | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
|

Attachment 4

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

## QUALIFICATION CARD FOR SEPARATORY FUNNEL LIQUID-LIQUID EXTRACTION

Trainee: _____ Signature: _____

Trainer: _____ Signature: _____

I. Knowledge Factors:

SOP Title: _____ Revision Number/Date: _____

| | | | |
|---|---|---|---|
| 1. Did the Trainee read and understand the above SOP? | Yes ☐ | No ☐ | NA ☐ |
| 2. Was the Trainee instructed on how to properly fill out the documentation? | Yes ☐ | No ☐ | NA ☐ |
| 3. Has the Trainee been instructed on the proper procedures for addressing potential problems? | Yes ☐ | No ☐ | NA ☐ |

II. Practical Factors:

| | | | |
|---|---|---|---|
| 1. Has the Trainee completed a Precision and Accuracy Study? | Yes ☐ | No ☐ | NA ☐ |
| 2. Has the Trainee completed an acceptable Performance Evaluation sample? | Yes ☐ | No ☐ | NA ☐ |
| 3. Did the Trainee completed an acceptable Laboratory Control Sample (LCS)? | Yes ☐ | No ☐ | NA ☐ |
| 4. Has the Trainee performed manual integration as indicated in the SOP? | Yes ☐ | No ☐ | NA ☐ |

Completion Date: _____ Trainer's Signature: _____

I _____ have read, understood and follow the above method/SOP, which is in use at AMRO Laboratories for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

Section Manager/ Supervisor: _____ Date: _____

QA Manager: _____ Date: _____

qc/qcmemos/forms/qualcardsepfunliqliqex Rev. 0 10/00

Property of AMRO Environmental Laboratories Corporation

# Attachment 5

| Analysis | QC | Matrix | Drying Agent | Type of Surr. | Surr. Amt | Type of Spike | Spike Amt | Acid / Base Fract. | Extraction Solvent | Solvent Amt (mL) | Final Vol. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 8270 PAH SIM | MB, LCS MS, MSD | A | N/A | BNA Tinted Surrogate | 50µL | BNA Full List Spike | 50µL | N/A | CH2CL2 | 3 x 60mL | 1mL |
| | | S | Sodium Sulfate | | | | | N/A | CH2CL2/Acetone | 70 / 70 | |
| 8270 PAH ONLY | MB, LCS MS, MSD | A | N/A | BNA Tinted Surrogate | 500µL | BNA Full List Spike | 500µL | N/A | CH2CL2 | 3x60mL | 1mL |
| | | S | Sodium Sulfate | | | | | N/A | CH2CL2/Acetone | 70 / 70 | |
| 8270 | MB, LCS MS, MSD | A | N/A | BNA Tinted Surrogate | 500µL | BNA Full List Spike | 500µL | 1 H2SO4 2 NaOH | CH2CL2 | 6x60mL | 1mL |
| | | S | Sodium Sulfate | | | | | N/A | CH2CL2/Acetone | 70 / 70 | |
| 625 | MB, LCS MS, MSD | A | N/A | BNA Tinted Surrogate | 500µL | BNA Full List Spike | 500µL | 1.NaOH 2 H2SO4 | CH2CL2 | 6x60mL | 1mL |
| | | S | Sodium Sulfate | | | | | N/A | CH2CL2/Acetone | N/A | |
| BNA TCLP | MB LCS, MS,MSD | S | N/A | BNA TintedSurrogate | 500µL | BNA TCLP Spike | 500µL | 1 H2SO4 2 NaOH | CH2CL2 | 6X60mL | 1mL |
| EPH Rev. 4.1 | MB,LCS LCSD, LCSD | A | N/A | EPH Surrogate | 1000µL | EPH Matrix Spike = LCS+LCSD | 1000µL | HCL to controls | CH2CL2 | 3x60mL | 2mL |
| | | S | Sodium Sulfate | | | | | N/A | CH2CL2 | 140mL | 2mL |
| PCB ONLY | MB, LCS MS, MSD | A | N/A | PEST/PCB Surrogate | 200µL | PCB Matrix Spike= LCS + MS + MSD | 400µL | N/A | CH2CL2 | 3x60mL | 4mL |
| | | S | Sodium Sulfate | | 500µL | | 1000µL | N/A | Hexane/Acetone | 70 / 70 | 10mL |
| Pest ONLY | MB, LCS MS, MSD | A | N/A | PEST/PCB Surrogate | 200µL | Pest List Spike LCS + MS + MSD | 200µL | N/A | CH2CL2 | 3x60mL | 4mL |
| | | S | Sodium Sulfate | | 500µL | | 500µL | N/A | Hexane/Acetone | 70 / 70 | 10mL |
| PEST/ PCB | PP MB PCB LCS, Pest LCS, PCB MS&MSD, Pest MS&MSD | A | N/A | PEST / PCB Surrogate | 200µL | Pest Full List Spike= Pest LCS,MS,MSD PCB spike=PCB LCS, MS,MSD | 200µL Pest 400µLPCB | N/A | CH2CL2 | 3x60mL | 4mL |
| | | S | Sodium Sulfate | | 500µL | | 500µL Pest 1000µL PCB | N/A | Hexane/Acetone | 70 / 70 | 10mL |
| PEST TCLP | MB, LCS, MS, MSD | S | N/A | Pest/PCB Surrogate | 200µL | PEST TCLP Matrix Spike | 200µL | N/A | CH2CL2 | 3x60mL | 4mL |
| PCB Oil | MB,MS & MSD | Oil | N/A | PP Surr | 500µL | PCB Spike | 1000µL | N/A | Hexane | 9.5/5 5mL | 10mL |
| PCB Wipes | MB LCS, MS MSD | Wipe | N/A | PP Surr | 1000µL | PCB Spike | 2000µL | N/A | Hexane | 19/17mL | 20mL |
| Fuel | MB LCS, MS,MSD | A | N/A | O-terphenyl Surrogate 1000ng/µL | 100µL | #2 Fuel Oil Matrix Spike 10000 ng/µL | 200µL | N/A | CH2CL2 | 3x60mL | 1mL |
| | | S | Sodium Sulfate | | 100µL | | 400µL | N/A | CH2CL2 | 20mL | 20mL |
| DRO | MB LCS, MS MSD | A | N/A | O-terphenyl Surrogate 1000ng/µL | 100µL | #2 Fuel Oil Matrix Spike 10000 ng/µL | 200µL | N/A | CH2CL2 | 3x60mL | 1mL |
| | | S | Sodium Sulfate | | 100µL | | 400µL | N/A | CH2CL2 | 140mL | 10mL |
| MEDRO | MB,LCS,LCSD, LCS II | A | N/A | O-terphenyl Surrogate 200ng/µL | 1000µL | LCS=DRO MS 50 CS II=#2 Fuel Oil MS | 1000µL/ 100µL | N/A | CH2CL2 | 3x60mL | 1mL |
| | | S | Sodium Sulfate | | 1000µL | | 100µL | N/A | CH2CL2 | 140mL | 1mL |
| ETPH | MB LCS, MS MSD | A | N/A | O-terphenyl Surrogate 500ng/µL | 100µL | #2 Fuel Oil Matrix Spike 10000 ng/µL | 200µL | N/A | CH2CL2 | 3x60mL | 1mL |
| | | S | Sodium Sulfate | | 100mL | | 200µL | N/A | CH2CL2 | 140mL | 5mL |

qc/qcmenus/forms/extractionlist2009 Rev7 09/11/2009

Property of AMRO Environmental Laboratories Corporation

Attachment 6

## PREPARATION OF SURROGATES, MATRIX SPIKES AND INTERNAL STANDARDS

| Surrogate/Spike name | Compound name | Compound Amount (µL) | Solvent type | Final Volume |
|---|---|---|---|---|
| BNA SURROGATE Attachment 9 | BN SURROGATE MIX | 1000µL | METHANOL | 50mL |
| | ACID SURROGATE MX | 750µL | | |
| BN MATRIX SPIKE Attachment 10 | BN MATRIX SPIKE MIX | 500µL | METHANOL | 25mL |
| ACID SPIKE Attachment 11 | ACID MATRIX SPIKE MIX | 500µL | METHANOL | 25mL |
| BNA FULL LIST SPIKE Attachment 12 | CLP SEMIVOLATILE CALIBRATION MIX | 1000µL | METHANOL | 10mL |
| | BENZYL ALCOHOL | 500µL | | |
| | TCL BENZIDINES MIX | 500µL | | |
| | BENZOIC ACID | 500µL | | |
| | PYRIDINE | 500µL | | |
| | n-NITROSODIPHENYLAMINE | 200µL | | |
| | SS TCL PHENOLS MIX | 250µL | | |
| TCLP BNA SPIKE Attachment 13 | TCLP BN SPIKE MIX | 250µL | METHANOL | 5mL |
| | TCLP ACID SPIKE MIX | 250µL | | |
| EPH SURROGATE Attachment 14 | EPH SURROGATE MIX | 1000µL | ACETONE | 100mL |
| EPH SPIKE Attachment 14 | EPH MATRIX SPIKE MIX | 625µL | ACETONE | 25mL |
| PEST/PCB SURROGATE Attachment 15 | PEST/PCB SURROGATE MIX | 400µL | ACETONE | 250mL |
| PEST SPIKE | PEST MATRIX SPIKE | 500µL | ACETONE | 25mL |
| PCB SPIKE | AROCLOR 1016 | 1000µL | ACETONE | 100mL |
| | AROCLOR 1260 | 1000ul | | |
| TCLP PEST SPIKE Attachment 16 | TCLP PEST SPIKE MIX | 10µL | ACETONE | 50mL |
| BNA IS Attachment 17 | SEMIVOLATILE INTERNAL STANDARD | ALL | NOT APLLICABLE | ALL |
| EPH IS | 5-ALPHA ANDROSTANE | ALL | NOT APPLICABLE | ALL |
| EPH FRACTIONATION SURROGATE Attachment 18 | CUSTOM FRACTIONATION SURROGATE | ALL | NOT APPLICABLE | ALL |
| SIM IS | BNA IS | 100µL | METHYLENE CHLORIDE | 1000µL |

***Amount is subject to change- check with analyst before making it up.**

EPH Spike needs to be warmed up before use due to crystallization at room temperature.

Attachment 7

SURROGATE AND SPIKE CHECKS

| SOLUTION | DILUTION | SOLVENT |
|---|---|---|
| QQ PAH SURROGATE | 5X | CH2CL2 |
| QQ PAH MARTIX SPIKE | 5X | CH2CL2 |
| QQ PCB SURROGATE | 10X | HEXANE |
| QQ PCB MATRIX SPIKE | 5X | HEXANE |
| EPH SURROGATE | 5X | CH2CL2 |
| EPH MATRIX SPIKE | 5X | CH2CL2 |
| BNA SURROGATE | 2X | CH2CL2 |
| BN MATRIX SPIKE | 2X | CH2CL2 |
| ACID MARTIX SPIKE | 2X | CH2CL2 |
| BNA FULL LIST SPIKE | 2X | CH2CL2 |
| BNA TCLP SPIKE | 2X | CH2CL2 |
| PEST/PCB SURROGATE | 20X | HEXANE |
| PCB MATRIX SPIKE | 10X | HEXANE |
| PEST MATRIX SPIKE | 20X | HEXANE |
| PEST TCLP SPIKE | 10X | HEXANE |

Property of AMRO Environmental Laboratories Corporation

Attachment 8

DILUTION CHART

| EPH-A / S Dilutions | AMOUNT SAMPLE | AMOUNT CH2CL2 | AMOUNT 5 ALPHA IS | FINAL VOLUME |
|---|---|---|---|---|
| 1X | 300µL | N / A | 3µL | 300µL |
| 2X | 200µL | 200µL | 4µL | 400µL |
| 5X | 100µL | 400µL | 5µL | 500µL |
| 10X | 100µL | 900µL | 10µL | 1000µL |
| 20X | 50µL | 950µL | 10µL | 1000µL |
| 50X | 20µL | 980µL | 10µL | 1000µL |
| 100X | 10µL | 990µL | 10µL | 1000µL |
| 200X | 5µL | 995µL | 10µL | 1000µL |

| EPH-A SIM Dilution | AMOUNT SAMPLE | AMOUNT CH2CL2 | AMOUNT SIM IS | FINAL VOLUME |
|---|---|---|---|---|
| 1X | 300µL | N / A | 3µL | 300µL |

| BNA-A/S Dilutions | AMOUNT SAMPLE | AMOUNT CH2CL2 | AMOUNT BNA IS | FINAL VOLUME |
|---|---|---|---|---|
| 1X | 300µL | N / A | 6µL | 300µL |
| 2X | 200µL | 200µL | 8µL | 400µL |
| 5X | 100µL | 400µL | 10µL | 500µL |
| 10X | 100µL | 900µL | 20µL | 1000µL |
| 20X | 50µL | 950µL | 20µL | 1000µL |
| 50X | 20µL | 980µL | 20µL | 1000µL |
| 100X | 10µL | 990µL | 20µL | 1000µL |
| 200X | 5µL | 995µL | 20µL | 1000µL |

eous S = Soil BNA IS = Semivolatile Internal Standard

# Attachment 9

AMRO Environmental Laboratories Corporation

111 Merrick Street
Merrimack, NH 03054
(603) 424-2022

## FINGERPRINT EXTRACTION WORKSHEET

SOP No./Rev. No.: OL-2003/Rev.5 Matrix: Water
SOP No./Rev. No.: OL-2004/Rev.5 Matrix: Soil

Performed By: _____ Date: _____
Extraction Solvent/ Lot No.: _____ Surr. Amt.: _____
Surrogate /Spike Added Witness: _____ Spike Amt.: _____
Custody Released By: _____ LIMS Batch ID: _____
_____ Received By: _____

| Lab. Sample Number | Sample Volume (ml)/ Sample Weight (g) | Solvent Vol. (ml) | Final Volume (ml) | Comments |
|---|---|---|---|---|
| MB- | | | | |
| LCS- | | | | |
| | | | | |
| | | | | |
|

Environmental
Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

# VOLATILE ORGANICS ANALYSIS

## SW-846 METHOD 8260B

Procedure Number: OL-2001

Revision No.: 12

Revision Date: 12/03/2012

Review Date: N/A

Prepared By: Suzanne Kuan Date: 2/27/13

Approved By: Suzanne Kuan Date: 2/27/13
Organic Manager

Approved By: Mary Schmidt Date: 2/27/13
Laboratory Director

Approved By: Mary Schmidt Date: 2/27/13
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

# TABLE OF CONTENTS


| | | Page |
|---|---|---|
| 1.0 | SCOPE AND APPLICATION | 4 |
| 2.0 | METHOD SUMMARY | 7 |
| 3.0 | DEFINITIONS | 7 |
| 4.0 | SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE | 8 |
| 5.0 | POTENTIAL PROBLEMS AND INTERFERENCES | 11 |
| 6.0 | HEALTH AND SAFETY | 13 |
| 7.0 | INSTRUMENTS AND EQUIPMENT | 14 |
| 8.0 | REAGENTS AND STANDARDS | 14 |
| 9.0 | GC/MS PROCEDURE | 23 |
| | 9.1 Instrument Conditions and Setting | 23 |
| | 9.2 Instrument Demonstration of Capabilities | 24 |
| | 9.3 Tuning | 26 |
| | 9.4 Initial Calibration Procedure | 27 |
| | 9.5 GC/MS Daily Calibration Procedure | 30 |
| 10.0 | SAMPLE PROCEDURE | 32 |
| | 10.1 Preparation of Samples | 32 |
| | 10.2 Analysis of samples | 34 |
| | 10.3 Evaluation of Results | 35 |
| | 10.4 Quantitation of Compounds | 37 |
| 11.0 | INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR | 41 |
| 12.0 | CALCULATIONS | 42 |
| 13.0 | QUALITY CONTROL | 43 |
| 14.0 | DATA REVIEW AND STORAGE | 47 |

## TABLE OF CONTENTS (cont.)

15.0 REFERENCES 50

Attachment 1 Volatile Internal Standards With Corresponding Target 51

Attachment 2 8260 NSI MegaMix 54

## 1.0 SCOPE and APPLICATION

This procedure details the steps taken by AMRO Environmental Laboratories Corporation to produce accurate and reliable results for volatile organic analyses using Method 8260B, Rev. 2 12/96 from the SW-846 Manual.

Method 8260B is used to determine volatile organic compounds in ground and surface water, aqueous sludges, waste solvents, oily wastes, mousses, tars, fibrous wastes, polymeric emulsions, filter cakes, spent carbons, spent catalysts, soils, and sediments.

The following lists of compounds are analyzed by purge and trap GC/MS using a 5mL aliquot of sample:

**TABLE 1**

| CAS. NO. | COMPOUND | WATER REPORTING LIMITS (µg/L) | MEDIUM LEVEL (MeOH) SOILS REPORTING LIMITS (µg/Kg) | LOW LEVEL SOILS REPORTING LIMITS (µg/Kg) |
|---|---|---|---|---|
| 75-71-8 | Dichlorodifluoromethane | 5 | 100 | 5 |
| 74-87-3 | Chloromethane | 3 | 100 | 5 |
| 75-01-4 | Vinyl chloride | 2 | 50 | 5 |
| 75-00-3 | Chloroethane | 5 | 100 | 5 |
| 74-83-9 | Bromomethane | 2 | 100 | 5 |
| 75-69-4 | Trichlorofluoromethane | 2 | 100 | 5 |
| 79209 | Methyl acetate | 5 | 125 | 25 |
| 60297 | Diethyl ether | 5 | 250 | 25 |
| 74-88-4 | Idomethane | 2 | 50 | 5 |
| 67-64-1 | Acetone | 10 | 250 | 20 |
| 75-35-4 | 1,1-Dichloroethene | 1 | 50 | 5 |
| 75-15-0 | Carbon disulfide | 2 | 100 | 5 |
| 75-09-2 | Methylene chloride | 5 | 50 | 25 |
| 107-02-8 | Acrolein | 75 | N/A | N/A |
| 107-13-1 | Acrylonitrile | 10 | N/A | N/A |
| 1634-04-4 | Methyl tert-butyl ether | 2 (1) | 25 | 5 |
| 156-60-5 | trans-1,2-Dichloroethene | 2 | 50 | 5 |
| 75650 | tertiary Butanol | 20 | 2500 | 100 |
| 75-34-4 | 1,1-Dichloroethane | 2 | 50 | 5 |
| 108-20-3 | Diisopropyl ether | 2 | 50 | 5 |
| 109-05-4 | Vinyl acetate | 10 | N/A | N/A |
| 637-92-3 | Ethyl tertiary butyl ether | 2 | 50 | 5 |

| CAS. NO. | COMPOUND | WATER REPORTING LIMITS (µg/L) | MEDIUM LEVEL (MeOH) SOILS REPORTING LIMITS (µg/Kg) | LOW LEVEL SOILS REPORTING LIMITS (µg/Kg) |
|---|---|---|---|---|
| 78-93-3 | 2-Butanone | 10 | 250 | 20 |
| 594-20-7 | 2,2-Dichloropropane | 2 | 50 | 5 |
| 156-59-2 | cis-1,2-Dichloroethene | 2 | 50 | 5 |
| 67-66-3 | Chloroform | 2 | 50 | 5 |
| 74-97-5 | Bromochloromethane | 2 | 50 | 5 |
| 110-82-7 | Cyclohexane | 5 | 100 | 5 |
| 71-55-6 | 1,1,1-Trichloroethane | 2 | 50 | 5 |
| 56-23-5 | Carbon tetrachloride | 2 | 50 | 5 |
| 107-06-2 | 1,2-Dichloroethane | 2 | 50 | 5 |
| 71-43-2 | Benzene | 1 | 25 | 5 |
| 994-05-8 | Tertiary amyl methyl ether | 2 | 50 | 5 |
| 109999 | Tetrahydrofuran | 10 | 250 | 20 |
| 79-01-6 | Trichlororethene | 2 | 50 | 5 |
| 108872 | Methyl Cyclohexane | 2 | 50 | 5 |
| 78-87-5 | 1,2-Dichloropropane | 2 | 50 | 5 |
| 75-27-4 | Bromodichloromethane | 2 | 50 | 5 |
| 123-91-1 | 1,4-Dioxane | 50 | 2500 | 50 |
| 74-95-3 | Dibromomethane | 2 | 50 | 5 |
| 108-10-1 | 4-Methyl-2-pentanone | 10 | 250 | 20 |
| 10061-01-5 | cis-1,3-Dichloropropene | 1 | 50 | 5 |
| 108-88-3 | Toluene | 2 (1) | 25 | 5 |
| 10061-02-6 | trans-1,3-Dichloropropene | 2 | 50 | 5 |
| 79-00-5 | 1,1,2-Trichloroethane | 2 | 50 | 5 |
| 106-93-4 | 1,2-Dibromoethane | 2 | 50 | 5 |
| 110-75-8 | 2-Chloroethyl-vinyl-ether | 10 | N/A | N/A |
| 591-78-6 | 2-Hexanone | 10 | 250 | 20 |
| 142-28-9 | 1,3-Dichloropropane | 2 | 50 | 5 |
| 127-18-4 | Tetrachloroethene | 2 | 50 | 5 |
| 124-48-1 | Dibromochloromethane | 2 | 50 | 5 |
| 108-90-7 | Chlorobenzene | 2 | 25 | 5 |
| 630-20-6 | 1,1,1,2-Tetrachloroethane | 2 | 50 | 5 |
| 100-41-4 | Ethylbenzene | 2 (1) | 25 | 5 |
| 108-38-3 | m-Xylene | 2 (1) | 25 | 5 |
| 106-42-3 | p-Xylene | 2 (1) | 25 | 5 |
| 95-47-6 | o-Xylene | 2 (1) | 25 | 5 |
| 100-42-5 | Styrene | 2 | 50 | 5 |
| 75-25-2 | Bromoform | 2 | 50 | 5 |

| CAS. NO. | COMPOUND | WATER REPORTING LIMITS (µg/L) | MEDIUM LEVEL (MeOH) SOILS REPORTING LIMITS (µg/Kg) | LOW LEVEL SOILS REPORTING LIMITS (µg/Kg) |
|---|---|---|---|---|
| 98-82-8 | Isopropylbenzene | 2 (1) | 25 | 5 |
| 79-34-5 | 1,1,2,2-Tetrachloroethane | 2 | 50 | 5 |
| 96-18-4 | 1,2,3-Trichloropropane | 2 | 50 | 5 |
| 108-86-1 | Bromobenzene | 2 | 50 | 5 |
| 103-65-1 | n-Propylbenzene | 2 | 25 | 5 |
| 95-49-8 | 2-Chlorotoluene | 2 | 50 | 5 |
| 106-43-4 | 4-Chlorotoluene | 2 | 50 | 5 |
| 108-67-8 | 1,3,5-Trimethylbenzene | 2 (1) | 25 | 5 |
| 98-06-6 | tert-Butylbenzene | 2 (1) | 25 | 5 |
| 95-63-6 | 1,2,4-Trimethylbenzene | 2 (1) | 25 | 5 |
| 135-98-8 | sec-Butylbenzene | 2 (1) | 25 | 5 |
| 99-87-6 | 4-Isopropyltoluene | 2 (1) | 25 | 5 |
| 541-73-1 | 1,3-Dichlorobenzene | 2 | 25 | 5 |
| 106-46-7 | 1,4-Dichlorobenzene | 2 | 25 | 5 |
| 104-51-8 | n-Butylbenzene | 2 (1) | 25 | 5 |
| 95-50-1 | 1,2-Dichlorobenzene | 2 | 25 | 5 |
| 96-12-8 | 1,2-Dibromo-3-chloropropane | 5 | 125 | 5 |
| 120-82-1 | 1,2,4-Trichlorobenzene | 2 | 25 | 5 |
| 87-68-3 | Hexachlorobutadiene | 2 | 50 | 5 |
| 91-20-3 | Naphthalene | 5 (2) | 50 | 5 |
| 87-61-6 | 1,2,3-Trichlorobenzene | 2 | 50 | 5 |
| 110-57-6 | Trans-1,4-dichloro-2-butene | 5 | 50 | 5 |

* (Reporting Limit for 8260Aromatics)

## 2.0 METHOD SUMMARY

2.1 Samples are introduced to the GC/MS System by directly placing the VOA vials into the autosampler tray. Standards are prepared in volumetrics and transferred to 40mL VOA vials. The autosampler syringe delivers 5mL to the purging chamber along with the internal standards and surrogates (the autosampler is equipped with a syringe or vial, which the operator fills with the internal standard and surrogate mix for waters and internal standard mix for soils). Also, a 40mL VOA vial containing Bromofluorobenzne (BFB) at a concentration of 50ng/5mL is placed on the tray for tuning (no SS is added).

2.2 Helium purges through the chamber and the volatile analytes are absorbed on the trap, a tube containing an OV-1/Tenax/Silica Gel/Charcoal mixture. After purging is complete, the trap is heated and backflushed with helium to desorb the compounds. The analytes are carried along a heated transfer line to the GC inlet, where the glass liner meets the narrow bore capillary column. At this point the analytes are heated, mixed and split. The column is temperature programmed to separate the analytes and is interfaced by a Mass Spectrometer for detection.

2.3 Identification of target analytes is accomplished by comparing their mass spectra with that of standards. Quantitation is done by comparing the response of a major ion relative to that of an internal standard using from 8 to 10 point calibration curve.

2.4 The GC/MS operators should be thoroughly trained and skilled in the use of purge and trap GC/MS before being authorized to analyze and report sample results independently. All analysts shall complete Qualification Card for SW-846 Method 8260B.

2.5 Method Modification – The compounds listed above include the 8260 compounds. AMRO has demonstrated that the additional analytes are achievable through initial demonstration of capability.

## 3.0 DEFINITIONS

3.1 **Method Blank:** An aliquot of reagent water, which is carried through the entire analytical procedure with the samples, its purpose is to determine whether contamination is present during the analysis. A method blank is analyzed 1 for every analytical batch of samples.

3.2 **Laboratory Control Sample:** An aliquot of reagent water which known quantities of the method analyte are added in the laboratory. The LCS is analyzed exactly like a sample, and its purpose is to determine the degree to

which the analytical result approaches the "true value" of the concentration of the analyte being determined. The percentage recovery is calculated in order to assess the efficiency of the analysis.
One (1) LCS is analyzed for every analytical batch of samples. An LCSD is analyzed for MCP projects.

3.3 **Sample Duplicate:** A duplicate is analyzed for every 20 samples in the form of a Matrix Spike/Matrix Spike Duplicate to verify the method precision.

3.4 **Matrix Spike:** A specific aliquot of sample into which a known amount of analyte is added. The analytical spike is analyzed with the sample batch and the percent recovery is calculated in order to assess the matrix effect on the analytical system.

## 4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 All samples must be iced or refrigerated at 4°C ± 2°C from the time of collection until analysis.

4.2 **Aqueous** sample collection is done by our clients using 40mL pre-washed and pre- preserved glass vials. The sampler is instructed to fill the vial so it is completely full to the point of a positive meniscus but not overflowing without any air bubbles. A Teflon-sealed cap is then screwed tight onto the vial. The vial is inverted to insure that there are no air bubbles. A duplicate sampling is always done so that another vial of the same sample is available for analysis in case one of the following occurs:

A. The sample dilution has to be made.
B. There's an air bubble in the vial
C. The vial is broken in transport.

4.3 All aqueous samples **must** be analyzed within 14 days of collection and **should** be field preserved with 1:1 HCl to a pH<2.

4.4 All aqueous samples are pH checked **after** analysis. Paper pH strips are used to determine the pH of the sample by dipping the paper strip into the sample VOA vial and comparing it to the color chart on the front of the pH strip container. The pH results are documented in the injection run logs for each sample. All samples analyzed that have a pH of > 2 must be analyzed within **7 days of collection**. If this unpreserved holding time is exceeded, the data is to be flagged and this information is included on the final report. Samples analyzed using SW-846 Method 8260B may be unpreserved if reactive compounds are suspected to be present. If all the sample vials have a pH<2, the holding time is **14 days**.

4.5 If samples are suspected to contain Residual Chlorine, the samplers are sent 125ml bottles with 10 drops of a 10% Sodium Thiosulfate solution. The samples are collected in the 125ml bottles and then poured into VOA vials preserved with HCL.

All wastewater and drinking water samples are checked after analysis for residual chlorine with chlorine test strips. The results are recorded on the injection log with a - , for none detected, and a + for a positive reading. Any positive would cause the data to be flagged.

4.6 Sample Compositing Procedure: The following method is used upon client request to prepare a composite of wastewater volatile samples for analysis:

4.6.1 Check the chain-of-custody to determine if the flow rates are equal or unequal.
4.6.2 The sample vials are stored in the refrigerator banded together.
4.6.3 If flows are ***equal***, pour the entire contents of all the VOA vials that need to be composited into an appropriate size Erlenmeyer flask (250 or 500 mL).
4.6.4 Swirl the flask **gently** so as not to release the volatile compounds of the samples.

4.6.5 **Gently** pour the sample back into vials and tightly screw on Teflon-lined septa caps.
4.6.6 Label the vials with the appropriate project number and sample ID (comp).
4.6.7 Always prepare at least two vials of a composite.
4.6.8 If flow rates are ***unequal***, the client provides the amounts of sample needed of each sample vial to prepare the composite.
4.6.9 Using a graduated cylinder or gas-tight syringes, measure out the exact amount needed from each sample portion and gently pour into an Erlenmeyer flask.

4.7 Continue by following procedure steps 4.6.4 through 4.6.7.

4.8 Compositing of aqueous samples other than wastewater must be analyzed separately and the results averaged.

4.9 Store samples at 4°C until needed for analysis.

4.10 8260/5035 and VPH Methanol Soil Sample Preparation:

10mL of purge and trap grade methanol is measured out into VOA vials, weighed, recorded and sent out for sample collection. The VOA vials are returned with about 10g of soil in each sample vial. The VOA vials are

reweighed to determine sample weight and spiked with 20ul of the VOA surrogate spike mix at 1,250 ng/ul. One methanol vial is sent out as a trip blank with each project.

4.11 Methanol Soil Collection for the State of New Jersey:

4.11.1 25 mL of purge and trap methanol are measured into VOA vials, spiked with 25µL of VOA surrogate spike mix at a concentration of 2,500ng/µL, and sent out for sample collection. One is sent as methanol trip blank. The VOA vials are returned with approximately 10g of soil in each sample vial.

4.12 EnCore Sampler Procedure:

EnCore samplers containing soil samples have a 48 hour holding time. When EnCore samplers are received from the field, two sodium bisulfate vials, or two Voa water vials if they will be frozen, and one methanol vial are prepared. Using the EnCore Extrusion tool, remove the soil from each EnCore sampler and place into a vial prepared with sodium bisulfate. Repeat the procedure for another prepared sodium bisulfate vial. Remove a soil aliquot from another EnCore sampler and place into a prepared methanol vial. These vials are used for extraction and analysis. The 14-day hold time for soil samples begins at the time of collection, not the time of preservation.

4.13 Methanol Vials: 10mL of purge and trap grade methanol is measured out into VOA vials, spiked with 20µL of a VOA surrogate mix at 1,250 ng/µL, weighed and recorded in the EnCore soil prep log.

4.14 Sodium Bisulfate Vials: 5mL of VOA reagent water and 1.0g of sodium bisulfate is added to a VOA vial, weighed and recorded into the Sodium Bisulfate preparation logbook. One NaHSO4 vial is sent out as a trip blank with each project.

4.15 Soil samples may be collected in a VOA vial and either frozen on site (14 days holding time) or sent to the lab where they must be either frozen or preserved in methanol within 48 hours. The holding time is 14 days from sample collection.

4.16 Soil samples for low soil analysis may also be collected in VOA vials and frozen on site, with or without voa reagent water or 20% NaHSO4 solution. Samples frozen without the 20% NaHSO4 solution must be analyzed within 48 hours of thawing unless preserved with 20% NaHSO4 solution.The holding time is 14 days from sample collection.

4.17 Soil samples received for low soil analysis which are not preserved by 20% NaHSO4 solution or frozen on site must be analysed within 48 hours or preserved by freezing.

## 5.0 POTENTIAL PROBLEMS AND INTERFERENCES

It is important to be able to demonstrate that analytical results are not biased by laboratory contamination. The GC/MS operator is responsible for taking the following precautions.

5.1 GLASSWARE and SYRINGES:

1.1.1 All glassware and syringes used in the preparation of volatile organic standards or samples are thoroughly cleaned before each use.

1.1.2 Syringes for transferring methanol based standards are rinsed with methanol a minimum of three times before each use. Syringes for samples and aqueous standards are rinsed with methanol and then three times with distilled volatile-free water before each use.

1.1.3 Volumetric flasks and other glassware used in the preparation of samples or standards are rinsed with methanol and then three times with distilled water for aqueous based samples and standards or three times with methanol for methanol standards.

5.2 PURGE and TRAP UNITS Tekmar LSC 2000,Tekmar LSC 3000

The Purge and trap unit can be a source of contamination in volatile organic samples.

To minimize the possibility of this occurring, the following steps are taken.

5.2.1 The Tekmar LSC 2000, 3000 and autosampler automatically drains the sample out after purging and bakes out the trap at 225°C for 8 minutes while purging helium through the purging chamber. The autosampler rinses its syringe with distilled water and also flushes the purge lines and purge chamber twice during the bake cycle.

5.2.2 The sample analyses are examined before running the instrument the next day. If a sample contains high amounts of analytes, the next sample is examined to see if it contains any of the analytes. If there is any possibility of analytes carrying

over from the previous sample, the sample(s) following are re-analyzed.

5.2.3 Method blanks are analyzed daily and must meet acceptance criteria, analytes other than common laboratory contaminants should be less than ½ the RL, before samples are analyzed..

5.2.4 Occasionally, the purging chamber is cleaned with soap and water, or solvents and then rinsed.

## 5.3 CONTAMINATION FROM OTHER SOURCES:

5.3.1 Special precautions are taken for Methylene Chloride and Acetone contamination. The analytical and sample storage area is isolated from the extraction lab. All carrier gas lines and purge gas plumbing are made of copper or stainless steel tubing. The volatile lab is isolated in a separate room. Occasionally Methylene Chloride will show up in water blanks or methanol blanks, rarely above 5ppb. All data must be flagged if the level of Methylene Chloride exceeds the reporting level.

5.3.2 Trip blanks are analyzed with samples to check for contamination. Trip blanks are provided by AMRO and if returned by the client they are always analyzed to check for contamination by diffusion of volatile organics through the septum seal of the sample container into the sample during shipment and storage.

5.3.3 Volatile organic sampling vials may be contaminated. Vials supplied by AMRO have been purchased pre-cleaned from a reputable supplier that uses the EPA protocol to clean their vials. AMRO policy does not allow re-use of volatile organic sampling vials.

## 5.4 MATRIX INTERFERENCE

5.4.1 Sometimes, when a sample is analyzed, it foams, or contains compounds that interfere with the internal standards or surrogates. Such a sample is not re-analyzed due to potential harm to the instruments. It is considered to be due to matrix interference and the data is flagged and listed in the case narrative. A copy of the chromatogram may be sent to the client.

## 6.0 HEALTH AND SAFETY

6.1 AMRO has a laboratory safety program in place that applies to all employees. There is a safety officer as well as employees with 40 hours of OSHA training. The air quality of the laboratory has been monitored and employees are sent for physicals. All employees receive fire and safety training upon employment.

6.2 Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place.

6.3 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean laboratory coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.4 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eyewash stations and an emergency shower.

6.5 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.7 Waste control – AMRO takes whatever steps possible to minimize waste. This includes volume reduction where appropriate. AMRO also properly segregates wastes according to contaminants and a commercial vendor is utilized for waste disposal.

## 7.0 INSTRUMENTS AND EQUIPMENT

7.1 SW-846 Method 8260B is performed on Hewlett Packard 5890 and 6890 Gas Chromatographs with 5971 and 5972 Mass Selective Detectors. They are equipped with purge and trap units, auto samplers, and data systems with the following software: Hewlett Packard DOS Chemstation for data acquisition, and Enviroquant for data processing, including the NBS 54K Library or NIST 74K Library of Mass Spectra. Columns used for each instrument are listed in section 9.1.

7.2 Edwards Vacuum Pump

7.3 Balance: Analytical 0.0001g

7.4 Gas Tight Syringes: 10, 25, 50, 100, 250, 500, 1,000uL, 5, 10, or 25 mL with manufacturer tolerances of ±1%.

7.5 Class A volumetric flasks: 1, 2, 5, 10, 25, 50, 100, 250, 500, &1,000mL

7.6 Stainless steel spatulas.

7.7 Glass disposable pipets.

7.8 Pre-cleaned 40mL VOA vials with Teflon Septum and screw caps.

## 8.0 REAGENTS AND STANDARDS

8.1 AMRO VOA reagent water – Reverse Osmosis/Granular Activated Carbon (RO/GAC) Water from a Culligan System. Method Blanks are used to monitor contaminant levels of volatile analytes. Reagent water is used for making up daily standards, dilutions, water blanks, and rinsing flasks and syringes.

8.2 Methanol, purge and trap grade, from Fisher Scientific or Burdick and Jackson is used for making up standards and rinsing syringes.

8.3 1:1 Hydrochloric Acid (HCl) for preservation.

8.4 Sodium Thiosulfate (ACS) Granular – purchased from Fisher Scientific. Refer to sample receipt SOP for more information.

8.5 Sodium Bisulfate (ACS) Granular from Fisher Scientific.

8.6 Stock solutions of standards

8.7 Both stock and working standards in methanol are stored in the freezer. Daily standards are made up in water, stored without headspace, and are discarded after each day of use.

8.8 Occasionally, clients may ask for additional compounds, which may be purchased and analyzed to provide a semi-**quantitative result that would be considered estimated.** Complete method start-up and initial demonstration of proficiency is required for all new analytes reported without qualifiers.

8.9 Good laboratory procedure for making up standards is as follows:

8.9.1 All syringes and volumetric flasks are rinsed three times with methanol.

8.9.2 Syringe needles are wiped with Kimwipes and air dried by pumping the plunger up and down several times

8.9.3 The volumetric flask is filled with methanol as high as possible, leaving room for the addition of the standard.

8.9.4 The standard is drawn up in the syringe above the desired level, inverted to allow any air bubble to rise to the needle, and the plunger is pushed to the correct amount.

8.9.5 The needle is wiped with a Kimwipe and the needle is placed into the flask, preferably under the methanol and the plunger is pushed down gently to avoid purging.

8.9.6 If the needle can not reach the methanol, even with tilting the flask, then it should be eluted slowly down the side of the glass.

8.10 Initial and CCV calibration stock standards: Used within six months after ampule opening unless otherwise indicated:

8.10.1 Refer to Attachment 1. NSI MegaMix obtained from NSI at 2,000µg/mL in Methanol.

8.10.2 VOC MIX #6 obtained from Supelco at concentration 2,000µg/mL is used for calibration. Ampule used weekly.

8.10.3 8260 Ketone Mix obtained from ECS at 2,000µg/mL containing Acetone, 2-Butanone, 2-Hexanone, 4-Methyl-2-pentanone (µg/mL)

8.10.4 8260 Add-ons Mix obtained from ECS at 2,000 ug/mL containing Carbon Disulfide, Vinyl Acetate, Iodomethane and Methyl-tert-butyl ether (MTBE).

8.10.5 New Hampshire Oxgenates Mix from ECS at 2,000 ug/mL containing Ethyl tertiary butyl ether, Diisopropyl ether, Tertiary amyl methyl ether, and at 20,000 ug/mL, tertiary Butanol.

8.10.6 Acrolein obtained from Restek 20,000 µg/mL used for calibration.

8.10.7 1,4-Dioxane obtained from Restek 20.000 ug/ml used for calibration.

8.11 Stock Quality Control check standards (used for LCS): Used within **six months** after ampule opening unless otherwise indicated.

8.12 CAL MIX 2000 obtained from Restek at 2,000µg/mL.

8.13

8.14 CAL MIX #1 obtained from Restek, concentration 2,000µg/mL. Used from calibration verification. Good for one month after opening.

8.15

Restek Custom VOA Mix #1: Used for Calibration

| Compound | Concentration (µg/mL) |
|---|---|
| Acetone | 2,000 |
| 2-Butanone | 2,000 |
| 2-Hexanone | 2,000 |
| 4-Methyl-2-Pentanone | 2,000 |
| Methyl-tert-butyl-ether | 2,000 |
| Tetrahydrofuran | 2,000 |
| Diethyl ether | 2,000 |

Restek Custom VOA Mix #2: Used for Calibration

| Compound | Concentration (µg/mL) |
|---|---|
| Carbon Disulfide | 2,000 |
| 1,1,2-Trichlorotrifluoroethane | 2,000 |
| Dichlorofluoromethane | 2,000 |
| Methylmethacrylate | 2,000 |
| 2-Chloroethylvinyl ether | 2,000 |
| Acrylonitrile | 2,000 |
| Iodomethane | 2,000 |

Restek Custom Oxygenates Standard: Used for Calibration

| Compound | Concentration (µg/mL) |
|---|---|
| Diisopropyl ether | 2,000 |
| Tertiary amyl methyl ether | 2,000 |
| Tertiary Butanol | 20,000 |
| Ethyl tertiary butyl ether | 2,000 |

8260 Add Ons Mix #3 from ECS at 2,000ug/ml containing methyl acetate, cyclohexane, methyl cyclohexane, and freon(113).

Vinyl Acetate is obtained from Restek at 2,000ug/mL.

Trans-1,4-Dichloro-2-butene is obtained from Restek at 2000ug/mL.

1,3,5 Trichlorobenzene is obtained from Chem Service at 99.5% purity. A primary stock solution is prepared by dissolving 0.1343g in 10mLs of Methanol. 745ul of the primary stock solution is diluted to 5mLs of Methanol to produce a stock stock of 2000ng/uL.

8.16 1,4-Dioxane is obtained from Supelco at 2,000 ug/mL.

8.17 8260A Internal Standard obtained from Restek, contains Fluorobenzene, Chlorobenzene-d5, 1,4 Dichlorobenzene-d4 at 2,500 ng/µL.

8.18 8260A surrogate solution is obtained from Restek and contains 1,2-Dichloroethane-d4, Toluene-d8, p-Bromofluorobenzene, Dibromofluoromethane at 2,500 ng/µL.

8.21 4-Bromofluorobenzene (BFB) obtained from Supelco at concentration 2,000 ng/µL used to tune instruments. Used within three months.

8.22 Working standards - **good for one week** unless otherwise indicated. When calibrating the system, a new standard is always used. The daily CCV, which is used to check the initial calibration, may be used until it fails to pass criteria.

8.22.1 Initial and daily calibration working standards mix. Combine the following stock mixes into one 5mL volumetric flask and transfer to a 5mL vial with a septum cap. Store in the freezer at all times.

8.22.1.1 NSI MegaMix – 250 µL of Stock to 5 mL final volume with Methanol for a final concentration of 100 ng/µL.

8.22.1.2 VOC mix #6: 250uL of stock to 5 mL in methanol, final concentration.100ng/µL.

8.22.1.3 8260 Add Ons Mix – 250 µL of Stock to 5 mL final volume with Methanol for a final concentration of 100 ng/µL.

8.22.1.4 8260 Ketones Mix – 250 µL Stock to 5 mL final volume with Methanol for a final concentration of 100 ng/µL.

8.22.1.5 NH Oxygenates Mix—250uL Stock to 5 mL final volume with Methanol for a final concentration of 100 ng/µL.

8.22.1.6 Acrolein – 250 µL of stock to 5mL final volume in methanol for a final concentration of 1000 ng/µL.

8.22.1.7 1,4-Dioxane-100uL of Stock to 5mL final volume with Methanol for a final concentration of 500 ng/uL

8.23 Quality control check standards (LCS)– good three months unless otherwise specified.

8.23.1 CAL Mix #1: 25uL of stock Cal Mix #1 to 5mL final volume in Methanol for a final concentration of 10ng/µL. Good one week.

8.23.2 CAL Mix – consists of the following:

8.23.2.1 CAL MIX 2000 – 125 uL of Stock to 25mL final volume with Methanol for a final concentration of 10 ng/µL.

8.23.2.2 Custom std mix #1 - 125uL stock to 25mL final volume in methanol for a final concentration of 10ng/µL.

8.23.2.3 Custom std mix #2 – 125µL of Stock to 25mL final volume with Methanol for a final concentration of 10ng/µL.

8.23.2.4 Custom Oxygenates Mix – 125µL of Stock to 25mL final volume with Methanol for a final concentration of 10ng/uL.

8.23.2.5 8260 Add Ons Mix #3- 125uL of Stock to 25mL final volume with Methanol for a final concentration of 10ng/uL.

8.23.2.6 1,4-Dioxane- 625uL of Stock to 25mL final volume with Methanol for a final concentration of 50ng/uL.

8.23.7 Trans-1,4-dichloro-2-butene – 125uL of Stock to 25mL final volume with Methanol for a final concentration of 10ng/uL.

8.23.8 1,3,5-Trichlorobenzene – 125uL of Stock to 25mL final volume with Methanol for a final concentration of 10ng/uL.

8.24 IS/Surrogate solution

8.24.1 Instrument V1a
120 µL of 8260 IS Mix and 8260 SS mix to 10 mL in methanol. Final concentration 30ng/µL.

Instrument V2
400uL of 8260 IS Mix to 10 mL in methanol. Final concentration 100ng/µL.

Instrument V3
400uL of 8260 IS Mix and 8260 SS Mix to 10 mL in methanol. Final concentration 100ng/µL.

8.26 BFB

8.26.1 125µL stock to 10 mL in methanol, final concentration 25ng/µL.

8.27 Surrogate soil spiking solution

8.27.1 2.5mL of Restek 8260A surrogate stock solution into 5mL of methanol, for a final concentration of 1,250µg/mL

8.28. Daily Standards are made up daily in VOA reagent water. All standards for extracted soil calibration or calibration verification are made in reagent water with 4% methanol added. Surrogates and Internal Standards are added by the autosampler for all water and low level soil standards.

8.29.1 Initial calibration standards:

8.29.1.1 0.5, 1, 2, 5, 10, and 25µL of the combined working solution, plus 40uL of the surrogate calibration working solution when calibrating for soils, into 100mL of reagent water to prepare the 0.5, 1, 2, 5, 10, and 25µg/L aqueous and soil standards, respectively. To prepare the 50, 100, 200, and 300 µg/L aqueous standards, add 25, 50, 100, and 150µL of the combined working solution, plus 15, 10, 5, and 2µL respectively of the surrogate calibration working solution when calibrating for soils, into 50mL of reagent water. For low soils; 5mls of 5, 10, 25, 50, 100, 200, and 300ug/L standard is transferred to VOA vial containing 5g of sand. Lowest level standard for specific compounds are listed below:

| COMPOUND | LOWEST CONC. STD (UG/L) WATER | LOWEST CONC. STD (UG/L) LOW LEVEL SOIL | LOWEST CONC. STD (UG/L) MED. LEVEL SOIL |
|---|---|---|---|
| Dichlorodifluoromethane | 1 | 5 | 1 |
| Chloromethane | 1 | 5 | 1 |
| Chloroethane | 1 | 5 | 1 |
| Bromomethane | 1 | 5 | 1 |
| Dichlorofluoromethane | 1 | 5 | 1 |
| Trichlorofluoromethane | 1 | 5 | 1 |
| Freon –113 | 2 | 5 | 1 |
| Diethyl Ether | 1 | 5 | 1 |
| Acetone | 5 | 10 | 2 |
| Carbon Disulfide | 1 | 5 | 1 |
| Methylene Chloride | 1 | 10 | 1 |
| Tertiary Butanol | 20 | 50 | 20 |
| Diisopropyl ether | 1 | 5 | 1 |
| Butanone | 5 | 10 | 2 |
| Tetrahydrofuran | 2 | 10 | 2 |
| 1,4-Dioxane | 25 | 25 | 25 |
| 4-Methyl-2-Pentanon | 2 | 10 | 2 |
| 2-Hexanone | 2 | 10 | 2 |
| Bromoform | 1 | 5 | 1 |
| 1,2-Dibromo-3-chloropropane | 2 | 5 | 2 |
| Hexachlorobutadiene | 1 | 5 | 1 |
| m,p-Xylene | 1 | 4 | 1 |
| Vinyl acetate | 5 | 10 | 5 |
| Acrolein | 50 | NA | NA |
| Acrylonitrile | 2 | 10 | 2 |

8.30.1 Daily calibration verification standards

8.30.1.1 LCS: 100µL Cal Mix solutions to 50 mL DI, and Cal Mix #1, 100 µL to 50 mL DI, for a final concentration 20µg/L.

8.30.1.2 BFB: 40µL working standard solution to 100 mL DI, final concentration 10ng/mL.

8.31 Tracking of Analytical Standards

8.31.1 Chemical Receipt

The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a five digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and the disposal dates are completed by AMRO employees when standards are used up or disposed.

8.31.2 Standards Preparation

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

8.31.2.1 AMRO purchases pesticide residue grade solvents and purge and trap grade Methanol for organic standard preparation and organic sample extractions.

8.31.2.2 ACS reagent grade chemicals are used when the method warrants.

8.31.2.3 Any stock standards that are purchased are accompanied by a certificate of analysis from the manufacturer.

8.31.2.4 Class A volumetric glassware is used to prepare standards.

8.32 Standard Tracking

It is important to be able to track all analytical standards back to their sources. The following procedure is used by AMRO personnel to accomplish this goal:

All chemicals that are received are logged into the Chemical Receiving Logbook, which assigns a number prefixed with the letter "A". The lot number, manufacturer, expiration date, and date received are also recorded. The Certificates of Analysis have the "A"number on them as well as the ampules or bottles, etc. Identical

Property of AMRO Environmental Laboratories Corporation

ampules are further identified by using numbers ( 1, 2, 3, etc.). The Amro number is recorded in the various logbooks whenever these chemicals are used.

Organic Standard Tracking

8.32. Working Section - Whenever a working standard solution opened or is prepared, whether from AMRO stocks or commercially obtained stocks, the information is recorded in the Working Standard section of the standard tracking log. The solution is assigned a new ID number based on the date it is prepared plus a letter suffix. This number along with a descriptive name, concentration (or conc. varied) and the initials of the person preparing the solution are included on the label. Standards should be used in accordance with method specifications and manufacturer's instructions.

8.33 Standard Storage - Standards and reagents are stored per method specifications and manufacturer's instructions. Volatile standards are stored in a freezer at minus 10°C to 20°C.

8.34 Solvent Check Analysis

All extraction procedures are performed using pesticide residue grade solvents and a method or procedural blank analysis is performed when a new lot number is received to verify the absence of target analytes.

## 9.0 GC/MS PROCEDURE

9.1 Instrument Conditions and Settings

9.1.1 GC/MS (V-1A): HP-624 20 m x 0.18 mm ID column 35 ° C for 5 min., 8 ° C/min to 195 ° C, hold for 3 min. for a total of 28 min. analyzed time Tekmar LSC 3000 purge and trap Centurion Autosampler Supelco Trap E

9.1.2 GC/MS (V-2): HP-624 25m x 0.2mm ID column 35 ° C for 5 min., 8 ° C/min to 195 ° C, hold for 3min. for a total of 28 min. analyzed time

Tekmar LSC 2000 purge and trap Dynatech Archon w/s autosampler.
Supelco Trap E

9.1.3 GC/MS (V-3): HP-624 25m x 0.2mm ID column 35°C for 5 min., 8°C/min to 195°C, hold for 3 min. for a total of 28 mins analyzed time
Tekmar LSC 3000 purge and trap Dynatech Archon w/s autosampler. Trap E

9.1.4 V1A and V3 have Water Management Systems with a 150°C Bake, 100°C Purge and 50°C Desorb.

9.1.5 Settings:

| | |
|---|---|
| Purge gas - helium grade 99.995 | Desorb Flow - 30 mL/min |
| Purge time - 11 minutes | Desorb Time - 4 min at 200°C |
| Purge flow - 30-40 mL/min | Bake Time - 8 min at 225°C |

Tekmar valve and transfer line temp - 105°C
Injection port temp - 225°C
Detector temp - 160-180°C
Transfer line temp - 280°C
Split Ratio 30:1

Purge temp. – ambient for all Dynatrap/Tekmar 2000 AS. 40°C for all low level soils.

V-1 has an Electronic Pressure Control – constant flow 0.5 mL/min.

9.2 Initial Demonstration of Capabilities

It is important to be able to demonstrate that all sample analyses were performed in an 'in-control' manner. It is the responsibility of the GC/MS operator to perform the following procedures prior to sample analysis.

9.2.1 Initial Demonstration of Lab Performance

The ability of AMRO to produce accurate and precise data is demonstrated per instrument/per analyst for each method. This information was entered on an Excel® spreadsheet and is kept on file with the QC department along with the associated chromatograms and quantitation output pages. It consists of an Initial Calibration (IC) for all target analytes, Initial Calibration Verification (ICV) for all target analytes, a Method Detection

Limit Study (MDL) and Precision and Accuracy Study (P&A) for each analyte, each instrument and each matrix .

9.2.2 MDL

The method detection limit is defined in 40 CFR 136 Appendix B. The MDL is determined initially by the analysis of a minimum of seven replicate samples, all containing an analyte(s) of the same low-level concentration. These replicate samples are put through all the preparation steps that a sample is put through. The standard deviation of the results of these analyses are multiplied by the appropriate student T-test value and the resulting value is deemed the method detection limit for that specific analyte.

MDL studies of each analyte must be reported initially for each instrument, column, matrix, and extraction method. To ensure that reasonable MDL values are determined, an MDL check sample is analyzed by spiking an interference free matrix with all target analytes at about two times the determined MDL. The MDL check sample is taken through the same process as the MDL. If any of the target analytes are not detected, the MDL study is modified and repeated until the MDL check sample is detectable. The MDL check will be analyzed quarterly and/or after major instrument maintenance or changes in the instrumentation or instrumental conditions to verify sensitivity of the method.

LOQ/LOD

The LOD (limit of detection) is an estimate of the lowest amount of an analyte that can be detected. This estimate would be derived from MDL studies and calibration curves (the low-level standards).

To determine the LOQ (limit of quantation), low level standards are prepped and analyzed. The level should be at one to two times the reporting limit. The percent recoveries are calculated and criteria established for expected recoveries. For 8260 analysis, a standard at 2ppb and 10ppb are analzyed. The 10ppb standard will be used for determining the recoveries of analytes with reporting limits of 5 or 10ppb. The 2ppb standard can be used for determining the recoveries of analytes with a reporting limit of 1 or 2ppb. To start, the criteria will be 70-130%, with 10% allowed at 60-140%. The LOQ studies should be done annually.

Property of AMRO Environmental Laboratories Corporation

9.2.3 Precision &Accuracy

Accuracy is a measure of the degree to which the analytical result approaches the "true" value of the concentration of the analyte being determined. Precision in the laboratory is determined by the comparison of duplicates, where duplicate samples result from an original sample that has been split for identical analyses. Precision and Accuracy in the laboratory is assessed initially by the analyses of a minimum of 4 replicate samples at a mid-level point of the expected range. The percent recoveries and Relative Standard Deviations (RSD) are evaluated and compared to method specifications or default limits where applicable.

The regular analysis of known standards such as the Laboratory Control Samples (LCS), and matrix and analytical spikes also assess accuracy. Accuracy within the laboratory is expressed in terms of percent recovery.

The precision of data is regularly evaluated by determining the relative percent difference (RPD) of duplicate (replicate) analyses.

9.3 Tuning

The mass spectrometer must be verified to be in tune, has adequate sensitivity, is standardizing for the compounds of interest, and is demonstrating that the system is free of interferences. Calibration begins with the analysis of Bromofluorobenzene (BFB). This performance test must be passed before any samples, blanks, or standards are analyzed. The calibration is good for 12 hrs from the injection time of the BFB for 8260B.

9.3.1 **Tuning** - 50 ng of BFB (40 µL of a 25ng/µL solution) is added to 100 mL of VOA free water. 5 mL is purged for 11 minutes and desorbed onto the chromatographic column. The analysis is performed at 100°C to 150°C. A scan delay of two to five minutes is used. After the scan delay, data is acquired for five to ten minutes. The expected elution time of the BFB is six to eight minutes from the start of data acquisition. The background corrected average of three scans at the apex or of the entire peak of the peak is checked against the tuning requirements in Table 1. One simple subtraction of background is required within twenty scans of the left side of the peak. Also an average or a single scan is acceptable. There is a procedure file program in the software that will locate and check the BFB for a passing spectrum in the manner explained above. This procedure will be used routinely to eliminate any subjectivity from the tuning process. If this procedure fails to produce ion abundances that meet the criteria, it will display the message "no passing

spectrum found in data file: xxxxx" on the printer. If this occurs the BFB must be re-analyzed. If repeated analyses fail to produce acceptable results, then the instrument must be manually tuned according to the Hewlett-Packard reference manual, if the tune does not meet criteria. Once an acceptable tune is obtained, the following items are documented in the analyzed log:

9.3.1.1 The scan number(s) of the good tune and background corrections used to achieve it.

9.3.1.2 The time of injection.

9.3.1.3 Once a good spectrum is found a hardcopy of the following information is filed in the daily calibration file.

9.3.1.4 The following is the BFB tune criteria:

**Table 2**
**BFB Mass - Intensity Specifications**

| Mass | Intensity Required (relative abundance) |
|---|---|
| 50 | 15 to 40% of Mass 95 |
| 75 | 30 to 60% of Mass 95 |
| 95 | Base peak, 100% relative abundance |
| 96 | 5 to 9% of Mass 95 |
| 173 | Less than 2% of Mass 174 |
| 174 | Greater than 50% of Mass 95 |
| 175 | 5 to 9% of Mass 174 |
| 176 | Greater than 95% but less than 101% of Mass 174 |
| 177 | 5 to 9% of Mass 176 |

9.4 Initial Calibration Procedure

A multi-level calibration consisting of 0.5, 1, 2, 5, 10, 25, 50, 100, 200, 300 ug/l is performed using standards obtained commercially. The three internal standards that are used: Fluorobenzene, Chlorobenzene-d5, and 1,4 Dichlorobenzene-d4 at a level of 25.0 ug/L. An ICV( Initial calibration verification ) std containing the full list of compounds is also analyzed with the calibration curve.

9.4.1 The RRF (Relative Response Factor) is calculated as follows:

$$RRF = \frac{(Ax \times Cis)}{(Ais \times Cx)}$$

where: Ax = Area of the characteristic ion for the compound being measured.
Ais = Area of the characteristic ion for the specific internal standard.
Cis = Concentration of the specific internal standard.
Cx = Concentration of the compound being measured.

The average RRF and % Relative Standard Deviation (%RSD) must be calculated for each compound using the 8-10 RRF values calculated for each compound from the initial (8-10 point) calibration curve.

If the % RSD of any compound is less than or equal to 15%, then the relative response factor is assumed to be constant over the calibration range, and the average relative response factor may be used for quantitation. See Table 3 for analyte list and criteria.

If the % RSD of any compound is 15% or greater, construct calibration curves of area ratio (A / Ais) versus concentration ratio (Cx/ Cis) using first order (Linear Regression) or second order (Quadratic Regression) regression fit of the initial calibration points. The requirement for coefficient of determination ($R^2$) is equal to or greater than 0.990. If the Linear Regression criteria is not met, then Quadratic equation (second order) may be used with a minimum of 6 data points. In either case, the curve must be printed and stored in the file with the initial calibration to document evaluation. The analyst should select the regression order, which introduces the least calibration error into the quantitation and minimizes the y-intercept value (constant term).

Linear and Quadratic Regressions each have several options available in the software. The analyst must chose which order will be used. Options available are equal weighting, inverse of conc., and inverse square of conc.. The analyst should choose the curve order and weighting which gives the best coefficient of the determination (COD) and a y-intercept nearest to the origin, given the calibration blank is clean.

Property of AMRO Environmental Laboratories Corporation

The percent relative standard deviation ***must*** be less than 15% for each compound. However, the % RSD for each individual calibration check compound (CCC) ***must*** be less than 30%. Late-eluting compounds usually have much better agreement. The CCCs are:

1,1-Dichloroethene
Chloroform
1,2-Dichloropropane
Toluene
Ethylbenzene
Vinyl chloride

If the % RSD greater than 30% is measured for any CCC, then corrective action to eliminate a system leak and / or column reactive sites is required before attempting another calibration.

9.4.1.1 A system performance check should be made before this calibration curve is used. Five compounds (the System Performance Check Compounds, or SPCCs) are checked for a minimum average relative response factor. These compounds are:

| | |
|---|---|
| Chloromethane | 0.1 |
| 1,1-Dichloroethane | 0.1 |
| Bromoform | 0.1 |
| 1,1,2,2-Tetrachloroethane | 0.3 |
| Chlorobenzene | 0.3 |

These compounds are used to check compound stability and to check degradation caused by contaminated lines or active sites in the system. See Table 3 for summary of the acceptance limits.

The analyst may drop the lowest or highest point for an analyte, possibly requiring either a change in reporting limits or narrowing the calibration range. An entire level may be deleted if there is cause to believe there was a poor injection, etc. The section head should examine the calibration to ensure the proper procedures were followed.

**Table 3**
Criteria for Initial and Continuing Calibration for 8260B

| Volatile Compound | | Initial and Continuing Calibration Minimum RRF | Initial Calibration Maximum % RSD | Continuing Calibration Maximum % Drift |
|---|---|---|---|---|
| Chloromethane | (SPCC) | (0.100) | | |
| Vinyl chloride | (CCC) | | (30%) | (20%) |
| 1,1-Dichloroethane | (SPCC) | (0.100) | | |
| 1-1-Dichloroethene | (CCC) | | (30%) | (20%) |
| Chloroform | (CCC) | | (30%) | (20%) |
| Bromoform | (SPCC) | (0.100) | | |
| 1,1,2,2-Tetrachloroethane | (SPCC) | (0.300) | | |
| Toluene | (CCC) | | (30%) | (20%) |
| Chlorobenzene | (SPCC) | (0.300) | | |
| Ethylbenzene | (CCC) | | (30%) | (20%) |
| 1,2 Dichloropropane | (CCC) | | (30%) | (20%) |

The ICV, which was analyzed with the calibration , ***must*** be evaluated at +/- 25%.

9.5 GC/MS Daily Calibration Procedure:

9.5.1 Daily Calibration Check:

9.5.1.1 The 8260 ccv; 25ul of the 100ng/ul 8260 working standard into a 100ml volumetric containing Voa water,(continuing calibration at 25ppb but
varied periodically) must pass 8260B criteria to continue.
The average response factor or calibration curve of the initial calibration is verified daily using a calibration standard and must meet the criteria of CCC's <20% drift.

% Drift = c1 - c2/c1 x 100

where: c1 is the analyte concentration
c2 is the standard concentration

The CCC's are Vinyl Chloride, 1-1 Dichloroethene, Chloroform, 1-2 Dichloropropane, Toluene, and Ethyl Benzene.

For MCP or RCP samples, any target analyte outside of +/- 30% is listed on the narrative form. If more than 10% of the compounds are outside the criteria, then recalibration is required.

9.5.1.2 The five SPCC compounds are checked for a minimum average relative response factors. The acceptance criteria is listed in Table 2.

9.5.2 The internal standards must be monitored for retention time and area of response. The internal standard areas may not vary by more than - 50% or + 200% and their retention times by ±30 seconds from the comparable standard in the initial calibration.

9.5.2.1 If the first CCV standard does not pass the system should be checked for problems and corrected before analyzing a second CCV. Common causes of failure are: (1) purge flow too slow which will depress the RRFs of the poor purgers like bromoform and 1,1,2,2-tetrachloroethane, (2) purge flow too fast which will depress the RRFs of the gas analytes like chloromethane, (3) contamination in the autosampler/purge&trap system trap, valves, or lines which can degrade 1,1-dichloroethane and 1,1,2,2-tetrachloroethane.

9.5.2.2 New initial calibrations are always analyzed after major system changes such as replacing filaments, cleaning the source, significant re-tuning of the mass spectrometer, significant changes in purge & trap conditions, etc.

Laboratory Control Sample : A LCS is prepared using 100µL in 50ml DI of a 10ng/µL secondary source standard. For soil LCS, 2 mL Methanol, 100µL of 10 ng/µL second Source standard mix in 50 ml DI is used.

Clients requesting QC are provided with the full list of target analtyes, the % recoveries achieved, and the laboratory control limits.
For samples requiring MCP or RCP, an LCSD is also analyzed and all target compounds outside of +/- 30% must be noted on the case narrative.

9.5.3 Blank analysis: A 5 mL aliquot of volatile free laboratory water is analyzed in the same manner as standards and samples to demonstrate that the system is interference free. When this has been demonstrated sample analysis may begin. A hardcopy of the blank chromatogram and quant output page is filed with the daily calibration data. The blank should not contain any analyte above one half the reporting limit with the possible exception of common laboratory contaminants such as Acetone and Methylene Chloride. The common laboratory contaminants must be less than the reporting limit. If there are any analytes over these limits and the samples are positive for these analytes, the samples must be re-analyzed when possible. If re-analysis is not possible, all results must be appropriately qualified on the client's report.

## 10.0 SAMPLE PROCEDURE

### 10.1 Preparation of Samples

Once the calibration procedure has been successfully completed the analysis of actual samples may begin. It is the responsibility of the GC/MS operator to follow these procedures. To determine which samples need to be analyzed on a given day, a daily work list is printed and used by the analyst to know when the analysis needs to be completed to satisfy the preservation / holding time requirements and the client's requests.

10.1.1 Preserved aqueous samples must be analyzed within 14 days from date of sampling. The pH must be <2.

10.1.2 Nonpreserved aqueous samples must be analyzed within 7 days.

10.1.2 In general, water samples are analyzed at 5 mL unless there is a known history of contamination in the sample or some matrix problem, which requires a dilution to be analyzed. For a dilution of 1:10, 5mls of sample is removed with a gastight syringe and added to a 50ml volumetric flask containing distilled water. VOA Reagent water is added to the 50mL mark, capped, the volumetric is inverted three times, and poured gently into a VOA vial for analysis.

10.1.3.1 All water samples, standards and blanks are spiked with internal standards and surrogate standards at 25µg/l prior to analysis by the instrument.

10.1.3.2 Allow samples to come to room temperature.

10.1.3.3 Aqueous samples are checked the day after analysis with low range pH paper to ensure it was preserved to a pH <2 at the time of collection, unless sample was not preserved. If the pH is <2 of a preserved sample,it is noted in the case narrative. Drinking and wastewater samples are also checked for residual chlorine with chlorine test strips.

Soil samples are extracted by weighing out 10 grams of sample into a 40-mL vial and adding 10 mL of methanol and spiked with 20ul of surrogate mix. The weights and the procedure used are recorded in the Soil Prep Log. Methanol blanks and a LCS are prepared each day soils are analyzed. 10 mls of methanol is added to a VOA vial and spiked with 20ul of surrogate mix. The LCS also has 100ul of the QC mix containing all compounds added upon dilution into a 50ml volumetric. For every twenty soil samples a spike and spike duplicate are prepared by spiking 100ul of a 10ng/ul mix in to a 50ml volumetric containing 2mls of a methanol extraction. EPA 5035 Methanol Field Preserved , VPH, and New Jersey soils are extracted on-site using the VOA vials containing methanol that were prepared in the laboratory.

Soil samples must be extracted and analyzed within 14 days from the date of collection. EnCore samplers soil contents must be preserved in methanol or 20% sodium bisulfate solution within 48 hours of sampling and analyzed within 14 days from collection. The Method blank and LCS are prepped daily by adding 5g of clean Ottawa sand to a VOA vial and 5mls of the sodium bisulfate solution. Ten ul of The QC mix (containing the full list of compounds), is added to the LCS.
Soil samples that are frozen on site have 14 days holding time.

Property of AMRO Environmental Laboratories Corporation

Soil samples may be extracted in 5ml of VOA water and frozen in the lab within 48 hours of collection to preserve them for a holding time of 14 days.

10.2 Analysis of Samples

10.2.1 Every analytical batch of samples requires the following:

- BFB TUNE
- 8260 STANDARD (at 25ppb usually but concentration varied)
- LABORATORY CONTROL SAMPLE (LCS) – 20 µg/L PROCEDURAL (METHOD) BLANK
- SAMPLES
- MS/MSD- For every 20 client samples a spike and spike duplicate is required. They are spiked by AMRO with the LCS spike containing the full list of compounds . 100µl of a 10ng/µl mix is added to a 50ml volumetric containing 10mls of a water sample. Samples must be selected for spiking at random and rotated among clients and sites from batch to batch. In some cases, the client may specify which sample is to used for MS/MSD; if not , the laboratory shall pick a representative sample based on the following:

  A. MS/MSD shall not be performed on the Trip Blank, Rinsate Blank or Field Blank.
  B. Adequate sample weight/volume.
  C. Client requested QC deliverables.

10.2.2 Samples and standards are introduced to the GC/MS System using 40mL VOA vials, which are put into the autosampler tray. The autosampler syringe delivers 5mL to the purging chamber along with the internal standards and surrogates (the autosampler is equipped with a syringe or vial, which the operator fills with the internal standard and surrogate mix for waters). Also, a 40mL VOA vial containing Bromofluorobenzene (BFB) at a concentration of 50ng/5mL is placed on the tray for tuning (no SS is added).

10.2.3 Check the reservoir for water.

10.2.4 Check the IS and SS vials.

10.2.5 Type in the sequence of samples into the computer.

10.2.6 Recheck the vials in the autosampler to make sure they match the typed sequence.

10.2.7 Check the Helium.

10.2.8 Helium purges through the chamber and the volatile analytes are absorbed on the trap, a tube containing an OV-1/Tenax/Silica Gel/Charcoal mixture. After purging is complete, the trap is heated and backflushed with helium to desorb the compounds. The analytes are carried along a heated transfer line to the GC inlet, where the glass liner meets the narrow bore capillary column. At this point the analytes are heated, mixed and split. The column is temperature programmed to separate the analytes and is interfaced by a Mass Spectrometer for detection.

10.2.9 The raw data will print from the instrument as each sample is running.

10.3 Evaluation of Results

10.3.1 Identification of Compounds (Qualification)

Carefully evaluate the EICP and sample to reference spectrum match for each hit above or near the reporting limit that is detected by the data system. The qualitative identification of compounds is based on retention time and on the comparison of the sample mass spectrum, after background subtraction, with characteristic ions in a reference mass spectrum. The characteristic ions are the three ions of greatest relative intensity, or any ions over 30% relative intensity if less than 3 such ions occur in the reference spectrum. Compounds are identified as being present if:

- The intensities of the characteristic ions of a compound maximize in the same scan within one scan of each other.

- The relative retention time of the sample component is within ± 0.06 RRT units of the RRT of the standard component.

- The relative intensities of the characteristic ions agree within 20% of the relative intensities of those ions in the reference spectrum.

10.3.1.1 All 624 target isomers are reported individually, with the exception of m- and p-xylene, which co-elute and are reported as an isomer sum. All other target isomers should meet the following resolution requirement: Sufficient GC resolution is achieved if the height of the valley between the two isomer peaks is less than 25% of the sum of the two peak heights.

10.3.1.3 Clients sometimes ask for identification of the 10 to 20 largest non-target peaks in sample chromatograms, referred to as Tentatively Identified Compounds (TICs). The Hewlett Packard Enviroquant Library Search Compounds (LSC) program will automatically print out the spectral PBM search results for the largest peaks (operator chooses the number) along with possible matches for their spectra. The operator decides whether there is a good match of the sample and reference spectra or the spectrum remains classified as "unknown". Use the following guidelines when making tentative identifications:

- Relative intensities of the major ions in the reference spectrum (ions greater than 10% of the most abundant ion) should be present in the sample spectrum.
- The relative intensities of the major ions should agree within 20%.
- Molecular ions present in the reference spectrum should be present in the sample spectrum.

- Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or the presence of co-eluting compounds.
- Ions present in the reference spectrum but not in the sample spectrum should be reviewed for possible subtraction from the sample spectrum because of background contamination or co-eluting peaks. Data system library reduction programs can sometimes create these discrepancies.

10.4 Quantitation of Compounds

The identified compound will be quantitated based on its response compared to that of its internal standard. Refer to Attachments (7A-7C)

10.4.1 When the mass spectrometer is linear, the concentration of each analyte in the sample is, for water samples:

$$\text{Concentration } \mu g/L = \frac{(Ax)(Is)}{(Ais)(RF)}$$

Ax = area of characteristic ion for compound being measured
Is = concentration of internal standard injected (ng/ul)
Ais = area of characteristic ion for internal standard
RF = mean relative response factor for compound being measured

10.4.2 The integration of compounds for standards and samples should be performed to be in the same manner as the initial calibration integration. Cases where the initial calibration is in question should be investigated to ensure it is not related to poor maintenance, damaged or defective column, or other issues, which should be solved before further analysis.

10.4.3 The following must be checked for each compound present in standards and samples to ensure proper integration has been performed.

- The peak shape of the calibration compound must be maintained for standards and samples. This should take into account any shouldering, peak tailing, and peak co-elution. Carefully evaluate the EICP of each gas analyte, all ketone targets (esp. acetone and 2-butanone), methylene chloride, all esters, and tetrahydrofuran for proper integration in all standards and samples because these targets often exhibit broad peaks and poor signal to noise ratios. Carefully examine the following target hits due to posible misidentification by the data system: chloroethane, 1,2,3-trichloropropane, 4-methyl-2-pentanone, n-propyl benzene, 2-chlorotoluene, and the dichlorobenzene isomers.

- The EICP retention time windows for each compound of the calibration must be applied to standards and samples. If there is a retention time shift confirmed by comparison of the Internal Standards and Surrogates then carefully examine each EICP for potential target shifts. Watch especially in the narrow retention time windows where a shift might cause all or part of a peak to leave the window and be missed or mis-integrated by the data system. If false negatives due to retention time shifting appear likely then the sample must be reanalyzed.

- The baseline integration techniques for each compound of the calibration must be maintained for the standards and the samples. This should take into account elevated baselines, column compensation corrections and negative peaks in samples.

- Make sure that positive identification of compounds has been established thru EICP's and all method requirements have been met.

- Ensure any positive results are within the lower and upper levels of the calibration curve and above the reporting limits for each compound.

Property of AMRO Environmental Laboratories Corporation

All positive results above the calibration curve must be reanalyzed in dilution.

Manual integration and Q-deleting procedures:

The raw data is printed out before any manual integration or Q-deleting is performed and handed in with the report. This raw data can be reproduced at any time by requanting the data file by the method used.

The Q-deleting procedure is used when the area counts are very low and produce a negative or false positive. Also it is used when the computer finds an incorrect peak.

Manual integration is used when the computer gets only part of a peak, due to the irregular shape of the peak or a very large peak, or misses a peak entirely.

All manual integration is performed by integrating the entire peak at the baseline, exactly as the computer would.

10.4.4 If there are any cases where the integration or spectral identification of a compound is questionable after ensuring the above steps have been followed then consult another qualified analyst. The chromatograms and spectra should be printed in these cases, dated and initialed by the analyst and the qualified consultant.

10.4.5 Analytes with initial calibration RRFs >15%RSD are fitted to a linear regression or quadratic regression in the initial calibration. The software will automatically quantitiate the analyte by the parameters set for the initial calibration, average response, linear regression or quadratic regression.

10.4.6 Clients may ask for estimated concentrations of non-calibrated compounds. The Hewlett Packard LSC software will do this automatically, requiring only a dilution factor.

10.4.7 Once all the data has been evaluated it is submitted for data review. The following must be submitted for each project:

10.4.7.1 The raw data from the instrument that was printed while the sample was running. This consists of the quantitiation report and the chromatograms.

10.4.7.2 The data after it has been reviewed by the analyst. This consists of the quantitiation report that was reviewed.

10.4.7.3 A copy of the injection log(s) associated with the samples for the project.

10.4.7.4 Copies of the preparation sheets associated with the samples.

10.4.7.5 A copy of the applicable blanks if the project is a Level 2 package or higher. See the Quality Systems Manual for Package Levels.

10.4.7.6 If the project is a Level 4 or 5, copies of the following items must be provided to data review: Initial Calibration summary and raw data along with the information described in sections 10.4.7.1 to 10.4.7.5 are required.

10.4.7.7 The GC/MS Checklist is completed by the analyst that provides an overview of the issues associated with the data. Any items that do not meet acceptable criteria must be qualified by the analyst in the form of a documented investigation of the issue(s) written on the narrative form.

## 11.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

Instrument maintenance and repair records are maintained to document satisfactory instrument performance. The operator is generally responsible to see that records are well kept. Records of major maintenance and repair are kept in the instrument maintenance log per instrument. Routine maintenance procedures such as changing the internal standards and surrogates in the autosampler need only be recorded in the instrument analysis log.

11.1 Daily maintenance procedures:

The following items should be checked on every day that an instrument is used for analysis.

11.1.1 Trap and column performance is monitored by checking the response factor of key compounds, which indicate trap and column degradation and observing column bleed. Change trap or column if necessary.

11.1.2 Check that gases have adequate supply to last until the following day. Change tanks if necessary.

11.1.3 Check data file space and quant space.

11.2 As needed maintenance procedures:

11.2.1 Check split flow on GC.

11.2.2 Check purge gas flow on the purge&trap. Adjust if necessary.

11.2.3 Check Teflon ferrules on purge&trap for wear. Replace if necessary.

11.2.4 Check Teflon purge lines on purge&trap for wear. Replace if necessary.

11.2.5 Change the vacuum pump oil.

11.2.6 Clean the analyzer source. This will become necessary if a high background becomes apparent which is not attributable to column degradation or the system cannot meet BFB criteria.

11.2.7 Replace the electron multiplier when the maximum gain no longer provides the required sensitivity.

Property of AMRO Environmental Laboratories Corporation

11.2.8 Replace the ion source filament as needed.

## 12.0 CALCULATIONS

12.1 All data files, which are imported into the LIMS data system must have specific headers, test codes, etc.

12.1.1 An example of water and soil 8260 sample headers are as follows:

[0503005-01A] df=1MF=5UG{8260_W}
xtr03/03/05 samp=5ml fv=5ml

Example of an *8260 water sample* which arrived in March of 2005
The DF=1, signifies a dilution factor of one.
MF=5UG, indicates the results are in ug, and the sample amount purged is 5mls.
The sample was collected on 3/3/5.
The samp=5ml, means a 5ml sample size
The fv=5ml, final volume(purged) is equal to 5mls.

[0503005-01A]df=10MF=250UG{8260_MS}
xtr03/03/05 samp=21.345g s=88.5 fv=5ml

Example of an *8260 methanol soil sample* which arrived in March Of 2005.

The df=10, signifies a dilution factor of 10.
MF=250UG, indicates the results are in ug, and the 500 equals;

MF=(total amount purged-5mls water / 0.2mls methanol extract purged) * 10mls methanol –total volume methanol

samp=21.345g, means 21.345grams sample extracted.
S=88.5 , indicates the percent solids = 88.5%
The fv=5ml, signifies a final volume of 5mls.

12.1.2 For MCP and some specific projects, the methanol soil samples are corrected for % moisture in the soils, which dilutes out the methanol. This diluting factor can to be calculated as follows:

(100-%solids) * sample weight(g)/100 = total amount(mls) of water in sample.

mls of water in sample + mls of methanol / mls of methanol = dilution factor.

For example, a sample with a weight of 15.543g extracted with 10mls of methanol and a %solids of 81.5%, would have a dilution factor (LIMS factor) as follows.

(100-81.5) * 15.543g/100 + 10mls / 10mls = 1.288

This LIMS factor would adjust all target analytes and surrogates. (by * 1.288)

## 13.0 QUALITY CONTROL

A formal quality control program is in operation at the present time at AMRO. The Laboratory Control limits for surrogate, matrix spikes and laboratory control sample spike are updated as needed.

### 13.1 Standards

13.1.1 The spiking solutions are obtained commercially. New lots of spiking solution are compared to the ones currently in use before being used. If they differ by more than 10%, then replace spike. If still out, new calibration curves will probably need to be prepared with the new solutions.

### 13.2 Internal standard

13.2.1 All samples, standards, and blanks are spiked with internal standards at 25 µg/l in water and soil extractions prior to analysis. Internal standard areas are monitored.

13.2.2 If examination of the total ion chromatogram shows no evidence of matrix interference or elevated baseline, the samples should be re-analyzed to determine if there is some other matrix effect behavior or that the added internal standard solution is no longer acceptable for use. If re-analysis exhibits the same behavior then the analyst will report the data and

generate a Non-Conformance report with some assessment of data impact.

13.2.3 If examination of the total ion chromatogram shows evidence of matrix interference or elevated baseline, the analyst should evaluate whether a dilution is warranted due to peak distortion. If there are no chromatographic anomalies, the data is reported as is since the internal standard is designed to allow for some matrix effects or inlet discrimination.

13.3 Surrogates

13.3.1 All samples, standards, and blanks are spiked with surrogate standards at 25µg/l in water and low soil analysis, and at 100µg/l in methanol preserved soils prior to analysis. Surrogate recoveries are monitored. Surrogate recoveries for samples are input into spreadsheets to calculate mean and standard deviation and to establish laboratory guidelines for recovery limits. All surrogates recovery limits are generated based on Control Charts. These limits are updated as needed. If the percent recovery for any surrogate compound is found to be out of acceptable range, the data must be evaluated. If the surrogate recovery is outside of the upper acceptance limit and there is an assignable cause, the data can be reported with a note of qualification. If the surrogate recovery is outside of the range and there is no assignable cause, the sample must be re-analyzed. If it is not possible to re-analyzed the samples due to hold time constraints, the data must be qualified.

13.3.2 For samples requiring MCP or RCP, surrogate recovery outside of ±30%, must be noted in Case Narrative.

13.4 Blanks

13.4.1 Blanks are analyzed daily. Soil extraction method blanks are analyzed with soils. Blanks are evaluated to ensure analyte levels are below reporting limits. If any compounds are seen in blanks greater than one half the reporting limit, the system is checked for contamination, and the blank is re-analyzed. If common laboratory contaminants Methylene Chloride and/or Acetone are present above the reporting limits and samples contain positive results for these analytes the samples must be reanalyzed or reported with B flag qualifiers. AMRO has

observed Naphthalene presence in the blanks at levels below reporting limits due to carryover from the VPH Standard containing 100 ppb of Naphthalene. Analysis should not proceed if the initial blanks are greater than one half the reporting limit for any other analytes and the problem can be corrected by instrument adjustment or cleaning, e.g. analyzing additional blanks

13.4.2 Trip blanks are analyzed along with the samples they arrived at the lab with. Their purpose is to assess the possibility of cross-contamination of the samples while in transport. If provided, they are analyzed with the samples they are used to assess.

13.4.3 Field blanks are also analyzed when they are provided by the client.

13.5 Laboratory Control Samples

13.5.1 Laboratory Control Samples (LCS) are prepared with samples and analyzed with the sample matrix they correspond to. The LCS for water contains all target analytes. *If LCS does not produce acceptable recoveries based on 8260 limits then they are re-analyzed. If the LCS is still unacceptable, the LCS solution is checked, as well as the calibration. If the LCS % Recovery results are above the acceptance limits and the sample results are ND, the sample's results are not impacted. This however must be noted in the project case narrative.*

13.5.2 All Laboratory Control Sample limits are generated based on Control Charts. These limits are updated as needed.

13.6 Matrix Spikes

13.6.1 For aqueous samples, an MS and an MSD must be analyzed with every 20 sample analytical batch.

13.6.2 MS and MSD limits are generated based on Control Charts. These limits are updated on an annual basis.

13.6.3 If the results of both matrix spike samples do not meet acceptance criteria then matrix interference is suspected. The Laboratory Control Sample (LCS) is reported to prove that the system is 'in-control' and

the spike results are suspected to be due to matrix interference, providing the LCS was acceptable.

13.7 Duplicates

13.7.1 A duplicate is analyzed for every 20 samples in the form of a Matrix Spike/Matrix Spike Duplicate. The results are evaluated to ensure acceptable reproducibility for the analysis. The Relative Percent Difference (RPD) between the concentrations of the analysis are calculated as follows:

$$\%RPD = \frac{(MS\ conc. - MSD\ conc)}{(MS\ conc. + MSD\ conc.)/2)} * 100$$

13.7.2 The %RPD must be ≤25%.

13.7.3 If the %RPD is not acceptable then an assignable cause such as sample non-homogeneity or carry over from a high sample, etc is explored. If a reasonable cause is found the batch is accepted, if not the MS and MSD are reanalyzed.

13.8 The following Quality Control rules should be followed for all Massachusetts Contingency Plan (MCP) and Reasonable Confidence Protocol (RCP) projects:

13.8.1 MS/MSD: Must contain all target compounds. %REC's should be between 70-130% for all target compounds. RPD's should be <20% for all water and soil samples.

13.8.2 LCS/LCSD: %REC's must be between 70-130% for all target compounds. Document exceedances in Case Narrative.

13.8.3 Surrogates: %REC's must be between 70-130% for all surrogates. Reanalyze unless obvious interference or Methanol preserved soil with moisture >25% or high recovery but no target hits.

13.8.4 ICAL: Recalibrate if >20% of non-CCC analyte have %RSD's >30 or r<0.99. Report all analyte with quadratic regression quant in the Case Narrative.

13.8.5 CCAL: Recalibrate if >10% of non-CCC analyte have %D>30%.

13.8.6 Reporting: Report both sets if one is extracted inside the holding

time and other outside the holding time. Provide chromatograms if the Quality Control problems are attributed to matrix effects. Report reanalysis if Internal Standard areas fail after re-run. Report all analytes with quadratic regression quant in Case Narrative. Document dilution in Case Narrative.

13.9 Corrective Action

13.9.1 Problems that are identified at the bench level and are corrected by the analysts are noted on the GC/MS Data Review Checklist. If any non-conformance is determined by lab manager review, a QC review or Corrective Action is to be included with the applicable report. Sections are informed of non-conformance issues in an effort to prevent reoccurrence. Any issues that are made evident by a client, resulting in corrective actions being completed which identify the issue, cause and correction. This information is provided to the client.

## 14.0 DATA REVIEW AND STORAGE

AMRO's goal for completeness is 100%. The following data calculating, reviewing and reporting procedures are followed to obtain that goal.

14.1 Data Validation - performed by the analyst:

When an analysis of a sample is complete, the analysis for that sample should be checked and the data calculated as soon as possible to identify any problems while still within the holding time for the analysis. The following steps should be taken to ensure that a good analysis has been obtained.

14.1.1 Check that all calibration analyses associated with the sample meet criteria to ensure acceptance criteria is met.

14.1.2 Check the internal standard areas. They should be -50 to +200% of the I.S. areas in the Initial Calibration standard.

14.1.3 Compare the surrogate recoveries to the AMRO limits. The default VOA surrogate recovery limits are as follows and are used until in house limits are generated.

14.1.4 Check the LCS to be sure the results are inside the limits, as well as the matrix spike and matrix spike duplicate results.

14.1.5 Check the analyzed times to be sure the tuning requirements are met.

4.1.6 Check that no compounds exceed the calibration range. If there are, these samples must be reanalyzed at a dilution.

14.1.7 Check the chromatography (good peak shape, baseline not noisy, good sensitivity).

14.1.8 Check the analysis for carryover or contamination. If any carryover is evident, these samples must be reanalyzed.

14.1.9 Check that the amount of sample analyzed is correctly recorded in the chromatogram header.

14.1.10 Check spectrum, area, and retention time of any positive hits on the quant output page.

14.1.11 Perform the final calculations on any positively identified compound in µg/L, taking into account dilution factors, etc.

Calculate the multiplier which equals grams of sample purged and write it on the quant output page. The soil multiplier is calculated by the following calculation:

$$\text{grams sample purged} = \frac{\text{sample wt. grams}}{\text{mL Methanol extracted}} \times \frac{\%\ \text{solids}}{100} \times \text{mL Methanol purged}$$

soil multiplier = 5mls purge/ gms sample purged

14.1.12 Check the chromatogram for very large peaks not picked up by quant. If any are present, check the spectrum to be sure it is not a target compound that is over the calibration range or outside the normal retention time window. If not a target compound, make a note on the chromatogram that the peak is an unknown and use the library to identify if possible.

14.1.13 Check to see if there are any other analyses of the sample. If so, check to see if the data agrees.

Property of AMRO Environmental Laboratories Corporation

Any problems discovered during this preliminary data check will necessitate re-analysis unless the lab manager authorizes use of the data with appropriate data qualifiers.

All calculations should be written in black ballpoint pen ink. All cross-outs should be a single line and should be initialed. The person performing these data calculations and checks should sign and date the bottom of the quant page.

14.2 Data Review - performed by the department supervisor or designate.

When all samples for a given project have been analyzed and the results have been calculated, the project goes through the following data review procedure:

14.2.1 The reviewer reads over all associated paperwork to become familiar with the requirements of the project.

14.2.2 The project is checked for completeness.

14.2.3 Data sheets are checked for accuracy.

14.2.4 The data calculations are spot-checked. If any problems are encountered then the whole package should be checked.

14.2.5 The QC data sheets are checked.

Any problems encountered by the reviewer are brought to the attention of the lab manager.

14.3 Data Reporting

Many report options are available to clients of AMRO. It is AMRO policy to discuss with all clients their reporting requirements soon after receipt of the samples. The cover letter for the data reports will address any quality control problems, either with the condition of the samples upon receipt or with the analyses, or contain a statement that no quality control problems were encountered. The letter will also contain a statement that it is an integral part of the data report.

14.4 Data Archival

14.4.1 GC/MS Data Files.

Property of AMRO Environmental Laboratories Corporation

All raw GC/MS data files are archived through the Network and are backed up on a tape drive through the server.

14.4.2 Data Reports.

Final data and QC reports are input into Excel and spreadsheet files. Template files exist on the Network for final data reports, daily QC check reports, sample spike reports, initial precision and accuracy data, wastewater method accuracy data, surrogate recovery data, and MDL data. When data is input template files are renamed as follows:

data reports XXX#####

Where X 's are the first three characters of the AMRO client code and #'s are the AMRO project and sample number.

## 15.0 REFERENCES

15.1 40 CFR Part 136 Appendix B, 1984.

15.2 USEPA Office of Solid and Hazardous Waste - SW-846 Method Chapter 1, Rev. 1 7/92.

15.3 USEPA Office of Solid and Hazardous Waste - SW-846 Method 8000B, Rev. 2 12/96.

15.4 USEPA Office of Solid and Hazardous Waste - SW-846 Method 8260B, Rev. 2 12/96

15.5 New Jersey Department of Environmental Protection "Methodology for the Field Extraction/Preservation of Soil Samples with Methanol for Volatile Organic Compounds", 2/97.

15.6 Department of Defense Quality Systems Manual For Environmental Laboratories, Final Version 3, January 2006.

15.7 Massachusetts Contingency Plan (MCP), Revision 4, May 28, 2004.

Attachment 1

Volatile Internal Standards With Corresponding Target Compounds and Surrogates Assigned For Quantitation

| # | Compound Name | Primary Ion | Secondary Ion |
|---|---|---|---|
| Internal Standard | Fluorobenzene | 96 | 70 |
| | Dichlorodifluoromethane | 85 | 87 |
| | Chloromethane | 50 | 52 |
| | Vinyl Chloride | 62 | 64 |
| | Chloroethane | 64 | 66 |
| | Bromomethane | 94 | 96 |
| | Dichlorofluoromethane | 67 | 69 |
| | Trichlorofluoromethane | 101 | 103 |
| | Methyl Acetate | 59 | 43 |
| | Freon 113 | 151 | 153 |
| | Diethyl Ether | 74 | 59 |
| | Acetone | 58 | 43 |
| | Iodomethane | 142 | 127 |
| | 1,1-Dichloroethene | 96 | 61 |
| | Carbon Disulfide | 76 | 78 |
| | Methylene Chloride | 49 | 84 |
| | Acrolein | 56 | 55 |
| | Acrylonitrile | 53 | 52 |
| | Tertiary Butanol | 59 | 87 |
| | Methyl tert-butyl ether | 73 | 41 |
| | trans-1,2-Dichloroethene | 96 | 61 |
| | Diisopropyl Ether | 45 | 87 |
| | 1,1-Dichloroethane | 63 | 65 |
| | Vinyl Acetate | 43 | 86 |
| | Ethyl Tertiary Butyl Ether | 59 | 87 |
| | 2-Butanone | 72 | 43 |
| | 2,2-Dichloropropane | 77 | 79 |
| | cis-1,2-Dichloroethene | 96 | 61 |
| | Chloroform | 83 | 85 |
| | Tetrahydrofuran | 42 | 72 |
| | Bromochloromethane | 128 | 130 |
| Surrogate | Dibromofluoromethane | 113 | 111 |
| | Tertiary Amyl Methyl Ether | 73 | 55 |
| Surrogate | 1,2-Dichloroethane-d4 | 65 | 67 |
| | Cyclohexane | 56 | 84 |
| | 1,1,1-Trichloroethane | 97 | 99 |
| | 1,1-Dichloropropene | 75 | 110 |
| | Carbon Tetrachloride | 117 | 119 |
| | 1,2-Dichloroethane | 62 | 49 |
| | 1,4-Dioxane | 88 | 58 |

Attachment 1 Page 2

Volatile Internal Standards With Corresponding Target Compounds and Surrogates Assigned For Quantitation

| # | Compound Name | Primary Ion | Secondary Ion |
|---|---|---|---|
| | Benzene | 78 | 77 |
| | Trichloroethene | 95 | 132 |
| | Methyl Cyclohexane | 83 | 55 |
| | 1,2-Dichloropropane | 63 | 62 |
| | 2,4,4-Trimethyl-2-pentene | 55 | 97 |
| | Methyl Methacrylate | 69 | 100 |
| | Bromodichloromethane | 83 | 85 |
| | Dibromomethane | 93 | 95 |
| | 4-Methyl-2-Pentanone | 85 | 43 |
| | cis-1,3-Dichloropropene | 75 | 39 |
| Surrogate | Toluene-d8 | 98 | 100 |
| | Toluene | 92 | 91 |
| | trans-1,3-Dichloropropene | 75 | 39 |
| | 1,1,2-Trichloroethane | 97 | 85 |
| | 1,2-Dibromoethane | 107 | 109 |
| | 2-Chloroethyl-Vinyl-ether | 63 | 43 |
| Internal Standard | Chlorobenzene-d5 | 117 | 82 |
| Surrogate | 4-Bromofluorobenzene | 174 | 95 |
| | 2-Hexanone | 58 | 43 |
| | 1,3-Dichloropropane | 76 | 41 |
| | Tetrachloroethene | 164 | 166 |
| | Dibromochloromethane | 129 | 127 |
| | Chlorobenzene | 112 | 77 |
| | 1,1,1,2-Tetrachloroethane | 131 | 133 |
| | Ethylbenzene | 91 | 106 |
| | m,p-Xylene | 106 | 91 |
| | o-Xylene | 106 | 91 |
| | Styrene | 104 | 78 |
| | Bromoform | 173 | 175 |
| Internal Standard | 1,4-Dichlorobenzene-d4 | 152 | 150 |
| | Isopropylbenzene | 105 | 120 |
| | Cyclohexanone | 55 | 98 |
| | 1,1,2,2-Tetrachloroethane | 83 | 85 |
| | 1,2,3-Trichloropropane | 75 | 77 |

Property of AMRO Environmental Laboratories Corporation

Attachment 1 Page 3

Volatile Internal Standards With Corresponding Target Compounds and Surrogates Assigned For Quantitation

| # | Compound Name | Primary Ion | Secondary Ion |
|---|---|---|---|
| | Bromobenzene | 156 | 77 |
| | n-Propylbenzene | 91 | 120 |
| | 2-Chlorotoluene | 91 | 126 |
| | 4-Chlorotoluene | 91 | 126 |
| | 1,3,5-Trimethylbenzene | 105 | 120 |
| | tert-Butylbenzene | 119 | 91 |
| | 1,2,4-Trimethylbenzene | 105 | 120 |
| | sec-Butylbenzene | 105 | 134 |
| | 4-Isopropyltoluene | 119 | 134 |
| | 1,3-Dichlorobenzene | 146 | 111 |
| | 1,4-Dichlorobenzene | 146 | 111 |
| | n-Butylbenzene | 91 | 92 |
| | 1,2-Dichlorobenzene | 146 | 111 |
| | 1,2-Dibromo-3-chloropropane | 75 | 156 |
| | 1,2,3-Trichlorobenzene | 180 | 182 |
| | Hexachlorobutadiene | 225 | 227 |
| | Naphthalene | 128 | 129 |
| | 1,2,4-Trichlorobenzene | 180 | 182 |
| Surrogate | 2,5-Dibromotoluene | 250 | 89 |

Property of AMRO Environmental Laboratories Corporation

Attachment 2
8260 NSI MegaMix

# Certificate of Analysis

A09955
#1-#4

NSI Solutions, Inc. * 7212 ACC Blvd. * Raleigh, NC 27617 * 1-800-234-7837

**Mixture Name:** 8260 VOC Mix
**Catalog Number:** C-700-06

**Expiration Date:** 04/15
**Solvent:** P&T Methanol
(FLAMMABLE, IRRITANT,CARCINOGEN)

| COMPOUND NUMBER | ANALYTE | PURITY (%) | GRAVIMETRIC CONCENTRATION (ug/mL) |
|---|---|---|---|
| W-212-09 | Bromoform | 99.65 | 2001 |
| W-360-05 | Carbon tetrachloride | 99.97 | 2000 |
| W-21-05 | Chloroform | 98.33 | 2000 |
| W-200-12 | Chlorodibromomethane | 99.82 | 2000 |
| W-46-09 | Dichlorobromomethane | 99.35 | 2000 |
| W-12-05 | 1,1-Dichloroethane | 99.64 | 2000 |
| W-09-04 | 1,2-Dichloroethane | 99.92 | 2000 |
| W-27-07 | 1,1-Dichloroethene | 99.91 | 2000 |
| W-28-06 | trans-1,2-Dichloroethene | 99.44 | 1999 |
| W-42-03 | Dichloromethane | 99.84 | 2001 |
| W-30-06 | 1,2-Dichloropropane | 99.92 | 2000 |
| W-520-14 | cis-1,3-Dichloropropene | 99.08 | 2000 |
| W-451-08 | trans-1,3-Dichloropropene | 98.73 | 2000 |
| W-14-06 | 1,1,2,2-Tetrachloroethane | 98.15 | 2000 |
| W-10-07 | 1,1,1-Trichloroethane | 99.45 | 2000 |
| W-13-05 | 1,1,2-Trichloroethane | 98.53 | 2000 |
| W-04-04 | Benzene | 99.95 | 2000 |
| W-406-05 | Bromobenzene | 99.98 | 1999 |
| W-136-02 | Bromochloromethane | 99.84 | 2000 |
| W-1104-05 | sec-Butylbenzene | 99.97 | 2000 |
| W-06-10 | Chlorobenzene | 99.92 | 2000 |
| W-152-03 | 4-Chlorotoluene | 97.30 | 2000 |
| W-1097-03 | Dibromomethane | 98.95 | 2000 |
| W-23-04 | 1,2-Dichlorobenzene | 99.30 | 2000 |
| W-214-05 | 1,3-Dichlorobenzene | 99.77 | 2000 |
| W-25-07 | 1,4-Dichlorobenzene | 99.85 | 2000 |
| W-1167-06 | 2,2-Dichloropropane | 99.91 | 2003 |
| W-36-05 | Ethylbenzene | 99.81 | 2000 |
| W-669-03 | 1-Methyl ethyl benzene | 99.97 | 2000 |
| W-83-06 | Tetrachloroethene | 99.79 | 2000 |
| W-84-04 | Toluene | 99.87 | 2000 |
| W-175-03 | 1,2,3-Trichlorobenzene | 99.80 | 2000 |
| W-07-03 | 1,2,4-Trichlorobenzene | 99.75 | 2000 |
| W-85-04 | Trichloroethene | 98.62 | 2000 |
| W-201-03 | o-Xylene | 99.36 | 2000 |
| W-50-05 | Hexachlorobutadiene | 98.22 | 2000 |
| W-53-04 | Naphthalene | 99.76 | 2000 |
| W-150-02 | 2-Chlorotoluene | 99.47 | 2000 |
| W-171-04 | 1,2-Dibromoethane | 99.90 | 2000 |
| W-173-13 | cis-1,2-Dichloroethene | 96.49 | 2000 |
| W-202-05 | m-Xylene | 99.82 | 2000 |
| W-257-03 | Styrene | 99.93 | 2000 |
| W-368-05 | 1,2,3-Trichloropropane | 99.60 | 2000 |
| W-1107-04 | 1,2,4-Trimethylbenzene | 98.40 | 2000 |

Property of AMRO Environmental Laboratories Corporation

Attachment 2
8260 N SI MegaMix

# Certificate of Analysis

NSI Solutions, Inc. * 7212 ACC Blvd. * Raleigh, NC 27617 * 1-800-234-7837

| COMPOUND NUMBER | ANALYTE | PURITY (%) | GRAVIMETRIC CONCENTRATION (ug/mL) |
|---|---|---|---|
| W-1105-04 | n-Butylbenzene | 99.96 | 2000 |
| W-1106-02 | tert-Butylbenzene | 99.41 | 2000 |
| W-993-10 | 1,2-Dibromo-3-chloropropane | 99.22 | 2000 |
| W-1109-02 | 1,3-Dichloropropane | 99.89 | 2001 |
| W-1166-04 | 1,1-Dichloropropene | 96.76 | 2000 |
| W-1108-03 | 4-Isopropyltoluene | 99.16 | 2000 |
| W-1112-04 | n-Propylbenzene | 99.72 | 2000 |
| W-335-04 | 1,1,1,2-Tetrachloroethane | 98.94 | 2000 |
| W-1103-02 | 1,3,5-Trimethylbenzene | 98.85 | 2000 |
| W-203-06 | p-Xylene | 99.82 | 2000 |
| W-473-04 | Acetonitrile | 99.86 | 2001 |
| W-03-08 | Acrylonitrile | 99.97 | 2006 |
| W-476-05 | Allyl chloride | 99.01 | 2001 |
| W-363-06 | Carbon disulfide | 99.88 | 1993 |
| W-1110-01 | 2-Chloroethanol | 99.45 | 2008 |
| W-827-02 | cis-1,4-Dichloro-2-butene | 94.14 | 2002 |
| W-831-06 | trans-1,4-Dichloro-2-butene | 97.06 | 1998 |
| W-285-03 | Diethyl ether | 99.96 | 2001 |
| W-480-04 | 1,4-Dioxane | 99.95 | 2004 |
| W-687-03 | Ethyl methacrylate | 99.30 | 2000 |
| W-253-04 | Iodomethane | 99.57 | 1997 |
| W-659-07 | Isobutyl alcohol | 99.97 | 2004 |
| W-686-02 | Methacrylonitrile | 99.95 | 1999 |
| W-439-03 | Methyl methacrylate | 99.96 | 2000 |
| W-54-04 | Nitrobenzene | 99.92 | 1997 |
| W-1313-01 | 2-Nitropropane | 96.89 | 1998 |
| W-338-02 | Propionitrile | 99.14 | 2000 |
| W-685-02 | Tetrahydrofuran | 99.95 | 2000 |
| W-493-02 | 1,1,2-Trichlorotrifluoroethane | 99.81 | 1990 |
| W-1246-02 | Di isopropyl ether | 99.84 | 1999 |
| W-528-02 | Methyl acrylate | 99.94 | 2001 |
| W-901-02 | Cyclohexane | 99.97 | 2008 |
| W-1305-02 | Methyl cyclohexane | 99.97 | 2008 |
| W-1429-02 | Methyl acetate | 99.88 | 2001 |

**PREPARATION:** Reported concentration value has been corrected for purity. Concentration is calculated from wt/vol or vol/vol measurements using microbalances calibrated with NIST traceable weights and/or ASTM Class A volumetric glassware or calibrated equivalent labware.

**STORAGE & HANDLING:** Store at ≤ -18° C. Allow to equilibrate to room temperature before use.

Kristi Bright

Kristi Bright, Organic Chemist

Property of AMRO Environmental Laboratories Corporation

Environmental
Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

**Determination of Trace Metals using Perkin Elmer AAnalyst 600 Graphite Furnace Atomic Absorption Spectroscopy**
**Method EPA 200.9 and SW-846 7000 Series**

Procedure Number: IL-3065

Revision No.: 1

Revision Date: 03/09/2010

Review Date: N/A

Prepared By: _____ Date: 03/11/10

Approved By: _____ Date: 03/11/10
Inorganic Manager

Approved By: _____ Date: 03/10/10
Laboratory Director

Approved By: _____ Date: 03/10/10
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

# TABLE OF CONTENTS


| | | Page |
|---|---|---|
| 1.0 | SCOPE AND APPLICATION | 3 |
| 2.0 | METHOD SUMMARY | 3 |
| 3.0 | DEFINITIONS | 4 |
| 4.0 | SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE | 5 |
| 5.0 | POTENTIAL PROBLEMS AND INTERFERENCES | 6 |
| 6.0 | HEALTH AND SAFETY | 8 |
| 7.0 | INSTRUMENTS AND EQUIPMENT | 8 |
| 8.0 | REAGENTS AND STANDARDS | 9 |
| 9.0 | PROCEDURE | 12 |
| 10.0 | INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR | 21 |
| 11.0 | CALCULATIONS | 24 |
| 12.0 | QUALITY CONTROL | 25 |
| 13.0 | DATA REVIEW AND STORAGE | 28 |
| 14.0 | REFERENCES | 30 |
| | Attachment 1 Calibration and QC Standards | 31 |
| | Attachment 2 GFAA and CVAA Data Review Checklist | 32 |
| | Attachment 3 Qualification Card for Methods EPA 200.9/SW-846 7000 Series | 33 |

## 1.0 SCOPE and APPLICATION

1.1 The Perkin Elmer AAnalyst 600 is used to determine metals in aqueous, soil, solid sludge, air and wipe sample matrices. The methods listed in section 1.3 are applicable to metals in drinking, surface, and saline waters and domestic and industrial wastes.

1.2 The samples must undergo a digestion procedure in order to dissolve the metals of interest from the matrix. The digestion procedures used are dependent on what metals are being identified. Applicable metals digestion procedures for Methods listed in section 1.3 are listed below:

| **Water Digestion Methods:** | **Soil Digestion Methods:** |
|---|---|
| SW-846 Method 3010A | SW-846 Method 3050B |
| EPA 200.2 & 200.9 | SW-846 Method 3051 |

1.3 Applicable analysis methods are listed below:

1.3.1 Arsenic (As), 7060A, Antimony (Sb) 7041, Cadmium (Cd) 7131A, Lead (Pb) 7421, Selenium (Se) 7740, Thallium 7841 (Tl), Silver (Ag) 7761.

1.3.2 200.9 for Arsenic (As), Antimony (Sb), Cadmium (Cd), Lead (Pb), Selenium (Se), Thallium (Tl), Silver (Ag).

## 2.0 METHOD SUMMARY

2.1 Samples are digested by an appropriate method (See Preparation SOPs). The digestates are poured into 1.1mL autosampler cups and placed into an autosampler tray. The sample ID's are recorded in a sample information file in the Perkin Elmer software. By software command, the autosampler will pipet 20uL (or any specified volume) of sample along with 5 uL of matrix modifier onto a graphite platform that has been inserted into a graphite tube. The sample is put through a multistep furnace program consisting of drying, charring, and atomizing. During atomization, the absorption of an appropriate wavelength of light is measured and corrected for background absorption using a Zeeman background correction method and Stabilized temperature Platform Furnace technology.

2.2 Modifications:

2.2.1 The matrix modifiers used are palladium and magnesium nitrate.

2.2.2 Dissolved metals do not require digestion but AMRO digests them to allow matrix matching between the samples and the instrument standards.

2.2.3 Hydrochloric acid (HCl) is used to facilitate the sample preparation for both GFAA and ICP analyses. To over come the use of HCl in the preparation the following action are taken:

2.2.3.1 Modifier of palladium magnesium nitrate.
2.2.3.2 Hydrogen (5%)- argon (95%) gas mixture.

2.2.4 For DOD projects, the ICB, CCB, and Method Blank values **must** be <1/2 RL.

## 3.0 DEFINITIONS

3.1 Reporting Limit Standard (RL/CRA): The lowest level standard is incorporated in the calibration curve as a calibration standard.

3.2 Preparation Sheet: The hardcopy of the preparation sheet prepared at the time of digestion to convey amounts used and dilutions made to samples.

3.3 Preparation Batch: The set of 20 samples or less prepared on the same day.

3.4 Method Blank (MB): A DI water sample carried through the entire analytical procedure.

3.5 Laboratory Fortified Blank (LCS): A DI water sample spiked with a known amount of analyte and then carried through the entire analytical procedure. The analyte recovery must be within 85-115% of the true value for 200.9 and 80-120% for 7000.

3.6 Laboratory Fortified Blank (LCSD): A DI water sample spiked with a known amount of analyte and then carried through the entire analytical procedure. The analyte recovery must be within 80-120% for 7000.

3.7 Matrix Spike (MS & MSD): Routine samples spiked with a known amount of analyte and then carried through the entire analytical procedure. The analyte recovery must be within 70-130% of the true value for 200.9 and 75-125% for 7000 series or a matrix effect suspected. The difference between the MS and the MSD should be <20%.

3.8 Sample Duplicate: A separate aliquot of sample carried through the entire analytical procedure. The difference between the Sample and Duplicate should be less than 20%

3.9 Method Detection Limit (MDL): The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater then zero. It is determined by analyzing seven replicates of a low-level standard that is 2-3 times the IDL and has been carried through the entire analytical procedure. The standard deviation is then multiplied by 3.143 (the student T test value for seven replicates) to obtain the MDL. For eight replicates, the Student T test value is 2.996.

3.10 Instrument Detection Limit (IDL): The IDL is calculated by analyzing seven or eight replicates of UNDIGESTED low level standard (2 – 3 times the estimated IDL) and calculating the standard deviation. The standard deviation is then multiplied by 3.143 (the student T test value for seven replicates) to obtain the IDL. For eight replicates, the Student T test value is 2.996.

3.11 Reporting Limit Standard (CRA/RL): A low level standard used to verify linearity near the detection limit. The concentration is generally 2 to 5 times the MDL.

3.12 Post Digestion Spike (PDS): A spike added to a sample after digestion to evaluate its matrix. A recovery of 85-115% indicates no matrix interference.

3.13 Matrix Modifier: A combination of elements added to the furnace along with the sample in order to minimize matrix effects. AMRO uses Palladium and Magnesium Nitrate for all elements in combination with a gas mixture of 95% Argon and 5% Hydrogen.

3.14 Instrument Stability Demonstration: Precision study prior to calibration with an RSD < 5% - 5 reps for 200.9 and 3 reps for 7000.

## 4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 Aqueous Samples:

Prior to sample collection, consideration should be given to the type of data required (i.e. dissolved or total recoverable), so that appropriate preservation and pretreatment steps can be taken. The pH of all aqueous samples must be tested upon receipt at the Laboratory to ensure the sample has been properly preserved. If properly acid preserved, the sample can be held up to 6 months before analysis.

4.1.1 Dissolved elements:

For the determination of dissolved elements, the sample must be filtered through a 0.45μm pore diameter membrane filter at the time of collection or as soon thereafter as practically possible. Acidify the filtrate with (1+1) nitric acid immediately following filtration to pH <2.

4.1.2 Total elements:

For the determination of total recoverable elements in aqueous samples, samples are not filtered, but acidified with (1+1) nitric acid to pH < 2. Preservation is done at the time of collection.

4.2 Solid Samples:

Digestion is required for all soil, sediment, sludge samples. Solid samples usually require no preservation prior to analysis other than storage at 4°C. The sample can be held up to 6 months before analysis.

## 5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 Interferences during preparation:

5.1.1 Organic materials present in samples must be oxidized by an acid digestion prior to analysis.

5.1.2 Contamination of sample can be a major source of error. Sample preparation work areas should be scrupulously clean. Method blanks are used as indication of contamination. Calibration blanks are used to auto zero the instrument before calibration. These absorbances should be monitored. Too high a calibration blank will lower the absorbance on calibration standards.

5.2 Interferences during analysis:

5.2.1 Spectral interferences

5.2.1.1 These interferences occur when light is absorbed at the same wavelength as the element of interest by an element, molecule, or compound that is not the element of interest.

5.2.1.2 Molecular- Gases generated in the furnace during atomization may have molecular absorption bands encompassing the analytical wavelength, which can

cause interference. Background correction or using an alternate wavelength outside the absorption band can help eliminate the interference. Also a background correction using the Zeeman effect where the atomic

spectral line is split in a magnetic field. The atomic signal is affected by the magnetic field, whereas the background molecular absorbance is not.

5.2.1.3 Atomic- This occurs when an absorbing wavelength of an element present in the sample but not being determined falls within the width of the absorption line of the element of interest. The result can cause erroneously high concentration, due to the contributing interfering element.

5.2.1.3.1 Also interference can occur when resonant energy from an element in a multi-element lamp or a metal impurity in the lamp cathode falls within the band pass of the slit setting and that metal is present in the sample. Electrodeless discharge lamps can also prevent these types of interferences.

5.2.2 Non-spectral interferences

5.2.2.1 These interferences are caused by elements or compounds which enhance or suppress the formation of "free analyte atoms" during the atomization step. Examples are chloride, sulfide, sulfate, phosphate, magnesium, nickel, and many elemental oxides. For the most part these interferences are reduced or eliminated by using matrix modifiers in conjunction with end cap graphite tubes with platforms. The effectiveness of these modifiers is evaluated for every prep batch by performing analytical spikes. In the instance where the modifiers are unsuccessful, the method of standard additions is employed to compensate for the specific interference.

5.2.2.2 The pyrolytically-coated graphite tubes need to be high temperature conditioned to remove impurities. The conditioning process will also enhance the life of the tube.

5.2.2.3 Smoke-producing matrices- The interferences from these types of matrices can be reduced by extending the charring time.

5.2.2.4 Ionization interferences have not been reported with furnace techniques.

## 6.0 HEALTH AND SAFETY

6.1 AMRO places a high value on lab safety. The air quality of the laboratory has been monitored. Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place.

6.2 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean lab coats and gloves are worn when working with samples. All standards are made up in hoods or an appropriately clean Lab bench. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.3 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eye-wash stations and an emergency shower.

6.4 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.5 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

## 7.0 INSTRUMENTS AND EQUIPMENT

7.1 Perkin Elmer AAnalyst 600

7.1.1 Lamps:

7.1.1.1 As EDL (Perkin-Elmer cat. No. N305-0605)
7.1.1.2 Se EDL (Perkin-Elmer cat No. N305-0672)
7.1.1.3 Sb Hollow Cathode Lamp cat No. N0305-0170
7.1.1.4 Pb Hollow Cathode Lamp cat No. N066-1299
7.1.1.5 Tl Hollow Cathode Lamp cat No. N305-0183
7.1.1.6 Ag Hollow Cathode Lamp cat No. N305-0102

7.1.1.7 Cd Hollow Cathode Lamp cat No. N305-0115

7.2 AS-800 Autosampler for model AAnalyst 600

7.3 Perkin Elmer cooling system for AAnalyst 600

7.4 Computer – Lenovo with MS Windows XP Professional with Service Pack 3.

7.5 Perkin Elmer software AA using Winlab 32 version 6.5 for AAnalyst 600

7.6 PCI-GPIB (MINIMITE] IEEE interface card (ordered through National Instruments).

7.7 Brother Laser HL-5240 printer for AAnalyst 600.

7.8 THGA graphite tubes end cap type Perkin Elmer P/N 8300-0655 box of 20

7.9 Box of 5 set THGA contact rings Perkin Elmer P/N 8050-4036

7.10 Compressed Argon gas, ultra high purity

7.11 Compressed gas 95.0% argon and 5.0% hydrogen, ultra high purity

7.12 2.0mL disposable sample cups from Perkin Elmer B0119079 qty: 1000 cups

7.13 1.1mL disposable sample cups from Perkin Elmer B0510397 qty: 2000/bag

7.14 7.0 L disposable sample cups from Perkin Elmer B3001567 qty: 100/bag.

**7.15** American Power Conversion battery pack power Back Ups 650 for computer.

## 8.0 REAGENTS AND STANDARDS

8.1 Deionized Water (DI), ASTM Type I. or purchased distilled water.

8.2 Diluent – DI water acidified with HCL and HNO3, 2% solution of each.

8.3 Magnesium nitrate solution (10000mg/L; Perkin Elmer cat No. 8019-0634).

8.4 Palladium stock solution (10000 mg/L; Perkin Elmer cat No. 8019-0635).

8.5 Modifier preparation:
To a 200mL volumetric flask containing approximately 50mL of DI water, add 100mL of concentrated nitric acid and swirl flask. Pipet 2.0mL of stock Palladium solution into flask and 1.2mL of stock magnesium nitrate solution. Add DI water to bring volume to the 200mL mark.

8.9 Super stock standard solutions are purchased annually from Inorganic Ventures or another approved supplier:

8.9.1 Custom multi-element solution AMRO CAL/CCV1 see certificate of analysis included in Graphite Furnace Standard Log.

8.9.2 Custom multi-element solution AMRO CAL/CCV2 see certificate of analysis included in Graphite Furnace Standard Log.

8.10 Independent standard from AccuStandard Inc., or other approved supplier.

8.10.1 Multi-element Plasma Emission (ICP) Standard Item Number QCS-01-1-5 see certificate of analysis included in Graphite Furnace Standard Log.
An equivalent standard, but different standard Item Number from AccuStandard may also be used.

8.10.2 Multi-element Plasma Emission (ICP) Standard Item Number: QCS-02-1-5 see certificate of analysis included in Graphite Furnace Standard Log.
An equivalent standard, but different standard Item Number from AccuStandard may also be used.

8.11 Working Stocks- Working stocks (for calibration standards) are prepared from super stocks in 10% hydrochloric acid (HCl) and 2.0% nitric acid (HNO3) solution. For preparation detail please refer to Graphite Furnace Standard Log. New standards are always evaluated against old standards. The new standards should agree within 10% of the old standards. These stocks are prepared monthly. Working stocks for the independent standard is prepared in 2% HCl and 2% HNO3 from super stocks.

8.12 Daily calibration standards- These standards are prepared from the working stock solutions. Standards are prepared weekly. Refer to Attachment 1. For DoD projects all standards are prepared daily.

Property of AMRO Environmental Laboratories Corporation

8.13 ICV solutions- Independent calibration verification standards. The stock solutions are prepared monthly and daily solutions are prepared weekly. Refer to Attachment 1. For DoD projects all standards are prepared daily.

8.14 CCV solutions- Continuing calibration verification solutions. These solutions are the middle point calibration standard. Refer to Attachment 1. For DOD projects all standards are prepared daily.

8.15 RL solutions- These solutions are the reporting limit solutions used as the lower limit standard in the calibration curve. For preparation please refer to Attachment 1.

8.16 Calibration Blanks - These solutions are 2.0% HCl and 2.0% nitric acid solutions. These solutions are also used as diluent solutions in diluting and in standard preparation.

8.17 Tracking of Analytical Standards

It is important to be able to track all analytical reagents and standards back to their sources. The following procedure is used by AMRO Inorganic personnel to accomplish this:

8.17.1 Chemical Receiving Log: The receipt of all standards and reagents from commercial sources is documented in the Chemical Receiving Log. The date received, AMRO ID, chemical name, source, lot number, quantity, storage location, and expiration date are recorded. The AMRO ID is written as an A followed by a 4 digit number (example A0001). Refer to the Graphite Furnace Standard Logbook for standard concentration information.

8.17.2 Graphite Furnace Standard Log: Working standards and LCS solutions made from stock standards listed in the Chemical Receiving Log are documented in the Graphite Furnace Standard Log. The corresponding analysis, preparation date, standard name, AMRO ID, amount used, final volume, final concentration, Standard ID, expiration date, storage location and analyst initials are recorded. The Standard ID is written as an S followed by 1, 2, 3, 4, and 5 then month, day, and year

(example S#MMDDYY). The # refers to the standard number that has been assigned by arbitration.

8.17.2.1 The LCS/MS/MSD spikes/stock solution is referred to as FSPKkMMDDYY which indicates furnace spike month, day and year of preparation.

8.18 Standard Storage: Standards and reagents are stored per method specifications and manufacturer's instructions. Metals standards are stored in a dark, cool area of the lab in a labeled box.

## 9.0 PROCEDURE

9.1 All calibrations are linear.

9.1.1 Lead and Thallium are calibrated at 2, 5, 10, 25 and 37.5µg/L
9.1.2 Arsenic, Selenium and Antimony are calibrated at 5, 10, 25, 50 and 75 µg/L
9.1.3 Silver is calibrated at 0.4, 1.0, 2.0, 5.0, 10 and 20.0 µg/L
9.1.4 Cadmium is calibrated at 1.0, 2.5, 4.99, 12.5, 24.9 µg/L
9.1.5 Calibration solutions are poured into autosampler cups at least once a day. The standard positions are noted in the method file for each element located in the method editor window of AA WinLab software.

9.2 Instrument Parameters forAAnalyst 600:

| | AS | PB | SE | CD | TL | AG | SB |
|---|---|---|---|---|---|---|---|
| Wavelength (nm) | 193.7 | 283.3 | 196.0 | 228.8 | 276.8 | 328.1 | 217.6 |
| Slit Width | 0.70 | 0.70 | 2.0 | 0.70 | 0.70 | 0.70 | 0.70 |
| Timing (Sec) | | | | | | | |
| Read Time | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Read delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| BOC Time | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |

Furnace program: **Thallium**

| STEP NO. | TEMP. (°C) | RAMP | HOLD | INTERNAL FLOW | GAS TYPE | READ |
|---|---|---|---|---|---|---|
| 1 | 110 | 20 | 20 | 250 | Spl | - |
| 2 | 140 | 10 | 30 | 250 | Spl | - |
| 3 | 700 | 10 | 20 | 250 | Spl | - |
| 4 | 400 | 1 | 5 | 250 | Norm | - |
| 5 | 1600 | 0 | 5 | 0 | Norm | Yes |
| 6 | 2400 | 1 | 3 | 250 | Norm | - |

Furnace program: **Selenium**

| **STEP NO.** | **TEMP. (°C)** | **RAMP** | **HOLD** | **INTERNAL FLOW** | **GAS TYPE** | **READ** |
|---|---|---|---|---|---|---|
| 1 | 110 | 10 | 20 | 250 | Spl | - |
| 2 | 140 | 10 | 30 | 250 | Spl | - |
| 3 | 1150 | 10 | 20 | 250 | Spl | - |
| 4 | 800 | 1 | 15 | 250 | Norm | - |
| 5 | 1900 | 0 | 5 | 0 | Norm | Yes |
| 6 | 2400 | 1 | 3 | 250 | Norm | - |

Furnace program: **Silver**

| **STEP NO.** | **TEMP. (°C)** | **RAMP** | **HOLD** | **INTERNAL FLOW** | **GAS TYPE** | **READ** |
|---|---|---|---|---|---|---|
| 1 | 110 | 10 | 20 | 250 | Spl | - |
| 2 | 140 | 10 | 30 | 250 | Spl | - |
| 3 | 800 | 10 | 20 | 250 | Spl | - |
| 4 | 600 | 1 | 5 | 250 | Norm | - |
| 5 | 1700 | 0 | 4 | 0 | Norm | Yes |
| 6 | 2400 | 1 | 3 | 250 | Norm | - |

Furnace program: **Cadmium**

| STEP NO. | TEMP. (°C) | RAMP | HOLD | INTERNAL FLOW | GAS TYPE | READ |
|---|---|---|---|---|---|---|
| 1 | 110 | 10 | 20 | 250 | Spl | - |
| 2 | 140 | 10 | 30 | 250 | Spl | - |
| 3 | 500 | 10 | 20 | 250 | Spl | - |
| 4 | 300 | 1 | 5 | 250 | Norm | - |
| 5 | 1400 | 0 | 4 | 0 | Norm | Yes |
| 6 | 2400 | 1 | 3 | 250 | Norm | - |

Furnace program: **Lead**

| STEP NO. | TEMP. (°C) | RAMP | HOLD | INTERNAL FLOW | GAS TYPE | READ |
|---|---|---|---|---|---|---|
| 1 | 110 | 10 | 20 | 250 | Spl | - |
| 2 | 140 | 10 | 30 | 250 | Spl | - |
| 3 | 1000 | 10 | 20 | 250 | Spl | - |
| 4 | 800 | 1 | 5 | 250 | Norm | - |
| 5 | 1900 | 0 | 5 | 0 | Norm | Yes |
| 6 | 2400 | 1 | 3 | 250 | Norm | - |

Furnace program: **Arsenic**

| STEP NO. | TEMP. (°C) | RAMP | HOLD | INTERNAL FLOW | GAS TYPE | READ |
|---|---|---|---|---|---|---|
| 1 | 110 | 10 | 20 | 250 | Spl | - |
| 2 | 140 | 10 | 30 | 250 | Spl | - |
| 3 | 1200 | 10 | 20 | 250 | Spl | - |
| 4 | 800 | 1 | 5 | 250 | Norm | - |
| 5 | 2000 | 0 | 5 | 0 | Norm | Yes |
| 6 | 2400 | 1 | 3 | 250 | Norm | - |

Property of AMRO Environmental Laboratories Corporation

Furnace program: **Antimony**

| STEP NO. | TEMP. (°C) | RAMP | HOLD | INTERNAL FLOW | GAS TYPE | READ |
|---|---|---|---|---|---|---|
| 1 | 110 | 10 | 20 | 250 | Spl | - |
| 2 | 140 | 10 | 30 | 250 | Spl | - |
| 3 | 1200 | 10 | 20 | 250 | Spl | - |
| 4 | 800 | 1 | 5 | 250 | Norm | - |
| 5 | 1900 | 0 | 5 | 0 | Norm | Yes |
| 6 | 2400 | 1 | 3 | 250 | Norm | - |

9.3 Method editor/ checks window:

**Calibration:**
Recalibrate instrument periodically - no
Analyze standards at end of run -no
**Analysis:**
Check precision -yes
Check precision on samples, calibration standards, recovery samples, and QC samples.
**Limits:** precision check signal – peak area
Signal limit – 0.005 A-s
If signal >limit and RSD > 20% then reanalyze 1 time.
If background > 1 au then reanalyze 1 time.
Reanalyze samples beyond calibration range – yes
Over cal limit is 90% of calibration range
Check range on samples dilute and reanalyze after all replicates
Alternate sample vols (µl): 10 and 5.
For cadmium – alternate sample vols (µl): 2 and 1.
For silver-alternate sample vols (µl): 5 and 2.
Perform matrix check calculation: No
Perform recovery measurements: Yes
Concentration units: calibration µg/l
For most elements, the expected Post Spike concentration increase is 25µg/l
Recovery limits: lower –85% upper – 115%

9.10 MSA files:

9.10.1 If the MSA (Method of Standard Addition} is needed, two procedures are followed: *One point* MSA is acceptable in most cases. The one point MSA is achieved by formula correcting the solution concentration for the percent recovery of the analytical spike recovery. The corrected solution concentration would be equal to the uncorrected solution concentration divided by percent recovery in the analytical spike of the sample expressed as a fraction. For all DOD/ projects and for special projects, or sometimes at the choice of the analyst a *Three points* MSA is performed. A correlation coefficient of equal to or greater than 0.995 is needed.

9.10.2 The method of standard additions is an indirect technique and is never as accurate as the direct determination of concentration from a calibration curve. It is always preferable to avoid MSA's by attempting to remove interferences;
The absorbance of samples and spiked additions are plotted on x and y axes, respectively. The absolute value of the x-intercept is the MSA-corrected concentration.
There are two assumptions that must be true for accurate results for MSA's.
The calibration curve must be linear up to the concentration of the sample plus the concentrated addition and the matrix must have the same effect on the added analyte as it has on the naturally – occurring analyte.
For the purposes of this SOP, the three point MSA is conducted by manual spiking of the sample at approximately 50%, 100%, and 150% of the sample concentrated.

**If the correlation coefficient is less than 0.995, reanalyze and choose the analysis with the highest correlation coefficient.**

9.11 Furnace Optimization/Method development

9.11.1 Generally select the default conditions for the method as a starting point. Then optimize the drying conditions by running a blank and

checking for drying by placing a mirror over the injection port {with the fume extractor off} and observe for moisture as an indicator of drying completeness. For the purposes of this SOP the fume extractor is not used in any of the methods run. Hot injection is used, injecting at approximately 110°C with a two step dry program at 110°C and 140°C. The drying temperature should be as high as possible without boiling or spattering.

9.11.2 Optimizing for the char step is done by varying the char temperatures by 50°C either up or down from the default condition and choosing the temperature that gives the highest absorbances and sharpest peaks.

9.11.3 The char ramp time should use one second for each 100°C change in going from the dry to the char step. With the use of the alternate gas a second char step is included with only a 1s ramp time. In that step the alternate gas is shut off to purge with pure argon gas.

9.11.4 Optimizing for the atomization step is similar to optimizing for the char step. The default temperature is the starting point. Vary the temperature by 50°C either up or down from the default temperature and choose the temperature with the highest absorbances and sharpest peaks.

9.11.5 A final burn out step is included to clean the tube after each burn. This burn out temperature is at 2400°C ramp 1s and hold for 3 s.
Generally in an analysis if the peaks are trailing not giving a sharp peak, or returning to the base line an increase of 50°C in the atomization temperature will correct the problem.

9.12 Reformat

9.12.1 The data will automatically be exported at the end of the run to C:\Bob's AA RESULTS as a text file (Ammddyy.txt). Open the file in Excel and make sure the test codes and sample ID's are correct and all columns are complete. Save the file in: LIMS IMPORT ON PLUTO (N)\OPTIMA3\METALS\AA 600. Save as an Excel file. Import the file into LIMS.

9.12.2 Then at the GFAA computer, go to UTILITIES and DATA MANAGER. MAKE SURE THE DATES FOR THE STANDARDS, THE ICV, AND THE MOCIFIER are correct. Highlight a file and select REPORT titled AANALYST 600 REPORT.rep. Make sure the correct element and all the samples are selected and print the report and include it with the raw data. If there is more than one element in a data file, select each (one at a time) and print.

9.12 Sample Analysis:

9.15.1 Turn on the power to the instrument. The argon and argon-hydrogen for the alternate gas may be left on to deliver gas at 50psi. The instrument has internal valves that shut the gas off when the instrument is not in use. The instrument may be left on at all times also.

9.15.2 After the AAnalyst 600 has been on for **One Minute**, start the Winlab software.

9.15.2 The water cooler is activated by the instrument.

9.15.4 Arrange samples to be analyzed as follows:

| Sequence | Cup No. | Sample id | Comment |
|---|---|---|---|
| 1 | 148 | S0 | Calibration blank |
| 2-7 | 1 - 6 | S1, S2, S3, S4, S5, S6 | Calibration Standards (r2>=0.995) |
| 8 | 121/129 | IPC (Applicable to 200 series only.) | Instrument performance check for 200.9 method (±5%) |
| 9 | 124/131 | ICV | Initial calibration verification (±10%) |
| 10 | 148 | ICBMMDDYY | Instrument controlled at ±RL. |
| 11 | ½ | RL1/RL2 | Instrument controlled at ±30% |
| 12 | 10 | BW, BSMMDDYY | Method Blank (±RL) |
| 13 | 11/12 | LW, LSMMDDYY | Laboratory control sample (±20% SW-846 Methods, ±15% 200.9 Methods) |
| 14 | 13 | Xxxxxxxxxxxxxxxxxxxx | Batch QC sample |
| 15 | 13 | Xxxxxxxxxxxxxxxxxxxx | Analytical spike of sample (±15%). All samples are spiked except MCP |
| 16 | 14 | XxxxxxxxxxxxxxxxD | Sample duplicate (<20% RPD). |
| 17 | 15 | XxxxxxxxxxxxxxxxS | Matrix spike of sample (±25% SW-846 Methods, 70 – 130% 200.9 Method). |
| 18 | 16 | XxxxxxxxxxxxxxxxxSD | Matrix spike duplicate (See above, <20%RPD between recoveries). |
| 19-22 | 17-20 | Xxxxxxxxxxxxxxxxxxxx | 4 samples |
| 23 | 121/129 | CCVMMDDYY | Continuing Calibration Verification (±10%). |
| 24 | 148 | CCBMMDDYY | Instrument controlled at ±RL. |
| 25-34 | 21-30 | Xxxxxxxxxxxxxxxxxx | 10 sample + analytical spikes |
| 35 | 121/129 | CCV | Continuing Calibration Verification (±10%). |
| 36 | 148 | CCB | Instrument controlled at ±RL. |

Note: 1. For ICB and CCB, when the blank values are greater than ±RL limits and sample concentrations are over 10X the blank value, the sample data is acceptable. If sample concentrations are over the RL and less than 10X the blank value the samples require re-analysis.

2. All DOD projects: ICB, CCB and Method Blank values must be <1/2RL.

9.15.5 More samples can be added to tray. Sample tray has 148 positions. The first six positions are standards and instrument QC. Position 121 is for IPC/CCV at 25 ug/L. Position 124 is a 25 u/L ICV. Position 129 is an IPC/CCV at 50 ug/L and position 131 is for a 50 ug/L ICV. Position 126 is for the matrix modifier. Position 134 is the stock (100 ug/L) solution for post digestion spikes. Position 148 is for the calibration blank and CCB.

9.15.5.1 Start with the blanks and LCS's from all batches added to the run.

9.15.5.2 Proceed following the order in which the samples appear on the prep sheet.

9.15.5.3 Mark on the prep sheet the numbers of the autosampler positions in which each sample will go. Generally this will be position number seven to start.

9.15.5.4 Pour samples into autosampler cups and load into the appropriate position.

9.15.8 Pour all the samples into the 1.1mL sample cups. Place the samples into the autosampler tray as outlined by the autosampler positions marked on the prep sheet. The standards will be poured into the1.1 mL sample cups and placed in the auto sampler tray as outlined in the method for the elements to be run.

9.15.9 The matrix modifiers are poured in the larger 2mL or 7mL cups as appropriate. Sometimes the 2mL cups are OK to use.

9.15.11 From the AAWinLab main window click on the box labeled method. Select the method to be run. Click on OK. The computer screen will return to the main window of AA WinLab. The method name selected will be shown in the upper right hand corner of the window on the right side of the box named method. Click on the box for method editor. The method editor window will be opened for the method selected. Click on the on bottom tab for calibration. The calibration window will be opened. Click on the bottom tab for Checks. The check window will be opened. Click on set for perform recovery measurements. The recovery measurement window will be opened. Click on the side tab frequency. The frequency window will be opened. In the box for

samples in AS locations fill in the autosampler locations for samples to be analytically spiked. Generally all samples are analytically spiked except the LCS, and the two matrix spike samples. Click on OK. The main checks window will be opened. Click on the bottom tab QC. The QC sample description window will be opened. If new QC samples have been made enter the new QC sample ID's . When everything is correct go to file and save. If multiple methods are being run go to file open method and click and select the methods to be run. Click on OK. Repeat procedure as with the first method and finally save. Repeat with any other methods to be run. Finally open up the method to be first run. Close the method editor window once the first method to be run as been selected. The main window for AA WinLab will be opened. Click on the top box for lamps. The align lamps window will be opened.

*Note:* Make sure that the proper lamps have been installed, and aligned. The lead lamp should always be lamp No.3. The lamp type is either HCL or EDL. It will show the current in mA. The wavelength and slit width is also shown. For arsenic and selenium {the two EDL lamps} make sure these two lamps have been turned on previously at least one half hour ahead before running these elements.

9.15.12 The main window of AAWinLab software will be opened. At the top of the window open up the window Automated analysis.

The Automated analysis window has a column for methods to be run. A column for delay in minutes between methods. An columns to use the entire sample info file, or to use autosampler locations as listed. Double click on method entry field to display methods dialog. Select the Sample Information file to be run. These entries are all under the automated analysis window setup. Once the methods to be run have been selected, and autosampler positions for each method have been entered. The sample information file to be run selected. Click on the bottom button Analyze. The automated analysis window /analysis progress window will be open. This window will show % of samples complete {run}, current status idle or replicate of 1 or 2 if running, autosampler location, and Id. The atomizer section will show step of, time and, temp. The autosampler controls block will show select location, flush sampler, and standby. Before doing analysis click on the flush sampler button to flush the autosampler tip.

9.15.13 The cooling water to furnace is activated once the furnace method has been started.

9.15.14 Check that the printer has enough paper for the analysis data.

9.15.15 Before the first analysis of the day, check the number of burns on the tube to see if it needs to be replaced. Then analyze five replicate analyses of a mid-range standard. The precision MUST be < 5 % to continue. Also use one of the data points to calculate the characteristic mass. The acceptable range for characteristic mass is ±20%.

9.15.16 If the precision check is OK, and the autosampler has been filled and checked, start the analysis by pressing the "Analyze All" button in the software.

9.16 Method of Standard Additions:

9.16.1 The method of standard additions (MSA) is an indirect technique and is never as accurate as the direct determination of concentration from a calibration curve.

9.16.2 The absorbances of samples and spiked additions is plotted on x and y axes, respectively. The absolute value of the x-intercept is the MSA-corrected concentration.

9.16.3 There are two assumptions that must be true for accurate results for MSA's:

9.16.3.1 The calibration curve must be linear up to the concentration of the sample plus the most concentrated addition.

9.16.3.2 The matrix must have the same effect on the added analyte as it has on the naturally-occurring analyte.

9.16.4 Unless specifically requested otherwise, a one point MSA is used for all SW-846-7000 series. DOD samples require 3 point MSA's if an MSA is needed. For one point MSA's and formula MSA-corrected solution concentration in µg/L= uncorrected solution concentration divided by percent recovery in the analytical spike of the sample expressed as a fraction.

## 10.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

10.1 Fill the wash reservoir with 2% mixture of Nitric and Hydrochloric acids and a few drops of Triton X-100 to prevent cross contamination on the autosampler tip.

10.2 A stock of replacement lamps should be on hand for all elements routinely used.

10.3 Do not leave EDL's lit longer than is necessary. However, care should be taken to avoid lighting them an excessive number of times.

10.4 The air filters at the rear of the instrument should be cleaned monthly in order to keep dust out of the electronics department. There is also a filter on the side of the instrument also. Clean the side filter when doing the back filter.

10.5 Be careful not to hit the IEEE cables on the rear of the instrument when cleaning the bench. This could cause communication problems.

10.6 Furnace maintenance to occur daily:

10.6.1 Change graphite tube when:

10.6.1.1.1 A portion of the tube visible from the introduction port is rough, or upon opening the furnace a bad deterioration of tube or badly burned tube is noted. Generally three to four hundred burns is max and tubes usually last about 700 burns.

10.6.1.2 To change a graphite tube or contact rings follow this procedure:
From the main window of AAWinLab click on the button at the top of screen labeled furnace. The furnace control window is opened click on the button on the bottom labeled open/close. This will open the furnace. For changing of the graphite tube. Remove the old tube. Before inserting the new tube clean the rings with 1% nitric acid using cotton tipped cleaning sticks that have no glue on them. Clean the sample port also with 1% nitric acid. This removes excess carbon build up on the rings. Reinsert a new tube and click on the open/close button on the screen. This will close the graphite furnace. On each end of the furnace there are quartz windows that are held by a rubber gasket in a holder screwed into the furnace. Remove the window holders on each side with the metal tool that is supplied.

Clean the quartz windows with methyl alcohol and lens paper. Reinsert the windows back on each end of the furnace. Tightened the holder with the metal tool . Make sure it is tight. In the furnace control window click on the standby button. This will raise the autosampler arm into up position. Clean the autosampler tip with methyl alcohol first and then 1% nitric acid by inserting the tip into the solution and wiping with Kimwipes. Check the alignment of the tip by lowering the auto sampler arm into the furnace tube. There is a mirror on an arm on the right side of the furnace. On the left side of the furnace the arm has a light blocker. These arms can be lowered to see the tip in the tube. The tip should go in the center of the sample port hole of the tube. Observe this by looking straight down on the sample port hole with a flash light. If touching one side or other realign the tip. On the front of the AS-800 there are two adjusting thumb screws on the auto sampler. The one on the front of the auto sampler adjusts the inward and outward of the auto sampler arm. The thumb screw on the left side of the auto sampler adjusts the movement to the left or right of the arm. There are two thumb screws on top of the auto sampler. The depth control knob on the right of the autosampler is used to adjust the depth of the tip in the sample cup. The depth in the tube should be adjusted to not quite touching the bottom of the tube. The dept in the cup should be not quite touching the bottom of the cup. Once the tip has been aligned in the tube and the cup.

To change the contact rings follow the procedure as outlined in the Users Guide for the THGA Graphite Furnace and AS-800 Autosampler.

Contact ring life is 3000 to 4000 cycles. Once a tube or contact rings have been changed the tube and contact rings need to be conditioned. In AAWinLab software a furnace program has been installed for furnace conditioning. To run the conditioning program of the furnace an analytical method must be opened that has a lamp installed for that method. Generally a lead method is ok. The lead lamp is always kept in the first position of the lamp turret. This is recommended by Perkin Elmer because of the wavelength of the lead line

is optimal for initialization of the instrument after shut down. From the furnace control window click on the button condition tube. This will start the conditioning program. Once the conditioning program has been run close the window for Furnace control. The main window of AAWinLab will be open. At the top of the window click on tools, diagnostics, and furnace, to reset the tube cycles to zero, and cylinder cycles to zero. Before resetting for both note the number of cycles for each in the furnace maintenance book.

10.7 When handling any of the graphite parts wear gloves to prevent skin oils from contaminating the graphite. **NOTE**: Fingerprints shorten tube's life.

## 11.0 CALCULATIONS

11.1 Instrument concentrations are in µg/L.

11.2 For water samples: The results are reported in µg/L. The sample concentration reported will be in µg/L units times the dilution factor.

11.3 For soil samples: Multiply the results in µg/L times the final volume of digestate in liters divided by the dry wt of sample in grams times the dilution factor to give results in mg/kg. In the sample info file if the sample weight has been entered in wet weight, and units entered in as mg/Kg the AAWinLab software will calculate the sample result in mg/Kg as wet weight. For sample results being reported in LIMS. The raw data being imported into LIMS is in calibration units of ug/L. The LIMS has the prep info entered separately such as weight and volume. The percent solids info is entered separately. The final sample result will be mg/Kg accounting also for dilution factor. To check this result for correctness take the sample result on the raw data in mg/Kg and divide by the percent solids and multiply times 100. This will account for the dry weight. Always multiply times the dilution factor.

11.4 Recovery measurements of Spikes: Recovery measurements are calculated by subtracting the unspiked sample concentration in standard concentration units (µg/L) from the spiked sample concentration in standard concentration units and dividing by the true value of the spike in µg/L. If the sample concentration was "undetected, then the recovery calculation is done with a value of Zero for the unspiked result.

11.5 Method of standard additions:

11.5.1 Unless specifically requested, a one-point MSA is used for all analyses. The MSA-corrected solution concentration equals the uncorrected solution concentration in µg/L divided by the percent recovery in the analytical spike of the sample expressed as a fraction.

11.5.2 The equation used for three point MSA's is A = K1 + (K2 C). The concentration is the x-intercept, where A = the difference between the Absorbance for the aliquot with added standard and the Absorbance measured for the sample, K1 = the coefficient on the untreated sample,

K2 = the coefficient on the sample that has been spiked. Both coefficients are determined by the least squares routine. The sample with no addition is treated as just another point by the least squares routine that determines the K1 and K2 coefficients. Quantitative measurements in atomic absorption are based on the Beer-Lambert Law, which states that concentration is proportional to Absorbance.

$$C = K\,A = K \log \frac{Io}{I}$$

C = Concentration added to an aliquot of sample.
A = Absorbance
Io and I are incident and transmitted source intensities.
K is a proportionality constant.

11.5.3 All calculations for the batch QC are done on the raw data showing the LCS recovery, the matrix spike recovery, matrix spike duplicate recovery, % RPD between sample and sample duplicate concentrations.

## 12.0 QUALITY CONTROL

12.1 Instrument QC:

12.1.1 Calibration equation – Linear, zero intercept.

12.1.2 Control limits for calibration ≥ 0.995 correlation coefficient.

12.1.3 Frequency of calibration-Once in 24 hours or whenever switching elements, or whenever limits for instrument QC are not met.

12.1.4 Initial Calibration Verification (ICV): This standard is run initially after the calibration. The control limits are ± 10%. If out of control stop and recalibrate.

12.1.5 Initial Performance Check (IPC): This standard is run initially after the calibration for 200.9 methods. The control limits are ± 5%. If out of control stop and recalibrate.

12.1.6 Initial calibration blank (ICB)- This blank solution is analyzed initially after the ICV check. The control limit is ±RL. If out of control, stop and recalibrate. If the initial calibration blank value is > ±RL, this indicates biases in the analysis. Any sample that is 10X this value or greater is reportable. Any sample that is between the RL and <10X the value is not reportable. Any value that is <RL is reportable. A nonconformance summary report is required.

12.1.7 Reporting limit standard (RL/CRA)- This low level standard is run as the first or second standard in the calibration after the ICB check. The control limits are ±30%. If out of control the instrument will recalibrate..

12.1.8 Continuing Calibration Verification standard (CCV)- This is the midpoint standard in the calibration. This standard is run every 10 samples. The control limits are ±10%. If out of control, recalibrate. Rerun samples since last acceptable CCV.

12.1.9 Continuing Calibration blank (CCB)- This blank solution is analyzed after the CCV check standard. The instrument control limit is ±RL. Refer to Section 9.4 for guidance on what is acceptable to report if the CCB is out of control. If samples are between the RL and <10X the CCB value, recalibrate and rerun all samples from the last good CCV and CCB QC check that fall into this category.

12.1.10 Any sample will automatically be diluted if its concentration is greater than 90% of the highest standard. Also, samples with background absorbance >1.0 are automatically diluted.

12.2. Batch QC:

12.2.1 Preparation Blank (MB) - The control limits are **< RL**. If out of control, reanalyze the blank to confirm. If still out of control reprep any sample that has a concentration that is greater than the reporting limit but is less than 10 times the determined blank value. All other samples can be reported. Indicate the blank being out of control on the metals validation/ outlier report. Control limits for all DOD projects is **< ½ RL**.

12.2.2 Laboratory Control Sample (LCS/LCSD)- This is the blank spike sample. There should be one blank spike sample per twenty samples for 200.9 and two for SW-846 batches. The control limits are ±15% for 200.9 or ±20% for SW-846 samples. If out of control re-digest the entire batch is required.

12.2.3 Matrix Spike (MS) - This is the matrix spike sample. There is one matrix spike sample per twenty samples. The control limits are 75-125% for SW-846 and 70-130% for 200.9. If out of control, sample dilution can be performed if the sample concentration is high enough. Don't dilute below the reporting limit. If sample concentration is greater than four times the spike concentration, the sample spike recovery is not applicable. A comment on the metals validation/ outlier report is necessary when the MS recovery is outside the acceptance limits.

12.2.4 Matrix Spike Duplicate (MSD)- The matrix spike duplicate sample is run following the matrix spike sample. There is one matrix spike duplicate sample per twenty samples The control limits are the same as the matrix spike sample. If out of control follow the same procedure as for the matrix spike sample. The %RPD must be calculated between the two spiked sample concentrations to show sample heterogeneity. The %RPD limit between the MS and MSD is <20%.
In some cases, the client may specify which sample is to used for MS/MSD; if not, the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall not be performed on Rinsate Blank or Field Blank.
B. Adequate sample weight/volume.
C. Client requested QC deliverables.

12.2.5 Sample duplicate (DUP): The control limit of 20% or less RPD for the sample results. If out of control, rerun samples to confirm. A greater than 20% result indicates sample heterogeneity. A comment on the metals validation/ outlier report should be filled out indicating sample heterogeneity. A duplicate is required every 20 samples.

12.2.6 Serial Dilution: Routine Serial Dilutions are not typically needed for the majority of drinking and waste water samples due to the limited working range of the furnace methods. However, all samples are given a post digestion spike (PDS). If the PDS fails, the sample is diluted (serial dilution) and the diluted sample is analyzed followed by a PDS on the dilution. By calculating the spike recovery on the

original sample and the diluted sample as well as the RPD between the original and diluted sample, the effect of the matrix can be evaluated and corrected. The criteria for the serial dilution is +/- 10%.

12.2.7 The control limits for spike recoveries are 85-115%. If out of control, sample interference may be indicated. This may be over come by either diluting the sample, if sample concentration permits it. If it is not possible to dilute, Method of Standard Additions can be done. A one point MSA calculation is acceptable. The sample in ppb is divided by the percent recovery of the analytical spike and multiplied by 100. This will give the corrected sample concentration in ppb. Since the instrument will automatically dilute and respike the sample, two PDS values plus the serial dilution will be available for matrix evaluation.

12.2.8 Duplicate injections (no post digestion spikes) or Sample + PDS must be performed on every sample in the batch.

## 13.0 DATA REVIEW AND STORAGE

13.1 Data Reduction:

13.1.1 Immediately after analysis of samples, the original data is reviewed. QC calculations are performed manually in the raw data. A metals validation/ outlier report is filled out. Any items whether instrument QC or batch QC that are out of control are noted in this outlier report. If samples are to be rerun or diluted these are noted in the outlier report.

13.1.2 Data that is bracketed by instrument QC which do not meet control limits need to be crossed out.

13.1.3 Dilute and reanalyze samples when the background peak height exceeds 2 AU's.

13.1.4 Dilute and reanalyze samples when the "uncorrected concentration" exceeds the concentration of the highest standard.

13.2 Transfer Data to LIMS and verify with raw data.

13.3 Data Review:

13.3.1 All related preparation information and observations will be noted in the digestion logbook.

13.3.2 All cross-outs must be a single line and should be initialed and dated. Analyst review is documented on the GFAA and CVAA Data Review Checklist (Attachment 2).

13.3.3 When an analysis of a sample is complete, the analysis for that sample should be checked and the data calculated as soon as possible to identify any problems while still within the holding time for the analysis. A copy of the Runlog which has been signed with analyst initials and dated needs to be put into a 3 ring notebook for Runlogs.

13.3.4 The Section Supervisor and/or Data Reviewer shall review all samples for a given project that have been analyzed and the results have been calculated, the project goes through the following data review procedure. The reviewer reads over all associated paperwork to become familiar with the requirements of the project. The project is checked for completeness. The Runlog is checked for accuracy. The data calculations are checked. The QC requirements are checked. Any Non-Conformance reports are included. Any problems encountered by the reviewer are brought to the attention of the lab manager.

## 14.0 REFERENCES

14.1 Test Methods for Evaluating Solid Waste, SW-846, Edition, Revision 2, USEPA, December 1996.

14.2 The THGA Graphite Furnace: Techniques and Recommended Conditions", by Perkin Elmer, Publication B3210.10, release 1.2.

14.3 Atomic Absorption Spectroscopy AA WinLab Software Guide", by Perkin Elmer Part No. 0993-6190, 1996.

14.4 AAnalyst 600 Simultaneous Mult-element Atomic Absorption Spectrometer Installation Maintenance System Description", by Perkin Elmer Publication B3119.10 release 1.1 / Feb. 95.

14.5 Department of Defense Qualtity Systems Manual for Environmental Laboratories, Revision 3, January 2006.

14.6 Massachusetts Contingency Plan (MCP), Revision 3, May 22, 2003.

14.7 Method 200.9, Determination of Trace Elements by Stabilized Temperature Graphite Furnace Atomic Absorption, Revision 2.2, May 1994.

Property of AMRO Environmental Laboratories Corporation

Attachment 1

Attachment 1

AMRO SPECTROSCOPY STANDARDS FOR 2009/2010

14-Sep-09

PE-4100ZL & PE-6000 SIGMA

| Element | IV CAL/CCV-1 Stock ug/mL | IV CAL/CCV-2 Stock ug/mL | AMRO INITCAL Monthly ug/L 1.0->100mL | AMRO 53-minute WEEKLY ug/L 2.0->100 | AMRO 53-minute WEEKLY ug/L 1.0->100mL | AMRO 52-minute WEEKLY ug/L 0.50->100 | AMRO 51-minute WEEKLY ug/L 0.50->500 | AMRO 51-minute WEEKLY ug/L 0.20->500 | AMRO 51-minute WEEKLY ug/L 0.20->100 | AMRO SPKLCS PER BATCH ug/L 0.25->50 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 4.76 | 2.80 | 1.78 | 6 | 71 | 72.79 | |
| As | | 499.9 | 4999 | 100.0 | 50.0 | 25.0 | 5.00 | 2.00 | 10.0 | 25.0 |
| Pb | | 499.9 | 4999 | 100.0 | 50.0 | 25.0 | 5.00 | 2.00 | 10.0 | 25.0 |
| Se | | 500.1 | 5001 | 100.0 | 50.0 | 25.0 | 5.00 | 2.00 | 10.0 | 25.0 |
| Tl | | 499.9 | 4999 | 100.0 | 50.0 | 25.0 | 5.00 | 2.00 | 10.0 | 25.0 |
| Cd | | 249.3 | 2493 | 49.9 | 24.9 | 12.5 | 2.49 | 1.00 | 4.99 | 12.5 |
| Sb | 500 | 500.0 | 5000 | 100.0 | 50.0 | 25.0 | 5.00 | 2.00 | 10.0 | 25.0 |
| Ag | 100.07 | 100.07 | 1000.7 | 20.0 | 10.0 | 5.00 | 1.00 | 0.400 | 2.00 | 5.00 |

INDEPENDENT

| Element | VHG ICV QS-1 ug/mL | VHG ICV QS-2 ug/mL | AMRO INIT-ICV MONTHLY ug/L 1->100mL | AMRO ICV-minute WEEKLY ug/L 5->100mL | AMRO anICV-minute WEEKLY ug/L 2.5->100mL | ICV-CAL-minute WEEKLY ug/L 2.5->500mL |
|---|---|---|---|---|---|---|
| | | | | 5 | 10 | 75 |
| As | 100 | | 1000 | 50.0 | 25.0 | |
| Pb | 100 | | 1000 | 50.0 | 25.0 | |
| Se | 100 | | 1000 | 50.0 | 25.0 | |
| Tl | 100 | | 1000 | 50.0 | 25.0 | |
| Cd | 100 | | 1000 | 50.0 | 25.0 | 5.00 |
| Sb | 100 | | 1000 | 50.0 | | 2.50 |
| Ag | | 50 | 500 | | | |

Property of AMRO Environmental Laboratories Corporation

# Attachment 2

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

## GFAA and CVAA DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

Method:

Analysis:

| | | | | |
|---|---|---|---|---|
| A. | GENERAL | | | |
| 1. | Copy of Digestion Log? | Y | N | NA |
| 2. | Copy of Instrument Run Log? | Y | N | NA |
| 3. | All samples met digestion and/or analysis holding time criteria? | Y | N | NA |
| 4. | Initial Calibration meets method criteria for GFAA, min. 3 std plus a blank? R >0.995 | Y | N | NA |
| 5. | Initial Calibration meets method criteria for CVAA, min. 5 std plus a blank? R >0.995 | Y | N | NA |
| 6. | Initial Calibration Verification (ICV) meets method criteria: ±10%? | Y | N | NA |
| 7. | Is the RL1 check QC at ±20%? | Y | N | NA |
| 8. | Initial Calibration Blank (ICB) free of contamination?(<½RL) | Y | N | NA |
| 9. | Initial Performance Calibration(IPC) meets criteria: ±5% ? | Y | N | NA |
| 10. | Continuing Calibration Verification(CCV) meets method criteria: ±10% ? | Y | N | NA |
| 11. | Continuing Calibration Blank(CCB) free of contamination?(<½RL) | Y | N | NA |
| 12. | Are CCV and CCB analyzed after every 10 samples ? | Y | N | NA |
| 13. | Was post digestion performed? If yes was %R=85-115? | Y | N | NA |
| 14. | Was the serial dilution performed? If yes was %R= 90-110? | Y | N | NA |
| 15. | Method Blank- contaminant free(<½RL)? | Y | N | NA |
| 16. | Are all reported results within calibration range? | Y | N | NA |
| 17. | LCS % Recovery criteria met for all compounds? | Y | N | NA |
| 18. | MS/MSD %R's and %RPD's are met for all compounds? | Y | N | NA |
| 19. | %RPD criteria met between sample and duplicate? | Y | N | NA |

COMMENTS

Analyst (s) _____ DATE: _____

REVIEWER _____ DATE OF REVIEW: _____

qc/qcmemos/Forms/GFAACVAAchecklist Rev. 1 07/03/01

## Attachment 3

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

# QUALIFICATION CARD FOR SW-846 METHOD 7000 SERIES

Trainee: _____ Signature: _____

Trainer: _____ Signature: _____

I. Knowledge Factors:

SOP Title: _____ Revision Number/Date: _____

| | | | |
|---|---|---|---|
| 1. Did the Trainee read and understand the above SOP? | Yes ☐ | No ☐ | NA ☐ |
| 2. Was the Trainee instructed on how to properly fill out the documentation? | Yes ☐ | No ☐ | NA ☐ |
| 3. Has the Trainee been instructed on the proper procedures for addressing potential problems? | Yes ☐ | No ☐ | NA ☐ |

II. Practical Factors:

| | | | |
|---|---|---|---|
| 1. Has the Trainee completed a Precision and Accuracy Study? | Yes ☐ | No ☐ | NA ☐ |
| 2. Has the Trainee completed the maintenance schedule followed by a successful calibration? | Yes ☐ | No ☐ | NA ☐ |
| 3. Has the Trainee demonstrated the ability to review and document Instrument QC and Batch QC problems? | Yes ☐ | No ☐ | NA ☐ |

Completion Date: _____ Trainer's Signature: _____

I _____ have read, understood and follow the above method/SOP, which is in use at AMRO Laboratories for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

Section Manager/ Supervisor: _____ Date: _____

QA Manager: _____ Date: _____

qc/qcmemos/forms/7000qualcard Rev. 0 09/00

**Property of AMRO Environmental Laboratories Corporation**

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

# Pensky-Martens Closed Cup Method for Determining Ignitability

## SW-846 Method 1010

Procedure Number: IL-3045

Revision No.: 1

Revision Date: 08/25/2003

Review Date: 03/02/2010

Prepared By: Peter Adam Date: 3/2/10

Approved By: Robert E. Bouchard Date: 03/02/10
Inorganic Manager

Approved By: [signature] Date: 3/2/10
Laboratory Director

Approved By: Robert E. Bouchard Date: 03/02/10
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

# Pensky-Martens Closed Cup Method for Determining Ignitability

## SW-846 Method 1010

Procedure Number: IL-3045

Revision No.: 1

Revision Date: 08/25/2003

Review Date: 03/10/2008

Prepared By: Paula Benham Date: 3/10/08

Approved By: Gowri Mahendraraja Date: 3/10/08
Inorganic Manager

Approved By: Maria W. Bowles Date: 3/10/08
Laboratory Director

Approved By: Paula Benham Date: 3/10/08
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

# TABLE OF CONTENTS


| | | Page |
|---|---|---|
| 1.0 | SCOPE AND APPLICATION | 3 |
| 2.0 | METHOD SUMMARY | 3 |
| 3.0 | DEFINITIONS | 3 |
| 4.0 | SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE | 4 |
| 5.0 | POTENTIAL PROBLEMS AND INTERFERENCES | 4 |
| 6.0 | HEALTH AND SAFETY | 4 |
| 7.0 | INSTRUMENTS AND EQUIPMENT | 5 |
| 8.0 | INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR | 5 |
| 9.0 | REAGENTS AND STANDARDS | 6 |
| 10.0 | PROCEDURE | 7 |
| 11.0 | CALCULATIONS | 9 |
| 12.0 | QUALITY CONTROL | 9 |
| 13.0 | DATA REVIEW AND STORAGE | 10 |
| 14.0 | REFERENCES | 11 |
| | Attachment 1 Flash Point SW-846 Method 1010 worksheet | 12 |
| | Attachment 2 Wet Chemistry Data Review Checklist | 13 |
| | Attachment 3 Flash Point SW-846 Method 1010 Qualification Card | 14 |

## 1.0 SCOPE and APPLICATION

1.1 Determination of flashpoint using a Pensky-Martens closed cup tester for soils or liquids.

## 2.0 METHOD SUMMARY

2.1 Flashpoint is determined by heating the sample at a slow constant temperature, during which time a small flame is applied to the cup at regular intervals. Flashpoint is the lowest temperature at which application of the test flame causes the vapor above the sample to ignite. Combustion does not continue. Flashpoint can indicate the possible presence of highly volatile and flammable metals in a relatively nonvolatile and non flammable material.

## 3.0 DEFINITIONS

3.1 **Analytical Batch -** A group of samples of a similar matrix analyzed together with the same procedure, using the same reagents and within the same time period. Samples in each batch should be of similar composition (i.e. soil, water, oil, etc.). A batch shall not exceed 20 samples.

3.2 **Sample Duplicate - (DUP)** A duplicate sample aliquots of sample which is carried through the same digestion and analysis. The relative percent difference between the sample and sample duplicate is calculated and used to assess analytical precision.

3.3 **Water Halo-** This phenomenon is a dull bluish halo or glow around the test flame that can be confused with a true flash. This usually occurs at flash temperature but can occur at any temperature with halogenated hydrocarbons.

3.4 **Flash-** A large, distinct flame which propogates itself away from the test flame and over the entire surface of the sample instantaneously.

3.5 **Flashpoint-** The lowest temperature corrected to a barometric pressure of 760mm Hg at which an application of a test flame causes the vapor of a specimen to

## 4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 Sample must be collected in a pre-cleaned, wide mouth glass bottle with a Teflon lined lid.

4.2 No preservative is required.

4.3 Holding Time, None Specified.

## 5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 None Specified

## 6.0 HEALTH AND SAFETY

6.1 AMRO has a laboratory safety program in place that applies to all employees. There is a safety officer as well as employees with 40 hours of OSHA training. The air quality of the laboratory has been monitored and employees are sent for physicals. All employees receive fire and safety training upon employment.

6.2 Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place.

6.3 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean laboratory coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.4 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eyewash stations and an emergency shower.

6.5 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

Property of AMRO Environmental Laboratories Corporation

6.7 Waste control – AMRO takes whatever steps possible to minimize waste. This includes volume reduction where appropriate. AMRO also properly segregates wastes according to contaminants and a commercial vendor is utilized for waste disposal.

## 7.0 INSTRUMENTS AND EQUIPMENT

7.1 Pensky-Martens Flashpoint tester with stirrer at 250 rpm ± 10rpm.

7.2 Standard thermometer:
7.2.1 must go to at least 200 degrees Fahrenheit.
7.2.2 Divisions: min. 1°F

7.3 Spatula

7.4 Igniter(to light flame)

7.5 Propane Source

7.6 Timer to check rate of temperature increase ± 1.1°F
(FP 27.2°C or 81°F ±2°F)

## 8.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

8.1 Clean benchtop area around tester.

8.2 Make sure tester is free of dust and dirt. Especially in cup holder.

8.3 Clean cup to make sure it is free of dirt, corrosive liquids and residue which could could interfere with analyses.

## 9.0 REAGENTS AND STANDARDS

9.1 Chemical Receipt: The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a four digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the

manufacturer and the disposal dates are completed by AMRO employees when standards are used up or disposed.

9.2 Standards Preparation:. In order to assure the accuracy of standards the following general guidelines are used:

9.2.1 ACS reagent grade chemicals are used when the method warrants.

9.2.2 Any stock standards that are purchased are accompanied by a certificate of analysis from the manufacturer.

9.2.3 Class A volumetric glassware is used to prepare standards.

9.3 Standard Tracking: It is important to be able to track all analytical standards back to their sources. The following procedure is used by AMRO personnel to accomplish this:

9.3.1 Wet Chemistry and Mercury Standards - Working Standards and LCS solutions made from stock standards listed in the Chemical Receiving Log are documented in the Inorganic Standard Log. The corresponding analysis, preparation date, standard name, AMRO ID, amount used, initial concentration of standard, amount used, final volume, final concentration, Standard ID, expiration date, storage location, and analyst initials are recorded. The initial concentration of the standard is obtained from the certificates received from the manufacturer. The Standard ID is written as an "S" followed by a four digit sequential number. The expiration of working standards vary depending on the use. Standards should be used in accordance with method specifications and manufacturer's instructions.

9.3.2 Wet Chemistry and Metals Reagent Log - Working reagents are made from reagents listed in the Chemical Receiving Log are documented in the Reagent Log. The corresponding analysis, preparation date, reagent name, AMRO ID, initial concentration, amount used, final volume, final concentration, Solution ID, expiration date, storage location, and analyst initials are recorded. The initial concentration is obtained from the certificate received from the manufacturer. The Solution ID is written as an "R" followed by a 4 digit sequential number. The expiration of prepared reagents varies. Reagents should be used in accordance with method specifications and manufacturer's instructions.

9.3.4 Standard Storage - Standards and reagents are stored per method specifications and manufacturer's instructions. Wet Chemistry standards are stored at ambient temperature and in refrigerators at 4°C ± 2°C depending upon the method and manufacturers requirements.

Property of AMRO Environmental Laboratories Corporation

9.4 P- xylene , reagant grade(FP 27.2°C or 81°F ± 2°F)

9.5 3% acetone solution

9.6 Silica sand

## 10.0 PROCEDURE

10.1 Inspect sample container to make sure there is no headspace. Keep the time the sample is exposed to air to a minimum.

10.2 Inspect tester tubing for wear and cracking, check shutter to see if it operates freely.

10.3 Turn on tester and gas.

10.3.1 Heater should be on so that the rate of increase doesn't exceed 11 degrees Fahrenheit.
10.3.2 Flame height should be about 1/4 " high.

10.4 Calibrate with p-Xylene and 3% acetone and record temperatures in flashpoint worksheet

10.4.1 p-Xylene should flash at 80.6° F 2 ° F;3% acetone should flash at 100° F ± 2 °F.

10.4.2 The p-Xylene can be poured back and reused. The acetone is dumped into trace solvent waste.

10.5 Between tests, clean cup lightly with methylene chloride, pour rinse into solvent waste and wipe with a paper towel.

10.5.1 Drive off any volatiles by briefly warming cup in tester.

10.5.2 After any sample flashes and before the next sample, a "blank" of silica sand must be tested.

10.6 For samples: place sample in cool ( room temperature ) cup up to fill line, place cup in tester, place lid securely on cup and insert thermometer until it sits in sample.

10.6.1 When analyzing soils, stirrer is not necessary.

10.6.2 For the analysis of liquid samples, attach the stirrer motor to the attachment on the cup lid and turn on the motor. Stop the stirrer when the flame is applied.

***NOTE: Make sure the thermometer sits above the propeller so that it isn't broken by it and doesn't send mercury everywhere.***

10.7 Record the temperature at the initial application of the test flame (expect = room temperature, 70-75°F maximum).

10.8 Apply flame every 2-5 degrees for at least a full second until thermometer reaches 200 °F. Check the rate of the rise for at least one full minute, using a timer. Temperature should rise 9-11 per minute.
For ordinary liquids 2-3°F/min. for solids and highly viscous materials.

10.9 If flash occurs then sample must be RE-TESTED by a different individual using fresh sample.

10.9.1 If no flash occurs on second try a third replicate must be performed to confirm results.

10.9.2 No flash on third test would confirm/suggest a water halo on the first test.

10.9.3 If a flash occurs on the re-test, the average of the two temperatures shall be reported. (The results should agree within 4°F.)

## 11.0 CALCULATIONS

11.1 If no flash occurs after reaching 200°F, report result as >200° F.

11.2 If flash does occur, report the average of the two flash positive flash tests.

11.3 Record the ambient barometric pressure (do not use pressure recorded at airport weather station as these are corrected for sea level readings) at the time of the test. When the pressure differs from 760mmHg (10.13kPa_, correct the flashpoint:
Corrected flash point = °F + 0.069760-Ambient barometric pressure, mm Hg)

11.4 Record the flash point to the nearest 1.0°F

11.5 RPD

$$\%RPD = \frac{(\text{sample result - duplicate result})}{(\text{sample result + duplicate result})/2} \times 100\%$$

## 12.0 QUALITY CONTROL

12.1 Samples must be selected for spiking and or duplicate at random and rotated among clients and sites from batch to batch. In some cases, the client may specify which sample is to used for MS/MSD and or duplicate; if not, the laboratory shall pick a representative sample based on the following:

A. MS/MSD, duplicate shall not be performed on Trip Blank, Rinsate Blank or Field Blank.
B. Adequate sample weight/volume.
C. Client requested QC deliverables.

12.2 One LCS of p-Xylene is performed with every batch of 10 samples.

12.3 One sample duplicate is analyzed with batch of 10 samples.

12.4 p-Xylene must be run at the beginning and at the end of each batch of 10 samples. Acceptance Criteria for p-Xylene: 81 ± 2°F.

12.5 3% Acetone analyzed once per day. Acceptance Criteria for 3% Acetone: 100 ± 2°F

## 13.0 DATA REVIEW AND STORAGE

13.1 All related information and observations will be noted in the Flash Point/ Ignitability SW-846 Method 1010 worksheet (Attachment 1).

13.2 All cross-outs must be a single line and should be initialed and dated.

13.3 The analyst must complete the Wet Chemistry Data Review Checklist (Attachment 2).

## 14.0 REFERENCES

14.1 D 93-80, Test Methods for Flash Point by Pensky-Martens Closed Tester, American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103, 04.09, 1986.

14.2 Umana, M., Gutknecht, W., Salmons, C., et al., Evaluation of Ignitability Methods (Liquids), EPA/600/S4-85/053, 1985.

14.3 SW846 method 1010. Office of Solid and Hazardous Waste, Update III A&B, 4/98.

Property of AMRO Environmental Laboratories Corporation

Attachment 1

AMRO Environmental Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

# FLASH POINT/ IGNITABILITY

**SW-846 Method 1010**

**IL-3045**

Analyst: _____ Date: _____

Barometric Pressure (mm Hg): _____ p-Xylene Lot No.: _____

3% Acetone Lot No.: _____

| Lab. Sample ID | Matrix O; L; S (1) | Flash Point (°F)(2,3) | %RPD(4) | Comments |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Notes:

1. O= Oil; L= Liquid; S= Soil
2. Acceptance Criteria for p-Xylene: 81 ± 2°F
3. Acceptance Criteria for 3% Acetone: 100 ± 2°F
4. %RPD between Sample and Sample Duplicate: <20%
5. **p-Xylene must be run at the beginning and at the end of each bacth of samples**
6. Barometric Pressure Correction = °F + 0.06 (760- Barometric Pressure mm Hg)

qc/qcmemos/forms/flashpoint Rev. 2 08/00

Property of AMRO Environmental Laboratories Corporation

Attachment 2

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

## WET CHEMISTRY DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

Method:

Analysis:

| | | | | |
|---|---|---|---|---|
| A. | GENERAL | | | |
| 1. | Copy of Digestion Log? | Y | N | NA |
| 2. | Copy of Instrument Run Log? | Y | N | NA |
| 3. | All samples met digestion and/or analysis holding time criteria? | Y | N | NA |
| 4. | Initial Calibration meets method criteria? | Y | N | NA |
| 5. | Initial Calibration Verification (ICV) meets method or laboratory criteria? | Y | N | NA |
| 6. | Continuing Calibration Verification(CCV) meets method criteria? | Y | N | NA |
| 7. | Continuing Calibration Verification analyzed after every 10 samples ? | Y | N | NA |
| 8. | Method Blank- contaminant free (½RL)? | Y | N | NA |
| 9. | Are all reported results within calibration range? | Y | N | NA |
| 10. | LCS % Recovery criteria met for all compounds? | Y | N | NA |
| 11. | MS/MSD %R's and %RPD's are met for all compounds? | Y | N | NA |
| 12. | %RPD criteria met between sample and duplicate? | Y | N | NA |

COMMENTS:

Analyst (s) _____ DATE: _____

REVIEWER: _____ DATE OF REVIEW: _____

qc/qcmemos/Forms/wetchemchecklist Rev.1 07/06/01

Property of AMRO Environmental Laboratories Corporation

Attachment 3

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

## QUALIFICATION CARD FOR FLASH POINT/IGNITABILITY SW-846 1010

Trainee: _____ Signature: _____

Trainer: _____ Signature: _____

I. Knowledge Factors:

SOP Title: _____ Revision Number/Date: _____

| | | | |
|---|---|---|---|
| 1. Did the Trainee read and understand the above SOP? | Yes ☐ | No ☐ | NA ☐ |
| 2. Was the Trainee instructed on how to properly fill out the documentation? | Yes ☐ | No ☐ | NA ☐ |
| 3. Has the Trainee been instructed on the proper procedures for addressing potential problems? | Yes ☐ | No ☐ | NA ☐ |

II. Practical Factors:

| | | | |
|---|---|---|---|
| 1. Has the Trainee completed a Precision and Accuracy Stud | Yes ☐ | No ☐ | NA ☐ |
| 2. Has the Trainee completed an acceptable Performance Evaluation sample? | Yes ☐ | No ☐ | NA ☐ |
| 3. Did the Trainee completed an acceptable Laboratory Control Sample (LCS)? | Yes ☐ | No ☐ | NA ☐ |

Completion Date: _____ Trainer's Signature: _____

I _____ have read, understood and follow the above method/SOP, which is in use at AMRO Laboratories for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

Section Manager/ Supervisor: _____ Date: _____

QA Manager: _____ Date: _____

qc/qcmemos/forms/1010qualcard Rev. 0 8/28/03

Property of AMRO Environmental Laboratories Corporation

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

# Microwave Assisted Acid Digestion of Sediments, Sludges, and Soils according to SW-846 Method 3051

Procedure Number: IL-3022

Revision No.: 6

Revision Date: 04/25/2012

Review Date: 04/02/2013

Prepared By: _____ Date: 04/02/13

Approved By: _____ Date: 04/02/13
Inorganic Manager

Approved By: _____ Date: 4-2-13
Laboratory Director

Approved By: _____ Date: 4-2-13
Quality Assurance Manager

## TABLE OF CONTENTS


| | | Page |
|---|---|---|
| 1.0 | SCOPE AND APPLICATION | 3 |
| 2.0 | METHOD SUMMARY | 3 |
| 3.0 | DEFINITIONS | 4 |
| 4.0 | SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE | 4 |
| 5.0 | POTENTIAL PROBLEMS AND INTERFERENCES | 5 |
| 6.0 | HEALTH AND SAFETY | 5 |
| 7.0 | INSTRUMENTS AND EQUIPMENT | 6 |
| 8.0 | REAGENTS AND STANDARDS | 7 |
| 9.0 | PROCEDURE | 11 |
| 10.0 | INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR | 13 |
| 11.0 | CALCULATIONS | 13 |
| 12.0 | QUALITY CONTROL | 14 |
| 13.0 | DATA REVIEW AND STORAGE | 17 |
| 14.0 | REFERENCES | 17 |

## 1.0 SCOPE and APPLICATION

1.1 Application

1.1.1 This method is applicable to the microwave assisted acid digestion of sludges, sediments, and soils for analysis by graphite furnace absorption spectroscopy (GFAA) and inductively coupled argon plasma spectroscopy (ICP). This method is an alternative to EPA Method 3050B hot plate digestion.

1.1.2 Samples prepared by Method 3051 using nitric acid digestion may be analyzed by GFAA or ICP for Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Strontium, Thallium, Tin, Titanium, Vanadium and Zinc.

1.1.3 This method is not applicable to EPA CLP samples or oil samples.

## 2.0 METHOD SUMMARY

2.1 A representative sample of 0.40g to 0.45g is digested in 8mL of $HN0_3$ and 2mL of HCL in a Teflon vessel for 10 minutes using microwave heating. After the digestion process, the sample is then cooled, mixed, and filtered prior to analysis.

2.2 Modifications

2.2.1 EPA Method 3051, Section 4.1.4: MARS Xpress vessels are used instead of PFA or TFM to accommodate the laboratory microwave unit.

2.2.2 EPA Method 3051, Section 7.3.1: Weighing of the vessel prior to use was eliminated in order to reduce labor costs without impacting quality. The vessel is tared before the sample aliquot is added and weighed (See section 7.2.1.).

2.2.3 Prior work over the past six years has shown that a modified 3051 procedure using 8mL of $HN0_3$ (instead of 10mL, Section 7.3.3 of Method 3051) and 2mL of HCl is valid. These modifications will permit the accurate determination of antimony, silver and tin in soils and was suggested by CEM.

2.2.4 Tin and Titanium are added as additional elements. Both are supported by startup data. Clients request tin periodically.

## 3.0 DEFINITIONS

3.1 Method Blank: An aliquot of reagent water, which is carried through the entire analytical procedure with the samples, its purpose is to determine whether contamination is present during the analysis. One method blank is analyzed for every batch of 20 samples.

3.2 Laboratory Control Sample: An aliquot of reagent water into which known quantities of the method analyte are added in the laboratory. The LCS is analyzed exactly like a sample, and its purpose is to determine the degree to which the analytical result approaches the "true value" of the concentration of the analyte being determined. The percentage recovery is calculated in order to assess the efficiency of the analysis. One LCS is analyzed for every batch of 20 samples.

3.3 Sample Duplicate: Two aliquots of a sample are which are carried through the same preparation and analytical procedures to verify the method precision. One sample duplicate is analyzed for every batch of 20 samples.

3.4 Sample Matrix Spike: A specific aliquot of sample into which a known amount of analyte is added. The analytical spike is analyzed with the sample batch and the percent recovery is calculated in order to assess the matrix effect on the analytical system. One sample matrix spike is analyzed for every batch of 20 samples.

## 4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 Nonaqueous samples are refrigerated upon receipt. The holding time is six months.

## 5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 Very reactive or volatile materials that may create high pressures when heated may cause venting of the vessels with potential loss of sample or analytes. Allow samples to react completely after addition of concentrated acid before capping.

5.2 At the end of the microwave program, allow the vessels to cool to 100°C before opening the unit.

## 6.0 HEALTH AND SAFETY

6.1 AMRO places a high value on laboratory safety. The air quality of the laboratory has been monitored. Fire extinguishers are located in various areas of the lab. The laboratory evacuation plan is posted in every room, with a designated meeting place.

6.2 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean lab coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.3 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eyewash stations and an emergency shower.

6.4 Cautions for nitric acid and hydrochloric acid:

6.4.1 All handling of hot solutions containing these materials must be performed under a hood. Contact hazards and contingencies - Liquid and vapor cause severe burns. May be fatal if swallowed. Harmful if inhaled and may cause delayed lung injury. Do not get in eyes, on skin, on clothing. Do not breathe vapor. Keep in tightly closed container. Use with adequate ventilation. In case of contact, remove clothing and flush area with water spray. In case of ingestion, administer fluids immediately. In case of inhalation, remove from exposure.

6.4.2 Spills, storage and contingencies - Spillage may cause fire or liberate dangerous gas. Keep from contact with clothing and other combustible materials. Do no store near combustible materials. In case of spill, stop the spill, use the Acid Spill Kit and ventilate the area.

6.4.3 Fire hazards and contingencies - Strong oxidizer - contact with other material may cause fire. In case of fire, use water spray, alcohol foam, dry chemical, or carbon dioxide.

6.4.4 During addition to sample, nitric acid may evolve toxic nitrogen oxide Fumes. Therefore all work must be performed in a properly operating hood.

6.5 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention: The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

## 7.0 INSTRUMENTS AND EQUIPMENT

7.1 CEM MARS (Microwave Accelerated Reaction System) 5 Microwave Sample Preparation System with Infrared Temperature Control Option.

7.2 This unit is NRTL approved. (ISO 9002 certified). The power rating is 1600 W at 100% power.

7.3 The cavity has been fluoropolymer coated and the exhaust system is corrosion resistant.

7.4 Xpress Vessels of 55 mL capacity vessels capable of 260 C.

7.4.1 24-Vessel set (cat# 907390) - $4,270
7.4.2 16-Vessel set (cat# 907370) - $3,165
7.4.3 8-Vessel set (cat# 907365) - $2065
7.4.4 Liner and screw cap (cat# 574125) - $175
7.4.5 Vent plug (cat# 212020) - $19.00
7.4.6 40-Place turntable (cat# 166000) - $960
7.4.7 Composite Sleeve (cat# 212025) - $46.00

7.5 0.25mL Eppendorf Pipet for spiking (Fisher# 03402-69, or comparable) or equivalent)

7.6 Repipet Universal Dispenser - 10mL volume range in the 0.05mL graduations (or equivalent)

7.7 52mL containers for sample storage (SCP Science #010-500-261)

7.8 10 cc. Syringe with Leur Lok Tip (VWR Cat # BD309604)

7.9 0.45u Syringe Filters, Non-Sterile (VWR Cat # 28196-077)

7.10 Fisher Top Loading Balance capable of weighing to 0.001 grams

7.11 Chemware Ultra-Pure PTFE boiling stones (Cat # 1590-G21)

7.12 Numbered plastic tray for weighing vessels.

## 8.0 REAGENTS AND STANDARDS

8.1 AMRO reagent water – Deionized Water (DI) from a DI System that is checked monthly for Residual Chlorine, Conductivity, pH, Arsenic, Barium, Cadmium, Chromium, Copper, Iron, Lead, Nickel, Selenium, Silver, Zinc and Mercury. Resistivity and pH are monitored daily. Instrument and Procedural Blanks are also used to monitor contaminant levels through out the laboratory. Alternatively, bottled distilled water may be used.

8.2 Before performing the analysis, the analyst should **read the Materials Safety Data Sheet (MSDS)** of all the reagents and standards carefully and be prepared to take necessary emergency action at all times.

8.3 Nitric acid for Trace Metals Analysis, Tedia, (NE4123), Concentrated.

8.4 Hydrochloric acid for Trace Metals Analysis, Tedia, (HE4088), Concentrated

8.5 Spiking solutions

8.5.1 The concentration of analytes in the spiking solution should be:

| ANALYTE | CONCENTRATION IN SPIKE SOLUTION, MG/L | CONCENTRATION IN DIGESTATE, UG/L |
|---|---|---|
| Aluminum | 200 | 8000 |
| Antimony by ICP | 50 | 2000 |
| Antimony by GFAA | 5.0 | 20 |
| Arsenic by GFAA | 5.0 | 20 |
| Arsenic by ICP | 200 | 2000 |
| Barium | 200 | 4000 |
| Beryllium | 5.0 | 800 |
| Cadmium by ICP | 5.0 | 800 |
| Cadmium by GFAA | 2.5 | 12.5 |
| Calcium | 500 | 20000 |
| Chromium | 20 | 4000 |
| Cobalt | 50 | 4000 |
| Copper | 500 | 2000 |
| Iron | 100 | 4000 |
| Lead by GFAA | 5.0 | 20 |
| Lead by ICP | 50 | 2000 |
| Magnesium | 500 | 20000 |
| Manganese | 50 | 4000 |
| Molybdenum | 50 | 4000 |
| Nickel | 50 | 4000 |
| Potassium | 500 | 20000 |
| Selenium by GFAA | 5.0 | 20 |
| Selenium by ICP | 200 | 1600 |
| Silver by GFAA | 1.0 | 5.0 |
| Silver by ICP | 5.0 | 400 |
| Sodium | 500 | 20000 |
| Strontium | 25 | 2000 |
| Thallium by GFAA | 5.0 | 20 |
| Thallium by ICP | 200 | 1600 |
| Titanium | 50 | 4000 |
| Vanadium | 50 | 4000 |
| Zinc | 50 | 4000 |

8.5.2 The ICP Spiking solution is a purchased Superstock. (See ICP Standard Log.)

8.5.3 The GFAA spiking solution is prepared from a purchased Superstock. (See GFAA Standard Log.)

## TRACKING OF ANALYTICAL STANDARDS

8.6 Chemical Receipt

The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a four digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and AMRO employees complete the disposal dates when standards are used up or disposed.

8.7 Standards Preparation

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

8.7.1 ACS reagent grade chemicals are used when the method warrants.

8.7.2 A certificate of analysis accompanies any stock standards that are purchased from the manufacturer.

8.7.3 Class A volumetric glassware is used to prepare standards.

8.8 Standard Tracking

It is important to be able to track all analytical standards back to their sources. AMRO personnel to accomplish this use the following procedure:

8.8.1 Wet Chemistry and Mercury Standards - Working Standards and LCS solutions made from stock standards listed in the Chemical Receiving Log are documented in the Inorganic Standard Log. The corresponding analysis, preparation date, standard name, AMRO ID, amount used, initial concentration of standard, amount used, final volume, final concentration, Standard ID, expiration date, storage location, and analyst initials are recorded. The initial concentration of the standard is obtained from the certificates received from the manufacturer. The Standard ID is written as an "S" followed by a four digit sequential number. The expiration of working standards varies depending on the use. Standards should be used in accordance with method specifications and manufacturer's instructions. . The expiration date for ICP standards

is six months. The expiration dates for GFAA intermediate and spiking solution is one month with the calibration standards made weekly but made daily for DOD.

8.8.2 Metals Standards

8.8.2.1 Axial Standards Log (OPTIMA) - Preparation and Standard ID's are listed in the Standard Log. Standards include: S1 (Calibration #1 & RL2), S2 (Calibration #2 & IPC/CCV), S3 Calibration #3, RL 1 (Reporting Limit), RL2 ( two times the Reporting Limit),S4,S5 (linear range extending standards) ICSA & ICSAB (Interference Check Standards), ICV (Independent Souree QC Standards), and Stock Solutions for Matrix/LCS spike additions. The Solution ID is written as the ID followed by the date prepared (example: S1042798 is standard S1 prepared on 042798). After a conformational analysis to verify the new standard and just prior to its use, the new ID is entered into the OPTIMA software. Until updated, this will be the ID printed on every run log and standard page for hardcopy tracking.

8.8.2.2 Graphite Furnace Standard Logs (GFAA): Preparation and Standard ID's listed in this log include: Purchased Stock Certificates: Intermediate Calibration, CCV, ICV, LCS/MS Solutions: and final Calibration Solutions, final ICV final CCV and final reporting limit. These standards are prepared from the same stock solution as those used for the ICP. The nomenclature is essentially the same, but there are more dilutions needed, which necessitate Intermediate Solutions. Nomenclature for intermediate solutions includes "INT", the type of solution, and the date prepared. After a conformational analysis to verify the new standard and just prior to its use, the new ID is entered into the PE-4100ZL and/or PE-SIMMA software. Until updated, this will be the ID printed on every run log and standard page for hardcopy training.

8.8.3 Wet Chemistry and Metals Reagent Log - Working reagents are made from reagents listed in the Chemical Receiving Log are documented in the Reagent Log, The corresponding analysis, preparation date, reagent name, AMRO ID, initial concentration, amount used, final volume, final concentration, Solution ID, expiration date, storage location, and analyst initials are recorded. The initial concentration is obtained from the certificate received

from the manufacturer. The Solution ID is written as an "R" followed by a 4 digit sequential number. The expiration of prepared reagents varies. Reagents should be used in accordance with method specifications and manufacturer's instructions.

## 9.0 PROCEDURE

9.1 Calibration of Microwave Equipment

9.1.1 This unit uses temperature feedback control capable of replicating the performance specifications for the method; therefore the calibration procedure may be omitted.

9.1.2 Microwave unit is calibrated yearly by CEM technicians. Pressure and temperature functions are checked as well as possible microwave leakage. Documentation of performance is to be kept on file in the laboratory.

9.2 Obtaining a Homogeneous Sample

10.5.1 Refer to SOP GL-1013 "Sample Homogenization for Soil, Solid and Semisolid Waste" for sample homogenization guidance and how to obtain a representative subsample.

9.2.1 If multiphase samples are submitted, the client is called to determine which phase is to be digested and by what method – for example, oils are typically digested by 3050B while homogeneous soils are digested by 3051.

9.3 Sample Digestion

9.3.1 Weigh 0.40g (0.40 to 0.45 to the nearest 0.001g) aliquot of a well-mixed sample into a tared vessel.

9.3.1.1 Set a vessel in the numbered tray to give it stability before transferring the sample aliquot into the liner.

9.3.1.2 It is important that the sample be deposited into the bottom of the liner without any on the sidewalls.

9.3.2 Note the number of the tray position on the Microwave Digestion logbook.

9.3.3 Add 8mL of $HNO_3$ and 2mL of HCl to each liner. Note any reactions that take place upon addition of acid. (NOTE: 8mL $HNO_3$ is added instead of 10mL in order to reduce waste. 2mL HCl is added in order to achieve matrix matching.

9.3.3.1 Add 0.20mL of each of the two ICP spike solutions and 0.10mL each of Sn and Mo stock spike solution to the LCS, MS and MSD. For GFAA LCS/LCSD, add 0.20mL of the HGA stock spike mix.

9.3.3.2 For the method blank (MB) and the LCS/LCSD samples, add 0.35 – 0.45 g of Teflon Boiling Stones. Since the boiling stones do not contribute to the analyte concentration, a nominal weight of 0.40 g will be recorded.

9.3.4 After making sure any initial reaction has stopped, screw the sample caps onto the vessel finger-tight, but snug.

9.3.5 Weigh the Vessel and sample to the nearest 0.001g prior to use and record this information in the microwave digestion log.

9.3.6 Put the first vessel from the number one tray position into the Number one position on the microwave tray, the second vessel into the number two position on the tray and continue until all vessels are on the tray. Make sure there are at least six vessels or the program will not work.

9.3.7 Place the tray into the microwave lining up the half-moon into the slot.

9.3.7.1 If running 16 or less samples, run program EPA 3051_16-xpress.

9.3.7.2 If running 16 or more samples, run program EPA 3051_24-xpress.

9.3.8 The program must bring the samples to 175°C in less than 5.5 minutes and maintain temperature between 170-180°C for the remainder of the 10-minute irradiation period. This program is identical to the requirements stated in SW-846 Method 3051.

9.3.9 To change programs, highlight "load Method" the hit select and highlight user directory and hit select again. Choose method and hit select.

9.3.10 After the program has finished, let samples cool for 15 – 20 minutes. Remove the vessels from the tray and weigh them a second time. The second weight must not differ by more than 1.4 g from the first weight or the sample must be reprepped.

9.3.11 Uncap each vessel and carefully transfer the contents into a labeled 50-ml tube. Rinse the Xpress vessel with DI and pour the contents into the tube. Bring the volume of the tube up to the 50-ml mark with DI and mix well. Let any precipitate settle and filter through a 0.45u filter before analysis.

9.4 Microwave Unit Setup

9.4.1 Turn on the microwave by depressing the toggle switch located in the rear of the system.

9.4.2 Place the loaded carousel onto the stand in the microwave cavity so that the pegs on the stand are inserted into the holes on the carousel

9.4.3 Close the microwave door and initiate program.

## 10.0 INSTRUMENT PREVENTAIVE MAINTENANCE AND REPAIR

10.1 Rinse the vessels and caps with tap water. Make sure all soil residue is removed.

10.2 Scrub vessels vigorously with soap and hot water. If any residue is still present, wipe the liner with acetone and rinse with water before soaking in acid.

10.3 Soak the vessels and caps in 10% $HNO_3$ for 20 minutes, rinse thoroughly with DI water and allow to dry completely.

## 11.0 CALCLATIONS

11.1 Correct all final results according to the formula: Final Concentration (mg/kg) = Observed concentration (ug/L) x Final Volume (L)/Aliquot Weight (g)

## 12.0 QUALITY CONTROL

12.1 Method Blanks:

A sample of deionized (DI) water is put through the procedure and analyzed as a Method Blank. A Method Blank is required 1 for every 20 samples. Teflon boiling stones are added to the method blank vessel.

12.2 Laboratory Control Sample:

A sample using DI water plus a spike of the appropriate analytes is put through the entire procedure and analyzed as a laboratory control sample (LCS). Control limits, which are not met for percent recovery in the LCS, indicate errors during the procedure and require reprep unless there is a definite assignable cause. The LCS control limits are 80%-120% for 6010B and 7000 Series. A LCS is required 1 for every 20 samples. Teflon boiling stones are added to the LCS/LCSD vessels.

12.3 Matrix Spike/ Matrix Spike Duplicate:

Duplicate aliquots of a commercial sample are spiked as a Matrix Spike and a Matrix Spike Duplicate and are put through the entire procedure. The concentration of the analyte in the unspiked sample aliquot should be no more than four times the amount added. If the sample result is greater than four times the amount added, the LCS is the only valid assessment of accuracy for the batch and the spike recovery is not evaluated for control. If the control limits are not met for Relative Percent Difference, the control limits for Percent Recovery in the Matrix Spike are not applicable, since sample heterogeneity is indicated and an inaccurate sample result used to calculate percent recovery is suspected. A matrix spike and matrix spike duplicate is required for every 20 samples for 6010B and 7000series. In some cases, the client may specify which sample is to used for MS/MSD; if not, the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall not be performed on Rinsate Blank or Field Blank.
B. Adequate sample weight/volume.
C. Client requested QC deliverables.

12.4 Duplicate:

12.4.1 Duplicate samples are two aliquots of a sample, which are carried through the same sample preparation and analysis procedure to verify the precision of the method for that sample matrix. The %RPD (Relative Percent Difference) is calculated from the original and the duplicate sample. The %RPD can also be calculated between a matrix spike and matrix spike duplicate. The %RPD is calculated using the concentration of the matrix spike and matrix spike duplicate. If the control limits are not met for Relative Percent Difference, the control limits for Percent Recovery in the Matrix Spike are not applicable, since sample heterogeneity is indicated and an inaccurate sample result used to calculate percent recovery is suspected. The control limits are 0%-20% for 6010B and 7000 Series. The duplicate often refers to the %RPD between the matrix spike and the matrix spike duplicate. In some cases, the client may specify which sample is to be used for MS/Dup; if not, the laboratory shall pick a representative sample based on the following:

A. Method of extraction or digestion.
B. Duplicate shall not be performed on Trip Blank, Rinsate Blank or Field Blank.
C. Adequate sample weight/volume.
D. Client requested QC deliverables

12.5 Corrective Actions for Batch QC

12.5.1 The initial investigation of the problem involves:

12.5.1.1 Checking sample concentrations for being high compared to the spike concentration.

12.5.1.2 Checking calculations and raw data transcriptions (both QC and sample).

12.5.1.3 Checking sample concentrations and analytical sequence for influences such as carryover and mislabeling.

12.5.1.4 Reviewing the notes in the digestion worksheet and analytical notebook for signs of problems or heterogeneity.

12.6 Method Blank Corrective Actions

12.6.1 Method Blank results greater than ½ Reporting Limits (RL) will be investigated. If a sample is greater than the reporting limit and less than ten times the Method Blank results, the sample will be re-prepped and reanalyzed

12.7 Laboratory Control Sample Corrective Actions

12.7.1 Control limits, which are not met for recovery in the LCS requires the batch to be prepared and reanalyzed.

12.8 Matrix Spike Corrective Actions

12.8.1 Control limits which are not met for a majority of elements in the Matrix Spike, but are met in both the Post-Digestion Spike and the Serial Dilution may indicate analyst error during preparation or sample-specific interferences during preparation; re-preparation and reanalysis are required.

12.8.2 If the original results are confirmed after re-preparation, the results indicate sample-specific interferences during preparation. The original data are reported and flagged according to AMRO policy.

12.9 Relative Percent Difference Corrective Actions

12.9.1 Control limits, which are not met for Relative Percent Difference in the Duplicate Sample indicates sample heterogeneity. Check sample observations for documentation of visible heterogeneity. If no sign of failure of the total analytical system, including sample preparation, is found, the result will be flagged according to AMRO policy. A sign of failure of the analytical system requires re-prepping of the entire batch.

**Property of AMRO Environmental Laboratories Corporation**

## 13.0 DATA REVIEW AND STORAGE

13.1 All related preparation information and observations will be noted in the digestion logbook.

13.2 All cross-outs must be a single line and should be initialed and dated. Analyst review is documented on the Microwave Trace Metals Digestion worksheet.

13.3 All data from each run will be properly labeled and placed in the central file in an appropriate storage area. Each central file will include a run log, sample digestion work sheet, and all original data.

## 14.0 REFERENCES

14.1 EPA-200.7 Determination of Metals and Trace Elements in Water and Wastes.

14.2 EPA-200.9 Determination of Trace Elements by Stabilized Temperature Graphite Furnace Atomic Absorption, Revision 2.2, May 1994.

14.3 Microwave Assisted Acid Digestion of Aqueous Samples and Extracts 3051,Test Methods for Evaluating Solid Waste, US EPA SW-846, 3rd Edition, Revision 2. December 1996.

14.4 40 CFR Part 136. Appendix B.

14.5 Department of Defense Quality Systems Manual for Environmental Laboratories, Revision 3, January 2006.

14.6 MARS Operation Manual, 600122, Rev. 1, August 2004.

Property of AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

**Analysis of Metals by Inductively Coupled Plasma Optical Emission Spectrometry according to SW-846 Method 6010B**

Perkin-Elmer Optima 7300 Dual View
**SN – 077C0062402 09/24/12**

Procedure Number: IL-3021

Revision No.: 9

Revision Date: 01/03/2013

Review Date: NA

Prepared By: _____ Date: 01-11-13

Approved By: _____ Date: 01-11-13
Inorganic Manager

Approved By: _____ Date: 1-11-13
Laboratory Director

Approved By: _____ Date: 1-11-13
Quality Assurance Manager

# TABLE OF CONTENTS


| | | Page |
|---|---|---|
| 1.0 | SCOPE AND APPLICATION | 3 |
| 2.0 | METHOD SUMMARY | 3 |
| 3.0 | DEFINITIONS | 4 |
| 4.0 | SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE | 5 |
| 5.0 | POTENTIAL PROBLEMS AND INTERFERENCES | 6 |
| 6.0 | HEALTH AND SAFETY | 8 |
| 7.0 | INSTRUMENTS AND EQUIPMENT | 9 |
| 8.0 | REAGENTS AND STANDARDS | 11 |
| 9.0 | PROCEDURE | 15 |
| 10.0 | INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR | 21 |
| 11.0 | CALCULATIONS | 23 |
| 12.0 | QUALITY CONTROL | 25 |
| 13.0 | DATA REVIEW AND STORAGE | 31 |
| 14.0 | REFERENCES | 32 |
| | Table 1 Primary Wavelengths 6010B/3010A | 33 |
| | Table 2 Secondary Wavelengths 6010B/3010A | 34 |
| | Table 3 Primary Wavelengths 6010B/3050A | 35 |
| | Table 4 Primary Wavelengths 6010B/3051A | 36 |
| | Table 5 Standard and QC Concentrations | 37 |

## 1.0 SCOPE and APPLICATION

1.1 Application

1.1.1 This SOP describes the hardware and software operations of the Optima-DV ICP Spectrometer for the analysis of: Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Lithium, Magnesium, Manganese, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, Zinc, Boron, Tin, Titanium, Strontium, and Molybdenum in acidic, aqueous solutions. The instrument is capable of analyzing other elements as required following appropriate start-up procedures.

1.1.2 The Optima has the capability to determine elements simultaneously at different wavelengths. Whenever possible, this feature is employed to:

1.1.2.1 Confirm primary analytical result at secondary wavelength,
1.1.2.2 Extend Linear Range,
1.1.2.3 Permit reporting of data from secondary wavelength in instances where primary wavelength is out-of-control, useful for fast turn-around-samples.

1.1.3 This SOP is an equivalent to EPA Method 6010B with exceptions noted for TCLP analyses according to 40 CFR Appendix II.

1.1.4 This SOP is applicable to waters, wastewaters, soils, oils, and sludges prepared by acid digestions such as 3005, 3010,3050B, and 3051.

## 2.0 METHOD SUMMARY

2.1 An aliquot of the sample is mixed with an Internal Standard Solution (Yttrium/Scandium) then pumped to the nebulizer where it is met by a precisely controlled flow of argon creating a very fine aerosol. This aerosol is transported by the argon to the center of the plasma. Within this axial channel, the sample is atomized and the elements are excited to emission at temperatures in the range of 4000-80000K. The emitted energy is directed through the entrance slit, diffracted by the grating, refocused on the exit slits, and then projected on to two appropriate segmented-Array charge-coupled devices (SCD). The SCD's convert the light energy into electrical signals that are digitized and processed by the computer.

2.2 AMRO routinely digests MS, MSD and sample duplicate to meet all

varying project QC requirements.

## 3.0 DEFINITIONS

3.1 **Analyte:** The element the analyst seeks to determine.

3.2 **Analytical Run:** A continuous analytical sequence consisting of digested samples plus all associated quality assurance measurements as described in the AMRO QA/QC Manual.

3.3 **Analytical Sample:** - Any solution introduced into the instrument on which an analysis is performed, excluding instrument calibration, calibration verification, and calibration blanks. The following are all analytical samples: digested samples, Duplicate Samples, Serial Dilutions, Post-Digestion Spikes, Matrix Spikes, Interference Check Standard A (ICSA), Interference Check Standard AB (ICSAB), Reporting Limit Standard (RL), Laboratory Control Sample (LCS & LCSD), and Method Blanks.

3.4 **Post-Digestion Spike (PDS):** The addition of a known amount of standard after digestion.

3.5 **Background Correction:** A technique to compensate for variable background contribution to the instrument signal.

3.6 **Batch:** A group of 20 or fewer samples digested (prepared) at the same time, in the same location, using the same method. Associated with each batch is a set of QC samples, including: Duplicate Samples, Matrix Spike (MS), Matrix Spike Duplicate (MSD), Serial Dilution (SD), Laboratory Control Sample (LCS & LCSD), and a Method Blank. Teflon boiling chips are used for solid/soil samples for Method Blanks, LCS and LCSD.

3.7 **Interelement Correction Factor (IEC):** Interelement interferences occur when elements in the sample emit radiation at wavelengths so close to that of the analyte that they contribute significant intensity to the analyte channel. This intensity contribution will then cause a high and erroneous concentration to be reported for the analyte. IEC's must be applied to the analyte to remove the effects of these unwanted emissions.

3.8 **Interference Check Standard A (ICSA):** A sample with Aluminum, Calcium, and Magnesium at 500 mg/L, Iron at 320 mg/L.

3.9 **Interference Check Sample (ICSAB):** A sample with aluminum, Calcium, and Magnesium at 500 mg/L Iron at 320 mg/L and all other Analyte elements at 0.5-1.0 mg/L except Na & K at 2.5mg/L..

3.10 **Instrument Detection Limit (IDL):** A value determined by analyzing seven calibration blanks. The standard deviation is multiplied by 3 to obtain the IDL. The IDL limits must be ≤ MDL limits.

3.11 **Linear Range:** The highest concentration of an analyte that can be analyzed with a recovery of the True Value between 90-110 %.

3.12 **Method Detection Limit (MDL):** The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater then zero. It is determined by analyzing seven replicates of a low level standard that is 2-3 times the IDL. The standard deviation is then multiplied by 3.143 (the student t test value for seven replicates) to obtain the MDL. For solid/soils an MDL study is performed using Teflon boiling chips.

3.13 **Reporting Limit Standard (RLP):** A low level standard used to verify linearity near the detection limit. The concentration is generally 3-5 times the MDL. See Table 1 for a list of metals RLs.

3.14 **Internal Standard (IS):** An internal standard solution containing Yttrium and Scandium at 10 mg/L is mixed with all calibration standards, all QC standards, and all samples. The intensity of Yttrium is used by the instrument as an internal standard to ratio the analytical intensity signals for both calibration and quantitation. This technique is useful in overcoming matrix interferences especially those caused by high dissolved solids. A second element, Scandium, is added to the IS solution in the rare event that Yttrium is present in the sample.

3.15 **Calibration:** Multi-element standards are used for calibration. For routine applications, a Blank and Four or Five Standards are used for the majority of the elements while Four Standards are employed for Aluminum, Calcium, Iron, and Magnesium.

## 4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 All sample digestates (calibration, QC, and unknowns) must be in an aqueous matrix of Hydrochloric Acid (HCl) and Nitric Acid ($HNO_3$).

4.2 All standards and samples are corrosive. Care must be taken when handling, including the use of vinyl gloves, safety glasses and a lab coat. Hands must be washed before eating or smoking.

4.3 AMRO routinely stores all digestates for three months after digestion in case further analyses are required.

## 5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 Several types of interference effects may contribute to inaccuracies in the determination of trace elements. They can be summarized as follows:

5.1.1 Spectral interferences:

5.1.1.1 Overlap of a spectral line from another element-Interelement correction factors (IEC's) are required to compensate for any spectral interferences. These are mandatory for Aluminum, Calcium, Iron, and Magnesium. They should be determined and utilized for the remaining analytical channels. As an example of the impact of IEC's, if Arsenic were being determined in the presence of 500,000µg/L (500 mg/L) of Aluminum, an apparent (but false) Arsenic concentration of 4500 ug/L would be reported in an Arsenic-free sample if only background correction were being applied. With a properly selected IEC, this false signal would be reduced to a value less than the MDL. One additional point should be made. Note the effect of Cobalt on Lead. As with Arsenic, a false signal would be reported but this time the spurious signal is a negative value, -1,800µg/L. A negative concentration value indicates that the interfering line from Cobalt is on, or near, the background correction point selected for the lead wavelength. An IEC would be determined, however, instead of entering a positive value, a negative value would be entered into the ICP software. Once entered and verified, nebulization of the interferent (Cobalt) should produce an apparent concentration with an absolute value of less than the MDL for Lead.

5.1.1.2 Unresolved overlap of molecular band spectra - may require selection of an alternate wavelength.

5.1.1.3 Background contribution from continuous or recombination phenomena and Background contribution from stray light from the line emission of high concentration elements - Background must be measured adjacent to analyte lines on samples during analysis. The position selected for the background intensity measurement, on either or both sides of the analytical line, will be determined by the complexity of the spectrum adjacent to the analyte line. The position used must be free of spectral interference and reflect the same change in background intensity as occurs at the analyte wavelength measured. In addition, users of simultaneous multi-element instrumentation must assume the responsibility of verifying the absence of spectral interference from an element that could occur in a sample but for which there is no channel in the instrument array.

5.1.2 Physical Interferences:

5.1.2.1 Generally considered to be effects associated with the sample nebulization and transport processes. Such properties as change in viscosity and surface tension can cause significant inaccuracies especially in samples which may contain high dissolved solids and/or acid concentrations. The use of a peristaltic pump may lessen these interferences. If these types of interferences are operative, they must be reduced by employing the Internal Standard technique, dilution of the sample and/or utilization of standard addition techniques. Another problem which can occur from high dissolved solids is salt buildup at the tip of the nebulizer. This affects aerosol flow rate causing instrumental drift. Wetting the argon prior to nebulization or sample dilution has been used to control this problem. Also, it has been reported that better control of the argon flow rate improves instrument performance. This is accomplished with the use of mass flow controllers.

5.1.3 Chemical Interferences:

5.1.3.1 Characterized by molecular compound formation, ionization effects and solute vaporization effects. Normally these effects are not pronounced with the ICP technique. However, if observed, they can be minimized by careful selection of operating conditions (that is, incident power, observation position, and so forth), by buffering of the sample, by matrix matching, and by standard addition procedures. These types of interferences can be highly dependent on matrix type and the specific analyte element.

5.2 The instrument is programmed to analyze *two exposures* and report an average between the two results. The standard deviation and percent relative standard deviation (%RSD) along with the average result are printed for each metal. The %RSD must be <5%. This data is reviewed and the professional judgement of the analyst is used to determine if the precision between the replicates is acceptable. Typically, this type of review is not necessary with ICP unless there is a problem with the sample introduction system.

## 6.0 HEALTH AND SAFETY

6.1 AMRO places a high value on laboratory safety. The air quality of the laboratory has been monitored. Fire extinguishers are located in various areas of the lab. The laboratory evacuation plan is posted in every room, with a designated meeting place.

6.2 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean lab coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.3 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eye-wash stations and an emergency shower.

6.4 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.5 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

## 7.0 INSTRUMENTS AND EQUIPMENT

7.1 Equipment:

7.1.1 Dual View ICP with the following specifications:

7.1.1.1 Optics – Two segmented-Array charged-coupled Device Detectors each cooled to 40° C.

7.1.1.2 Resolution - 0.006 in UV region.

7.1.1.3 Wavelength Range – 165-782 nm.

7.1.2 Source 1.5 KW R.F. solid state generator operating at 40 Mhz with automatic power control and automatic tuning.

7.1.3 Cooling Water Supply – Polyscience chiller Whisper Cool Model N0772046 (SN # 1C1280479).

7.1.4 Mass Flow Controller for argon flow to the nebulizer.

7.1.5 Three Channel Peristaltic Pump.

7.1.6 AS-90 Autosampler with automated restandardization and automated analysis of quality control check samples.

7.1.7 Lenovo Computer: Microsoft Windows XP Version 5.1.

7.1.8 WinLab32 Software Version 5.3.0.0656.

7.1.9 Torch, Perkin-Elmer Dual View, PE Cat. # N077-1500

7.1.10 Radial Purge Quartz Window, PE Cat # N077-0944.

7.1.11 Axial Purge Quartz Window, PE Cat # N077-1116.

7.1.12 Gem Cone, Low Flow Nebulizer, PE Cat # N077-0358

7.1.13 Cyclonic Spray Chamber, PE Cat. # N077-1501.

7.1.14 Alumina Injector Tip, 2.0 mm I.D., PE Cat # N069-5362.

7.1.15 Quartz Torch Bonnet, PE Cat # N077-5289.

7.1.16 RF Coil, PE Cat # N077-1536 (Requires PE Service to install).

7.1.17 Sipper for Auto Sampler, PE Cat. # B300-0159

7.1.18 Standard & QC Tubes, PE Cat. # B019-3234

7.1.19 17-mL Polypropylene Sample Tubes, 100mm round bottom, non-sterile, culture tubes, Elkay, Cat # 000-2018-001 (H&L)

7.1.20 Eppendorf Metal Free Clear Pipet Tips, (1000 µL)

7.1.21 Peristaltic Pump Tubing

7.1.21.1 Black/Black, VHG Cat # D180203

7.1.21.2 Green/Orange, VHG Cat # DCPT-007, Fisher Cat # 14-190-103

7.1.21.3 Red/Red, VHG Cat # D180201

7.1.22 Eppendorf Clear (Metal Free) Pipet Tips, 100 µL size

7.1.23 Nalgene Syringe Filters (0.45 u size),

7.1.24 10cc Syringe, Luer Lok,

7.1.25 Graduated, Conical Tubes with Caps, 15 mL polypropylene (used for IEC studies), Becton Dickinson, Cat. # Falcon 2097 Blue Max.

7.1.26 Serological Pipets, disposable and non-sterile, 10x1/10 mL size, Baxter, Cat. # P4650-110.

7.2 Materials:

7.2.1 Liquid Argon – 99.999 % at 70-120psig.

7.2.2 High Purity Nitrogen to purge the optical system at 30-120psig.

7.2.3 Compressed Air or Liquid Nitrogen for Shear Gas Supply at 75-100psig with pressure at the air dryer filter at 60psig.

7.2.4 Labware

7.2.4.1 For the determination of trace levels of elements, contamination and loss are of prime consideration. Potential contamination sources include improperly cleaned laboratory apparatus and general contamination within the laboratory environment from dust, rust, etc. A clean laboratory work area, designed for trace element sample handling must be used. Sample containers can introduce positive and negative errors in the determination of trace elements by (1) contributing contaminants through surface desorption or leaching, (2) depleting element concentrations through adsorption processes. All re-useable labware (glass, quartz, polyethylene, Teflon, etc.) including the sample container should be cleaned prior to use. Labware may be soaked overnight and thoroughly washed with laboratory-grade detergent and water, rinsed with water, and soaked in a mixture of dilute nitric and hydrochloric acid. (See AMRO dishwashing SOP.)

7.2.5 Glassware - 500mL and 1000mL volumetric flasks.

7.2.6 Storage - Teflon and Polyethylene bottles of 500 mL and 1000 mL size.

7.2.7 Disposable, metal free pipet tips.

7.2.8 Air Displacement Pipettes (Eppendorf) - 100µL 500µL, and 1000µL volumes.

## 8.0 REAGENTS AND STANDARDS

8.1 Nitric acid, VWR Omni Trace for Trace Metals Analysis or equivalent.

8.2 Hydrochloric acid, VWR Omni Trace for trace Metals Analysis or equivalent.

8.3 Water, Deionized Water, ASTM Type II (DI).

8.4 Standards

8.4.1 See ICP Standard Log OPTIMA for all standard preparation information. It is readily available near the ICP. This log contains copies of the Certificates of Analysis for each stock purchased for OPTIMA. It also gives an in depth explanation of all the standards required for OPTIMA ICP analysis. This log is used to document the preparation of all ICP calibration standards and instrument QC standards.

8.4.2 Calibration Standards (for concentrations, see Table 5)

8.4.2.1 The calibration standards are prepared as needed as described in the ICP Standard Log.

8.4.2.2 The superstock solutions are replaced annually.

8.4.3 Initial Calibration Verification Standard (ICV) (for concentrations, see Table 1)

8.4.3.1 The independent standards MUST be purchased from a different company than the calibration standards or, alternatively, the manufacturer must supply documentation that they trace back to different original stocks than the calibration standards do.

8.4.3.2 The ICV standard is prepared by adding 5mL of each ICV Superstock solution to a 500mL volumetric flask containing 5mL nitric acid and 25mL hydrochloric acid and diluting to the mark with DI water.

8.4.3.3 The ICV superstock solutions are replaced annually.

8.4.3.4 Analytical solutions are diluted from superstock as needed as described in the standards log.

8.4.4 Continuing Calibration Verification Standard (CCV) (for concentrations see Table 1).

8.4.4.1 The CCV is the same as ICP Standard S2. (See ICP Standard Log.)

8.4.4.2 The Custom Multielement Stock Standards are replaced annually.

8.4.4.3 Analytical solutions are diluted from the stock as needed.

8.4.5 Reporting Limit Standards for ICP (RL) (for concentrations see Tables 1-4).

8.4.5.1 See ICP Standard Log for prep instructions.

8.4.5.2 The stock solutions are replaced annually.

8.4.5.3 Analytical solutions are prepared as needed.

8.4.6 Interference Check Standard AB (ICSA) and Calibration Standard S4.

8.4.6.1 See ICP Standard Log for prep instructions.

8.4.6.2 The stock solutions are replaced annually.

8.4.6.3 Analytical solution is prepared as needed

8.4.7 Interference Check Standard AB (ICSAB).

8.4.7.1 See ICP Standard Log for prep instructions.

8.4.7.2 The stock solutions are replaced annually.

8.4.7.3 Analytical solution is prepared as needed.

8.4.8 Individual Element Solutions at 1000mg/L.

8.5 Chemical Receipt

8.5.1 The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a four digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and the disposal dates are completed by AMRO employees when standards are used up or disposed.

8.6 Standards Preparation

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

8.6.1 ACS reagent grade chemicals are used when the method warrants.

8.6.2 Any stock standards that are purchased are accompanied by a certificate of analysis from the manufacturer.

8.6.3 Class A volumetric glassware is used to prepare standards.

8.7 Standard Tracking

It is important to be able to track all analytical standards back to their sources. The following procedure is used by AMRO personnel to accomplish this:

8.7.1 Metals Standards

8.7.1.1 Optima Standards Log (OPTIMA) - Preparation and Standard ID's are listed in the Standard Log. Standards include: Low S1 = RL1 (Reporting Limit), S1 (Calibration #1 & RL2), S2 (Calibration #2 & CCV), S3 (Calibration #3), S4 (Calibration #4 and ICSA), RL1 (Reporting Limit), RL2 ( two times the Reporting Limit), ICSA &ICSAB (Interference Check Standards), ICV (Independent Source QC Standards), and Stock Solutions for Matrix/LCS spike additions. The Solution ID is written as the ID followed by the date prepared (example: S1042798 is standard S1 prepared on 042798). After a conformational analysis to verify the new standard and just prior to it's use, the new ID is entered into the OPTIMA software. Until updated, this will be the ID printed on every run log and standard page for hardcopy tracking.

8.7.2 Wet Chemistry and Metals Reagent Log - Working reagents are made from reagents listed in the Chemical Receiving Log are documented in the Reagent Log, The corresponding analysis, preparation date, reagent name, AMRO ID, initial concentration, amount used, final volume, final concentration, Solution ID, expiration date, storage location, and analyst initials are recorded. The initial concentration is obtained from the certificate received from the manufacturer. The Solution ID is written as an "R" followed by a 4 digit sequential number. The expiration of prepared reagents varies. Reagents should be used in accordance with method specifications and manufacturer's instructions.

## 9.0 PROCEDURE

9.1 Determination of IEC's

9.1.1 After the ICP has been calibrated, nebulize the single element solutions listed in Table 1 and note the "apparent concentration" values produced at each channel.

9.1.1.1 ICSA & ICSAB QC samples are analyzed daily and if under or over corrections are noted, single element solutions of Aluminum, Calcium, Iron, and Magnesium are analyzed and the IEC's are updated.

9.1.1.2 The elements with an "*" are analyzed quarterly (or as needed after maintenance: new torch, injector tip, etc.) and the IEC's are updated. These elements, along with Al, Ca, Fe, & Mg, compromise the majority of the interfering elements routinely encountered in environmental samples. In addition, they are analyzed annually to verify/update IEC's and to verify Linearity.

9.1.1.3 The following elements cause no spectral interferences: Antimony, Arsenic, Boron, Cadmium, Lithium, Sodium, Potassium, Strontium, Selenium, Silver, Thallium and Tin. However, they are analyzed annually to verify that fact and to confirm Linearity.

9.1.1.3 The following elements have little or no interference on the primary wavelengths of the environmental elements: Barium, Beryllium, Copper, Lead, Manganese, and Zinc. However, they are analyzed annually to update the IEC's on the secondary wavelengths and to confirm Linearity.

9.1.1.4 In the event of a major maintenance problem (new power tube, clean optics, etc.) a full IEC and Linearity study is performed.

9.1.2 The correction factor, K1, is then calculated from the equation, K1 = (Apparent Analyte Concentration, µg/L)/(Interferent Concentration, mg/L).

9.1.3 The IEC is then entered into the ICP software.

9.1.4 To verify the IEC's, reprocess the data file and observe the "apparent concentrations."

9.1.4.1 A value of less than 2 x MDL for each analyte should be obtained if the IEC is correct.

9.1.4.2 This data can also be used to verify the linear range for the elements

9.1.5 To update an existing IEC, analyze pure solutions as previously described and calculate the correction factor from the equation:

9.1.5.1 K1 = [(Current IEC x Conc. of interfering element) + (Apparent Conc.)]/Conc. of interfering element.

9.2 Determination of Linear Ranges

9.2.1 After calibration, analyze solutions of high concentration for all elements for which the instrument is calibrated.

9.2.1.1 The same solution of pure single elements may be used to determine Linear Range and verify IEC's in the same analytical run (See IEC Section)

9.2.2 The Linear Range for an element is established if the recovery of the high standard is within 90-110%.

9.2.2.1 For any element, which does not meet this requirement, the linear range will default to the highest calibration standard

9.3 Determination of IDL's

9.3.1 Pour a calibration blank solution into seven autosampler tubes, and analyze as individual samples.

9.3.2 Determine the standard deviation for seven replicates for each analyte.

9.3.3 The IDL = 3 x (standard deviation).

9.3.4 Provide all required information on the current Instrument Detection Limit study worksheet provided by the QA Department.

9.3.5 An IDL study is required at start-up and after any significant modification to the instrument.

9.4 Determination of MDL's

9.4.1 Digest seven individual aliquots of an MDL Solution using an appropriate digestion procedure which is 3-5 times the IDL for 6010B or

20% of the AMRO reporting limit. For soils the MDL study is performed using Teflon boiling chips.

9.4.2 Determine the standard deviation for the seven digestions for each analyte.

9.4.3 The MDL = 3.143 (the student T test value for seven replicates) x (average of the standard deviations).

9.4.4 Provide all required information on the current Method Detection Limit study worksheet provided by the QA department.

9.4.5 The MDL is performed annually.

9.4.6 To ensure that reasonable MDL values are determined, an MDL check sample is analyzed by spiking an interference free matrix with all target analytes at about two times the determined MDL. The MDL check sample is taken through the same process as the MDL. If any of the target analytes are not detected, the MDL study is modified and repeated until the MDL check sample is detectable. The MDL check will be analyzed quarterly and after major instrument maintenance or changes in the instrumentation or instrumental conditions to verify sensitivity of the method.

9.5 Precision and Accuracy

9.5.1 Precision and accuracy is done annually by each analyst for each matrix and analysis type. Digest and Analyze four Laboratory Control Samples with an acceptance limit of 80-120%.

9.6 Operational Parameters for the Optima Dual View

9.6.1 Plasma Information

9.6.1.1 Nebulizer argon flow – Approximately 0.55 LPM (Adjust for each nebulizer)

9.6.1.2 Plasma argon flow - 15 LPM

9.6.1.3 Auxiliary argon flow – 0.30 LPM

9.6.1.4 Forward RF power – 1450 watts

9.6.2 Peristaltic pump flow rate (sample) - 1.8mL/min.

9.6.3 Torch observation height - 18mm

9.6.4 Method Information (Optima_DV)

9.6.4.1 Number of elements – 27 (Variable – multiple wavelengths used)

9.6.4.2 Replicates – 2

The method states "multiple exposures" without giving a number. AMRO analyzes a comprehensive list of metals to meet all client needs while maintaining optimal use of the instruments. In order to accomplish this, three replicates of each sample are analyzed. For the Optima ICP three replicates would seriously degrade the analytical performance. There is a concern with buildup on the Nebulizer tip and other Sample Introduction problems from the length of sample period. Each replicate is read in the axial and radial mode which result in a "sample nebulization time" of nearly eight minutes. An %RSD of 2.5% between replicates is required to ensure the accuracy of the data. If the %RSD acceptance limit is exceeded, the sample is re-analyzed.

9.6.4.3 Read Delay – 45 seconds.

9.6.4.4 Flush time – 30 seconds.

9.6.4.5 Analysis data file name – MMDDYY A, B, C where: MM is the month, DD is the day and YY is the year of the analysis. A, B, C are analytical runs during the day.

9.6.4.6 Autosampler (SIF) table name – same as Analysis file.

9.6.4.7 Approximate analysis time – 4 to 7 minutes.

9.6.4.8 Integration Time – 5 to 25 seconds depending on elemental concentrations.

9.6.5 Rinse time between QC samples - 90 seconds

9.6.6 Additional 70 second rinse will be performed if previous sample contained high concentrations (> CCV) of prior selected analytes.

9.7 Start-Up ICP

9.7.1 Turn on Liquid Nitrogen Tank.

NOTE: Argon and chiller are always on!

9.7.2 Turn on the Nitrogen regulator to a pressure of 60 psig. Set the Argon pressure to 85 psig. Chiller temp should be <25 C.

9.7.3 Tighten the pump tubing, check flow of pump tubing and check the levels in the internal standard bottle, autosampler wash bottle, and the drain bottle.

9.7.4 Check DIAGNOSTIC WINDOW for any instrument "Warning Flags" and correct.

9.7.5 Open PLASMA CONTROL window.

9.7.6 Click the "PLASMA ON" button.

9.7.7 After ignition, wait about 60min. before starting to ensure temperature equilibrium. (This time can be used to prepare the autosampler table in the software and to pour the samples into the autosampler tubes).

9.8 Autosampler Table Setup (Sample Information Editor)

9.8.1 Open appropriate SIF format file (Water-200.7, Water-SW, Soil-3050B, Soil-3051, TCLP). These have the correct "Samp Types" and "Test Codes" necessary to transfer the data to LIMS.

9.8.2 Enter sample ID's and weight/ volume for soil samples and dilution factors as appropriate.

9.8.3 Save SIF as MMDDYY A, B, C. (Same as data files.)

9.8.3.1 Enter a CCV and CCB between every 10 samples at a minimum.

9.8.3.2 When all the samples have been entered, review the table and make sure the correct sample units (ug/L or mg/kg) have been selected and the appropriate initial, final, and continuing QC samples have been entered. Save the file.

9.8.3.3 Print the completed table and save in the Run Log File.

9.9 Profile - Profiling is used to establish optimum alignment of the spectrometer entrance slit image with respect to the exit slits. This is only necessary after cleaning sample introduction system and prior to Automatic Alignment of viewing position for Axial and Radial modes. To profile, select View Mode (Axial or Radial) then select Spectrometer Control.

9.9.1 Nebulize a 1.0 ppm manganese solution for Axial Viewing and a 10 ppm Mn for Radial Viewing and Click on "Optimize X & Y."

9.9.2 Optimize both Axial and Radial modes.

9.10 **Calibration** – Calibration is accomplished in the Automated Analysis Mode which has two options: (1) Calibrate and stop or (2) Run All (Calibrate and run QC and samples. After calibration, the instrument will print a "Calibration Summary". This includes: Analyte, Number of Standards, Equation Used, Intercept, Slope, Curvature, and Correlation Coefficient. The Correlation Coefficient MUST be ≥0.995 to report the data. The "Mean Corrected Intensities" for Standard # 2 (CCV – mid-standard) should be constant (within ±30%) over time and they provide an excellent indicator of correct instrument performance in the following areas:

9.10.1 Optical Alignment,

9.10.2 Transfer optics,

9.10.3 Nebulizer,

9.10.4 Torch and spray chamber,

9.10.5 Torch alignment,

9.10.6 Argon flow rates to the nebulizer and the torch,

9.10.7 RF power,

9.10.8 Peristaltic pump rate, and

9.10.9 Calibration standard solutions.

9.11 Sample Analysis

9.11.1 Select Automated Analysis Control

9.11.1.1 Select method "Dual View," for example.

9.11.1.2 Enter the SIF and the Result Set (Data File).

9.11.1.3 For auto shutdown, select SET then check "Shutdown Enabled for: End of Run, Wash 30 minutes after analysis, Turn off Plasma & Pump.

9.11.1.4 Select Analyze.

9.11.1.5 Click on Analyze All.

9.12 Shut-down ICP

9.12.1 Open PLASMA CONTROL and click on "PLASMA OFF".

9.12.2 DO NOT turn off Argon or Chiller.

9.12.3 Turn off Nitrogen, Air Compressor (if used), and Vent..

9.12.4 Cap the Autosampler QC tubes.

9.12.5 Fill the Autosampler rinse bottles for the next day's run, (Deionized Water).

9.12.6 Empty autosampler drain bottle as needed.

9.12.7 Preventive Maintenance.

## 10.0 INSTRUMENT PREVENTAIVE MAINTENANCE AND REPAIR

Preventative Maintenance is designed to keep the instrument operating at a consistent performance level. A maintenance program must be followed with some "common sense" regarding the quality of samples that are introduced. For example:

10.1 General Guidelines

10.1.1 Samples containing particulate must be filtered before analysis.

10.1.2 The TDS (Total Dissolved Solids) in a sample should not exceed 3,000mg/L (this is about the level in TCLP samples).

10.1.3 The acid matrix of HCl and HNO3 should be similar between standards and samples.

10.1.4 Organic samples **must** not be analyzed unless the entire sample introduction system is cleaned afterwards and an analytical method is developed, tested, and verified.

10.2 DAILY Schedule (D):

10.2.1 Check autosampler Rinse and Waste solutions and Argon & Nitrogen pressures.

10.2.2 Verify that intensity counts for first standard are in a range that indicates efficient sample introduction. Verify the precision values between replicates for the high standard are less than 1% RSD.

10.2.3 Change pump tubing every other day.

10.2.4 Make any standards that are low and verify concentration prior to use.

10.3 BI-WEEKLY (W):

10.3.1 Clean torch and Injector Tip. Replace O-rings as needed. Acid wash torch and soak tip in dilute Aqua Regia.

10.3.2 Check coolant level and top off water. Watch for green growth in water lines.

10.3.3 Check Nebulizer (if sputtering clean in Ultrasonic Bath) and Spray Chamber and clean if necessary.

10.3.4 Do Alignment (Axial and Radial) then run IEC single element standards.

10.3.5 Tweak IEC's as necessary. Update IEC Table and Method.

10.4 MONTHLY (M):

10.4.1 Clean filters.

10.4.2 Wipe off Rail on Auto Sampler and oil lightly.

10.4.3 Dust off instrument.

10.4.4 Archive database Results Data to LIMS. Then Delete data from database, Check database and Pack database.

10.5 SEMIANNUAL (S):

10.5.1 Drain chiller and refill with tap water.

10.6 REPAIRS/SERVICE (RS)

10.6.1 Record problem and resolution.

## 11.0 CALCULATIONS

11.1 All calculations pertaining to the conversion of intensity units into concentration units are done by the PE software. After calibration, the instrument will print a "Calibration Summary". This includes: Analyte, Number of Standards, Equation Used, Intercept, Slope, Curvature, and Correlation Coefficient. The Correlation Coefficient MUST be $\geq 0.995$ to report the data.

11.2 Data from the ICP are rounded to three significant figures by the PE software. (This can be changed easily in the method.)

11.3 MSA-corrected concentrations (mg/L) = the absolute value of (-b/m)

11.3.1 b = y-intercept (Constant) of the regression analysis performed in the MSA.WK3 worksheet.

11.3.2 m - slope (X Coefficient) of the regression analysis performed in the MSA.WK3 worksheet.

11.4 Interelement Correction factor (K1) = (Apparent Analyte Concentration, µg/L)/(Interferent Concentration, mg/L).

11.5 Hardness, mg equivalent CaCO3/L = ({Ca} in mg/L x 2.497) + ({Mg} in mg/L x 4.118

11.6 Instrument concentrations are in µg/L.

11.7 For water samples: The results are reported in µg/L. The sample concentration reported will be in µg/L units times the dilution factor.

11.8 For soil samples: Multiply the results in µg/L times the final volume of digestate in liters divided by the dry wt of sample in grams times the dilution factor to give results in mg/kg. In the sample info file if the sample weight has been entered in wet weight, and units entered in as mg/Kg the PE software will calculate the sample result in mg/Kg as wet weight. For sample results being reported in LIMS. The raw data being imported into LIMS is in calibration units of ug/L. The LIMS has the prep info entered separately such as weight and volume. The percent solids info is entered separately. The final sample result will be mg/Kg accounting also for dilution factor. To check this result for correctness take the sample result on the raw data in mg/Kg and divide by the percent solids and multiply times 100. This will account for the dry weight. Always multiply times the dilution factor.

11.9 % Recovery MS/MSD = Determined concentration – sample concentration/true value x 100

11.10 %RPD MS/MSD or DUP = (sample - dup)/((sample + dup)/2) x 100. Use concentrations of each in calculations.

## 12.0 QUALITY CONTROL

12.1 Periodic Demonstrations of Performance

12.1.1 Interelement Correction Factors: IEC's are updated as described in Section 9.1.1.

12.1.2 Linear Ranges: Linear Ranges are updated on an annual basis or as required.

12.1.3 The Internal Standard recovery (Y and/or Sc) must be between 75 – 125% or the sample will be diluted and reanalyzed.

| QC Sample | Frequency | ICP QC Table | ICP Action Level | ICP Action | Analyst Response |
|---|---|---|---|---|---|
| ICV | Once, after calibration | ICV | ± 10% of True Value | Stop | Correct problem and recalibrate. |
| ICB | Once, after ICV | ICB | >±2 x MDL | Flag Data | Correct problem and reanalyze affected samples. |
| RLP | Start | RLP | ±30% of True Value | Flag Data | Correct problem; then recalibrate/reanalyze samples. |
| ICSA | Start | ICSA | <2 x MDL | Stop | Correct problem; then recalibrate/reanalyze samples. |
| ICSAB | Start | ICSAB | ±20% of True Value | Stop | Correct problem; then recalibrate/reanalyze samples. |
| CCV | 10% of analytical samples | CCV | ±10% of True Value | Flag Data | Correct problem and reanalyze affected samples |
| CCB | Following each CCV | CCB | >±2 x MDL | Flag Data | Correct problem and reanalyze affected samples. |

12.2 Calibration Curves are verified using a ICV solution from an independent source. The Correlation Coefficient for each element reported must be ≥ 0.995.

12.3 The ICB and CCB's are a solution of 1% HNO3 and 5% HCl in DI.

12.4 The frequency of Batch QC samples is 5% for Method 6010B, Method Blank, Laboratory Control Sample (LCS), Matrix Spikes and Serial Duplication sample (SD).

| Analyte | Matrix Spike (MS) %R Limit | Matrix Spike Duplicate (MSD) %R Limit | Post-Digestion Spike (PDS) %R Limit | Serial Dilution (SD) RPD Limit | Matrix Duplicate (DUP) RPD Limit | MS/MSD Duplicate (DUP) RPD Limit | LCS Laboratory Control Sample |
|---|---|---|---|---|---|---|---|
| All Elements | 75-125 (DoD limit 80-120%) | 75-125 (DoDlimit 80-120%) | 75-125 | 10 | 20 | 20 | 80-120 |

12.4.1 Method Blanks:

A sample of deionized (DI) water is put through the procedure and analyzed as a Method Blank. Method Blank results above the Laboratory Reporting Limits indicate contamination. The source of contamination will be investigated and corrected. A Method Blank is required 1 for every 20 samples. For DOD projects the method blank must be less than one half the reporting limit.

12.4.2 Laboratory Control Sample:

A sample using DI water plus a spike of the appropriate analytes is put through the entire procedure and analyzed as a laboratory control sample (LCS). Control limits which are not met for percent recovery in the LCS indicate errors during the procedure and require reprep unless there is a definite assignable cause. The LCS control limits are 80%-120% for 6010B. A LCS is required 1 for every 20 samples.

12.4.3 Matrix Spike/ Matrix Spike Duplicate:

Duplicate aliquots of a commercial sample are spiked as a Matrix Spike and a Matrix Spike Duplicate and are put through the entire procedure. The concentration of the analyte in the unspiked sample aliquot should be no more than four times the amount added. If the sample result is greater than four times the amount added, the LCS is the only valid assessment of accuracy for the batch and the spike recovery is not evaluated for control. If the control limits are not met for Relative Percent Difference, the control limits for Percent Recovery in the Matrix Spike are not applicable, since sample heterogeneity is indicated and an inaccurate sample result used to calculate percent recovery is suspected. The control limits are 75% - 125%. For DOD projects the limit is 80-120%. A matrix spike and matrix spike duplicate is required for every 20 samples for 6010B. In some cases, the client may specify which sample is to used for MS/MSD; if not the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall not be performed on Rinsate Blank or Field Blank.
B. Adequate sample weight/volume.
C. Client requested QC deliverables.

12.4.4 Duplicate:

12.4.4.1 Duplicate samples are two aliquots of a sample, which are carried through the same sample preparation and analysis procedure to verify the precision of the method for that sample matrix. The %RPD (Relative Percent Difference) is calculated from the original and the duplicate sample. The %RPD can also be calculated between a matrix spike and matrix spike duplicate. The %RPD is calculated using the concentration of the matrix spike and matrix spike duplicate. If the control limits are not met for Relative Percent Difference, the control limits for Percent Recovery in the Matrix Spike are not applicable, since sample heterogeneity is indicated and an inaccurate sample result used to calculate percent recovery is suspected. The control limits are ≤20% for 6010B. The duplicate for 6010B often refers to the %RPD between the matrix spike and the matrix spike duplicate. In some cases, the client may

specify which sample is to be used for MS/Dup; if not, the laboratory shall pick a representative sample based on the following:

A. Method of extraction or digestion.
B. Duplicate shall not be performed on Trip Blank, Rinsate Blank or Field Blank.
C. Adequate sample weight/volume.
D. Client requested QC deliverables

12.4.5 Serial Dilution sample:

An aliquot of the analytical solution of a representative sample is diluted five-fold and analyzed as the Serial Dilution Sample to determine the presence of interferences during analysis. The control limit is ±10% for 6010B. A serial dilution is required 1 every 20 samples for 6010B.

12.4.5.1 The ICP Serial Dilution Analysis must be performed on a sample from each group of samples of a similar matrix type (i.e., water, soil).

12.4.5.2 Samples identified as field, site, or rinse blanks cannot be used for Serial Dilution Analysis.

12.4.6 Post-Digestion Sample:

An aliquot of analytical solution from a representative solution is spiked and analyzed as the Post-Digestion Sample to determine the presence of interferences during analysis. A post digestion spike is performed whenever a new or unusual sample matrix is encountered. It is also used when a matrix spike fails to verify matrix effects.

12.4.6.1 An analyte spike added to a portion of a prepared sample, or its dilution, should be recovered to within 75-125% of the known value. The spike addition should produce a minimum level of 10x and a maximum of 100x the IDL. If the spike is not recovered within the specified limits, a matrix effect should be suspected.

12.4.6.2 If the sample results are greater than four times the amount added, the Serial Dilution is the only valid assessment of interferences.

12.5 TCLP requirements:

12.5.1 If the concentration of any TCLP extract is within ±20% of the regulatory limit, or if the recovery rate of the matrix spike is <50%, a four-point method-of-standard additions is required (40 CFR 261)

12.5.1.1 Four aliquots are required; See supervisor for instructions on preparation of MSA aliquots.

12.5.1.2 The observed concentrations of the four aliquots will be entered into the Excel MSA_CALC.XLS worksheet which will subject the data to linear regression of external-calibration-derived concentrations (y-axis). The absolute value of the x-intercept is the MSA-corrected concentration.

12.6 Corrective Actions for Batch QC

12.6.1 The initial investigation of the problem involves:

12.6.1.1 Checking sample concentrations for being high compared to the spike concentration.

12.6.1.2 Checking calculations and raw data transcriptions (both QC and sample).

12.6.1.3 Checking sample concentrations and analytical sequence for influences such as carryover and mislabeling.

12.6.1.4 Reviewing the notes in the prep worksheet and analytical notebook for signs of problems or heterogeneity.

12.6.2 When control limits are not met for any batch QC, the analytical replicates are checked to verify that the out-of-control result is not a function of analytical variability.

12.6.3 Method Blank Corrective Actions

12.6.3.1 Method Blank results greater than the laboratory reporting limits it will be investigated. If a sample is greater than the reporting limit and less than ten times the Method Blank results, the sample will be re-prepped and reanalyzed. For DoD projects all analytes must be <½ RL. Any sample associated with a blank not meeting the criteria shall be re-

prepped and re-analyzed, except when the sample analysis resulted in a non-detect.

12.6.4 Laboratory Control Sample Corrective Actions

12.6.4.1 Control limits, which are not met for recovery in the LCS requires the batch to be prepared and reanalyzed

12.6.5 Post-Digestion Spike Corrective Actions

12.6.5.1 If the control limits are not met in the Post-Digestion Spike sample, a chemical or physical interference must be suspected, and the data for all affected analytes in the sample with that Post-Digestion Spike must be flagged according to AMRO policy.

12.6.6 Serial Dilution Corrective Actions

12.6.6.1 If the control limits are not met in the Serial Dilution sample, a chemical or physical interference must be suspected, and the data for all affected analytes in the sample with that Serial Dilution must be flagged according to AMRO policy.

12.6.7 Matrix Spike Corrective Actions

12.6.7.1 Control limits which are not met for a majority of elements in the Matrix Spike, but are met in both the Post-Digestion Spike and the Serial Dilution may indicate analyst error during preparation or sample-specific interferences during preparation; re-preparation and reanalysis are required.

12.6.7.2 If the original results are confirmed after re-preparation, the results indicate sample-specific interferences during preparation. The original data are reported and flagged according to AMRO policy.

12.6.8 Relative Percent Difference Corrective Actions

12.6.8.1 Control limits, which are not met for Relative Percent Difference in the Duplicate Sample indicates sample heterogeneity. Check sample observations for documentation of visible heterogeneity. If no sign of failure of the total analytical system, including sample preparation, is found, the result will be flagged according to AMRO

policy. A sign of failure of the analytical system requires re-prepping of the entire batch.

## 13.0 DATA REVIEW AND STORAGE

13.1 All related preparation information and observations will be noted in the digestion logbook.

13.2 All cross-outs must be a single line and should be initialed and dated. Analyst review is documented on the ICP Data Review Checklist.

13.3 All data from each run will be properly labeled and placed in the central file in an appropriate storage area. Each central file will include a run log, sample digestion worksheet, and all original data.

13.4 The Optima has the capability to generate analytical results with multiple lines. This is an extremely valuable feature. For example, the primary Antimony line at 206.833 has a serious spectral interference from Chromium. With the Optima, Antimony can be simultaneously determined at the 217.582 line and the results compared. Multiple wavelengths are utilized as much as practical in all methods to ensure accurate results (it's rare that two wavelengths would have the same spectral interference, for example) and to provide the analyst and the data reviewers a "reality check."

13.5 Another use of multiple lines is to extend linearity. The most sensitive Manganese line is 257.610 and it has a Linear Range of 20,000 µg/L. The slightly weaker Manganese line at 293.0000 can extend the Linear Range to 50,000µg/L.

13.6 Data Transfer

13.6.1 At the completion of the run, go to File/Utilities/and select WinLab32 – Off-Line.
13.6.2 Go to File/Utilities and select Data Manager.
13.6.3 Select a files (or files) to transfer and click on COPY.
13.6.4 Click BROUSE to locate the Limsimport on 'AMRO2' and click to open. Double click results to open the database and click OK to transfer the data.

13.6.5 After transferring, close the Data Manager (WinLab32 can stay open and run in the background).

## 14.0 REFERENCES

14.1 Optima 7300 Family Hardware Guide Operator's Manual, Perkin-Elmer (09906878 Release C), November 2010.

14.2 ICP WinLab Software Guide built into the WinLab software.

14.3 Inductively Coupled Plasma-Atomic Emission Spectrometry,6010B, Test Methods for Evaluating Solid Waste, SW-846, Edition, Revision 2, US EPA, December 1996.

14.4 40 CFR Part 136. Appendix B.

14.5 Department of Defense Quality Systems Manual for Environmental Laboratories, Final Version 3, January 2006.

# Table 1. Primary Wavelengths

## SW-846 Methods 6010B/3010A

| ELEMENT | Wavelength, nm | RL (µg/L) | Linear Range(µg/L) |
|---|---|---|---|
| Aluminum | 308.215 | 200 | 500,000 |
| Antimony | 206.833 | 20 | 20,000 |
| Arsenic | 188.979 | 50 | 10,000 |
| Barium | 233.527 | 200 | 60,000 |
| Beryllium | 313.107 | 4 | 2,000 |
| Boron | 208.957 | 250 | 40,000 (Carryover Likely) |
| Cadmium | 214.44 | 5 | 10,000 |
| Calcium | 227.546 | 2500 | 500,000 |
| *Chromium | 267.716 | 10 | 20,000 |
| *Cobalt | 228.616 | 50 | 20,000 |
| Copper | 324.452 | 25 | 20,000 (Carryover Likely) |
| Iron | 273.955 | 100 | 320,000 |
| Lead | 220.353 | 12 | 100,000 |
| Lithium | 670.784 (Radial) | 100 | 50,000 |
| Magnesium | 279.077 | 2500 | 500,000 |
| Manganese | 257.61 | 15 | 20,000 |
| *Molybdenum | 202.03 | 25 | 20,000 |
| *Nickel | 213.604 | 40 | 40,000 |
| Potassium | 766.474 (Radial) | 2500 | 500,000 |
| Selenium | 196.026 | 80 | 10,000 |
| Silver | 328.068 | 7 | 2,000 |
| Sodium | 589.592 (Radial) | 2500 | 500,000 |
| Strontium | 421.522 (Radial) | 10 | 12,500 |
| Thallium | 190.5 | 50 | 10,000 |
| Tin | 189.933 | 250 | 20,000 |
| *Titanium | 368.519 | 100 | 20,000 |
| *Vanadium | 292.402 | 50 | 40,000 |
| Zinc | 206.2 | 20 | 40,000 |

# Table 2. Secondary Wavelengths

## SW-846 Methods 6010B/3010A

| ELEMENT | (Secondary Wavelength, nm) | RL (µg/L) | Linear Range (µg/L) |
|---|---|---|---|
| Aluminum | 237.335 | 200 | 100,000 |
| Aluminum | 394.401 | 200 | 100,000 |
| Antimony | 217.582 | 20 | 20,000 |
| Arsenic | 193.696 | 50 | 10,000 |
| Barium | 230.425 | 200 | 60,000 |
| Beryllium | 234.861 | 4 | 10,000 |
| Boron | 182.527 | 250 | 40,000 |
| Boron | 249.677 | 250 | 40,000 |
| Cadmium | 226.502 | 5 | 10,000 |
| Cadmium | 228.802 | 5 | 10,000 |
| Calcium | 315.887 | 2500 | 100,000 |
| Calcium | 317.933 | 2500 | 100,000 |
| Chromium | 205.56 | 10 | 20,000 |
| Copper | 224.7 | 25 | 20,000 (Carryover Likely) |
| Copper | 327.393 | 25 | 20,000 (Carryover Likely) |
| Iron | 238.204 | 100 | 10,000 |
| Iron | 238.616 | 100 | 320,000 |
| Lead | 217 | 12 | 100,000 |
| Lead | 283.306 | 12 | 100,000 |
| Manganese | 260.568 | 15 | 20,000 |
| Manganese | 293.305 | 15 | 50,000 |
| Nickel | 227.022 | 40 | 40,000 |
| Nickel | 341.476 | 40 | 40,000 |
| Silver | 338.289 | 7 | 2,000 |
| Sodium | 330.237 (Axial) | NA | 500,000 (Reference Only) |
| Strontium | 407.771 (Radial) | 10 | 5,000 |
| Titanium | 334.903 (Radial) | 100 | 20,000 |
| Titanium | 337.279 | 100 | 20,000 |
| Vanadium | 270.093 | 50 | 40,000 |
| Vanadium | 290.88 | 50 | 40,000 |
| Zinc | 202.548 | 20 | 20,000 |
| Zinc | 213.857 | 20 | 20,000 |

# Table 3. Primary Wavelengths

## SW-846 Methods 6010B/3050A

| ELEMENT | Wavelength, nm | RL (mg/Kg) | Linear Range(µg/L) |
|---|---|---|---|
| Aluminum | 308.215 | 20 | 500,000 |
| Antimony | 206.833 | 4 | 20,000 |
| Arsenic | 188.979 | 5 | 10,000 |
| Barium | 233.527 | 20 | 60,000 |
| Beryllium | 313.107 | 0.5 | 2,000 |
| Boron | 208.957 | 25 | 40,000 |
| Cadmium | 214.44 | 0.5 | 10,000 |
| Calcium | 227.546 | 250 | 500,000 |
| Chromium | 267.716 | 1 | 20,000 |
| Cobalt | 228.616 | 5 | 20,000 |
| Copper | 324.452 | 2.5 | 20,000 (Carryover Likely) |
| Iron | 273.955 | 10 | 320,000 |
| Lead | 220.353 | 2.5 | 100,000 |
| Lithium | 670.784 (Radial) | 10 | 50,000 |
| Magnesium | 279.077 | 250 | 500,000 |
| Manganese | 257.61 | 1.5 | 20,000 |
| Molybdenum | 202.03 | 2.5 | 20,000 |
| Nickel | 213.604 | 4 | 40,000 |
| Potassium | 766.474 (Radial) | 250 | 500,000 |
| Selenium | 196.026 | 12 | 10,000 |
| Silver | 328.068 | 1.4 | 2,000 |
| Sodium | 589.592 (Radial) | 250 | 500,000 |
| Strontium | 421.522 (Radial) | 1 | 12,500 |
| Thallium | 190.5 | 5 | 10,000 |
| Tin | 189.933 | 25 | 20,000 |
| Titanium | 368.519 | 10 | 20,000 |
| Vanadium | 292.402 | 5 | 40,000 |
| Zinc | 206.2 | 4 | 40,000 |

# Table 4. Secondary Wavelengths

## SW-846 Methods 6010B/3051A

| ELEMENT | Wavelength, nm | RL (mg/Kg) | Linear Range(µg/L) |
|---|---|---|---|
| Aluminum | 308.215 | 20 | 500,000 |
| Antimony | 206.833 | 4 | 20,000 |
| Arsenic | 188.979 | 5 | 10,000 |
| Barium | 233.527 | 20 | 60,000 |
| Beryllium | 313.107 | 0.5 | 2,000 |
| Boron | 208.957 | 25 | 40,000 |
| Cadmium | 214.44 | 0.5 | 10,000 |
| Calcium | 227.546 | 250 | 500,000 |
| Chromium | 267.716 | 1 | 20,000 |
| Cobalt | 228.616 | 5 | 20,000 |
| Copper | 324.452 | 2.5 | 20,000 (Carryover Likely) |
| Iron | 273.955 | 10 | 320,000 |
| Lead | 220.353 | 2.5 | 100,000 |
| Lithium | 670.784 (Radial) | 10 | 50,000 |
| Magnesium | 279.077 | 250 | 500,000 |
| Manganese | 257.61 | 1.5 | 20,000 |
| Molybdenum | 202.03 | 2.5 | 20,000 |
| Nickel | 213.604 | 4 | 40,000 |
| Potassium | 766.474 (Radial) | 250 | 500,000 |
| Selenium | 196.026 | 8 | 10,000 |
| Silver | 328.068 | 1.4 | 2,000 |
| Sodium | 589.592 (Radial) | 250 | 500,000 |
| Strontium | 421.522 (Radial) | 1 | 12,500 |
| Thallium | 190.5 | 5 | 10,000 |
| Tin | 189.933 | 25 | 20,000 |
| Titanium | 368.519 | 10 | 20,000 |
| Vanadium | 292.402 | 5 | 40,000 |
| Zinc | 206.2 | 2 | 40,000 |

# Table 5. Standard and QC Concentrations

SCP_STDS_2012

PERKIN-ELMER OPTIMA 3300DV ICP

December 2012 to 2013

| Element | AMRO S1 ug/L 1.0_>1L | AMRO S2/CCV ug/L 5mL->1L | AMRO S3 ug/L 5mL->0.5L | AMRO S4 ug/L 100->1L 4->1L | AMRO ICV ug/L VHG | AMRO RL0.5 ug/L 0.20->1L sn@0.2 | AMRO RL1 ug/L 0.5->1L | AMRO RL2 ug/L 1.0->1L | AMRO CCV ug/L 5mL->1L | AMRO CCV/Low ug/L 3mL->1L | AMRO LCS/SPK ug/L 0.20mL->0.05L | AMRO ICSA ug/L 100->1L 4->1L | AMRO ICSAB ug/L 100->1L 10.->1L 4->1L | (from CRI) AMRO PDS ug/L 5.0->0.05L 0.10->5.0mL | (from CRI) (+ Mix) AMRO IDL/MDL ug/L 0.5-->50 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Al | 400 | 10,000 | 20,000 | 500,000 | 1,000 | 80 | 200 | 400 | 10,000 | 6,000 | 8,000 | 500,000 | 501,000 | 784 | 40.0 |
| Sb | 40 | 2,525 | 5,050 | | 1,000 | 8 | 20 | 40 | 2,525 | 1,515 | 2,020 | | 253 | 78 | 4.00 |
| As | 100 | 2,500 | 5,000 | | 1,000 | 20 | 50 | 100 | 2,500 | 1,500 | 2,000 | | 250 | 196 | 10.0 |
| Ba | 400 | 5,000 | 10,000 | | 1,000 | 80 | 200 | 400 | 5,000 | 3,000 | 4,000 | | 500 | 784 | 40.0 |
| Be | 9.99 | 1,000 | 2,000 | | 1,000 | 1.998 | 5.0 | 9.99 | 1,000 | 600 | 800 | | 100 | 20 | 1.00 |
| Cd | 8 | 1,000 | 2,000 | | 1,000 | 1.6 | 4.0 | 8 | 1,000 | 600 | 800 | | 100 | 16 | 0.80 |
| Ca | 5000 | 25,000 | 50,000 | 500,000 | 21,006 | 1000 | 2500 | 5000 | 25,000 | 15,000 | 20,000 | 500,000 | 502,500 | 9,804 | 500 |
| Cr | 20 | 5,000 | 10,000 | | 1,000 | 5.0 | 10 | 20 | 5,000 | 3,000 | 4,000 | | 500 | 39 | 2.00 |
| Co | 100 | 5,000 | 10,000 | | 1,000 | 25 | 50 | 100 | 5,000 | 3,000 | 4,000 | | 500 | 196 | 10.0 |
| Cu | 50 | 2,500 | 5,000 | | 1,000 | 12.5 | 25 | 50 | 2,500 | 1,500 | 2,000 | | 250 | 98 | 5.00 |
| Fe | 200 | 5,000 | 10,000 | 301,204 | 1,000 | 40 | 100 | 200 | 5,000 | 3,000 | 4,000 | 300,200 | 300,451 | 392 | 20.0 |
| Pb | 50 | 2,500 | 5,000 | | 1,000 | 10 | 25 | 50 | 2,500 | 1,500 | 2,000 | | 250 | 98 | 5.00 |
| Mg | 5001 | 25,000 | 50,000 | 500,000 | 20,998 | 1000.2 | 2501 | 5001 | 25,000 | 15,000 | 20,000 | 500,000 | 502,500 | 9,806 | 500 |
| Mn | 30 | 5,000 | 10,000 | | 1,000 | 6 | 15 | 30 | 5,000 | 3,000 | 4,000 | | 500 | 59 | 3.00 |
| Mo | 50 | 2,505 | 5,010 | | 1,000 | 10 | 25 | 50 | 2,505 | 1,002 | 2,004 | | 501 | 98 | 5.00 |
| Ni | 80 | 5,000 | 10,000 | | 1,000 | 16 | 40 | 80 | 5,000 | 3,000 | 4,000 | | 500 | 157 | 8.00 |
| K | 5000 | 25,000 | 50,000 | | 30,000 | 1000 | 2500 | 5000 | 25,000 | 15,000 | 20,000 | | 2,500 | 9,804 | 500 |
| Se | 120 | 2,000 | 4,000 | | 1,000 | 24 | 60 | 120 | 2,000 | 1,200 | 1,600 | | 200 | 235 | 12.0 |
| Ag | 14 | 500 | 1,000 | | 500 | 2.8 | 7.0 | 14 | 500 | 300 | 400 | | 50 | 27 | 1.40 |
| Na | 5000 | 25,000 | 50,000 | | 21,000 | 1000 | 2500 | 5000 | 25,000 | 15,000 | 20,000 | | 2,500 | 9,804 | 500 |
| Sr | 20 | 2,500 | 5,000 | | 1,000 | 4 | 10 | 20 | 2,500 | 1,500 | 2,000 | | 250 | 39 | 2.00 |
| Tl | 100 | 2,000 | 4,000 | | 1,000 | 20 | 50 | 100 | 2,000 | 1,200 | 1,600 | | 200 | 196 | 10.0 |
| Ti | 200 | 5,000 | 10,000 | | 1,000 | 40 | 100 | 200 | 5,000 | 3,000 | 4,000 | | 500 | 392 | 20.0 |
| V | 100 | 5,000 | 10,000 | | 1,000 | 20 | 50 | 100 | 5,000 | 3,000 | 4,000 | | 500 | 196 | 10.0 |
| Zn | 40 | 5,000 | 10,000 | | 1,000 | 8 | 20 | 40 | 5,000 | 3,000 | 4,000 | | 500 | 78 | 4.00 |
| Li | 200 | 2,500 | 5,000 | | 1,000 | 40 | 100 | 200 | 2,500 | 1,500 | 2,000 | | 250 | 392 | 20.0 |
| B | 500 | 5,000 | 10,000 | | 1,000 | 100 | 250 | 500 | 5,000 | 3,000 | 4,000 | | 500 | 980 | 50.0 |
| Sn | 500 | 2,500 | 5,000 | | 1,000 | 100 | 250 | 500 | 2,500 | 1,500 | 1,000 | | 250 | 980 | 50.0 |

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

# Aqueous Samples for Total or Dissolved Metals for analysis by ICP/Graphite Furnace Atomic Absorption by SW-846 Method 3010A

Procedure Number: IL-3020

Revision No.: 2

Revision Date: 01/12/2004

Review Date: 01/04/2010

Prepared By: Paula Benham Date: 1/11/10

Approved By: Robert E. Bothard Date: 01/12/10
Inorganic Manager

Approved By: [signature] Date: 1/11/10
Laboratory Director

Approved By: Paula Benham Date: 1/11/10
Quality Assurance Manager

# TABLE OF CONTENTS


| | | Page |
|---|---|---|
| 1.0 | SCOPE AND APPLICATION | 3 |
| 2.0 | METHOD SUMMARY | 4 |
| 3.0 | DEFINITIONS | 4 |
| 4.0 | SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE | 5 |
| 5.0 | POTENTIAL PROBLEMS AND INTERFERENCES | 5 |
| 6.0 | HEALTH AND SAFETY | 6 |
| 7.0 | INSTRUMENTS AND EQUIPMENT | 7 |
| 8.0 | REAGENTS AND STANDARDS | 7 |
| 9.0 | PROCEDURE | 12 |
| 10.0 | INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR | 14 |
| 11.0 | CALCULATIONS | 14 |
| 12.0 | QUALITY CONTROL | 14 |
| 13.0 | DATA REVIEW AND STORAGE | 17 |
| 14.0 | REFERENCES | 18 |
| | Attachment 1 Trace Metals Digestion Worksheet | 19 |
| | Attachment 2 3010A Qualification Card | 20 |

# 1.0 SCOPE and APPLICATION

## 1.1 Application

1.1.1 This digestion procedure is used for the preparation of aqueous samples, TCLP extracts, and wastes that contain suspended solids for analysis by Inductively Coupled argon Plasma spectroscopy (ICP). The procedure is a hot acid leach for determining available metals.

1.1.2 Samples prepared by Methods 3010A using nitric acid digestion may be analyzed by ICP for Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chromium, Cobalt, Copper, Gold, Iron, Lead, Magnesium, Manganese, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Strontium, Thallium, Tin, Titanium, Vanadium and Zinc.

1.1.3 Samples prepared by Method 3010A can be analyzed on the graphite furnace since Hydrochloric Acid is added to the standards and does not present an interference with STPF technology employed at AMRO Laboratory.

1.1.4 The results derived from analyses of the digestates produced by following the total metals procedures of this SOP will be reported as "Total Metals"; those following the dissolved metals procedures of this SOP will be reported as "Dissolved Metals".

## 1.2 Modifications

1.2.1 The initial sample volumes used by AMRO is 50mL, not 100 mL as specified by the Method. Instrument sensitivity is sufficient to not require concentration. Also the nature of the samples received by AMRO typically require dilution via digestion and/or analysis to provide accurate results.

1.2.2 Arsenic, Lead, Selenium, Thallium, Cadmium, Antimony, and Silver can be determined by Graphite Furnace since Hydrochloric Acid is added to the standards and does not present an interference with STPF technology employed at AMRO.

1.2.3 In place of beakers and hot plate, samples are digested on a hotblock with a digital temperature controller using 50mL tubes designed for use on the hotblock.

## 2.0 METHOD SUMMARY

2.1 Total Metals: A representative 50mL sample is refluxed in a covered beaker. This step is repeated with additional Nitric Acid until the digestate is clear in color or until the color has stabilized. After the sample has been brought to a low volume, it is refluxed with Hydrochloric Acid and brought to a final volume of 50 mL.

2.2 Dissolved Metals: The sample is filtered through a 0.45 um filter at the time of collection and the liquid phase is then acidified immediately with nitric acid.

2.3 AMRO routinely digests MS, MSD and sample duplicate to meet all varying project QC requirements.

## 3.0 DEFINITIONS

3.1 Method Blank: An aliquot of reagent water, which is carried through the entire analytical procedure with the samples, its purpose is to determine whether contamination is present during the analysis. One method blank is analyzed for every batch of 20 samples.

3.2 Laboratory Control Sample: An aliquot of reagent water into which known quantities of the method analyte are added in the laboratory. The LCS is analyzed exactly like a sample, and its purpose is to determine the degree to which the analytical result approaches the "true value" of the concentration of the analyte being determined. The percentage recovery is calculated in order to assess the efficiency of the analysis. One LCS is analyzed for every batch of 20 samples.

3.3 Sample Duplicate: Two aliquots of a sample are which are carried through the same preparation and analytical procedures to verify the method precision. One sample duplicate is analyzed for every batch of 20 samples.

3.4 Sample Matrix Spike: A specific aliquot of sample into which a known amount of analyte is added. The analytical spike is analyzed with the sample batch and the percent recovery is calculated in order to assess the matrix effect on the analytical system. One sample matrix spike is analyzed for every batch of 20 samples.

## 4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 All sample containers must be cleaned according to the SOP on glassware cleaning.

4.2 Samples shall be acidified at the time of collection with nitric acid to pH<2. The holding time is six months at room temperature.

4.3 For the determination of dissolved elements, the sample should be filtered through a 0.45 um membrane filter at the time of collection.

4.3.1 If the samples are not filtered and acidified at the time of collection, the client is contacted to determine if filtration and acidification by the laboratory are desired.

4.3.1.1 If the client desires filtration and acidification by the laboratory use a portion of the sample to rinse the filter assembly, discard and then collect at least 100mL of filtrate. Transfer the filtrate into an appropriately labeled container. Record the volume in the preparation log. Acidify the filtrate to (pH < 2) immediately following filtration.

4.3.1.2 Make sure the container is labeled with the appropriate AMRO ID number, labeled as "Dissolved Metals," and has date filtered and analyst initials.

4.3.1.3 The resultant data are flagged with a footnote, which States: "These samples were filtered at the request of the client. The results represent the dissolved metals content at the time of filtering."

## 5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 Non-homogeneous samples may result in poor accuracy and precision. The analyst should note problem samples under comments on the digestion worksheet.

## 6.0 HEALTH AND SAFETY

6.1 AMRO places a high value on laboratory safety. The air quality of the laboratory has been monitored. Fire extinguishers are located in various areas of the lab. The laboratory evacuation plan is posted in every room, with a designated meeting place.

6.2 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean lab coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.3 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eyewash stations and an emergency shower.

6.4 Cautions for nitric acid and hydrochloric acid:

6.4.1 All handling of hot solutions containing these materials must be performed under a hood. Contact hazards and contingencies - Liquid and vapor cause severe burns. May be fatal if swallowed. Harmful if inhaled and may cause delayed lung injury. Do not get in eyes, on skin, on clothing. Do not breathe vapor. Keep in tightly closed container. Use with adequate ventilation. In case of contact, remove clothing and flush area with water spray. In case of ingestion, administer fluids immediately. In case of inhalation, remove from exposure.

6.4.2 Spills, storage and contingencies - Spillage may cause fire or liberate dangerous gas. Keep from contact with clothing and other combustible materials. Do no store near combustible materials. In case of spill, stop the spill, use the Acid Spill Kit and ventilate the area.

6.4.3 Fire hazards and contingencies - Strong oxidizer - contact with other material may cause fire. In case of fire, use water spray, alcohol foam, dry chemical, or carbon dioxide.

6.4.4 During addition to sample, nitric acid may evolve toxic nitrogen oxide Fumes. Therefore all work must be performed in a properly operating hood.

6.5 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention: The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

## 7.0 INSTRUMENTS AND EQUIPMENT

7.1 Thermolyne Type 2200 Heavy-Duty hotplate (or equivalent).

7.2 100 mL Kimax Beakers (Fisher# 02-555-20A or equivalent)

7.3 Hotplate thermometer (Fisher Cat # 15-170-10D)

7.4 200 & 500uL Eppendorf pipets (or equivalent). (Fisher# 03402- or equivalent)

7.5 Repipet Universal Dispenser, 10 mL volume range in 0.05 mL graduations

7.6 52 mL containers for sample storage (Cat. #3264)

7.7 Digibloc 3000 hotblock (SCP Science p/n 010-500-001)

7.8 Digitubes, 50mL with caps and certification of volume (SCP p/n 010-500-261).

7.9 Disposable watch glasses (SCP p/n 010-500-019).

## 8.0 REAGENTS AND STANDARDS

8.1 AMRO reagent water – Deionized Water (DI) from a Culligan System that is checked monthly for Residual Chlorine, Conductivity, pH, Arsenic, Barium, Cadmium, Chromium, Copper, Iron, Lead, Nickel, Selenium, Silver, Zinc and Mercury. Resistivity and pH are monitored daily. Instrument and Procedural Blanks are also used to monitor contaminant levels through out the laboratory.

8.2 Before performing the analysis, the analyst should **read the Materials Safety Data Sheet (MSDS)** of all the reagents and standards carefully and be prepared to take necessary emergency action at all times.

8.3 Nitric acid for Trace Metals Analysis, Tedia, NE4123

8.4 Hydrochloric acid for Trace Metals Analysis, Tedia, NE408

8.5 Spiking solutions

8.5.1 The concentration of analytes in the spiking solution should be:

| ANALYTE | CONCENTRATION IN SPIKE SOLUTION, MG/L | CONCENTRATION IN DIGESTATE, UG/L |
|---|---|---|
| Aluminum | 2000 | 8000 |
| Antimony by GFAA | 5.0 | 20 |
| Antimony by ICP | 1000 | 2000 |
| Arsenic by GFAA | 5.0 | 20 |
| Arsenic by ICP | 500 | 2000 |
| Barium | 1000 | 4000 |
| Beryllium | 100 | 800 |
| Cadmium by GFAA | 2.0 | 12.5 |
| Cadmium by ICP | 200 | 800 |
| Calcium | 5000 | 20000 |
| Chromium | 1000 | 4000 |
| Cobalt | 1000 | 4000 |
| Copper | 500 | 2000 |
| Iron | 1000 | 4000 |
| Lead by GFAA | 5.0 | 20 |
| Lead by ICP | 500 | 2000 |
| Magnesium | 5000 | 20000 |
| Manganese | 1000 | 4000 |
| Molybdenum | 500 | 2000 |
| Nickel | 1000 | 4000 |
| Potassium | 5000 | 20000 |
| Selenium by GFAA | 4.0 | 20 |
| Selenium by ICP | 400 | 1600 |
| Silver by GFAA | 1.0 | 4.0 |
| Silver by ICP | 100 | 400 |
| Sodium | 5000 | 20000 |
| Strontium | 500 | 2000 |
| Thallium by GFAA | 4.0 | 20 |
| Thallium by ICP | 400 | 1600 |
| Titanium | 1000 | 4000 |
| Vanadium | 1000 | 4000 |
| Zinc | 1000 | 4000 |

8.5.2 The ICP Spiking solution is a purchased Superstock. (See ICP Standard Log.)

8.5.3 The GFAA spiking solution is prepared from a purchased Superstock. (See GFAA Standard Log.)

## TRACKING OF ANALYTICAL STANDARDS

8.6 Chemical Receipt

The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a four digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and AMRO employees complete the disposal dates when standards are used up or disposed.

8.7 Standards Preparation

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

8.7.1 ACS reagent grade chemicals are used when the method warrants.

8.7.2 A certificate of analysis accompanies any stock standards that are purchased from the manufacturer.

8.7.3 Class A volumetric glassware is used to prepare standards.

8.8 Standard Tracking

It is important to be able to track all analytical standards back to their sources. AMRO personnel to accomplish this use the following procedure:

8.8.1 Wet Chemistry and Mercury Standards - Working Standards and LCS solutions made from stock standards listed in the Chemical Receiving Log are documented in the Inorganic Standard Log. The corresponding analysis, preparation date, standard name, AMRO ID, amount used, initial concentration of standard, amount used, final volume, final concentration, Standard ID, expiration date, storage location, and analyst initials are recorded. The initial concentration of the standard is obtained from the certificates received from the manufacturer. The Standard ID is written as an "S" followed by a four digit sequential number. The expiration of

working standards vary depending on the use. Standards should be used in accordance with method specifications and manufacturer's instructions. The expiration date for ICP standards is six months. The expiration dates for GFAA intermediate and spiking solution is one month with the calibration standards made weekly but made daily for DOD.

8.8.2 Metals Standards

8.8.2.1 Axial Standards Log (OPTIMA) - Preparation and Standard ID's are listed in the Standard Log. Standards include: S1 (Calibration #1 & RL2), S2 (Calibration #2 & IPC/CCV), S3 Calibration #3, RL 1 (Reporting Limit), RL2 ( two times the Reporting Limit),S4,S5 (linear range extending standards) ICSA & ICSAB (Interference Check Standards), ICV (Independent Source QC Standards), and Stock Solutions for Matrix/LCS spike additions. The Solution ID is written as the ID followed by the date prepared (example: S1042798 is standard S1 prepared on 042798). After a conformational analysis to verify the new standard and just prior to it's use, the new ID is entered into the OPTIMA software. Until updated, this will be the ID printed on every run log and standard page for hardcopy tracking.

8.8.2.2 Radial Standards Log (SPECTRO 2) - Preparation and Standard ID's are listed in the Standard Log. Standards include: NS1 (Calibration #1 & CCV), NS2 (Calibration #2 & IPC), NRL 1 (Reporting Limit), NRL2 ( two times the Reporting Limit), NS3, NS4, NS5 and NS6 (Linear Range Extending Standards), ICSA &ICSAB (Interference Check Standards), NICV (Independent Source QC Standards), and Stock Solutions for Matrix/LCS spike additions. The Solution ID is written as the ID followed by the date prepared (example: NS1042798 is standard NS1 prepared on 042798). After a conformational analysis to verify the new standard and just prior to its use, the new ID is entered into the SPECTRO2 software. Until updated, this will be the ID printed on every run log and standard page for hardcopy tracking.

8.8.2.3 Graphite Furnace Standard Logs (GFAA): Preparation and Standard ID's listed in this log include: Purchased Stock Certificates: Intermediate Calibration, CCV, ICV, LCS/MS Solutions: and final Calibration Solutions, final ICV final

CCV and final reporting limit. These standards are prepared from the same stock solution as those used for the ICP. The nomenclature is essentially the same, but there are more dilutions needed, which necessitate Intermediate Solutions. Nomenclature for intermediate solutions includes "INT", the type of solution, and the date prepared. After a conformational analysis to verify the new standard and just prior to it's use, the new ID is entered into the PE-4100ZL and/or PE-SIMMA software. Until updated, this will be the ID printed on every run log and standard page for hardcopy training.

8.8.3 Wet Chemistry and Metals Reagent Log - Working reagents are made from reagents listed in the Chemical Receiving Log are documented in the Reagent Log, The corresponding analysis, preparation date, reagent name, AMRO ID, initial concentration, amount used, final volume, final concentration, Solution ID, expiration date, storage location, and analyst initials are recorded. The initial concentration is obtained from the certificate received from the manufacturer. The Solution ID is written as an "R" followed by a 4 digit sequential number. The expiration of prepared reagents varies. Reagents should be used in accordance with method specifications and manufacturer's instructions.

## 9.0 PROCEDURE

Obtaining a Homogeneous Sample

9.1.1 Thoroughly mix the sample in the original container.

9.1.2 Any problems encountered, which might interfere in getting a homogeneous sample, should be noted (flagged) on the worksheet (e.g. half water and half silt organic material, etc.).

9.2 Dissolved Metals

9.2.1 See Section on Sample Handling and Preservation for proper handling of dissolved samples.

9.2.2 DI water must be prepared and analyzed in the same fashion as the samples as a filter blank.

9.3 Digestion

9.3.1 If samples contain undissolved solids at greater than 1% (i.e. visible solid matter) see your supervisor for further instructions.

9.3.2 Label the containers with the sample I.D. and pour the sample into the appropriately labeled tube up to the 50mL mark (see obtaining a homogeneous sample).

9.3.3 Record the volume in the preparation log.

9.3.4 Transfer the sample to a 100mL acid-washed beaker if using beakers and hotblock in place of Digibloc.

9.3.5 Add 1.5 mL of concentrated nitric acid and cover with a ribbed watch glass.

9.3.5.1 NOTE: For laboratory control samples, matrix spike (MS) and matrix duplicates (D), the spiking solution must be added after the water and the acids, or low spike recoveries may be obtained.

9.3.5.2 Add 0.20mL each of the ICP spike solutions and 0.20 mL of the GFAA spike solution to the respective LCS, MS and MSD samples. See Section 9.2 for QC frequency.

9.3.5.3 A preparation blank consisting of DI water and all reagents is digested along with the samples.

9.3.5.4 Document and notify the immediate supervisor if acid additions cause precipitation of the sample.

9.3.6 Place the samples on a heated hot plate and cautiously reduce the volume to 5-10mL (NOTE: The final volume is left to the discretion of the analyst in cases where samples spatter or contain high TDS). Cool and add another portion of Nitric Acid. Cover the beaker with a non-ribbed watch glass and reflux gently.

NOTE: If the sample goes to dryness, it MUST be reprepped.

9.3.7 Continue heating, adding additional nitric acid, as necessary until the digestion is complete: either light in color or no change of appearance with continued refluxing. Evaporate to a low volume 5-10mL and
remove the beaker to cool.

9.3.8 Add 2.5mL of concentrated Hydrochloric Acid, cover the beaker, and reflux an additional 15 minutes to dissolve any precipitate or reside. Cool the sample. Transfer the sample to the appropriately labeled tube if using beakers and hotplate.

9.3.9 Rinse the beaker or flask into the container with DI water to the 50 mL mark. For Digibloc only need to carefully bring to 50mL mark **Mix all samples thoroughly**.

9.3.10 Record the final volume in the logbook.

9.3.11 The sample is now ready for analysis. If the sample contains insoluble material that could clog the nebulizer, it MUST be filtered using a 0.45u filter prior to analysis.
Note: Filtration, if required, is ALWAYS done by the ICP or HGA analyst and never as part of the preparation procedure.

9.4 Preventive Maintenance

9.4.1 See SOP's for glassware washing, and maintenance and use of pipettes. There is no required preventive maintenance for heaters and associated equipment.

9.4.2 On a weekly basis, or as needed, wipe down hothlock and racks with DI dampened cloth.

## 10.0 INSTRUMENT PREVENTAIVE MAINTENANCE AND REPAIR

10.1 Refer SOP's for glassware washing, and maintenance and use of pipettes. There is no required preventive maintenance for heaters and associated equipment.

10.2 On a weekly basis, or as needed, wipe down hotblock and racks with DI dampened cloth.

## 11.0 CALCLATIONS

11.1 Not applicable unless initial volume is different than the final volume. If it is see instrument analyst.

## 12.0 QUALITY CONTROL

12.1 Method Blanks:

A sample of deionized (DI) water is put through the procedure and analyzed as a Method Blank. Method Blank results above ±2x MDL (MDL check) indicate contamination. The source of contamination will be investigated and corrected. If the samples are less than ten times the Method Blank results and greater than 2x MDL (MDL check), the samples will be re-prepped. A Method Blank is required 1 for every 20 samples.

12.2 Laboratory Control Sample:

A sample using DI water plus a spike of the appropriate analytes is put through the entire procedure and analyzed as a laboratory control sample (LCS). Control limits which are not met for percent recovery in the LCS indicate errors during the procedure and require reprep unless there is a definite assignable cause. The LCS control limits are 80%-120% for 6010B. A LCS is required 1 for every 20 samples.

12.3 Matrix Spike/ Matrix Spike Duplicate:

Duplicate aliquots of a commercial sample are spiked as a Matrix Spike and a Matrix Spike Duplicate and are put through the entire procedure. The concentration of the analyte in the unspiked sample aliquot should be no more than four times the amount added. If the sample result is greater than four times the amount added, the LCS is the only valid assessment of accuracy for the batch and the spike recovery is not evaluated for control. If the control limits are not met for Relative Percent Difference, the control limits for Percent Recovery in the Matrix Spike are not applicable, since sample heterogeneity is indicated and an inaccurate sample result used to calculate percent recovery is suspected. A matrix spike and matrix spike duplicate is required for every 20 samples for 6010B and 7000 series. In some cases, the client may specify which sample is to used for MS/MSD; if not , the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall not be performed on Rinsate Blank or Field Blank.
B. Adequate sample weight/volume.
C. Client requested QC deliverables.

12.4 Duplicate:

12.4.1 Duplicate samples are two aliquots of a sample, which are carried through the same sample preparation and analysis procedure to verify the precision of the method for that sample matrix. The %RPD can also be calculated between a matrix spike and matrix spike duplicate. The %RPD (Relative Percent Difference) is calculated from the original and the duplicate sample. The %RPD is calculated using the concentration of the matrix spike and matrix spike duplicate. If the control limits are not met for Relative Percent Difference, the control limits for Percent Recovery in the Matrix Spike are not applicable, since sample heterogeneity is indicated and an inaccurate sample result used to calculate percent recovery is suspected. The control limits are 0%-20% for 6010B and 7000 series. The duplicate for 6010B often refers to the %RPD between the matrix spike and the matrix spike duplicate. In some cases, the client may specify which sample is to be used for MS/Dup; if not, the laboratory shall pick a representative sample based on the following:

A. Method of extraction or digestion.
B. Duplicate shall not be performed on Trip Blank, Rinsate Blank or Field Blank.
C. Adequate sample weight/volume.
D. Client requested QC deliverables

12.5 Corrective Actions for Batch QC

12.5.1 The initial investigation of the problem involves:

12.5.1.1 Checking sample concentrations for being high compared to the spike concentration.

12.5.1.2 Checking calculations and raw data transcriptions (both QC and sample).

12.5.1.3 Checking sample concentrations and analytical sequence for influences such as carryover and mislabeling.

12.5.1.4 Reviewing the notes in the digestion worksheet and analytical notebook for signs of problems or heterogeneity.

12.6 Method Blank Corrective Actions

12.6.1 Method Blank results greater than 2 x MDL will be investigated. If a sample is greater than the reporting limit and less than ten times the Method Blank results, the sample will be re-prepped and reanalyzed

12.7 Laboratory Control Sample Corrective Actions

12.7.1 Control limits which are not met for recovery in the LCS requires the batch to be prepared and reanalyzed

12.8 Matrix Spike Corrective Actions

12.8.1 Control limits which are not met for a majority of elements in the Matrix Spike, but are met in both the Post-Digestion Spike and the Serial Dilution may indicate analyst error during preparation or sample-specific interferences during preparation; re-preparation and reanalysis are required.

12.8.2 If the original results are confirmed after re-preparation, the results indicate sample-specific interferences during

preparation. The original data are reported and flagged according to AMRO policy.

12.9 Relative Percent Difference Corrective Actions

12.9.1 Control limits which are not met for Relative Percent Difference in the Duplicate Sample indicates sample heterogeneity. Check sample observations for documentation of visible heterogeneity. If no sign of failure of the total analytical system, including sample preparation, is found, the result will be flagged according to AMRO policy. A sign of failure of the analytical system requires re-prepping of the entire batch.

## 13.0 DATA REVIEW AND STORAGE

13.1 All related preparation information and observations will be noted in the digestion logbook.

13.2 All cross-outs must be a single line and should be initialed and dated. Analyst review is documented on the Trace Metals Digestion (Attachment 1).

13.3 All data from each run will be properly labeled and placed in the central file in an appropriate storage area. Each central file will include a run log, sample prep sheet, and all original data.

## 14.0 REFERENCES

14.1 EPA-200.7 Determination of Metals and Trace Elements in Water and Wastes.

14.2 EPA-200.9 Determination of Trace Elements by Stabilized Temperature Graphite Furnace Atomic Absorption, Revision 2.2, May 1994.

14.3 Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by FLAA or ICP Spectroscopy, 3010A. Test Methods for Evaluating Solid Waste, US EPA SW-846, 3rd Edition, Revision 2. December 1996.

14.4 40 CFR Part 136. Appendix B.

14.5 Department of Defense Quality Systems Manual for Environmental Laboratories, Revision 3, January 2006.

# Attachment 1

AMRO Environmental Laboratories Corporation

111 Hermck Street
Merrimack, NH 03054
(603) 424-2022

## TRACE METALS DIGESTION WORKSHEET

SW-846 Methods: 3010A / 3050B
EPA Methods: 200.7 / 200.9

Performed By: _____ Date: _____

Temp: _____ HNO3 ID No.: _____

HCl ID No.: _____

Acceptable temperature of 90-95 °C LIMS Batch ID: _____

| Lab Order | Lab Sample Number | Sample Description | Initial Volume(mL)/ Weight (g) | Final Volume (mL) | Spike Added (mL) | Comments |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| Matrix Spike | |
|---|---|
| Solution ID | Spiking Compounds and Concentration |
| | |
| | |

qc/qcmemos/forms/tmdig Rev. 4 05/00

Attachment 2

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

# QUALIFICATION CARD FOR SW-846 METHOD 3010A

Trainee: _____ Signature: _____

Trainer: _____ Signature: _____

I. Knowledge Factors:

SOP Title: _____ Revision Number/Date: _____

| | | | |
|---|---|---|---|
| 1. Did the Trainee read and understand the above SOP? | Yes ☐ | No ☐ | NA ☐ |
| 2. Was the Trainee instructed on how to properly fill out the documentation? | Yes ☐ | No ☐ | NA ☐ |
| 3. Has the Trainee been instructed on the proper procedures for addressing potential problems? | Yes ☐ | No ☐ | NA ☐ |

II. Practical Factors:

| | | | |
|---|---|---|---|
| 1. Has the Trainee completed a Precision and Accuracy Study? | Yes ☐ | No ☐ | NA ☐ |
| 2. Has the Trainee demonstrated the ability to review and correct Batch QC problems? | Yes ☐ | No ☐ | NA ☐ |

Completion Date: _____ Trainer's Signature: _____

I _____ have read, understood and follow the above method/SOP, which is in use at AMRO Laboratories for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

Section Manager/ Supervisor: _____ Date: _____

QA Manager: _____ Date: _____

qc/qcmemos/forms/3010Aqualcard Rev. 1 07/17/03

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

# REACTIVE SULFIDE

## SW-846 Chapter 7 Section 7.3.4.2

Procedure Number: IL-3012

Revision No.: 2

Revision Date: 03/01/2010

Review Date: N/A

Prepared By: _____ Date: 3/1/10

Approved By: _____ Date: 03/01/10
Inorganic Manager

Approved By: _____ Date: 3/1/10
Laboratory Director

Approved By: _____ Date: 03/01/2010
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

# TABLE OF CONTENTS


| | | Page |
|---|---|---|
| 1.0 | SCOPE AND APPLICATION | 3 |
| 2.0 | METHOD SUMMARY | 3 |
| 3.0 | DEFINITIONS | 4 |
| 4.0 | SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE | 5 |
| 5.0 | POTENTIAL PROBLEMS AND INTERFERENCES | 5 |
| 6.0 | HEALTH AND SAFETY | 5 |
| 7.0 | INSTRUMENTS AND EQUIPMENT | 6 |
| 8.0 | INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR | 7 |
| 9.0 | REAGENTS AND STANDARDS | 7 |
| 10.0 | PROCEDURE | 8 |
| 11.0 | CALCULATIONS | 9 |
| 12.0 | QUALITY CONTROL | 9 |
| 13.0 | DATA REVIEW AND STORAGE | 10 |
| 14.0 | REFERENCES | 10 |
| | Attachment 1 Reactive Sulfide worksheet | 11 |
| | Attachment 2 Wet Chemistry Data Review Checklist | 12 |
| | Attachment 3 Reactive Sulfide Qualification Card | 13 |

## 1.0 SCOPE and APPLICATION

1.1 This method is applicable to all wastes, with the condition that waste that are combined with acids do not form explosive mixtures.

1.2 This method provides a way to determine the specific rate of release of hydrogen sulfide upon contact with an aqueous acid.

1.3 The procedure releases only the hydrogen sulfide evolved at the test conditions. It is not intended to measure forms of sulfide other than those that are evolvable under the test conditions.

1.4 AMRO Reporting Limits: 100mg/Kg.

## 2.0 METHOD SUMMARY

2.1 The regulation in 40 CFR 261.23 defines reactive wastes to include wastes that have any of the following properties: (1) readily undergo violent chemical change; (2) react violently or form potentially explosive mixtures with water; (3) generate toxic fumes when mixed with water or, in the case of cyanide - or sulfide-bearing wastes, when exposed to mild acidic or basic conditions; (4) explode when subjected to a strong initiating force; (5) explode at normal temperatures and pressures; or (6) fit within the Department of Transportation's forbidden explosives, Class A explosives, or Class B explosives classifications.

2.2 This definition is intended to identify wastes that, because of their extreme instability and tendency to react violently or explode, pose a problem at all stages of the waste management process. The definition is to a large extent a paraphrase of the narrative definition employed by the National Fire Protection Association. The Agency chose to rely almost entirely on a descriptive, prose definition of reactivity because most of the available tests for measuring the variegated class of effects embraced by the reactivity definition suffer from a number of deficiencies.

2.3 Characteristic of Reactivity Regulation
A solid waste exhibits the characteristic of reactivity if a representative sample of the waste has <u>any</u> of the following properties:

2.3.1 It is normally unstable and readily undergoes violent change without detonating.
2.3.2 It reacts violently with water.
2.3.3 It forms potentially explosive mixtures with water.

2.3.4 When mixed with water, it generates toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment.

2.3.5 It is a cyanide - or sulfide-bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment. (Interim Guidance for Reactive Cyanide and Reactive Sulfide, Steps 7.3.3 and 7.3.4 below, can be used to detect the presence of reactive cyanide and reactive sulfide in wastes.)

2.3.6 It is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement.

2.3.7 It is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure.

## 3.0 DEFINITIONS

3.1 **Analytical Batch -** A group of samples of a similar matrix analyzed together with the same procedure, using the same reagents and within the same time period. Samples in each batch should be of similar composition (i.e. soil, water, oil, etc.). A batch shall not exceed 20 samples.

3.2 **Sample Duplicate - (DUP)** A duplicate sample aliquots of sample which is carried through the same digestion and analysis. The relative percent difference between the sample and sample duplicate is calculated and used to assess analytical precision.

3.3 **Method Blank** An analytical control consisting of all reagents which is carried through the entire analytical procedure. It is used to define the level of laboratory background contamination.

## 4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 Samples containing, or suspected of containing, sulfide wastes should be collected with a minimum of aeration. The sample bottle should be filled completely, excluding all headspace, and stoppered. Analysis should commence as soon as possible, and samples should be kept in a cool, dark place until analysis begins.

4.2 It is suggested that samples of sulfide wastes be tested as quickly as possible, although they can be preserved by adjusting the sample pH to12 with strong base and adding zinc acetate to the sample, these will cause dilution of the sample, increase the ionic strength, and, possibly, change other physical or chemical characteristics of the waste which may affect the rate of release of the hydrogen sulfide. Storage of samples should be under refrigeration and in the dark.

4.3 Testing should be performed in a ventilated hood.

4.4 Holding time for this analysis is 7 days, which must include both preparation and analysis.

## 5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 Interference's are undetermined.

## 6.0 HEALTH AND SAFETY

6.1 AMRO has a laboratory safety program in place that applies to all employees. There is a safety officer as well as employees with 40 hours of OSHA training. The air quality of the laboratory has been monitored and employees are sent for physicals. All employees receive fire and safety training upon employment.

6.2 Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place.

6.3 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean laboratory coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.4 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the laboratory There are also eyewash stations and an emergency shower.

6.5 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals .They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.7 Waste control – AMRO takes whatever steps possible to minimize waste. This includes volume reduction where appropriate. AMRO also properly segregates wastes according to contaminants and a commercial vendor is utilized for waste disposal.

## 7.0 INSTRUMENTS AND EQUIPMENT

7.1 Round-bottom flask - 500 mL, three-neck, with 24/40 ground-glass joints.

7.2 Gas scrubber - 50 mL calibrated scrubber.

7.3 Stirring apparatus - To achieve approximately 30 rpm. This may be either a rotating magnet and stirring bar combination or an overhead motor-driven propeller stirrer.

7.4 Addition funnel - With pressure-equalizing tube and 24/40 ground-glass joint and Teflon sleeve.

7.5 Flexible tubing - For connection from nitrogen supply to apparatus.

7.6 Water-pumped or oil-pumped nitrogen gas - With two-stage regulator.

7.7 Rotometer - for monitoring nitrogen gas flow rate.

7.8 Analytical balance - capable of weighing to 0.001 g.

## 8.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

8.1 AMRO used Class I weights to check the calibration of the balances daily each day of use. The weights are inspected periodically for cleanliness. They are sent to an outside vendor for verification once every five years.

8.2 The analytical balance has a sensitivity of 0.01mg. It is checked using ASTM Class I weights at weights routinely measured on a daily basis and the actual weights are recorded in the Daily Balance Check Logbook. The balance is kept on a marble slab on a heavy table and is checked regularly to be sure it is level. The balance is calibrated annually by a certified service representative.

## 9.0 REAGENTS AND STANDARDS

9.1 AMRO reagent water – Deionized Water (DI) from a Culligan System that is checked monthly for Residual Chlorine, Conductivity, Heterotrophic Plate count, pH, Arsenic, Barium, Cadmium, Chromium, Copper, Iron, Lead, Nickel, Selenium, Silver, Zinc and Mercury. Resistivity and pH are monitored daily. Instrument and Procedural Blanks are also used to monitor contaminant levels through out the laboratory.

9.2 Sulfuric Acid (0.01N): - Add 2.8 mL concentrated $H_2SO_4$ to 500mL DI water and dilute to 1 L. Withdraw 100 mL of this solution and dilute to 1 L to make the 0.01N $H_2SO_4$

9.3 Sulfide reference solution - Dissolve 4.02 g of $Na_2S_9H_2O$ in 1.0 L of DI water. This solution contains 680mg/L hydrogen sulfide. Dilute this stock solution to cover the analytical range required (100-570 mg/L).

9.4 Sodium hydroxide solution (0.25N): -Dissolve 10 g of NaOH in 100mL DI water and dilute to final volume of 1 L.

9.5 Tracking of Reagents and Standards

It is important to be able to track all analytical reagents and standards back to their sources. AMRO Inorganic personnel to use the following procedure:

9.5.1 Chemical Receiving Log: The receipt of all standards and reagents from commercial sources is documented in the Chemical Receiving Log. The date received, AMRO ID, chemical name, source, lot number, quantity, storage location, and expiration date are recorded. The AMRO ID is written as an A followed by a 4 digit number (example A0001). Refer to the Inorganic Certificate of Analysis Logbook for standard concentration information.

9.5.2 Reagent Log: Working reagents made from reagents listed in the Chemical Receiving Log are documented in the Reagent Log. The corresponding analysis, preparation date, reagent name, AMRO ID, amount used, final volume, final concentration, Solution ID, expiration date, storage location and analyst initials are recorded. The Solution ID is written as an R followed by a 4 digit number (example R0001).

9.5.3 Inorganic Standard Log: Working standards and LCS solutions made from stock standards listed in the Chemical Receiving Log are documented in the Inorganic Standard Log. The corresponding analysis, preparation date, standard name, AMRO ID, amount used, final volume, final concentration, Standard ID, expiration date storage location and analyst initials are recorded. The Standard ID is written as an S followed by a 4 digit number (example S0001).

9.6 Starch indicator: obtained commercially from Fisher Scientific.

9.7 Sodium thiosulfate 0.0250 N: obtained commercially from Fisher Scientific.

## 10.0 PROCEDURE

10.1 Add 30 mL of 0.25N NaOH solution to a calibrated scrubber and dilute with DI water to obtain an adequate depth of liquid.

10.2 Assemble the system and adjust the flow rate or nitrogen, using the rotometer. Flow should be 60 mL/min.

10.3 Add 10g of the waste to be tested to the system.

10.4 With the nitrogen flowing, add 250ml of 0.01N sulfuric acid to fill the flask half full, while starting the 30 minute test period.

10.5 Begin stirring while the acid is entering the round-bottom flask. The stirring speed must remain constant throughout the test.

*NOTE 1:* The stirring should not be fast enough to create vortex.

10.6 After 30 minutes, close off the nitrogen and disconnect the scrubber. Transfer solution and bring up to 50ml volume with a graduated cylinder. Transfer the solution to a 250ml plastic bottle. Seal the bottle and store at 4 °C.

10.7 Take 20 ml of digested sample and make up 100ml with DI water in 250 ml Erlenmeyer flask.

10.8 Place a 5mL of standard iodine solution (0.025 N iodine) in flask. The amount should be estimated to be in excess of the sulfide expected.

10.9 Add 1 mL of 6 N HCL

10.10 If the iodine color disappears, add more iodine until the color remains. Record the total number of millimeters of standard iodine used in performing steps 10.8

10.11 Add 2-3 drops of starch indicator. This will turn the contents of the flask blue. Continue the titration until the blue color disappears. Record the number of millimeters used for both steps.

10.12 Titrade with 0.0250N Sodium thiosulfate until clear.

## 11.0 CALCULATIONS

11.1 Determine the specific rate of release of H2S, using the following parameters:

11.1 $$\text{Total releasable H2S (mg/kg)} = \frac{400\,(A-B)}{\text{sample weight (g)}}$$

where:

A = mL of 0.0250N iodine solution
B = mL of 0.0250N Standard reduction Sodium thiosulfate Normality of iodine solution

11.2 The final sample results and the associated reporting limit should be adjusted for the moisture content of the sample.

## 12.0 QUALITY CONTROL

12.1 One Method Blank must be digested with every 20 samples. The acceptable criteria: < RL and <½ RL for USACE and NAVY Projects.

12.2 One Sample Duplicate is analyzed per batch of 10 samples. The RPD between the sample and duplicate results should be less than 20% (if the results are less than 4 times the reporting limit the RPD is not applicable.). If the RPD is greater than 20% reanalysis of the sample should be done to rule out analytical error.

12.3 Samples must be selected for Duplicatre at random and rotated among clients and sites from batch to batch. In some cases, the client may specify which sample is to used for MS/MSD; if not, the laboratory shall pick a representative sample based on the following:

A. Duplicate shall not be performed on Trip Blank, Rinsate Blank or Field Blank.
B. Adequate sample weight/ volume.
C. Client requested QC deliverables

12.4 The ICV is analyzed at the beginning of the analytical run and must be in the range 80 - 120 %. If not it should be re prepped and reanalyzed. If still out the analysis is halted until the failure is investigated.

12.5 CCVs are analyzed one for every 10 samples analyzed and must be in the range 80-120 %. If a CCV is out then all associated samples must be reanalyzed.

12.6 The ICB is analyzed at the beginning of the analytical run and must be less than the RL.

12.7 CCBs are analyzed one for every 10 samples analyzed and must be less than the RL. If the CCB is out, it and the associated samples must be reanalyzed.

## 13.0 DATA REVIEW AND STORAGE

13.1 All related preparation information and observations will be noted in the Reactive Sulfide worksheet (Attachment 1).

13.2 All cross-outs must be a single line and should be initialed and dated.

13.3 The analyst must complete the Wet Chemistry Data Review Checklist (Attachment 2)

## 14.0 REFERENCES

14.1 SW-846 Chapter 7 Section 7.3.4.2.

14.2 Sulfide, IL-3012.

# Attachment 1

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

## REACTIVE SULFIDE

SW-846 Chapter 7 Section 7.3.4.2

IL-3012

Preparation Date : _____

Analyst: _____

Titration Date: _____

Analyst: _____

Iodine N: _____ Iodine Stock Std. A: _____ Std. Lot No.: _____

Na2S2O3 N: _____ Na2S2O3 Stock Std. A: _____ ICV Lot No.: _____

| Sample ID | Sample Amt. (mL) or (g) | Dry Wt. (%) | Vol. of 0.25N NaOH (mL) | Titrate Vol. (mL) | Dilution | Iodine (mL) | Na2S2O3 (mL) | Final Conc. (mg/L) or (mg/Kg) | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

mg/L Sulfide = $\frac{400\,(A-B)}{\text{mL of sample}}$

Where:

A = mL of 0.0250 N Standard Iodine Solution

B = mL of 0.0250 N Standard reducing Na2SO2O3 Solution

qc/qcmemos/forms/REC Sulfide Rev 2 04/08/02

Property of AMRO Environmental Laboratories Corporation

# Attachment 2

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

## WET CHEMISTRY DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

Method:

Analysis:

| | | | | |
|---|---|---|---|---|
| A. | GENERAL | | | |
| 1. | Copy of Digestion Log? | Y | N | NA |
| 2. | Copy of Instrument Run Log? | Y | N | NA |
| 3. | All samples met digestion and/or analysis holding time criteria? | Y | N | NA |
| 4. | Initial Calibration meets method criteria? | Y | N | NA |
| 5. | Initial Calibration Verification (ICV) meets method or laboratory criteria? | Y | N | NA |
| 6. | Continuing Calibration Verification(CCV) meets method criteria? | Y | N | NA |
| 7. | Continuing Calibration Verification analyzed after every 10 samples ? | Y | N | NA |
| 8. | Method Blank- contaminant free (½RL)? | Y | N | NA |
| 9. | Are all reported results within calibration range? | Y | N | NA |
| 10. | LCS % Recovery criteria met for all compounds? | Y | N | NA |
| 11. | MS/MSD %R's and %RPD's are met for all compounds? | Y | N | NA |
| 12. | %RPD criteria met between sample and duplicate? | Y | N | NA |

COMMENTS:

Analyst (s) _____ DATE: _____

REVIEWER _____ DATE OF REVIEW: _____

qc/qcmemos/Forms/wetchemchecklist Rev.1 07/06/01

Property of AMRO Environmental Laboratories Corporation

Attachment 3

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

QUALIFICATION CARD FOR REACTIVE SULFIDES Chapter 7 Section 7.3.4.2

Trainee: _____ Signature: _____

Trainer: _____ Signature: _____

I. Knowledge Factors:

SOP Title: _____ Revision Number/Date: _____

1. Did the Trainee read and understand the above SOP? Yes☐ No☐ NA☐
2. Was the Trainee instructed on how to properly fill out the documentation? Yes☐ No☐ NA☐
3. Has the Trainee been instructed on the proper procedures for addressing potential problems? Yes☐ No☐ NA☐

II. Practical Factors:

1. Has the Trainee completed a Precision and Accuracy Study? Yes☐ No☐ NA☐
2. Has the Trainee completed an acceptable Performance Evaluation sample? Yes☐ No☐ NA☐
3. Did the Trainee completed an acceptable Laboratory Control Sample (LCS)? Yes☐ No☐ NA☐

Completion Date: _____ Trainer's Signature: _____

I _____ have read, understood and follow the above method/SOP, which is in use at AMRO Laboratories for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

Section Manager/ Supervisor: _____ Date: _____

QA Manager: _____ Date: _____

qc/qcmemos/forms/Reactive Sulfide qualcard Rev. 0 9/10/03

Property of AMRO Environmental Laboratories Corporation

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

# REACTIVE CYANIDE

## SW846 Chapter 7 Section 7.3.3.2

Procedure Number: IL-3011

Revision No.: 2

Revision Date: 08/14/2003

Review Date: 03/02/2010

Prepared By: _____ Date: 3/2/10

Approved By: _____ Date: 03/02/10
Inorganic Manager

Approved By: _____ Date: 3/2/10
Laboratory Director

Approved By: _____ Date: 03/02/10
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

# REACTIVE CYANIDE

## SW846 Chapter 7 Section 7.3.3.2

Procedure Number: IL-3011

Revision No.: 2

Revision Date: 08/14/2003

Review Date: 03/07/2008

Prepared By: Paula Benham Date: 3/10/08

Approved By: Gowri Mahendrarajah Date: 3/10/08
Inorganic Manager

Approved By: Maria W. Bostic Date: 3/10/08
Laboratory Director

Approved By: Paula Benham Date: 3/10/08
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

## TABLE OF CONTENTS


| | | Page |
|---|---|---|
| 1.0 | SCOPE AND APPLICATION | 3 |
| 2.0 | METHOD SUMMARY | 3 |
| 3.0 | DEFINITIONS | 3 |
| 4.0 | SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE | 4 |
| 5.0 | POTENTIAL PROBLEMS AND INTERFERENCES | 4 |
| 6.0 | HEALTH AND SAFETY | 5 |
| 7.0 | INSTRUMENTS AND EQUIPMENT | 6 |
| 8.0 | INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR | 6 |
| 9.0 | REAGENTS AND STANDARDS | 7 |
| 10.0 | PROCEDURE | 10 |
| 11.0 | CALCULATIONS | 12 |
| 12.0 | QUALITY CONTROL | 12 |
| 13.0 | DATA REVIEW AND STORAGE | 13 |
| 14.0 | REFERENCES | 14 |
| | Attachment 1 Reactive Cyanide worksheet | 15 |
| | Attachment 2 Wet Chemistry Data Review Checklist | 16 |
| | Attachment 3 Reactive Cyanide Qualification Card | 17 |

## 1.0 SCOPE and APPLICATION

1.1 This method is applicable to the determination of reactive cyanide in all wastes, with the condition that wastes that are combined with acids do not form explosive mixtures.

1.2 This method provides a way to determine the specific rate of release of hydrocyanic acid upon contact with aqueous acid.

1.3 This test measures only the hydrocyanic acid evolved at the test conditions. It is not intended to measure forms of cyanide other than those evolvable under the test conditions.

1.4 AMRO Reporting Limit: 20mg/Kg.

## 2.0 METHOD SUMMARY

2.1 A known aliquot of sample is treated with a dilute acidic solution in a closed system. The generated gas is swept into a scrubber with 0.25 N Sodium Hydroxide with Nitrogen gas. The resulting solution is then determined for Cyanide by titration or colormetrically.

2.2 This test measures only the hydrocyanic acid evolved at the test conditions. It is not intended to measure forms of cyanide other than those that are evolved under these test conditions.

## 3.0 DEFINITIONS

3.1 **Analytical Batch** - A group of samples of a similar matrix analyzed together with the same procedure, using the same reagents and within the same time period. Samples in each batch should be of similar composition (i.e. soil, water, oil, etc.). A batch shall not exceed 20 samples.

3.2 **Sample Duplicate - (DUP)** A duplicate sample aliquots of sample which is carried through the same digestion and analysis. The relative percent difference between the sample and sample duplicate is calculated and used to assess analytical precision.

3.3 **Method Blank** An analytical control consisting of all reagents which is carried through the entire analytical procedure. It is used to define the level of laboratory background contamination.

## 4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 The sample should be collected in plastic or glass bottles of 100 mL or larger size. All bottles must be thoroughly cleansed and thoroughly rinsed to remove soluble material from containers. Samples containing, or suspected of containing, sulfide or a combination of sulfide and cyanide wastes should be collected with a minimum of aeration. The sample bottle should be filled completely, excluding all headspace, and stoppered.

4.2 Holding time for this analysis is 14 days, which must include both preparation and analysis.

4.3 Testing should be performed in a vented hood.

4.4 The preservation required for soil / sediment samples is maintenance at 4°C (± 2°C) until analysis.

## 5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 Interferences are undetermined.

## 6.0 HEALTH AND SAFETY

6.1 AMRO has a laboratory safety program in place that applies to all employees. There is a safety officer as well as employees with 40 hours of OSHA training. The air quality of the laboratory has been monitored and employees are sent for physicals. All employees receive fire and safety training upon employment.

6.2 Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place.

6.3 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean laboratory coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.4 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eyewash stations and an emergency shower.

6.5 MSDSs are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention – The use of chemical exhaust hoods are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.7 Waste control – AMRO takes whatever steps possible to minimize waste. This includes volume reduction where appropriate. AMRO also properly segregates wastes according to contaminants and a commercial vendor is utilized for waste disposal.

6.8 Caution should be used when handling cyanide standards and distillates. Waste from this analysis must be disposed of in the appropriate waste streams: Waste from the distillation flask can be disposed of in the acid waste stream. Cyanide standards and the waste from the color portion of the analysis must be disposed in the basic (pyridine) stream. This waste must have the pH maintained at $\geq 12$ while being stored prior to disposal

Property of AMRO Environmental Laboratories Corporation

## 7.0 INSTRUMENTS AND EQUIPMENT

7.1 Round bottom flasks-500 mL, three neck, with 24/40 ground glass joints.

7.2 Stir plate

7.3 50 mL. gas scrubber

7.4 Addition funnel with pressure equalizing tube and 24/40 ground glass joints and Teflon sleeve.

7.5 Nitrogen gas cylinder

7.6 Flow meter for Nitrogen gas

7.7 HACH DR2010 Spectrophotometer

7.8 1.0 cm cell or larger.

7.9 Class A graduated glass volumetric clyinders 50mL.

7.10 Assorted volumetric glassware, pipette and micropipets

7.11 Balance

## 8.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

Distillation apparatus.

8.1 Clean area around equipment
8.2 Check tubing for leaks
8.3 Check glassware for cracks or jagged edges.
8.4 Change Nitrogen tank if necessary.

Spectrophotometer.

8.2 Daily:

8.2.1 Check that light bulb is working.
8.2.2 Wipe spectrophotometer clean with DI water.
8.2.3 Check cuvette for scratches or cracks.

8.3 Weekly:

8.3.1 Perform wavelength check.

8.4 Annual:

8.4.1 An outside contractor services instrument. AMRO uses Caley and Whitmore.

## 9.0 REAGENTS AND STANDARDS

AMRO reagent water – Deionized Water (DI) from a Culligan System that is checked monthly for Residual Chlorine, Conductivity, Heterotrophic Plate count, pH, Arsenic, Barium, Cadmium, Chromium, Copper, Iron, Lead, Nickel, Selenium, Silver, Zinc and Mercury. Resistivity and pH are monitored daily. Instrument and Procedural Blanks are also used to monitor contaminant levels through out the laboratory

9.1 Distillation and Preparation Reagents

9.1.1 Sodium hydroxide absorbing solution, and sample wash solution, 0.25 N: Dissolve 10 g of NaOH and dilute to one liter with distilled water.

9.1.2 Sulfuric acid (0.01N): add 2.8 mL. Concentrated $H_2SO_4$ to reagent water and dilute to 1000 mL. Withdraw 100 mL. of this solution and dilute to 1000mL.to obtain a final normality of 0.01N.

## TRACKING OF ANALYTICAL STANDARDS

9.2 Chemical Receipt

The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a four digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and AMRO employees complete the disposal dates when standards are used up or disposed.

9.3 Standards Preparation

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

9.3.1 ACS reagent grade chemicals are used when the method warrants.

9.3.2 A certificate of analysis accompanies any stock standards that are purchased from the manufacturer.

9.3.3 Class A volumetric glassware is used to prepare standards.

9.4 Standard Tracking

It is important to be able to track all analytical standards back to their sources. AMRO personnel to accomplish this use the following procedure:

9.4.1 Wet Chemistry and Mercury Standards - Working Standards and LCS solutions made from stock standards listed in the Chemical Receiving Log are documented in the Inorganic Standard Log. The corresponding analysis, preparation date, standard name, AMRO ID, amount used, initial concentration of standard, amount used, final volume, final concentration, Standard ID, expiration date, storage location, and analyst initials are recorded. The initial concentration of the standard is obtained from the certificates received from the manufacturer. The Standard ID is written as an "S" followed by a four digit sequential number. The expiration of working standards varies depending on the use. Standards should be used in accordance with method specifications and manufacturer's instructions.

9.4.2 Wet Chemistry and Metals Reagent Log - Working reagents are made from reagents listed in the Chemical Receiving Log is documented in the Reagent Log. The corresponding analysis, preparation date, reagent name, AMRO ID, initial concentration, amount used, final volume, final concentration, Solution ID, expiration date, storage location, and analyst initials are recorded. The initial concentration is obtained from the certificate received from the manufacturer. The Solution ID is written as an "R" followed by a 4 digit sequential number. The expiration of prepared reagents varies. Reagents should be used in accordance with method specifications and manufacturer's instructions.

Property of AMRO Environmental Laboratories Corporation

9.5 Calibration and QC Standards

9.5.1 Calibration Standards:- Stock cyanide solution A, 1000mg/L CN : Commercially available through Lab Chem.

9.5.2 Working calibration standard cyanide solution A1: Prepare fresh daily by diluting 1.0mL of stock cyanide solution A (per section 9.5.1) ) to 100mL with deionized water. (True Value= 10ppm CN).

9.5.3 Working calibration Standard solution A2- prepare freshly by diluting 10mL working solution A1 (per section 9.5.2) to 100mL deionized water (1.0ppm CN).

9.5.4 If necessary Stock Cyanide A can be prepared from Crystalline Potassium Cyanide from available from Aldrich:.

9.5.4.1 QC Stock Cyanide solution A, 1000mg/L CN: Dissolve 0.2510g of KCN in 100mL of 0.25N NaOH **and dilute to 1 liter**. Standardize with 0.0192N $AgNO_3$ to obtain the true value.

9.5.5 QC Standard:- Stock cyanide solution B, 1000mg/L CN : Commercially available through Lab Chem.

**Must be a different lot # than Stock Solution A**

9.5.6 Working QC Cyanide Solution B1: Prepare fresh daily by diluting 1.0mL of stock cyanide solution B (per section 9.5.5) to 100mL with deionized water. (True Value = 10ppm CN).

*This solution is to be used for preparing the Laboratory Control Sample.*

9.5.7 Standard silver nitrate solution, (0.0192 N): Prepare by crushing approximately 5 g. AgNO3 crystals and drying to a constant weight at 104 deg. C. Weigh out 3.2647 g. of dried AgNO3, dissolve in distilled water and dilute to 1000 mL. (1mL. corresponds to 1 mg. CN)
This solution is to be used to determine the concentrations of the stock cyanide solutions and for any samples that are being quantified using the titrimetric method. This solution can be purchased commercially from Lab Chem

9.5.8 Rhodanine indicator: Used as the indicator for the titration procedure. Dissolve 20 mg of p-dimethyl-amino-benzalrhodanine in 100mL of acetone.

9.6 Colorimetric Reagents:

9.6.1 Sodium dihydrogenphosphate, 1 M: Dissolve 138 g of NaH2PO4 H2O in One liter of distilled water. **Refrigerate this solution at 4 degrees C**.

9.6.2 Chloramine-T solution, 0.4% (w/v): Dissolve 1.0 g of white soluble Chloramine T in 100mL of distilled water. **Prepare fresh at time of analysis.**

9.6.3 Pyridine-Barbituric Acid Reagent (Color Reagent): **Prepare this solution in the hood**. Place 15 g of barbituric acid in a 250 mL volumetric flask and add just enough distilled water to wash the sides of the flask (about 100 mL) and wet the barbituric acid. Add 75 mL of pyridine and mix. Add 15 mL of conc. HCl, mix, and cool to room temperature. Stir solution until reagents have dissolved. Dilute to 250 mL with distilled water and mix. This reagent is stable for approximately six months if stored in a cool, dark place. Discard if precipitate develops. This solution can be purchased commercially from Lab Chem.

## 10.0 PROCEDURE

10.1 Add 30 mL of 0.25N NaOH to the gas absorbing impinger.

10.2 Add about 10g of sample (weighed to the nearest 0.01 g) to 500 mL. flask.

10.3 Add 250mL of 0.01N H2SO4 to the addition funnel and set up the apparatus.

10.4 Close system and adjust flow rate of Nitrogen, using the flow meter, to 60 mL/min.

10.5 With the system closed and the Nitrogen flowing, slowly add the sulfuric acid solution.

10.6 Begin the 30 minute test period.

10.7 Stir solution throughout the test period with the magnetic stir plate. The speed should be enough to agitate the sample but not enough to cause a vortex.

10.8 After the 30 minute test period, close off the Nitrogen gas and disconnect the scrubber. Transfer solution and bring up to 50mL volume with a graduated cylinder. Transfer the solution to a 250mL plastic bottle. Seal the bottle and store at 4 °C.

Property of AMRO Environmental Laboratories Corporation

10.9 Calibration

Prepare a series of cyanide standards by pipeting suitable volumes of standard solution A into 25mL volumetric flasks and add comparable volumes of 0.25N NaOH to bring standards to a final volume of 25mL. These standard solutions do not need to be distilled as long as the Laboratory Control Sample and another blank has gone through the distillation procedure.

Prepare as follows:

| **mL of Working Standard Solution A2/ final volume with 0.25N NaOH** | **Conc. mg/mL CN (1mL = 1mg CN)** |
|---|---|
| 0.00 25mL | 0.00 |
| 0.50mL of 1ppm → 25mL | 0.020 |
| 1.25mL of 1ppm → 25mL | 0.050 |
| 2.50mL of 1ppm → 25mL | 0.10 |
| 0.50mL of 10ppm → 25mL | 0.20 |
| 0.75mL of 10ppm → 25mL | 0.30 |
| 1.00mL of 10ppm → 25mL | 0.40 |

10.10 Next, withdraw 25mL or less of the solution from the absorber and transfer to a 50mL volumetric flask. If less than 25mL is taken, dilute to 25mL with 0.25N NaOH 8.11 Add 7.5mL of sodium phosphate solution and mix.

10.11 Add 1mL of Chloramine T and mix. *See Note1.*

10.12 After 1 to 2 minutes, add 2.5mL of pyridine-barbituric acid solution and mix. Dilute to mark with distilled water and mix again. Allow 8 minutes for color development then read absorbance at 578 nm in a 1 cm cell within 15 minutes.

*Note 1: Some distillates may contain compounds that have a chlorine demand. One minute after the addition of Chloramine T, test for residual chlorine with KI-starch paper. If the test is negative, add an additional 0.5mL of Chloramine T. After one minute, recheck the sample.*

## 11.0 CALCULATIONS

11.1 Using the "lsqm 1" software program, prepare a standard curve by plotting absorbance of standards vs. standard cyanide concentrations.

11.2 Multiply by any dilution factors that were used either prior to distillation or when taking the sample through the colorimetric procedure.

11.3 To calculate the cyanide of solid samples in mg/Kg of original sample :

$$CN, mg/Kg = \frac{A \times D \times F}{B}$$

where: A = µg/L CN of sample from regression analysis curve
B = calculated grams of sample that on a dry weight basis
D = any dilution factor necessary to bracket sample value within standard values
F = sample receiving solution volume (0.050L)

## 12.0 QUALITY CONTROL

12.1 One Method Blank must be digested with every 20 samples. The acceptable criteria: < RL and <½ RL for Department of Defense (DOD) Projects.

12.2 One Sample Duplicate is analyzed per batch of 10 samples. The RPD between the sample and duplicate results should be less than 20% (if the results are less than 4 times the reporting limit the RPD is not applicable.). If the RPD is greater than 20% reanalysis of the sample should be done to rule out analytical error.

12.3 Curve generated from standards must have a correlation coefficient ≥ 0.995. If this in not achieved the curve must be re-made.

12.4 The ICV is analyzed at the beginning of the analytical run and must be in the range 85 - 115 %. If not it should be re prepped and reanalyzed. If still out the analysis is halted until the failure is investigated.

12.5 CCVs are analyzed one for every 10 samples analyzed and must be in the range 85-115 %. If a CCV is out then all associated samples must be reanalyzed.

Property of AMRO Environmental Laboratories Corporation

12.6 The ICB is analyzed at the beginning of the analytical run and must be less than the RL (<½ RL for Department of Defense (DOD) Projects). If the blank is greater than 0.020mg/L it must be repeated on a fresh sample of De-ionized water to rule out contamination. If the second blank is still greater than the RL (<½ RL for Department of Defense (DOD) Projects) the analysis should be halted until the contamination is investigated.

12.7 CCBs are analyzed one for every 10 samples analyzed and must be less than the RL (<½ RL for Department of Defense (DOD) Projects). If the CCB is out, it and the associated samples must be reanalyzed.

12.8 One Sample Duplicate should be run every batch of ten samples or one per day. The RPD between the sample and Duplicate must be ≤20%. If the RPD is >20% the sample is tested again to confirm the result and any comments on sample matrix type recorded in the Reactive Cyanide worksheet.

12.9 Samples must be selected for Duplicatre at random and rotated among clients and sites from batch to batch. In some cases, the client may specify which sample is to used for MS/MSD; if not, the laboratory shall pick a representative sample based on the following:

A. Duplicate shall not be performed on Trip Blank, Rinsate Blank or Field Blank.
B. Adequate sample weight/ volume.
C. Client requested QC deliverables

## 13.0 DATA REVIEW AND STORAGE

13.1 All related preparation information and observations will be noted in the Reactive Cyanide worksheet (Attachment 1).

13.2 All cross-outs must be a single line and should be initialed and dated.

13.3 The analyst must complete the Wet Chemistry Data Review Checklist (Attachment 2)

## 14.0 REFERENCES

14.1 SW-846 Chapter 7 Section 7.3.3.2

14.2 EPA Method 335.2 (Titrimetric; Spectrophotometric)

14.3 Standard Methods for the Examination of Water and Wastewaters, 19th Method 412.D

14.4 Method for Total Cyanide analysis by Midi Distillation

14.5 Test Method to Determine Hydrogen Cyanide Released from Wastes.

# Attachment 1

AMRO Environmental Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

**REACTIVE CYANIDE**
**SW-846 Chapter 7 Section 7.3.3.2**
**IL-3011**

Analyst Distillation: _____ Analyst Colorimetric: _____
Distillation Date: _____ Date Colored: _____

Standard Curve: HACH DR/2010 at 578 nm

| Std. Value (mg/L) | Intermed. Std. Conc. (ppm) | Vol. Cal. in 25mL | ABS |
|---|---|---|---|
| 0.000 | 1 | 0.00 | |
| 0.020 | 1 | 0.50 | |
| 0.050 | 1 | 1.25 | |
| 0.100 | 1 | 2.50 | |
| 0.200 | 10 | 0.50 | |
| 0.300 | 10 | 0.75 | |
| 0.400 | 10 | 1.00 | |

Corr. Coff.=_____
CN Stock Std A_____
CN Stock Std QC A_____
1 ppm Std S_____ 1 ppm QC S_____
10 ppm Std S_____ 10 ppm QC S_____
ICV True Value= 0.2 mg/L
Low Level Std.True Value= 0.02 mg/L

RL (water)=20 mg/L RL (soil)=20 mg/Kg
1000 ppm Titrated Value_____
1000 ppm Titrated Value_____

| Colorimetric Reagents | ID | mL |
|---|---|---|
| Sodium Phosphate Mono | | |
| Chloramine-T | | |
| Pyridine Barbituric Acid | | |

Volume colored = 25 mL

| Sample ID | Sample Amt. (mL) or (g) | Dry Wt. | Volume of 0.25N NaOH | Color Volume (mL) | ABS @ 578nm | Initial Conc. (mg/L) | Final Conc. (mg/L) or (mg/Kg) | Comments |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

* Acceptance Limits for the ICV and CCV: ± 15% of the true value

qc/qcmemos/forms/RECCN Rev.3 06/00

Property of AMRO Environmental Laboratories Corporation

# Attachment 2

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

## WET CHEMISTRY DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

Method:

**Analysis:**

| | | | | |
|---|---|---|---|---|
| A. | **GENERAL** | | | |
| 1. | Copy of Digestion Log? | Y | N | NA |
| 2. | Copy of Instrument Run Log? | Y | N | NA |
| 3. | All samples met digestion and/or analysis holding time criteria? | Y | N | NA |
| 4. | Initial Calibration meets method criteria? | Y | N | NA |
| 5. | Initial Calibration Verification (ICV) meets method or laboratory criteria? | Y | N | NA |
| 6. | Continuing Calibration Verification(CCV) meets method criteria? | Y | N | NA |
| 7. | Continuing Calibration Verification analyzed after every 10 samples ? | Y | N | NA |
| 8. | Method Blank- contaminant free (½RL)? | Y | N | NA |
| 9. | Are all reported results within calibration range? | Y | N | NA |
| 10. | LCS % Recovery criteria met for all compounds? | Y | N | NA |
| 11. | MS/MSD %R's and %RPD's are met for all compounds? | Y | N | NA |
| 12. | %RPD criteria met between sample and duplicate? | Y | N | NA |

**COMMENTS:**

Analyst (s) _____ DATE: _____

REVIEWER: _____ DATE OF REVIEW: _____

qc/qcmemos/Forms/wetchemchecklist Rev.1 07/06/01

Property of AMRO Environmental Laboratories Corporation

Attachment 3

**AMRO Environmental Laboratories Corporation**
111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

## QUALIFICATION CARD FOR REACTIVE CYANIDE SW-846 Chapter 7 Section 7.3.3.2

Trainee: _____ Signature: _____

Trainer: _____ Signature: _____

**I. Knowledge Factors:**

SOP Title: _____ Revision Number/Date: _____

1. Did the Trainee read and understand the above SOP? Yes☐ No☐ NA☐
2. Was the Trainee instructed on how to properly fill out the documentation? Yes☐ No☐ NA☐
3. Has the Trainee been instructed on the proper procedures for addressing potential problems? Yes☐ No☐ NA☐

**II. Practical Factors:**

1. Has the Trainee completed a Precision and Accuracy Study? Yes☐ No☐ NA☐
2. Has the Trainee completed an acceptable Performance Evaluation sample? Yes☐ No☐ NA☐
3. Did the Trainee completed an acceptable Laboratory Control Sample (LCS)? Yes☐ No☐ NA☐

Completion Date: _____ Trainer's Signature: _____

I_____have read, understood and follow the above method/SOP, which is in use at AMRO Laboratories for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

Section Manager/ Supervisor: _____ Date: _____

QA Manager: _____ Date: _____

qc/qcmemos/forms/Reactive Cyanide qualcard Rev. 0 9/10/03

Property of AMRO Environmental Laboratories Corporation

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

# pH

## SM 4500-H+ B (Electrometric)

## AND

## SW-846 Method 9045C

Procedure Number: IL-3007

Revision No.: 8

Revision Date: 03/05/13

Review Date: N/A

Prepared By: Dawn M. Hengl Date: 3-5-13

Approved By: Robert G. Bouchard Date: 03-07-13
Inorganic Manager

Approved By: Mary Schmidt Date: 3-5-13
Laboratory Director

Approved By: Mary Schmidt Date: 3-5-13
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

## TABLE OF CONTENTS


| | | Page |
|---|---|---|
| 1.0 | SCOPE AND APPLICATION | 3 |
| 2.0 | METHOD SUMMARY | 3 |
| 3.0 | DEFINITIONS | 3 |
| 4.0 | SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE | 3 |
| 5.0 | POTENTIAL PROBLEMS AND INTERFERENCES | 4 |
| 6.0 | HEALTH AND SAFETY | 5 |
| 7.0 | INSTRUMENTS AND EQUIPMENT | 5 |
| 8.0 | INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR | 6 |
| 9.0 | REAGENTS AND STANDARDS | 6 |
| 10.0 | PROCEDURE | 7 |
| 11.0 | CALCULATIONS | 10 |
| 12.0 | QUALITY CONTROL | 10 |
| 13.0 | DATA REVIEW AND STORAGE | 11 |
| 14.0 | REFERENCES | 11 |

## 1.0 SCOPE and APPLICATION

1.1 SM 4500H+ B is applicable to drinking, surface, and saline waters, domestic and industrial waters and acid rain (atmospheric deposition).

1.2 SW-846 Method 9045C is an electrometric procedure for measuring pH in solids and waste samples. Wastes may be solids, sludges, or non-aqueous liquids. If water is present, it must constitute less than 20% of the total volume of the sample.

## 2.0 METHOD SUMMARY

2.1 The pH of a sample is determined electrometrically using a combination electrode.

2.2 The soil sample is mixed with deionized water, and the pH of the resulting aqueous solution is measured. The pH of a sample is determined electrometrically using a combination electrode.

2.3 This procedure has been modified to use the TCLP tumbler for extraction rather than stirring in a beaker.

## 3.0 DEFINITIONS

3.1 **Analytical Batch** - A group of samples of a similar matrix analyzed together with the same procedure, using the same reagents and within the same time period. Samples in each batch should be of similar composition (i.e. soil, water, oil, etc.). A batch shall not exceed 20 samples.

3.2 **Sample Duplicate - (DUP)** A duplicate sample aliquot which is carried through the same through the same analysis. The relative percent difference between the sample and sample duplicate is calculated and used to assess analytical precision. A duplicate is performed every 10 client samples.

## 4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 Aqueous samples should be analyzed within 24 hours of sampling. Soil samples should be analyzed as soon as possible.

4.2 High-purity waters and waters not at equilibrium with the atmosphere are subject to changes when exposed to the atmosphere, therefore the sample containers should be filled completely and kept sealed prior to analysis.

4.3 Soil samples are collected in glass jars and can be stored at 4°C until analysis is complete.

## 5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 The glass electrode, in general, is not subject to solution interferences from color, turbidity, colloidal matter, oxidants, reductants or high salinity. However, it must be thoroughly rinsed using DI water between testing of each buffer and sample.

5.2 Sodium error at pH levels greater than 10 can be reduced or eliminated by using a "low sodium error" electrode.

5.3 Coatings of oily material or particulate matter can impair electrode response. These coatings can usually be removed by gentle wiping or detergent washing, followed by distilled water rinsing. An additional treatment with hydrochloric acid (1:10) may be necessary to remove any remaining film.

5.4 Temperature effects on the electrometric measurement of pH arise from two sources:

5.4.1 The first is caused by the change in electrode output at various temperatures. This interference can be controlled with instruments having temperature compensation or by calibrating the electrode-instrument system at the temperature of the samples. AMRO utilizes a temperature compensation probe.

5.4.2 The second source is the change of pH inherent in the sample at various temperatures. This error is sample dependent and cannot be controlled. Bring all samples and calibration buffers to room temperature and record that temperature in the logbook. One calibration buffer and the samples should be within 2 pH units of each other.

5.5 Samples with very low or high pH may give incorrect readings on the meter. For samples with a true pH >10, the measurement may be incorrectly low. Strong acid solutions, with a pH of <1.0, may give incorrectly high measurements.

5.6 Calibration range is limited. If a result is outside the window of pH 4-10, then an additional pH buffer must be used to bracket the sample results to support extrapolation of the calibration. The control limits for these QC check standards will be ± 0.2 pH.

## 6.0 HEALTH AND SAFETY

6.1 AMRO has a laboratory safety program in place that applies to all employees. There is a safety officer as well as employees with 40 hours of OSHA training. The air quality of the laboratory has been monitored and employees are sent for physicals. All employees receive fire and safety training upon employment.

6.2 Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place.

6.3 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean laboratory coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.4 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eyewash stations and an emergency shower.

6.5 MSDSs are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.7 Waste control – AMRO takes whatever steps possible to minimize waste. This includes volume reduction where appropriate. AMRO also properly segregates wastes according to contaminants and a commercial vendor is utilized for waste disposal.

## 7.0 INSTRUMENTS AND EQUIPMENT

7.1 pH Meter: Thermo Orion Star Series pH Meter – SN 010527

7.2 VWR Scientific pH Electrode, cat. No. 14002-778

7.3 Magnetic stirrer and Teflon-coated stirring bar.

7.4 Beaker: 50mL

7.5 Balance capable of weighing to 0.01g

7.6 250mL plastic bottles

7.7 Spatula

## 8.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

8.1 Electrode Maintenance

8.1. Daily (each time meter is in use)

8.1.1 Inspect the electrode for scratches, cracks, salt crystal build-up, or membrane/junction deposits.

8.1.2 Rinse off any salt build-up with distilled water, and remove any membrane/junction deposits as directed in the cleaning procedures below.

8.2 Probe Cleaning Procedures (as needed)

8.2.1 General – Soak in 0.1 M HCl or 0.1 M $HNO_3$ for half-hour. After any cleaning procedure, soak electrode in pH storage solution for at least one hour.

8.2.2 To remove Membrane/Junction Deposits Protein – Soak in 1% pepsin in 0.1 M HCl, for 15 minutes.

8.2.3 Inorganic - Soak in 0.1 M tetrasodium EDTA solution for 15 minutes.

8.2 .4 Grease and Oil – Rinse with mild detergent or methanol solution.

8.3 If cleaning and maintenance procedures fail to rejuvenate the electrode, replace the entire electrode.

## 9.0 REAGENTS AND STANDARDS

9.1 AMRO reagent water – Deionized Water that is checked monthly for Residual Chlorine, Conductivity, pH, Arsenic, Barium, Cadmium, Chromium, Copper, Iron, Lead, Nickel, Selenium, Silver, Zinc and Mercury. Resistivity and pH are monitored daily. Instrument and Procedural Blanks are also used to monitor contaminant levels through out the laboratory.

9.2 Buffer solutions: Commercially prepared Buffer Solutions (pH 2.0, 4.0, 7.0, 10.0 and 12.0).

9.3 Independent QC Check Buffer at pH 6.00.

9.4 Concentrated Hydrochloric Acid.

9.5 Hydrochloric Acid - (1:10) - To 9 mls DI water add 1 ml concentrated Hydrochloric Acid.

9.6 Storage Solution: pH 7.0 buffer or suggested manufacturer's solution.

9.7 TRACKING OF ANALYTICAL STANDARDS

9.8.1 Chemical Receipt

The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a five digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and AMRO employees complete the disposal dates when standards are used up or disposed.

## 10.0 PROCEDURE

10.1 Calibration

10.1.1 The pH meter is calibrated daily using pH Buffers 4, 7 and 10.

***NOTE:*** *Make sure there are no air bubbles in the bulb of the glass electrode. If there are any, just simply shake the electrode in a downward motion to get the solution into the bulb.*

10.1.2 Attach the pH electrode(s) to the meter.

10.1.3 Press the "calibrate" key to initiate the calibration sequence. PH CAL will be displayed for five seconds.

10.1.4 The first standard annuciator will be displayed, indicated by CAL.1. Place the electrode in pH 7.00 buffer. The reading will be displayed and updated as the calibration continues. When the flashing "pH" light stops blinking, press the

"calibrate" key to accept the value. Record the value of the reading in the logbook.

10.1.5 The pH 4 buffer annuciator will be displayed, indicated by CAL. 2. Remove the electrode from the pH 7.00 buffer. Rinse the electrode with deionized water and place it in the pH 4.00 buffer. The reading will be displayed and updated as the calibration continues. When the flashing "pH" light stops blinking, indicating electrode stability, press the "calibrate" key to accept the reading. Record the value of the reading in the logbook.

10.1.6 The pH 10 buffer annuciator will be displayed, indicated by CAL.3. Remove the electrode from the pH 4.00 buffer. Rinse the electrode with deionized water and place it in the pH 10.00 buffer. The reading will be displayed and updated as the calibration continues. When the flashing "pH" light stops blinking, indicating electrode stability, press the "measure" key to accept the reading. Record the value of the reading in the logbook.

10.1.7 SLP followed by the calculated slope will be displayed for two seconds. The meter will automatically switch to the MEASURE mode. Note the slope in the pH logbook. The slope should be between 92 and 102%. If the slope is outside of this range, re-calibrate the pH meter using fresh buffer solutions. If it is still out of range, follow the electrode cleaning procedures outlined in section 8.2.

**10.1.8** Read pH Buffer 6.00 (the independent QC check buffer). Place probe in buffer and press the MEASURE key. When the pH light stops blinking, record the value in the pH logbook. The value should be in the range of 5.95 to 6.05. If the buffer solution is outside of the acceptance range, re-read using fresh buffer. If it is still out of range, re-calibrate the pH meter using fresh aliquots of pH 4 and 7 buffers and re-read the pH 6 buffer again. If it is still out of range, follow the electrode cleaning procedures outlined in section 8.2.

**10.1.9** Read the deionized water (DI). Place probe in the DI aliquot and press the MEASURE key. When the pH light stops blinking, record the value in the pH logbook. The value should read in the range of 5.50 to 7.50. If the DI water is outside of the acceptance range, re-read using fresh aliquot. If it is still out of range, re-calibrate the pH meter using fresh aliquots of buffers and re-read the DI again. If it is still out of range, follow the electrode cleaning procedures outlined in Section 8. Continued out of range readings for the DI sample may indicate a problem with the water deionizing equipment. If this is the case, the deionized water system manufacturer should be notified if the equipment is in need of repair.

Property of AMRO Environmental Laboratories Corporation

10.2 Procedure for water samples:

10.2.1 Standardize the meter and electrode system as outlined in Section 10.1.

10.2.2 Place the aqueous sample in a clean tube using a sufficient volume to cover the sensing elements of the electrodes and to give adequate clearance for the magnetic stirring bar.

10.2.3 If field measurements are being made, the electrodes may be immersed directly in the sample stream to an adequate depth and moved in a manner to insure sufficient sample movement across the electrode sensing element as indicated by drift free (<0.1 pH) readings.

10.2.4 Note and record the sample pH. As always after 10 samples are run a duplicate pH must be run.

10.2.5 Bracketing pH checks must be analyzed every 10 samples (i.e. if the sample pH is 5.55, read the pH 4 and 7 buffers as bracketing checks.) Results must be within acceptance criteria. If not, clean probe and read the checks again. If still not acceptable re-calibrate and re-analyze samples.

***NOTE:*** *For acid rain samples it is most important that the magnetic stirrer is not used. Instead, swirl the sample gently for a few seconds after the introduction of the electrode(s). Allow the electrode(s) to equilibrate. The air-water interference should not be disturbed while measurement is being made. If the sample is not in equilibrium with the atmosphere, pH values will change as the dissolved gases are either absorbed or desorbed. Record sample pH and temperature.*

10.2.6 When the pH electrode is not in use, immerse it in the pH 7.0 buffer storage solution.

10.2.7 If any sample reading is <pH 4 or >pH 10, then a bracketing QC must be analyzed after the sample and achieve ± 0.2 pH units from true value to support control.

10.3 pH on Soils and Wastes Procedure Sample Preparation:

10.3.1 Weigh out a representative sample aliquot of 20g into a 250mL plastic bottle.

10.3.2 Add 20mL of DI water to sample aliquot.

10.3.3 One duplicate per 10 samples must be tumbled and analyzed.

10.3.4 Mix sample on TCLP tumbler for 5 minutes

10.3.5 Let soil suspension stand until the layers separate.

10.3.6 Decant some of the supernatent into a beaker or measuring tube. Stir the sample to insure homogeneity, but stir gently to minimize carbon dioxide entrapped. Electrodes may also be conditioned by dipping them into sample for 1 minute, blotting dry, then immersing in a fresh portion to read pH. For dilute, poorly buffered samples, 3-4 successive portions of sample may be used to equilibrate before reading pH.

10.3.7 Read the pH and record the value in the logbook.

10.3.8 If samples are hygroscopic and all the reagent water is absorbed, additional dilutions can be made. Begin with 20g of sample and 40mL of reagent water. If the supernatent is multiphasic, decant the oily phase and measure the pH of the aqueous phase.

10.3.9 If any sample reading is <pH 4 or >pH 10, then a bracketing QC must be analyzed after the sample and achieve ± 0.2 pH units from true value to support control.

## 11.0 CALCULATIONS

11.1 pH meters read directly in pH units. Report pH to the nearest 0.01 unit.

## 12.0 QUALITY CONTROL

12.1 Batch QC is performed in the form of duplicate samples, one every 10 client samples. Calculation of % RPD is inappropriate for comparison of pH values due to logarithmic nature. Subtract the duplicate values. The absolute difference between the original and the duplicate samples must be ± 0.1 pH units. However, for reporting purposes, the %RPD limit in LIMS is set 5%. However, for reporting purposes, the acceptable %Recovery limits in LIMS is set to 99-101%. If this limit is exceeded, then the sample, and its duplicate must be re-analyzed. The other nine client samples in the batch must also be re-analyzed to confirm accuracy in original readings, unless investigation determines some assignable cause of error unrelated to these values.

12.2 QC check buffer 7.0 must be within 6.95-7.05 pH units. It is analyzed after calibration and before analyzing samples. If outside these limits the meter must be re-calibrated. If it still doesn't work the buffer should be checked for contamination and a new bottle should be used.

12.3 An independent QC solution is used as an additional check. AMRO uses pH buffer 6.0 and it must be within 5.95-6.05 pH units.

12.4 All samples must be bracketed by control QC and must be within $\pm$ 0.05 pH units.

## 13.0 DATA REVIEW AND STORAGE

13.1 All related information and observations will be noted in the pH logbook.

13.2 All cross-outs must be a single line and should be initialed and dated.

13.3 The analyst must complete the Wet Chemistry Data Review Checklist.

## 14.0 REFERENCES

14.1 Standard Methods for the Examination of Water and Wastewaters, 22nd Edition: Method 4500-H+B.

14.2 Method 9045C, USEPA SW-846, Update III, Rev. 3, January, 1995.

14.3 VWR Scientific Products – VWR Brand Electrodes Manual for Ag/AgCl pH, Gel and Triode Electrodes.

14.5 THERMO Electron Corporation- Orion Star Series Meter User's Guide

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

# Mercury in Solid or Semisolid Waste

## SW-846 Method 7471A by Perkin Elmer FIMS 100 Automated Mercury Analyzer

Procedure Number: IL-3005

Revision No.: 5

Revision Date: 04/2/2013

Review Date: NA

Prepared By: Peter LeBrun Date: 4/2/13

Approved By: Robert E. Bosselman Date: 04/02/13
Inorganic Manager

Approved By: Date: 4-2-13
Laboratory Director

Approved By: Date: 4-2-13
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

## TABLE OF CONTENTS


| | | Page |
|---|---|---|
| 1.0 | SCOPE AND APPLICATION | 3 |
| 2.0 | METHOD SUMMARY | 3 |
| 3.0 | DEFINITIONS | 3 |
| 4.0 | SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE | 5 |
| 5.0 | POTENTIAL PROBLEMS AND INTERFERENCES | 5 |
| 6.0 | HEALTH AND SAFETY | 5 |
| 7.0 | INSTRUMENTS AND EQUIPMENT | 6 |
| 8.0 | INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR | 7 |
| 9.0 | REAGENTS AND STANDARDS | 7 |
| 10.0 | PROCEDURE | 11 |
| 11.0 | CALCULATIONS | 19 |
| 12.0 | QUALITY CONTROL | 19 |
| 13.0 | DATA REVIEW AND STORAGE | 22 |
| 14.0 | REFERENCES | 22 |

## 1.0 SCOPE and APPLICATION

1.1 This procedure is used for the preparation/determination of mercury in soils, sediments, bottom deposits and sludge-type materials.

1.2 AMRO routinely digests MS and MSD and Duplicate sample per batch, to meet all varying project QC requirements.

1.3 AMRO uses a Perkin-Elmer FIMS (Flow Injection Mercury System) 100 automated mercury analyzer. This instrument is an automated flameless AA mercury analyzer.

1.4 The Aqua Regia is generated in the sample tube by adding concentrated Hydrochloric Acid and concentrated Nitric Acid to ensure a fresh reagent for each sample and standard.

## 2.0 METHOD SUMMARY

2.1 Aqua Regia (generated in the sample tube) is added to a representative 0.6g aliquot of sample and heated for two minutes in a hot block at 95°C (± 2°C). Potassium Permanganate is added and the mixture is heated for an additional 30 minutes in a hot block at 95°C (± 2°C). Mercury in the digested sample is reduced with stannous chloride to elemental mercury, which is volatile and swept from the solution with argon and measured by a flameless AA procedure at wavelength of 253.7nm.

### 2.2 MODIFICATIONS:

2.2.1. Add 2 mL of hydroxylamine hydrochloride to each tube and mix well by shaking to reduce background noise.

2.2.2. The concentration of the Stannous Chloride is 1.1% per Perkin Elmer.

2.2.3. 16 ml of Potassium Permanganate: 5% solution. Is added to all samples and standards instead of 15 ml.

2.2.4. 5% nitric acid is use to dilute samples after they are digested and cooled.

## 3.0 DEFINITIONS

3.1 **Analytical Batch -** A group of samples of a similar matrix analyzed together with the same procedure, using the same reagents and within the same time period. Samples in each batch should be of similar composition (i.e. soil, water, oil, etc.). A batch shall not exceed 20 samples.

| | | |
|---|---|---|
| 3.2 | **Matrix Spike (MS)/ - Duplicate (MSD)** | Predetermined quantities of stock solutions of certain analytes, which are added to a sample matrix prior to sample digestion and analysis. Percent recoveries are calculated for each of the analytes detected. The relative percent difference between the samples is calculated and used to assess analytical precision. The concentration of the spike should be at the regulatory standard level. |
| 3.3 | **Sample Duplicate - (DUP)** | A duplicate sample aliquots of sample which is carried through the same digestion and analysis. The relative percent difference between the sample and sample duplicate is calculated and used to assess analytical precision. |
| 3.4 | **Laboratory Control-Sample (LCS)/ Duplicate (LCSD)** | A control sample of known composition. Aqueous and solid laboratory control samples are analyzed using the same sample preparation, reagents and analytical methods employed for samples received. Percent recoveries are calculated for each of the analytes detected. The relative percent difference between the samples is calculated and used to assess analytical precision. The concentration of the spike should be at the regulatory standard level. |
| 3.5 | **Method Blank** | An analytical control consisting of all reagents which is carried through the entire analytical procedure. It is used to define the level of laboratory background contamination. |
| 3.6 | **Instrument Detection Limit (IDL)** | Determined by multiplying by 3 the standard deviation obtained for the analysis of a standard solution (each Analyte in reagent water) at a concentration of 3 to 5 times instrument detection limit within 7 consecutive measurements per day. |
| 3.7 | **Method Detection Limit (MDL)** | The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater then zero. It is determined by analyzing seven replicates of a standard solution that is 2–3 times the IDL. The standard deviation is then multiplied by 3.143 (the student t test for seven replicates) to obtain the MDL or 2.998 for eight replicates. For soil MDL studies play sand must be used (7.11). |

| | | |
|---|---|---|
| 3.8 | **Reporting Limit (RL)** | The lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. |
| 3.9 | **Linear Range** | The highest concentration of mercury that can be analyzed which is true value of the highest calibration standard. |

## 4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 Soil samples shall be refrigerated at 4°± 2°C until analyzed. The holding time for mercury is 28 days from collection date.

4.2 All sample containers must be cleaned according to the SOP on glassware cleaning.

## 5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 Possible interference from sulfide is eliminated by the addition of Potassium Permanganate.

5.2 Copper has been reported to interfere; however, copper concentrations as high as 10mg/L had no effect on recovery of Mercury from spiked samples.

5.3 Sea waters, brines and industrial effluents high in chlorides require additional permanganates. During the oxidation step, chlorides are converted to free chlorine, which will also absorb radiation at 253nm. Care must be taken to assure free chlorine is absent before the mercury is reduced and swept into the cell. This may be accomplished by using an excess of hydroxylamine hydrochloride reagent. Both inorganic and organic mercury spikes have been quantitatively recovered from seawater using this technique.

5.4 Low level mercury sample preparation, digestion and analysis may be subject to environmental contamination. This analysis should not be performed in areas with high ambient backgrounds where mercury was previously employed as an analytical reagent in analyses such as chemical oxygen demand (COD).

## 6.0 HEALTH AND SAFETY

6.1 AMRO has a laboratory safety program in place that applies to all employees. There is a safety officer as well as employees with 40 hours of OSHA training. The air quality of the laboratory has been monitored and employees are sent for physicals. All employees receive fire and safety training upon employment.

6.2 Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place.

6.3 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instrurnents. In the lab, clean laboratory coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.4 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the lab. There are also eyewash stations and an emergency shower.

6.5 MSDS's are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals. They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.7 Waste control – AMRO takes whatever steps possible to minimize waste. This includes volume reduction where appropriate. AMRO also properly segregates wastes according to contaminants and a commercial vendor is utilized for waste disposal.

## 7.0 INSTRUMENTS AND EQUIPMENT

7.1 Perkin-Elmer FIMS 100 automated mercury analyzer. This instrument is an automated flameless AA mercury analyzer. It is controlled by a Dell Octiplex computer with WinLab/FIMS software Ver 2.5. Samples and Standards are introduced by an AS-90 autosampler.

7.2 Environmental Express Hot block capable of reaching 95°C (±3°C).

7.3 Argon Cylinder with regulator

7.4 100µL, 200µL, 500µL and 1000uL Eppendorf pipets for spiking

7.5 Repipet Universal Dispensers, 5 mL volume range in 0.05 mL graduations

7.6 100mL containers for sample storage

7.7 100mL, 50mL, 500mL volumetric flasks. Only Class A volumetric glassware is used to prepare standards.

7.8 Plastic autosampler tubes

7.8 Autosampler racks B for samples and standards (Perkin-Elmer # B300-0132)

7.9 Analytical balance, capable of weighing to 0.0001g.

7.10 Thermometer

7.11 Play Sand, heated to 475 C, is added to the Method Blank and LCS/LCSD.

## 8.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

8.1 All maintenance must be documented in the maintenance logbook.

8.2 Daily:

8.2.1 Check calibration curve correlation (>0.995).

8.3 As Needed

8.3.1 Change pump and drain tubing.
8.3.2 Wipe off instrument with a damp cloth.
8.3.3 Archive files.
8.3.4 Clean racks and standard cups with DI water.
8.3.5 Change waste drain tubing.
8.3.6 Clean external optics.
8.3.7 Replace the mercury lamp

8.4 Semi Annually:

8.4.1 Change activated carbon in filter at the end of mercury system.

## 9.0 REAGENTS AND STANDARDS

**Note:** ***All reagents should be of analytical grade, suitable for mercury determination***

9.1 Nitric acid for Trace Metals Analysis, Omni Trace, EM or equivalent.

9.2 Sulfuric acid for Trace Metals Analysis,

9.3 Hydrochloric acid for Trace Metals Analysis, Omni Trace, or equivalent.

9.4 Deionized (DI) Water, ASTM Type I.

9.5 Potassium Permanganate: 5% solution. (W/V)

9.5.1 Dissolve 50g of potassium permanganate in 1000mL of DI water

9.6 Hydroxylamine Hydrochloride

7.7.1 Dissolve 120g of Hydroxylamine Hydrochloride in 1000 mL of DI water.

9.7 Stannous Chloride Solution: Add 13.2g of stannous chloride to 1000mL of 3%hydrochloric acid. Prepare fresh daily.

9.8 5% Nitric acid: Add 25 ml Nitric acid for Trace Metals Analysis, into 500 ml DI water.

9.9 3% Hydrochloric Acid Rinse Solution: Add 30mL of Hydrochloric acid for Trace Metals Analysis, Omni Trace or equivalent, to 1000mL DI water.

9.10 Refer to Mercury Standard Log for all standard preparation information. It is readily available near the FIMS. This log contains copies of the Certificates of Analysis for each stock purchased. It also gives an in depth explanation of all the standard required for analysis. This log is used to document the preparation of all Hg calibration standards and instrument QC standards.

9.11 Stock Mercury Solution: Hg 5 mg/L Standard. Use to prepare Working Standards for Calibration Standards, LCS and Spikes.

9.12 Calibration Standards - The Calibration Standard is a purchased standard. The Calibration Standard is replaced annually. The analytical solutions are prepared as needed.

9.12.1 Mercury Spike and LCS solution (500 ug/L): To a 50mL volumetric flask, add 5mL of DI and 2.5mL of HNO3 **THEN** 5.0mL of the Mercury Calibration Solution (5.0 mg/L) and dilute to the mark with DI. This solution is prepared Daily. If a 10-mg/L Calibration standard is used, reduce volume to 2.5 mL.

9.12.2 Working Mercury Calibration Solution (0.20mg/L): Use to prepare Calibration Standards. To prepare, add 2.5mL Nitric Acid and 2.0mL Of 5.0mg/L Hg Calibration Standard up to 50mL with DI water. Document in Mercury Standard Tracking Log. This solution is prepared Daily. If a 10 mg/L Calibration standard is used, reduce volume to 1.0 mL.

9.13 Stock Mercury Solution: Hg 20 mg/L Standard. Use to prepare Initial Calibration Verification (ICV). Note: ICV standard must be from a different source from the Hg standard. Initial Calibration Verification Standard (ICV) and be replaced annually. The ICV solution is run at the beginning of each run with a control limit of 90-110%. Analytical solutions are diluted as needed:

9.13.1 Working Mercury ICV Solution (0.60mg/L): Use to prepare ICV. To prepare, bring 1.25mL Nitric Acid and 3.0mL of 20mg/L Hg Standard. Bring to 100mL with DI water. Document in Mercury Standard Tracking Log. This standard is prepared Daily.

9.15 Continuing Calibration Verification Standard (CCV)

9.15.1 The CCV is prepared daily from the calibration standard. (See Hg Standard Log.) CCVs are run every 10 samples with a control limit of 80-120%.

9.16 Standards

9.16.1 Refer to Mercury Soil Standard Log for all standard preparation information. It also gives an in depth explanation of all the standards required for analysis. This log is used to document the preparation of all Hg calibration standards and instrument QC standards.

9.16.2 Calibration Standards

9.16.2.1 The Calibration Standard is a purchased standard.

9.16.3.2 The analytical solutions are prepared fresh.

9.16.3 Initial Calibration Verification Standard (ICV):

9.16.3.1 The analyst must document that the source of this standard is different than the calibration standard. The ICV Standard is a purchased standard. It is run at the beginning of each run. The acceptance criteria: 90-110%.

9.16.4 Continuing Calibration Verification Standard (CCV):

9.16.4.1 The CCV is prepared daily from the calibration standard. (Refer to

Hg Standard Log.) CCV's are run every 10 samples and at the end of the analytical sequence. The acceptance criteria: 80-120%.

9.16.5 Reporting Limit (RL) Standard for Hg (concentration = 0.20µg/L).

9.16.5.1 The RL Standard is prepared from the Calibration Standard. Refer to Mercury Soil Standard Log.

9.16.5.2 Analytical solutions are prepared fresh.

## 9.17 TRACKING OF ANALYTICAL STANDARDS

### 9.17.1 Chemical Receipt:

The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a 5 digit sequential number. The date received, source, lot number, expiration date and disposal date are recorded. The expiration dates are provided from the manufacturer and the disposal dates are completed by AMRO employees when standards are used up or disposed as indicated in the SOP "Sample Management GL-1006".

### 9.17.2 Standards Preparation:

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

9.17.2.1 ACS reagent grade chemicals are used when the method warrants.

9.17.2.2 A certificate of analysis accompanies any stock standards that are purchased from the manufacturer.

### 9.17.3 Standard Tracking:

It is important to be able to track all analytical standards back to their sources. The following procedure is used by AMRO personnel to accomplish this:

9.17.3.1 Mercury Standards, LCS Standards, and ICV Standards

Preparation and Standard ID's are listed in the Hg soil Standard Log. Standards include: S1 (Calibration Blank, ICB, CCB), S2 (0.20 µg/L

Calibration Standard and RL Standard), S3 (2.0 µg/L Calibration Standard), S4 (4.0 µg/L Calibration Standard), S5 (8.0 µg/L Calibration Standard), S6 (10.0µg/L Calibration Standard), S7 (16 ug/L Calibration Standard), CCV 6.0 µg/L Standard, and ICV (3.0 µg/L Independent Source QC Standard), and Stock Solutions for Matrix/LCS spike additions (Matrix/LCS spike addition = 5.0 µg/L). The Solution ID is the date prepared (example: is standard 032713 prepared on 03/27/13).

9.17.3.2.1 Wet Chemistry and Metals Reagent Log - Working reagents are made from reagents listed in the Chemical Receiving Log and are documented in the Reagent Log. The corresponding analysis, preparation date, reagent name, AMRO ID, initial concentration, amount used, final volume, final concentration, Solution ID, expiration date, storage location, and analyst initials are recorded. The initial concentration is obtained from the certificate received from the manufacturer. The Solution ID is written as an "R" followed by a 5 digit sequential number. The expiration of prepared reagents varies. Reagents should be used in accordance with method specifications and manufacturer's instructions as indicated in the SOP "Sample Management GL-1006".

## 10.0 PROCEDURE

10.1 Determination of Instrument Detection Limit (IDL):

10.1.1 Pour a calibration blank solution into seven autosampler tubes, and analyze as individual samples.

10.1.2 Determine the standard deviation for seven replicates.

10.1.3 The IDL = 3 x (standard deviations).

10.1.4 Provide all required information on the current Instrument Detection Limit study worksheet provided by the QA Department.

10.2 Determination of Method Detection Limit (MDL):

10.2.1 Digest at least seven individual aliquots of an MDL Solution using an appropriate digestion procedure, which is 3-5 times the IDL or 20% of the AMRO reporting limit. For soil MDL studies play sand must be used (7.11).

10.2.2 Determine the standard deviation for the seven digestions.

10.2.3 The MDL = 3.143 x (average of the standard deviations). If eight samples re digested, use 2.998.

10.2.4 Provide all required information on the current Method Detection Limit study on the worksheet provided by the QA department.

10.2.5 The MDL must he performed annually.

10.3 Precision and Accuracy:

10.3.1 Run four LCS's. Acceptance limits are 80-120%. Precision and accuracy is done annually by each analyst for each matrix and analysis type.

10.4 Linear Range:

10.4.1 The highest concentration of mercury that ean be analyzed which is the true value of the highest calibration standard. This must be determined initially and verified annually.

10.5 Calibration Curve:

10.5.1 Take clean, labeled 100mL tubes and make the 8 standards listed below by adding the amount of Deionized Water shown plus 4.0mL of concentrated Hydrochloric Acid and 1.0 mL of concentrated Nitric Acid followed by the amount of Mercury standard listed below:

| Standard (µg/L) | 3 DI Water | Hg Calibration Working Std. |
|---|---|---|
| 0 (CCB) | 5.0 mL | 0 |
| 0.2 | 5.0mL | 100µL (Reporting Limit) |
| 2.00 | 5.0mL | 1.0mL |
| 4.00 | 5.0mL | 2.0mL |
| 6.00 (CCV) | 5.0mL | 3.0mL |
| 8.00 | 5.0mL | 4.0mL |
| 10.00 | 5.0mL | 5.0mL |
| 16 | 5.0ml | 8.0ml |
| 3.0 (ICV) | 5.0mL | 500µL Hg ICV Working Std |

10.5.2 Place tubes in water bath at 95°C (±3°C) for two minutes. After two minutes remove the tubes.

10.5.3 After cooling, add 40 mL of DI and 16mL of Potassium Permanganate.

10.5.4 Mix thoroughly.

10.5.5 Place tubes back in hot block at 95°C (±3°C) and heat for 30 minutes. Document the temperature of the hot block in the mercury logbook. The temperature of the **hot block MUST be at 95 ±3°C**. Add the samples and wait until the temperature returns to 95 before starting the 30 minutes count.

10.5.6 Cool then add 2mL hydroxylamine hydrochloride to all samples to reduce the excess permanganate.

10.5.7 Fill standard to 100ml line with 5% nitric acid.

10.5.8 Pour standards into appropriately labeled standard tubes. Document preparation of the curve in the Mercury Standard Tracking Log.

10.6 Obtaining a Homogeneous Sample

10.6.1 Refer to SOP GL-1013 "Sample Homogenization for Soil, Solid and Semisolid Waste" for sample homogenization guidance and how to obtain a representative subsample.

10.6.2 If multiphase samples are submitted, the client is called to determine which phase is to be digested.

10.7 Sample Digestion

10.7.1 Transfer three well-mixed portions of sample, totaling 0.6g into an appropriately labeled tube. Weigh sample using an analytical balance to the 0.0001g place. Document weight in Hg logbook.

10.7.2 Prepare blank by adding 5.0mL DI, 4.0mL of HCl, and 1.0mL of $HNO_3$ to an appropriately labeled tube. Each batch of twenty samples requires a blank. Add 0.6 g of Blank Sand to the method blank.

10.7.3 Prepare LCS/LCSD by adding 5.0mL DI, 4.0mL of HCl, and 1.0mL of $HNO_3$ to an appropriately labeled tube then 1.0 mL of spiking solution (Sec 9.12.1). Each batch of twenty samples requires an LCS (true value = 5.0µg/L). Add 0.6 g of Blank Sand to the LCS & LCSD.

10.7.4 To each soil sample add 5.0mL DI, 4.0mL of HCl, and 1.0mL of $HNO_3$.

10.7.5 Prepare the Matrix Spike (MS) and Matrix Spike Duplicate (MSD) by choosing a sample and adding three well-mixed portions of sample, totaling a 0.6g aliquot of sample into tubes labeled with the sample ID plus MS or MSD. Add 1.0mL Spiking Solution (Sec 9.12.1) to the

appropriate commercial MS and MSD samples. Add 5.0mL DI, 4.0mL of HCl, and 1.0mL of $HNO_3$. Each batch of twenty samples requires an MS and an MSD. (true value = 5.0µg/L)

10.7.6 If needed for training or internal reference, an ERA soil sample can be prepped as an LCS.

10.7.7 Place tubes in the hot block at 95°C (±3°C) for two minutes then remove and cool. Add DI water to a volume of 40mL by using the 40mL line on the centrifuge tube.

10.7.8 Add 16mL Potassium Permanganate to each sample.

10.7.9 Mix thoroughly.

10.7.10 Loosely cap samples.

10.7.11 Place samples in the hot block at 95°C (± 3°C) for 30 minutes. Document the temperature of the hot block in the mercury logbook. The temperature of the **hot block MUST be at 95 ± 3°C**. Add the samples and wait until the temperature returns to 95 before starting the 30 minute count.

10.7.12. Allow samples to cool and add 2mL hydroxylamine hydrochloride to all samples to reduce the excess permanganate.

10.7.13. Fill samples to the 100ml line with 5% nitric acid solution.

10.7.14. Pour samples into appropriately labeled glass centrifuge tubes. Centrifuge as needed. They can also be filtered w/ a syringe filter and a 45µL syringe filter.

10.8 Instrument Start-up:

10.8.1 Switch on the spectrometer with the switch at the left-hand side of the spectrometer's front panel.

10.8.2 Switch on the computer and monitor with power switches on the front of each one.

10.8.3 Windows 95 will come up.

10.8.4 Double click AAWinLab folder on desktop. Instrument software will come up.

10.8.5 One the initial screen click Menus and Toolbar.

10.8.6 Put pump tubing in place, place reductant line in the Stannous Chloride and carrier line in 3% HCl.

10.8.7 Display FIAS Control window by choosing FIAS on the tool bar.

10.8.8 Press the FIAS on/off button. Instrument will go into an internal test mode.

10.8.9 Go to Autorun or press pump 1 on the FIAS control screen to rinse.

10.9 Creating and Modifying Sample Information Files

10.9.1 The system uses this file to label the data from samples both on the printed log of the results and in the results file. Information in this file is also used by the system to calculate final concentrations. A sample information file is especially useful for other data handling programs to manipulate the data.

10.9.2 To create a new sample information file, click on New Sample Info File in the File menu. The Sample Information Editor will appear.

10.9.3 Enter the sample information including all IDs in the cup where the sample will be placed. The amount of information that is entered depends on how the analysis results are to be reported, in weight/weight units or weight/volume units. The first eight positions are dedicated to Standards and Instrument QC as follows:

| **Position No.** | **4 Sample ID** |
|---|---|
| 1 | Calibration Blank |
| 2 | Std. 0.20µg/L |
| 3 | Std. 2.0µg/L |
| 4 | Std. 4.0µg/L |
| 5 | Std. 8.0µg/L |
| 6 | Std. 10.0µg/L |
| 9 | Std 16.0 ug/L |
| 7 | ICV 3.0µg/L |
| 8 | CCV 6.0µg/L |

The next nine positions are reserved for future QA/QC samples. Start analytical samples at Auto Sampler Position 17.

10.9.4 Save the sample information file by clicking on Save As Sample Info File in the File menu. The Save As dialog will appear. Type a name for the file (Mmddyy for example, M031099A) and click on OK.

10.9.5 To modify a stored sample information file click on Open Sample Info File in the File menu.

10.9.6 In the Open dialog select the sample information file to be opened and click OK.

10.9.7 In the Tools menu, click on Sample Information Editor and enter the new sample information.

10.9.8 Save the sample information file by clicking on Save As Sample Info File in the File menu. The Save As dialog will appear.

10.9.9 In this dialog, type a name for the file and click OK.

10.10 Setting Up the Automated Analysis Window:

10.10.1 Select the correct methods by double clicking on an entry field in the Method column in the Automated Analysis window. The Open Method dialog appears. Use this dialog to select the methods that are required.

10.10.2 Set a delay time between methods to allow the lamps to warm up before the system makes measurements by typing a value in the Delay column. This is not needed for mercury analysis.

10.10.3 Select the samples to be analyzed by using a sample information file or by selecting individual sample tray locations. To use a sample information file click on Open next to the Sample Information File entry field. Then Open Dialog appears. This dialog is used to select the name of the sample information file. In the Automated Analysis window, in the table, select the box in the Defined in Sample Info. File column. To select individual sample tray locations clear the box in the Defined in Sample Info. File column in the table in the Automated Analysis window. Type the locations of the samples in the Use Autosampler Locations Listed Below column. Type individual locations or a range of locations. Use commas to separate the locations and the ranges. Example: 10-15, 18,20,25-30 for the analyte addition technique, type only the locations of the pure sample solutions. If the locations of blanks, QC, checks or calibration solutions are typed in, they will be analyzed as if they were normal samples.

10.10.4 Select the data saving and print options by clicking Open next to the Results Data Set entry field. The Choose Results Data Set dialog will appear. Use this dialog to select the results data set. If the data set exists, new data will be added to it. Select the Save Data box to save the results in the selected data set. To print the results during the analysis, select the Print Log box.

10.10.5 Select items to switch off after the analysis by selecting the Off After Analyses options that are required.

10.11 Starting a Calibration Curve Analysis

There are two different options for performing a calibration curve analysis.

10.11.1 In the Automated Analysis Window, click on Analyze All. The system analyzes the calibration solutions first, immediately followed by the samples and any other solutions, for example, the QC and check samples.

10.11.2 In the Automated Analysis Window, click on Calibrate. The system will analyze the calibration solutions. If necessary edit the calibration curve. When the calibration curve is acceptable, click on Analyze Samples in the Automated Analysis window.

10.11.3 Following calibration, the instrument will print out a "Calibration data for Hg." The Correlation Coefficient MUST be better than 0.995.The Calculated Concentrations should be in good agreement with the True Values for the standards. The %RSD is usually less than 1.0%, with the possible exception of the 0.20 ug/L standard.

10.12 Loading the Autosampler Tray

10.12.1 Flow Injection autosampler – Make sure that the correct sample tray (Tray B) has been selected in the Method Editor on Calib. – Autosampler page. In the Automated Analysis window, click on the Analyze tab. Click on Load Tray. Place the loaded sample tray in the autosampler, or load the samples and other solutions into the sample tray in the autosampler. Make sure that the solutions are in the locations specified in the Method Editor, in the sample information file and in the Automated Analysis – Setup window. Click on Load Tray again.

10.13 Rinsing the Fluid System

10.13.1 Place the inlets of the pump tubes for the carrier, reductant and any other reagents in a container of the first rinsing solution.

10.13.2 Place the inlet of the sampling tube in a container of the first rinsing solution or if the autosampler is being used, place a container of the first rinsing solution in the wash location of the autosampler. In the Automated Analysis window, click on Select Location. In the Autosampler dialog, select Go to wash. Click on OK.

10.13.3 In the FIAS Control window click on the pump #1 icon to start the pump.

10.13.4 In the FIAS Control window, switch the FIAS-valve between the Fill and Inject positions a few times to rinse the inside of the valve.

10.13.5 Rinse the system for as long as necessary to remove all traces of the solution used previously.

10.13.6 If more than one rinsing solution is used, place the inlets of the pump tubes for the carrier, reductant and any other reagents in a container of the next rinsing solution.

10.14 Analysis Start up

10.14.1 When analysis is started, the system first checks for errors in the method and in the sample information file. If the system finds a fault that must be corrected before analysis can start, a message will appear and the fault must be corrected before the system will start the analysis.

10.14.2 When the button is clicked to start an analysis procedure, a green indicator will appear on the button and the other buttons will become inactive. The system uses the analytical conditions in the active method for each replicate. When all the solutions have been analyzed, the green indicator button disappears and the other buttons will become active.

10.14.3 The progress of the analysis is shown in the Automated- or Manual Analysis window.

10.15 Shutting Down the Flow Injection System

10.15.1 Rinse the fluid system with the correct rinsing solutions.

10.15.2 Switch the FIAS pumps off by clicking on On/Off for each pump in the FIAS Control window.

10.15.3 Switch off the spectrometer with the switch at the left-hand side of the front panel.

10.15.4 Turn off the carrier gas supply

10.15.5 Release the pressure on the pump tubes. Swing the pressure levers away from the pump tube magazines.

10.15.6 Empty the waste bottle. Dispose of waste solutions correctly, according to the safety regulations.

10.15.7 Switch off the computer and printer.

## 11.0 CALCULATIONS

11.1 Instrument Calibration Concentrations are in µg/L and Sample Concentration are in mg/kg. To verify soil results, perform the following calculation:

$$\text{Reported Conc. (mg/kg)} = \frac{\text{Determined conc. (µg/L) x Final Vol.(0.025L) x Dilution}}{\text{sample weight (g) x total solids (in decimal form)}}$$

11.2 % Recovery Laboratory Control Sample (water) = Determined concentration (µg/L)/true value x 100.

11.3 % Recovery MS/MSD = Determined concentration - sample concentration/true value x 100

11.4 %RPD MS/MSD or DUP = (sample - dup)/((sample + dup)/2) x 100. Use concentrations of each in calculations.

## 12.0 QUALITY CONTROL

12.1 Method Blank:

12.1.1 One Method Blank must be digested with every 20 samples or for every batch. The acceptable criteria: < RL and <½ RL for Department of Defense (DoD) projects.

12.1.2 The Method Blank results above the reporting limit indicate contamination. The source of contamination will be investigated and corrected. If a sample is greater than the reporting limit and less than ten times the Method Blank results, the sample will be re-digested and re-analyzed.

12.2 Matrix Spike and Matrix Spike Duplicate:

12.2.1 One matrix spike and one matrix spike duplicate are required for every 20 samples or for every preparation batch.

12.2.2 Samples must be selected for spiking at random and rotated among clients and sites from batch to batch. In some cases, the client may specify which sample is to used for MS/MSD; if not , the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall not be performed on Trip Blank, Rinsate Blank or Field Blank.
B. Adequate sample volume.
C. Client requested QC deliverables

12.2.3 The concentration of the analyte in the unspiked sample aliquot should be no more than four times the amount added. If the sample result is greater than four times the amount added, the LCS is the only valid assessment of accuracy for the batch and the spike recovery is not evaluated for control. If the control limits are not met for Relative Percent Difference, the control limits for Percent Recovery in the Matrix Spike are not applicable, since sample heterogeneity is indicated and an inaccurate sample result used to calculate percent recovery is suspected. The acceptable criteria: % R=75-125%

12.3 Sample Duplicate:

12.3.1 One sample duplicate is required for every 20 samples or for every preparation batch.

12.3.2 Duplicate samples are two aliquots of a sample, which are carried through the same sample preparation and analysis procedure to verify the precision of the method for that sample matrix. The RPD (Relative Percent Difference) is calculated from the original and the duplicate sample. If one sample result is above the reporting limit and one is less than five times the reporting limit the data is acceptable. An RPD can also be calculated between a matrix spike and matrix spike duplicate. The RPD is calculated using the concentration of the matrix spike and matrix spike duplicate. If the control limits are not met for Relative Percent Difference, the control limits for Percent Recovery in the Matrix Spike are not applicable, since sample heterogeneity is indicated and an inaccurate sample result used to calculate percent recovery is suspected. The control limits are $\leq 20\%$.

12.4 Laboratory Control Sample

12.4.1 One LCS is required for every 20 samples or for every preparation batch.

12.4.2 The %R control limit for the LCS is 80-120%.

12.4.3 If the Control limits which are not met for percent recovery in the LCS indicates inaccuracy during the procedure and requires re-digestion and re-analysis.

12.5 The following chart contains the frequency and control limits for QC required during the analytical run.

| QC Sample | Frequency | Hg Action Level | Hg Action | Analyst Response |
|---|---|---|---|---|
| ICV | Once, after calibration | ±10% of True Value | Stop | Correct problem and recalibrate |
| ICB* | Once, after ICV | ±RL | Stop | Correct problem and recalibrate |
| RL | Start | ±30% of True Value | Flag Data | Use caution regarding low level samples |
| CCV | 10% of analytical samples | ±20% of True Value | Flag Data | Correct problem and reanalyze affected samples |
| CCB* | Following each CCV | ± RL | Flag Data | Correct problem and reanalyze affected samples |

* ± ½ RL for Department of Defense (DoD) projects.

12.6 Corrective Action for Batch QC:

12.6.1 The initial investigation of the problem involves:

12.6.1.1 Checking sample concentrations for being high compared to the spike or too low for the RPD limits.

12.6.1.2 Checking calculations and raw data transcriptions (both QC and sample).

12.6.1.3 Checking sample concentrations and analytical sequence for influences such as carryover and mislabeling.

12.6.1.4 Reviewing the notes in the Mercury Digestion worksheet ( 2) and analytical notebook for signs of problems or heterogeneity. A conclusion of heterogeneity is not made as an afterthought.

12.6.2 When the control limits are not met for any batch QC, the batch QC is rerun to verify that the out-of-control result is not a function of analytical variability.

## 13.0 DATA REVIEW AND STORAGE

13.1 All related preparation information and observations will be noted in the digestion logbook.

13.2 All cross-outs must be a single line and should be initialed and dated. Analyst review is documented on the GFAA and CVAA Data Review Checklist.

13.3 All data from each run will be properly labeled and placed in the central file in an appropriate storage area. Each central file will include a run log, sample digestion sheet, and all original data.

## 14.0 REFERENCES

14.1 SW846 Method 7471A. Office of Solid and Hazardous Waste, rev. 1, 9/94.

14.2 FIMS, Software Guide, Publication B3118.30, Release 1.0/July 1994.

14.3 Flow Injection Mercury Analysis, Setting Up and Performing Analyses, Publication B3118.20, Release 1.1/March 1994.

14.4 Flow Injection Mercury/Hydride Analyses, Recommended Analytical Conditions and General Information, Publication B3505, Release 4.0.

14.5 FIMS, Installation Maintenance System Description, Publication B3118.10, Release 1.1/June 1994.

14.6 40 CFR Part 136 Appendix B, 1984

14.7 Department of Defense Quality Systems Manual for Environmental Laboratories, Revision 3, January 2006.

Property of AMRO Environmental Laboratories Corporation

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 • FAX: (603) 429-8496
www.amrolabs.com

# Mercury in Liquid Waste (Manual Cold-Vapor Technique)

## SW-846 Method 7470A

Procedure Number: IL-3002

Revision No.: 4

Revision Date: 01/23/2004

Review Date: 01/05/10

Prepared By: Paula Benham Date: 1/12/10

Approved By: Robert E. Bushard Date: 01/12/10
Inorganic Manager

Approved By: [signature] Date: 1/12/10
Laboratory Director

Approved By: Paula Benham Date: 1/12/10
Quality Assurance Manager

Property of AMRO Environmental Laboratories Corporation

# TABLE OF CONTENTS


| | | Page |
|---|---|---|
| 1.0 | SCOPE AND APPLICATION | 3 |
| 2.0 | METHOD SUMMARY | 3 |
| 3.0 | DEFINITIONS | 3 |
| 4.0 | SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE | 5 |
| 5.0 | POTENTIAL PROBLEMS AND INTERFERENCES | 5 |
| 6.0 | HEALTH AND SAFETY | 6 |
| 7.0 | INSTRUMENTS AND EQUIPMENT | 6 |
| 8.0 | INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR | 7 |
| 9.0 | REAGENTS AND STANDARDS | 8 |
| 10.0 | PROCEDURE | 12 |
| 11.0 | CALCULATIONS | 21 |
| 12.0 | QUALITY CONTROL | 22 |
| 13.0 | DATA REVIEW AND STORAGE | 25 |
| 14.0 | REFERENCES | 26 |
| | Attachment 1 Mercury Standard Log | 27 |
| | Attachment 2 Mercury Digestion Log | 28 |
| | Attachment 3 GFAA and CVAA Data Review Checklist | 29 |
| | Attachment 4 SW-846 Method 7470A Qualification Card | 30 |


Property of AMRO Environmental Laboratories Corporation

## 1.0 SCOPE and APPLICATION

1.1 This procedure is used for the preparation/determination of mercury in mobility-procedure extracts (Toxicity Characteristic Leaching Procedure - TCLP), aqueous wastes and ground waters.

1.2 Modifications:

1.2.1 Sample volume is reduced from 100mL to 25mL to reduce waste, all reagents are reduced accordingly. Reagent volume is rounded up to the nearest whole number for both the curve and samples due to limitations of the pipettes and various other measuring devices used in the laboratory.

## 2.0 METHOD SUMMARY

2.1 A representative 25mL aliquot of aqueous sample (or TCLP extract) is oxidized in a mixture of nitric acid/sulfuric acid, potassium permanganate and potassium persulfate at 95°C (±2°C) for two hours. Mercury in the digested sample is reduced with stannous chloride to elemental mercury, which is volatile and swept from the solution with argon and measured by a flameless AA procedure.

## 3.0 DEFINITIONS

3.1 **Analytical Batch -** A group of samples of a similar matrix analyzed together with the same procedure, using the same reagents and within the same time period. Samples in each batch should be of similar composition (i.e. soil, water, oil, etc.). A batch shall not exceed 20 samples.

3.2 **Matrix Spike (MS)/ - Duplicate (MSD)** Predetermined quantities of stock solutions of certain analytes, which are added to a sample matrix prior to sample digestion and analysis. Percent recoveries are calculated for each of the analytes detected. The relative percent difference between the samples is calculated and used to assess analytical precision. The concentration of the spike should be at the regulatory standard level.

3.3 **Sample Duplicate - (DUP)** A duplicate sample aliquot of sample which is carried through the same digestion and analysis. The relative percent difference between the sample and sample duplicate is calculated and used to assess analytical precision.

3.4 **Laboratory Control-Sample(LCS)/ Duplicate (LCSD)** A control sample of known composition. Aqueous and solid laboratory control sample are analyzed using the same sample preparation, reagents and analytical methods employed for samples received. Percent recoveries are calculated for each of the analytes detected. The relative percent difference between the samples is calculated and used to assess analytical precision. The concentration of the spike should be at the regulatory standard level.

3.5 **Method Blank** An analytical control consisting of all reagents which is carried through the entire analytical procedure. It is used to define the level of laboratory background contamination.

3.6 **Instrument Detection Limit (IDL)** Determined by multiplying by 3 the standard deviation obtained for the analysis of a standard solution (each Analyte in reagent water) at a concentration of 3 to 5 times instrument detection limit within 7 consecutive measurements per day.

3.7 **Method Detection Limit (MDL)** The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater then zero. It is determined by analyzing seven replicates of a standard solution that is 2–3 times the IDL. The standard deviation is then multiplied by 3.143 (the student t test for seven replicates) to obtain the MDL or 2.998 for eight replicates.

3.8 **Reporting Limit (RL)** The lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions.

3.9 **Linear Range** The highest concentration of mercury that can be analyzed

which is within 10% of the true value of the highest calibration standard.

## 4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

4.1 Aqueous samples shall be acidified at the time of collection with (1+1) nitric acid to pH<2. The holding time is 28 days for aqueous samples and TCLP extracts.

## 5.0 POTENTIAL PROBLEMS AND INTERFERENCES

5.1 Possible interference from sulfide is eliminated by the addition of Potassium Permanganate.

5.2 Copper has been reported to interfere; however, copper concentrations as high as 10mg/L had no effect on recovery of Mercury from spiked samples.

5.3 Seawater brines and industrial effluents high in chlorides require additional permanganates. During the oxidation step, chlorides are converted to free chlorine, which will also absorb radiation at 253nm. Care must be taken to assure free chlorine is absent before the mercury is reduced and swept into the cell. This may be accomplished by using an excess of hydroxylamine hydrochloride reagent. Both inorganic and organic mercury spikes have been quantitatively recovered from seawater using this technique.

5.4 Low level mercury sample preparation, digestion and analysis may be subject to environmental contamination. This analysis should not be performed in areas with high ambient backgrounds where mercury was previously employed as an analytical reagent in analyses such as total Kjeldahl nitrogen (TKN) or chemical oxygen demand (COD).

## 6.0 HEALTH AND SAFETY

6.1 AMRO has a laboratory safety program in place that applies to all employees. There is a safety officer as well as employees with 40 hours of OSHA training. The air quality of the laboratory has been monitored and employees are sent for physicals. All employees receive fire and safety training upon employment.

6.2 Fire extinguishers are located in various areas of the lab. A lab evacuation plan is posted in every room, with a designated meeting place.

6.3 All new analysts receive training on the safe handling of samples, standards, the changing of gas cylinders, and the operation of instruments. In the lab, clean laboratory coats and gloves are worn when working with samples. Neat standards are made up in hoods. When gas tanks are replaced, the carrier with chain is used properly, and all gas tanks are chained in place. Soap is used to check for any leaks.

6.4 Care is taken with glassware and syringes to prevent injury. Broken glass and syringes are promptly removed to broken glass containers. First aid kits are available throughout the laboratory There are also eyewash stations and an emergency shower.

6.5 MSDSs are reviewed for each chemical used to ensure proper precautions are observed when handling chemicals.

6.6 Pollution prevention – The use of chemical exhaust hood are required when working with chemicals .They are specifically designed to minimize analyst exposure. The hood exhaust is monitored periodically to ensure environmental exposure is minimized.

6.7 Waste control – AMRO takes whatever steps possible to minimize waste. This includes volume reduction where appropriate. AMRO also properly segregates wastes according to contaminants and a commercial vendor is utilized for waste disposal.

## 7.0 INSTRUMENTS AND EQUIPMENT

7.1 Perkin-Elmer FIMS 100 automated mercury analyzer. This instrument is an automated flameless AA mercury analyzer. It is controlled by a Dell Octiplex computer with WinLab/FIMS software Ver 2.5. Samples and Standards are introduced by an AS-90 autosampler.

7.2 Hot Block Digestor (Environmental Express) or Water Bath capable of reaching 95°C (±2°C).

7.3 Argon Cylinder with regulator

7.4 100µL, 200µL and 1000µL Eppendorf pipets for spiking (Fisher # 03402-69) or equivalent).

7.5 Repipet Universal Dispensers, 5 mL volume range in 0.05 mL graduations

7.6 52 mL containers for sample storage (cat #3264)

7.7 100mL, 50mL, 500mL volumetric flasks. Only Class A volumetric glassware is used to prepare standards.

7.8 Glass autosampler tubes (Fisher #14-961-29)

7.8 Autosampler racks B for samples and standards (Perkin-Elmer # B300-0132)

7.9 Thermometer

## 8.0 INSTRUMENT PREVENTATIVE MAINTENANCE AND REPAIR

8.1 All maintenance must be documented in the maintenance logbook.

8.2 Daily:

8.2.1 Check calibration curve correlation (>0.995).
8.2.2 Rinse before and after running samples for 10 minutes with 10% HCL.

8.3 Weekly:

8.3.1 Change pump and drain tubing.
8.3.2 Wipe off instrument with a damp cloth.
8.3.3 Archive files.
8.3.4 Clean racks and standard cups with DI water.

8.4 Monthly:

8.3.1 Change waste drain tubing.
8.3.2 Clean external optics.

8.5 Annually:

8.5.1 Replace liquid/gas separator.

8.6 As Needed

8.6.1 Replace the mercury lamp.

## 9.0 REAGENTS AND STANDARDS

**Note:** ***All reagents should be of analytical grade, suitable for mercury determination***

9.1 Nitric acid for Trace Metals Analysis, Omni Trace, EM (VWR# NX0407/2)

9.2 Sulfuric acid for Trace Metals Analysis, Fisher (Fisher # AS10SK-212)

9.3 Hydrochloric acid for Trace Metals Analysis, Omni Trace, EM (VWR# HX0607/2)

9.4 Deionized (Dl) Water, ASTM Type I

9.5 Potassium Permanganate: 5% solution.

9.5.1 Dissolve 5 of potassium permanganate (Fisher P279-212) in 100mL of DI water.

9.6 Potassium Persulfate: 5% solution

9.6.1 Dissolve 5g of potassium persulfate (JT Baker 3239-01) in 100 mL of DI water.

9.7 Hydroxylamine Hydrochloride

9.7.1 Dissolve 120g of Hydroxylamine Hydrochloride in 1000 mL of DI water (JT Baker 2196-01)

9.8 Stannous Chloride Solution: Add 11g of stannous chloride (Fisher TI42-500) to 1.0L of 0.5N hydrochloric acid. Prepare fresh daily.

9.8.1 0.5N Hydrochloric Acid: Add 2.8mL Hydrochloric acid for Trace Metals Analysis, Omni Trace, EM (VWR# HX0607/2) to 200mL of DI water.

9.9 3% Hydrochloric Acid Rinse Solution: Add 30mL of Hydrochloric acid for Trace MetalsAnalysis, Omni Trace, EM (VWR# HX0607/2) to 900mL DI water.

9.10 Stock Mercury Solution: Hg 5ppm Standard . Use to prepare Working Standards for Calibration Standards, LCS and Spikes.

9.10.1 Working Mercury Calibration Solution (50µg/L): Use to prepare Calibration Standards, LCS, and Spikes. To prepare, bring 5.0mL Nitric Acid and 1.0mL of 5.0ppm Hg Calibration Standard up to 100mL with DI water. This Standard is prepared daily. Document in Mercury Standard Log (Attachment 1).

9.10.2 Working LCS and Spike solution (500µg/L): To a 50mL volumetric flask add 5.0mL DI and 2.5mL $HNO_3$. Add 0.5mL of Mercury cal solution. Dilute to 50-mL final volume with DI. This Standard is prepared daily.

9.11 Stock Mercury Solution: Hg 20mg/L Standard . Use to prepare Initial Calibration Verification (ICV). Note: ICV standard must be from a different source from the Hg standard.

9.11.1 Working Mercury ICV Solution (600µg/L): Use to prepare ICV. To prepare, bring 5.0mL Nitric Acid and 3.0mL of 20,000µg/L Hg Standard. Bring to 100mL with DI water. This Standard is prepared daily. Document in Mercury Standard Log (Attachment 1).

9.12 Standards

9.12.1 Refer to Mercury Standard Log for all standard preparation information. It is readily available near the PS200II. This log contains copies of the Certificates of Analysis for each stock purchased. It also gives an in depth explanation of all the standards required for analysis. This log is used to document the preparation of all Hg calibration standards and instrument QC standards.

9.12.2 Calibration Standards

9.12.2.1 The Calibration Standard is a purchased standard.

9.12.2.2 The Stock Calibration Standard is replaced annually.

9.12.2.3 The analytical solutions are prepared fresh.

9.12.3 Initial Calibration Verification Standard (ICV):

9.12.3.1 The analyst must document that the source of this standard is different than the calibration standard. The ICV Standard is purchased from AccuStandard Inc. It is run at the beginning of each run. The acceptance criteria: 90-110%.

9.12.3.2 The ICV Stock Standard is replaced annually.

9.12.3.3 Analytical solutions are diluted as needed.

9.12.4 Continuing Calibration Verification Standard (CCV):

9.12.4.1 The CCV is prepared daily with every calibration curve from the calibration standard. (Refer to Hg Standard Log.) CCV's are run every 10 samples and at the end of the analytical sequence. The acceptance criteria: 80- 120%.

9.12.4.2 The Calibration Stock Standard is replaced annually.

9.12.4.3 Analytical solutions are prepared fresh.

9.12.5 Reporting Limit (RL) Standard for Hg (concentration = 0.20µg/L).

9.12.5.1 The RL Standard is prepared daily with every calibration curve from the Calibration Standard. Refer to Mercury Standard Log (Attachment 1).

9.12.5.2 The Calibration Standard is replaced annually.

9.12.5.3 Analytical solutions are prepared as needed.

9.12.6 <u>TRACKING OF ANALYTICAL STANDARDS</u>

9.12.6.1 <u>Chemical Receipt</u>:

The receipt of all standards, neat compounds and reagents from commercial sources is documented in the Chemical Receiving Logbook by sample receiving personnel or designate. Each solution or compound is assigned a unique standard receipt ID number, the letter "A" and a four digit sequential number. The date received, source, lot number, expiration date and

disposal date are recorded. The expiration dates are provided from the manufacturer and the disposal dates are completed by AMRO employees when standards are used up or disposed as indicated in the SOP "Sample Management GL-1006".

9.12.6.2 Standards Preparation:

Standards are prepared as written in the respective SOPs. In order to assure the accuracy of standards the following general guidelines are used:

9.12.6.2.1 ACS reagent grade chemicals are used when the method warrants.

9.12.6.2.2 A certificate of analysis accompanies any stock standards that are purchased from the manufacturer.

9.12.6.3 Standard Tracking:

It is important to be able to track all analytical standards back to their sources. The following procedure is used by AMRO personnel to accomplish this:

9.12.6.3.1 Metals Standards

Hg Standards Log (PS200II)-Preparation and Standard ID's are listed in the Standard Log.
Standards include:
S1 (Calibration Blank, ICB, CCB),
S2 (0.20 µg/L Calibration Standard and RL Standard),
S3 (2.0 µg/L Calibration Standard),
S4 (4.0 µg/L Calibration Standard),
S5 (8.0 µg/L Calibration Standard) and
S6 (10.0 Calibration Standard),
CCV 6.0 µg/L Standard,
ICV (2.4 µg/L Independent Source QC Standard),
Stock Solutions for Matrix/LCS spike additions (Matrix/LCS spike addition = 4.0 µg/L).

The Solution ID is written as the ID followed by the date prepared (example: S1042798 is standard S1 prepared on 042798).

9.12.6.3.2 Wet Chemistry and Metals Reagent Log - Working reagents are made from reagents listed in the Chemical Receiving Log and are documented in the Reagent Log. The corresponding analysis, preparation date, reagent name, AMRO ID, initial concentration, amount used, final volume, final concentration, Solution ID, expiration date, storage location, and analyst initials are recorded. The initial concentration is obtained from the certificate received from the manufacturer. The Solution ID is written as an "R" followed by a 4 digit sequential number. The expiration of prepared reagents varies. Reagents should be used in accordance with method specifications and manufacturer's instructions as indicated in the SOP "Sample Management GL-1006".

## 10.0 PROCEDURE

10.1 Determination of Instrument Detection Limit (IDL):

10.1.1 Pour a calibration blank solution into seven autosampler tubes, and analyze as individual samples.

10.1.2 Determine the standard deviation for seven replicates.

10.1.3 The IDL = 3 x (standard deviations).

10.1.4 Provide all required information on the current Instrument Detection Limit study worksheet provided by the QA Department.

10.2 Determination of Method Detection Limit (MDL):

10.2.1 Digest seven individual aliquots of an MDL Solution using an appropriate digestion procedure which is 3-5 times the IDL or 20% of the AMRO reporting limit.

10.2.2 Determine the standard deviation for the seven digestions.

10.2.3 The MDL = 3.143 x (Standard Deviation). If eight samples re digested, use 2.998.

10.2.4 Provide all required information on the current Method Detection Limit study on the worksheet provided by the QA department.

10.2.5 The MDL must be performed annually.

10.3 Precision and Accuracy:

10.3.1 Run four LCS's. Acceptance limits are 80-120%. Precision and accuracy is done annually by each analyst for each matrix and analysis type.

10.4 Linear Range:

10.4.1 The highest concentration of mercury that can be analyzed which is the true value of the highest calibration standard. This must be determined initially and verified annually.

10.5 Calibration Curve:

10.5.1 Take clean, labeled 50mL tubes and make the 7 standards listed below by adding the amount of mercury standard listed for each one. Bring the volume to 25 mL with 5% nitric acid. Add 1.5mL of $H_2SO_4$, 1mL of $HNO_3$, 4mL of potassium permanganate, and 2mL of potassium persulfate.

| Standard | Amount to add |
|---|---|
| 0 (ICB) | 0 |
| 0.2µg/L | 100µL Hg Calibration Working Std |
| 2.00µg/L | 1.0mL Hg Calibration Working Std |
| 4.00µg/L | 2.0mL Hg Calibration Working Std |
| 6.00µg/L (CCV) | 3.0mL Hg Calibration Working Std |
| 8.00µg/L | 4.0mL Hg Calibration Working Std |
| 10.00µg/L | 5.0mL Hg Calibration Working Std |
| 2.4µg/L (ICV) | 100µL Hg ICV Working Std |

10.5.2 Place tubes in water bath at 95°C (±2 °C) for 2 hours.

10.5.3 After cooling, add 2 mL of hydroxylamine hydrochloride to each tube and mix well by shaking..

10.5.4 Pour into labeled plastic calibration tubes.

10.5.5 Document preparation in the Mercury Standard Tracking Log.

10.6 Sample Digestion:

10.6.1 The digestion volume has been reduced from 100mL to 25mL. As a result of this, reagent volumes are also reduced but the volume is rounded up to the nearest whole number due to limitations of the pipettes and various other measuring devices used in the laboratory.

10.6.2 Transfer a 25mL aliquot of sample into appropriately labeled tube.

10.6.3 Prepare the digestion blank (MB) and LCS by adding 25mL DI water to the appropriately labeled tubes. For TCLP extracts: the blank and LCS are prepared using the TCLP Extraction Blank extracted the same day as the TCLP sample extracts. TCLP extracts are prepared by pipetting 5mL of leachate into a tube and diluting to a final volume of 25mL with DI water.

10.6.4 Add 1.5mL $H_2SO_4$ and 1.0mL of $HNO_3$ to each sample.

10.6.5 Add 200µL Working Mercury LCS Solution (Sec 9.10.3) to the appropriate commercial MS and MSD samples.

10.6.6 Add 200µL Working Mercury LCS Solution (Sec 9.10.3) to the LCS sample.

10.6.7 Add 4mL Potassium Permanganate, shake and add additional portions if necessary until purple color persists for at least 15 minutes.

10.6.8 Add 2mL Potassium Persulfate to all samples.

10.6.9 Loosely cap samples.

10.6.10 Place samples in water bath at 95°C (± 2 °C) for 2 hours.

10.6.11 Remove samples from water bath and allow to cool.

10.6.12 Add 2mL hydroxylamine hydrochloride to all samples to reduce the excess permanganate. Mix well.

10.6.13 Pour samples into appropriately labeled glass centrifuge tubes.

10.7 Instrument Start-up:

10.7.1 Switch on the spectrometer with the switch at the left-hand side of the spectrometer's front panel.

10.7.2 Switch on the computer and monitor with power switches on the front of each one.

10.7.3 Windows 95 will come up.

10.7.4 Double click AAWinLab folder on desktop. Instrument software will come up.

10.7.5 One the initial screen click Menus and Toolbar.

10.7.6 Put pump tubing in place, place reductant line in the Stannous Chloride and carrier line in 3% HCl.

10.7.7 Click on Auto Icon to open AA window. Select the correct methods by double clicking on an entry field in the Method column in the Automated Analysis window. The Open Method dialog appears. Use this dialog to select the methods that are required.

10.7.8 Display FIAS Control window by choosing FIAS on the tool bar.

10.7.9 Press the FIAS on/off button. Instrument will go into an internal test mode.

10.8 Creating and Modifying Sample Information Files:

10.8.1 The system uses this file to label the data from samples both on the printed log of the results and in the results file. Information in this file is also used by the system to calculate final concentrations. A sample information file is especially useful for other data handling programs to manipulate the data.

10.8.2 To create a new sample information file, click on New Sample Info File in the File menu. The Sample Information Editor will appear.

10.8.3 Enter the sample information including all IDs in the cup where the sample will be placed. The amount of information that is entered depends on how the analysis results are to be reported, in weight/weight units or weight/volume units. The first eight positions are dedicated to Standards and Instrument QC as follows:

| Position No. | Sample ID |
|---|---|
| 1 | Cal Blank |
| 2 | Std 0.20 µg/L |
| 3 | Std 2.0 µg/L |
| 4 | Std 4.0 µg/L |
| 5 | Std 8.0 µg/L |
| 6 | Std 10.0 µg/L |
| 7 | ICV 2.4 µg/L |
| 8 | CCV 6.0 µg/L (Also IPC when needed) |

The next nine positions are reserved for future QA/QC samples. Start analytical samples at Auto Sampler Position 17.

10.8.4 Save the sample information file by clicking on Save As Sample Info File in the File menu. The Save As dialog will appear. Type a name for the file (Mmmddyy for example, M031099A) and click on OK.

10.8.5 To modify a stored sample information file click on Open Sample Info File in the File menu.

10.8.6 In the Open dialog select the sample information file to be opened and click OK.

10.8.7 In the Tools menu, click on Sample Information Editor and enter the new sample information.

10.8.8 Save the sample information file by clicking on Save As Sample Info File in the File menu. The Save As dialog will appear.

10.8.9 In this dialog, type a name for the file and click OK.

10.9 Setting Up the Automated Analysis Window

10.9.1 Set a delay time between methods to allow the lamps to warm up before the system makes measurements by typing a value in the Delay column. This is not needed for mercury analysis.

10.9.2 Select the samples to be analyzed by using a sample information file or by selecting individual sample tray locations. To use a sample information file click on Open next to the Sample Information File entry field. Then Open Dialog appears. This dialog is used to select the name of the sample information file. In the Automated Analysis window, in the table, select the box in the Defined in Sample Info. File column. To select individual sample tray locations clear the box in the Defined in Sample Info. File column in the table in the Automated Analysis window. Type the locations of the samples in the Use Autosampler Locations Listed Below column. Type individual locations or a range of locations. Use commas to separate the locations and the ranges. Example: 10-15, 18,20,25-30 for the analyte addition technique, type only the locations of the pure sample solutions. If the locations of blanks, QC, checks or calibration solutions are typed in, they will be analyzed as if they were normal samples.

10.9.3 Select the data saving and print options by clicking Open next to the Results Data Set entry field. The Choose Results Data Set dialog will appear. Use this dialog to select the results data set. If the data set exists, new data will be added to it. Select the Save Data box to save the results in the selected data set. To print the results during the analysis, select the Print Log box.

10.9.4 Select items to switch off after the analysis by selecting the Off After Analyses options that are required.

10.10 Starting a Calibration Curve Analysis

There are two different options for performing a calibration curve analysis.

10.10.1 In the Automated Analysis Window, click on Analyze All. The system analyzes the calibration solutions first, immediately followed by the samples and any other solutions, for example, the QC and check samples.

10.10.2 In the Automated Analysis Window, click on Calibrate. The system will analyze the calibration solutions. If necessary edit the calibration curve. When the calibration curve is acceptable, click on Analyze Samples in the Automated Analysis window.

10.10.3 Following calibration, the instrument will print out a "Calibration data for Hg." The Correlation Coefficient MUST be better than 0.995, and it's usually better than 0.999. The Calculated Concentrations should be in good agreement with the True Values for the standards. The %RSD is usually less than 1.0%, with the possible exception of the 0.20 ug/L standard.

10.11 Loading the Autosampler Tray

10.11.1 Flow Injection autosampler – Make sure that the correct sample tray (Tray B) has been selected in the Method Editor on Calib. – Autosampler page. In the Automated Analysis window, click on the Analyze tab. Click on Load Tray. Place the loaded sample tray in the autosampler, or load the samples and other solutions into the sample tray in the autosampler. Make sure that the solutions are in the locations specified in the Method Editor, in the sample information file and in the Automated Analysis – Setup window. Click on Load Tray again.

10.12 Rinsing the Fluid System

10.12.1 Place the inlets of the pump tubes for the carrier, reductant and any other reagents in a container of the rinsing solution. (3% HCL)

10.12.2 Place the inlet of the sampling tube in a container of the first rinsing solution (3% HCL) or if the autosampler is being used, place a container of the first rinsing solution in the wash location of the autosampler. In the Automated Analysis window, click on Select Location. In the Autosampler dialog, select Go to wash. Click on OK.

10.12.3 In the FIAS Control window set a speed in 100 for the pump. Click on Pump # for each pump to start the pumps.

10.12.4 In the FIAS Control window, switch the FIAS-valve between the Fill and Inject positions a few times to rinse the inside of the valve.

10.12.5 Rinse the system for as long as necessary to remove all traces of the solution used previously.

10.12.6 If more than one rinsing solution is used, place the inlets of the pump tubes for the carrier, reductant and any other reagents in a container of the next rinsing solution.

10.12.7 Place the inlet of the sampling tube in a container of the next rinsing solution or in the Automated Analysis window, click on Probe Up/Down, and then place a container of the next rinsing solution in the wash location of the autosampler.

10.12.8 Repeat rinsing and setup for each rinsing solution.

10.12.9 After rinsing with the final rinsing solution, remove the inlets for the pump tubes from the rinsing solution. If the autosampler is used, in the Automated Analysis window, click on Probe Up/Down to raise the probe. Allow the pumps to run until the fluid system is empty. In the FIAS Control window, click on Pump # for each pump to stop the pumps.

10.13 Analysis Start up

10.13.1 When analysis is started, the system first checks for errors in the method and in the sample information file. If the system finds a fault that must be corrected before analysis can start, a message will appear and the fault must be corrected before the system will start the analysis.

10.13.2 When the button is clicked to start an analysis procedure, a green indicator will appear on the button and the other buttons will become inactive. The system uses the analytical conditions in the active method for each replicate. When all the solutions have been analyzed, the green indicator button disappears and the other buttons will become active.

10.13.3 The progress of the analysis is shown in the Automated- or Manual Analysis window.

10.14 Shutting Down the Flow Injection System

10.14.1 Prepare the correct rinsing solutions.

10.14.2 Rinse the fluid system with the correct rinsing solutions.(3% HCL then DI water)

10.14.3 Remove the lines and allow to pump dry for a few minutes.

10.14.3 Switch the FIAS pumps off by clicking on On/Off for each pump in the FIAS Control window.

10.14.4 Switch off the spectrometer with the switch at the left-hand side of the spectrometer's front panel.

10.14.5 Turn off the carrier gas supply

10.14.6 Release the pressure on the pump tubes. Swing the pressure levers away from the pump tube magazines.

10.14.7 Empty the waste bottle. Dispose of waste solutions correctly, according to the safety regulations.

10.14.8 Switch off the computer and printer.

## 11.0 CALCULATIONS

11.1 Instrument concentrations are in µg/L. To report in mg/L aqueous sample results must be divided by 1000. Water sample results must be multiplied by any dilutions performed. Reported Concentration (µg/L) = Determined concentration (mg/L) / 1000 x dilution.

11.2 % Recovery (%R) for LCS = Determined concentration/true value x 100.

11.3 % Recovery (%R) for MS and MSD = Determined concentration - sample concentration/true value x 100.

11.4 %RPD MS/MSD or DUP= sample – dup./((sample + dup.)/2) x 100. Use concentrations of each in calculations.

## 12.0 QUALITY CONTROL

12.1 Method Blank:

12.1.1 One Method Blank must be digested with every 20 samples. The acceptable criteria: < RL and <½ RL for Department of Defense (DoD) projects.

12.1.2 The Method Blank results above the reporting limit indicate contamination. The source of contamination will be investigated and corrected. If a sample is greater than the reporting limit and less than ten times the Method Blank results, the sample will be re-digested and re-analyzed.

12.2 Matrix Spike and Matrix Spike Duplicate

12.2.1 One matrix spike is required for every 20 samples for as long as matrix spike duplicate.

12.2.2 Samples must be selected for spiking at random and rotated among clients and sites from batch to batch. In some cases, the client may specify which sample is to used for MS/MSD; if not , the laboratory shall pick a representative sample based on the following:

A. MS/MSD shall not be performed on Trip Blank, Rinsate Blank or Field Blank.
B. Adequate sample volume.
C. Client requested QC deliverables

12.2.3 The concentration of the analyte in the unspiked sample aliquot should be no more than four times the amount added. If the sample result is greater than four times the amount added, the LCS is the only valid assessment of accuracy for the batch and the spike recovery is not evaluated for control. If the control limits are not met for Relative Percent Difference, the control limits for Percent Recovery in the Matrix Spike are not applicable, since sample heterogeneity is indicated and an inaccurate sample result used to calculate percent recovery is suspected. The acceptable criteria: % R=75-125%.

Property of AMRO Environmental Laboratories Corporation

12.3 Sample Duplicate:

12.3.1 One sample duplicate is required for every 20 samples.

12.3.2 Duplicate samples are two aliquots of a sample, which are carried through the same sample preparation and analysis procedure to verify the precision of the method for that sample matrix. The RPD (Relative Percent Difference) is calculated from the original and the duplicate sample. If one sample result is above the reporting limit and one is less than five times the reporting limit the data is acceptable. An RPD can also be calculated between a matrix spike and matrix spike duplicate. The RPD is calculated using the concentration of the matrix spike and matrix spike duplicate. If the control limits are not met for Relative Percent Difference, the control limits for Percent Recovery in the Matrix Spike are not applicable, since sample heterogeneity is indicated and an inaccurate sample result used to calculate percent recovery is suspected. The control limits are ≤20%.

12.4 Laboratory Control Sample

12.4.1 One LCS is required for every 20 samples.

12.4.2 The %R control limit for the LCS is 80-120%.

12.4.3 If the Control limits which are not met for percent recovery in the LCS indicates inaccuracy during the procedure and requires re-digestion and re-analysis.

12.5 The following chart contains the frequency and control limits for QC required during the analytical run.

| QC Sample | Frequency | Hg Action Level | Hg Action | Analyst Response |
|---|---|---|---|---|
| ICV | Once, after calibration | ±10% of True Value for SW-846 Method 7470A | Stop | Correct problem and recalibrate |
| IPC | Once, after Calibration | ±5% of True Value for EPA Method 245.1, Not applicable for SW-846 Method 7470A | Stop | Correct problem and recalibrate |
| ICB* | Once, after ICV | ±RL | Stop | Correct problem and recalibrate |
| RL | Start & Finish | ±20% of True Value | Flag Data | Use caution regarding low level samples |
| CCV | 10% of analytical samples | ±20% of True Value for SW-846 Method 7470A | Flag Data | Correct problem and reanalyze affected samples |
| CCB* | Following each CCV | ± RL | Flag Data | Correct problem and reanalyze affected samples |

* ±½ RL for Department of Defense (DoD) projects

12.6 Corrective Action for Batch QC:

12.6.1 The initial investigation of the problem involves:

12.6.1.1 Checking sample concentrations for being high compared to the spike or too low for the RPD limits.

12.6.1.2 Checking calculations and raw data transcriptions (both QC and sample).

12.6.1.3 Checking sample concentrations and analytical sequence for influences such as carryover and mislabeling.

12.6.1.4 Reviewing the notes in the Mercury Digestion worksheet (Attachment 2 and analytical notebook for signs of problems or heterogeneity. A conclusion of heterogeneity is not made as an afterthought.

12.6.2 When the control limits are not met for any batch QC, the batch QC is rerun to verify that the out-of-control result is not a function of analytical variability.

## 13.0 DATA REVIEW AND STORAGE

13.1 All related preparation information and observations will be noted in the digestion logbook.

13.2 All cross-outs must be a single line and should be initialed and dated. Analyst review is documented on the GFAA and CVAA Data Review Checklist (Attachment 3.

13.3 All data from each run will be properly labeled and placed in the central file in an appropriate storage area. Each central file will include a run log, sample digestion sheet, and all original data.

## 14.0 REFERENCES

14.1 SW846 method 7470A. Office of Solid and Hazardous Waste, Update II, 9/94.

14.2 40 CFR Part 136 Appendix B, 1984.

14.3 Department of Defense Quality systems Manual for Environmental Laboratories, Final Version 3, January 2006.

14.4 FIMS, Installation Maintenance System Description, Publication B3118.10, Release 1.1/June 1994.

14.5 Flow Injection Mercury Analysis, Setting Up and Performing Analyses, Publication B3118.20, Release 1.1/March 1994.

14.6 Flow Injection Mercury/Hydride Analyses, Recommended Analytical Conditions and General Information, Publication B3505, Release 4.0.

Property of AMRO Environmental Laboratories Corporation

## Attachment 1

Storage: Hg Hood

| Standard ID | Manufacturer | Lot No. | Expiration Date | Stock Conc. | Analyst |
|---|---|---|---|---|---|
| Hg Calib. Stock ID | | | | 1000 µg/L | |
| Hg ICV Stock ID | | | | 10,000 µg/L | |
| Hg Calib. Stock ID | | | | 1000 µg/L | |
| Hg ICV Stock ID | | | | 10,000 µg/L | |
| Hg Calib. Stock ID | | | | 1000 µg/L | |
| Hg ICV Stock ID | | | | 10,000 µg/L | |
| Hg Calib. Stock ID | | | | 1000 µg/L | |
| Hg ICV Stock ID | | | | 10,000 µg/L | |
| Hg Calib. Stock ID | | | | 1000 µg/L | |
| Hg ICV Stock ID | | | | 10,000 µg/L | |
| Hg Calib. Stock ID | | | | 1000 µg/L | |
| Hg ICV Stock ID | | | | 10,000 µg/L | |
| Hg Calib. Stock ID | | | | 1000 µg/L | |
| Hg ICV Stock ID | | | | 10,000 µg/L | |
| Hg Calib. Stock ID | | | | 1000 µg/L | |
| Hg ICV Stock ID | | | | 10,000 µg/L | |
| Hg Calib. Stock ID | | | | 1000 µg/L | |
| Hg ICV Stock ID | | | | 10,000 µg/L | |
| Hg Calib. Stock ID | | | | 1000 µg/L | |
| Hg ICV Stock ID | | | | 10,000 µg/L | |
| Hg Calib. Stock ID | | | | 1000 µg/L | |
| Hg ICV Stock ID | | | | 10,000 µg/L | |
| Hg Calib. Stock ID | | | | 1000 µg/L | |
| Hg ICV Stock ID | | | | 10,000 µg/L | |

AMRO Environmental
Laboratories Corporation

111 Hermit Street
Merrimack, NH 03054
(603) 424-2022

Mercury Standard Log
Working Standards and Solutions

Matrix: Water

Storage: Hg Hood

| Prep. Date/ Exp. Date | Standard ID | Stock Conc. | Amount Used (ml) | Final Vol. (ml) | Final Conc. | Hg Working Std. ID | Hg ICV Std. ID | LCS Std. ID: | HNO3 Lot No. | Prepared By |
|---|---|---|---|---|---|---|---|---|---|---|
| | Hg Calib Init. Working | 5,000 µg/L (Hg Calib. Solution) | 1.00 | 100 | 50 µg/L | | | | | |
| | Hg ICV Init. Working | 20,000 µg/L (Hg ICV Solution) | 3.00 | 100 | 600 µg/L | | | | | |
| | LCS | | | | | | | | | |
| | 0.0 Std | NA | 0.00 | 25 | 0 µg/L | | | | | |
| | 0.2 Std. | 50 µg/L | 0.10 | 25 | 0.2 µg/L | | | | | |
| | 2.0 Std. | 50 µg/L | 1.00 | 25 | 2.0µg/L | | | | | |
| | 4.0 Std. | 50 µg/L | 2.00 | 25 | 4.0µg/L | | | | | |
| | 6.0 Std. (CCV) | 50 µg/L | 3.00 | 25 | 6.0 µg/L | | | | | |
| | 8.0 Std. | 50 µg/L | 4.00 | 25 | 8.0 µg/L | | | | | |
| | 10.0 Std. | 50 µg/L | 5.00 | 25 | 10.0 µg/L | | | | | |
| | 2.4 ICV | 600 µg/L | 0.1 | 25 | 2.4 µg/L | | | | | |
| | Hg Calibration Working | 5,000 µg/L (Hg Calib. Solution) | 1.00 | 100 | 50 µg/L | | | | | |
| | Hg ICV Working | 20,000 µg/L (Hg ICV Solution) | 3.00 | 100 | 600 µg/L | | | | | |
| | LCS | | | | | | | | | |
| | 0.0 Std | NA | 0.00 | 25 | 0 µg/L | | | | | |
| | 0.2 Std | 50µg/L | 0.10 | 25 | 0.2 µg/L | | | | | |
| | 2.0 Std | 50µg/L | 1.00 | 25 | 2.0µg/L | | | | | |
| | 4.0 Std | 50µg/L | 2.00 | 25 | 4.0 µg/L | | | | | |
| | 6.0 Std. (CCV) | 50µg/L | 3.00 | 25 | 6.0 µg/L | | | | | |
| | 8.0 Std | 50µg/L | 4.00 | 25 | 8.0 µg/L | | | | | |
| | 10.0 Std | 50µg/L | 5.00 | 25 | 10µg/L | | | | | |
| | 2.4 ICV | 600 µg/L | 0.1 | 25 | 2.4 µg/L | | | | | |

Property of AMRO Environmental Laboratories Corporation

AMRO Environmental
Laboratories Corporation

# Attachment 2

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

## Mercury Digestion Logbook

Methods: EPA 245.1( IL-3028); SW846- 7470A (IL-3002); SW846- 7471A (IL-3005)

Weighed Date: _____
Digestion Date: _____
Digested By: _____
Curve Prep. Date: _____
Wk. Hg Cal. Sol. ID: _____
Wk. Hg ICV. Sol. ID: _____
WK. Hg Spike/LCS ID: _____
Bath Temp. In: _____
Time In: _____
Bath Temp. out: _____
Time out: _____

H2SO4 Lot No.: _____
SnCl2 Lot No.: _____
KMnO4 Lot No.: _____
K2SO4 Lot No.: _____
HNO3 Lot No.: _____
HCl Lot No.: _____
Hydroxylamine
HCl Lot No.: _____
LIMS Batch ID No.: _____

Water Bath Temp.= 93°C - 97°C

| Lab. Sample ID | Sample Wt./ Vol. (g) or (ml) | Final Volume (ml) | Spike Amount (ml) | Spike Conc. | Comments |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |



Property of AMRO Environmental Laboratories Corporation

# Attachment 3

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

## GFAA and CVAA DATA REVIEW CHECKLIST

LAB ORDER: _____ CLIENT: _____

Method:

Analysis:

| | A. GENERAL | | | |
|---|---|---|---|---|
| 1. | Copy of Digestion Log? | Y | N | NA |
| 2. | Copy of Instrument Run Log? | Y | N | NA |
| 3. | All samples met digestion and/or analysis holding time criteria? | Y | N | NA |
| 4. | Initial Calibration meets method criteria for GFAA, min. 3 std plus a blank? R >0.995 | Y | N | NA |
| 5. | Initial Calibration meets method criteria for CVAA, min. 5 std plus a blank? R >0.995 | Y | N | NA |
| 6. | Initial Calibration Verification (ICV) meets method criteria: ±10%? | Y | N | NA |
| 7. | Is the RL1 check QC at ±20%? | Y | N | NA |
| 8. | Initial Calibration Blank (ICB) free of contamination?(<½RL) | Y | N | NA |
| 9. | Initial Performance Calibration(IPC) meets criteria: ±5% ? | Y | N | NA |
| 10. | Continuing Calibration Verification(CCV) meets method criteria: ±10% ? | Y | N | NA |
| 11. | Continuing Calibration Blank(CCB) free of contamination?(<½RL) | Y | N | NA |
| 12. | Are CCV and CCB analyzed after every 10 samples ? | Y | N | NA |
| 13. | Was post digestion performed? If yes was %R=85-115? | Y | N | NA |
| 14. | Was the serial dilution performed? If yes was %R= 90-110? | Y | N | NA |
| 15. | Method Blank- contaminant free(<½RL)? | Y | N | NA |
| 16. | Are all reported results within calibration range? | Y | N | NA |
| 17. | LCS % Recovery criteria met for all compounds? | Y | N | NA |
| 18. | MS/MSD %R's and %RPD's are met for all compounds? | Y | N | NA |
| 19. | %RPD criteria met between sample and duplicate? | Y | N | NA |

COMMENTS

Analyst (s)_____ DATE: _____

REVIEWER_____ DATE OF REVIEW: _____

qe/qcmemos/Forms/GFAACVAAchecklist Rev. 1 07/05/01

## Attachment 4

AMRO Environmental
Laboratories Corporation

111 Herrick Street
Merrimack, NH 03054
(603) 424-2022

# QUALIFICATION CARD FOR SW-846 METHOD 7470A

Trainee: _____ Signature: _____

Trainer: _____ Signature: _____

I. Knowledge Factors:

SOP Title: _____ Revision Number/Date: _____

| | | | |
|---|---|---|---|
| 1. Did the Trainee read and understand the above SOP? | Yes☐ | No☐ | NA☐ |
| 2. Was the Trainee instructed on how to properly fill out the documentation? | Yes☐ | No☐ | NA☐ |
| 3. Has the Trainee been instructed on the proper procedures for addressing potential problems? | Yes☐ | No☐ | NA☐ |

II. Practical Factors:

| | | | |
|---|---|---|---|
| 1. Has the Trainee completed a Precision and Accuracy Study? | Yes☐ | No☐ | NA☐ |
| 2. Has the Trainee completed the maintenance schedule followed by a successful calibration? | Yes☐ | No☐ | NA☐ |
| 3. Has the Trainee demonstrated the ability to review and document Instrument QC and Batch QC problems? | Yes☐ | No☐ | NA☐ |

Completion Date: _____ Trainer's Signature: _____

I _____ have read, understood and follow the above method/SOP, which is in use at AMRO Laboratories for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

Section Manager/ Supervisor: _____ Date: _____

QA Manager: _____ Date: _____

qc/qcmemos/forms/7470Aqualcard Rev. 0 07/16/01

Property of AMRO Environmental Laboratories Corporation

| AnalyteType | Analyte | MDL ug/Kg | PQL ug/Kg |
|---|---|---|---|
| A | 1,1,1,2-Tetrachloroethane | 12.5 | 25 |
| A | 1,1,1-Trichloroethane | 12.5 | 25 |
| A | 1,1,2,2-Tetrachloroethane | 12.5 | 25 |
| A | 1,1,2-Trichloroethane | 12.5 | 25 |
| A | 1,1-Dichloroethane | 12.5 | 25 |
| A | 1,1-Dichloroethene | 12.5 | 25 |
| A | 1,1-Dichloropropene | 12.5 | 25 |
| A | 1,2,3-Trichlorobenzene | 12.5 | 25 |
| A | 1,2,3-Trichloropropane | 12.5 | 25 |
| A | 1,2,4-Trichlorobenzene | 12.5 | 25 |
| A | 1,2,4-Trimethylbenzene | 12.5 | 25 |
| A | 1,2-Dibromo-3-chloropropane | 50 | 125 |
| A | 1,2-Dibromoethane | 12.5 | 25 |
| A | 1,2-Dichlorobenzene | 12.5 | 25 |
| A | 1,2-Dichloroethane | 12.5 | 25 |
| A | 1,2-Dichloropropane | 12.5 | 25 |
| A | 1,3,5-Trichlorobenzene | 12.5 | 50 |
| A | 1,3,5-Trimethylbenzene | 12.5 | 25 |
| A | 1,3-Dichlorobenzene | 12.5 | 25 |
| A | 1,3-Dichloropropane | 12.5 | 25 |
| A | 1,4-Dichlorobenzene | 12.5 | 25 |
| A | 1,4-Dioxane | 625 | 1250 |
| A | 2,2-Dichloropropane | 12.5 | 25 |
| A | 2-Butanone | 125 | 250 |
| A | 2-Chloroethyl vinyl ether | 50 | 250 |
| A | 2-Chlorotoluene | 12.5 | 25 |
| A | 2-Hexanone | 125 | 250 |
| A | 4-Chlorotoluene | 12.5 | 25 |
| A | 4-Isopropyltoluene | 12.5 | 25 |
| A | 4-Methyl-2-pentanone | 125 | 250 |
| A | Acetone | 125 | 250 |
| A | Acrylonitrile | 12.5 | 25 |
| A | Benzene | 12.5 | 25 |
| A | Bromobenzene | 12.5 | 25 |
| A | Bromochloromethane | 12.5 | 25 |
| A | Bromodichloromethane | 12.5 | 25 |
| A | Bromoform | 25 | 50 |
| A | Bromomethane | 25 | 50 |
| A | Carbon disulfide | 25 | 50 |
| A | Carbon tetrachloride | 12.5 | 25 |
| A | Chlorobenzene | 12.5 | 25 |
| A | Chloroethane | 25 | 50 |
| A | Chloroform | 12.5 | 25 |
| A | Chloromethane | 25 | 50 |
| A | cis-1,2-Dichloroethene | 12.5 | 25 |
| A | cis-1,3-Dichloropropene | 12.5 | 25 |
| A | Cyclohexanone | 12.5 | 25 |
| A | Dibromochloromethane | 12.5 | 25 |
| A | Dibromomethane | 12.5 | 25 |
| A | Dichlorodifluoromethane | 12.5 | 50 |
| A | Dichlorofluoromethane | 12.5 | 25 |
| A | Diethyl ether | 125 | 250 |

| | | | |
|---|---|---|---|
| A | Diisopropyl ether | 25 | 50 |
| A | Ethyl Tertiary Butyl Ether | 12.5 | 50 |
| A | Ethylbenzene | 12.5 | 25 |
| A | Freon-113 | 12.5 | 25 |
| A | Hexachlorobutadiene | 25 | 50 |
| A | Iodomethane | 12.5 | 25 |
| A | Isopropylbenzene | 12.5 | 25 |
| A | m,p-Xylene | 12.5 | 25 |
| A | Methyl methacrylate | 12.5 | 25 |
| A | Methyl tert-butyl ether | 12.5 | 25 |
| A | Methylene chloride | 25 | 50 |
| A | n-Butylbenzene | 12.5 | 25 |
| A | n-Propylbenzene | 12.5 | 25 |
| A | Naphthalene | 25 | 50 |
| A | o-Xylene | 12.5 | 25 |
| A | sec-Butylbenzene | 12.5 | 25 |
| A | Styrene | 12.5 | 25 |
| A | tert-Butylbenzene | 12.5 | 25 |
| A | Tertiary Amyl Methyl Ether | 12.5 | 50 |
| A | Tertiary Butanol | 250 | 500 |
| A | Tetrachloroethene | 12.5 | 25 |
| A | Tetrahydrofuran | 125 | 250 |
| A | Toluene | 12.5 | 25 |
| A | trans-1,2-Dichloroethene | 12.5 | 25 |
| A | trans-1,3-Dichloropropene | 12.5 | 25 |
| A | trans-1,4-Dichloro-2-butene | 12.5 | 25 |
| A | Trichloroethene | 12.5 | 25 |
| A | Trichlorofluoromethane | 25 | 50 |
| A | Vinyl acetate | 50 | 250 |
| A | Vinyl chloride | 12.5 | 25 |
| I | 1,4-Dichlorobenzene-d4 | 0 | 0 |
| I | Chlorobenzene-d5 | 0 | 0 |
| I | Fluorobenzene | 0 | 0 |
| S | 1,2-Dichloroethane-d4 | 0 | 25 |
| S | 4-Bromofluorobenzene | 0 | 25 |
| S | Dibromofluoromethane | 0 | 25 |
| S | Toluene-d8 | 0 | 25 |

| AnalyteType | Analyte | MDL ug/L | PQL ug/L |
|---|---|---|---|
| A | 1,1,1,2-Tetrachloroethane | 0.5 | 2 |
| A | 1,1,1-Trichloroethane | 0.5 | 2 |
| A | 1,1,2,2-Tetrachloroethane | 0.5 | 2 |
| A | 1,1,2-Trichloroethane | 0.5 | 2 |
| A | 1,1-Dichloroethane | 0.5 | 2 |
| A | 1,1-Dichloroethene | 0.5 | 1 |
| A | 1,1-Dichloropropene | 0.5 | 2 |
| A | 1,2,3-Trichlorobenzene | 0.5 | 2 |
| A | 1,2,3-Trichloropropane | 0.5 | 2 |
| A | 1,2,4-Trichlorobenzene | 0.5 | 2 |
| A | 1,2,4-Trimethylbenzene | 0.5 | 2 |
| A | 1,2-Dibromo-3-chloropropane | 1.25 | 5 |
| A | 1,2-Dibromoethane | 0.5 | 2 |
| A | 1,2-Dichlorobenzene | 0.5 | 2 |
| A | 1,2-Dichloroethane | 0.5 | 2 |
| A | 1,2-Dichloropropane | 0.5 | 2 |
| A | 1,3,5-Trichlorobenzene | 0.5 | 2 |
| A | 1,3,5-Trimethylbenzene | 0.5 | 2 |
| A | 1,3-Dichlorobenzene | 0.5 | 2 |
| A | 1,3-Dichloropropane | 0.5 | 2 |
| A | 1,4-Dichlorobenzene | 0.5 | 2 |
| A | 1,4-Dioxane | 25 | 50 |
| A | 2,2-Dichloropropane | 0.5 | 2 |
| A | 2-Butanone | 2.5 | 10 |
| A | 2-Chloroethyl vinyl ether | 2 | 10 |
| A | 2-Chlorotoluene | 0.5 | 2 |
| A | 2-Hexanone | 2.5 | 10 |
| A | 4-Chlorotoluene | 0.5 | 2 |
| A | 4-Isopropyltoluene | 0.5 | 2 |
| A | 4-Methyl-2-pentanone | 2.5 | 10 |
| A | Acetone | 2.5 | 10 |
| A | Acrylonitrile | 0.5 | 2 |
| A | Benzene | 0.5 | 1 |
| A | Bromobenzene | 0.5 | 2 |
| A | Bromochloromethane | 0.5 | 2 |
| A | Bromodichloromethane | 0.5 | 2 |
| A | Bromoform | 0.5 | 2 |
| A | Bromomethane | 0.5 | 2 |
| A | Carbon disulfide | 0.5 | 2 |
| A | Carbon tetrachloride | 0.5 | 2 |
| A | Chlorobenzene | 0.5 | 2 |
| A | Chloroethane | 1.25 | 5 |
| A | Chloroform | 0.5 | 2 |
| A | Chloromethane | 1.25 | 3 |
| A | cis-1,2-Dichloroethene | 0.5 | 2 |
| A | cis-1,3-Dichloropropene | 0.5 | 1 |
| A | Cyclohexanone | 0.5 | 2 |
| A | Dibromochloromethane | 0.5 | 2 |
| A | Dibromomethane | 0.5 | 2 |
| A | Dichlorodifluoromethane | 1.25 | 5 |
| A | Dichlorofluoromethane | 0.5 | 2 |
| A | Diethyl ether | 1.25 | 5 |

| | | | |
|---|---|---|---|
| A | Diisopropyl ether | 1 | 2 |
| A | Ethyl Tertiary Butyl Ether | 1 | 2 |
| A | Ethylbenzene | 0.5 | 2 |
| A | Freon-113 | 0.5 | 2 |
| A | Hexachlorobutadiene | 0.5 | 2 |
| A | Iodomethane | 0.5 | 2 |
| A | Isopropylbenzene | 0.5 | 2 |
| A | m,p-Xylene | 0.5 | 2 |
| A | Methyl methacrylate | 0.5 | 2 |
| A | Methyl tert-butyl ether | 0.5 | 2 |
| A | Methylene chloride | 0.5 | 5 |
| A | n-Butylbenzene | 0.5 | 2 |
| A | n-Propylbenzene | 0.5 | 2 |
| A | Naphthalene | 1 | 5 |
| A | o-Xylene | 0.5 | 2 |
| A | sec-Butylbenzene | 0.5 | 2 |
| A | Styrene | 0.5 | 2 |
| A | tert-Butylbenzene | 0.5 | 2 |
| A | Tertiary Amyl Methyl Ether | 0.5 | 2 |
| A | Tertiary Butanol | 10 | 20 |
| A | Tetrachloroethene | 0.5 | 2 |
| A | Tetrahydrofuran | 2.5 | 10 |
| A | Toluene | 0.5 | 2 |
| A | trans-1,2-Dichloroethene | 0.5 | 2 |
| A | trans-1,3-Dichloropropene | 0.5 | 1 |
| A | trans-1,4-Dichloro-2-butene | 0.5 | 1 |
| A | Trichloroethene | 0.5 | 2 |
| A | Trichlorofluoromethane | 0.5 | 2 |
| A | Vinyl acetate | 0.5 | 2 |
| A | Vinyl chloride | 0.5 | 2 |
| I | 1,4-Dichlorobenzene-d4 | 0 | 0 |
| I | Chlorobenzene-d5 | 0 | 0 |
| I | Fluorobenzene | 0 | 0 |
| S | 1,2-Dichloroethane-d4 | 0.5 | 2 |
| S | 4-Bromofluorobenzene | 0.5 | 2 |
| S | Dibromofluoromethane | 0.5 | 2 |
| S | Toluene-d8 | 0.5 | 2 |

| AnalyteType | Analyte | MDL ug/Kg | PQL ug/Kg |
|---|---|---|---|
| A | 1,2,4,5-Tetrachlorobenzene | 50 | 250 |
| A | 1,2,4-Trichlorobenzene | 50 | 250 |
| A | 1,2-Dichlorobenzene | 50 | 250 |
| A | 1,2-Diphenylhydrazine (as Azobenzene) | 50 | 250 |
| A | 1,3-Dichlorobenzene | 50 | 250 |
| A | 1,4-Dichlorobenzene | 50 | 250 |
| A | 1,4-Dioxane | 0 | 0 |
| A | 2,4,5-Trichlorophenol | 50 | 250 |
| A | 2,4,6-Trichlorophenol | 50 | 250 |
| A | 2,4-Dichlorophenol | 50 | 250 |
| A | 2,4-Dimethylphenol | 50 | 250 |
| A | 2,4-Dinitrophenol | 100 | 500 |
| A | 2,4-Dinitrotoluene | 50 | 250 |
| A | 2,6-Dinitrotoluene | 50 | 250 |
| A | 2-Chloronaphthalene | 50 | 250 |
| A | 2-Chlorophenol | 50 | 250 |
| A | 2-Methylnaphthalene | 50 | 250 |
| A | 2-Methylphenol | 50 | 250 |
| A | 2-Nitroaniline | 100 | 500 |
| A | 2-Nitrophenol | 50 | 250 |
| A | 3,3´-Dichlorobenzidine | 50 | 250 |
| A | 3-Nitroaniline | 100 | 500 |
| A | 4,6-Dinitro-2-methylphenol | 100 | 500 |
| A | 4-Bromophenyl phenyl ether | 50 | 250 |
| A | 4-Chloro-3-methylphenol | 100 | 330 |
| A | 4-Chloroaniline | 50 | 250 |
| A | 4-Chlorophenyl phenyl ether | 50 | 250 |
| A | 4-Methylphenol | 50 | 250 |
| A | 4-Nitroaniline | 100 | 500 |
| A | 4-Nitrophenol | 100 | 500 |
| A | Acenaphthene | 50 | 250 |
| A | Acenaphthylene | 50 | 250 |
| A | Acetophenone | 50 | 250 |
| A | Aniline | 50 | 250 |
| A | Anthracene | 50 | 250 |
| A | Benz(a)anthracene | 50 | 250 |
| A | Benzidine | 100 | 250 |
| A | Benzo(a)pyrene | 50 | 250 |
| A | Benzo(b)fluoranthene | 50 | 250 |
| A | Benzo(g,h,i)perylene | 50 | 250 |
| A | Benzo(k)fluoranthene | 50 | 250 |
| A | Benzoic acid | 100 | 500 |
| A | Benzyl alcohol | 100 | 500 |
| A | Bis(2-chloroethoxy)methane | 50 | 250 |
| A | Bis(2-chloroethyl)ether | 50 | 250 |
| A | Bis(2-chloroisopropyl)ether | 50 | 250 |
| A | Bis(2-ethylhexyl)phthalate | 50 | 250 |
| A | Butyl benzyl phthalate | 50 | 250 |
| A | Carbazole | 50 | 250 |
| A | Chrysene | 50 | 250 |
| A | Di-n-butyl phthalate | 50 | 250 |
| A | Di-n-octyl phthalate | 50 | 250 |

| | | | |
|---|---|---|---|
| A | Dibenz(a,h)anthracene | 50 | 250 |
| A | Dibenzofuran | 50 | 250 |
| A | Diethyl phthalate | 50 | 250 |
| A | Dimethyl phthalate | 50 | 250 |
| A | Fluoranthene | 50 | 250 |
| A | Fluorene | 50 | 250 |
| A | Hexachlorobenzene | 50 | 250 |
| A | Hexachlorobutadiene | 50 | 250 |
| A | Hexachlorocyclopentadiene | 50 | 250 |
| A | Hexachloroethane | 50 | 250 |
| A | Indeno(1,2,3-cd)pyrene | 50 | 250 |
| A | Isophorone | 50 | 250 |
| A | N-Nitrosodi-n-propylamine | 50 | 250 |
| A | N-Nitrosodimethylamine | 100 | 500 |
| A | N-Nitrosodiphenylamine | 50 | 250 |
| A | Naphthalene | 50 | 250 |
| A | Nitrobenzene | 50 | 250 |
| A | Pentachloronitrobenzene | 100 | 500 |
| A | Pentachlorophenol | 100 | 500 |
| A | Phenanthrene | 50 | 250 |
| A | Phenol | 50 | 250 |
| A | Pyrene | 50 | 250 |
| A | Pyridine | 100 | 500 |
| I | 1,4-Dichlorobenzene-d4 | 0 | 0 |
| I | Acenaphthene-d10 | 0 | 0 |
| I | Chrysene-d12 | 0 | 0 |
| I | Naphthalene-d8 | 0 | 0 |
| I | Perylene-d12 | 0 | 0 |
| I | Phenanthrene-d10 | 0 | 0 |
| S | 1,2-Dichlorobenzene-d4 | 0 | 0 |
| S | 1-Methylnaphthalene-d10 | 0 | 0 |
| S | 2,4,6-Tribromophenol | 50 | 50 |
| S | 2-Chlorophenol-d4 | 0 | 0 |
| S | 2-Fluorobiphenyl | 50 | 50 |
| S | 2-Fluorophenol | 50 | 50 |
| S | 4-Terphenyl-d14 | 50 | 50 |
| S | Nitrobenzene-d5 | 50 | 50 |
| S | Phenol-d5 | 50 | 50 |
| S | Phenol-d6 | 0 | 0 |

| AnalyteType | Analyte | MDL ug/L | PQL ug/L |
|---|---|---|---|
| A | 1,2,4,5-Tetrachlorobenzene | 1 | 5 |
| A | 1,2,4-Trichlorobenzene | 1 | 5 |
| A | 1,2-Dichlorobenzene | 1 | 5 |
| A | 1,2-Diphenylhydrazine (as Azobenzene) | 1 | 10 |
| A | 1,3-Dichlorobenzene | 1 | 5 |
| A | 1,4-Dichlorobenzene | 1 | 5 |
| A | 2,4,5-Trichlorophenol | 1 | 10 |
| A | 2,4,6-Trichlorophenol | 1 | 10 |
| A | 2,4-Dichlorophenol | 1 | 10 |
| A | 2,4-Dimethylphenol | 1 | 10 |
| A | 2,4-Dinitrophenol | 2 | 20 |
| A | 2,4-Dinitrotoluene | 1 | 10 |
| A | 2,6-Dinitrotoluene | 1 | 10 |
| A | 2-Chloronaphthalene | 1 | 10 |
| A | 2-Chlorophenol | 1 | 5 |
| A | 2-Methylnaphthalene | 1 | 10 |
| A | 2-Methylphenol | 1 | 10 |
| A | 2-Nitroaniline | 2 | 20 |
| A | 2-Nitrophenol | 1 | 10 |
| A | 3,3′-Dichlorobenzidine | 1 | 10 |
| A | 3,3′-Dimethylbenzidine | 1 | 5 |
| A | 3-Nitroaniline | 2 | 20 |
| A | 4,6-Dinitro-2-methylphenol | 2 | 20 |
| A | 4-Bromophenyl phenyl ether | 1 | 10 |
| A | 4-Chloro-3-methylphenol | 2 | 20 |
| A | 4-Chloroaniline | 1 | 5 |
| A | 4-Chlorophenyl phenyl ether | 1 | 10 |
| A | 4-Methylphenol | 1 | 10 |
| A | 4-Nitroaniline | 2 | 20 |
| A | 4-Nitrophenol | 2 | 20 |
| A | Acenaphthene | 1 | 10 |
| A | Acenaphthylene | 1 | 10 |
| A | Acetophenone | 1 | 10 |
| A | Aniline | 2 | 5 |
| A | Anthracene | 1 | 10 |
| A | Benz(a)anthracene | 1 | 10 |
| A | Benzidine | 2 | 5 |
| A | Benzo(a)pyrene | 1 | 10 |
| A | Benzo(b)fluoranthene | 1 | 10 |
| A | Benzo(g,h,i)perylene | 1 | 10 |
| A | Benzo(k)fluoranthene | 1 | 10 |
| A | Benzoic acid | 2 | 20 |
| A | Benzyl alcohol | 2 | 20 |
| A | Bis(2-chloroethoxy)methane | 1 | 10 |
| A | Bis(2-chloroethyl)ether | 1 | 10 |
| A | Bis(2-chloroisopropyl)ether | 1 | 10 |
| A | Bis(2-ethylhexyl)phthalate | 1 | 5 |
| A | Butyl benzyl phthalate | 1 | 10 |
| A | Carbazole | 1 | 10 |
| A | Chrysene | 1 | 10 |
| A | Di-n-butyl phthalate | 1 | 10 |
| A | Di-n-octyl phthalate | 1 | 10 |

| | | | |
|---|---|---|---|
| A | Dibenz(a,h)anthracene | 1 | 10 |
| A | Dibenzofuran | 1 | 10 |
| A | Diethyl phthalate | 1 | 10 |
| A | Dimethyl phthalate | 1 | 10 |
| A | Fluoranthene | 1 | 10 |
| A | Fluorene | 1 | 10 |
| A | Hexachlorobenzene | 1 | 10 |
| A | Hexachlorobutadiene | 1 | 10 |
| A | Hexachlorocyclopentadiene | 2 | 10 |
| A | Hexachloroethane | 1 | 10 |
| A | Indeno(1,2,3-cd)pyrene | 1 | 10 |
| A | Isophorone | 1 | 10 |
| A | N-Nitrosodi-n-propylamine | 1 | 10 |
| A | N-Nitrosodimethylamine | 1 | 20 |
| A | N-Nitrosodiphenylamine | 1 | 5 |
| A | Naphthalene | 1 | 5 |
| A | Nitrobenzene | 1 | 5 |
| A | Pentachloronitrobenzene | 1 | 5 |
| A | Pentachlorophenol | 2 | 20 |
| A | Phenanthrene | 1 | 10 |
| A | Phenol | 1 | 10 |
| A | Pyrene | 1 | 10 |
| A | Pyridine | 2 | 20 |
| I | 1,4-Dichlorobenzene-d4 | 0 | 0 |
| I | Acenaphthene-d10 | 0 | 0 |
| I | Chrysene-d12 | 0 | 0 |
| I | Naphthalene-d8 | 0 | 0 |
| I | Perylene-d12 | 0 | 0 |
| I | Phenanthrene-d10 | 0 | 0 |
| S | 2,4,6-Tribromophenol | 1 | 1 |
| S | 2-Fluorobiphenyl | 1 | 1 |
| S | 2-Fluorophenol | 1 | 1 |
| S | 4-Terphenyl-d14 | 1 | 1 |
| S | Nitrobenzene-d5 | 1 | 1 |
| S | Phenol-d5 | 1 | 1 |

| AnalyteType | Analyte | MDL mg/Kg | PQL mg/Kg |
|---|---|---|---|
| A | Aluminum | 1.16 | 20 |
| A | Antimony | 0.78 | 4 |
| A | Arsenic | 0.96 | 5 |
| A | Barium | 0.05 | 20 |
| A | Beryllium | 0.004 | 0.25 |
| A | Boron | 1 | 25 |
| A | Cadmium | 0.01 | 0.5 |
| A | Calcium | 11.7 | 250 |
| A | Chromium | 0.05 | 1 |
| A | Cobalt | 0.21 | 5 |
| A | Copper | 0.28 | 2.5 |
| A | Iron | 1.7 | 10 |
| A | Lead | 0.61 | 5 |
| A | Lithium | 0 | 10 |
| A | Magnesium | 3.6 | 250 |
| A | Manganese | 0.146 | 1.5 |
| A | Molybdenum | 0.22 | 2.5 |
| A | Nickel | 0.24 | 4 |
| A | Potassium | 8.29 | 250 |
| A | Selenium | 1.11 | 12 |
| A | Silver | 0.057 | 1.4 |
| A | Sodium | 5.351 | 250 |
| A | Strontium | 0.025 | 1 |
| A | Thallium | 0.73 | 5 |
| A | Tin | 0.71 | 25 |
| A | Titanium | 0.3 | 10 |
| A | Vanadium | 0.276 | 5 |
| A | Zinc | 1.72 | 6 |

| AnalyteType | Analyte | MDL ug/L | PQL ug/L |
|---|---|---|---|
| A | Aluminum | 19 | 200 |
| A | Antimony | 5.24 | 20 |
| A | Arsenic | 3.11 | 50 |
| A | Barium | 1.51 | 200 |
| A | Beryllium | 0.106 | 4 |
| A | Boron | 29 | 250 |
| A | Cadmium | 0.1 | 4 |
| A | Calcium | 261.4 | 2500 |
| A | Chromium | 0.49 | 10 |
| A | Cobalt | 2.05 | 50 |
| A | Copper | 2.72 | 25 |
| A | Iron | 6.3 | 100 |
| A | Lead | 1.03 | 12.5 |
| A | Lithium | 20 | 100 |
| A | Magnesium | 14.73 | 2500 |
| A | Manganese | 0.593 | 15 |
| A | Molybdenum | 0.92 | 25 |
| A | Nickel | 1.56 | 40 |
| A | Potassium | 49.6 | 2500 |
| A | Selenium | 17.3 | 80 |
| A | Silver | 0.32 | 7 |
| A | Sodium | 29.9 | 2500 |
| A | Strontium | 0.421 | 10 |
| A | Thallium | 5.18 | 50 |
| A | Tin | 3.5 | 250 |
| A | Titanium | 0.53 | 100 |
| A | Vanadium | 0.605 | 50 |
| A | Zinc | 2.57 | 20 |

# AMRO Environmental Laboratories Corp.

**Date:** 23-May-13

**Test Code:** FING_S
**Test Number:** SW8015B
**Test Name:** TPH by GC/FID (modified 8015B)
**Matrix:** Soil **Units:** mg/Kg

## METHOD DETECTION / REPORTING LIMITS

**Updated:**

| Type | Analyte | MDL | PQL |
|---|---|---|---|
| A | Diesel Fuel/Fuel Oil #2 | 50 | 50 |
| A | Gasoline | 50 | 50 |
| A | Kerosene | 50 | 50 |
| A | Mineral Spirits | 50 | 50 |
| A | Motor Oil/Hydraulic Oil | 100 | 100 |
| A | Unidentified Hydrocarbons | 100 | 100 |
| S | o-Terphenyl | 0 | 0 |

## AMRO Environmental Laboratories Corp.

**Date:** 23-May-13

**Test Code:** FING_W
**Test Number:** SW8015B
**Test Name:** TPH by GC/FID (modified 8015B)
**Matrix:** Aqueous **Units:** mg/L

# METHOD DETECTION / REPORTING LIMITS

**Updated:**

| Type | Analyte | MDL | PQL |
|---|---|---|---|
| A | Diesel Fuel/Fuel Oil #2 | 0.05 | 0.05 |
| A | Gasoline | 0.05 | 0.05 |
| A | Kerosene | 0.05 | 0.05 |
| A | Mineral Spirits | 0.05 | 0.05 |
| A | Motor Oil/Hydraulic Oil | 0.1 | 0.1 |
| A | Unidentified Hydrocarbons | 0.1 | 0.1 |
| S | o-Terphenyl | 0 | 0 |

## AMRO Environmental Laboratories Corp.

**Date:** 23-May-13

**Test Code:** 8082_SSOX
**Test Number:** SW8082
**Test Name:** EPA 8082 PCBS IN SOIL/SOLIDS
**Matrix:** Soil **Units:** µg/Kg

# METHOD DETECTION / REPORTING LIMITS

**Updated:**

| Type | Analyte | MDL | PQL |
|---|---|---|---|
| A | Aroclor 1016 | 25 | 50 |
| A | Aroclor 1221 | 25 | 50 |
| A | Aroclor 1232 | 25 | 50 |
| A | Aroclor 1242 | 25 | 50 |
| A | Aroclor 1248 | 25 | 50 |
| A | Aroclor 1254 | 25 | 50 |
| A | Aroclor 1260 | 25 | 50 |
| A | Aroclor 1262 | 25 | 50 |
| A | Aroclor 1268 | 25 | 50 |
| S | Decachlorobiphenyl | 0 | 0 |
| S | Tetrachloro-m-xylene | 0 | 0 |

## AMRO Environmental Laboratories Corp.

**Date:** 23-May-13

**Test Code:** 8082_WX
**Test Number:** SW8082
**Test Name:** EPA 8082 PCBS IN WATER
**Matrix:** Aqueous **Units:** µg/L

# METHOD DETECTION / REPORTING LIMITS

**Updated:**

| Type | Analyte | MDL | PQL |
|---|---|---|---|
| A | Aroclor 1016 | 0.1 | 0.2 |
| A | Aroclor 1221 | 0.1 | 0.2 |
| A | Aroclor 1232 | 0.1 | 0.2 |
| A | Aroclor 1242 | 0.1 | 0.2 |
| A | Aroclor 1248 | 0.1 | 0.2 |
| A | Aroclor 1254 | 0.1 | 0.2 |
| A | Aroclor 1260 | 0.1 | 0.2 |
| A | Aroclor 1262 | 0.1 | 0.2 |
| A | Aroclor 1268 | 0.1 | 0.2 |
| S | Decachlorobiphenyl | 0 | 0 |
| S | Tetrachloro-m-xylene | 0 | 0 |

## AMRO Environmental Laboratories Corp.

**Date:** 23-May-13

**Test Code:** Hg_7471
**Test Number:** SW7471A
**Test Name:** EPA 7471 MERCURY, Soil
**Matrix:** Soil **Units:** mg/Kg

# METHOD DETECTION / REPORTING LIMITS

**Updated:**

| Type | Analyte | MDL | PQL |
|---|---|---|---|
| A | Mercury | 0.00192 | 0.05 |

## AMRO Environmental Laboratories Corp.

**Date:** 23-May-13

**Test Code:** HG_7470
**Test Number:** SW7470A
**Test Name:** EPA 7470 MERCURY, Total
**Matrix:** Aqueous **Units:** µg/L

# METHOD DETECTION / REPORTING LIMITS

**Updated:**

| Type | Analyte | MDL | PQL |
|---|---|---|---|
| A | Mercury | 0.0233 | 0.2 |

# AMRO Environmental Laboratories Corp.

**Date:** 04-Jun-13

**Test Code:** Sb_7041
**Test Number:** SW7041
**Test Name:** EPA 7041 ANTIMONY, Total
**Matrix:** Aqueous **Units:** µg/L

## METHOD DETECTION / REPORTING LIMITS

**Updated:**

| Type | Analyte | MDL | PQL |
|---|---|---|---|
| A | Antimony | 0.37 | 5 |

# AMRO Environmental Laboratories Corp.

**Date:** 04-Jun-13

**Test Code:** AS_7060
**Test Number:** SW7060A
**Test Name:** EPA 7060 ARSENIC, Total
**Matrix:** Aqueous **Units:** µg/L

## METHOD DETECTION / REPORTING LIMITS

**Updated:**

| Type | Analyte | MDL | PQL |
|---|---|---|---|
| A | Arsenic | 0.236 | 4 |

# AMRO Environmental Laboratories Corp.

**Date:** 04-Jun-13

**Test Code:** Se_7740
**Test Number:** SW7740
**Test Name:** EPA 7740 SELENIUM, Total
**Matrix:** Aqueous **Units:** µg/L

## METHOD DETECTION / REPORTING LIMITS

**Updated:**

| Type | Analyte | MDL | PQL |
|---|---|---|---|
| A | Selenium | 0.609 | 5 |

## AMRO Environmental Laboratories Corp.

**Date:** 04-Jun-13

**Test Code:** Tl_7841
**Test Number:** SW7841
**Test Name:** EPA 7841 THALLIUM, Total
**Matrix:** Aqueous **Units:** µg/L

# METHOD DETECTION / REPORTING LIMITS

**Updated:**

| Type | Analyte | MDL | PQL |
|---|---|---|---|
| A | Thallium | 0.509 | 2 |

# AMRO Environmental Laboratories Corp.

**Date:** 21-Jun-13

**Test Code:** Sb_7041
**Test Number:** SW7041
**Test Name:** EPA 7041 ANTIMONY, Total
**Matrix:** Aqueous
**Sample Type:** LCSD

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | Antimony | 80 | 120 | 20 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

**Date:** 21-Jun-13

**Test Code:** AS_7060
**Test Number:** SW7060A
**Test Name:** EPA 7060 ARSENIC, Total
**Matrix:** Aqueous
**Sample Type:** LCSD

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | Arsenic | 80 | 120 | 20 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

**Date:** 21-Jun-13

**Test Code:** Se_7740
**Test Number:** SW7740
**Test Name:** EPA 7740 SELENIUM, Total
**Matrix:** Aqueous
**Sample Type:** LCSD

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | Selenium | 80 | 120 | 20 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

**Date:** 21-Jun-13

**Test Code:** Tl_7841
**Test Number:** SW7841
**Test Name:** EPA 7841 THALLIUM, Total
**Matrix:** Aqueous
**Sample Type:** LCSD

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | Thallium | 80 | 120 | 20 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

Date: 23-May-13

**Test Code:** 8260_MS
**Test Number:** SW8260B
**Test Name:** EPA 8260B VOLATILES by GC/MS, Medi
**Matrix:** Soil
**Sample Type:** LCSF

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | 1,1,1,2-Tetrachloroethane | 63 | 113 | 20 |
| A | 1,1,1-Trichloroethane | 59 | 131 | 20 |
| A | 1,1,2,2-Tetrachloroethane | 64 | 133 | 20 |
| A | 1,1,2-Trichloroethane | 72 | 121 | 20 |
| A | 1,1-Dichloroethane | 70 | 122 | 20 |
| A | 1,1-Dichloroethene | 51 | 134 | 20 |
| A | 1,1-Dichloropropene | 71 | 130 | 20 |
| A | 1,2,3-Trichlorobenzene | 74 | 139 | 20 |
| A | 1,2,3-Trichloropropane | 64 | 134 | 20 |
| A | 1,2,4-Trichlorobenzene | 80 | 132 | 20 |
| A | 1,2,4-Trimethylbenzene | 75 | 127 | 20 |
| A | 1,2-Dibromo-3-chloropropane | 41 | 129 | 20 |
| A | 1,2-Dibromoethane | 73 | 122 | 20 |
| A | 1,2-Dichlorobenzene | 75 | 128 | 20 |
| A | 1,2-Dichloroethane | 65 | 126 | 20 |
| A | 1,2-Dichloropropane | 81 | 125 | 20 |
| A | 1,3,5-Trimethylbenzene | 76 | 127 | 20 |
| A | 1,3-Dichlorobenzene | 74 | 129 | 20 |
| A | 1,3-Dichloropropane | 78 | 130 | 20 |
| A | 1,4-Dichlorobenzene | 77 | 129 | 20 |
| A | 2,2-Dichloropropane | 59 | 145 | 20 |
| A | 2-Butanone | 41 | 145 | 20 |
| A | 2-Chlorotoluene | 72 | 127 | 20 |
| A | 2-Hexanone | 39 | 131 | 20 |
| A | 4-Chlorotoluene | 72 | 124 | 20 |
| A | 4-Isopropyltoluene | 79 | 134 | 20 |
| A | 4-Methyl-2-pentanone | 63 | 127 | 20 |
| A | Acetone | 25 | 130 | 20 |
| A | Benzene | 72 | 128 | 20 |
| A | Bromobenzene | 73 | 126 | 20 |
| A | Bromochloromethane | 71 | 123 | 20 |
| A | Bromodichloromethane | 51 | 110 | 20 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

Date: 23-May-13

**Test Code:** 8260_MS
**Test Number:** SW8260B
**Test Name:** EPA 8260B VOLATILES by GC/MS, Medi
**Matrix:** Soil
**Sample Type:** LCSF

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | Bromoform | 41 | 120 | 20 |
| A | Bromomethane | 53 | 151 | 20 |
| A | Carbon disulfide | 3.4 | 164 | 20 |
| A | Carbon tetrachloride | 45 | 127 | 20 |
| A | Chlorobenzene | 77 | 123 | 20 |
| A | Chloroethane | 41 | 132 | 20 |
| A | Chloroform | 70 | 122 | 20 |
| A | Chloromethane | 31 | 155 | 20 |
| A | cis-1,2-Dichloroethene | 72 | 123 | 20 |
| A | cis-1,3-Dichloropropene | 60 | 120 | 20 |
| A | Dibromochloromethane | 47 | 102 | 20 |
| A | Dibromomethane | 72 | 123 | 20 |
| A | Dichlorodifluoromethane | 6.3 | 179 | 20 |
| A | Diethyl ether | 46 | 123 | 20 |
| A | Ethylbenzene | 75 | 123 | 20 |
| A | Hexachlorobutadiene | 52 | 132 | 20 |
| A | Isopropylbenzene | 74 | 132 | 20 |
| A | m,p-Xylene | 78 | 124 | 20 |
| A | Methyl tert-butyl ether | 64 | 117 | 20 |
| A | Methylene chloride | 40 | 146 | 20 |
| A | n-Butylbenzene | 78 | 136 | 20 |
| A | n-Propylbenzene | 73 | 133 | 20 |
| A | Naphthalene | 71 | 135 | 20 |
| A | o-Xylene | 77 | 124 | 20 |
| A | sec-Butylbenzene | 76 | 137 | 20 |
| A | Styrene | 81 | 128 | 20 |
| A | tert-Butylbenzene | 75 | 133 | 20 |
| A | Tetrachloroethene | 77 | 132 | 20 |
| A | Tetrahydrofuran | 60 | 143 | 20 |
| A | Toluene | 70 | 127 | 20 |
| A | trans-1,2-Dichloroethene | 63 | 123 | 20 |
| A | trans-1,3-Dichloropropene | 56 | 113 | 20 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

Date: 23-May-13

**Test Code:** 8260_MS
**Test Number:** SW8260B
**Test Name:** EPA 8260B VOLATILES by GC/MS, Medi
**Matrix:** Soil
**Sample Type:** LCSF

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | Trichloroethene | 72 | 126 | 20 |
| A | Trichlorofluoromethane | 27 | 156 | 20 |
| A | Vinyl chloride | 51 | 160 | 20 |
| S | 1,2-Dichloroethane-d4 | 47 | 140 | 0 |
| S | 4-Bromofluorobenzene | 44 | 135 | 0 |
| S | Dibromofluoromethane | 51 | 137 | 0 |
| S | Toluene-d8 | 55 | 140 | 0 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

Date: 23-May-13

**Test Code:** 8260_W
**Test Number:** SW8260B
**Test Name:** EPA 8260B VOLATILES by GC/MS
**Matrix:** Aqueous
**Sample Type:** LCSF

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | 1,1,1,2-Tetrachloroethane | 65 | 133 | 20 |
| A | 1,1,1-Trichloroethane | 68 | 145 | 20 |
| A | 1,1,2,2-Tetrachloroethane | 65 | 132 | 20 |
| A | 1,1,2-Trichloroethane | 79 | 122 | 20 |
| A | 1,1-Dichloroethane | 81 | 131 | 20 |
| A | 1,1-Dichloroethene | 77 | 139 | 20 |
| A | 1,1-Dichloropropene | 71 | 141 | 20 |
| A | 1,2,3-Trichlorobenzene | 63 | 135 | 20 |
| A | 1,2,3-Trichloropropane | 64 | 139 | 20 |
| A | 1,2,4-Trichlorobenzene | 73 | 137 | 20 |
| A | 1,2,4-Trimethylbenzene | 79 | 125 | 20 |
| A | 1,2-Dibromo-3-chloropropane | 44 | 122 | 20 |
| A | 1,2-Dibromoethane | 71 | 124 | 20 |
| A | 1,2-Dichlorobenzene | 82 | 123 | 20 |
| A | 1,2-Dichloroethane | 61 | 140 | 20 |
| A | 1,2-Dichloropropane | 81 | 134 | 20 |
| A | 1,3,5-Trimethylbenzene | 76 | 125 | 20 |
| A | 1,3-Dichlorobenzene | 86 | 125 | 20 |
| A | 1,3-Dichloropropane | 81 | 129 | 20 |
| A | 1,4-Dichlorobenzene | 82 | 126 | 20 |
| A | 2,2-Dichloropropane | 47 | 155 | 20 |
| A | 2-Butanone | 47 | 141 | 20 |
| A | 2-Chlorotoluene | 78 | 121 | 20 |
| A | 2-Hexanone | 41 | 138 | 20 |
| A | 4-Chlorotoluene | 82 | 122 | 20 |
| A | 4-Isopropyltoluene | 66 | 132 | 20 |
| A | 4-Methyl-2-pentanone | 54 | 124 | 20 |
| A | Acetone | 44 | 133 | 20 |
| A | Benzene | 75 | 129 | 20 |
| A | Bromobenzene | 82 | 119 | 20 |
| A | Bromochloromethane | 77 | 138 | 20 |
| A | Bromodichloromethane | 63 | 118 | 20 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

Date: 23-May-13

**Test Code:** 8260_W
**Test Number:** SW8260B
**Test Name:** EPA 8260B VOLATILES by GC/MS
**Matrix:** Aqueous
**Sample Type:** LCSF

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | Bromoform | 44 | 115 | 20 |
| A | Bromomethane | 53 | 128 | 20 |
| A | Carbon disulfide | 55 | 129 | 20 |
| A | Carbon tetrachloride | 58 | 130 | 20 |
| A | Chlorobenzene | 86 | 121 | 20 |
| A | Chloroethane | 65 | 138 | 20 |
| A | Chloroform | 69 | 132 | 20 |
| A | Chloromethane | 51 | 149 | 20 |
| A | cis-1,2-Dichloroethene | 78 | 128 | 20 |
| A | cis-1,3-Dichloropropene | 65 | 115 | 20 |
| A | Dibromochloromethane | 59 | 119 | 20 |
| A | Dibromomethane | 76 | 123 | 20 |
| A | Dichlorodifluoromethane | 25 | 168 | 20 |
| A | Diethyl ether | 73 | 121 | 20 |
| A | Ethylbenzene | 81 | 125 | 20 |
| A | Hexachlorobutadiene | 70 | 145 | 20 |
| A | Isopropylbenzene | 75 | 139 | 20 |
| A | m,p-Xylene | 81 | 125 | 20 |
| A | Methyl tert-butyl ether | 66 | 130 | 20 |
| A | Methylene chloride | 77 | 133 | 20 |
| A | n-Butylbenzene | 59 | 143 | 20 |
| A | n-Propylbenzene | 73 | 129 | 20 |
| A | Naphthalene | 67 | 128 | 20 |
| A | o-Xylene | 68 | 134 | 20 |
| A | sec-Butylbenzene | 69 | 132 | 20 |
| A | Styrene | 66 | 133 | 20 |
| A | tert-Butylbenzene | 69 | 129 | 20 |
| A | Tetrachloroethene | 87 | 137 | 20 |
| A | Tetrahydrofuran | 63 | 144 | 20 |
| A | Toluene | 81 | 123 | 20 |
| A | trans-1,2-Dichloroethene | 79 | 128 | 20 |
| A | trans-1,3-Dichloropropene | 55 | 126 | 20 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

Date: 23-May-13

**Test Code:** 8260_W
**Test Number:** SW8260B
**Test Name:** EPA 8260B VOLATILES by GC/MS
**Matrix:** Aqueous
**Sample Type:** LCSF

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | Trichloroethene | 81 | 129 | 20 |
| A | Trichlorofluoromethane | 56 | 157 | 20 |
| A | Vinyl chloride | 59 | 152 | 20 |
| S | 1,2-Dichloroethane-d4 | 73 | 135 | 0 |
| S | 4-Bromofluorobenzene | 77 | 119 | 0 |
| S | Dibromofluoromethane | 82 | 122 | 0 |
| S | Toluene-d8 | 82 | 117 | 0 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

Date: 23-May-13

**Test Code:** 8270_S
**Test Number:** SW8270C
**Test Name:** EPA 8270C SEMIVOLATILE ORGANICS,
**Matrix:** Soil
**Sample Type:** LCSDF

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | 1,2,4-Trichlorobenzene | 33 | 89 | 50 |
| A | 1,2-Dichlorobenzene | 31 | 86 | 50 |
| A | 1,2-Diphenylhydrazine (as Azobenzene) | 43 | 106 | 50 |
| A | 1,3-Dichlorobenzene | 30 | 83 | 50 |
| A | 1,4-Dichlorobenzene | 31 | 82 | 50 |
| A | 2,4,5-Trichlorophenol | 43 | 103 | 50 |
| A | 2,4,6-Trichlorophenol | 41 | 100 | 50 |
| A | 2,4-Dichlorophenol | 38 | 99 | 50 |
| A | 2,4-Dimethylphenol | 38 | 92 | 50 |
| A | 2,4-Dinitrophenol | 10 | 107 | 50 |
| A | 2,4-Dinitrotoluene | 47 | 106 | 50 |
| A | 2,6-Dinitrotoluene | 44 | 106 | 50 |
| A | 2-Chloronaphthalene | 39 | 97 | 50 |
| A | 2-Chlorophenol | 35 | 89 | 50 |
| A | 2-Methylnaphthalene | 36 | 92 | 50 |
| A | 2-Methylphenol | 38 | 92 | 50 |
| A | 2-Nitroaniline | 46 | 103 | 50 |
| A | 2-Nitrophenol | 34 | 94 | 50 |
| A | 3,3´-Dichlorobenzidine | 40 | 94 | 50 |
| A | 3-Nitroaniline | 43 | 99 | 50 |
| A | 4,6-Dinitro-2-methylphenol | 19 | 111 | 50 |
| A | 4-Bromophenyl phenyl ether | 42 | 106 | 50 |
| A | 4-Chloro-3-methylphenol | 43 | 99 | 50 |
| A | 4-Chloroaniline | 32 | 86 | 50 |
| A | 4-Chlorophenyl phenyl ether | 42 | 100 | 50 |
| A | 4-Methylphenol | 39 | 93 | 50 |
| A | 4-Nitroaniline | 45 | 103 | 50 |
| A | 4-Nitrophenol | 40 | 109 | 50 |
| A | Acenaphthene | 40 | 93 | 50 |
| A | Acenaphthylene | 39 | 93 | 50 |
| A | Anthracene | 44 | 104 | 50 |
| A | Benz(a)anthracene | 45 | 107 | 50 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

Date: 23-May-13

**Test Code:** 8270_S
**Test Number:** SW8270C
**Test Name:** EPA 8270C SEMIVOLATILE ORGANICS,
**Matrix:** Soil
**Sample Type:** LCSDF

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | Benzo(a)pyrene | 48 | 106 | 50 |
| A | Benzo(b)fluoranthene | 45 | 106 | 50 |
| A | Benzo(g,h,i)perylene | 47 | 105 | 50 |
| A | Benzo(k)fluoranthene | 47 | 106 | 50 |
| A | Benzoic acid | 10 | 55 | 50 |
| A | Benzyl alcohol | 34 | 94 | 50 |
| A | Bis(2-chloroethoxy)methane | 34 | 93 | 50 |
| A | Bis(2-chloroethyl)ether | 32 | 87 | 50 |
| A | Bis(2-chloroisopropyl)ether | 29 | 92 | 50 |
| A | Bis(2-ethylhexyl)phthalate | 44 | 110 | 50 |
| A | Butyl benzyl phthalate | 44 | 111 | 50 |
| A | Carbazole | 46 | 108 | 50 |
| A | Chrysene | 49 | 107 | 50 |
| A | Di-n-butyl phthalate | 45 | 107 | 50 |
| A | Di-n-octyl phthalate | 47 | 107 | 50 |
| A | Dibenz(a,h)anthracene | 49 | 105 | 50 |
| A | Dibenzofuran | 43 | 98 | 50 |
| A | Diethyl phthalate | 45 | 103 | 50 |
| A | Dimethyl phthalate | 44 | 100 | 50 |
| A | Fluoranthene | 45 | 107 | 50 |
| A | Fluorene | 42 | 98 | 50 |
| A | Hexachlorobenzene | 43 | 107 | 50 |
| A | Hexachlorobutadiene | 34 | 93 | 50 |
| A | Hexachlorocyclopentadiene | 21 | 89 | 50 |
| A | Hexachloroethane | 32 | 85 | 50 |
| A | Indeno(1,2,3-cd)pyrene | 46 | 106 | 50 |
| A | Isophorone | 36 | 91 | 50 |
| A | N-Nitrosodi-n-propylamine | 36 | 87 | 50 |
| A | N-Nitrosodiphenylamine | 43 | 105 | 50 |
| A | Naphthalene | 33 | 90 | 50 |
| A | Nitrobenzene | 35 | 92 | 50 |
| A | Pentachlorophenol | 32 | 99 | 50 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

Date: 23-May-13

**Test Code:** 8270_S
**Test Number:** SW8270C
**Test Name:** EPA 8270C SEMIVOLATILE ORGANICS,
**Matrix:** Soil
**Sample Type:** LCSDF

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | Phenanthrene | 44 | 101 | 50 |
| A | Phenol | 37 | 91 | 50 |
| A | Pyrene | 46 | 102 | 50 |
| S | 2,4,6-Tribromophenol | 33 | 117 | 0 |
| S | 2-Fluorobiphenyl | 26 | 100 | 0 |
| S | 2-Fluorophenol | 21 | 102 | 0 |
| S | 4-Terphenyl-d14 | 40 | 116 | 0 |
| S | Nitrobenzene-d5 | 19 | 107 | 0 |
| S | Phenol-d5 | 25 | 106 | 0 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

Date: 23-May-13

**Test Code:** 8270_W
**Test Number:** SW8270C
**Test Name:** EPA 8270C SEMIVOLATILE ORGANICS,
**Matrix:** Aqueous
**Sample Type:** LCSDF

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| a | 1,2,4-Trichlorobenzene | 45 | 104 | 50 |
| A | 1,2-Dichlorobenzene | 33 | 103 | 50 |
| A | 1,2-Diphenylhydrazine | 44 | 125 | 50 |
| A | 1,2-Diphenylhydrazine (as Azobenzene) | 53 | 123 | 50 |
| A | 1,3-Dichlorobenzene | 38 | 100 | 50 |
| A | 1,4-Dichlorobenzene | 40 | 98 | 50 |
| A | 2,4,5-Trichlorophenol | 58 | 115 | 50 |
| A | 2,4,6-Trichlorophenol | 57 | 113 | 50 |
| A | 2,4-Dichlorophenol | 54 | 106 | 50 |
| A | 2,4-Dimethylphenol | 37 | 100 | 50 |
| A | 2,4-Dinitrophenol | 29 | 112 | 50 |
| A | 2,4-Dinitrotoluene | 58 | 116 | 50 |
| A | 2,6-Dinitrotoluene | 56 | 116 | 50 |
| A | 2-Chloronaphthalene | 49 | 110 | 50 |
| A | 2-Chlorophenol | 51 | 98 | 50 |
| A | 2-Methylnaphthalene | 48 | 103 | 50 |
| A | 2-Methylphenol | 40 | 98 | 50 |
| A | 2-Nitroaniline | 51 | 125 | 50 |
| A | 2-Nitrophenol | 51 | 112 | 50 |
| A | 3,3´-Dichlorobenzidine | 40 | 109 | 50 |
| A | 3-Nitroaniline | 46 | 124 | 50 |
| A | 4,6-Dinitro-2-methylphenol | 44 | 112 | 50 |
| A | 4-Bromophenyl phenyl ether | 58 | 113 | 50 |
| A | 4-Chloro-3-methylphenol | 51 | 112 | 50 |
| A | 4-Chloroaniline | 43 | 106 | 50 |
| A | 4-Chlorophenyl phenyl ether | 56 | 108 | 50 |
| A | 4-Methylphenol | 34 | 91 | 50 |
| A | 4-Nitroaniline | 47 | 119 | 50 |
| A | 4-Nitrophenol | 20 | 57 | 50 |
| A | Acenaphthene | 54 | 106 | 50 |
| A | Acenaphthylene | 52 | 105 | 50 |
| A | Anthracene | 56 | 110 | 50 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

Date: 23-May-13

**Test Code:** 8270_W
**Test Number:** SW8270C
**Test Name:** EPA 8270C SEMIVOLATILE ORGANICS,
**Matrix:** Aqueous
**Sample Type:** LCSDF

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | Benz(a)anthracene | 57 | 115 | 50 |
| A | Benzo(a)pyrene | 53 | 114 | 50 |
| A | Benzo(b)fluoranthene | 54 | 116 | 50 |
| A | Benzo(g,h,i)perylene | 57 | 115 | 50 |
| A | Benzo(k)fluoranthene | 54 | 117 | 50 |
| A | Benzoic acid | 10 | 65 | 50 |
| A | Benzyl alcohol | 33 | 104 | 50 |
| A | Bis(2-chloroethoxy)methane | 46 | 113 | 50 |
| A | Bis(2-chloroethyl)ether | 47 | 106 | 50 |
| A | Bis(2-chloroisopropyl)ether | 36 | 115 | 50 |
| A | Bis(2-ethylhexyl)phthalate | 61 | 120 | 50 |
| A | Butyl benzyl phthalate | 45 | 129 | 50 |
| A | Carbazole | 56 | 117 | 50 |
| A | Chrysene | 55 | 116 | 50 |
| A | Di-n-butyl phthalate | 56 | 118 | 50 |
| A | Di-n-octyl phthalate | 58 | 121 | 50 |
| A | Dibenz(a,h)anthracene | 55 | 116 | 50 |
| A | Dibenzofuran | 56 | 108 | 50 |
| A | Diethyl phthalate | 41 | 115 | 50 |
| A | Dimethyl phthalate | 10 | 129 | 50 |
| A | Fluoranthene | 54 | 112 | 50 |
| A | Fluorene | 54 | 107 | 50 |
| A | Hexachlorobenzene | 58 | 114 | 50 |
| A | Hexachlorobutadiene | 32 | 112 | 50 |
| A | Hexachlorocyclopentadiene | 10 | 92 | 50 |
| A | Hexachloroethane | 29 | 107 | 50 |
| A | Indeno(1,2,3-cd)pyrene | 53 | 117 | 50 |
| A | Isophorone | 46 | 112 | 50 |
| A | N-Nitrosodi-n-propylamine | 48 | 110 | 50 |
| A | N-Nitrosodiphenylamine | 56 | 113 | 50 |
| A | Naphthalene | 41 | 105 | 50 |
| A | Nitrobenzene | 45 | 112 | 50 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

Date: 23-May-13

**Test Code:** 8270_W
**Test Number:** SW8270C
**Test Name:** EPA 8270C SEMIVOLATILE ORGANICS,
**Matrix:** Aqueous
**Sample Type:** LCSDF

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | Pentachlorophenol | 34 | 109 | 50 |
| A | Phenanthrene | 56 | 109 | 50 |
| A | Phenol | 16 | 54 | 50 |
| A | Pyrene | 58 | 115 | 50 |
| S | 2,4,6-Tribromophenol | 54 | 127 | 0 |
| S | 2-Fluorobiphenyl | 48 | 107 | 0 |
| S | 2-Fluorophenol | 25 | 69 | 0 |
| S | 4-Terphenyl-d14 | 37 | 125 | 0 |
| S | Nitrobenzene-d5 | 42 | 117 | 0 |
| S | Phenol-d5 | 15 | 54 | 0 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

Date: 23-May-13

**Test Code:** 6010_SOIL
**Test Number:** SW6010B
**Test Name:** EPA 6010B ICP METALS, 3051/6010
**Matrix:** Soil
**Sample Type:** LCSD

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | Aluminum | 80 | 120 | 20 |
| A | Antimony | 80 | 120 | 20 |
| A | Arsenic | 80 | 120 | 20 |
| A | Barium | 80 | 120 | 20 |
| A | Beryllium | 80 | 120 | 20 |
| A | Boron | 80 | 120 | 20 |
| A | Cadmium | 80 | 120 | 20 |
| A | Calcium | 80 | 120 | 20 |
| A | Chromium | 80 | 120 | 20 |
| A | Cobalt | 80 | 120 | 20 |
| A | Copper | 80 | 120 | 20 |
| A | Iron | 80 | 120 | 20 |
| A | Lead | 80 | 120 | 20 |
| A | Lithium | 0 | 0 | 0 |
| A | Magnesium | 80 | 120 | 20 |
| A | Manganese | 80 | 120 | 20 |
| A | Molybdenum | 80 | 120 | 20 |
| A | Nickel | 80 | 120 | 20 |
| A | Potassium | 80 | 120 | 20 |
| A | Selenium | 80 | 120 | 20 |
| A | Silver | 80 | 120 | 20 |
| A | Sodium | 80 | 120 | 20 |
| A | Strontium | 80 | 120 | 20 |
| A | Thallium | 80 | 120 | 20 |
| A | Tin | 80 | 120 | 20 |
| A | Titanium | 80 | 120 | 20 |
| A | Vanadium | 80 | 120 | 20 |
| A | Zinc | 80 | 120 | 20 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

Date: 23-May-13

**Test Code:** 6010
**Test Number:** SW6010B
**Test Name:** ICP METALS, TOTAL
**Matrix:** Aqueous
**Sample Type:** LCSD

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | Aluminum | 80 | 120 | 20 |
| A | Antimony | 80 | 120 | 20 |
| A | Arsenic | 80 | 120 | 20 |
| A | Barium | 80 | 120 | 20 |
| A | Beryllium | 80 | 120 | 20 |
| A | Boron | 80 | 120 | 20 |
| A | Cadmium | 80 | 120 | 20 |
| A | Calcium | 80 | 120 | 20 |
| A | Chromium | 80 | 120 | 20 |
| A | Cobalt | 80 | 120 | 20 |
| A | Copper | 80 | 120 | 20 |
| A | Iron | 80 | 120 | 20 |
| A | Lead | 80 | 120 | 20 |
| A | Lithium | 80 | 120 | 20 |
| A | Magnesium | 80 | 120 | 20 |
| A | Manganese | 80 | 120 | 20 |
| A | Molybdenum | 80 | 120 | 20 |
| A | Nickel | 80 | 120 | 20 |
| A | Potassium | 80 | 120 | 20 |
| A | Selenium | 80 | 120 | 20 |
| A | Silver | 80 | 120 | 20 |
| A | Sodium | 80 | 120 | 20 |
| A | Strontium | 80 | 120 | 20 |
| A | Thallium | 80 | 120 | 20 |
| A | Tin | 80 | 120 | 20 |
| A | Titanium | 80 | 120 | 20 |
| A | Vanadium | 80 | 120 | 20 |
| A | Zinc | 80 | 120 | 20 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

**Date:** 23-May-13

**Test Code:** FING_S
**Test Number:** SW8015B
**Test Name:** TPH by GC/FID (modified 8015B)
**Matrix:** Soil
**Sample Type:** LCSD

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | Diesel Fuel/Fuel Oil #2 | 40 | 140 | 40 |
| S | o-Terphenyl | 40 | 140 | 0 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

**Date:** 23-May-13

**Test Code:** FING_W
**Test Number:** SW8015B
**Test Name:** TPH by GC/FID (modified 8015B)
**Matrix:** Aqueous
**Sample Type:** LCSD

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | Diesel Fuel/Fuel Oil #2 | 42 | 119 | 40 |
| S | o-Terphenyl | 31 | 131 | 0 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

Date: 23-May-13

**Test Code:** 8082_SSOX
**Test Number:** SW8082
**Test Name:** EPA 8082 PCBS IN SOIL/SOLIDS
**Matrix:** Soil
**Sample Type:** LCSD

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | Aroclor 1016 | 70.9 | 125 | 50 |
| A | Aroclor 1260 | 60.1 | 126 | 50 |
| S | Decachlorobiphenyl | 30 | 150 | 0 |
| S | Tetrachloro-m-xylene | 30 | 150 | 0 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

Date: 23-May-13

**Test Code:** 8082_WX
**Test Number:** SW8082
**Test Name:** EPA 8082 PCBS IN WATER
**Matrix:** Aqueous
**Sample Type:** LCSD

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | Aroclor 1016 | 40 | 140 | 50 |
| A | Aroclor 1260 | 40 | 140 | 50 |
| S | Decachlorobiphenyl | 30 | 150 | 0 |
| S | Tetrachloro-m-xylene | 30 | 150 | 0 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

Date: 23-May-13

**Test Code:** Hg_7471
**Test Number:** SW7471A
**Test Name:** EPA 7471 MERCURY, Soil
**Matrix:** Soil
**Sample Type:** LCSD

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | Mercury | 80 | 120 | 20 |

A = Target Analyte S = Surrogate

# AMRO Environmental Laboratories Corp.

Date: 23-May-13

**Test Code:** HG_7470
**Test Number:** SW7470A
**Test Name:** EPA 7470 MERCURY, Total
**Matrix:** Aqueous
**Sample Type:** LCSD

## Control Limits

| Type | Analyte | Lower Control Limit | Upper Control Limit | RPD Limit |
|---|---|---|---|---|
| A | Mercury | 80 | 120 | 20 |

A = Target Analyte S = Surrogate

**Eurofins Lancaster Laboratories**

**LBG ENGINEERING SERVICES, P.C.**

# Environmental Quality Policy Manual

## Prepared by

Amy L. Doupé, QA Principal Specialist — Date: 01/23/2012

## Approvals

Harolyn Clow, Manager, Environmental Microbiology — Date: 01/23/2012

Duane Luckenbill, Director, Environmental Chemistry — Date: 1/24/2012

Timothy Oostdyk, President — Date: 1/31/2012

J. Wilson Hershey, Chairman of the Board — Date: 1/25/2012

Kathleen M. Loewen, Quality Assurance Director — Date: 2/3/2012

# Table of Contents

**1. INTRODUCTION ..... 6**

1.1. Our Unique Promise of Value ..... 6
1.2. Mission Statement ..... 6
1.3. Quality Policy ..... 6
1.4. Statement of Values ..... 7
1.5. Sample Flow-Through Diagram ..... 8
1.6. Certifications, Accreditations, and Registrations ..... 9

**2. ORGANIZATION AND PERSONNEL ..... 9**

2.1. Company Overview and History ..... 9
2.2. Organizational Structure ..... 10
2.3. Management Responsibilities ..... 10
2.4. Overview of the Quality Assurance Program ..... 10
2.5 Quality Assurance Responsibilities ..... 11
2.6. Communication of Quality Issues to Management ..... 12
2.7. Personnel Qualifications and Responsibilities ..... 12
2.8. Relationship of Functional Groups and the Quality Assurance Program ..... 13
2.9. Balancing Laboratory Capacity and Workload ..... 13
2.10. Identification of Approved Signatories ..... 14
2.11. Personnel Training ..... 14
2.12. Regulatory Training ..... 15
2.13. Employee Safety ..... 15
2.14. Client Services/Project Management Responsibilities ..... 16
2.15. Confidentiality ..... 17
2.16. Business Conduct ..... 17
2.17. Operational Integrity ..... 17

**3. BUILDINGS AND FACILITIES ..... 18**

3.1. Facility ..... 18
3.2. Security ..... 19
3.3. Disaster Recovery ..... 19
3.4. Environmental Monitoring ..... 19
3.5. Water Systems ..... 20
3.6. Housekeeping/Cleaning ..... 20
3.7. Insect & Rodent Control ..... 20
3.8. Emergency Power Supply ..... 21
3.9. Facility Changes ..... 21

**4. DOCUMENT CONTROL ..... 21**

4.1. Hierarchy of Internal Operating Procedures ..... 21
4.2. Document Approval, Issue, Control, and Maintenance ..... 24
4.3. Client-Supplied Methods and Documentation ..... 24
4.4. Laboratory Notebooks, Logbooks, and Forms ..... 25
4.5. Control of External Documents ..... 25

**5. SAMPLE HANDLING ..... 26**

5.1. Sample Collection ..... 26
5.2. Sample Receipt and Entry ..... 27
5.3. Sample Identification and Tracking ..... 28
5.4. Sample Storage ..... 28

5.5. Sample Return/Disposal ..... 28
5.6. Chain of Custody ..... 29
5.7. Representativeness of Samples ..... 29

**6. TECHNICAL REQUIREMENTS – TRACEABILITY OF MEASUREMENTS ..... 29**

6.1. Reagents and Solvents ..... 29
6.2. Media ..... 30
6.3. Calibration Standards ..... 30
6.4. Equipment and Instrumentation ..... 31
6.5. Computerized Systems and Computer Software ..... 33
6.6. Change Control ..... 36
6.7. Labware Cleaning ..... 36

**7. PURCHASING EQUIPMENT AND SUPPLIES ..... 37**

7.1. Procurement ..... 37
7.2. Supplier Evaluation ..... 37

**8. ANALYTICAL METHODS ..... 38**

8.1. Scope of Testing ..... 38
8.2. Analytical Test Methods ..... 39
8.3. Client Supplied Methods ..... 39
8.4. Method Validation ..... 40
8.5. Procedural Deviations ..... 40

**9. INTERNAL QUALITY CONTROL CHECKS ..... 41**

9.1. Laboratory Quality Control Samples and Acceptance Criteria ..... 41
9.2. Quality Control Sample Frequency and Corrective Action ..... 42
9.3. Quality Control Charts ..... 43
9.4. Measurement Uncertainty ..... 43

**10. ASSURING QUALITY OF TEST RESULTS ..... 44**

10.1. Data Management ..... 44
10.2. Data Documentation ..... 46
10.3. Data Calculations ..... 47
10.4. Reporting Limits ..... 47
10.5. Data Review ..... 47
10.6. Data Qualification ..... 48
10.7. Data Reporting ..... 48
10.8. Data Storage, Security, and Archival ..... 49

**11. AUDITS AND INSPECTIONS ..... 50**

11.1. Internal Quality Assurance Audits ..... 50
11.2. Review of the Quality Assurance Program ..... 50
11.3. Good Laboratory Practice Critical Phase Inspections ..... 51
11.4. Client Audits ..... 51
11.5. Agency Inspections ..... 52
11.6. Proficiency Testing ..... 53

**12. CORRECTIVE AND PREVENTIVE ACTION ..... 54**

12.1. Laboratory Investigations and Corrective Action ..... 54
12.2. Investigation Processes ..... 55
12.3. Client Feedback ..... 55

12.4. PREVENTIVE ACTIONS ..... 56

**13. SERVICE TO CLIENTS ..... 57**

13.1. SERVICE TO CLIENTS ..... 57
13.2. REVIEW OF WORK REQUESTS, TENDERS, AND CONTRACTS ..... 57
13.3. TIMELY DELIVERY ..... 58
13.4. SUBCONTRACTING ..... 58
13.5. USE OF NELAP AND A2LA LOGO ..... 58

Appendix A – Procedure Cross Reference List
Appendix B – Certifications, Accreditations, Registrations, and Contracts
Appendix C – Organizational Charts, Personnel to Sign Reports
Appendix D – Personnel Qualifications and Responsibilities
Appendix E – SOPs and Analytical Methods
Appendix F – Instrument and Equipment List
Appendix G – Preventive Maintenance Schedule
Appendix H – Calibration Schedules
Appendix I – NELAP Scope of Testing
Appendix J – Quality Control Types, Frequency, and Corrective Action
Appendix K – Microbiological Testing

## Revision Log:

| Revision: 11 | | Effective Date: This version |
|---|---|---|
| **Section** | **Justification** | **Changes** |
| Revision Log | Formatting requirements per LOM-SOP-LAB-201 | Removed revision logs up to the previous version. |
| Entire Document | Logo changed | Updated company logo |

| Revision: 10 | | Effective Date: 10/05/11 |
|---|---|---|
| **Section** | **Justification** | **Changes** |
| Revision Log | Formatting requirements per LOM-SOP-LAB-201 | Removed revision logs up to the previous version. |
| Entire Document | Title changes | Changed President to Chairman of the Board |
| 1.4 | Thermo-Fisher language | Removed the reference to the "Four 'I's" |
| 1.5 | To reflect current practice | Updated diagram |
| 2.1 | Change in ownership | Updated to include sale to Eurofins |
| 2.2 | Title Changes | Added Chairman of the Board and Vice Presidents to Vice President |
| 2.3 | To reflect current practice | Added responsibility of assigning deputies for key personnel |
| 2.4 | Change in ownership | Revised reference from being wholly owned subsidiary of Thermo Fisher to Eurofins Scientific |
| 2.17 | To reflect current practice | Added that all employees sign the ethics statement on the first day of employment. |
| 10.1 Sample Flow Table | To reflect current practice | Deleted microfilmed |
| 12.3 | To include all client feedback | Changed section title from Client Complaints to Client Feedback |
| 12.3 | To reflect current practice | Added that client concerns are tracked in the LIMS |
| 12.3 | To reflect current practice | Added description of the client survey |

# 1. INTRODUCTION

This *Quality Policy Manual* is based upon Lancaster Laboratories' overall business and management philosophies, mission, and goals. This manual was written to present the policies employed by the Environmental Division of Lancaster Laboratories as well as the support departments that serve the environmental laboratories and to comply with the requirements of the National Environmental Laboratory Accreditation Program and ISO 17025. These policies define the "what" we do with emphasis on management's responsibilities and commitment to quality. Governing SOPs are in place within the organization, to ensure the proper execution of this policy document (refer to Appendix A). The most recent and up-to-date *Quality Policy Manual* and all referenced documents are available to all laboratory personnel who work in or support the Environmental Division. Lancaster Laboratories actively strives for continuous improvement of its quality systems to better serve our clients.

## 1.1. Our Unique Promise of Value

The global leader in the National Environmental Laboratory Accreditation Program (NELAP) for accredited environmental laboratory services; Lancaster Laboratories provides unmatched regulatory compliance, capacity, and technical expertise for an outstanding service experience to environmental clients worldwide.

## 1.2. Mission Statement

Lancaster Laboratories offers analytical and consulting services in the chemical and biological sciences with comprehensive expertise in environmental and pharmaceutical laboratory applications. The company mission statement describes the corporate philosophy:

At Lancaster Laboratories, we are people working together to serve the health and environmental needs of society through science and technology. We strive to be the recognized leader in all that we do.

Our mission is to provide independent laboratory services in the chemical and biological sciences with excellent quality and service. As a corporate community, we:

- Deliver quality by fully understanding and always meeting the requirements of those we serve.
- Live our values by relating to our clients, coworkers, shareholders, suppliers, and community in a fair and ethical manner.
- Manage our growth and financial resources so we can serve our clients well, provide a satisfactory return to shareholders, and maintain our meaningful and enriching workplace.

## 1.3. Quality Policy

The Executive Management Group recognizes quality as a key element of the laboratory's standard of service. The group supports the laboratory's commitment to quality as defined by NELAP and ISO 17025 through the strict adherence to the Quality Policy Statement. The Quality Assurance Officer wrote the Quality Policy Statement, with final approval from the Chairman of the Board. The policy can not be revised without the Chairman of the Board and Quality Assurance Officer's approval.

The Quality Policy Statement gives employees clear requirements for the production of analytical data. Employees are trained on the components of the Quality Policy Statement during their first day of orientation. Each employee signs the statement as agreement to implement the policy in all aspects of their work. The statement is as follows:

We strive to provide the highest quality data achievable by:

- Describing clearly and accurately all activities performed; documenting "real time" as the task is carried out; understanding that it is never acceptable to "back date" entries and should additional information be required at a later date, the actual date and by whom the notation is made must be documented.
- Providing accountability and traceability for each sample analyzed through proper sample handling, labeling, preparation, instrument calibration/qualification, analysis, and reporting; establishing an audit trail that identifies date, time, analyst, instrument used, instrument conditions, quality control samples (where appropriate and/or required by the method), and associated standard material.
- Emphasizing a total quality management process and commitment to continuous improvement which provides accuracy, and strict compliance with agency regulations and client requirements, giving the highest degree of confidence; understanding that meeting the requirements of the next employee in the work flow process is just as important as meeting the needs of the external client.
- Providing thorough documentation and explanation to qualify reported data that may not meet all requirements and specifications, but is still of use to the client; understanding this occurs only after discussion with the client on the data limitations and acceptability of this approach.
- Responding immediately to indications of questionable data, out-of-specification occurrences, equipment malfunctions, and other types of laboratory problems, with investigation and applicable corrective action; documenting these activities completely, including the reasons for the decisions made.
- Providing a work environment that ensures accessibility to all levels of management and encourages questions and expression of concern on quality issues to management.

We each take personal responsibility to provide this quality product while meeting the company's high standards of integrity and ethics, understanding that improprieties, such as failure to conduct the required test, manipulation of test procedures or data, or inaccurate documentation will not be tolerated. Intentional misrepresentation of the activities performed is considered fraud and is grounds for termination.

## 1.4. Statement of Values

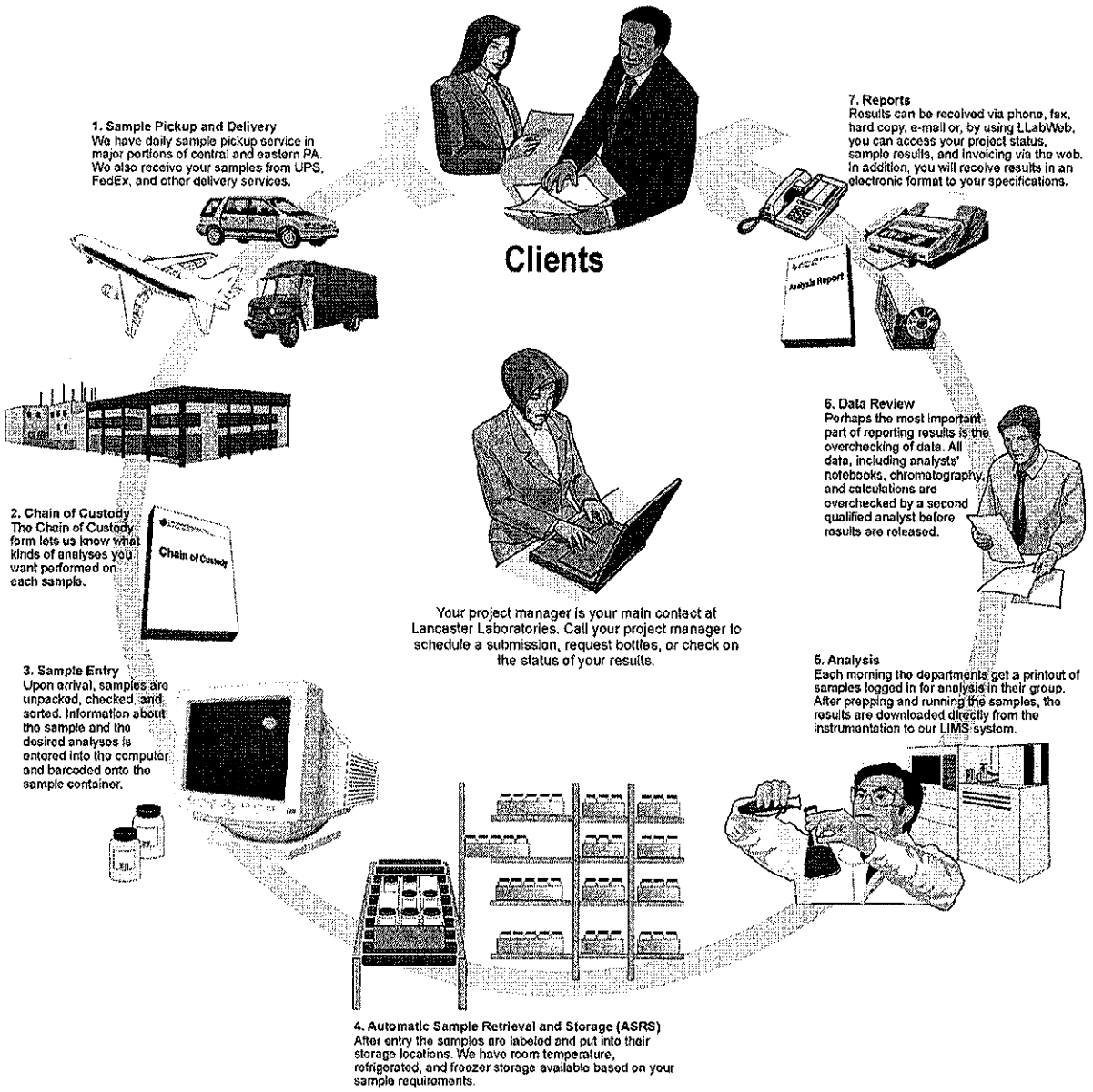
As a corporate community, we embrace our heritage of integrity and strive to live by the following principles:

- Fairness and honesty in all our relationships
- Mutual trust
- A respect for ourselves and others
- A sense of caring that leads us to act responsibly toward each other and society, now and in the future
- Loyalty to our clients and one another

- A spirit of open-mindedness as we deal with all
- Dedication to service
- Good stewardship of our resources
- A commitment to flexibility and continuous improvement

We each take personal responsibility to live these values in all of our dealings, knowing full well our pledge may involve difficult choices, hard work, and courage.

## 1.5. Sample Flow-Through Diagram



### 1.6. Certifications, Accreditations, and Registrations

Accreditation/Certification is the process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications and/or standards. It is the one generally accepted method by which a laboratory such as ours can demonstrate its capability of generating acceptable, professional, quality test results in those areas in which it claims competence. To this end, we have actively sought accreditation by organizations offering it in those areas relevant to our technical expertise. We strive to ensure that the facilities, equipment, procedures, records, and methods used by Lancaster Laboratories in the testing of environmental samples are in compliance with the requirements of these standards.

Although organizations offering accreditation differ somewhat in the details of their programs, they generally evaluate laboratories in four basic areas: personnel (adequate staffing, education, training, and experience), physical facilities, instrumentation/equipment, and quality assurance program. This evaluation is performed by one or more of the following procedures: periodic on-site inspections of the laboratory by assessors experienced in technical operations and management, periodic testing of proficiency test samples, and periodic updating of the laboratory's file to reflect changes in personnel, equipment, or services offered. Some states offer reciprocity with other state programs.

Appendix B lists accreditations, registrations, and contracts held by Lancaster Laboratories, Inc. in support of environmental work. Current copies of all scopes of accreditation are kept on file in the Quality Assurance Department.

## 2. ORGANIZATION AND PERSONNEL

### 2.1. Company Overview and History

Lancaster Laboratories was founded in 1961 by Dr. Earl Hess in response to a need for high quality technical services by the agricultural and industrial communities in southeastern Pennsylvania. Nourished in a culture of quality and caring about all those associated with the business, the corporation became an industry leader known for innovative business practices and people-friendly policies. The company was independently owned until the retirement of Dr. Hess in 1995. At that time, LLI was acquired by a publicly held company, Thermo TerraTech, Inc., a Thermo Electron company. Ownership changed in September 2000, when Lancaster Laboratories was acquired by Goldner, Hawn, Johnson, and Morrison, Inc. (GHJ&M), a private equity investment firm. In August 2005, LLI was acquired by Fisher Scientific under their BioPharma Division. On November 9, 2006, Thermo Electron and Fisher Scientific merged to form Thermo Fisher Scientific. In April 2011, Thermo Fisher Scientific sold Lancaster Laboratories to Eurofins Scientific. Lancaster Laboratories continues to operate as an independent laboratory and is incorporated by the State of Minnesota.

Lancaster Laboratories provides a wide array of laboratory services to clients working in the pharmaceutical and environmental industries. We strive to offer high quality technical services in the chemical and biological sciences with personal attention to client needs. These services include chemical analyses, microbiological testing, biopharmaceutical testing, and analytical method development. We are, therefore, a technical service company and do not manufacturer or distribute goods. Our "product" is accurate and timely technical information and our continued existence depends on the quality of the services we offer and efficiency with which we deliver them.

## 2.2. Organizational Structure

The Chairman of the Board of Lancaster Laboratories, J. Wilson Hershey, Ph.D., is responsible for the daily operations of the Environmental Division of the laboratory.

The Executive Management Group is defined as Lancaster Laboratories' Chairman of the Board, President and Vice President.

Senior Management is defined as directors and above, including the Quality Assurance Director.

The management staff includes directors, managers and group leaders. Organizational charts are presented in Appendix C of this manual. A list of key personnel is also provided.

## 2.3. Management Responsibilities

Management/supervisor is defined as group leaders, managers, directors, and above.

Laboratory management duties are outlined for supervisory personnel using a job plan format, which details each individual's responsibilities along with expected results. Typically, management duties include, but are not limited to:

- Personnel hiring and training
- Supervision of personnel
- Ensuring quality of data produced
- Resource allocation
- Directing daily work operations, including scheduling of work
- Maintaining awareness of technical developments and regulatory requirements
- Assessing laboratory capacity and workload
- Contributing to the continuous improvement of the laboratory operation
- Providing resources to ensure a safe work environment
- Providing resources to ensure a work environment free of undue pressures
- Communicating problems and concerns to Senior and Executive Management to enlist a higher level of support for corrections and continuous improvements.
- Ensuring compliance with the requirements of ISO 17025 and NELAP.
- Ensuring that corrective actions are carried out in an appropriate and agreed time-frame.

The Chairman of the Board and Director of Quality Assurance are responsible for appointing deputies for all key personnel.

The Technical Director ensures that the laboratory's policies and objectives for quality of testing services are documented in this quality manual. The Technical Director must assure that the manual is communicated to, understood, and implemented by all personnel concerned.

## 2.4. Overview of the Quality Assurance Program

Quality Assurance (QA) is responsible for developing planned activities whose purpose is to provide assurance to all levels of management that a quality program is in place within the laboratory, and that it is functioning in an effective manner that is consistent with ISO 17025 and the requirements of NELAP. Although LLI is a wholly owned subsidiary of Eurofins Scientific, the Quality Assurance and Quality Systems operations described in this manual are specific to LLI.

The administration of the QA program is the responsibility of the QA Director in cooperation with all levels of management.

2.4.1. Quality Assurance Director

The Quality Assurance Director ensures that the quality system is followed at all times. The QA Director reports directly to the Chairman of the Board, thus ensuring corrective actions to quality issues are taken promptly and are separate from business decisions. The QA Director has no direct supervisory responsibility for the generation of technical data to avoid any conflict of interest in administrating the QA program. The QA Director has the final authority to stop work that compromises our integrity or data quality. The situation must be investigated and appropriate corrective action must be put in place before the QA Director will authorize the resumption of work. The specific duties of the QA Director are communicated in job plan format.

The QA program, as directed by executive management, was established to:

- Ensure accountability, accuracy, and traceability of all analytical data generated.
- Ensure that current regulatory, agency, and client requirements are being met.
- Ensure that operating procedures are in place to minimize the possible loss, damage, and tampering with data, in addition to ensuring that raw data is stored in a secured area and is maintained by designated archivists and/or system administrators.
- Ensure that curriculum vitae (CVs) and training records are maintained to document that staff members have the necessary education, training, and experience to perform their job responsibilities and functions.
- Ensure that regulatory training is provided to applicable employees on a routine and ongoing basis.
- Ensure that all procedures are available, controlled, and current.
- Ensure that all equipment and instrumentation is qualified, maintained, and calibrated, as appropriate, in accordance with written standard operating procedures.
- Ensure that all significant laboratory problems are investigated and corrective action is put in place as documented
- Ensure that an internal audit program is in place to confirm that laboratory personnel are adhering to standard operating procedures and applicable regulations.
- Ensure that quality issues are brought to the attention of management in a timely manner.
- Communicate (within 30 days) to the relevant state authorities when there are management or facility changes that impact the environmental division.

## 2.5 Quality Assurance Responsibilities

Responsibilities within the QA Department are divided between divisions and assigned in accordance with the regulations the business unit of interest is required to follow (i.e., Food and Drug Administration [FDA], Environmental Protection Agency [EPA]). The QA Director assigns tasks with input from the company Chairman of the Board. The primary responsibilities of QA in support of the Environmental Division include, but are not limited to the following:

- Oversee the laboratories' internal audit program which consists of various audit types and applies to all laboratory activities (technical and administrative).
- Review and approve standard operating procedures and LLI analytical methods.
- Review and approve validation documentation.
- Review non-conforming quality control data and approve laboratory investigation and corrective action reports.
- Perform tracking and trending of quality measurements and investigation report issues.
- Ensure that appropriate corrective actions are implemented as needed in response to quality issues or audit findings.
- Host client and regulatory agencies during facility audits and follow-up to any cited deficiencies.
- Provide regulatory guidance to the laboratory.
- Monitor GLP regulatory activities.
- Communicate quality issues to management.
- Provide and/or coordinate on-going regulatory training (e.g., Good Laboratory Practice [GLP], Good Manufacturing Practice [GMP]).
- Participate in the vendor and supplier approval process, including subcontractors.
- Review analytical data.
- Prepare and review QA project plans (QAPPs) as required by EPA and client projects.
- Maintain and update this *Quality Policy Manual*.
- Administer proficiency test sample programs, both single and double blinds.

## 2.6. Communication of Quality Issues to Management

The QA Department is responsible for preparing reports to Senior Management to keep them apprised of outstanding quality issues. Reports to management foster communication, review, and refinement of QA activities to ensure that the QA program is adequate to meet regulatory and Lancaster Laboratories' quality objectives. The following reports are used to communicate quality issues and include, but are not limited to:

- Internal, client, and agency audit reports and corrective action plans
- Proficiency test reports
- Investigation and corrective action reports
- Monthly and quarterly quality status reports
- Plans for corrective action

## 2.7. Personnel Qualifications and Responsibilities

Full resumes and responsibilities of key personnel are provided in Appendix D.

Due to the number of analysts on staff, entry level chemists, technicians, and support personnel are not included in the resume section. However, all employees have job plans that define their responsibilities. Duties for these personnel typically include:

- Sample storage
- Sample preparations
- Performance of tests
- Calibration, operation, and maintenance of instruments
- Data entry
- Standard and reagent preparation
- Glassware preparation
- Data package preparation

## 2.8. Relationship of Functional Groups and the Quality Assurance Program

In addition to this *Quality Policy Manual*, aspects of the QA program are documented in a series of standard operating procedures that support the proper execution of this document. Technical operation procedures with required quality components are also in place. A list of the titles of relevant SOPs is provided in Appendix E. There are a variety of mechanisms used to communicate requirements and verify compliance with the QA program, including:

- Management requires that all employees read and be trained in the policies and SOPs that are pertinent to their jobs.
- Employee job plans define individual responsibilities. All job plans include QA aspects, and performance is reviewed annually.
- Laboratory audit findings are circulated to management and require a response and follow-up to items needing corrective action.
- Cross-functional meetings, including representatives from QA, Client Services, Marketing, management, and technical operations are held regularly to review specific projects and quality issues.

## 2.9. Balancing Laboratory Capacity and Workload

Evaluating laboratory capacity to perform specific projects is the responsibility of the Chairman of the Board, the lead Technical Director and the Director of the Client Services/Project Management Group. These responsibilities are documented in the individual job plans for these positions.

The laboratory facilities and staff size are very large compared to other laboratories serving the environmental industry. Many analysts are cross-trained to perform a variety of tests, and there is redundant equipment available in case of malfunctions. This minimizes the need to evaluate small and medium size projects against capacity available to complete them. Large projects are reviewed against capacity estimates before bids are submitted to ensure that the client's analysis schedule is met.

Regularly scheduled meetings are held with upper management, laboratory middle management, Client Services and QA personnel to review progress with current projects, as well as special requirements of new work scheduled for the laboratory.

Laboratory capacity and backlog is tracked on a continuous basis using information from the sample management system, including turnaround time, and work in-house.

## 2.10. Identification of Approved Signatories

Approved signatories for laboratory reports are defined in the SOP on final review of laboratory generated reports. Directors, managers, group leaders, and other designated employees (such as project managers and senior technical staff) are designated to sign reports. Request for approval of an employee to review/sign reports must be made through the QA Department. Approved signatories are designated with an asterisk in the personnel list provided in Appendix C.

## 2.11. Personnel Training

The experience and training received by personnel is of great importance to our clients and regulatory agencies. CVs and on-going training documentation are available to demonstrate how personnel have been prepared for the tasks they routinely perform. To ensure the highest quality of services at Lancaster Laboratories, training programs and plans are developed to match skills with job functions. Accurate training documentation is the responsibility of both the employee and their supervisor. On a routine basis, the supervisor reviews and signs training documentation to verify that it is complete and current.

Training requirements can be met through education, prior job experience, internal and external training classes, on-the-job training, TRN training modules, procedure reading, or any combination thereof, to enable the person to perform assigned job functions and meet regulatory compliance.

Each analyst training to perform a new analysis is required to perform an initial demonstration of capability and meet the requirements for accuracy and precision before working independently on the test method. Typically, this is accomplished by the successful analysis of four known samples. However, there are certain tests performed that are not required by the mandated test method or regulation to perform the above procedure (i.e., EPA 1010, 9095). In this case, the analyst's documentation of proficiency is satisfied by the sign-off of having read, understood, and agreed to follow the SOP as written and observation by a senior analyst.

Management personnel are responsible for planning ongoing professional growth and development activities for an employee through on-the–job training and/or internal and external training courses so an employee can maintain a current skill set to match job responsibilities.

An annual performance review based on job accountabilities, objective measures, and pre-defined standards is completed by management personnel for each employee. This assessment is documented and maintained. Input is obtained from other managerial personnel as needed.

### 2.11.1. New Hire Training

New employees are oriented as part of a year-long process that is designed to make the employee feel welcome and comfortable by defining our culture, traditions, philosophies, and work practices. During the orientation process an employee learns about personnel and safety policies and business strategies in addition to quality, ethics, and customer satisfaction expectations through a formal process administered by our Human Resources Department.

New employees are required to attend a "core" technical orientation as applicable, which can entail the participation in training module exercises, short session attendance, and/or other skill training specific to their assigned department or job function. Additional job-specific training required for an employee is based upon their assigned duties and is identified by their supervisor. Technical orientation occurs during the first few weeks of employment.

The orientation process is designed to enable employees to initiate and take responsibility for their personal and professional career growth at Lancaster Laboratories. The orientation process is conducted without regard to employee race, color, creed, national origin, sex, age, or disability in accordance with LLI's Employee Equal Opportunity (EEO) policy.

2.11.2. Ongoing Training

Refresher and ongoing training occurs through various means, which include but are not limited to, training in or independently review new/updated LLI standard operating procedures and TRN training procedures; on-going regulatory training; in-house or off-site classes or seminars. The goal of this training is to ensure that employees remain current with changes to laboratory systems and practices, as applicable to their job function. Retraining and re-qualification activities occur as directed by procedures or regulations. Employees are retrained if an issue or investigation warrants that retraining is a necessary corrective action. Management directs when employee re-training is required, and the extent of the re-training.

## 2.12. Regulatory Training

The QA Department is responsible for coordinating and conducting initial and ongoing regulatory training (i.e., GMP, GLP) for all applicable laboratory and support personnel. It is the responsibility of management within each department to ensure that personnel attend the required training sessions.

The choice of training format and topics covered for ongoing regulatory training is left to the discretion of QA and the trainer. All training sessions reinforce the concepts in the regulations as they are relevant to Lancaster Laboratories.

Whenever possible, after training is completed, a demonstration of proficiency of the training topic is given. The demonstration of proficiency is generally in the form of a quiz although other demonstrations of proficiency are acceptable depending on the scope and content of the training. If necessary, training is presented and/or repeated one-on-one with individuals who do not demonstrate proficiency in the training topic. This is performed by QA in conjunction with applicable laboratory management personnel.

## 2.13. Employee Safety

Lancaster Laboratories, being mindful of its responsibilities as an employer and active corporate citizen, has established the following objectives of its safety program:

- Provide a safe environment for its employees, visitors, and the community surrounding its place of business.
- Provide ongoing safety training for employees.

- Provide all necessary facilities and equipment to ensure the safety of its employees and to minimize all chemical exposure during the normal performance of their required tasks, and to take all necessary precautions to safeguard the surrounding environment.
- Provide periodic health physicals for employees.
- Foster and encourage safe operations and a proper safety attitude on the part of our employees through general operations and systems, training, and the *Chemical Hygiene Plan* (CHP).

The *Lancaster Laboratories Chemical Hygiene Plan* addresses various aspects of our safety program in greater detail.

A Safety Committee works to enhance our overall safety program. The committee meets on a routine and ongoing basis and its specific responsibilities are detailed below:

- Review accident and incident reports. Make recommendations for methods of prevention to eliminate further accidents.
- Promote safety awareness and distribute safety information by various means (e.g., posters, videotapes, pamphlets, and books). Use internal communication channels to promote safety awareness.
- Enhance and recommend safety-training programs for all employees, as necessary.
- Maintain up-to-date information on employee concerns that are safety related. Offer input and information to the Chemical Hygiene Officer and/or Safety Officer, as needed.

## 2.14. Client Services/Project Management Responsibilities

Members of the Environmental Client Services/Project Management Group are responsible for organizing and managing client projects. Clients are assigned a project manager who serves as their primary contact at LLI. It is the project manager's responsibility to act as the client advocate by communicating client requirements to laboratory personnel and ensuring that clients provide complete information needed by the laboratory to meet those requirements. All client verbal communications are documented by the project manager in a controlled notebook. In addition to information management, Project Management responsibilities include:

- Coordinating and preparing proposals in conjunction with technical staff.
- Confirming certification status.
- Hosting client visits and audits.
- Coordinating and communicating turnaround time (TAT) requirements for high priority samples/projects.
- Answering common technical questions, facilitating problem resolution.
- Providing clients with sample status report or results prior to receipt of hardcopy analytical reports (e.g., fax, e-mail, phone).
- Scheduling sample submissions, sample containers, and sample pick-up via LL courier service.
- Informing the client of deviation from their contract.

## 2.15. Confidentiality

Strict confidentiality is maintained in all of our dealings with clients. Confidentiality agreements, therefore, are willingly provided. Clients are promptly notified any time their data is subpoenaed or requested by a regulatory or legal body.

All employees are required to protect company technical data, including client names and test results from disclosure to any third party. This policy, as described in the *Lancaster Laboratories Personnel Manual*, is provided and presented to employees during their orientation period.

Intellectual property associated with the testing that we perform under contract for a client is the property of the client.

In an attempt to ensure the confidentiality of our systems and procedures within our laboratory, it is our policy to restrict the distribution of our internal procedures to clients. Clients are permitted to review our procedures while on-site as part of an audit or visit. Based on this policy, we would request that any documents viewed would not be shared or made available to any third parties without the permission of Lancaster Laboratories.

## 2.16. Business Conduct

Our business conduct policy applies to all operations of the company. All employees must avoid any relationship with other individuals or organizations (including Eurofins Scientific sister companies) that might impair, or even appear to impair, the proper performance of their company-related responsibilities. Employees must avoid any situation that might affect their independence of judgment with respect to any business dealings between the company and any other organization or individual. Any employee who believes that they have such a conflict, whether actual or potential, or who is aware of any conflict involving any other employee must report all pertinent details to the President of the company or Chairman of the Board. The company's management vigorously enforces this policy and takes prompt and appropriate action, including termination, against any employee found to be in violation.

## 2.17. Operational Integrity

All employees sign an Employee Ethics Statement on their first day of employment. Employees responsible for generating, handling, or reviewing laboratory data understand that Lancaster Laboratories mission is to perform all work with the highest level of integrity. Under no circumstances are shortcuts or generating results to suit a client's purpose rather than good scientific practice considered acceptable. Any violation of the laboratory ethics policy results in a detailed investigation that could lead to termination.

All levels of management consider the following activities unacceptable:

- Knowingly recording inaccurate data.
- Fabrication of data without performing the work needed to generate the information. This includes creating any type of fictitious data or documentation.
- Time travel or adjusting clocks on computerized systems to make it appear that data was acquired at some time other than the actual time.
- Manipulation of data for the express purpose of passing system suitability or quality control criteria.

- Selective use of data generated, or not using data that was legitimately generated and has an impact on the outcome of the test.
- Executing significant deviations from approved test methods and procedures without prior approval from Lancaster Laboratories management and/or the client.

If an issue does arise which could compromise data integrity, personnel are instructed to perform the following activities:

- Clearly document the situation and maintain all data generated. There is a big difference between poor judgment and fraud. Fraud usually involves intent to conceal an action taken. Therefore, the more documentation that is maintained, the less likely an action is considered fraudulent if further scrutinized.
- When out-of-specification results or quality type issues are detected, all supporting data and relative background information must be documented and presented for management review. Problem resolution and client contact, as applicable, must also be documented.
- Review any questionable situations and decisions with a supervisor.
- Bring a questionable or uncomfortable issue directly to the QA Director or a member of the QA Department as part of our QA open door policy.
- Utilize the company's Ethics Committee. See Section 12.4 of this manual.

## 3. BUILDINGS AND FACILITIES

### 3.1. Facility

Lancaster Laboratories is located at 2425 New Holland Pike (Route 23), Lancaster, PA 17601. The facility consists of three primary buildings (A, B, and C). Building A and B are connected by a pedestrian bridge spanning Route 23.

Building A resides on a commercial plot measuring 13.6 acres on the north side of Route 23. Building A is a three-story building of concrete and steel construction. It is approximately 116,000 square feet and consists of approximately 62,000 square feet of laboratory space; 25,000 square feet of office space; and 29,000 square feet of storage, mechanical, and service space. On this plot, adjacent to Building A, sits a 1000 square foot chemical storage building (Building I) (solvent, acid and gas cylinder storage) and an 8000 square foot storage building which also houses stability chambers (referred to as Building J). The bottles packing area, which includes preservation of bottles being sent to clients for sampling, is located in a separate 3000 square foot building (referred to as Building K). In addition, there are two other buildings on the north side of Route 23 that include 1200 square feet for supply storage, 600 square feet for recycling, and 3500 square feet for shop and facilities maintenance areas.

Building B resides on a commercial plot measuring 13.7 acres on the south side of Route 23. Building B is a three-story building of steel and concrete construction. It is approximately 55,000 square feet and consists of approximately 15,000 square feet of laboratory space; 18,000 square feet of office space; and 22,000 square feet of storage, mechanical, and service space.

Building C is also located on the south side of Route 23, connected to Building B. Building C is a three-story building of steel and concrete construction providing approximately 50, 000 square feet of space used for Biopharmaceutical and Analytical Development testing laboratories. The first floor houses the main lobby, visitor's entrance, and conference rooms.

An automatic fire alarm monitors the entire facility. The system is monitored by the central dispatch station. Building B, Building C, and Building J are fully protected by sprinklers for fire suppression. High-risk areas of Building A are protected by sprinklers as well. The entire campus and all exterior doors are monitored by video surveillance.

### 3.2. Security

Lancaster Laboratories is considered a secure facility. All outside doors except the main lobby entrance are kept locked during normal business hours to prevent unauthorized entry. An attendant monitors these entrances at all times.

During evenings, weekends, and holidays, all doors are locked and Security personnel are on site to prevent unauthorized entry into the building. Video cameras are utilized by Security personnel to monitor the facility grounds.

Every employee is issued a photo ID badge, which also serves as a building access card. This badge must be worn at all times while on laboratory property so that employees are easily identified. Access to secured/designated areas within the building is limited to only applicable employees through the building security system. This system is administered by Security staff.

All visitors must register with the lobby attendant and are issued a visitor badge. A staff person must accompany visitors while in the facility. Additional visitor rules are outlined in the *Visitor Security and Safety Rules* pamphlet, which is provided to all guests.

Building access cards are issued on a temporary basis to contractors or service technicians (e.g., electricians and plumbers) who need access to the building to work on a project. These cards provide the contractor with limited access during the normal workday and must be returned when the work is complete.

### 3.3. Disaster Recovery

A disaster recovery plan is in place to provide direction for situations where normal operations of the laboratory are not possible. In the event that the building would be severely challenged, a designated disaster recovery team, which includes Physical Services, Maintenance, Safety, Corporate Management, Public Relations, and other applicable personnel depending on the scope of the disaster, would assemble at a designated area to assess the situation and formulate a plan.

The plan addresses, in general terms, how to approach the following issues: electrical failures, heating/air conditioning failures, fire/building evacuation, computer failures, hazardous material spills, injury to employees, pandemic flu, disruption of phone service, and stability chamber failures.

### 3.4. Environmental Monitoring

The air handling system for the main laboratory is specially designed to protect sensitive instruments from harmful vapors to ensure that samples are not contaminated. The Physical Services/Maintenance Group is responsible for maintaining the HVAC and exhaust hood systems. This is particularly important in our instrumentation rooms and computer center where a controlled environment, positive pressure system is maintained.

Most refrigerators, freezers, incubators, and ovens used for analysis are monitored by a computerized system equipped with stationary thermometer temperature probes linked to a master panel that is accessed through a computer in the Plant Engineer's office. If a unit is outside of a predefined temperature range for a specified period of time, the system alarms. Units not on the computerized system must be monitored manually by recording thermometer temperature readings twice daily.

The laboratory is set up so that there is effective separation between neighboring areas in which there is potential for contamination. Laboratory storage blanks are also used to evaluate conditions under which samples for volatile analysis are stored to monitor for cross-contamination potential. QA provides oversight of the environmental monitoring system.

### 3.5. Water Systems

Well water and the public sewer system service the facility. The water system is monitored to meet the permit requirements of the Pennsylvania Department of Environmental Protection.

Quality control of laboratory analyses involves the control and quality of laboratory water available to analysts for preparation, dilutions, and rinsing of glassware. Two reverse-osmosis deionized water systems deliver highly purified water to a sealed fiberglass storage tank. From the storage tank the water is delivered to an ion-exchange-carbon filter system for further polishing. The water is also exposed to an in-line ultraviolet sterilization lamp before being circulated to taps throughout the laboratory.

Daily monitoring and preventive maintenance for the system is the responsibility of the Maintenance Department. Monthly and annual testing is performed as required by regulatory guidance. QA provides oversight of the water system monitoring. In addition, method blanks are tested with each batch (≤20) of samples.

### 3.6. Housekeeping/Cleaning

Lancaster Laboratories is dedicated to providing a clean workplace. A third party professional cleaning service provides routine cleaning of "common areas" that include lavatories, drinking fountains, floors, and windows. Technical staff are responsible for the cleaning (or the contract of cleaning) of specific laboratory work areas.

Detergents used for cleaning contain no to very low levels of metals, pesticides/herbicides/ fungicides, or volatile solvents.

### 3.7. Insect & Rodent Control

Steps are taken to prevent, monitor, and control insect and rodent infestation. The coordination of this program is the responsibility of the Physical Services Department under the direction of QA. An outside service firm is contracted to perform routine and ongoing monitoring of the facility to ensure that preventive measures which are in place are effective and are working as intended.

No insect or rodent control chemical agents in a liquid or vapor form are applied or sprayed in any laboratory building, unless there is no other option, in which case department management must be contacted for approval.

### 3.8. Emergency Power Supply

The laboratory is located at the junction of two power grids that supply electrical service to the facility. If one of the power grids fails, we have the ability to work with the power company to have service switched to the other grid. Various types of diesel and natural gas generators are also available on a standby basis to supply power to selected areas of the laboratory in case of a power outage.

To reduce spikes and spurious line voltage changes to laboratory instruments that can affect results or damage electronic equipment, "conditional power" is fed to these sensitive instruments. All essential computer systems are on uninterrupted power supply (UPS) which is a battery system that provides continuous conditional power for a limited time period in the event of a short power outage.

### 3.9. Facility Changes

Procedures are in place to manage change, ensure communication, and to minimize negative consequences through active participation of personnel involved in a facility change. The goal is to ensure that physical and environmental condition changes are adequately evaluated for impact and reduction of risk to quality, safety, health, employee, environment, property, analytical services, and business operations before and after the change is implemented.

## 4. DOCUMENT CONTROL

The administration of the document control system including tracking, filing, updating, distribution of new procedures, and archiving of historical copies is the responsibility of the Office Services (OS) Department.

It is our policy to restrict the distribution of our internal procedures to clients and we discourage the distribution of company confidential documents outside of the facility. Clients are permitted to review our procedures while on-site as part of an audit or visit. Any documents that are distributed are only sent with the approval of QA.

The goals of the document control process are:

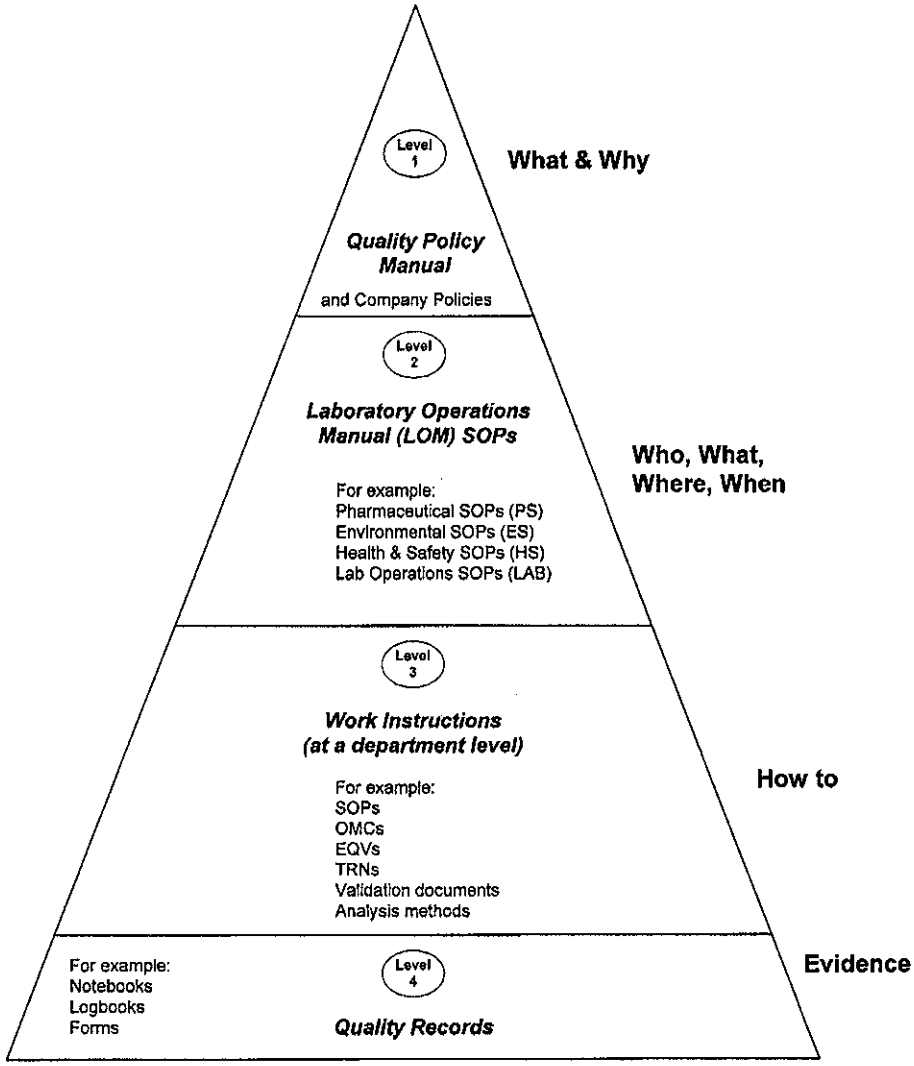
- Format documents according to consistent and defined standards
- Review and approve new documents
- Schedule review of existing documents
- Control of document versions and effective dates
- Review and approval of document changes
- Control document distribution and return of obsolete documents
- Archive and protect obsolete documents

### 4.1. Hierarchy of Internal Operating Procedures

The hierarchy of controlled procedures at Lancaster Laboratories is defined in the following pyramid diagram. These procedures and documentation are made available to promote consistency throughout the organization and to meet regulatory requirements. A list of relevant methods and procedures is located in Appendix E. The development of new procedures and the updating and reclassification of current procedures is an ongoing project.

Lancaster Laboratories
2425 New Holland Pike • Lancaster, PA 17601

## Controlled Documentation Hierarchy




3606.03

4.1.1. Level 1 – *Quality Policy Manual* and Company Policies

The intent of these documents is to define "what" we do with emphasis on Executive and Senior Management's responsibility for quality.

The purpose of the *Quality Policy Manual* is to provide a framework to outline the quality systems at Lancaster Laboratories. Organizational charts, list of SOPs, a list of equipment, instrumentation, and personnel resumes are included as attachments to this manual.

- Executive Management is responsible for ensuring adequate personnel, resources, and support are available to carry out the requirements of this *Quality Policy Manual.*
- Senior Management is responsible for ensuring that SOPs or other appropriate documents are written and available to personnel to define the practices and systems which support these policies.
- All employees are responsible for conducting business in a manner, which is compliant with quality and company policies and associated SOPs or other appropriate documents. Review of these policies and procedures must be documented.

Additional company policies are written to support and expand upon this *Quality Policy Manual.* These policies contain more detailed information about a subject with approval signatures executed at the Executive and/or Senior Management level.

4.1.2. Level 2 – Laboratory Operations Manual (LOM) SOPs

The intent of these standard operating procedures is to define "who, what, where, and when." These procedures provide specific information for a process or topic so that the requirements outlined in this *Quality Policy Manual* and company policies can be achieved. The review and approval of these SOPs is performed at the director/manager/group leader level, including QA review and signoff, and the responsibility of these SOPs lies with the area or person directing the operation.

SOPs are organized into different categories dependent on subject matter and area to which they apply within the company. They can apply across the entire company, across a division, or a specific operating area. Some examples of areas addressed at this level are:

LAB – Laboratory Section
HS – Health and Safety
ES – Environmental Sciences

4.1.3. Level 3 – Work Instructions (at a departmental level)

The intent of these procedures or documents is to define in greater detail the specific "how to". The level of detail in these documents must be sufficient so any appropriately trained person can perform the task accurately. Examples include, but are not limited to standard operating procedures (SOPs); operation, maintenance and calibration (OMC) procedures; equipment, qualification, and validation (EQV) procedures; validation documents; and Lancaster Laboratories'

analytical methods. Departmental level procedures/documents are reviewed and approved at the manager or group leader level including QA review and signoff.

4.1.4. Level 4 – Quality Records

The intent of these documents is to provide documented evidence to support our quality systems and operations. Examples include but are not limited to, data notebooks/logbooks, and preformatted data recording forms.

## 4.2. Document Approval, Issue, Control, and Maintenance

The document control process ensures that documents are approved and adequate for use. It ensures that documents are readily available to personnel and at locations where essential operations are performed. Distribution of each document is controlled to ensure that analysts are working with the correct version.

Controlled policies, procedures, and work instructions are reviewed and approved by appropriate individuals and are formally issued and administered through the Office Services Group. Each document is uniquely identified and includes an effective date, revision identification, and page numbering (totaling number of pages). All documents are indexed and identified on a "master list." Each procedure has a unique file record that contains pertinent information used in the tracking process.

The original signed hard copy of the procedure is maintained in a secure area while in the active status. Electronic copies of each procedure are stored in a secure directory that is accessible only to designated personnel. Office Services also monitors the number of copies of each procedure in the laboratory.

Procedures are reviewed to ensure they remain accurate and current. The frequency of review is either annual or biennial, depending on the procedure. Upon the receipt of new or updated documents, all copies of obsolete documents are removed from service and destroyed. The original historical copy of each outdated/obsolete procedure is clearly identified as a historical version and maintained in a permanent archive file separate from any current versions. (Note: OH EPA is required to review all revised documents applicable to its certification).

Company policies and corporate level procedures are available in electronic form on the company's intranet site. Electronic copies are made available to enhance communication across the company. Electronic copies are scanned-in versions of the most recent hard copy of the document. These procedures cannot be printed from this system. The Office Services Group maintains this system in a current and accurate state.

## 4.3. Client-Supplied Methods and Documentation

Client documentation to support environmental testing at Lancaster Laboratories is maintained in a centralized area. This information is organized by client/project in the Client Services/Project Management Group. Client documentation includes the following information depending on project size and scope:

- Client supplied analyte lists
- Client supplied project plans
- Client contract quality manuals with specified limits, QC criteria, etc.

- Communication/correspondence records which relate to testing requirements, interpretation of results, or reporting formats

## 4.4. Laboratory Notebooks, Logbooks, and Forms

Procedures are in place to ensure that all data is traceable, authentic, complete, and retrievable. The following general requirements outline our system for the issuing, control, and archival of laboratory notebook and logbooks.

- The administration of notebooks and logbooks is controlled by the Office Services Group. They maintain a master index to uniquely number and identify each book distributed.
- Notebooks and logbooks can contain blank or preformatted pages.
- Notebooks and logbooks are bound, uniquely identified and have sequentially pre-numbered pages.
- If notebooks or logbooks contain preprinted laboratory form pages:
  - A unique identification number is assigned to each form
  - Forms are approved by appropriate management personnel before they are put into production use
  - Forms are reviewed on a routine basis to ensure they are still accurate and current
- Completed notebooks are returned to an archivist. Incomplete books are returned to Document Control:
  - when an employee leaves the company
  - when an employee transfers to another division
  - when the project for which it was used is complete
  - at a defined time line from the issue date
- Office Services verifies the status and location of any notebook or logbook which has been signed out for longer than two (2) years.
- In specific situations, records are bound to create books at the time of archival (e.g., temperature charts).
- At the time of archival any page(s) in the notebook or logbook that does not contain data documentation is crossed-out or a statement is written on the last page used to note that the book is complete to prevent data from being entered at a later date.
- Notebooks and logbooks identified as requiring permanent archival are assigned a designated qualifier.

## 4.5. Control of External Documents

Hard copy versions of external documents are controlled through the form system.

External documents such as copies of the 40 CFR and ASTM methods are stored exclusively in the QA Department. QA also keeps applicable agency documents on file, these include, but are not limited to, the TNI (The NELAC Institute) and ISO 17025 standards.

Environmental methods from the EPA or Standard Methods are available in the QA Department, but the technical areas also have copies that pertain to the tests that they perform. Any external document that is maintained in these areas must be inventoried and listed on a controlled form. Some methods are available on-line and are accessed through the Internet. Regulatory methods are used as references by the laboratory and testing is performed as per written SOPs that fall under our existing document control system and have scheduled reviews. It is the laboratory's understanding that the need to control external documents is to ensure that the most current version of a method is referenced or appropriate manual is being used. While using the most current version of an analytical method is our typical practice, there are specific client needs and accreditation rules that require previous versions of a method be used. Our scheduled review of SOPs is used to ensure that the proper version of a method is referenced.

The technical areas are responsible for ensuring that all manufacturer's manuals are current and available to analysts. The vendor provides instrument manuals when new equipment is purchased or existing instruments are updated. These manuals are kept with the instruments to which they are associated. The laboratory labels the instrument books with the corresponding identification number of the instrument. Logbooks, which fall under the document control system also include the title and date/version of the instrument manual.

## 5. SAMPLE HANDLING

### 5.1. Sample Collection

In order for meaningful analytical data to be produced, the samples analyzed must be representative of the system from which they are drawn.

It is the responsibility of the client to send us representative and/or homogeneous and properly preserved samples of the system from which they are drawn. Lancaster Laboratories assumes that all multiple sample containers with the same designator/description and bottle type contain a homogeneous, representative sample. We also assume that it is acceptable to deplete one container and move to the next, without implications unless otherwise indicated by the client.

The laboratory provides the appropriate sample containers, required preservative, chain-of-custody forms, shipping containers, labels, and seals. The laboratory also provides trip blanks and analyte-free water for field blanks. Preparation of methanol containers for field preservation of volatile soil samples is available.

Sample containers are purchased pre-cleaned by the supplier. Special containers with traceability documentation are available upon request. For pre-preserved bottles, each lot of preservative is checked for contaminants before use and this testing is documented.

The laboratory provides instructions with all bottle orders that define how to sample, preserve, store, and ship the samples prior to their delivery at Lancaster Laboratories. These instructions inform the client of the importance of proper sampling and advise them that non-compliant samples are rejected or reported with a qualifier.

If samples are collected by Lancaster Laboratories personnel, applicable sampling methods are in place to perform the sampling operation.

As samples are analyzed at Lancaster Laboratories, there are times when additional sample volume is necessary to complete testing or perform retesting. If this situation arises, "additional sample" is requested by Lancaster Laboratories and/or submitted by a client to supplement current work being performed within our facility. Additional sample received is either assigned a new Lancaster Laboratories sample ID number and/or a comment noted on the final report to state that additional sample was received, depending on the situation. It is our goal to provide accurate traceability between sample submission and when testing is performed.

## 5.2. Sample Receipt and Entry

### 5.2.1. Sample Receipt

Samples can be received at the laboratory 24 hours a day, 7 days a week, 365 days of the year. Receipt can occur in one of three ways:

- Lancaster Laboratories courier services (i.e., Transportation Department)
- Personal delivery
- Commercial courier

All samples received for testing are delivered to the Sample Administration Department immediately upon arrival. This group is responsible for the unpacking and organizing of the samples. This process includes checking custody seals if present, paperwork agreement, signing the chain of custody, recording cooler temperatures, documenting the condition of containers, accounting for all sample bottles, and observing any safety hazards, and reporting any problems to Client Services for communication to the client. This receipt process is documented.

### 5.2.2. Sample Entry

As soon as practical after sample receipt, all samples are entered into our laboratory information management system (LIMS). Samples awaiting log-in are stored in temporary holding areas, at appropriate storage conditions to maintain sample integrity. If there is doubt about the suitability of items received or if items do not conform to the description provided or the testing required is not clear or specified, the client is contacted and the conversation documented.

At the time of entry, the LIMS assigns a unique Lancaster Laboratories' sample number to each sample. This number is sequentially assigned and a label is generated and is attached to the sample container.

Samples are tracked to the minute upon arrival. This allows the client to see exactly how long it took the samples to pass through receipt, unpacking, and entry.

A sample acknowledgement prints from the LIMS per sample delivery group (SDG). This notification is sent to the client to confirm sample receipt and entry on the day following sample log-in. Internally, appropriate personnel audit all applicable sample entry and client paperwork.

5.2.3. Sample Preservation Check

Support personnel check and document preservation of non-volatile liquid samples after the samples have been entered into the LIMS and before they are placed into storage. Any checks of volatile samples are performed at the time of analysis and documented.

5.2.4. Sample Rejection Policy

Any time a sample is received in a condition that does not meet the method requirements, the condition of the sample is clearly documented on a sample administration documentation log or sample problem form. These forms are forwarded to the project manager and the client is contacted to discuss the best course of action. The client is given the option to resample or have the sample analyzed and reported with a comment.

## 5.3. Sample Identification and Tracking

A sample label is generated for each sample and; in addition to the assigned Lancaster Laboratories' sample number; the following information is printed on the label: client name, sample identification assigned by the client, sample collection information, storage area, bottle code ID, analyses requested, and any applicable notes to laboratory personnel.

To ensure accountability of results, the unique sample number assigned is used to identify the sample in all laboratory data documentation, including notebooks, instrument printouts, and final reports. The sample number is also used to identify additional containers of the sample that are created during sample preparation and analysis (e.g., subsamples, extracts, digests).

## 5.4. Sample Storage

After sample entry, samples are placed in an assigned and identified storage location until needed for analysis. Room temperature, refrigerated, and freezer storage are available and samples are stored in accordance with regulatory, method, or client direction. The LIMS is used to assign storage locations, which assists in the orderly storage of samples. Sample storage locations are secured and monitored for accurate temperature control.

The central locked storage facility contains 3430 square feet of refrigerated space, including 2740 square feet equipped for automated sample retrieval. Samples are stored in the laboratory's automated storage and retrieval system (ASRS) or other assigned storage locations (separate volatiles areas) within the laboratory until completion of all analytical work.

When a sample is scheduled for analysis, the analyst retrieves it from the storage area. To maintain the integrity and security of the sample(s), the amount needed for analysis is removed and the sample(s) returned to storage as soon as possible

## 5.5. Sample Return/Disposal

Samples remain in the storage area following analysis until the testing results have been authorized and the analysis report has been generated. On a regular basis, a list is printed from the LIMS that summarizes samples that can be removed from the storage area. Samples are either returned to the client or disposed of in accordance with local, state, and federal regulations.

Due to the variety of waste generated at Lancaster Laboratories, several general categories of wastes and waste streams have been identified. Identification of waste occurs through information provided by the client, historical information, and/or analytical testing. Lancaster Laboratories uses a sophisticated, computerized sample management system, which includes programming to assist in the identification of hazardous wastes at time of discard.

For reasons of environmental liability, client confidentiality, proprietary product formulation protection, etc., wastes generated by Lancaster Laboratories are disposed of via incineration at EPA licensed facilities. The three exceptions include bulk neutralized acid waste, COD analysis waste, and lab pack waste containing mercury. None of these exceptions involve containers with client information.

### 5.6. Chain of Custody

Samples being tested for litigation require locked storage and documentation of the time and personnel responsible when the sample was not in storage. Procedures to define these activities are in place and include the following:

- A chain-of-custody document is initiated for each bottle type submitted by the client.
- The chain of custody is signed each time the sample is stored, removed from storage, or changes hands.
- Clients requesting internal chain-of-custody documentation receive the completed forms after the analysis is complete.

### 5.7. Representativeness of Samples

Each analytical method provides specific procedures for ensuring that a representative aliquot of the sample is used for testing. These procedures include shaking water samples and mixing solid samples. Analysts are instructed in sampling techniques that prevent contamination of samples.

## 6. TECHNICAL REQUIREMENTS – TRACEABILITY OF MEASUREMENTS

### 6.1. Reagents and Solvents

The reliability of our analytical results can be directly affected by the quality of reagents used in the laboratory. Procedures are in place to address labeling, storing, and evaluation of these materials. Reagents and solvents include acids, bases, indicators, buffer solutions, colorimetric solutions (CS), test solutions (TS), and volumetric solutions (VS). *The Lancaster Laboratories' Chemical Hygiene Plan* provides safety information in regard to the storage and handling of laboratory chemicals.

Each analytical method includes a list of reagents needed to perform the test. Reagents are fully described, including chemical name, purity, and description of preparation. Where applicable, shelf life and storage conditions are also listed. The laboratory is responsible for checking that new supplies meet the method requirements. These checks are documented and maintained.

Departmental management ensures that an adequate inventory of reagents needed to perform testing is maintained. Reagents received at the laboratory funnel through the Shipping and Receiving Department and deliveries are verified and labeled with the date of receipt. Large volume reagents (e.g., solvents, acids) are stored in a building outside of the laboratory until needed for use.

In addition to the name and concentration of the reagent, all reagents are labeled with the manufacturer/vendor, storage conditions, the date opened, and an expiration or re-evaluation date. Before using any reagent, the analyst must ensure that the material was properly stored and labeled. If a reagent has passed its expiration date or shows signs of deterioration, the material is not to be used in the laboratory and must be discarded. If a re-evaluation date is reached before a reagent is completely consumed, the reagent will be inspected by physical observation for signs of degradation. Physical signs include, but are not limited to, color changes, clumping or other texture changes for solids and formation of precipitate in solutions. This evaluation is performed by an experienced chemist or microbiologist.

Subsequent reagent solutions or mixtures prepared at the laboratory are fully documented in a logbook and labeled to include: unique name, concentration, date prepared, name of analyst preparing or reference to the logbook, storage conditions, and expiration/re-evaluation date. The information recorded allows these solutions to be traced to the original stock solution.

All reagent certificates and MSDSs are retained by the laboratory.

## 6.2. Media

Within the microbiology laboratory, procedures are in place to address preparation, labeling, storage, expiration, documentation, and quality/sterility evaluation requirements for these materials. These procedures are described in Appendix K of this manual.

## 6.3. Calibration Standards

Written calibration procedures are required, where applicable, for all instruments and equipment used in the laboratory. The source and accuracy of standards used for calibration purposes are integral to obtaining quality data. Requirements for calibration are provided in each analytical method including specifications for the standards used. Calibration measurements made by the laboratory must be traceable to national standards of measurement (e.g., NIST) where available. C of As are maintained for each material, as applicable.

Standards are usually purchased from commercial supply houses either as neat compounds or as solutions with certified concentrations. The accuracy and quality of these purchased standards is documented on a C of A and these certificates are maintained on file in the laboratory. Upon receipt at Lancaster Laboratories, material must be labeled with a date of receipt and stored appropriately.

Most solutions and all neat materials require subsequent dilution to an appropriate working range. Records of all standard preparations include the dilution(s) made and a reference to the original and any intermediate mixtures. Solutions are labeled according to laboratory procedures and assigned unique names or code numbers that provide traceability to the original components and stored appropriately. Each new preparation of standard is tested for integrity by comparison to standards from another source or previously prepared solutions. Standards are not to be used in the laboratory past their expiration date.

## 6.4. Equipment and Instrumentation

The laboratory is equipped with all equipment and instrumentation required for testing the scope of work which it supports. All equipment and instrumentation is maintained in proper working order. A master list of our equipment is maintained by our accounting department and includes the date that the instrument was received and the condition at receipt (new v. used). Our major equipment capabilities are summarized within Appendix F of this manual. In addition, we have numerous other instruments including pH meters and analytical balances along with support equipment such as ovens, incubators, muffle furnaces, centrifuges, etc.

6.4.1. General Requirements

- Equipment/instrumentation is assigned a unique designation. This unique number or system identification is used to track the piece of equipment within data documentation.
- An equipment logbook is established in conjunction with installation and is readily available to document all incidents that pertain to the equipment as they occur.
- All test, measuring, and inspection of laboratory systems, equipment, and instrumentation used at Lancaster Laboratories is routinely calibrated and maintained in accordance with applicable standard operating procedures.
- A member of the technical group, or designated individual, performs routinely scheduled maintenance and calibration of laboratory equipment as required by laboratory procedures. These activities are documented.
- If appropriate standards or expertise for calibration or maintenance are not available in-house, the operation is conducted by an outside service firm. Certificates or other data generated by the service firm are reviewed by applicable Lancaster Laboratories personnel to verify acceptability. This information is maintained on file.
- All equipment taken out of service is tagged "DO NOT USE". The following minimum information is documented:
  - Date taken out of service
  - Employee who took the equipment out of service
  - Reason for tag-out
- The date that the instrument is returned to service, the corrective action taken, and performance checks performed must be documented.

6.4.2 Standard Operating Procedures

Information regarding operation, maintenance, and calibration of equipment and instrumentation are found in respective SOPs. The procedures include a routine schedule for preventive maintenance and calibration as applicable, along with acceptance criteria and remedial action to be taken in the event of failure. These procedures are maintained in the document control system and reviewed on a regular basis to verify they remain current and accurate. Equipment manuals are also available to provide additional information in regard to operation and maintenance.

6.4.3. Maintenance

- Equipment maintenance is performed as either a preventive or corrective operation.
- Preventive maintenance procedures and schedules are developed for each piece of equipment, where applicable. Preventive maintenance operations are performed by an analyst, equipment maintenance specialist, or contracted (manufacturer's representative or service firm personnel). Documentation is maintained for the procedure(s) performed as part of the preventive maintenance operation. It is the responsibility of departmental management to ensure that a preventive maintenance schedule is addressed by a procedure where appropriate and is followed.
- Corrective maintenance is performed by an analyst, equipment maintenance specialist, or contracted (manufacturer's representative or service firm personnel) in response to indications of equipment malfunctions. The unit must be clearly tagged as out of service. All corrective actions taken to bring the unit back into service are documented. After repair, a notation is made in the logbook to note whether the function has been fixed. Calibration activities are performed as applicable, before the instrument is placed back into service.
- A supply of commonly needed replacement parts is maintained by the laboratory.
- A preventive maintenance schedule for major instruments is given in Appendix G. Maintenance of equipment used in microbiological testing is documented in Appendix K of this manual

6.4.4. Calibration

- Calibration is the establishment of, under specified conditions, the relationship between the values/response indicated by a measuring instrument or system and the corresponding known/certified values associated with the standards used. Some types of calibrations are performed with a set frequency (e.g. daily), while others provide intermediate checks to ensure that the instrument response has not changed significantly.
- All measuring and testing equipment having an effect on the accuracy, precision, or validity of calibrations and tests are calibrated and/or verified on an on-going and routine basis. Methods for calibration of instruments and equipment vary widely with the nature of the device and the direction given by analytical procedures, departmental procedures, or manufacturer recommendations. Frequency of calibration can also depend on additional factors including ruggedness of the instrument or equipment and the frequency of use.
- Departmental management is responsible for developing or acquiring written calibration procedures for the types of relevant equipment and instruments employed within their area, as applicable. Procedures address the following aspects: description of the calibration method, frequency/schedule for calibration, acceptance criteria, and corrective actions if failure occurs.

- Calibration information is recorded in a logbook that is associated with the instrument/equipment and/or a calibration certificate is maintained and/or data printouts are generated to document the activity.
- Calibration measurements are traceable to national standards of measurement (e.g., NIST) where available. Physical standards, such as NIST certified weights or thermometers, are re-certified on a routine basis. Calibration certificates are maintained on file, where applicable, to indicate the traceability to national standards of measurement. These physical standards are used for no other purpose than calibration.
- Calibration failures are documented in the logbook for the instrument and/or within the data printouts from the instrument. Management personnel perform an evaluation and review of failures and assess any potential impact the failure might have on previously generated data. Lancaster Laboratories utilizes "real-time" controls to ensure the accuracy of the data. These controls are used to assist in assessing the impact of the situation.
- After repair, adjustments, or relocation that could affect instrument response, calibration/verification activities are performed, as applicable, before the unit is returned to service.
- Analytical data is not reported from instrumentation or equipment that fails to meet calibration requirements.
- A summary of the calibrations for most major equipment is given in Appendix H.
- Procedures for calibration of equipment used in microbiological testing are documented in Appendix K of this *Quality Policy Manual.*

## 6.5. Computerized Systems and Computer Software

6.5.1. Computer Usage

Lancaster Laboratories provides computer equipment for employees to use as a tool in performing their work. Computer equipment is the property of LLI and used in accordance with defined terms and conditions. Our goal is to provide standard hardware and software that meets the needs of the user. The majority of desktop PCs in use are standardized using cloning software.

6.5.1.1. Physical security of computer systems – It is company policy to protect computer hardware, software and data documentation from misuse, theft, unauthorized access and environmental hazards. The corporate computer area and computer "Hot-Site" is locked and requires identification/building card access. All vendors, contractors, or other visitors must be escorted into this area. Controlled access of the laboratory buildings is outlined in Section 3.2.

6.5.1.2. Passwords – Passwords are important for the security of company data and resources. Lancaster Laboratories' primary network operating system is Windows and each employee must have a user ID and password combination to access the system. Other computer systems within the Environmental Division also require a user ID password combination for access. The following procedures apply regardless of what system(s) is being utilized:

- Passwords must be kept confidential
- Users must log-out of a system when not in use to prevent unauthorized access.
- Forgotten passwords can only be reset by the Computer Systems Department or by an appropriate System Administrator.
- Network passwords automatically expire every 90 days. The computer prompts a user to change the password when the expiration date nears.

6.5.1.3. Computer viruses – Lancaster Laboratories centrally and continuously monitors the computer network for computer viruses. Employees are prohibited from using the company's computer equipment to propagate any virus. Anti-virus software is employed to detect viruses on the Windows network. A notification is sent when there is a particularly dangerous or virulent data destructive program that employees need to be aware of. However, employees are reminded to always be cautious and observant even if there are no current warnings. Employees must report any virus concerns to the anti-virus administrator or Computer Service Management as soon as possible. Employees who share files between their home computer and the laboratory should install anti-virus software on their home computer. If an employee does not have such software, the laboratory can suggest various no-cost anti-virus software products.

6.5.1.4. Internet and e-mail system – The e-mail system is used primarily for Lancaster Laboratories' business purposes. The *Lancaster Laboratories' Personnel Manual* provides additional information in regard to system usage. Employee access to the Internet is restricted to those employees who have a business need for it. All employees have access to e-mail. Access to the internet is configured through a user's Windows network account. All internet and e-mail activity is subject to monitoring. All messages created, sent or received over the internet are the property of LLI and can be regarded as public information. E-mail and website filtering software is utilized.

6.5.1.5. Lancaster Laboratories' Intranet (LabLinks) – The Lancaster Laboratories' Intranet is designed to be a useful tool for employees to acquire company information and to provide a company communication system. The *Lancaster Laboratories' Personnel Manual* provides additional information in regard to usage.

6.5.1.6. Software policy

- Copyright laws protect software, and Lancaster Laboratories' intent is to abide by all software agreements.
- Software purchases must be formally requested and approved by management and/or validation personnel, as necessary.
- All software is used in accordance with applicable license agreements.
- Employees are not to install any software on computer(s) unless authorized by the Computer Systems Department.

- Software upgrades must occur in accordance with applicable change control procedure
- Employees must not give software to outsiders (e.g., clients, contractors), unless approval is granted by management.
- Users must not make copies of any licensed software or related documentation without permission. Any user that illegally reproduces software is subject to civil and criminal penalties including fines and imprisonment.

6.5.1.7. Computer system backup, data restoration, and data archival – Mission critical data is stored on several computers throughout the laboratory. These computers are connected through the local area network. Selected files on these computers are backed up using an enterprise-level backup software program. The objective of this backup is to have the ability to restore data after a total loss (e.g., theft, fire, natural disaster). Procedures are in place to perform data backups and restores.

6.5.1.8. Remote access to computer systems – Employees are able to remotely connect to the laboratory computer systems through an encrypted (SSL) login. When logging in, users are authenticated with their Windows Active Directory account and password.

6.5.2. System and Software Verification – Before a new computer system or significant modification of an existing system is implemented in our laboratory, it is necessary to meet the following documents:

- Requirements documents – Describe the required system functionality and specifications
- Design documents – System overview, screen design, report layout, data description, system configuration, file structure and module design
- Testing documentation for system development/verification – Structural testing of the internal mechanisms and user testing of the installation and system qualification
- Standard operating procedures and/or manuals

6.5.3. CROMERRR – The laboratory has reviewed and evaluated EPA's proposed Cross-Media Electronic Reporting and Record-keeping Rule. We monitor the rules progress; and the laboratory will wait to make any definitive changes in response to the rule until it is clear what direction the agency plans to take and within what timeline. Working with FDA's 21 CFR Part 11 regulation in our Pharmaceutical Division has given the laboratory a head start in understanding the demands of CROMERRR.

## 6.6. Change Control

Procedures are in place to define how to maintain processes, instrumentation, equipment, computerized systems, and computer software in a validated or controlled state through a plan of change control. Successful changes require a thorough evaluation and testing for potential consequences prior to implementation. Planning, authorizing, testing, and reviewing of proposed changes are documented throughout the change process. Changes are planned or could be made in response to an emergency situation. The following "general" elements apply to changes, as appropriate:

- Request to perform a change
- Evaluation of a change
- Authorization of a change request
- Preparation for an authorized change
- Execution and testing of the change
- Documentation of the change
- Approval of the change
- Change implementation and follow-up (Documentation is required to summarize the change and to reflect the outcome of the change. Formal approval of the change is performed by designated responsible individuals and QA.)

## 6.7. Labware Cleaning

Dedicated washroom personnel are in place to support the laboratory operations in regard to labware preparation, washing, rinsing, and drying. Labware can include, but is not limited to glassware, plasticware, utensils, and pipettes. Procedures are in place to outline the washing process for each type of labware. Most labware is cleaned using a Miele glass washing machine. Some labware is still washed by hand and either air-dried or dried in specifically designed ovens.

Most of the labware used in the laboratory is "common or non-dedicated" labware (common to a department), but some of the labware used in the laboratory is identified as "dedicated" labware. Dedicated labware is exclusively used for certain analyses. Examples of dedicated labware include glassware used for MBAS and Ortho (acid washed) and "oils" glassware. This labware is isolated and cleaned only with "like" labware.

All glassware is type A and 100% visually inspected for breakage (e.g., cracks, chips), cleanliness, and dryness before being returned to the laboratory for use.

Generally, each test has controls in place to ensure that results were not negatively affected by unclean labware. These controls include blanks to detect positive interferences and controls to detect negative interferences.

# 7. PURCHASING EQUIPMENT AND SUPPLIES

## 7.1. Procurement

It is the responsibility of management personnel within each department to ensure that the appropriate supplies are available and/or ordered with sufficient lead-time to perform analytical testing or to provide support to the testing areas. The individual technical departments have trained personnel who enter the supply order into the company's requisition software system. The selection of these products is based on technical input at the analyst level and authorized by technical departmental management. The Purchasing Department maintains an ordering system in which purchase requisitions are managed. Common laboratory items (e.g., beakers, flasks, reagents) are ordered directly through the Purchasing Department. Purchase orders over a specified dollar amount require verification from the appropriate member(s) of the Executive Management Group before an order can be placed.

Upon receipt of an order, the Purchasing Department checks the order to ensure that all items were received as specified. Products that have specific storage requirements are taken to the technical area upon receipt. It is the technical area's responsibility to ensure that the product is stored in the appropriate manner. Any checks on the quality of the materials received for use in a specific test are the responsibility of the laboratory using them. This is based upon the experience of the laboratory with the usability of the product. Generally, each test has controls in place to ensure that test results are not negatively affected by the materials.

Any problems encountered when using a material in the laboratory must be brought to the attention of the Purchasing Department and/or Quality Assurance as applicable, to ensure that follow-up and corrective action occur.

## 7.2. Supplier Evaluation

Procedures are in place to evaluate vendors who supply us with: new equipment, instrumentation, computerized systems and computer software; commercially purchased glassware, including sample bottleware, reagents, chemicals, solvents, gases, media, and standards; and contracted and subcontracted services.

Lancaster Laboratories strives to ensure our suppliers continually improve their quality systems and we reserve the right to purchase from suppliers of our choice in order to best fulfill the needs of our clients and our business. When directed by a client to purchase from a specific supplier, we will do so. In this instance it is the client's responsibility to "qualify" the specified supplier. We attempt to purchase from businesses that we have an established purchase history or have previously acquired information regarding the supplier's quality programs.

Lancaster Laboratories does not evaluate every supplier. Risk assessment is taken into consideration when making this decision. The risk assessment analysis includes system, material, services, and number of samples or operations the purchase may affect or support. Evaluations are not required for computer operating systems, utilities, toolsets, or systems software. They also are not required for any off-the-shelf configurable software package that has an extensive market performance history (e.g., Microsoft Word, Excel, Access).

Additional quality systems are also in place within the laboratory to further verify and support the materials used:

- C of A for every lot of purchased prepared microbiological media and for purchased chemicals, where available, are reviewed and maintained on file.
- For many chemical analyses (e.g., HPLC, GC, IC) a blank is routinely run which serves as real time suitability testing of the reagent being used.
- Microbiological testing often employs positive and negative controls, which serve as real time control checks.

## 8. ANALYTICAL METHODS

### 8.1. Scope of Testing

Samples are analyzed in accordance with client-supplied methodology, official published methods, standard methods, or validated in-house methods. We recognize the importance of providing verifiable results and, therefore, use methods accepted and approved by a broad range of federal and state regulatory agencies. In order to meet the needs of our clients as well as regulatory agencies, the laboratory sometimes needs to support different versions of the same method (i.e. SW-846 8081A and 8081B). The laboratory can also assist in developing and validating analytical methods for specific products and matrices. All methods submitted for our review, as well as all analytical results, are considered confidential.

The laboratory performs a wide variety of environmental testing in support of the Safe Drinking Water Act (SDWA); Clean Water Act (CWA); Resource Conservation and Recovery Act (RCRA); Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA/Superfund); and the Clean Air Act (CAA). Standard methods approved by ASTM are also used in testing. Potable water, wastewater, soil, sediment, sludge, oils, biota, tissue, soil gas and air are among the matrices typically analyzed.

Our areas of expertise include:

| | |
|---|---|
| • Gas Chromatography (GC)<br>• Gas Chromatography/mass spectrometry (GC/MS)<br>• High Performance Liquid Chromatography (HPLC)<br>• High Resolution Gas Chromatography/High Resolution Mass Spectrometry (HRGC/HRMS)<br>• Liquid Chromatography/mass spectrometry/mass spectrometry (LC/MS/MS)<br>• Ion Chromatography (IC)<br>• Purge and Trap<br>• Selected Ion Monitoring (SIM)<br>• Atomic absorption spectrophotometry (CVAA)<br>• Cold vapor atomic fluorescence spectrometer (CVFA)<br>• Inductively coupled spectrophotometry (ICP)<br>• Inductively coupled spectrophotometry/mass spectrometry (ICP/MS)<br>• Autoanalyzer<br>• UV/VIS spectrophotometry<br>• Fourier transform spectrophotometry (FTIR) | • TOC Analyzer<br>• Water Quality and inorganic analysis<br>• Summa Canister & Tedlar Bag Air analysis<br>• Microbiology<br>• Full range of petroleum analysis/UST (including state-specific methods such as AK-101, AK-102, AK-103, CT ETPH, FL PRO, MA VPH, MA EPH, NW-DX/GX, NW-HCID, NY STARS, OA-1&2, QAM 025, TX-1005, TX-1006, WI DNR GRO, WI DNR DRO)<br>• Method development<br>• Data Package deliverables<br>• Electronic data deliverables<br>• QAPP development<br>• Consulting services |

A list of tests covered under the laboratory's NELAP accreditation can be found in Appendix I. A complete list of the tests routinely performed by the laboratory can be found in the *Schedule of Services*.

## 8.2. Analytical Test Methods

Each laboratory is required to establish and maintain an analytical methods manual containing current copies of all the methods used for standard testing. The sources for these methods include the most recent versions of these compendia:

- Test Methods for Evaluating Solid Waste, SW-846
- Standard Methods for the Examination of Water and Waste
- Code of Federal Regulations, Chapter 40
- EPA 100 through 600 and 1600 series methods
- Contract Laboratory Program Statement of Work

Most of the test methods used are re-written into a laboratory standard format, which provides consistency in content and allows the analysts to locate the information they need quickly. Procedures are in place to define the format, required approvals, and the control system for these method documents. The format requirements include:

- Uniquely assigned method number, which is used extensively for scheduling and documentation purposes.
- Reference to the original source of the method (e.g. SW-846)
- Scope
- Basic Principles
- Apparatus and Reagents
- Personnel Training and Qualifications
- Safety and Waste Disposal
- Detailed procedure (including any method modifications)
- Calculations
- QA/Quality Control
- Revision Log
- Approval signatures from technical, management, and QA personnel

Analytical methods are maintained as controlled documents to ensure that analysts are always working with the most current version and are reviewed periodically for accuracy.

## 8.3. Client Supplied Methods

Most of the client-supplied method requirements presented to us involve achieving specific quality control criteria or limits of quantitation using standard EPA methods. These requirements would be communicated to the appropriate technical groups prior to the project start up. Each technical group would evaluate the scope of work and the requirements to assure the criteria can be met using the standard EPA method. They would also monitor the data to assure the criteria are met throughout the project. A client service representative would notify the client if there is a more appropriate method available or if the client's criteria could not be achieved on a certain sample matrix (i.e., due to matrix or dilutions). Occasionally, we are asked to transfer a non-standardized method from a client into our lab or to develop a new method, when one is not available. In the case of a method transfer, we would set up the client's method and perform some initial

evaluation. After the initial evaluation, we may make recommendations on how to improve method performance. If the method appears to be adequate, we would determine linearity, specificity, precision, accuracy, LOD, and LOQ by performing calibrations, analyzing method blanks, and carrying out method detection limit and quad studies. In the case of method development, we would work with the client and/or data user to determine the level of validation required ensuring that the method meets its intended purpose. In addition to the elements above, we also determine standard and sample stability and robustness depending on the scope of the project. Typically, a standard operating procedure would be written and submitted to the client along with the results of the validation. These steps would be completed prior to analysis of field samples. Data related to the set up of the method would be archived at Lancaster Laboratories.

## 8.4. Method Validation

Before new or revised analytical methods are authorized for routine use in the laboratory, validation data is required to demonstrate that the method and analysts performing it are capable of meeting data quality objectives for precision and accuracy. A procedure is in place to outline this process.

Many methods published by USEPA include instructions for performing an initial demonstration of capability, which typically consist of determining the method detection limit and analyzing fortified samples in quadruplicate. This demonstration is performed and compared to acceptance limits for precision, accuracy, and detection limits, when available.

Methods that do not include specific validation requirements are validated by analyzing fortified samples or standard reference materials in replicate. The results of these analyses are used to assess accuracy and precision. Results of validation studies are documented and subject to review and approval.

## 8.5. Procedural Deviations

Analysts are required to follow a documented method for all tests performed. Procedures are in place to ensure that deviations from analytical methods are documented, approved, and justified in an appropriate and consistent manner (Note: Deviation from the OH EPA approved SOPs is not permitted). We classify method deviations as either being a planned deviation or an unplanned deviation. "In general," the following information is captured to document both types of situations:

- Description of the deviation
- Reason or justification for the deviation
- Impact the deviation had on the testing
- Signature/date of analyst performing test involved
- Signature/date of LL director approving the deviation
- Signature/date of client approval, if necessary

Deviations to written procedures are documented in raw data notebooks or through the ICAR (Investigation and Corrective Action Report) system. Both types of documentation require management review and approval.

# 9. INTERNAL QUALITY CONTROL CHECKS

## 9.1. Laboratory Quality Control Samples and Acceptance Criteria

Quality control (QC) samples are analyzed with each batch of samples to demonstrate that all aspects of the analysis are in control within established limits of precision and accuracy. As required in the procedure on written methods, each analytical method specifies (or cross-references another procedure) the type of QC sample, frequency of analysis, acceptance criteria for QC sample results, and corrective action to be taken if QC sample results fall outside of the *acceptable range*.

The types of QC samples and the information each provides are discussed in the following paragraphs.

Quality control checks used for microbiological tests can be found in Appendix K of this *Quality Policy Manual*.

9.1.1. Blanks - A blank is a designated sample designed to monitor for sample contamination during the analysis process. A volume of deionized laboratory water is typically used to monitor water sample analysis, while solid sample analysis blanks consist of a purified solid matrix or just the reagents used in the test. The blank and field samples are treated with the same reagents, internal standards, and surrogate standards and carried through the entire analytical procedure. Ideally, blanks demonstrate that no artifacts were introduced during the analysis process. The specific acceptance criteria for each test is given in the analytical method and is usually based on the required reporting limit.

9.1.2. Surrogates - Surrogates are organic compounds, which are chemically similar to the analytes of interest, but are not naturally occurring, in environmental samples. When required by the analytical method, surrogates are spiked into all the field and QC samples to monitor analytical efficiency by measuring recovery on an individual sample basis. The percent recovery is determined and compared to the acceptance criteria. Acceptance criteria limits are set as required by the method or based on a statistical determination from laboratory data.

9.1.3. Matrix Spikes - A matrix spike sample is created by fortifying a second aliquot of a water or soil sample with some or all of the analytes of interest. The concentration added is known and compared to the amount recovered to determine percent recovery. Matrix spike recoveries provide information about the accuracy of the method in light of the matrix analyzed. The acceptance criteria are given in the analytical method and limits are set as required by the method or based on a statistical determination from laboratory data.

9.1.4. Laboratory Control Samples - Laboratory control samples (LCS) are samples of known composition that are analyzed with each batch of samples to demonstrate laboratory accuracy. The samples either naturally contain the analytes of interest or are clean samples fortified with known concentrations. Laboratory fortified blank is another term used to describe a LCS. Percent recovery is calculated and compared to acceptance criteria, which are set as required by the method or based on a statistical determination from laboratory data.

9.1.5. Duplicates and Matrix Spike Duplicates and Laboratory Control Sample Duplicates - A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test. To compare the values for each compound, the relative percent difference (RPD) is calculated by dividing the difference between the numbers by their average. Precision for analytes that are not typically found in environmental samples (i.e., organic contaminants) is determined by analyzing a pair of matrix spike duplicates, defined as two spiked samples and comparing the RPD for the spiked compounds. The acceptance criteria are described as a maximum for the RPD value, which are set as required by the method or based on a statistical determination from laboratory data.

9.1.6. Internal Standards - Internal standards are organic compounds, which are chemically similar to the analytes of interest, but are not naturally occurring in environmental samples. When required by the method, internal standards are added to every field and QC sample after extraction but prior to analysis. Comparison of the peak areas of the internal standards is used for quantitation of target analytes. Internal standard peak area and retention time also provide a check for changes in the instrument response. The acceptance criteria is stipulated in the analytical method.

9.1.7. Serial Dilutions - A serial dilution is the dilution of a sample with sufficiently high concentration by a factor of five to check for the influence of interferents. This QC check is performed for inorganics analyzed by ICP or ICP-MS. When corrected by the dilution factor, the diluted sample result must agree with the original sample within specified limits.

9.1.8 Interelement Correction Standard – Analyzed to verify interelement and background correction factors. A solution containing both interfering and analyte elements of known concentration is analyzed at the beginning and end of each analysis run or a minimum of twice per 8 hours.

9.1.9. Second Source Check - A second source check is analyzed using either the LCS and/or an ICV (Initial Calibration Verification). The second source is a standard that is made from a solution or neat purchased from a different vendor than that used for the calibration standards. For some organic custom mixes, the same vendor but a different lot and preparation is used. This ensures that potential problems with a vendor supply would be evident in the analysis. Some areas of the lab use the continuing calibration verification standards as a second source from the initial calibration.

## 9.2. Quality Control Sample Frequency and Corrective Action

Each analytical method defines the frequency for the required QC samples. A summary is provided in Appendix J. The corrective action required when a QC result fails to meet the acceptance criteria is also given.

The QC acceptance criteria are available to analysts in the laboratory. If the method reference requires the use of specific limits, such as in Contract Laboratory Program methods, the laboratory uses the published limits that are documented as part of the analytical method. Many methods require that each laboratory determine their own acceptance criteria based on statistics from performance of the method. In these cases, the limits are available to the analysts and are entered into the laboratory's computerized QC system described below. Statistically determined acceptance criteria are frequently subject to change as the laboratory recalculates its control limits. Due to their dynamic nature, acceptance criteria are not included in this manual.

The results of all quality control samples are entered into the computer in the same way as the results of client samples. The LIMS compares the individual values with the acceptance limits (statistically determined or method specified) and identifies quality control sample results that are out of specification. If the results are not within the acceptance criteria, corrective action suitable to the situation must be taken. This includes, but is not limited to, checking calculations, examining other quality control analyzed with the same batch of samples, qualifying results with a comment stating the observed deviation, and reanalysis of the samples in the batch. In addition, computerized reports on the results for all quality control analyses including mean and standard deviation are generated monthly. These statistical analyses are used by the QA Department to check for trends that indicate method bias.

The laboratory allows for marginal exceedances based on the number of analytes in the LCS. The exceedances are carefully monitored so that any systemic problems would be identified and corrective action taken. If the LCS is being reported based on the marginal exceedance allowance, a comment is printed on the analytical report.

## 9.3. Quality Control Charts

Quality control results entered into the computer are used to generate control charts that are plotted via computer and can be accessed at any time by all analysts and Quality Assurance. The system charts results from surrogates, matrix spike/matrix spike duplicates, duplicates, and laboratory control samples. These charts provide a graphical method for monitoring precision and bias over time. They can be used to detect quality problems by observation of patterns. The computerized quality control system is used to report QC data to clients and to collect data for assessment of precision and accuracy statistical limits.

## 9.4. Measurement Uncertainty

(ISO 17025) "All uncertainty components which are of importance in a given situation shall be taken into account using appropriate methods of analysis" (5.4.6.3). This means the laboratory must determine the uncertainty contribution of all steps in the testing process such as equipment, calibration, standards, reagents, preparation, cleanups, etc. Since, in most methods, the laboratory control sample (LCS) goes through the entire process of preparation to analysis; all factors that would contribute to uncertainty is evident through the LCS results. LCSs are performed with every batch of samples where appropriate for the method.

Measurement uncertainty is calculated as two times the standard deviation of the LCS recoveries for the group and date range of data points selected for all applicable methods. This is reported as a percentage.

Tests that do not have LCSs (e.g. TCLP and paint filter test), are evaluated on a case-by-case basis by taking into account the uncertainty of each of the steps taken to perform the test.

Reports for uncertainty are generated and submitted to QA on an annual basis. At this point, it is not necessary to apply or report the uncertainty determination with sample results. When a client requests the measurement uncertainty it is applied by multiplying the determined analyte concentration by the uncertainty percentage.

## 10. ASSURING QUALITY OF TEST RESULTS

### 10.1. Data Management

At a minimum, data management is initiated when Lancaster Laboratories receives the samples from the client. More often the process begins with client communication of their needs and requirements for a specific project and/or testing. The client service representatives/project managers are responsible for entering the information in the sample set up function of the LIMS. Upon receipt of the samples the unique tracking number is generated based on this information. At this point, computer technology becomes an integral part of tracking the samples through laboratory operations. The flow of data from the time samples enter the laboratory until the data is reported is summarized in the following table:

**Sample and Data Flow**

| Action | Personnel Involved |
|---|---|
| Sample received at Lancaster Labs<br>• Unpacked and reconciled against the client paper work or Chain of Custody<br>• SA Documentation log completed | Sample Administration |
| Sample is entered into sample management system<br>• Lab ID number assigned<br>• Analyses entered<br>• Chain of custody started<br>• Storage location assigned<br>• Electronic record of sample number<br>• Labels generated<br>• Acknowledgement printed (record of samples received and analysis entered) | Sample Administration |
| Sample stored in assigned location (refrigerator, freezer, etc)<br>• Electronic record of sample #, bottle code, and location | Sample Support |
| Acknowledgment sent to client | Sample Administration |
| Sample removed from storage for analysis<br>• Electronic requisition of sample number by bottle code<br>• Necessary aliquot taken<br>• Sample returned to storage | Technical Personnel |
| Analysis is performed according to selected analytical method<br>• Raw data recorded<br>• Reviewed<br>• Transferred to computer by chemist or technician* (This is tracked by the unique sample number and batch number.) | Technical Personnel |
| Computer performs calculations as programmed according to methods | Data Processing |
| Second chemist or supervisor verifies raw data | Technical Personnel |
| Generation/signing of reports | Billing and Reporting Group, technical report signers |
| Data package deliverables are assembled | Data Package Group |
| Electronic Data Deliverables (EDDs) are generated | EDD Group |
| Data packages are reviewed prior to sending to client | QA, Data Package Personnel, and Laboratory Management |
| Data packages are scanned<br>Hard copy of batch raw data is archived<br>Electronic files are backed up and archived | Data Package Personnel, Office Services |

*Analyses requiring the chemist's interpretation may involve manual data reduction before entry into the computer.

## 10.2. Data Documentation

Analytical data generated in the laboratory is collected on printouts from the instruments or associated data system or is manually documented in bound notebooks. Analysts review data as it is generated to determine that the instruments/systems are performing within specifications. If any problems are observed during an analytical run or the testing process, corrective action is taken and documented.

Procedures are in place to ensure that all data is traceable, authentic, and complete. The following general requirements outline our system for notebook, logbook, and documentation recording:

- Observations, data, and calculations are recorded at the time they are made and are identifiable to the specific task
- Entries are legible, signed, and dated
- Errors are corrected in a manner that does not obliterate the original entry, initialed and dated
- Blank pages or substantial portions of pages which are left blank are crossed-out to eliminate the possibility of data entry at a later date
- Notebook pages and instrument printouts are signed/dated to indicate second party data review
- At periodic intervals a supervisor or data reviewer checks equipment/instrument logbook entries and temperature recordings for completeness, legibility, and conformance to procedures.
- At a minimum, the following information is recorded as part of data documentation:
    - Date of analysis/operation
    - Signature/date of analyst performing test/operation
    - Identification of client sample(s) and material(s) analyzed
    - Materials, reagents, standards used to perform the testing/operation
    - Method used to perform testing/operation (including version number and/or effective date)
    - Equipment/instrumentation used to perform testing/operation
    - Calculations and how they were derived
    - Departures, planned or unplanned, from the analytical method
    - Signature/date of person reviewing data documentation
- For computer generated data, the following information is recorded:
    - Sample(s) analyzed/operations performed
    - Date of analysis/operation
    - Unique instrument identification
    - Name/date of person operating the instrument
    - Name/date of person reviewing data
    - Any manual notations or interpretations made on instrument printouts are signed, dated, and reviewed

## 10.3. Data Calculations

Most instruments either include or are connected to a data system programmed to perform calculations needed to reduce the raw data to a reportable form. All calculations are maintained in the instrument manuals and/or as part of the analytical method.

In many cases, the data from the local instrument system are uploaded directly to the laboratory information management system for review and reporting. This direct upload eliminates the need to retype data and an associated source of transcription errors from the analytical scheme.

Some instruments report data that require application of additional factors before the data is in final form. For example, an extract concentration may be reported by the instrumental data system, but additional dilution and preparation factors may be needed before the result represents the concentration of analyte in the sample. Analysts input these additional factors into the laboratory sample management system, where final calculations are performed.

Analysts type manually collected data, such as pH and titration data, into the laboratory sample management system, which is programmed to perform calculations for final reporting. Documentation of the programming for each calculation performed by the sample management system is maintained.

## 10.4. Reporting Limits

It is important to ascertain the limit of quantitation that can be achieved by a given method, particularly when the method is commonly used to determine trace levels of analyte. The Environmental Protection Agency has set forth one method for determining method detection limits (MDLs) from which limits of quantitation (LOQs) can be extrapolated which is summarized in a laboratory procedure.

MDLs are verified or determined annually on each instrument and are the basis for the LOQ used in the default reporting format. Because MDLs change each time they are re-evaluated, they are not included in this manual, but are available in each laboratory and available to clients upon request.

The reporting limit used to determine whether a result is significant and reported as detectable is dependent upon agency and client requirements. A variety of formats are available and include use of the MDL, LOQ, method specified limits, and project specific limits. The MDL and LOQ for each analyte are programmed into LIMS for reporting purposes.

## 10.5. Data Review

Final review and verification of the data is performed by a trained analyst using the sample results and quality control information entered into the laboratory sample management system. A second analyst or supervisor knowledgeable in the test, other than the employee responsible for performing the test, reviews the data. The review includes checks for correct transcription, calculations, passing calibrations, and quality control results that meet acceptance criteria. Any errors identified during this stage are corrected and reviewed with the responsible person.

After determining that all necessary requirements for valid data are met, the reviewer electronically approves the data by changing the status of the data from "complete" to "verified". The computer is programmed with a list of approved reviewers for each test, and the system is password protected to ensure that only qualified individuals verify the data.

## 10.6. Data Qualification

Data qualifiers are used to provide additional information about the results reported. The most typical use for data qualifiers is for results that fall below the quantitation limit, in the region where it becomes more difficult to distinguish a positive result from the background instrument signal. The data systems used to generate and report results are programmed to flag values in this range as estimates.

Other qualifiers are applied to advise data users of any validation issues associated with the data. The laboratory makes every effort to meet all of the requirements for generation of data. Occasionally, generation of data that does not meet all the method requirements occurs due to sample matrix or other analytical problems. If the test can not be repeated or reanalysis would not yield better quality data, qualified data is reported. Qualifiers can be in the form of comments on the analytical report or flags applied to the results.

## 10.7. Data Reporting

When all analyses are completed, reviewed and verified, a report is generated. The client receives a copy of the report containing the results of the analysis, plus comments added by the analyst, where necessary. To avoid ambiguity in interpreting results, the reverse side of the client's copy of the report contains an explanation of all symbols and units used in reporting data. Copies of reports and associated supporting raw data are retained in our archives. The report contains the signatures of the people who reviewed the final report. Since each result was previously reviewed, the final report review provides a last look for obvious typographical errors and ensures that the results are consistent with each other. Personnel responsible to review and sign reports are noted in the key personnel list provided in Appendix C.

Lancaster Laboratories offers a variety of data levels and formats, from a basic report of results only, to a comprehensive data package of quality control information and raw data. The client and any agency involved direct the selection of report type. A summary of report formats and data packages types is provided in the laboratory *Schedule of Services*. Various electronic formats are also available formatted to client-specified file structure and sent via e-mail, direct upload, web-site access (LLabWeb), or common courier.

Client confidentiality of LLabWeb data is ensured by the use of a secured firewall internet environment coupled with the use of a user ID and password to gain login access to the system. User accounts are configured to only allow access to specific data associated with the user's Lancaster Laboratories business account number.

Amendments to a final report after issue are in the form of an additional document or data transfer and will include a reference to the original report. When a completely new final report is required, it is uniquely identified and includes a reference to the original report it replaces. A letter is sent with each revised report that clearly identifies the reason for the revision.

10.7.1. Reporting the Results

Analytical reports are printed with a cover page that summarizes all samples in that group. This page lists the Lancaster Laboratories' assigned sample number and the corresponding client description. The cover page identifies the laboratory contact person's name and phone number if there is a question about the report. Within this package, each page is uniquely identified and paginated. Analytical test results for methods listed on the laboratories' accreditation scope meet all requirements of NELAP accreditation and ISO 17025 unless noted otherwise. Ohio EPA VAP requires that a signed, notarized affidavit accompany each analytical report.

## 10.8. Data Storage, Security, and Archival

Lancaster Laboratories has documented procedures and instructions for the identification, collection, access, indexing, filing, storage, maintenance, and disposition of data records. Records are in the form of hard-copy paper records, electronic data files, magnetic tape, and CD-ROMs.

Data records are legible and identifiable to the samples or operations to which they apply. Lancaster Laboratories maintains records to demonstrate conformance to specified requirements and the effective operation of the quality system. Records are stored and maintained in such a way that they are readily retrievable in facilities that provide a suitable environment to minimize deterioration or damage and to prevent loss. Retention time for records is in accordance with specific procedures or instructions. At the end of Lancaster Laboratories defined archival period, the client is notified if requested and asked to provide the laboratory with instruction regarding whether the data on file are to be disposed of or whether the documentation is to be returned to the client.

If specified in client contract(s), archived records are transferred according to their instructions in the event of a change in laboratory ownership or if the laboratory go out of business. If not specified by the client, the sale agreement must require that archived records be maintained as scheduled by the new owners. In the case of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed.

The laboratory maintains all documentation which is necessary for historical reconstruction of data:

- Analysis reports
- Data notebooks
- Data logbooks
- Instrument printouts
- Correspondence and client files
- Instrument and equipment logbooks
- QA records
- Corporate documents
- Electronic records

# 11. AUDITS AND INSPECTIONS

## 11.1. Internal Quality Assurance Audits

The QA Department, which is independent of laboratory activities, performs routine and on-going system, traceability, and observation audits to objectively review current systems, operations, and procedures as well as automated data integrity audits of electronic data records. The goal of the audits is to ensure that the quality system activities are effective and in compliance with regulatory, including NELAP and ISO 17025, as well as internal policies and procedures. Audits are documented and tracked in a QA database.

Audits are scheduled and conducted following a predefined schedule, based on criticality of operation and prior audit results, with the goal of evaluating systems and technologies across the operation. If warranted, additional audits are performed to follow up on promised corrective action or areas of concern.

Results of an audit are documented in a report format and distributed to applicable management personnel responsible for the area(s) under audit. Management is responsible to address all non-conformances found during an audit.

Audit reports and responses are circulated to Management to communicate the outcome of the audit and the proposed plan(s) for corrective action, if warranted. If any of the audit findings cast doubt on the validity of the results, the clients must be notified within three business days of the investigation.

All records maintained as part of an audit are kept on file.

On an annual basis, an audit of the QA Department is performed as directed by the company Chairman of the Board. The auditors assigned to carry out this operation are qualified staff members independent of the QA Department.

The specific content and findings of internal audits are not shared with clients.

## 11.2. Review of the Quality Assurance Program

All levels of management are continually updated on the status of quality and compliance by circulation of pertinent documents. Management review is documented by signatures on the route list, along with any comments or request for additional follow-up. The types of documents circulated real-time include:

- Internal, client, and agency audit reports
- Plans for corrective action
- Proficiency test results
- Investigation and corrective action reports
- Monthly and quarterly QA status reports

Executive management reviews the elements of the total QA program on an annual basis to ensure its continuing suitability and effectiveness in meeting the stated objectives outlined in Section 2.4 of this manual. The evaluation entails review of reports to management, all audit findings, client complaints, laboratory investigations, staff adequacy and training, and projected

growth in workload. Patterns or trends in any of these areas are reviewed as a means to continually improve the quality system. This review also includes an evaluation of any audit

findings resulting from the audit of the QA Department. At the conclusion of this quality system review, executive management determines the need to introduce changes or improvements into the quality systems at Lancaster Laboratories. The minutes from the meeting and any recommendations for improvement are documented and a copy is forwarded to the QAU for review and follow-up.

## 11.3. Good Laboratory Practice Critical Phase Inspections

Any project that is subject to Good Laboratory Practice (GLP) regulations is audited by the QA Department at intervals adequate to ensure the integrity of the study, as required by the regulations. Inspections of a GLP project include direct observation of analysts as they perform various phases of the study. Documentation is reviewed as part of the inspection. The purpose of this type of audit is to ensure that there are no deviations from written methods, procedures, or study protocols.

Results of inspections are documented in a report format and distributed to applicable management personnel responsible for the area(s) under audit. Management is responsible to address all non-conformances found during an inspection. Inspection reports and responses are circulated to applicable Lancaster Laboratories management and an off-site study director, as applicable, to communicate the outcome of the inspection and the proposed plan(s) for corrective action, if warranted.

All records maintained as part of an inspection are kept on file.

## 11.4. Client Audits

Because clients place great importance on compliance with applicable regulations, data quality, and project requirements, they may audit our facility as assurance that their objectives are being met. QA, Project Management, and the analytical laboratories play a key role in these audits. Visits by clients can range anywhere from a tour (to verify laboratory facilities and instrumentation) to an intensive inspection of technical operations, procedures, regulatory compliance, and/or review of specific project(s).

- Audits are scheduled directly with the Environmental Project Management Group or QA. The request to audit is communicated to all applicable laboratory departments.
- In accordance with our policy on client confidentiality, a client is permitted to review only data and results that apply to their work, or which have been approved by Lancaster Laboratories' personnel.
- An escort (Lancaster Laboratories' employee) remains with an auditor at all times.

The following responsibilities are assigned to the following groups in regard to client audits:

11.4.1. QA Department

- Research previous audit reports and laboratory responses to past deficiencies.

- Follows-up with the applicable analytical laboratory areas to ensure follow-up items were completed from the last audit, as necessary.
- Function as an escort during the audit
- Answer questions the auditor has in regard to laboratory and quality systems.
- Take notes of areas where corrective action or suggestions are recommended during the audit.
- Communicate audit issues to management at the completion of the audit.
- Respond to client audit reports.
- Ensure follow-up to cited items are performed in a timely manner.

11.4.2. Project Management

- Work with client to set audit agenda.
- Gather and organize relevant information (e.g., client correspondences, analysis/project requests, copies of analytical data from archives).
- Be knowledgeable about client-specific project requirements and issues.
- Function as an escort during the audit.
- Communicate issues/problems to appropriate personnel.

11.4.3. Laboratories

- Gather and organize laboratory data and documentation in preparation for client review.
- Assure corrective action was implemented from past audit findings, if necessary.
- Be prepared to discuss project data/testing results during the audit.
- Be familiar with client-specific project requirements and be prepared to answer client questions.
- Be familiar with the location of routine laboratory information and equipment (e.g., SOPs, data notebooks, calibration data, etc.).
- Be prepared to answer specific technical questions in regards to laboratory procedures and instrumentation within the area.
- Functions as an audit escort within the department during the audit.

## 11.5. Agency Inspections

It is Lancaster Laboratories' policy to cooperate to the fullest extent and maintain cordial relations with all government agencies. The QA Department is assigned the responsibility of hosting and working with agency representatives. Their role includes, escorting the investigator(s); ensuring all questions are answered, promptly and accurately; making note of all unresolved issues; informing management of the audit status and outcome; responding to the audit report and ensuring that appropriate corrective action is completed.

Inspections can be performed by investigators or auditors from the FDA, DEA, United States Department of Agriculture (USDA), EPA, states, third-party accreditors (A2LA), or other regulatory agencies outside of the United States.

Government agencies have the right to investigate and inspect Lancaster Laboratories during normal business hours and permission to inspect is granted by Executive Management.

Clients are notified if their data or projects are being reviewed as part of an agency inspection.

Designated members of the QA Department are primary contacts for announced inspections. The QA Director is the primary contact for all unannounced agency inspections. If the QA Director is unavailable, the Chairman of the Board is notified, in addition to a designated member of the QA Department. The QA Director, or their designee, must obtain evidence of the investigator's authority either in the form of a letter or examination/explanation of credentials.

Inspections include the examination of records or the inspection of facilities. Investigators are usually concerned only with the records relating to their responsibilities. As a general rule, they are given copies of records and documents, if requested. All copied records taken by an investigator must be stamped as being confidential material. Lancaster Laboratories must make and keep duplicate copies of all items taken by an investigator.

Investigators must be escorted through the laboratory. The laboratory is not obligated to show an investigator the following types of information: sales, financial or pricing information, or any personnel data other than training or qualification documentation. On a case-by-case basis, internal QA audit reports and investigation reports that address internal problems, are made available for agency review. Investigators can not use recording devices and photographs must not be taken. Any questions or doubts about a request made by an investigator in regard to recording devices or photographs must be reviewed with legal counsel.

Lancaster Laboratories' personnel are not permitted to sign affidavits. If an affidavit is presented during an inspection, all personnel are directed not to sign it, read it, nor listen to it being read. The only document that is acceptable to sign is an acknowledgement that an inspection report has been received. If there is any doubt as to what should be signed, legal counsel must be consulted.

## 11.6. Proficiency Testing

Many of the organizations that certify our laboratory to perform various analyses require proof of our competency. Laboratory performance is checked regularly by participation in a variety of proficiency testing programs. When available, blind samples are obtained from vendors that are accredited to provide PT samples for NELAP for all test and matrices routinely tested in the Environmental Division at Lancaster Laboratories. In addition, some individual certification programs require analysis of specific sets of proficiency samples, and the laboratory also chooses to participate in a double blind program.

Generally, the proficiency test programs consist of samples or ampulated spiking solutions used to fortify laboratory water samples. Some studies provide spiked air and soil samples. The laboratories analyze the samples in the same manner as a client sample and the data is sent to the agency or vendor for evaluation. After the study results are returned to the laboratory, any data falling outside the acceptance criteria is investigated and corrective action is implemented, if needed. Results are circulated to management and communicated to the analyst. No proficiency testing samples or portion of a proficiency test sample are sent to another laboratory for analysis.

Double blind samples are submitted to the laboratories by the Client Services Department using a fictitious client name so that the analysts are not aware that the samples are proficiency tests. The samples are submitted quarterly with the scope of testing alternating between organic and inorganic tests. The acceptance criteria for these double blind samples are developed statistically using data from participating laboratories, providing a source of inter-laboratory comparison. Results are reviewed and investigated as needed and circulated to management.

If a trend in PT failures is identified, additional blind samples are ordered for that specific test as corrective action.

Clients routinely submit blind and double blind samples to evaluate the laboratory's performance. If a report is issued to the laboratory, it is handled in the same manner as a scheduled PT study evaluation and follow-up.

## 12. CORRECTIVE AND PREVENTIVE ACTION

### 12.1. Laboratory Investigations and Corrective Action

Due to the technical nature of laboratory work and the encompassing nature of our QA program, a wide variety of laboratory issues can require investigations, documentation, and corrective action. Prompt investigation and implementation of corrective action ensure that only data of known quality are reported and prevent the reoccurrence of errors. The following list provides "examples" of the type of issues that warrant investigation:

- Out-of-specification QC results
- Failed performance evaluation samples
- Reporting incorrect results
- Contamination issues
- Client technical complaints
- Procedural errors
- Missed holding times
- Systematic problems that compromise the accuracy or compliance of the data generated
- Problems with instrumentation and equipment which could compromise the data generated

Depending on the situation, system, and severity of the issue, Lancaster Laboratories uses a number of procedures to investigate laboratory problems. A "common" investigation and documentation format, which is outlined below, applies to each of the various types of investigations that need to be performed:

- Identification of the problem
- Steps taken to investigate the problem
- Explanation of probable cause(s) of the problem
- Steps taken to prevent future occurrence
- Determination of samples or systems affected by the problem

Management is informed of problem situations and the QA Department tracks documentation and the status of the investigation activities. The goal is to identify root cause, have the corrective action implemented promptly, and to the degree appropriate for the magnitude and risk of the problem. Corrective action issues are subject to follow up by the QA Department. Tracking and trending of laboratory issues is performed by the QA Department and reported to management on a monthly and quarterly basis.

## 12.2. Investigation Processes

All results from quality control (QC) samples are logged into the computerized quality control system, which is programmed to alert analysts to unacceptable results. Analysts are required to review the results and determine the source of the problem. The source of the problem and proposed corrective action must be documented. Corrective action may include, but is not limited to, re-analysis, re-extraction or re-digestion, instrument maintenance, or re-calibration. If these actions do not yield compliant data within the required hold time, a Nonconformance Form is initiated to document actions and communication with the client. The original form is archived with the associated raw data. Nonconformance Forms are reviewed by the technical department's management, or designee. A copy of the form is reviewed by QA.

Missed holding times are investigated and documented according to a procedure specific to this issue. A standard form is used for documenting this type of incident and signed by a representative of all areas involved, in addition to management and QA. Clients are informed of any problems involving holding time.

Other types of problems having the potential for impact on the quality of data are investigated and documented using a form titled Investigation and Corrective Action Report (ICAR). This process was developed to ensure that laboratory problems are investigated, documented, and corrective action is put into place to prevent reoccurrence. Any employee can initiate an ICAR to document a laboratory problem. Once initiated, the QA Department is notified to assign a unique tracking number and the due date for the investigation. The QA Department reviews and approves the completed ICAR then monitors the corrective action.

If a laboratory error is identified from the outcome of the investigation that impacts client data, the client must be immediately notified in writing of the situation. If the root cause of the problem has affected any other client sample results, all affected clients are notified immediately of the problem.

## 12.3. Client Feedback

Lancaster Laboratories is in the business of providing high quality analytical testing services. The data that we supply to our clients must be technically complete, accurate, and compliant with applicable regulations. Complaints can be received via letter, phone call, fax, e-mail, or face-to-face meeting.

When a complaint is received, it is our responsibility to determine, to the best of our ability, the extent of the issues and what data is in question. The person receiving the complaint documents this information and promptly forwards it to the appropriate management personnel where the work in question was performed. If a transcription or calculation error is discovered, the final report and/or data must be regenerated with the correct value(s).

The Client Service Representative is responsible for entering client concerns into the LIMS and an automated summary report is sent to QA weekly for review. In many cases, an investigation is initiated to address and document the situation.

On an annual basis, the Client Services and Business Development Groups send a client satisfaction survey to all clients. The results of these surveys are compiled and used to identify areas of improvement for the laboratory.

## 12.4. Preventive Actions

Various training courses are provided to all employees to assist with building quality and efficiency into their daily jobs. They stress a proactive approach/environment to problem solving and to review quality systems and operational efficiencies.

- "Making Quality a Science" is an introductory TQM course required for all employees to teach why quality is important and to explain the Lancaster Laboratories' quality philosophy and processes, and how to apply quality thinking and techniques on the job. Topics discussed include: communication, teamwork, serving the client, measurement, quality tools, and continuous process improvement. To foster continuous improvements of laboratory systems, MOS process improvement teams are formed, as needed, if an employee needs help in solving a problem or addressing an issue. The goal of these groups is to have representation from various areas of the laboratory work together to look at a problem, evaluate the need for a temporary fix, brainstorm root causes, plan process improvement, implement the process improvement, evaluate and follow-up to the corrective action.

- "Putting our Values to Work" is a seminar required for all employees to teach the Lancaster Laboratories Statement of Values by examining how it translates to our everyday jobs and ethical decision making. Topics discussed include: Statement of Values, ethical paradigms, and ethical decision making. Mandatory ethics training refresher seminars are offered on an annual basis.

  Lancaster Laboratories has an Ethics Committee that meets on a regular basis to discuss and handle ethical issues or situations that cause concern or make employees feel uncomfortable. The mission of this group is to promote sharing of concerns on ethical issues; encourage and maintain commitment among employees to our core ethical values; and to maintain an environment that ensures open access to committee members and all levels of management and the confidential handling of ethical issues.

- The laboratory also utilizes a formal program to encourage preventive action called, Practical Process Improvement (PPI). PPI embodies three principles: logical simplicity, practical methods & tools, and involve everyone. Using proven hands-on methodology, teams of employees learn the tools and immediately apply them to a real business problem in their functional area. Measurable results are key to process improvement therefore, the teams collect data, analyze it to find a solution, and then test the results, using metrics. Once the solution has been proven effective, the team implements it and then monitors the solution to ensure that the results are sustained.

- The Quality Assurance Group prepares monthly and quarterly program status reports for management. The reports include a variety of metrics and graphs which are used to evaluate trends in laboratory performance across all quality and compliance areas. Management responds to any negative trends by developing a corrective action plan.

- Employees are encouraged to communicate to their supervisor area(s) or operation(s) they feel could be streamlined, make their job easier, would provide a quality improvement, or could provide a cost savings to the company.

# 13. SERVICE TO CLIENTS

## 13.1. Service to Clients

We value our client relationships and support these partnerships through the following principles:

- Honesty and Fairness – Our corporate culture is founded on the principles of professionalism and high ethical standards in dealing with our clients. This may mean declining to provide the service requested (if we are convinced that to do so would be meaningless) or it may mean referring clients outside of our Lab if we believe that another company can better meet their needs.

- Complete Service – We will give our clients full value on every service provided. We will provide detailed information on our methods, procedures, and QA programs if requested, and take a personal interest and initiative in helping solve our client's problems within the area of our professional expertise.

- Trustworthiness – All data and information developed for a client will be held confidential and not disclosed to a third party except on written request of the client. If information is subpoenaed, we must, by law, release it, but the client will be informed of the release.

- Commitment to Quality – We constantly strive to improve our service in quality, flexibility, and dependability, to keep our competitive edge. We will achieve this through: meeting the requirements of those we serve, staying apprised of regulatory and industry expectations, and providing prompt responses to client concerns.

- Basics of Superlative Service – Our focus is on our client's success. Through proactive collaborative communication, our leadership ensures we understand our client's expectations and strives to exceed them. We foster a service culture in our training, reward and recognition, and performance management process so each employee takes ownership to deliver superlative service to our clients. Feedback from clients, whether positive or negative, is an important part of our continuous improvement system. Ways in which feedback is gathered can include, but is not limited to: customer satisfaction surveys, client audits, and the customer complaint system, which is described within section 12.3.

We also view our fellow employees as our clients since they frequently receive the results of our labor. Meeting the requirements of the next employee in the workflow process is just as important as meeting the needs of an external client.

## 13.2. Review of Work Requests, Tenders, and Contracts

Lancaster Laboratories places great importance on understanding client requirements for a project. We ensure, to the best of our ability, that client/project requirements are identified, including accreditations held by the laboratory, inconsistencies clarified, and nonstandard work requests are discussed and addressed with both the client and the technical laboratories before the project is accepted and samples arrive. This can be achieved in various ways, including the review of analytical methods, protocols, business contracts, and quality agreements. Project kick-off meetings can also be arranged through the Business Development and/or the Environmental Project Management Group. These meetings allow the client and key technical personnel to discuss project issues and requirements prior to project initiation.

A key client contact is assigned to oversee the project and review all results in a timely manner. Communication between the client and LL technical staff is available and is coordinated through the Environmental Project Management Group.

As a project continues, the Environmental Project Management Group provides continuous communication and status reports about the project to the client. This group relays any project changes or modifications to the technical groups. They also relay issues encountered by the technical laboratories back to the client.

### 13.3. Timely Delivery

Evaluating laboratory capacity and ability to perform specific projects is a joint responsibility between the Technical Director , Business Development, and the laboratory managers. We recognize that one of the most important aspects of the service we offer is turnaround time.

Many analysts are cross-trained to perform a variety of tests, and there is redundant equipment available in the laboratory area creating operation flexibility for routine work. Larger projects are reviewed against capacity estimates before bids are submitted to ensure that the client's schedule is met. Turnaround time is continually measured.

Regularly scheduled meetings are held with senior management, technical and support management, and project management personnel to review progress with current projects, as well as special requirements of new work scheduled for the laboratory.

Management receives a daily report of the status of all samples in the lab, including a printout of those with priority status or those that have exceeded a preset turnaround time. This is of inestimable value in planning and organizing the workload through efficient scheduling.

Any changes to the established timeline by the client or the laboratory must be communicated to the client or laboratory as soon as possible. Upon communication of changes, a new timeline is established and agreed upon by both parties. If a client requires a change in the scope of the project (e.g., number of samples submitted, change in analyses, revised protocol) the laboratory must be informed in writing and a new timeline and cost estimate is be provided.

Verified results are available by phone, fax, diskette, direct access (modem and password), or hardcopy report.

### 13.4. Subcontracting

Occasionally, Lancaster Laboratories subcontracts tests to other laboratories if the requested testing is not routinely performed in our laboratory or when backlog is high. Testing is only subcontracted with the client's knowledge and approval. Subcontract laboratories are selected based on their qualifications and review of their QA information. If tests require a specific agency certification, only another appropriately certified laboratory must be used.

Data obtained from subcontract laboratories is clearly marked as such when reported by Lancaster Laboratories.

### 13.5. Use of NELAP and A2LA logo

It is not laboratory policy to use these logos on any company letterhead, including analytical reports.

eurofins | Lancaster Laboratories

# Environmental Quality Policy Manual

# Appendix A
## Procedure Cross Reference List

Current as of October 05, 2011
5 Total Pages (including this coversheet)

# Procedure Cross Reference List

| Section # | Title | Procedure(s) |
|---|---|---|
| 1 | Introduction | |
| 1.1. | Vision Statement | Personnel Manual |
| 1.2. | Mission Statement | Personnel Manual |
| 1.3. | Quality Policy | Personnel Manual |
| 1.4. | Statement of Values | Personnel Manual |
| 1.6. | Certifications, Accreditations, and Registrations | Form 2528 |
| 2 | Organization and Personnel | |
| 2.2. | Organizational Structure | Organization Charts |
| 2.3. | Management Responsibilities | PMDs (Performance Management & Development) |
| 2.4. | Overview of the Quality Assurance Program | SOP-QC-024 |
| 2.5. | Quality Assurance Responsibilities | SOP-QC-024<br>“QC” SOP Series |
| 2.6. | Communication of Quality Issues to Management | SOP-QC-022<br>SOP-QC-025 |
| 2.7. | Personnel Qualifications and Responsibilities | LOM-SOP-LAB-231<br>PMDs<br>Task Specific Training |
| 2.8. | Relationship of Functional Groups and the Quality Assurance Program | Quality Orientation<br>“QC” SOP series<br>TQM Training<br>PMDs |
| 2.9. | Balancing Laboratory Capacity and Workload | PMDs |
| 2.10. | Identification of Approved Signatories | LOM-SOP-ES-218 |
| 2.11. | Personnel Training | LOM-SOP-LAB-231<br>PMDs<br>Task Specific Training |
| 2.12. | Regulatory Training | LOM-SOP-LAB-204 |
| 2.13. | Employee Safety | Analytical Methods<br>Chemical Hygiene Plan<br>Policy #0010<br>“EHS”/”HS” SOP Series |
| 2.14. | Client Services/Project Management Responsibilities | “CL” SOP Series |
| 2.15. | Confidentiality | Personnel Manual<br>LOM-SOP-LAB-205<br>SOP-QC-010<br>SOP-CL-005 |
| 2.16. | Business Conduct | Personnel Manual |
| 2.17. | Operational Integrity | Policy #0001<br>Policy #0007<br>LOM-SOP-LAB-226<br>LOM-SOP-ES-232 |
| 3 | Buildings and Facilities | |
| 3.1. | Facility | Floor Plans |
| 3.2. | Security | LOM-SOP-LAB-212 |
| 3.3. | Disaster Recovery | LOM-SOP-HS-212 |

| Section # | Title | Procedure(s) |
|---|---|---|
| 3.4. | Environmental Monitoring | LOM-SOP-ES-205<br>LOM-SOP-ES-210 |
| 3.5. | Water Systems | LOM-SOP-LAB-214 |
| 3.6. | Housekeeping/Cleaning | LOM-SOP-LAB-221 |
| 3.7. | Insect & Rodent Control | LOM-SOP-LAB-213 |
| 3.8. | Emergency Power Supply | LOM-SOP-HS-212 |
| 3.9. | Facility Changes | LOM-SOP-LAB-209 |
| 4 | Document Control | |
| 4.1. | Hierarchy of Internal Operating Procedures | LOM-SOP-LAB-201 |
| 4.2. | Document Approval, Issue, Control, and Maintenance | LOM-SOP-LAB-202<br>LOM-SOP-ES-226 |
| 4.3. | Client-Supplied Methods and Documentation | LOM-SOP-ES-221<br>SOP-QC-030<br>SOP-CL-007 |
| 4.4. | Laboratory Notebooks, Logbooks, and Forms | LOM-SOP-LAB-202<br>LOM-SOP-LAB-220 |
| 5 | Sample Handling | |
| 5.1. | Sample Collection | "FS" SOP Series<br>SOP-TR-001<br>SOP-TR-003 |
| 5.2. | Sample Receipt and Entry | "SA" SOP Series |
| 5.3. | Sample Identification and Tracking | "SA" SOP Series |
| 5.4. | Sample Storage | "SS" SOP Series |
| 5.5. | Sample Return/Disposal | LOM-SOP-HS-219<br>SOP-EHS-006 |
| 5.6. | Chain of Custody | LOM-SOP-ES-212 |
| 5.7. | Representativeness of Samples | Analytical Methods<br>SOP-SS-009 |
| 6 | Technical Requirements - Traceability of Measurements | |
| 6.1. | Reagents and Solvents | LOM-SOP-ES-225<br>Analytical Methods |
| 6.3. | Calibration Standards | LOM-SOP-ES-225<br>Analytical Methods |
| 6.4. | Equipment and Instrumentation | LOM-SOP-ES-222<br>LOM-SOP-LAB-208<br>LOM-SOP-ES-208<br>Technical SOPs, MCs and OMCs |
| 6.5. | Computerized Systems and Computer Software | LOM-SOP-LAB-206<br>LOM-SOP-ES-219<br>SOP-CS-031<br>Personnel Manual |
| 6.6. | Change Control | LOM-SOP-VAL-205 |
| 6.7. | Labware Cleaning | Technical SOPs |
| 7 | Purchasing Equipment and Supplies | |
| 7.1 | Procurement | LOM-SOP-LAB-218<br>SOP-PU-005 |
| 7.2 | Supplier Evaluation | LOM-SOP-LAB-218<br>LOM-SOP-ES-204 |
| 8 | Analytical Methods | |
| 8.1. | Scope of Testing | Schedule of Services |

| Section # | Title | Procedure(s) |
|---|---|---|
| 8.2. | Analytical Test Methods | LOM-SOP-ES-226 |
| 8.3. | Client Supplied Methods | LOM-SOP-ES-221 |
| 8.4. | Method Validation | LOM-SOP-ES-226 |
| 8.5. | Procedural Deviations | LOM-SOP-ES-230 |
| 9 | Internal Quality Control Checks | |
| 9.1. | Laboratory Quality Control Samples and Acceptance Criteria | LOM-SOP-ES-207<br>LOM-SOP-ES-213<br>Analytical Methods |
| 9.2. | Quality Control Sample Frequency and Corrective Action | LOM-SOP-ES-209<br>LOM-SOP-ES-213<br>Analytical Methods |
| 9.3. | Quality Control Charts | LOM-SOP-ES-213 |
| 9.4. | Measurement Uncertainty | LOM-SOP-ES-207 |
| 10 | Assuring Quality of Test Results | |
| 10.1. | Data Management | LOM-SOP-LAB-220 |
| 10.2. | Data Documentation | LOM-SOP-LAB-220<br>LOM-SOP-ES-224 |
| 10.3. | Data Calculations | LOM-SOP-ES-224<br>Analytical Methods |
| 10.4. | Reporting Limits | LOM-SOP-ES-203 |
| 10.5. | Data Review | LOM-SOP-LAB-220<br>LOM-SOP-ES-218<br>LOM-SOP-ES-224 |
| 10.6. | Data Qualification | LOM-SOP-ES-209 |
| 10.7. | Data Reporting | LOM-SOP-ES-218<br>LOM-SOP-ES-224<br>LOM-SOP-ES-227 |
| 10.8. | Reporting Data from Subcontract Laboratories | LOM-SOP-ES-215 |
| 10.9. | Data Storage, Security, and Archival | LOM-SOP-LAB-203 |
| 10.10. | Investigation of Nonconforming Work | LOM-SOP-ES-218<br>LOM-SOP-ES-230<br>LOM-SOP-ES-231 |
| 11 | Audits and Inspections | |
| 11.1. | Internal Quality Assurance Audits | SOP-QC-006<br>SOP-QC-021<br>SOP-QC-032 |
| 11.2. | Review of the Quality Assurance Program | SOP-QC-022<br>SOP-QC-025 |
| 11.3. | Good Laboratory Practice Critical Phase Inspections | SOP-QC-032 |
| 11.4. | Client Audits | Personnel Manual<br>SOP-QC-010 |
| 11.5. | Agency Inspections | Personnel Manual<br>SOP-QC-008 |
| 11.6. | Proficiency Testing | LOM-SOP-ES-216<br>SOP-QC-003<br>SOP-QC-007 |
| 12 | Corrective and Preventive Action | |
| 12.1. | Laboratory Investigations and Corrective Action | LOM-SOP-ES-209<br>LOM-SOP-ES-230<br>LOM-SOP-ES-231 |

| Section # | Title | Procedure(s) |
|---|---|---|
| 12.2. | Investigation Processes | LOM-SOP-ES-223<br>LOM-SOP-ES-230 |
| 12.3. | Client Technical Complaints | LOM-SOP-ES-231 |
| 12.4. | Preventive Actions | Corporate Training |
| 13 | Service to Clients | |
| 13.1. | Service to Clients | Personnel Manual<br>TQM Training |
| 13.2. | Review of Work Requests, Tenders, and Contracts | SOP-CL-007<br>SOP-QC-030 |
| 13.3. | Timely Delivery | SOP-CL-005<br>SOP-CL-010<br>TAT Tracking Report |
| 13.4. | Subcontracting | LOM-SOP-ES-215<br>SOP-QC-023 |

eurofins | Lancaster Laboratories

# Environmental Quality Policy Manual

# Appendix B
## Certifications, Accreditation, Registrations, and Contracts

Current as of October 05, 2011
4 Total Pages (including this coversheet)

**NOTE: Current certification status information maintained by QA Department.**

## Certifications, Accreditations, Registrations, and Contracts

| Agency | Parameter | Applicable Matrices | Lab ID No. Certificate No. |
|---|---|---|---|
| **Federal Programs:** | | | |
| American Association for Laboratory Accreditation (A2LA) | Various testing technologies in the environmental field using EPA methods, client specific methods, ISO 17025, DoD QSM 4.1 | Nonpotable water, solid and hazardous waste, air, tissue and tobacco | 0001.01 |
| USDA Quarantine Soil Permit | All | All | S-50452 |
| **State Programs:** | | | |
| State of Alaska, Department of Environmental Conservation | Organics, inorganics, UST analysis | Nonpotable water, solid and hazardous waste | UST-061 |
| State of Arkansas, Department of Environmental Quality | Organics, inorganics | Nonpotable water, solid and hazardous waste | 88-0660 |
| State of California, Department of Health ELAP | Organics, inorganics | Potable water, nonpotable water, solid and hazardous waste | 2501 |
| State of California, Department of Health NELAC | Dioxin and NDMA | Nonpotable water, solid and hazardous waste | 10276CA |
| State of Colorado, Department of Health | Organics, inorganics | Potable water | None |
| State of Connecticut, Department of Public Health | Organics, inorganics | Potable water, nonpotable water, solid and hazardous waste | PH-0746 |
| State of Delaware, Health and Social Services | Organics, inorganics, micro | Potable water | None |
| [3]State of Florida, Department of Health | Organics, inorganics | Potable water, nonpotable water, solid and chemical materials, air and emissions | E87997 |
| [3]State of Illinois, Environmental Protection Agency | Organics, inorganics | Nonpotable water, solid and chemical materials | 002445 |
| State of Indiana, Department of Health | Organics, inorganics | Potable water | C-PA-02 |
| State of Iowa, Department of Natural Resources | Organics, inorganics, UST analysis | Nonpotable water, solid and hazardous waste | 361 |
| [3]State of Kansas, Department of Health and Environment | Organics, inorganics | Potable water, nonpotable water, solid and chemical materials | E-10151 |
| [4]State of Kentucky, Division of Environmental Services | Organics, inorganics | Potable water | 90088 |
| State of Kentucky, Department for Environmental Protection – UST Branch | Organics, inorganics | UST | 89 |
| [3]State of Louisiana, Department of Environmental Quality | Organics, inorganics | Nonpotable water, solid and chemical materials, air and emissions | 02055 |
| State of Maine, Department of Health and Human Services | Organics, inorganics, micro., UST analysis | Potable, nonpotable water, solid and chemical materials | 2010033 |
| State of Maryland, Department of the Environment | Organics, inorganics, micro | Potable water | 100 |
| Commonwealth of Massachusetts, Department of Environmental Protection | Organics, inorganics | Potable water, nonpotable water | M-PA009 |

eurofins | Lancaster Laboratories

## Certifications, Accreditations, Registrations, and Contracts

| Agency | Parameter | Applicable Matrices | Lab ID No. Certificate No. |
|---|---|---|---|
| State of Michigan, Department of Public Health | Organics, inorganics | Potable water | 9930 |
| [1]NELAP Primary AA: Air and Emissions<br>[2]NELAP Primary AA: Potable Water, Nonpotable water, solid and chemical materials<br>[3]NELAP Secondary AA<br>[4]Approval for UST work by A2LA | | | |
| State of Montana, Department of Environmental Quality | UST analysis | Nonpotable water, solid and chemical materials | None |
| [3]State of Nevada, Division of Environmental Protection | Organics, inorganics | Nonpotable water, solid and chemical materials | PA00009007A |
| [3]State of New Hampshire, Department of Environmental Services | Organics, inorganics | Potable water, nonpotable water, solid and chemical materials | 2730 |
| [1,3]State of New Jersey, Department of Environmental Protection (NJDEP) | Organics, inorganics, micro | Potable water, solid and chemical materials, air and emissions (direct accreditation) | PA011 |
| [3]State of New York, Department of Health | Organics, inorganics | Nonpotable water, potable water, solid and chemical materials, air and emissions, Analytical Services Protocol | 10670 |
| State of North Carolina, Department of Environment and Natural Resources, | Organics, inorganics | Nonpotable water | 521 |
| North Carolina, Department of Health and Human Services | Volatile Organic Chemicals | Potable water | 42705 |
| State of Ohio, Environmental Protection Agency (Voluntary Action Program) | Organics, inorganics, UST analysis | Nonpotable water, solid and hazardous waste, air and emissions | CL0070 |
| State of Oklahoma, Department of Environmental Quality | Organics, inorganics | Nonpotable water, solid and hazardous waste | 9804 |
| [3]State of Oregon, Public Health Laboratory | Organics, inorganics | Nonpotable water, solid and chemical materials, air and emissions | PA200001 |
| [2]Commonwealth of Pennsylvania, Department of Environmental Protection (Bureau of Laboratories) | Organics, inorganics, micro | Potable water, nonpotable water, solid and chemical materials | 36-00037 |
| State of Rhode Island, Department of Health Laboratory | Organics, inorganics | Potable water, nonpotable water | None |
| State of South Carolina, Department of Health and Environmental Control | Organics, inorganics | Potable water, nonpotable water, solid and hazardous waste | 89002002 |
| State of Tennessee, Department of Health | Organics, inorganics | Potable water | TN02838 |
| [2]State of Texas, Commission on Environmental Quality | Organics, inorganics | Potable water, nonpotable water, solid and chemical materials, biological tissue (direct accreditation), air and emissions | T104704194-10-04 |
| [3]State of Utah, Department of Health | Organics, inorganics | Nonpotable water, solid and chemical materials | LANC |

## Certifications, Accreditations, Registrations, and Contracts

| Agency | Parameter | Applicable Matrices | Lab ID No. Certificate No. |
|---|---|---|---|
| State of Vermont, Department of Health Laboratory | Organics, inorganics | Potable water | VT 36-037 |
| Commonwealth of Virginia, Department of General Services | Organics, inorganics | Potable water | 00187 |
| State of Washington, Department of Ecology | Wet chem, metals, organics, inorganics | Nonpotable water, solid and hazardous waste, air and emissions | C574 |
| State of West Virginia, Department of Health | Organics, inorganics | Potable water | 9906C |
| State of West Virginia, Division of Environmental Protection | Organics, inorganics | Nonpotable water | 055 |
| State of Wisconsin, Department of Natural Resources | Organics, inorganics | Nonpotable water, solid and hazardous waste | 998035060 |

**NOTE:** This list accurately reflects the certifications, accreditations, registrations, and contracts held at the time of publication and is subject to change. Check with your account manager on the status of any certification needed for a specific project.

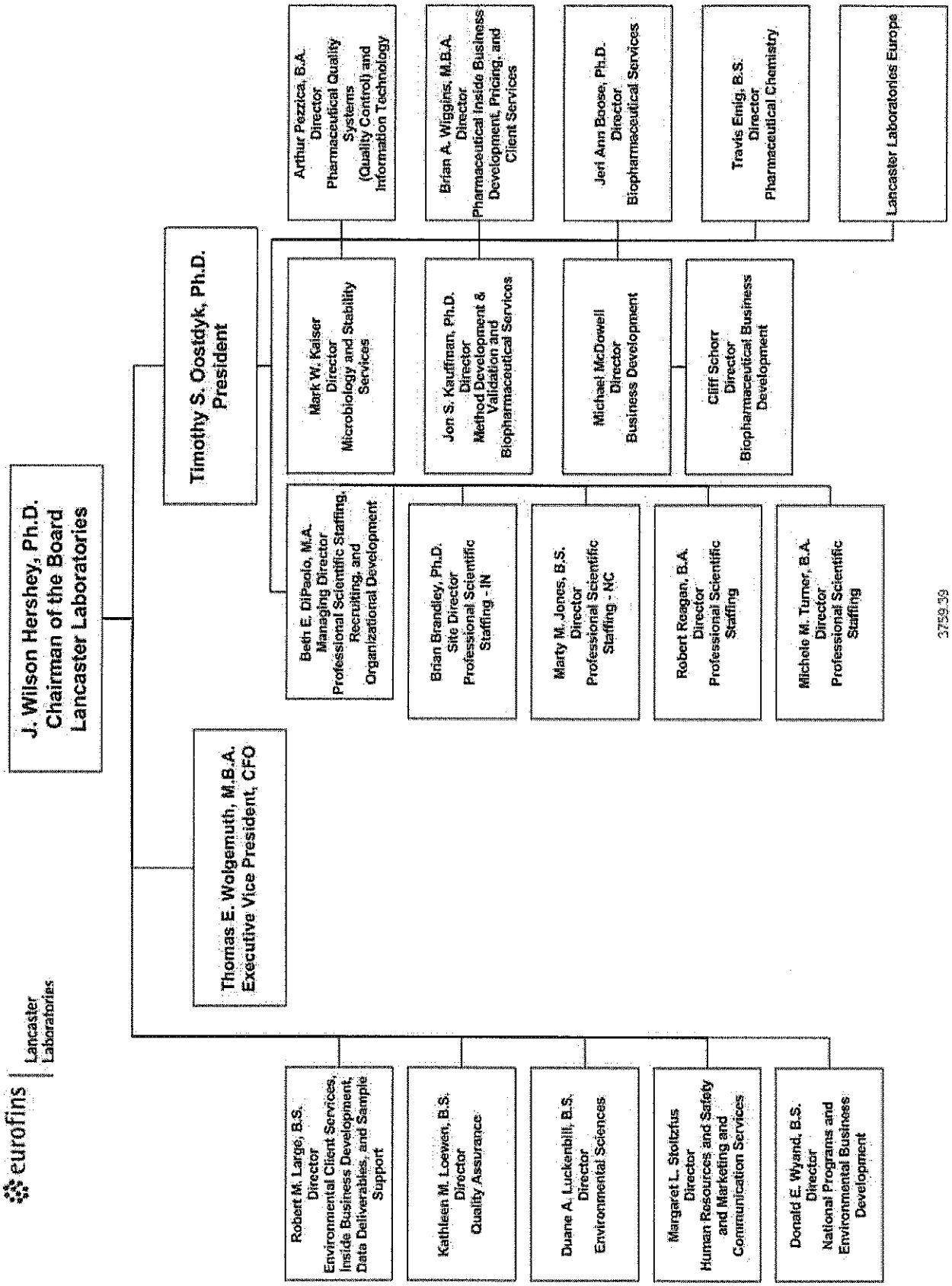
eurofins | Lancaster Laboratories

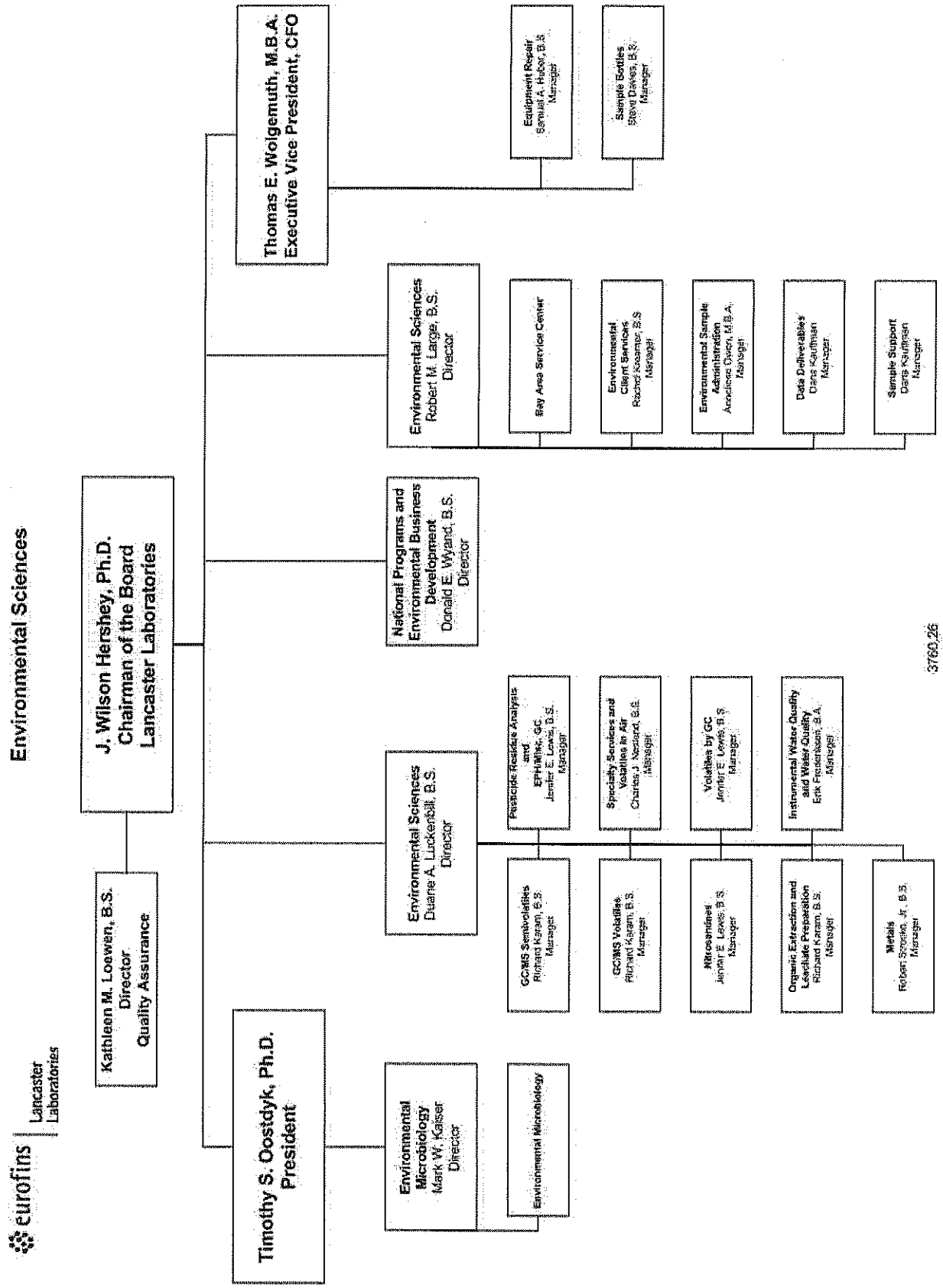
# Environmental Quality Policy Manual

# Appendix C
## Organizational Charts
## Personnel to Sign Reports

Current as of October 05, 2011
12 Total Pages (including this coversheet)

**NOTE: Current organizational charts available from Document Control. Current personnel to sign reports available in QA.**


eurofins | Lancaster Laboratories
J. Wilson Hershey, Ph.D.
Chairman of the Board
Lancaster Laboratories
Timothy S. Oostdyk, Ph.D.
President
Thomas E. Wolgemuth, M.B.A.
Executive Vice President, CFO
Arthur Pezzica, B.A.
Director
Pharmaceutical Quality Systems (Quality Control) and Information Technology
Brian A. Wiggins, M.B.A.
Director
Pharmaceutical Inside Business Development, Pricing, and Client Services
Jeri Ann Boose, Ph.D.
Director
Biopharmaceutical Services
Travis Ensig, B.S.
Director
Pharmaceutical Chemistry
Lancaster Laboratories Europe
Mark W. Kaiser
Director
Microbiology and Stability Services
Jon S. Kauffman, Ph.D.
Director
Method Development & Validation and Biopharmaceutical Services
Michael McDowell
Director
Business Development
Cliff Schorr
Director
Biopharmaceutical Business Development
Beth E. DiPaolo, M.A.
Managing Director
Professional Scientific Staffing, Recruiting, and Organizational Development
Brian Brandley, Ph.D.
Site Director
Professional Scientific Staffing - IN
Marty M. Jones, B.S.
Director
Professional Scientific Staffing - NC
Robert Reagan, B.A.
Director
Professional Scientific Staffing
Michele M. Turner, B.A.
Director
Professional Scientific Staffing
Robert M. Large, B.S.
Director
Environmental Client Services, Inside Business Development, Data Deliverables, and Sample Support
Kathleen M. Loewen, B.S.
Director
Quality Assurance
Duane A. Luckenbill, B.S.
Director
Environmental Sciences
Margaret L. Stoltzfus
Director
Human Resources and Safety and Marketing and Communication Services
Donald E. Wyand, B.S.
Director
National Programs and Environmental Business Development
3759.39


Environmental Sciences
eurofins | Lancaster Laboratories
Timothy S. Oostdyk, Ph.D.
President
Kathleen M. Loewen, B.S.
Director
Quality Assurance
J. Wilson Hershey, Ph.D.
Chairman of the Board
Lancaster Laboratories
Thomas E. Wolgemuth, M.B.A.
Executive Vice President, CFO
Equipment Repair
Samuel A. Huber, B.S.
Manager
Sample Bottles
Steve Davies, B.S.
Manager
Environmental Sciences
Robert M. Large, B.S.
Director
Bay Area Service Center
Environmental
Client Services
Rachel Kramer, B.S.
Manager
Environmental Sample
Administration
Anneliese Oxley, M.B.A.
Manager
Data Deliverables
Dana Kauffman
Manager
Sample Support
Dana Kauffman
Manager
National Programs and
Environmental Business
Development
Donald E. Wyand, B.S.
Director
Environmental Sciences
Duane A. Luckenbill, B.S.
Director
Pesticide Residue Analysis
and
EPH/TPH, GC
Jenifer E. Lewis, B.S.
Manager
Specialty Services and
Volatiles in Air
Charles J. Nessard, B.S.
Manager
Volatiles by GC
Jenifer E. Lewis, B.S.
Manager
Instrumental Water Quality
and Water Quality
Erik Pedersen, B.A.
Manager
GC/MS Semivolatiles
Richard Karam, B.S.
Manager
GC/MS Volatiles
Richard Karam, B.S.
Manager
Nitrosamines
Jenifer E. Lewis, B.S.
Manager
Organic Extraction and
Leachate Preparation
Richard Karam, B.S.
Manager
Metals
Robert Screven, Jr., B.S.
Manager
Environmental Microbiology
Environmental
Microbiology
Mark W. Kaiser
Director
3760.26

| Name | Degree | Title |
|---|---|---|
| **Corporate Services** | | |
| J. Wilson Hershey | Ph.D. | Chairman of the Board |
| Timothy Oostdyk | Ph.D. | President |
| **Quality Assurance** | | |
| Kathleen Loewen | B.S. | Quality Assurance Officer |
| Dorothy Love* | B.S. | Principal Specialist Group Leader |
| Kathryn Brungard | | Senior Specialist |
| Amy Doupe* | B.S. | Principal Specialist |
| M. Louise Hess | B.S. | Principal Specialist |
| Martina Janke | B.S. | Senior Specialist |
| Laura Judy | B.S. | Principal Specialist |
| Barbara Reedy* | B.S. | Senior Specialist |
| Joann Schweitzer | B.A. | Senior Specialist |
| Gary Siko | M.S. | Principal Specialist |
| Jill Sproat | B.S. | Senior Specialist |
| Alicia Staz | B.S. | Senior Specialist |
| Lee Ulmer | A.A.S. | Senior Specialist |
| **Environmental Sciences** | | |
| Donald Wyand | B.S. | Director |
| Christine Jampo | M.S. | Senior Specialist |
| Kevin Moran | M.B.A. | Senior Specialist |
| **Client Services/Business Development** | | |
| Robert Large | B.S. | Director |
| Rachel Kreamer | B.S. | Manager |
| Lynn Frederiksen | B.S. | Principal Specialist Group Leader |
| Wendy Kozma | B.S. | Principal Specialist Group Leader |
| Nicole Maljovec | M.S. | Senior Specialist Group Leader |
| Nancy Bornholm | B.S. | Principal Specialist |
| Marianne Bragg | B.S. | Principal Specialist |
| Loran Carter | B.S. | Specialist |
| Teresa Cunningham | B.S. | Principal Specialist |
| Irene Dodd | M.S. | Principal Specialist |
| Katherine Klinefelter | M.S. | Principal Specialist |
| Natalie Luciano | B.A. | Specialist |
| Angela Miller | B.S. | Specialist |
| Megan Moeller | B.S. | Senior Specialist |
| Jill Parker | B.S. | Senior Specialist |
| Tara Spaide | | Senior Specialist |
| Barbara Weyandt | M.S. | Specialist |
| Susan Wike | A.S. | Senior Specialist |
| Additional support personnel in this group: 1 | | |
| **Data Deliverables** | | |
| Robert Large | B.S. | Director |
| Dana Kauffman | | Manager |
| F. Bradley Ayars | | Senior Specialist Group Leader |
| Grace Salm | | Specialist Group Leader |

| Name | Degree | Title |
|---|---|---|
| Luz Torres | | Senior Specialist Group Leader |
| Jessica Baron | | Specialist |
| Judi Brown | | Specialist |
| Kathy Fair | | Specialist |
| M. Susan Kreider | | Senior Specialist |
| Raymond Longacre | | Specialist |
| Patricia Madrigal-Kauffman | A.S. | Specialist |
| Audrey McClune | | Specialist |
| Tina McNeil | | Specialist |
| Betsy Menefee | B.S. | Senior Specialist |
| Sandra Miller | | Specialist |
| Tracy Pang-Ward | | Specialist |
| Nancy Saunders | B.S. | Specialist |
| Elizabeth Smith | B.S. | Specialist |
| Lydia Steinke | B.S. | Specialist |
| Christiane Sweigart | B.S. | Senior Specialist |
| Michelle Tuel | B.S. | Specialist |
| Betty Umble | | Specialist |
| Additional support personnel in this group: 6 | | |
| **Bay Area Service Center** | | |
| Robert Large | B.S. | Director |
| Elizabeth Leonhardt | M.S. | Senior Specialist Group Leader |
| Additional support personnel in this group: 2 | | |
| **Environmental Microbiology** | | |
| Mark Kaiser | | Director |
| Harolyn Clow | M.S. | Manager |
| Jeffrey Groff* | B.S. | Microbiologist Group Leader |
| Hannah Conner | B.S. | Microbiologist |
| Martha Helwig* | B.S. | Senior Microbiologist |
| Keith Hoover* | B.S. | Microbiologist |
| Amy MacKay* | B.S. | Principal Microbiologist |
| Kimberly Small | B.A. | Senior Microbiologist |
| **Extractable Petroleum Hydrocarbons (EPH)/Miscellaneous GC** | | |
| Duane Luckenbill | B.S. | Director |
| Jenifer Hess* | B.S. | Manager |
| Robert Brown | | Principal Chemist Group Leader |
| Tracy Cole* | | Senior Specialist |
| Melissa McDermott* | B.A. | Senior Chemist |
| Dustin Underkoffler | B.S. | Chemist |
| Heather Williams | B.S. | Senior Chemist |
| Additional support personnel in this group: 1 | | |
| **Field Sampling** | | |
| Duane Luckenbill | B.S. | Director |
| Samuel Huber* | B.S. | Manager |
| Jeffrey Allen | | Specialist Group Leader |
| Timothy Hauck | | Specialist |

| Name | Degree | Title |
|---|---|---|
| **Flexible Staffing** | | |
| Kimberly Davies | M.B.A. | Manager |
| Andrew Agnew | B.S. | Chemist |
| Joseph Anderson | B.S. | Senior Chemist |
| Elizabeth Appleman | B.S. | Scientist |
| Audrey Baker | | Senior Administrator |
| Catherine Cammauf | | Specialist |
| Barton Conner | B.S. | Senior Chemist |
| Suzette Lehman | | Specialist |
| Stacie Powroznik | B.S. | Senior Chemist |
| Douglas Seitz | B.S. | Principal Scientist |
| Christopher Smith | B.S. | Scientist |
| Holly Weller | B.S. | Microbiologist |
| Matthew Woods | B.S. | Chemist |
| Additional support personnel in this group: 2 | | |
| **GC/MS Semivolatiles** | | |
| Duane Luckenbill | B.S. | Director |
| Richard Karam* | B.S. | Manager |
| Rachel Cochis* | B.A. | Senior Specialist Group Leader |
| Chad Moline* | B.S. | Senior Chemist Group Leader |
| Matthew Barton* | B.S. | Senior Specialist |
| Ryan Byrne | B.S. | Senior Chemist |
| Mark Clark | B.S. | Principal Chemist |
| Gregory Drahovsky | B.S. | Senior Chemist |
| Joseph Gambler | B.S. | Senior Chemist |
| Brian Graham | B.A. | Senior Chemist |
| Linda Hartenstine | B.A. | Senior Chemist |
| Mark Ratcliff | B.A. | Senior Specialist |
| Jennifer Riggs | B.S. | Chemist |
| Dale Stoneroad | B.S. | Senior Chemist |
| Andrew Strebel | | Principal Chemist |
| **GC/MS Volatiles** | | |
| Duane Luckenbill | B.S. | Director |
| Richard Karam | B.S. | Manager |
| Kenneth Boley | B.S. | Senior Chemist Group Leader |
| Susan Goshert* | B.S. | Principal Specialist Group Leader |
| Roy Mellott | B.S. | Senior Chemist Group Leader |
| Kathrine Muramatsu | B.S. | Chemist Group Leader |
| Ryan Nolt | B.S. | Principal Chemist Group Leader |
| Holly Berry | B.S. | Senior Chemist |
| Anita Dale | | Chemist |
| Christine Dulaney* | B.S. | Senior Specialist |
| Chelsea Eastep | B.S. | Chemist |
| Daniel Heller | B.S.E. | Chemist |
| Sara Johnson | B.S. | Senior Chemist |
| Kelly Keller | | Chemist |

| Name | Degree | Title |
|---|---|---|
| Laura Krieger | B.S. | Chemist |
| Kerri Legerlotz | B.S. | Chemist |
| Jason Long | B.S. | Senior Chemist |
| Marla Lord* | B.S. | Senior Specialist |
| Linda Pape | B.A. | Senior Chemist |
| Kristen Pelliccia | B.S. | Chemist |
| Nicholas Rossi | B.S. | Chemist |
| Robin Runkle* | B.S. | Senior Specialist |
| Stephanie Selis | B.S. | Senior Chemist |
| Angela Sneeringer | B.S. | Chemist |
| Kevin Sposito | B.S. | Chemist |
| Emily Styer | B.S. | Chemist |
| Lawrence Taylor* | B.S. | Senior Specialist |
| Lauren Temple | B.S. | Senior Chemist |
| Abraham Uysal | M.E. | Senior Specialist |
| Frank Valla, Jr. | M.S. | Chemist |
| Additional support personnel in this group: 3 | | |
| **Instrumental Water Quality** | | |
| Duane Luckenbill | B.S. | Director |
| Erik Frederiksen* | B.A. | Manager |
| Nicole Kepley | | Senior Chemist Group Leader |
| Ashley Adams | B.S. | Chemist |
| Elyse Brunstetter | B.S. | Chemist |
| K. Robert Caulfeild-James | M.S. | Chemist |
| William Hamaker | | Chemist |
| James Mathiot | | Chemist |
| Additional support personnel in this group: 5 | | |
| **Metals** | | |
| Duane Luckenbill | B.S. | Director |
| Robert Strocko* | B.S. | Manager |
| Debra Bryan | | Specialist Group Leader |
| Nina Haller* | | Senior Specialist Group Leader |
| David Beck | B.S. | Chemist |
| Eric Eby | B.S. | Senior Chemist |
| John Hook | B.S. | Senior Chemist |
| Deborah Krady | B.S. | Specialist |
| Parker Lindstrom* | B.S. | Senior Chemist |
| Nelli Markaryan | B.S. | Chemist |
| Jennifer Moyer | B.S. | Senior Specialist |
| Max Snavely* | B.S. | Senior Specialist |
| Tara Snyder | B.S. | Chemist |
| Choon Tian | B.A. | Chemist |
| Damary Valentin | | Chemist |
| John Yanzuk | B.S. | Chemist |
| Additional support personnel in this group: 5 | | |
| **Nitrosamines** | | |
| Duane Luckenbill | B.S. | Director |

| Name | Degree | Title |
|---|---|---|
| Jenifer Hess | B.S. | Manager |
| John Perkins | | Chemist |
| **Organic Extraction** | | |
| Duane Luckenbill | B.S. | Director |
| Richard Karam | B.S. | Manager |
| Joseph Feister | | Chemist Group Leader |
| David Hershey | | Chemist Group Leader |
| Wanda Oswald | | Chemist Group Leader |
| Kelli Barto | | Chemist |
| Maria Davenport | | Chemist |
| Kerrie Freeburn | B.S. | Chemist |
| Heidi Ortenzi | B.S. | Senior Chemist |
| Edwin Ortiz | | Chemist |
| Robert Vincent | B.S. | Principal Chemist |
| Darin Wagner | B.A. | Chemist |
| Additional support personnel in this group: 22 | | |
| **Pesticide Residue Analysis** | | |
| Duane Luckenbill | B.S. | Director |
| Jenifer Hess* | B.S. | Manager |
| Michele Hamilton* | B.S. | Senior Chemist Group Leader |
| Jamie Brillhart | B.S. | Senior Chemist |
| James Place | B.S. | Senior Chemist |
| Lisa Reinert | B.S. | Chemist |
| Richard Shober | B.S. | Principal Chemist |
| Sarah Snyder* | B.A. | Senior Specialist |
| **Specialty Services Group** | | |
| Duane Luckenbill | B.S. | Director |
| Charles Neslund* | B.S. | Manager |
| Paul Cormier | B.A. | Principal Specialist |
| Ginelle Haines | | Chemist |
| Nelson Risser | M.B.A. | Principal Chemist |
| Michele Smith* | B.S. | Senior Specialist |
| Timothy Trees | A.S. | Principal Chemist |
| Meng Yu | M.S. | Principal Chemist |
| Deborah Zimmerman | | Chemist |
| **Volatiles by GC** | | |
| Duane Luckenbill | B.S. | Director |
| Jenifer Hess* | B.S. | Manager |
| Valerie Tomayko* | B.S. | Senior Specialist Group Leader |
| Tyler Griffin | B.S. | Chemist |
| Marie John | B.S. | Chemist |
| Elizabeth Marin | B.S. | Chemist |
| Carrie Miller | B.S. | Chemist |
| **Volatiles in Air** | | |
| Duane Luckenbill | B.S. | Director |
| Charles Neslund* | B.S. | Manager |
| Jeffrey Smith | B.A. | Senior Chemist Group Leader |

| Name | Degree | Title |
|---|---|---|
| Florida Cimino | B.S. | Senior Chemist |
| Christine Ratcliff | B.S. | Principal Specialist |
| Michael Ziegler | B.S. | Chemist |
| **Water Quality** | | |
| Duane Luckenbill | B.S. | Director |
| Erik Frederiksen* | B.A. | Manager |
| Kenneth Bell* | B.S. | Senior Chemist Group Leader |
| Yolunder Bunch | | Chemist |
| Susan Engle | | Chemist |
| Michele Graham | B.S. | Chemist |
| Robert Heisey* | B.A. | Senior Specialist |
| Susan Hibner | B.S. | Chemist |
| Michelle Lalli | | Chemist |
| Hannah Royer | B.A. | Chemist |
| Additional support personnel in this group: 3 | | |
| **Accounting & Finance** | | |
| Thomas Wolgemuth | M.B.A. | Executive Vice President Chief Financial Officer |
| Tammy Robinson | B.B.A. | Senior Specialist Group Leader |
| Jeffrey Cooper | A.S.B. | Specialist |
| Lindsay Fisher | B.S. | Specialist |
| Marjorie Hollinger | | Senior Specialist |
| **Administration** | | |
| Katiria Agosto | | Specialist |
| Gerry Hershey | | Principal Specialist |
| **Billing & Reporting** | | |
| Thomas Wolgemuth | M.B.A. | Executive Vice President Chief Financial Officer |
| Beatrice Stauffer* | | Manager |
| Adrienne Kuhl* | | Senior Specialist Group Leader |
| Amanda Chao | A.A | Specialist |
| Jaime Ferguson* | A.S. | Senior Specialist |
| Shirley Habalar | | Specialist |
| Lauren Kready | A.S.B. | Specialist |
| Jacqueline Miller | | Specialist |
| Victoria Zacharias | | Specialist |
| Additional support personnel in this group: 3 | | |
| **Computer Applications Development** | | |
| Art Pezzica | B.A. | Director |
| Gordon Beitzel | B.S. | Manager |
| Holly Trego | B.S. | Manager |
| Tiffany Betz | B.S. | Senior Specialist |
| Catherine Holt | B.S. | Principal Specialist |
| Chadwick Hershey | B.S. | Senior Specialist |
| Kevin Lasher | B.S. | Principal Specialist |
| S. Scott Paist | B.A. | Specialist |
| Harry Thompson | B.A. | Principal Specialist |
| Timothy Weaver | B.A. | Senior Specialist |

| Name | Degree | Title |
|---|---|---|
| Andy Whang | B.S. | Senior Specialist |
| Jon Wright | B.S. | Principal Specialist |
| **Computer Systems** | | |
| Art Pezzica | B.A. | Director |
| Cynthia Ayars | M.B.A. | Manager |
| Shawn Beamenderfer | B.S. | Senior Specialist |
| James Butler | | Senior Specialist |
| Justin Risser | B.S. | Senior Specialist |
| Emiley Rodak | B.A. | Specialist |
| Lee Seats | M.B.A. | Principal Specialist |
| Susan Shorter | B.S. | Senior Specialist |
| Destry Usner | B.S. | Senior Specialist |
| Thomas Wise | B.S. | Principal Specialist |
| Edward Zeigler | A.A | Senior Specialist |
| Additional support personnel in this group: 1 | | |
| **Environmental Sample Administration** | | |
| Robert Large | B.S. | Director |
| Anneliese Owen | M.B.A. | Manager |
| Carolyn Cyms | B.S. | Senior Specialist Group Leader |
| Deborah Neslund | | Senior Specialist Group Leader |
| Traci Bedard | B.S. | Specialist |
| Katie Hartlove | | Specialist |
| Tamara Helsel | | Senior Specialist |
| Christine Knoedler | B.A. | Specialist |
| Katherine Metzger | B.A. | Specialist |
| Kristin Zeigler | B.S. | Specialist |
| Additional support personnel in this group: 4 | | |
| **Equipment Maintenance & Repair** | | |
| Thomas Wolgemuth | M.B.A. | Executive Vice President Chief Financial Officer |
| Samuel Huber | B.S. | Manager |
| Robert Allison | | Senior Specialist |
| **Human Resources** | | |
| Beth DiPaolo | B.S. | Director |
| Margaret Stoltzfus | | Director |
| Jodi Ho | B.A. | Senior Specialist Group Leader |
| Cindy Weiser | | Senior Specialist Group Leader |
| Jeanette Beisel | | Principal Specialist |
| William Gambler | B.S. | Specialist |
| Matthew Gehman | B.S. | Senior Specialist |
| Melanie Nixon-Stillman | B.A. | Senior Specialist |
| Beth Rich | | Senior Specialist |
| Jill Wilson | B.S. | Senior Specialist |
| **Corporate Training** | | |
| Kimberly Davies | M.B.A. | Manager |
| Harry Ward | Ph.D. | Principal Specialist Group Leader |
| Dennis Urban | M.S. | Principal Specialist |

| Name | Degree | Title |
|---|---|---|
| Barbara Weaver | M.S. | Principal Specialist |
| **Marketing & Communication Services** | | |
| Margaret Stoltzfus | | Director |
| Lisa Bamford | B.S. | Principal Specialist |
| Sherri Harlan | M.B.A. | Principal Specialist |
| **Office Services** | | |
| Thomas Wolgemuth | M.B.A. | Executive Vice President Chief Financial Officer |
| Denise Splain | | Manager |
| Maureen Caputo | A.S. | Specialist Group Leader |
| Dana Defibaugh | A.S. | Senior Specialist Group Leader |
| April Gibson | | Principal Specialist Group Leader |
| Raymond Bowen | | Specialist |
| Nancy Broderick | | Specialist |
| Nicole Hanna | | Specialist |
| Carol Martin | | Specialist |
| Marta Rodriguez Rivera | | Specialist |
| Lee Ann Ressler | | Specialist |
| Jazzire Sierra | A.A.S. | Specialist |
| Tracey Salkeld | | Specialist |
| Mary Stem | | Specialist |
| Michele White | | Specialist |
| Additional support personnel in this group: 4 | | |
| **Physical Services** | | |
| Samuel Huber | B.S. | Manager |
| Gerald Clipper | | Principal Specialist Group Leader |
| Mark Allison | | Principal Specialist |
| Robert Bishop | | Specialist |
| Traci Bowman | | Specialist |
| Barry Gehman | | Senior Specialist |
| Edward Huegel | | Specialist |
| Robert Hufford | | Principal Specialist |
| Ronald Hufford | | Senior Specialist |
| Thomas Koller | | Specialist |
| Ronald Reed | | Specialist |
| David Splain | | Specialist |
| Additional support personnel in this group: 2 | | |
| **Purchasing** | | |
| Thomas Wolgemuth | M.B.A. | Executive Vice President Chief Financial Officer |
| Charles Kurtz | | Senior Specialist Group Leader |
| Thomas Dull | A.S. | Senior Specialist |
| Adam Huegel | | Specialist |
| Lester Metzger | | Specialist |
| **Sample Bottles** | | |
| Steven Davies | B.S. | Manager |
| Jeffrey Moyer | B.S. | Senior Specialist Group Leader |
| Theresa Carlson | A.S. | Specialist |

| Name | Degree | Title |
|---|---|---|
| Samantha DeFalcis | | Specialist |
| Karen Guito | | Specialist |
| Sandra Muckle | | Specialist |
| **Sample Support** | | |
| Robert Large | B.S. | Director |
| Dana Kauffman* | | Manager |
| Lisa Cooke | | Chemist Group Leader |
| Chad Wettig | | Chemist Group Leader |
| Stephanie Sanchez | | Chemist |
| Additional support personnel in this group: 9 | | |
| **Transportation** | | |
| Steven Davies | B.S. | Manager |
| Tony Luque | | Specialist |
| L. Kenneth Miller | | Specialist |
| Timothy Miller | | Specialist |
| Christopher Winters | | Specialist |
| Leon Wolf | | Specialist On-Call |
| Additional support personnel in this group: 13 | | |

*Denotes those employees that sign reports for Environmental Sciences.

eurofins | Lancaster Laboratories

# Environmental Quality Policy Manual

# Appendix D
## Personnel Qualifications and Responsibilities

Current as of October 05, 2011
50 Total Pages (including this coversheet)

**Joseph D. Anderson, B.S., Senior Chemist, Flexible Staffing**

Education:

B.S. General Science, Pennsylvania State University (2004)

Professional Experience:

ALSI, GC GC/MS Analyst (2004-2010)
Responsibilities included preparing, running, and reviewing samples according to client and industry methods using various instrumentation including GC and GC/MS; performing analysis for various departments as determined by work volume and staffing needs; reviewing and reporting data within client specified criteria
With Lancaster Laboratories since 2010
Senior Chemist, Flexible Staffing (2010)
Responsibilities include preparing, running, and reviewing samples according to client, compendia, and industry methods using various wet chemistry techniques and instrumentation, which may include but is not limited to, gas chromatography, liquid chromatography, IC, and TOC instrumentation; performing analysis for various departments as determined by work volume and staffing needs

**F. Bradley Ayars, Senior Specialist Group Leader, Data Deliverables**

Continuing Education:

Environmental Law & Policy, Franklin & Marshall College (1991)

Professional Experience:

With Lancaster Laboratories since 1988
Client Services Specialist (1992)
Environmental Project Management (1994)
Senior Specialist Coordinator, Electronic Data Deliverables (1997)
Responsibilities included supervising EDD staff; developing and maintaining EDD formats; overchecking lab data for EDDs; primary contact for EDD issues
Senior Specialist Group Leader, Electronic Data Deliverables (2005)
Responsibilities include supervising EDD staff; developing and maintaining EDD formats; overchecking lab data for EDDs; primary contact for EDD issues

**Cynthia A. Ayars, M.B.A., Manager, Computer Systems**

Education:

B.S. Chemistry, Shippensburg University (1987)
M.B.A., Penn State University (1994)

Continuing Education:

Lancaster Labs University of Education: Hazardous Waste/Chemical Transfer, DOT: Safe Transport of Hazardous Materials, Respiratory Protection.
Unix Database Administration, Lawson Software (1998)
Unix System Administration, Lawson Software (1998)
Unix Technical Foundations, Lawson Software (1998)
Oracle 8 Backup and Recovery Workshop, Oracle (2000)
Software Quality Engineering – Systematic Software Testing (2004)

Professional Experience:

With Lancaster Laboratories since 1987
Chemist (06/87-10/89)
Client Service Specialist I (10/89-11/91)
Group Leader II, Sample Support (11/91-08/98)
Senior Specialist, Computer Applications Development (1998)
Responsibilities included Oracle based administrating, Lawson system administrating, and participating in development of Parallax system
Senior Specialist/Coordinator, Computer Applications Development (2002)
Responsibilities included developing software quality documentation and coordination of software quality effort for both Parallax and Nautilus
Manager, Computer Applications Development (2005)
Responsibilities included developing software quality documentation and coordination of software quality effort and database administration for both Parallax and Nautilus

Manager, Computer Systems (2008)
Responsibilities include developing software quality documentation and coordination of software quality effort and database administration for both Parallax and Nautilus

**Matthew Rusty E. Barton, B.S., Senior Specialist, GC/MS Semivolatiles**

Education:

B.S. Biochemistry, East Stroudsburg University (1991)

Professional Experience:

With Lancaster Laboratories since 1991
Senior Chemist (1998)
Senior Chemist/Coordinator (1999)
Responsibilities included: supervise personnel; schedule lab work; perform purge and trap gas chromatography testing; operate O.I. 4560/4551, Tekmar 3000, Archon 5100, and HP5890 Series II OC instruments; review and approve data; and developing and evaluating new methods.
Senior Chemist, Nitrosamines (2003)
Responsibilities included: Analysis of nitrites in tobacco samples
Senior Chemist, EPH/Misc. GC (2004)
Responsibilities include: Analysis of environmental samples for diesel range organics via gas chromatography
Senior Specialist, GC/MS Semivolatiles (2008)
Responsibilities include: audit and upload of departmental data

**Shawn Beamenderfer, B.S., Senior Specialist, Computer Systems**

Education:

A.A.S. Computer Networking, Thaddeus Stevens College (2003)
B.S. Computer Info System, Alvernia College (2006)

Professional Experience:

With Lancaster Laboratories since 2006
Software Quality Specialist, Computer Applications Development (2006)
Responsibilities included creating and executing test plans for pharmaceutical software
Specialist, Computer Systems (2007)
Responsibilities included creating and executing test plans for pharmaceutical software
Senior Specialist, Computer Systems (2009)
Responsibilities include creating and executing test plans for pharmaceutical software

Awards, Citations, Honorary Societies, and Publications:

Dean’s List, Alvernia College (2003-2006)
Certified Tester, Foundation Level – ASTQB

**Gordon Beitzel, B.S., Manager, Computer Applications Development**

Education:

B.S. Electrical Engineering, Pennsylvania State University (1987)

Continuing Education:

Microsoft Solutions Framework, Microsoft Consulting Services (1997)
Mastering Visual Basic 6 Development, Productivity Point International (1999)

Professional Experience:

Lancaster Laboratories, Inc., Computer Systems Specialist (1988-1994)
Data Pipeline Systems, Inc., Software Developer (1994-1996)
CDS Solutions Group, Project Manager (1996–1998)
With Lancaster Laboratories since 1998
Manager (previously titled Group Leader), Application Development (1998)
Responsibilities include management of various software development projects. This involves personnel management, coordinating the timelines, systems analysis, and communication of project progress and status.

Memberships & Appointments:

Microsoft Certified Solution Developer (1997)

**Kenneth A. Bell, B.S., Senior Chemist Group Leader, Water Quality**

Education:

B.S. Chemistry, Millersville University (1997)

Professional Experience:

Johnsons Chemical, Laboratory Assistant (1989-1992)
Responsibilities included collecting samples and performing testing on raw material
With Lancaster Laboratories since 1994
Senior Laboratory Technician, Water Quality (1994)
Responsibilities included routinely performing analytical testing using wet chemistry methods
Chemist/Coordinator, Water Quality (1994)
Responsibilities included performing wet chemistry analyses, sample verification, and coordinating workflow
Senior Chemist/Coordinator, Water Quality (1994)
Responsibilities included coordinating workflow, performing sample verification, back-up report signing, training new employees, revising standard operating procedures, writing annual job plans and reviews
Senior Chemist Group Leader, Water Quality (2005)
Responsibilities include coordinating workflow, performing sample verification, back-up report signing, training new employees, revising standard operating procedures, writing annual job plans and reviews

**Holly Berry, B.S., Senior Chemist, GC/MS Volatiles**

Education:

B.S. Forensic Chemistry, Buffalo State College (SUNY) (2006)

Professional Experience:

New York State Police, Toxicology Intern (2005-2006)
Responsibilities included performing analysis of alternative medicines using FPIA, SPE, GC/NPD, and GC/MS
With Lancaster Laboratories since 2006
Chemist, GC/MS Volatiles (2006)
Responsibilities included analyzing soils and waters for VOAs using purge and trap and GC/MS instrumentation
Senior Chemist, GC/MS Volatiles (2010)
Responsibilities include analyzing performing GC/MS analysis of water and soil samples along with other matrices by various analytical methods such as EPA 624, 8260B, and CLP; evaluating analytical data generated; calibrating and troubleshooting GC/MS instrumentation; assisting other employees with any questions that may arise and helping to train new employees

Memberships and Appointments:

Emergency Response Team (Hazmat technician) – LLI (2006-present)

**Tiffany D. Betz, B.S., Senior Specialist, Computer Applications Development**

Education:

B.S. Computer Science, Millersville University (2001)

Continuing Education:

Oracle Exam #1Z0-007, Introduction to Oracle 9i: SQL (May 17, 2004)
Oracle Exam #1Z0-147, Oracle 9i: Program with PL/SQL (August 4, 2004)

Professional Experience:

With Lancaster Laboratories since 2000
Specialist, Computer Applications Development (2000)
Responsibilities included computer applications development and maintenance.
Senior Specialist, Computer Applications Development (2006)
Responsibilities include computer applications development and maintenance.

**Kenneth L. Boley, Jr., B.S., Senior Chemist Group Leader, GC/MS Volatiles**

Education:

B.S. Chemistry, Messiah College (1995)

Professional Experience:

Heritage Custom Kitchens, Inc., Face Frame Assembler (1997–2001)
Responsibilities included reading and interpreting job orders; overseeing daily production of department; performing various manufacturing duties daily; member of the safety committee, first aid team, and security team
With Lancaster Laboratories since 2001
Chemist, GC/MS Volatiles (2001)
Responsibilities included analyzing samples and QC by purge and trap GC/MS; generating and reviewing raw data; performing maintenance on GC/MS, purge and traps, and various autosamplers; following methods and SOPs
Senior Chemist, GC/MS Volatiles (2005)
Responsibilities included performing routine and non-routine analyses; diagnosing and solving technical problems; maintaining and troubleshooting instrumentation; writing and revising SOPs; training new analysts; auditing and uploading data as work load deems necessary
Senior Chemist Group Leader, GC/MS Volatiles (2009)
Responsibilities include maintaining GC/MS instrumentation; tuning and calibrating instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; suggesting and implementing corrective action and system improvements when necessary; performing all duties with minimal supervision; working on special assignments; diagnosing complex problems and offering solutions with a high degree of independence; assisting in “brainstorming” client problems and projects; completing assigned projects on time; researching new and emerging technologies; producing written and oral reports on research activities; performing both technical and personnel aspects of group operations; performing work within the department or other areas as required; acting as a technical resource, trainer, and troubleshooter to specific department; making recommendations for operational and/or technical improvements; communicating effectively within the group; coaching and developing direct reports; planning and monitoring workflow

**Nancy J. Bornholm, B.S., Principal Specialist, Environmental Client Services**

Education:

B.S. Chemistry (magna cum laude), Muhlenberg College (1981)

Continuing Education:

Instrumental Analysis of Paints and Polymers, FBI Academy (1984)
Analytical Chemistry of Contaminants in Surface and Groundwater, ACS Short Course (1986)

Professional Experience:

University of Connecticut Health Center, Laboratory Technician (1977-1980)
Institute for Cancer Research, Research Technician (1981)
Baltimore City Crime Laboratory, Mobile Crime Unit Trainee (1981-1982)
Maryland State Police Crime Laboratory, Forensic Chemist III (1982-1985)
With Lancaster Laboratories since 1985
Senior Specialist, Environmental Client Services (1987)
Responsibilities included project management; audit sample entries; answer client questions; communicate client requirements to lab areas; and schedule sample submissions and provide sampling containers
Principal Specialist, Environmental Client Services (2004)
Responsibilities include project management; audit sample entries; answer client questions; communicate client requirements to lab areas; and schedule sample submissions and provide sampling containers

Awards, Citations, Honorary Societies, and Publications:

Quarterly Impact Award (2008)
Superlative Service President’s Award (2008)

**Marianne L. Bragg, B.S., Principal Specialist, Environmental Business Development**

Education:

B.S. Biology, Millersville University (1987)

Professional Experience:

With Lancaster Laboratories since 1985
Coordinator
Group Leader (1990)
Principal Specialist (1994)
Responsibilities included: advise clients on testing; provide price quotes and proposals; answer client questions; schedule sample submissions and provide sampling containers; communicate client requirements to lab areas; and assist with client visits to the lab.
Principal Specialist/Coordinator, Environmental Business Development (2002)
In addition to the responsibilities listed above, manage workload and workflow among business development staff.
Principal Specialist/Group Leader, Environmental Business Development (2005)
In addition to the responsibilities listed above, manage workload and workflow among business development staff.
Principal Specialist, Environmental Business Development (2007)
Responsibilities include: advise clients on testing; provide price quotes and proposals; answer client questions; schedule sample submissions and provide sampling containers; communicate client requirements to lab areas; and assist with client visits to the lab.

**Jamie L. Brillhart, B.S., Senior Chemist, Pesticide Residue Analysis**

Education:

B.S. Physical Science, York College of Pennsylvania (2003)

Professional Experience:

B-H Laboratories Inc./Analytical Laboratory Services Inc., Inorganic Laboratory Technician/Inorganic Chemist (2003-2005)
Responsibilities included performing wet chemistry testing on drinking waters and waste water; being responsible for analyses included fluoride, cyanide, phosphorus, nitrate/nitrite, cadmium reduction, and grease and oil testing when needed; prepping and analyzing for mercury on a mercury analyzer; analyzing for various metals on a graphite furnace; prepping leachates; prepping standards as needed
Hercon Laboratories, Inc., QC Analyst I (2005-2007)
Responsibilities included performing Quality Control Testing on Transdermal Systems; performing assays, dissolutions, degradation, residual solvents, and raw material testing; prepping necessary standards and performing instrument maintenance as needed
With Lancaster Laboratories since 2007
Chemist, Pesticide Residue Analysis (2007)
Responsibilities included analyzing soils for PPL Pesticides using 5890 and 6890 GCs with ECD detectors; performing instrument maintenance; prepping standards; auditing calibrations as necessary; being able to analyze for OPPAs, ACMOs, EDBs, PCBs, and Herbicides as needed
Senior Chemist, Pesticide Residue Analysis (2011)
Responsibilities include analyzing soils for PPL Pesticides using 5890 and 6890 GCs with ECD detectors; performing instrument maintenance; prepping standards; auditing calibrations as necessary; being able to analyze for OPPAs, ACMOs, EDBs, PCBs, and Herbicides as needed

**Robert Brown, Principal Chemist Group Leader, EPH/Misc. GC**

Education:

Attended 2.5 years at Pennsylvania State University towards B.S. in Microbiology (1988)
Completed 20 credits towards B.S. in Environmental Biology, Millersville University (1993)

Professional Experience:

With Lancaster Laboratories since 1988
Chemist (1993)
Senior Chemist (1997)
Responsibilities included: perform extractable petroleum testing; operate multiple Hewlett-Packard gas chromatographs (GC) instruments; data interpretation and entry; and developing and evaluating new methods.
Principal Chemist (2004)
Responsibilities included: perform extractable petroleum testing; operate multiple Hewlett-Packard gas chromatographs (GC) instruments; data interpretation and entry; and developing and evaluating new methods. Serve as primary technical contact for client service representatives and their clients.
Principal Chemist Group Leader, EPH/Misc. GC (2005)
Responsibilities include: perform extractable petroleum testing; operate multiple Hewlett-Packard gas chromatographs (GC) instruments; data interpretation and entry; and developing and evaluating new methods. Serve as primary technical contact for client service representatives and their clients.

**Kathryn A. Brungard, Senior Specialist, Quality Assurance**

Continuing Education:

Clinical Laboratory Science, Temple University (1984-1988)

Professional Experience:

Environmental Partners, Inc., Environmental Technician/Health and Safety Coordinator (2003-2005)
Responsibilities included determining personnel health and safety risks on each work site and determining appropriate measures to be taken for personal protection; maintaining and servicing sampling equipment; calibrating meters and analytical equipment; collecting and processing representative samples at each monitoring site following state mandated procedures; routinely measuring field water and soil quality parameters; performing product recovery as part of site remedial measures; evaluating and reporting upon trends and/or results that were out-of-range
Maxwell House Coffee/Kraft Foods, Quality Assurance Technician (2004-2005)
Responsibilities included conducting hourly audits on operating production lines which included weight of product, oxygen content, density, caffeine level by HPLC, moisture content, inspection for foreign or incidental materials, and packaging compliance; performing weekly water testing for level of chlorine and microbial contamination; producing result spreadsheets and accurate logs; notifying upper management of all results in a timely manner
Columbia Analytical Services, Inc, Quality Assurance Program Manager (2005-2009)
Responsibilities included being responsible for the overall coordination of the NELAP certified environmental laboratory program; monitoring laboratory quality systems through audits; identifying potential problem areas, recommending corrective actions, and providing technical assistance and training as necessary; informing management of potential problems and recommending remedial measures in a timely basis both orally and by written communication; maintaining performance evaluation records; maintaining accreditations for regulatory agencies and client programs; providing audit responses and initiating changes in procedures; maintaining the calibration of all weights, balances, and thermometers
With Lancaster Laboratories since 2010
Senior Specialist, Quality Assurance (2010)
Responsibilities include ensuring quality of data being produced in the laboratories by performing data review, auditing laboratories, and reviewing written procedures; ensuring laboratory adherence to government regulations and client requirements; reviewing client and government documents for requirements outside our usual laboratory practices; setting up and testing new analysis in the laboratory sample management system as required by the departments

Memberships and Appointments:

Florida Society of Environmental Analysts (2005-2009)

**Ryan P. Byrne, B.S., Senior Chemist, GC/MS Semivolatiles**

Education:

B.S. Biology, College/University (2003)

Professional Experience:

With Lancaster Laboratories since 2003
Chemist, GC/MS Semivolatiles (2003)
Responsibilities include preparing standards; performing maintenance and calibration of GC/MS systems; responding to audits
Senior Chemist, GC/MS Semivolatiles (2007)
Responsibilities include performing analysis and review of all departmental analyses; responding to audits

**Florida A. Cimino, B.S., Senior Chemist, Volatiles in Air**

Education:

B.S. Chemistry, Shippensburg University (2004)

Professional Experience:

With Lancaster Laboratories since 2005
Chemist, Flexible Staffing (2005)
Responsibilities included preparing, running, and reviewing samples according to client, compendia, and industry methods using various wet chemistry techniques and instrumentation including, but not limited to, gas chromatography, liquid chromatography, IC and TOC instrumentation; performing analysis for various departments as determined by work volume and staffing needs
Senior Chemist, Flexible Staffing (2008)
Responsibilities included preparing, running, and reviewing samples according to client, compendia, and industry methods using various wet chemistry techniques and instrumentation including, but not limited to, gas chromatography, liquid chromatography, IC and TOC instrumentation; performing analysis for various departments as determined by work volume and staffing needs

Senior Chemist, Volatiles in Air (2010)
Responsibilities include maintaining instrumentation; tuning and calibrating instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; diagnosing complex problems and offering solutions with a high degree of independence; suggesting and implementing improvements to maximize quality and productivity; acting as technical resource for internal problems and projects; assisting in "brainstorming" client problems and projects; training new employees in all aspects of instrumentation; researching new and emerging technologies

Awards, Citations, Honorary Societies, and Publications:

Girl Scout Gold Award (2000)
Who's Who Among College Students (2001-2004)

**Mark A. Clark, B.S., Principal Chemist, GC/MS Semivolatiles**

Education:

B.S. Biochemistry, Millersville University (1986)

Professional Experience:

With Lancaster Laboratories since 1985
Senior Chemist, GC/MS Semivolatiles (1985)
Responsibilities included performing GC/MS semivolatiles testing; operating GC/MS instruments; performing data Interpretation and entry; developing and evaluating new methods; calibrating and repairing instruments
Principal Chemist, GC/MS Semivolatiles (2001)
Responsibilities include performing PAH by HPLC analysis and assisting with GC/MS operations on third shift

**Gerald L. Clipper, Principal Specialist Group Leader, Physical Services**

Continuing Education:

Electrical Engineering, West Virginia University, Morgantown, WV (1965-1967)
Basic Electronics, US Navy, Great Lakes, IL
Advanced Electronics, US Navy, Bainbridge, MD
Radar and Special Circuits, Weapons Direction Equipment, US Navy, Dam Neck, VA
Telemetry, US Navy, San Francisco, CA
IBM-MRP MAPIC I and II
SMART CAM and CNC Programming
Industrial and Commercial Power Distribution, Energy Efficient Commercial Buildings, Power Quality
Data Communications for Engineers and Technicians
R&D Facilities: Concepts for Cost Effective Buildings
Raising FM Performance and Cutting Costs
Advanced Level Laboratory Ventilation, Laboratory Remodeling and New Lab Buildings
Fume Hood: Selection, Design, and Certifying
Engineering Calculations for Heat Load and Equipment Selection
Proportional Controls for HVAC Systems
Andover System Programming
Contingency Planning for Equipment and Machinery

Professional Experience:

US Navy, Vietnam Veteran (1967-1971)
Responsibilities included maintaining all electronic missiles test and telemetry equipment onboard ship; performing function tests on all missiles onboard on a periodic basis; periodically assigned as an observer on other ships during drills to analyze performance
Donnelly Printing, Apprentice Assistant Pressman (1971-1973)
Responsibilities included supervising crew in operation and maintenance of press
Redman Industries, Production Supervisor (1973-1974)
Responsibilities included supervising employees in assembly and finishing of homes; controlling inventories of materials; supervising repair crews; supervising testing and inspection; hiring, reviewing, and firing
Anderson Bakeries, Packaging Supervisor (1974-1977)
Responsibilities included supervising maintenance and machine set up for baggers, sealers, and carton machinery; scheduling production for shift; supervising packaging and storage of materials; hiring, training, review, and firing
Liberty Homes, Production Supervisor (1977-1981)
Responsibilities included managing employees in assembly and finishing of homes; inventory control; supervising repair crews, testing, and inspection; hiring, review, and firing

High Energy Corporation, Plant Manager/Product Manager (1981-1987)
Responsibilities included scheduling all production; managing employees in electro-mechanical assembly operations (pressing, soldering, welding, testing, etc.); developed automated equipment, fixtures, and dies for improved productivity; managed machine shop in production of assemblies and subassemblies to support production lines; designed and supervised design of capacitors; consulted with clients on applications for new designs and replacement parts; developed and produced new products; established annual budget; managed maintenance staff in equipment and building maintenance; made sales calls to major clients and helped to negotiate annual contracts; established work rates, hired, reviewed, and fired; CAM system design and CNC programming for automatic lathe
With Lancaster Laboratories since 1987
Senior Specialist, Physical Services (1987)
Principal Specialist, Physical Services (1998)
Principal Specialist Group Leader, Physical Services (2001)
Responsibilities include physical plant operations; evaluation and selection of building systems and services; short and long range expansion planning; laboratory and office layout and design (new and renovations); contracting/coordination of new projects; develop solutions to problems relating to safety, equipment, building, and services; manage technical maintenance staff; engineering support for parent company labs; facility energy management; equipment design for laboratory use; evaluate and market used lab equipment; interview and train new employees of the HVAC group to perform required duties; serve as a technical source for all departments; maintain, repair, and trouble shoot the building's control system; monitor, trouble shoot, and upgrade the programming as needed for the security system; manage (based on cost effectiveness and high quality standards) all new equipment being purchased by the Physical Services department to ensure compatibility with our current systems (i.e., HVAC, electrical, plumbing, etc.); maintain, implement, and update preventative maintenance program on all facility equipment; review and assist in the design of new or remodeled space to ensure high quality and cost savings

**Harolyn M. Clow, M.S., SM (NRCM), Manager, Pharmaceutical Microbiology**

Education:

B.S. Microbiology, Colorado State University (1986)
M.S. Quality Assurance/Regulatory Affairs, Temple University (1995)

Continuing Education:

Laboratory Identification of Gram Positive Bacteria, Colorado Association for Continuing Medical Laboratory Education (1989)
Enterobacteriaceae, Colorado Association for Continuing Medical Laboratory Education (1990)
Laboratory Management: Quality Assurance/Quality Control, Colorado Association for Continuing Medical Laboratory Education (1990)
Current Issues in the Pharmaceutical Microbiology Laboratory Seminar/Workshop, Applied Analytical Industries, Inc. (1992)
Entry Level Management, Lancaster Laboratories (1993)
MIDI Microbial Identification System Training (1993)
Moving Pharmaceutical Microbiology into the 21st Century, Seminar/Workshop, Applied Analytical Industries, Inc. (1997)
Bacteriology, Colorado Association for Continuing Medical Laboratory Education (2001)
Principles of Biosafety/ BBP Exposure Control Plan, LLU (2003)
ISPE Baseline Guide Series: Biopharmaceuticals Guide, Interphex (2004)
Drinking Water Laboratory Training (2007)

Professional Experience:

Benedict Nuclear Pharmaceuticals, Inc., Supervisor of Quality Control (1987-1990)
Responsibilities included managing Quality Control laboratory; supervising operations related to quality assurance and GMP compliance
Cell Technology, Inc., Quality Assurance/Quality Control Analyst (1990-1991)
Responsibilities included developing and implementing environmental monitoring programs; evaluating systems for GMP compliance and performing testing of finished product
With Lancaster Laboratories since 1991
Microbiologist II, Pharmaceutical Microbiology (1991)
Responsibilities included writing/revising operating procedures for sterility testing, microbial limit testing, and related operations; performing sterility testing, endotoxin testing, microbial limit testing, environmental monitoring, and related testing associated with process/facility validation; performing data entry, data verification, and equipment maintenance
Microbiologist III, Pharmaceutical Microbiology (1992)
Responsibilities included coordinating scheduling for microbial limit testing, performing sterility testing, and tests associated with support of process validation and facility validation
Coordinator, Pharmaceutical Microbiology (1993)
Responsibilities included managing and scheduling of personnel and verification of data; supervising daily laboratory operations; coordinating and conducting client method transfers; evaluating compliance of operations with corporate requirements and GMP regulations; performing duties related to support of client facility validations and process validations/method development
Group Leader, Pharmaceutical Microbiology (1996)
Responsibilities included managing daily operations of pharmaceutical microbiology department including personnel; performing quality assurance and regulatory compliance functions to maintain departmental operations in accordance with corporate requirements and GMP regulations; being responsible for management of the Facility Validation group and Media Preparation group within the department

Manager, Pharmaceutical Microbiology (2005)
Responsibilities include managing daily operations of pharmaceutical microbiology department including personnel; performing quality assurance and regulatory compliance functions to maintain departmental operations in accordance with corporate requirements and GMP regulations; being responsible for management of the Facility Validation group and Media Preparation group within the department

Awards, Citations, Honorary Societies & Publications:

Specialist Microbiologist in Consumer and Industrial Microbiology, National Registry of Certified Microbiologists of the American Academy of Microbiology
Publication: Lingenfelter, E.A., H.L. Evans, W.B. Atkins, and H.M. Clow. How to Improve Cleaning Processes. Pharmaceutical Formulation & Quality magazine. (June 2009)

Memberships & Appointments:

American Society for Microbiology
National Registry of Certified Microbiologists

**Rachel R. Cochis, B.A., Senior Specialist Group Leader, GC/MS Semivolatiles**

Education:

B.A. Science, Pennsylvania State University (1992)

Continuing Education:

Introduction to Mass Spec Interpretation, Hewlett-Packard (1995)
Gas Chromatography Principles & Practices (1994)

Professional Experience:

With Lancaster Laboratories since 1993
Chemist (1994), GC/MS Semivolatiles (1993)
Responsibilities included performing semvolatiles analysis on water and soil samples
Senior Chemist Coordinator, GC/MS Semivolatiles (1996)
Responsibilities included scheduling lab work; performing data interpretation and entry; reviewing and approving data; revising and updating SOPs and analytical methods; monitoring turnaround time; communicating client requirements to lab areas
Senior Specialist Group Leader, GC/MS Semivolatiles (2005)
Responsibilities include scheduling lab work; performing data interpretation and entry; reviewing and approving data; revising and updating SOPs and analytical methods; monitoring turnaround time; communicating client requirements to lab areas

**Tracy A. Cole, Senior Specialist, EPH/Miscellaneous GC**

Continuing Education:

Gas Chromatography: Principles and Practice, LLU (1997)

Professional Experience:

With Lancaster Laboratories since 1991
Laboratory Technician, Volatiles in Air (1991)
Responsibilities included preparing samples and standards; washing glassware; loading samples on instruments
Senior Technician, Volatiles in Air and EPH/Miscellaneous GC (1994)
Responsibilities included analyzing routine samples and QC by Gas Chromatography for DRO and miscellaneous organic compounds; preparing direct injection samples for analysis; preparing standards; reviewing chromatography data and uploading to the LIMS
Chemist, EPH/Miscellaneous GC (1999)
Responsibilities included analyzing routine and nonroutine samples and QC by Gas Chromatography for various organic analyses including DRO, TPH, and other petroleum related methods and miscellaneous organic compounds by direct injection; reviewing chromatography data and uploading to the LIMS; performing instrument maintenance; calibrating instruments for various methods
Senior Specialist, EPH/Miscellaneous GC (2008)
Responsibilities include reviewing/verifying data for technical correctness including raw chromatography data, initial calibrations, and analytical reports; ensuring that method and project requirements were followed and entry into the LIMS is correct; acting as a technical resource for the department; assisting in reviewing/writing SOPs and other technical documents

**Paul R. Cormier, B.A., Principal Specialist, Specialty Services Group**

Education:

B.S. Microbiology, Virginia Tech (1984)
B.A. Chemistry, Virginia Tech (1984)

Continuing Education:

Hewlett-Packard GC/MS Advance Operations/System Manager Course (1990)
Mass Spectral Interpretation, Finnigan MAT Institute (1991)
Technical Training, OI Analytical (1995)

Professional Experiences:

Environmental Testing & Certification (1985-1989)
Analytikem, Inc. (1989-1990)
With Lancaster Laboratories since 1990
- Senior Chemist (1990)
  - Responsibilities included: operate GC/MS instruments; data interpretation; review and approve data; repairing instruments; and train other analysts.
- Senior Specialist (2005)
  - Responsibilities included: operate GC/MS instruments; data interpretation; review and approve data; repairing instruments; and train other analysts.
- Principal Specialist, GC/MS Volatiles (2006)
  - Responsibilities include: operate GC/MS instruments; data interpretation; review and approve data; repairing instruments; and train other analysts.
- Principal Specialist, Specialty Services Group (2010)
  - Responsibilities include acting as technical resource within the environmental division; developing and validating analytical protocols; troubleshooting and solving analytical chemistry problems; optimizing instrument configuration and performance; evaluating and interpreting analytical results; writing SOPs; assisting in responding to and eliminating ICARs, assisting in optimizing procedures in prep lab; communicating effectively within department; performing routine work as required

Memberships & Appointments:

American Chemical Society

**Teresa L. Cunningham, B.S., Principal Specialist, Environmental Client Services**

Education:

B.S. Biology, St. Joseph's University (1999)

Continuing Education:

Chemical Monitoring Assistance Program, Pennsylvania Rural Water Association (2000)
How to Deliver Exceptional Customer Service, Fred Pryor Seminars (2000)
Organizational Behavior, Penn State University (2005)

Professional Experience:

With Lancaster Laboratories since 1999
- Specialist, Environmental Client Services (1999-2000)
- Senior Specialist, Environmental Client Services (2001)
- Senior Specialist Coordinator, Environmental Client Services (2001)
  - Responsibilities included serving as project manager for clients with petroleum-related testing accounts; coordinating client requests with laboratory groups to ensure that the client's needs are met; scheduling bottle shipments and sample pickups; preparing quotations; coordinating staff
- Senior Specialist Group Leader, Environmental Client Services (2005)
  - Responsibilities included serving as project manager for clients with petroleum-related testing accounts; coordinating client requests with laboratory groups to ensure that the client's needs are met; scheduling bottle shipments and sample pickups; preparing quotations; coordinating staff
- Manager, Environmental Client Services (2006)
  - Responsibilities included overseeing implementation of new projects; coordinating client requests with laboratory groups to ensure that the client's needs are met; coordinating staff
- Principal Specialist, Environmental Client Services (2008)
  - Responsibilities include performing project management; training new client service representatives; auditing sample entry; answering client questions; communicating client requirements to lab areas

**Carolyn M. Cyms, B.S., Senior Specialist Group Leader, Environmental Sample Administration**

Education:

B.S. Secondary Education/Chemistry, Bloomsburg University of Pennsylvania (1993)
Post Baccalaureate Certificate, Biology and MS Math, Millersville University (2002)

Continuing Education:

Accounting I, HACC (1996)
Introduction to the Internet, PC Focus (1996)
Self-Discipline & Emotional Control, Franklin-Covey (1997)
Child Growth & Development, HACC (1998)
Cell Biology, Millersville University (2000)
Botany; Genetics; Zoology; Biochemistry; Ecology, and Ecology Lab, Millersville University (2001)
Immunology; Animal Behavior; Teaching Biological Issues; Entomology, Millersville University (2002)
Introduction to Computer Programming, Millersville University (2003)

Professional Experience:

Lancaster Theological Seminary, Field Education Assistant-Special Project Coordinator (1996-1999)
Responsibilities included assisting with mailings, organization of the field education program; creating and preparing a student field education manual for the ministerial studies program; acting as liaison between Field Ed Professor, Field Ed sites, and students; preparing all written correspondences for the field ed office; organizing and preparing materials for meetings; tracking student progress through the program; assisting with other special projects requiring computer skills of PageMaker, WordPerfect, Quattro Pro, and Envoy
Self-Employed, Tutor (1994-2005)
Responsibilities included tutoring HACC students in Introduction to Chemistry, Chemistry, Biology, and Algebra
Millersville University – Biology Department, Assistant (2003)
Responsibilities included preparing Power Point presentations for a stream restoration monitoring program; photographing various stages of the project
With Lancaster Laboratories since 1994
Administrator III, Environmental Sample Administration (1994)
Responsibilities included receiving samples, entering samples, auditing, filing, noting discrepancies, and unpacking samples
Administrator III/Coordinator, Environmental Sample Administration (1995)
Responsibilities included relaying technical/client information when it became available; answering questions from clients/technical areas when CSR was unavailable; coordinating/prioritizing entry; supervising and evaluating work of 2nd Shift Environmental Entry Staff; training new personnel in the entry/interpretation process; preparing Job Plans on an as-needed basis
Specialist I, Environmental Sample Administration (1996)
Responsibilities included receiving samples; entering samples; auditing; filing; noting discrepancies; unpacking samples; acting as project coordinator on an as-needed basis
Senior Specialist, Environmental Sample Administration (2000)
Responsibilities included receiving samples; entering samples; auditing; filing; noting discrepancies; unpacking samples; acting as project coordinator on an as-needed basis; training; preparing resource materials; working on special projects as needed
Senior Specialist Coordinator, Environmental Sample Administration (2004)
Responsibilities included receiving samples; entering samples; auditing; filing; noting discrepancies; unpacking samples; acting as project coordinator on an as-needed basis; training; preparing resource materials; working on special projects as needed
Senior Specialist Group Leader, Environmental Sample Administration (2005)
Responsibilities include receiving samples; entering samples; auditing; filing; noting discrepancies; unpacking samples; acting as project coordinator on an as-needed basis; training; preparing resource materials; working on special projects as needed

Awards, Citations, Honorary Societies & Publications:

Residential Life Award of Merit (1990)
Bloomsburg University Dean's List 6 of 8 semesters, graduated cum laude (1990-1993)
Kappa Delta Phi (National Co-Ed Honor Society) (1994)
Spirit of LLI (2001)

Memberships & Appointments:

Elizabethtown Fire Company (1993-present)
Safety Committee (1994-1998)
Alpha Phi Omega (National Co-Ed Service Fraternity) (1991-1993)
NSTA (2000-2008)
Kappa Delta Phi (1994, 2001-2003)

**Kimberly A. Davies, M.B.A., Manager, Flexible Staffing**

Education:

B.S. Biology, Shippensburg University of Pennsylvania (1991)
M.B.A., Pennsylvania State University (1999)

Professional Experience:

Polybac Corporation, Technical Services (1991-1992)
Upper Saucon Township Wastewater Treatment Plant, Technician (1992-1993)
With Lancaster Laboratories since 1993
- Client Services Senior Specialist (1996)
- Senior Specialist/Coordinator, Pharmaceutical Project Management (1998)
- Principal Specialist/Coordinator, Pharmaceutical Project Management (2000)
- Group Leader, Pharmaceutical Project Management and Data Support (2001)
  - Responsibilities included managing pharmaceutical project management and data support staff; facilitating group meetings to communicate with staff; supporting company and division policies and provide information to department; supporting employee development and acknowledge innovative ideas; promoting group and department teamwork and collaboration
- Manager (previously titled Group Leader), Pharmaceutical Project Management (2003)
  - Responsibilities included managing pharmaceutical project management staff; facilitating group meetings to communicate with staff; supporting company and division policies and provide information to department; supporting employee development and acknowledge innovative ideas; promoting group and department teamwork and collaboration
- Manager, Flexible Staffing (2005)
  - Responsibilities included managing labor resources across departments and divisions, coordinating continuous improvement activities including Management Operating System (MOS) audits, new management MOS training, and MOS tool maintenance
- Manager, Flexible Staffing and Technical Training (2006)
  - Responsibilities included managing labor resources across departments and divisions, coordinating continuous improvement activities including Management Operating System (MOS) audits, new management MOS training, and MOS tool maintenance; managing the technical training staff responsible for designing and facilitating technical training
- Manager, PPI Process and Flexible Staffing (2008)
  - Responsibilities include managing labor resources across departments and divisions, coordinating continuous improvement activities including Management Operating System (MOS) audits, new management MOS training, and MOS tool maintenance; managing the technical training staff responsible for designing and facilitating technical training; qualified Practical Process Improvement process manager responsible for facilitating PPI project team training and PPI efforts within LLI

**Steven C. Davies, B.S., Manager, Transportation and Sample Bottles**

Education:

B.S. Elementary Education, Lancaster Bible College (1987)

Professional Experience:

With Lancaster Laboratories since 1990
- Transportation Coordinator (1991)
- Transportation Group Leader (1994)
- Transportation and Sample Bottles Group Leader (1998)
  - Responsibilities included supervise personnel; schedule lab work; manage financial resources; answer client questions; communicate client requirements to lab areas; and schedule sample submissions and provide sampling containers.
- Transportation and Sample Bottles Manager (2005)
  - Responsibilities include supervise personnel; schedule lab work; manage financial resources; answer client questions; communicate client requirements to lab areas; and schedule sample submissions and provide sampling containers.

**Irene Lynn Dodd, M.B.A., Principal Specialist, Environmental Business Development**

Education:

B.A. Chemistry, Washington & Jefferson College (1988)
M.B.A. Pennsylvania State University (1993)

Continuing Education:

- Mass Spectral Interpretation Course (1991)
- High Impact Communication Skills (1992)
- GC Troubleshooting Course (1993)
- Selected courses at Millersville University (1996)
- Effective Technical Communication (2000)
- Business Writing for Results (2002)
- Signature Service (2002)
- The Counselor Salesperson (2004)
- Pennsylvania Chamber Annual Environmental Laws and Regulations Conference (2004, 2005, 2006, 2007)
- Conceptual Selling (2009)
- Intermediate II and Advanced Excel (2011)

Professional Experience:

- Stauffer Chemical Company, Food Chemist (1987-1988)
- With Lancaster Laboratories since 1988
  - Chemist (1991)
  - Senior Chemist (1995)
  - Senior Specialist (1997)
  - Principal Specialist, Environmental Business Development (2003)
    - Responsibilities include: project management; review and approve data; consult with clients regarding testing needs; work with external auditors; assist with client visits to the lab, advise clients on testing; provide price quotes; monitoring turnaround time; audit sample entry; answer client questions; communicate client requirements to lab areas; provide status reports, including results, to clients; provide sampling containers; and schedule sample submissions.

Memberships and Appointments:

- American Chemical Society
- National Society of Collegiate Journalists
- American Business Women's Association
  - President (1998-1999); Vice President (1994-1995, 1997-1998); Secretary (2000-2001); Newsletter Chair (1993-1994, 2001-2003); Business Associate Night Chair (2000); Woman of the Year (1999, 2004); Thelma Farley Memorial Award (1995); Hospitality Chair (2003-2004) with Wheatland Conestoga Chapter
  - Vice President of Communications (2006-2007, 2007-2008) and Formation committee (2006-2007); Woman of the Year (2007) for Lancaster Area Express Network; Regional and National Newsletter Award Winner (2008)
- Girl Scouts in the Heart of Pennsylvania
  - Leader (2008-Present)

**Amy L. Doupé, B.S., Principal Specialist, Quality Assurance**

Education:

- B.S. Environmental Studies, Allegheny College (1989)

Professional Experience:

- With Lancaster Laboratories since 1994
  - Senior Technician, Volatiles by GC (1994)
    - Responsibilities included performing sample pre-screening.
  - Senior Administrator, Quality Assurance (1995)
    - Responsibilities included performing administrative and certification support
  - Specialist, Quality Assurance (1997)
    - Responsibilities include maintaining documentation of agency certifications
  - Senior Specialist, Quality Assurance (2003)
    - Responsibilities included maintaining documentation of agency certifications
  - Principal Specialist, Quality Assurance (2009)
    - Responsibilities include maintaining documentation of agency certifications

Memberships & Appointments:

- The NELAC Institute (TNI) Proficiency Testing Board
- The NELAC Institute (TNI) Proficiency Testing Committee
- Pennsylvania Association of Accredited Laboratories (1997-present)
- Maryland Environmental Laboratory Association (1999-present)
- Florida Society of Environmental Analysts (2010-present)

**Gregory J. Drahovsky, B.S., Senior Chemist, GC/MS Semivolatiles**

Education:

B.S. Forensic Science, Alvernia College (2006)

Professional Experience:

With Lancaster Laboratories since 2006
- Chemist Title, GC/MS Semivolatiles (2006)
  - Responsibilities included analyzing data for various methods; maintaining instrumentation including GC/MS (5890/5971) (5890/5972) (6890/5973) (6890/5975) (TRACE GC Ultra/DSQII); making standards for various types of methods; calibrating departmental syringes
- Senior Chemist, GC/MS Semivolatiles (2011)
  - Responsibilities include analyzing data for various methods; maintaining instrumentation including GC/MS (5890/5971) (5890/5972) (6890/5973) (6890/5975) (TRACE GC Ultra/DSQII); making standards for various types of methods; emptying waste in designated shed; training others on different analyses; calibrating departmental syringes

Awards, Citations, Honorary Societies, and Publications:

Berks County Undergraduate Research Conference Publication (2004)
Beta Kappa Chi science honors society (2006)

**Christine M. Dulaney, B.A., Senior Specialist, GC/MS Volatiles**

Education:

B.A. Biology, Meredith College (1984)

Continuing Education:

Waters Fundamentals of HPLC, Compuchem Laboratories (1989)

Professional Experience:

Compuchem Laboratories (1984-1998)
- Extraction Technician (1984-1986)
  - Responsibilities included performing extraction of various environmental matrices for pesticide GC analysis and semivolatile GC/MS analysis; extracting quarterly PE samples
- GC Technician (1986-1989)
  - Responsibilities included performing analysis of environmental extracts for pesticides, PAHs, and volatile organic compounds using GC, HPLC, and purge and trap, respectively; performing routine instrument maintenance
- Senior Chemist, Pesticide Review (1990-1995, 1996-1998)
  - Responsibilities included performing qualitative and quantitative review of pesticide, PAH, and volatile organic data; reviewing instrument maintenance and standard logbooks

With Lancaster Laboratories since 1998
- Chemist, Pesticide Residue (1998)
  - Responsibilities included reviewing GC pesticide residue data packages; responding to client inquiries and ICARs
- Project Management Specialist, Pharmaceutical Client Services (2003)
  - Responsibilities included managing details of various pharmaceutical client accounts using the laboratory information management system; acting as liaison between the client and internal laboratory personnel
- Senior Specialist, GC/MS Volatiles (2005)
  - Responsibilities include auditing data for various GCMS volatile analyses; verifying data within the laboratory information management system; reviewing standard preparation logbooks; signing final analytical reports

**Eric L. Eby, B.S., Senior Chemist, Metals**

Education:

B.S. Biology, Millersville University (1988)

Continuing Education:

OSHA 40-hour Hazardous Waste Management, Phoenix Safety Associates (1991)
DX500 Maintenance and Troubleshooting, Dionex (1996)
The Chemistry Behind the Techniques, EAS, Inc. (1996)
Cleaning Validation Strategies, Applied Analytical Industries, Inc. (1997)
Gas Chromatography Practical Theory and Applications, Lancaster Laboratories (1998)

Professional Experience:

With Lancaster Laboratories since 1988
Associate Chemist (1993)
Responsibilities included environmental wet chemistry testing and field sampling.
Chemist (1997)
Senior Chemist, Pharmaceutical Raw Materials (1998)
Responsibilities included IC, TOC analysis, IC maintenance, USP purified water testing, raw materials testing, USP <661> container closure testing.
Senior Chemist, Pharmaceutical Product Testing (2000)
Responsibilities included pharmaceutical product testing per client specific methods, IC and HPLC maintenance.
Senior Chemist, Metals (2005)
Responsibilities include ICP analysis for environmental testing and ICP instrument maintenance.

**Jaime L. Ferguson, A.S., Senior Specialist, Billing & Reporting**

Information not available at time of printing.

**Erik J. Frederiksen, B.A., Manager, Water Quality and Instrumental Water Quality**

Education:

B.A. Chemistry, University of Virginia (1990)

Continuing Education:

Infrared Spectral Interpretation (1993)

Professional Experience:

With Lancaster Laboratories since 1990
Chemist/Coordinator (1993)
Group Leader (1994)
Responsibilities included supervising personnel; managing laboratory operations; project management; managing financial resources; reviewing and approving data
Manager, Water Quality and Instrument Water Quality (2005)
Responsibilities include supervising personnel; managing laboratory operations; project management; managing financial resources; reviewing and approving data

**Lynn Frederiksen, B.S., Principal Specialist Group Leader, Environmental Client Services**

Education:

B.S. Conservation and Resource Development, University of Maryland (1981)

Professional Experience:

University of Missouri, Senior Research Lab Technician (1982 – 1984)
GPU Nuclear Corporation, Data Analyst (1985 – 1989)
With Lancaster Laboratories since 1989
Senior Specialist (1989)/Team Leader, Environmental Client Services (2006)
Responsibilities included: consult with clients regarding testing needs; revise and update SOPs; provide price quotes; audit sample entry; answer client questions; communicate client requirements to lab areas; provide status reports, including results, to clients; schedule sample submissions and provide sampling containers; assist Group Leader with training of new employees and delegating new projects.
Senior Specialist Group Leader, Environmental Client Services (2007)
Responsibilities included: managing a team of client service representatives, training of new employees, setting up and delegating new projects, serving as primary project manager for several large petroleum clients and consultants.
Principal Specialist Group Leader, Environmental Client Services (2011)
Responsibilities include serving as the primary contact or back-up with the laboratory for a number of assigned clients requiring specialized testing or complex projects; understanding and communicating technical information and client requirements to laboratory personnel, helping to ensure that requirements are met; leading broad-based complex projects to a satisfactory conclusion according to client technical and schedule requirements; developing strong relationships with major accounts resulting in additional sales; advising and training other members of the department; serving as a technical resource both internally and externally; proactively assisting Outside Business Development with client visits, presentations, and internal audits for assigned clients; participating on PPI teams

**Joseph M. Gambler, B.S., Senior Chemist, GC/MS Semivolatiles**

Education:

B.S. Chemistry, Millersville University (1996)

Professional Experience:

Wyeth, Biological Manufacturing Technician (1996)
With Lancaster Laboratories since 1996
Senior Chemist, GC/MS Semivolatiles (1996)
Responsibilities includes training new hires, maintaining GC/MS systems, preparing standards/stocks/spikes, maintaining Helium supply system, data interpretation, ordering supplies, auditing, and crosstrained in Pesticides Department.

**Matthew R. Gehman, B.S., Senior Specialist, Environmental Health and Safety Officer, Human Resources**

Education:

B.S. Occupational Safety and Environmental Health, Millersville University (2002)

Continuing Education:

24-Hour Emergency Response (HAZWOPER), Lancaster Laboratories (2004)
IATA/DOT 49 CFR, DGI Training Center (2004)
American Red Cross First Aid/CPR/AED certified, Lancaster Laboratories, Inc. (2004)
Advanced RCRA, Environmental Resource Center (2004)
In-depth Environmental Compliance, PA Chamber (2005)
In-depth Environmental Compliance, PA Chamber (2006)
National Incident Command System, Command School, Inc. (2006)
Life Safety Code, NFPA (2006)
International Conference on Biocontainment Facilities, Tradeline (2006)
In-depth Environmental Compliance, PA Chamber (2007)

Professional Experience:

United States Army Reserve, Military Police, Staff Sergeant (1996-2004)
Responsibilities included supporting joint FBI and military intelligence operations in the Iraq Theater (2003); supervising law enforcement and force protection activities in support of Operation Noble Eagle (2002); ensuring team members met training standards; monitoring health and welfare of team members
With Lancaster Laboratories since 2004
Senior EHS Specialist, Environmental Health and Safety, Human Resources (2004-2007)
Responsibilities included employee health program administration; maintaining current and developing new safety programs; managing environmental compliance program
Senior Specialist, Environmental Health and Safety Officer, Human Resources (2007)
Responsibilities include managing employee health programs; maintaining current and developing new safety programs; managing environmental compliance program

Memberships and Appointments:

Central PA section of American Industrial Hygiene Association (AIHA)
Member (2004-present)
VFW, Post 7362
Member (2004-present)
American Biological Safety Association (ABSA)
Member (2007-present)

**Susan M. Goshert, B.S., Principal Specialist Group Leader, GC/MS Volatiles**

Education:

B.S. Chemistry, Juniata College (1988)

Continuing Education:

Advanced Aquarius Report Training, Hewlett-Packard (1989)
How to Handle People with Tact and Skill, Harrisburg Area Community College (1992)
Positive Attitude and Peak Performance, Harrisburg Area Community College (1992)

Professional Experience:

With Lancaster Laboratories since 1988
Chemist (1990)
Senior Chemist Coordinator (1997)
Responsibilities include: supervise personnel; review and approve data; and monitoring turnaround time.
Senior Specialist Group Leader, EPH/Misc. GC (2005)
Responsibilities include: supervise personnel; review and approve data; and monitoring turnaround time.
Principal Specialist Group Leader, GC/MS Volatiles (2008)
Responsibilities include: supervise personnel; review and approve data; and monitoring turnaround time.

**Brian K. Graham, B.A., Senior Chemist, GC/MS Semivolatiles**

Education:

B.A. Mathematics, Millersville University (1996)

Professional Experience:

With Lancaster Laboratories since 1989
Chemist, GC/MS Semivolatiles (1989-2006)
Senior Chemist, GC/MS Semivolatiles (2006)
Responsibilities include maintaining GC/MS Instrumentation; tuning and calibrating GC/MS; analyzing samples by GC/MS; reviewing and assembling all supporting GC/MS data; preparing standards for calibrations; training new analysts

**Nina C. Haller, Senior Specialist Group Leader, Metals**

Continuing Education:

State Dairy Lab Cert., State of PA (1993)
Butterfat Testing License, State of PA (1995)
Seminar ICP/ICPMS, Fisons Instruments (1995)
Three-day ICP Trace Training Course, Thermo Jarrell Ash, MA (1996)

Professional Experience:

Hazelton Research Products, Lab Technician (1981-1984)
Responsibilities included rabbit production facility, removal of ovaries, care, and maintenance
With Lancaster Laboratories since 1987
Technical Associate, Foods (1987)
Responsibilities included coordinating Listeria Testing Program; performing data entry and verification
Chemist, Metals (1993)
Responsibilities included performing daily tracking of rushes; operating and maintaining ICP instrumentation; reviewing and verifying of ICP data, data package review
Specialist Group Leader, Metals (2003)
Responsibilities included overseeing the ICP/ICPMS personnel and instrumentation workflow; verifying ICP/ICPMS/GFAA/Hg data
Senior Specialist Group Leader, Metals (2006)
Responsibilities included overseeing the ICP/ICPMS personnel and instrumentation workflow; verifying ICP/ICPMS/GFAA/Hg data
Senior Specialist Group Leader, Metals (2007)
Responsibilities include overseeing metals instrument and verification personnel and instrumentation workflow; verifying metals data

**Michele D. Hamilton, B.S., Senior Chemist Group Leader, Pesticide Residue Analysis**

Education:

B.S. Chemistry, Temple University (1990)

Continuing Education:

Gas Chromatography: Practical Theory and Applications for LL (1993)
Practice of Modern HPLC, LC Resources (1996)

Professional Experience:

With Lancaster Laboratories since 1991
Senior Chemist (1997)
Senior Chemist/Coordinator (2000)
Responsibilities included supervising personnel; coaching and developing new employees; sample tracking; reviewing rush request; communicating client requirements; operating GC and HPLC instruments; data interpretation and entry; calibrating; repairing instruments and verifying data
Senior Chemist Group Leader, Pesticide Residue Analysis (2005)
Responsibilities include supervising personnel; coaching and developing new employees; sample tracking; reviewing rush request; communicating client requirements; operating GC and HPLC instruments; data interpretation and entry; calibrating; repairing instruments and verifying data

**Sherri L. Harlan, M.B.A., Principal Specialist, Marketing & Communication Services**

Information not available at time of printing.

**Linda M. Hartenstine, B.A., Senior Chemist, GC/MS Semivolatiles**

Education:

B.A. Chemistry, Millersville University (1994)

Professional Experience:

With Lancaster Laboratories since 1994
Associate Chemist (1994)
Chemist (1997)
Senior Chemist, GC/MS Semivolatiles (1998)
Responsibilities include performing GC/MS semivolatiles testing; operating GC/MS instruments; data interpretation; developing and evaluating new methods; calibrating and repairing instruments; preparing standards; revising and updating SOPs and analytical methods; training other analysts

**Robert G. Heisey, Jr., B.A., Senior Specialist, Water Quality**

Education:

B.A. Chemistry, Millersville State College (1972)

Professional Experience:

RCA Corp., Engineering Technician (1972-1987)
With Lancaster Laboratories since 1988
Chemist Coordinator (1989)
Senior Chemist Coordinator (1997)
Responsibilities included: supervise personnel; schedule lab work; review and approve data; develop and evaluate new methods; prepare test standards.
Senior Chemist Group Leader (2005)
Responsibilities included: supervise personnel; schedule lab work; review and approve data; develop and evaluate new methods; prepare test standards.
Senior Specialist, Water Quality (2006)
Responsibilities include: review and approve data; develop and evaluate new methods; prepare test standards; order laboratory supplies; maintain department's chemical inventory.

**Tamara J. Helsel, Senior Specialist, Environmental Sample Administration**

Professional Experience:

Willow Valley Retirement Communities, Certified Nursing Assistant (2000-2001)
Responsibilities included assisting nursing home residents with their daily activities and personal hygiene
Bayada Nurses, Certified Nursing Assistant (2000-2001)
Responsibilities included assisting people with disabilities in their homes with their personal hygiene and daily activities

With Lancaster Laboratories since 2001
Senior Administrator, Environmental Sample Administration (2001)
Responsibilities included performing sample receipt, interpretation, and entry
Specialist, Environmental Sample Administration (2001)
Responsibilities included performing sample receipt, interpretation, and entry
Senior Specialist, Environmental Sample Administration (2007)
Responsibilities include performing sample receipt, interpretation, and entry

Memberships and Appointments:

Lancaster Laboratories Safety Committee (2003-2007)

**J. Wilson Hershey, Ph.D., Chairman of the Board, Lancaster Laboratories**

Education:

B.A. Chemistry, Millersville State College (1972)
M.S. Chemistry, Villanova University (1983)
Ph.D. Analytical Chemistry, Villanova University (1985)
M.B.A., Villanova University (1991)

Professional Experience:

With Lancaster Laboratories since 1972
Director of Environmental Sciences (1986)
Executive Vice President (1991)
President (1995)
Responsibilities included presiding over all support and technical operations of Lancaster Laboratories; managing resources; establishing priorities to ensure the continued success of our business
Chairman of the Board (2011)
Responsibilities include reporting operational and financial to senior leadership of parent company; ensuring the continued success of Lancaster Laboratories

Awards, Citations, Honorary Societies & Publications:

12 publications in analytical chemistry and laboratory management

**Jenifer E. Hess, B.S., Manager, Pesticide Residue Analysis, EPH/Misc. GC, Nitrosamines, Volatiles by GC**

Education:

B.S. Chemistry, University of Delaware (1984)

Continuing Education:

21 credits towards M.B.A., University of Delaware

Professional Experience:

J. M. Huber Corporation, Research Chemist (1984-1985)
With Lancaster Laboratories since 1985
Chemist/Coordinator, Pesticide Residue Analysis (1989)
Group Leader, Pesticide Residue Analysis (1992)
Responsibilities included supervising personnel; managing laboratory operations and financial resources; project management; reviewing and approving data; consulting with clients regarding testing needs
Manager, Pesticide Residue Analysis (1992)
Responsibilities included supervising personnel; managing laboratory operations and financial resources; project management; reviewing and approving data; consulting with clients regarding testing needs
Manager, Pesticide Residue Analysis, EPH/Misc. GC (1996)
Responsibilities included supervising personnel; managing laboratory operations and financial resources; project management; reviewing and approving data; consulting with clients regarding testing needs
Manager, Pesticide Residue Analysis, EPH/Misc. GC, Nitrosamines (1998)
Responsibilities included supervising personnel; managing laboratory operations and financial resources; project management; reviewing and approving data; consulting with clients regarding testing needs
Manager, Pesticide Residue Analysis, EPH/Misc. GC, Nitrosamines, Volatiles by GC (2005)
Responsibilities include supervising personnel; managing laboratory operations and financial resources; project management; reviewing and approving data; consulting with clients regarding testing needs

**John P. Hook, B.S., Senior Chemist, Metals**

Education:

B.S. General Science, Pennsylvania State University (2002)

Continuing Education:

ICP/ICP-MS Seminar, Perkin-Elmer (2003)
ICP-MS Seminar, Agilent (2004)
ICP-MS training, Perkin-Elmer (2005)
PPI Team Training, Lancaster Laboratories (2008)
Facilitator Training, ThermoFisher Scientific (2009)

Professional Experience:

Sony Technology Corporation, Manufacturing Staff (2002-2003)
Responsibilities included assembly, final inspection, and packaging of television sets
ALCOA Primary Metals, Laboratory Technician (2003)
Responsibilities included observation and maintenance of aluminum production pilot test operation; analysis of product
With Lancaster Laboratories since 2003
Chemist, Metals (2003)
Senior Chemist, Metals (2006)
Responsibilities include performing setup, analysis, and review of ICP, ICP-MS runs; maintenance and troubleshooting of ICP, ICP-MS instruments; yearly, quarterly and start-up ICP instrument qualifications including IECs, IDLs, MDLs, and LDRs; maintaining adequate laboratory supply inventory; disposing of acid waste; writing SOPs

**Samuel A. Huber, B.S., Manager, Physical Services/Equipment Maintenance & Repair**

Education:

B.S. Biology, Lebanon Valley College (1988)
Certificate of Business Administration, Penn State University (1995)

Continuing Education:

24-hour HAZWOPER (spill response) (1995-2004)
40-hour HAZWOPER (2005-present)
DOT/IATA training (2004-present)
Incident Command System IS-00100 (2006)
National Incident Management System IS-00700 (2006)
Total Productive Maintenance (2007)
Basic Electricity for the Non-Electrician (2009)
Air Conditioning and Refrigeration (2010)

Professional Experience:

With Lancaster Laboratories since 1988
Environmental department responsibilities (1988-2007)
Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations and financial resources; project management; supervising method development
Manager, Physical Services/Equipment Maintenance & Repair (2007)
Responsibilities include overseeing facilities staff and operation of physical plant and grounds; growth planning; overseeing security functions

Awards, Citations, Honorary Societies & Publications:

Dawson-Grundmann Innovation Award, Lancaster Laboratories (1999)
Design and oversee installation of bulk solvent delivery system for organic extractions; annual savings in waste reduction and labor costs of greater than $12,000
Organizing the Laboratory to Efficiently and Accurately Process Soil Samples, Pittcon poster session (2006)
NFPA Industrial Fire Protection Section Member (2009-present)

**Christine M. Jampo, M.S., Senior Specialist, Environmental Business Development/Sales**

Education:

B.S. Chemistry/Biology, West Chester University (1987)
M.S. Environmental Health, West Chester University (1996)

Professional Experience:

ERM, QA/Chemist/Consultant (1987-1997)
Responsibilities included QA chemistry, client/lab/field liaison, data validation/technical review, project management
Self Employed/Consultant, Environmental Consultant (1997-2001)
Responsibilities included data interpretation and analysis; QA/QC of field and laboratory data
Prudential Fox & Roach Realtors, Realtor/Sales Professional (2004-2010)
Responsibilities included residential real estate sales including buyer, seller and relocation services
With Lancaster Laboratories since 2010
Senior Specialist, Environmental Business Development/Sales (2010)
Responsibilities include developing new business revenue for LL by performing account management duties for existing accounts and prospects in the commercial and DOD markets; identifying and securing sales opportunities through phone calls, sales visits, presentations, team selling, quotes, and proposals; generating new business opportunities consistent with our operational capabilities and capacity

**Sara E. Johnson, B.S., Senior Chemist, GC/MS Volatiles**

Education:

B.S. Chemistry, Biochemistry option, Millersville University (2006)

Professional Experience:

With Lancaster Laboratories since 2006
Chemist, Flexible Staffing (2006)
Responsibilities included flexing to various departments as needed and performing analysis ranging from GC/MS to SDS-PAGE Electrophoresis with colloidal blue or silver staining
Chemist, GC/MS Volatiles (2008)
Responsibilities included performing GC/MS analysis of water and soil samples along with other matrices by various analytical methods such as EPA 624, 8260B, and CLP; evaluating analytical data generated; calibrating and troubleshooting GC/MS instrumentation
Senior Chemist, GC/MS Volatiles (2010)
Responsibilities include performing GC/MS analysis of water and soil samples along with other matrices by various analytical methods such as EPA 624, 8260B, and CLP; evaluating analytical data generated; calibrating and troubleshooting GC/MS instrumentation; assisting other employees with any questions that may arise and helping to train new employees

**Mark Kaiser, Director; Pharmaceutical and Environmental Microbiology; Biopharmaceutical Services; Stability Services**

Education:

Elizabethtown College, Biology 120 credits (1983)

Continuing Education:

Fundamentals of D, Z, and F Valves, PDA (1989)
Viable and Nonviable Environmental Monitoring, PDA (1990)
Validation in the Pharmaceutical Microbiology Laboratory, Applied Analytical Laboratories (1993)
Introduction to Capillary GC, Hewlett-Packard (1993)
HP5890 GC Troubleshooting and Maintenance, Hewlett-Packard (1993)
Design and Validation of Sterilization Processes, PDA (1998)
Introduction to Basic Laboratory Techniques in Biotechnology, PDA (1999)
Microbiology and Engineering of Sterilization Processes, PDA (2000)

Professional Experience:

With Lancaster Laboratories since 1983
Technician, Food Microbiology (1983)
Responsibilities included performing microbiological testing of food and feed products
Senior Technician, Bioassays (1984)
Responsibilities included performing antibiotic bioassays, schedule testing, supervise analysts, review and approve results, technical contact for clients
Group Leader, Bioassays, Environmental Microbiology (1986)
Responsibilities included managing technical operations, quality, regulatory compliance, and financial performance of bioassays and environmental microbiology; developing new assays and services; acting as technical contact for clients
Group Leader, Pharmaceutical Microbiology and Environmental Microbiology (1989)
Responsibilities included establishing pharmaceutical microbiology services at Lancaster Laboratories; developing and validating services for sterile and non-sterile product testing as well as support for facility validation and monitoring; establish GMP and compliance systems; managing technical operations, quality, regulatory compliance, and financial performance; acting as technical contact for clients; marketing new services to prospects and clients

Manager, Pharmaceutical Microbiology and Pharmaceutical Sample Storage (1996)
Responsibilities included managing technical operations, quality, regulatory compliance, and financial performance for pharmaceutical microbiology; acting as technical and marketing contact for clients and prospects; managing centralized storage systems and facilities for pharmaceutical samples
Manager, Pharmaceutical and Environmental Microbiology, Stability Services, Pharmaceutical Sample Storage (2001)
Responsibilities included managing technical operations, quality, regulatory compliance, and financial performance for pharmaceutical and environmental microbiology and stability services; acting as technical and marketing contact for clients and prospects; managing centralized storage systems and facilities for pharmaceutical samples
Director (previously titled Manager), Pharmaceutical and Environmental Microbiology, Biopharmaceutical Services, Stability Services, Pharmaceutical Sample Storage (2004)
Responsibilities included managing technical operations, quality, regulatory compliance, and financial performance for pharmaceutical and environmental microbiology and stability service; acting as technical and marketing contact for clients and prospects; managing centralized storage systems and facilities for pharmaceutical samples; establishing biopharmaceutical services at Lancaster Laboratories; managing the development, set up, and validation of molecular, cell, and viral service offerings for the biopharmaceutical industry; establishing GMP and compliance systems; managing technical operations, quality, regulatory compliance, and financial performance for biopharmaceuticals
Director, Pharmaceutical and Environmental Microbiology, Biopharmaceutical Services, Stability Services, Pharmaceutical Sample Storage, Pharmaceutical Sample Entry (2006)
Responsibilities include managing technical operations, quality, regulatory compliance, and financial performance for pharmaceutical and environmental microbiology and stability service; acting as technical and marketing contact for clients and prospects; managing centralized sample entry, storage systems and facilities for pharmaceutical samples; establishing biopharmaceutical services at Lancaster Laboratories; managing the development, set up, and validation of molecular, cell, viral, and mycoplasma service offerings for the biopharmaceutical industry; establishing GMP and compliance systems; managing technical operations, quality, regulatory compliance, and financial performance for biopharmaceuticals

Memberships & Appointments:

PDA, Delaware Valley Chapter, Past Vice President
PDA, Delaware Valley Chapter, Program Committee
PDA, Microbiology Interest Group
PDA, Container/Closure Task Force
Pharmaceutical Stability Discussion Group (PSDG) (2001)

**Richard H. Karam, B.S., Manager, Organic Extraction/Leachate Preparation/GC/MS Volatiles/GC/MS Semivolatiles**

Education:

B.S. Environmental Studies, Green Mountain College (2000)

Professional Experience:

Severn Trent Laboratories (2000-2006)
Project Manager (2005-2006)
Responsibilities included managing environmental projects; writing case narratives; project set up
Analytical Chemist (2000-2005)
Responsibilities included analyzing environmental samples for various general chemistry parameters, metals by ICP/ICPMS, pesticides/PCBs/herbicides by GC, and semivolatiles by GC/MS
With Lancaster Laboratories since 2006
Group Leader, GC/MS Semivolatiles (2006)
Responsibilities included coordinating production in GC/MS Semivolatiles; reviewing and signing reports
Manager, GC/MS Semivolatiles (2007)
Responsibilities included ensuring the accuracy and acceptability of all data generated by the GC/MS Semivolatiles group; coordinating daily prioritization of workload and monitoring the holding time and turnaround time status of samples; responding to client questions regarding GC/MS Semivolatiles data and methods and communicating technical issues or concerns about samples to project managers for clarification or resolution with the client
Manager, Organic Extraction/Leachate Preparation/GC/MS Volatiles/GC/MS Semivolatiles (2008)
Responsibilities include ensuring the accuracy and acceptability of all data generated by the groups; coordinating daily prioritization of workload and monitoring the holding time and turnaround time status of samples; responding to client questions regarding data and methods and communicating technical issues or concerns about samples to project managers for clarification or resolution with the client

**Dana M. Kauffman, Manager, Sample Support and Data Deliverables**

Continuing Education:

Introduction to Electronics, Lancaster County Career & Technology Center, Brownstown (1994)
AC/DC Electronics, Lancaster County Career & Technology Center (1995)
Gas Chromatography: Principles and Practices, Lancaster Labs University (2003)

Professional Experience:

With Lancaster Laboratories since 1994
Lab Technician (1995)
Senior Technician (1996)
Sample Support Coordinator (1997)
Group Leader, Sample Support (1999); Group Leader, Volatiles by GC (2002)
Responsibilities included supervising personnel; managing laboratory operations; project management; sample preparation; developing and evaluating new methods; reagent preparation; revising and updating SOPs; ordering supplies; training other analysts; running the automated storage and retrieval system; lab cleaning and maintenance; monitoring laboratory activities; performing internal audits; enforcing regulatory compliance requirements; maintaining required certifications; communicating client requirements to lab areas
Manager, Sample Support and Data Deliverables (2005)
Responsibilities include overseeing all upfront sample handling requirements including storage, preservation, homogenization, moisture determination, volatile prescreen, and volatile soil prep; supervising group leader personnel; project management; revising and updating SOPs; performing internal audits; enforcing regulatory compliance requirements; maintaining required certifications; communicating client requirements to lab areas; data package and EDD TAT monitoring; overseeing all data package processes including data assembly, review, and processing; Practical Process Improvement (PPI) process manager responsible for facilitating PPI project team training and PPI efforts within LLI

**Nicole M. Kepley, B.S., Senior Chemist Group Leader, Instrumental Water Quality**

Education:

AA Psychology, Harrisburg Area Community College (1997)
B.S. Psychobiology, Lebanon Valley College (2000)

Professional Experience:

With Lancaster Laboratories since 2000
Senior Technician, Instrumental Water Quality (2000)
Responsibilities included various prep analyses, data entry, TOC and TOX analyses.
Chemist, Instrumental Water Quality (2003)
Responsibilities included performing various analyses, verification, and review and revise SOPs.
Senior Chemist, Instrumental Water Quality (2006)
Responsibilities include performing various analyses, method development, verification, and review and revise SOPs.
Senior Chemist Group Leader, Instrumental Water Quality (2009)
Responsibilities include performing various analyses, method development, verification, and review and revise SOPs; acting as a technical resource, trainer, and troubleshooter; making recommendations for operational and/or technical improvements; coaching and developing direct reports; planning and monitoring workflow.

Awards, Citations, Honorary Societies, and Publications:

Phi Theta Kappa National Honor Society (Alpha Nu Omega) (1996-2000)

**Katherine A. Klinefelter, M.S., Principal Specialist, Environmental Client Services**

Education:

B.S. Chemistry, Rutgers University (1983)
M.S. Physiology, Rutgers University (1985)

Continuing Education:

Additional graduate work in Physiology, Rutgers University (1985-1989)
Practical Process Improvement (Team Member Training), Lancaster Labs University (2009)

Professional Experience:

Rutgers University, Research and Teaching Assistant (1984-1989)
M. S. Hershey Medical Center of Penn State University, Senior Research Technician (1990-1993)
With Lancaster Laboratories since 1993
Environmental Project Management
Senior Specialist, Environmental Client Services (1993)
Senior Specialist/Coordinator, Environmental Client Services (1996)
Senior Specialist, Environmental Client Services (2000)
Principal Specialist, Environmental Client Services (2007)
Responsibilities include project management; training new client service representatives; auditing sample entry; answering client questions; communicating client requirements to lab areas

Awards, Citations, Honorary Societies & Publications:

Dean's Graduate Student Dissertation Research Award, Rutgers University
Dean's Graduate Student Travel Award, Rutgers University
Steinetz Memorial Fund Award, Department of Biological Sciences, Rutgers University
10 abstracts and 3 scientific papers on membrane transport physiology
4 presentations on membrane transport physiology
Quarterly Impact Award for Practical Process Improvement (2009)

**Wendy A. Kozma, B.S., Principal Specialist Group Leader, Environmental Client Services**

Education:

B.S. Environmental Science, Allegheny College (1991)

Professional Experience:

Roy F. Weston, Inc. (1992-1993)
With Lancaster Laboratories since 1993
- Senior Specialist, Environmental Client Services (1996)
  - Responsibilities included performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers
- Principal Specialist, Environmental Client Services (2004)
  - Responsibilities included performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers
- Principal Specialist Group Leader, Environmental Client Services (2006)
  - Responsibilities include performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers

**Rachel L. Kreamer, B.S., Manager, Environmental Client Services**

Education:

B.S. Biology, Eastern Mennonite College (1980)

Continuing Education:

Financial Accounting, Penn State (2005)
Behavioral Science in Business, Penn State (2006)
Price and Markets, Penn State (2006)

Professional Experience:

With Lancaster Laboratories since 1987
- Client Services Specialist, Environmental Client Services (1990)
- Environmental Project Manager, Environmental Client Services (1994)
- Coordinator, Environmental Client Services (1996)
- Group Leader, Environmental Client Services (1996)
  - Responsibilities included: supervise personnel; training; revise and update SOPs; and monitoring turnaround time.
- Manager, Environmental Client Services (2005)
  - Responsibilities included: supervise personnel; training; revise and update SOPs; and monitoring turnaround time.
- Manager, Pharmaceutical Client Services (2005)
  - Responsibilities included: supervise personnel; revise and update SOPs; training.
- Director, Professional Scientific Staffing – VA (2007)
  - Responsibilities included: managing all aspects of the PSS group in VA.
- Director, Bay Area Service Center (2008)
  - Responsibilities included: managing all aspects of the bay area service center.
- Manager, Environmental Client Services (2009)
  - Responsibilities include: managing all aspects of the environmental client services group.

Awards, Citations, Honorary Societies & Publications:

Senior Leadership Group Achievement Award (1996)

**M. Susan Kreider, Senior Specialist, Data Deliverables**

Continuing Education:

Chemistry and Psychology courses, F&M College

Professional Experience:

General Cigar Co., R&D Center, Laboratory Technician (1963-1966)
Responsibilities included testing tobacco products; smoke analysis; nicotine and tar analysis; preparing samples for gas chromatography
Company F. Weaver, Inc., Laboratory Technician (1966-1967)
Responsibilities included performing microbiological testing of food products, both raw materials and finished products; training factory employees in sterile food handling
Microbiological Associates, Inc., Stock Line/Sterile Technician (1968-1969)
Responsibilities included performing cancer research; dissection of animal and human tissue for cell line production; freezing of live cells; all phases of sterile lab work
Warner Lambert Co., Assistant Microbiologist/Organic Chemistry Technician (1970-1975)
Responsibilities included performing microbiological and chemical testing of raw material and finished products
Julia Winifred & Co. (Jacks III), Sales Clerk (1982-1983)
Responsibilities included retail sales; preparing windows and displays in store
With Lancaster Laboratories since 1983
Laboratory Technician, ExpressLAB (1983)
Responsibilities included performing sample prep and analyses
Senior Technician, ExpressLAB (1986)
Responsibilities included performing sample prep and analyses
Chemist, ExpressLAB (1988)
Responsibilities included performing sample prep and analyses
Specialist, Pesticide Residue Analysis (1998)
Responsibilities included performing sample prep and analyses
Specialist, EPH/Misc. GC (2003)
Responsibilities included performing sample prep and analyses
Specialist, Data Deliverables (2005)
Responsibilities included validating and sending data deliverables
Senior Specialist, Data Deliverables (2006)
Responsibilities include validating and sending data deliverables

**Robert M. Large, B.S., Director, Environmental Client Services/Inside Business Development/Sample Administration/Data Deliverables/Sample Support/Bay Area Service Center**

Education:

B.S. Zoology, Pennsylvania State University (1973)

Continuing Education:

Chromatography/Mass Spectral Interpretation, Finnigan MAT Institute (1981)
Foundations of Management, Gilbert Associates (1982)
M.B.A. Program, St. Joseph's University (1984-1987)
How to Market Professional Services, ACIL (1990)

Professional Experience:

Gilbert Associates, Inc., Program Manager (1977-1984)
Spotts, Stevens, & McCoy, Director of Client Services (1984-1990)
With Lancaster Laboratories since 1990
Marketing Specialist, Environmental Client Services (1990)
Group Leader, Environmental Client Services (1994)
Manager, Environmental Client Services (1995)
Responsibilities included: supervise personnel; project management; various office tasks; interpret QC implications to data quality; and advise clients on testing. Set up and managed the Bay Area Service Center in Richmond, CA (2001). Manage Environmental Sample Administration (2002). Manage Inside Business Development (2003).
Director, Environmental Client Services/Business Development/Sample Administration/Bay Area Service Center (2005)
Responsibilities include: supervise personnel; project management; various office tasks; interpret QC implications to data quality; and advise clients on testing. Set up and managed the Bay Area Service Center in Richmond, CA (2001). Manage Environmental Sample Administration (2002). Manage Inside Business Development (2003). Assisted setting up Professional Scientific Staffing (PSS) for a major biotech client (2004). Manage Data Deliverables and Sample Support (2010).

**Elizabeth Leonhardt, M.E.M., Senior Specialist Group Leader, Bay Area Service Center**

Education:

A.S. Biology, Santa Rosa Junior College (2000)
B.S. Animal Physiology & Neuroscience, University of California, San Diego (2002)
M.E.M. Natural Resource Management, University of Queensland, St. Lucia (2004)

Continuing Education:

DOT/IATA certified (2002)
Japanese Language, Diablo Valley College (2009)

Professional Experience:

MEC Analytical, Benthic Laboratory Technician (2002–2003)
Responsibilities included benthic invertebrate assessment; water quality monitoring; field sampling; stormwater monitoring; rapid stream bioassessment; freshwater crustacean taxonomy; provided assistance in microbiology and bioassay laboratories
With Lancaster Laboratories since 2005
Project Manager, Bay Area Service Center (2005)
Responsibilities included working as a liaison between the client and laboratory, as well as within the laboratory's departments, to ensure that projects are completed in a timely fashion and that the proper analyses are performed; provides technical and regulatory assistance to clients as needed; provides verbal and written quotations to clients; coordinates the efforts of assigned employees to provide coverage for all areas of responsibility; assists in packing and shipping as needed
Senior Specialist Group Leader, Bay Area Service Center (2006)
Responsibilities include working as a liaison between the client and laboratory, as well as within the laboratory's departments, to ensure that projects are completed in a timely fashion and that the proper analyses are performed; providing technical and regulatory assistance to clients as needed; providing verbal and written quotations to clients; coordinating the efforts of assigned employees to provide coverage for all areas of responsibility; assisting in packing and shipping as needed; assisting in EnCore preparation as needed; managing the bottle order operation for the Bay Area Service Center

**Parker D. Lindstrom, B.S., Senior Chemist, Metals**

Education:

B.S. Chemical Oceanography, Millersville University (2002)

Continuing Education:

Comprehensive Gas Chromatography Seminar, RESTEK (2002)
Comprehensive GC/MS Seminar, RESTEK (2002)
Statistics at Lancaster Laboratories, LLU (2005)
24-hour HAZWOPER, LLU (2006)

Professional Experience:

Fred Fiorentino, Assistant Laborer (1997-2002
Responsibilities included roofing, painting, general construction, clean-up, installation of windows, doors, stairs, decking
Dr. Kerper, Office Assistant (2000-2002)
Responsibilities included filing, cataloging children's books
Millersville University IMC/IMS, Media/Education Assistant (2000-2002)
Responsibilities included assisting teachers in creating media for the classroom, editing video and audio projects
With Lancaster Laboratories since 2002
Associate Chemist/Senior Chemist, GC/MS Volatiles (2002)
Responsibilities included running purge and trap and GC/MS to analyze samples and QC for VOCs; performing purge and trap and GC/MS maintenance
Senior Chemist, Metals (2006)
Responsibilities included running ICP/MS; verifying samples; performing maintenance; prepping samples; general troubleshooting for metals department; installation, maintenance and operation of CVAF low level Mercury; providing general computer help to Computer Services department
Senior Chemist Metrology, Metals (2009)
Responsibilities include helping the instrument (Metrology) group maintain and qualify HPLCs, GCs, and other pharmaceutical instruments; helping with other qualifications as needed (hoods, storage units, etc); for a short time in 2009 verifying data in Water Quality department

Memberships and Appointments:

Emergency Response Team (Spill Team), Lancaster Laboratories (2006)

**Kathleen M. Loewen, B.S., Director, Quality Assurance**

Education:

B.S. Biology, West Virginia Wesleyan College (1969)

Continuing Education:

Environmental Analytical Quality, Hewlett Packard (1988)
Environmental Analytical Laboratory Services, NUS (1989)
Symposium on Waste Testing and Quality Assurance, USEPA (1990-1996 annual attendance)
RCRA Quality Assurance Workshop, USEPA (1990)
Quality Assurance Workshop, USEPA (1991)
Environmental Seminar Series on SPE, GPC, and HPLC, Millipore (1992)
Conference on Quality Assurance in Environmental Monitoring (1993)
Solid Phase Micro Extraction, Supelco (1994)
Analytical Strategy for the RCRA Program, USEPA (1995)
Guidance Course on SW-846 Chapter One, IAETL (1995)
The Environmental Regulation Course, Executive Enterprises (1996)
GMPs Today & Tomorrow, University of Rhode Island (1997)
Complying with Laboratory cGMP Requirements, American Society for Quality (1997)
The Management of Change, Society of Quality Assurance (1997)
Leadership Conference, James Madison University (1998)
Training the Trainer, Society of Quality Assurance (1998)
Advanced QA Techniques for Facility Inspections, Society of Quality Assurance (1998)
Auditing Computer Validation, Society of Quality Assurance (1999)
Required Quality Records (Under Critical Elements & NELAC) PAAEL (2000)
Advanced ‘concepts in Computer Validation – “Maintaining the Validated State” SQACVC (2000)
ISO 17025: The New Standard for Laboratory Quality A2LA (2000)
Measurement Uncertainty A2LA (2000)
Application of ISO/IEC 17025: Uncertainty & Traceability, ILAC (2000)
Assuring Ethical Practices in the Laboratory, ACIL (2001)
Computer Validation, Part 11, Stelex University (2001)
Part 11 Meets CROMERRR, SQA (2001)
GAMP Computer Validation Initiative, SQA (2001)
Laboratory cGMP Compliance, FDA/PQI (2001)
Good Clinical Practices, SQA (2002)
Digging Deeper into Validation, SQA (2002)
Managing Process Deviation and Failure Investigations, CPT (2002)
Quality Responsibilities of Management, SQA (2003)
New Horizons in the Life of a GLP Auditor, SQA (2003)
FDA Inspection Etiquette, FDI (2004)
Biotechnology (Intro, Auditing Techniques, Data Review SQA (2004)
Change Control revisited, PDA (2005)
Analytical Instrument Qualification USP <1058>, LabCompliance (2005)
FDA/EU Compliance for Analytical Laboratories, LabCompliance (2005)
GMP Regulations for GLP Auditors, SQA (2006)
Preparing your Organization for the ‘New’ part 11, LabCompliance (2006)
FDA’s Expectations for cGMPs for QC Laboratories, Analysts/Process Chemists, Compliance Solutions, LLC (2006)
Value Added Auditing, SQA (2007)
Bioanalytical-PK, Biomarkers, Method Validation; Valve-added Auditing, SQA (2007)
Investigating OOS Test Results for Pharmaceutical Production, Ben Astrum (2007)
Advanced Good Laboratory Practice, SQA (2008)
Environmental QA/QC Requirements, Association of Public Health Laboratories (2008)
Successfully Using the One-Page Manager, QA Edge (2008)
The New TNI Lab Accreditation Standard, NY/PAAAEL (2010)
Disney Customer Service: Improve Your Quality & Raise Expectations, Progressive Business (2011)
Internal Audits: Meeting FDA Expectations, FOI (2011)
10 Essential Audit Questions, Paton (2011)

Professional Experience:

Microbiological Associates, Biology Laboratory Technician (1969-1970)
Schuyler Laboratories, Laboratory Technician (1970-1971)
Victor F. Weaver, Inc., Labeling Specifications Supervisor/Liaison with USDA (1985-1988)

With Lancaster Laboratories since 1988
Quality Assurance Specialist (1988)
Quality Assurance Senior Specialist/Coordinator (1991)
Quality Assurance Director, previously titled Officer (1996)
Responsibilities include supervising the Quality Assurance Unit which includes monitoring of current GLP and GMP activities, review of procedures and analytical data, work with client and agency audits and correspondence, enforcement of regulatory compliance requirements, regulatory and client document review, quality improvement, QA policy development and maintenance, and prompt follow-up of any quality or corrective action issues

Memberships & Appointments:

American Society of Quality (ASQ)
Institute of Validation Technology (IVT)
Mid-Atlantic Region Society of Quality Assurance (MARSQA)
Computer Validation Committee
PDA
Society of Quality Assurance (SQA)

**Jason M. Long, B.S., Senior Chemist, GC/MS Volatiles**

Education:

B.S. Chemistry, Shippensburg University (2004)

Professional Experience:

EA Engineering Science & Technology, Lab Tech (2004)
Responsibilities included setting up and running tests in toxicology lab; cleaning glassware used in performing tests; titrating for alkalinity and pH of water samples
With Lancaster Laboratories since 2004
Chemist, GC/MS Volatiles (2004)
Responsibilities included analyzing water and soil samples by purge and trap GC/MS; generating and reviewing raw data; performing maintenance on GC/MS, purge and traps, and various autosamplers
Senior Chemist, GC/MS Volatiles (2007)
Responsibilities include analyzing water and soil samples by purge and trap GC/MS; generating and reviewing raw data; performing maintenance on GC/MS, purge and traps, and various autosamplers; troubleshooting problems on GC/MS, purge and traps, and autosamplers

**Marla S. Lord, B.S., Senior Specialist, GC/MS Volatiles**

Education:

B.S. Industrial Hygiene, Purdue University (2000)

Continuing Education:

OSHA 8-Hour (2000)
Comprehensive GC/MS Seminar, Restek (2002)
Practical Process Improvement Facilitator Training (2010)

Professional Experience:

ALCOA, Industrial Hygiene Intern (1999)
Responsibilities included performing air sampling for a variety of substances; conducting noise survey including area and personal sampling; testing plant environment for heat stress and evaluated reports; assisting in formulation of written program
BP-Amoco Refinery/Orr Professional Services, Industrial Hygiene Technician (2000)
Responsibilities included performing air sampling to reevaluate Benzene Exposure Surveillance Program; conducting noise surveys including area and personal monitoring to reevaluate Hearing Conservation Program
With Lancaster Laboratories since 2000
Senior Technician, Volatiles by GC (2000)
Responsibilities included performing prescreen analysis, sample prep, GC maintenance, and data review
Chemist, GC/MS Volatiles (2001)
Responsibilities included analyzing samples and QC by purge and trap GC/MS; generating and reviewing raw data; performing maintenance on GC/MS, purge and traps, and various autosamplers
Senior Specialist, GC/MS Volatiles (2006)
Responsibilities include performing GC/MS volatile data interpretation; reviewing and approving data; signing reports; analyzing samples; generating raw data; sample verification; SOP revisions and updates

**Dorothy M. Love, B.S., Principal Specialist Group Leader, Quality Assurance**

Education:

B.S. Environmental Health, Indiana University of Pennsylvania (1981)

Professional Experience:

Sun Transport, Inc., Safety Assistant (1980-1981)
Texas A & M University, Research Assistant (1982-1984)
Texas Water Commission, Chemist (1984-1986)
GHR Analytical, Chemist (1986-1987)
Clean Harbors, Inc., Senior Chemist (1987-1989)
With Lancaster Laboratories since 1989
- Senior Specialist (1989)
- Senior QA Specialist (1998) Coordinator (2000)
- Principal Specialist/Coordinator, Quality Assurance (2003)
  - Responsibilities included supervise personnel; train other QA staff; revise and update analytical methods; monitor laboratory activities and corrective action for quality issues; perform internal audits; work with external auditors; review lab data and procedures; enforce regulatory compliance requirements; and review/write client/lab Quality Assurance Project Plans (QAPP).
- Principal Specialist Group Leader, Quality Assurance (2005)
  - Responsibilities include supervise personnel; train other QA staff; revise and update analytical methods; monitor laboratory activities and corrective action for quality issues; perform internal audits; work with external auditors; review lab data and procedures; enforce regulatory compliance requirements; and review/write client/lab Quality Assurance Project Plans (QAPP).

**Duane A. Luckenbill, B.S., Director, Environmental Sciences**

Education:

B.S. Chemistry, Clarion University of PA (1989)

Continuing Education:

Introduction to Mass Spectral Interpretation, Hewlett-Packard (1995)
Technical Training, OI Analytical (1995)

Professional Experience:

ATEC Associates, Inc., GC/MS Analyst (1989)
With Lancaster Laboratories since 1989
- Chemist (1991)
- Chemist/Coordinator (1993)
- Group Leader (1997)
- Manager (2001)
  - Responsible for client satisfaction, safety and quality systems administration, and all aspects of financial, personnel, and operations management of the GC/MS Volatiles and GC/MS Semivolatiles groups.
- Director (2005)
  - Responsible for client satisfaction, safety and quality systems administration, and all aspects of financial, personnel, and operations management of the GC/MS Volatiles, GC/MS Semivolatiles, Volatiles in Air, Organic Extraction, Leachate Preparation, Field Sampling, Pesticide Residue Analysis, Volatiles by GC, and EPH/Miscellaneous GC groups.

Awards, Citations, Honorary Societies & Publications:

Undergraduate Award in Analytical Chemistry, American Chemical Society (1988)
Department of Chemistry Competitive Award, Clarion University (1988 – 1989)
Outstanding Senior Chemistry Award, American Institute of Chemists Foundation (1989)
Senior College Award for Chemistry, Society for Analytical Chemists of Pittsburgh (1989)
1 publication on mass spectrometry

**Nicole L. Maljovec, M.S., Senior Specialist Group Leader, Environmental Client Services**

Education:

B.S. Chemistry, St. Bonaventure University (2004)
M.S. Adolescence Education, D'Youville College (2005)

Professional Experience:

CYTEC Industries, Industrial Hygiene Internship (2003-2004)
- Responsibilities included performing air monitoring and sampling; complying with OSHA standards; assisting R/D lab with the identification of unknown chemicals and wastes

Niagara Wheatfield, Environmental Science Teacher (2005-2006)
Responsibilities included teaching chemistry, chemistry lab, and environmental science; developing special education plans to assist students with learning disabilities
With Lancaster Laboratories since 2006
Specialist, Environmental Client Services (2006)
Responsibilities included performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers
Senior Specialist Group Leader, Environmental Client Services (2007)
Responsibilities include performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers; managing a team of client service representatives and administrative assistants, training of new employees, setting up and delegating new projects, serving as primary project manager for several large clients and consultants

**Melissa McDermott, B.A., Senior Chemist, EPH/Misc. GC**

Education:

B.A. Biology, Millersville University (1992)
Elementary Education Certification, PA (May 2009)
Middle School Science Certification, PA (July 2009)

Continuing Education:

Gas Chromatography Principles and Practices (1995)
Conflict Resolution and Confrontation Skills Seminar (1996)
Coaching Skills for Supervisors Seminar (1996)
Waste Testing and Quality Assurance Symposium (1996)
Entry Level Management (1997)
How to Deliver Exceptional Customer Service Seminar (1997)
Statistics at Lancaster Laboratories (2006)

Professional Experience:

With Lancaster Laboratories since 1992
Chemist, EPH/Misc. GC (1993)
Responsibilities included performing analysis of environmental samples for metals by AA flame and cold vapor generation; assembling client data packages
Chemist Coordinator, EPH/Misc. GC (1996)
Responsibilities included coordinating rush work; communicating with client service representatives regarding sample status; answering client questions; generating employee job plans; conducting employee evaluations
Senior Chemist, EPH/Misc. GC (1997)
Responsibilities included performing analysis of environmental samples for DRO and interpretive TPH analyses; verifying analyses performed by other analysts; preparing standards; revising departmental SOPs; method development; reviewing data packages
Senior Specialist, Environmental Client Services (1997)
Responsibilities included auditing sample entry; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions and providing sampling containers
Senior Chemist, EPH/Misc. GC (2002)
Responsibilities included reviewing and approving data; writing departmental methods; reviewing and approving data packages; acting as technical resource within department; answering client questions; monitoring and performing QA metrics
Senior Specialist, Environmental Client Services (2007)
Responsibilities included acting as technical resource between client services and laboratories; scheduling sample submissions and providing sampling containers; communicating client requirements to lab areas
Senior Chemist, EPH/Misc. GC (2009)
Responsibilities include reviewing and approving data; writing departmental methods; reviewing and approving data packages; acting as technical resource within department; answering client questions; monitoring and performing QA metrics

**Roy R. Mellott Jr., B.S., Senior Chemist Group Leader, GC/MS Volatiles**

Education:

B.S. Biology, Millersville University (1993)

Continuing Education:

Hazardous Waste Disposal, LLU (1996)
GC: Principles & Practices, LLU (1997)
GC/MS: Applications/Troubleshooting Seminar, ECS/MDL Systems, Inc. (1999)
GLP Training, LLU (1999)
Introduction to Interpretation of Mass Spectra, LLU (2005)
Interpretation of Mass Spectra, Intermediate, LLU (2005)

Professional Experience:

With Lancaster Laboratories since 1995
- Senior Lab Tech I, GC/MS Volatiles (1995)
  - Responsibilities included requisitioning samples; performing sample storage, prescreening, discard, hazardous waste disposal; tracking down missing samples by various means
- Chemist/Auditor, GC/MS Volatiles (1996)
  - Responsibilities included performing analysis of waters, soils, and other matrices for VOCs via various analytical methods; evaluation of analytical data; calibrating and trouble shooting various GC/MS equipment; evaluation/review of analyst-generated data; corresponding with analysts about possible trends (whether analyst- or system-related) in generated data; evaluation/review of corrections of problems with generated data
- Senior Chemist, GC/MS Volatiles (2002)
  - Responsibilities included performing analysis of waters, soils, and other matrices for VOCs via various analytical methods; evaluation of analytical data; setting up, calibrating, and trouble shooting various GC/MS equipment; evaluation/review of analyst-generated data; corresponding with analysts about possible trends (whether analyst- or system-related) in generated data; evaluation/review of corrections of problems with generated data; updating/correcting SOPs and laboratory and analytical procedures; preparation, tracking and documentation of analytical standards used in the laboratory; training of new employees to the department
- Senior Chemist Group Leader, GC/MS Volatiles (2005)
  - Responsibilities include performing analysis of waters, soils, and other matrices for VOCs via various analytical methods; evaluation of analytical data; setting up, calibrating, and trouble shooting various GC/MS equipment; evaluation/review of analyst-generated data; corresponding with analysts about possible trends (whether analyst- or system-related) in generated data; evaluation/review of corrections of problems with generated data; updating/correcting SOPs and laboratory and analytical procedures; preparation, tracking and documentation of analytical standards used in the laboratory; training of new employees to the department

Memberships & Appointments:

Nature Conservancy (1998-present)
Lancaster Laboratories Ethics Committee (1999-2003)
Lancaster Herpetological Society, President (2005-present)

**Betsy S. Menefee, B.S., Senior Specialist, Data Deliverables**

Education:

B.S. Chemistry (cum laude), Salem College (1958)

Continuing Education:

Service Operations Process Optimization, Penn State University (1993)
Group Discussions (Management Course), Penn State University (1994)

Professional Experience:

Duke University, Research Assistant (1958-1959)
With Lancaster Laboratories since 1980
- Senior Chemist, Metals (1985)
- Senior Specialist, Metals (1999)
  - Responsibilities included reviewing data packages for accuracy, preparing inorganic data packages, and assisting with electronic deliverables
- Senior Specialist, Data Deliverables (2006)
  - Responsibilities include reviewing data packages for accuracy, preparing inorganic data packages, and assisting with electronic deliverables

Awards, Citations, Honorary Societies & Publications:

2 scientific publications in analytical chemistry

**Megan A. Moeller, B.S., Senior Specialist, Environmental Client Services**

Education:

B.S. Environmental Science, University of Delaware (1999)

Professional Experience:

With Lancaster Laboratories since 1999
Sample Administration/Client Service Specialist, Environmental Client Services (2003)
Responsibilities included Interpretation and entry of incoming samples. Route samples to the correct locations. Assist Client Service representatives with auditing, reviewing reports, and reviewing invoices.
Specialist, Environmental Client Services (2004-2006)
Responsibilities included managing projects, prepare quotations, audit sample entries, answer client questions, communicate client requirements to lab areas, schedule sample submissions, and provide sample containers.
Senior Specialist, Environmental Client Services (2006)
Responsibilities include managing projects, prepare quotations, audit sample entries, answer client questions, communicate client requirements to lab areas, schedule sample submissions, and provide sample containers.

**Chad A. Moline, B.S., Senior Chemist Group Leader, GC/MS Semivolatiles**

Education:

B.S. Environmental Studies, Slippery Rock University (1998)
Teaching Certification, Secondary Education, Millersville University (2003)

Professional Experience:

Centre Analytical Laboratories, Lab Technician (1999-2000)
Responsibilities included running various wet chemistry analyses
Lancaster Laboratories, Chemist/Senior Chemist (2000-2005)
Responsibilities included maintaining GC/MS instrumentation
Warwick School District, Science Teacher (2005-2006)
Responsibilities included teaching chemistry and physics to 8$^{th}$ grade students
Conestoga Valley School District, Science Teacher (2006-2007)
Responsibilities included teaching chemistry and earth science to 8$^{th}$ grade students
With Lancaster Laboratories since 2007
Senior Chemist Group Leader, GC/MS Semivolatiles (2007)
Responsibilities include monitoring workflow; meeting client turnaround times

**Kevin T. Moran, M.B.A., Senior Specialist, Environmental Business Development/Sales**

Education:

B.S. Marine Engineering, U.S. Merchant Marine Academy (1972)
M.B.A. Marketing, Babson College (1981)

Professional Experience:

SAIC, Regional Sales Manager (1994-1999)
Responsibilities included selling process treatment equipment for groundwater remediation to environmental consulting companies and industrial end users; managing a staff of seven engineers and technicians engaged in operating and constructing groundwater treatment systems.
Mantech Environmental, Marketing Manager (1999-2000)
Responsibilities included developing strategy to target industrial customers with multiple sites for an innovative groundwater remediation technology.
Hazleton Environmental, Marketing Manager (2000-2003)
Responsibilities included developing marketing strategy for sales of process treatment equipment to industrial and municipal users; aiding company in breaking into DOD market for treatment equipment.
With Lancaster Laboratories since 2003
Senior Specialist, Environmental Business Development/Sales (2003)
Responsibilities include managing and growing revenue at assigned industrial accounts; using selling skills to add new industrial and environmental consulting firms for analytical services in New York, New Jersey, and New England.

**Jeffrey S. Moyer, B.S., Senior Specialist Group Leader, Sample Bottles**

Education:

B.S. Environmental Resource Management, Penn State University (1977)

Professional Experience:

Joseph A. Kodak, Carpenter's Helper (1977-1978)
Responsibilities included performing construction
BP Oil, Inc., Operations Supervisor (1978-1979)
Responsibilities included working on special projects in the regional operations office
Koch Hydrocarbon Company, Terminal Manager (1979-1997)
Responsibilities included managing the operation of a 24 hr/day, 365 day/year propane storage facility; coordinating inventory storage, product quality control, maintenance, safety, and personnel staffing and training; additional responsibilities included facility upgrades and expansion projects
With Lancaster Laboratories since 1997
Specialist, Environmental Sample Administration (1997)
Responsibilities included entering environmental samples for analysis; coordinating projects with client services; updating standard forms; filing client bottle orders; tracking change forms and forwarding updated info to SA department; tracking short hold/rush list; processing gold forms
Specialist, Environmental Client Services (1999)
Responsibilities included acting as technical resource for clients and SA entry; preparing quotes for clients; preparing bottle orders; scheduling sample pickups; auditing acknowledgements and client paperwork; troubleshooting client problems; updating standard forms; processing bottle orders, lab reports, acknowledgements, and COCs; handling reprint requests; preparing SDG reports
Senior Specialist Group Leader, Sample Bottles (2004)
Responsibilities include managing bottles department; coordinating projects with client services; updating bottle code and preservation sheets; updating SOPs; working with purchasing to ensure inventory levels are adequate; backing up transportation coordination

**Jennifer L. Moyer, B.S., Senior Specialist, Metals**

Education:

B.S. Chemistry, Lock Haven University (2000)

Professional Experience:

Lock Haven University, Lab Tech (1996-1998)
Responsibilities included setting up labs; stocking and setting up stock rooms; helping professors with projects
Croda Inc., Process Development Chemist (1998-2000)
Responsibilities included developing and improving procedures on existing products
With Lancaster Laboratories since 2000
Chemist, Metals (2000)
Responsibilities included running and maintaining ICP instruments
Chemist, Metals (2002)
Responsibilities included running and maintaining Graphite Furnace Atomic Absorption instruments
Group Leader/Specialist, Metals (2003)
Responsibilities included overseeing Graphite Furnace Atomic Absorption and Mercury analysts
Senior Specialist, Metals (2007)
Responsibilities include verifying ICP, GFAA, Mercury, and ICP-MS

**Charles J. Neslund, B.S., Manager, Volatiles in Air and Specialty Services Group**

Education:

B.S. Chemistry, University of Pittsburgh (1982)

Continuing Education:

Graduate studies in organic chemistry, University of Pittsburgh (1983)

Professional Experience:

- Lancaster Laboratories (1984-1996)
  - Chemist (1986)
  - Group Leader (1987)
  - Chemist (1991)
- OI Analytical, Sales Representative (1996)
- With Lancaster Laboratories since 1997
  - Group Leader, GC/MS Semivolatiles (1997)
    - Responsibilities included: supervise personnel; schedule lab work; manage laboratory operations and financial resources; project management; data interpretation; review and approve data; developing and evaluating new methods; consult with clients regarding testing needs; and revise and update SOPs and analytical methods.
  - Manager, GC/MS Semivolatiles and Volatiles in Air (2005)
    - Responsibilities included: supervise personnel; schedule lab work; manage laboratory operations and financial resources; project management; data interpretation; review and approve data; developing and evaluating new methods; consult with clients regarding testing needs; and revise and update SOPs and analytical methods.
  - Manager, Volatiles in Air and Specialty Services Group (2007)
    - Responsibilities include: supervise personnel; schedule lab work; manage laboratory operations and financial resources; project management; data interpretation; review and approve data; developing and evaluating new methods; consult with clients regarding testing needs; and revise and update SOPs and analytical methods: market specialty services capabilities, technical presentations

Awards, Citations, Honorary Societies & Publications:

- Dawson-Grundmann Innovation Award (1995)

Memberships & Appointments:

- American Chemical Society (ACS)
- Chromatography Forum of the Delaware Valley (CFDV)
  - Past member of Executive Committee of the Chromatography Forum of the Delaware Valley
- Air & Waste Management Association (A&WMA)
- Society of Environmental Toxicology and Chemistry (SETAC)
- Sediment Management Workgroup (SMWG)

**Deborah A. Neslund, Senior Specialist Group Leader, Environmental Sample Administration**

Professional Experience:

- Lancaster General Hospital, Phlebotomist (1976-1977)
- Fairfax Hospital, LPN (1978)
- Lancaster General Hospital, Phlebotomist/EKG Technician (1980-1986)
- With Lancaster Laboratories since 1986
  - Senior Specialist Coordinator
    - Responsibilities included: Supervise personnel; direct flow of samples to include prioritization to meet hold times and standards set for rush and other samples; develop and improve systems for efficiency within SA; represent SA in communications with Technical Groups, Client Services, and other support areas; log-in samples.
  - Senior Specialist Group Leader (2005)
    - Responsibilities include: Supervise personnel; direct flow of samples to include prioritization to meet hold times and standards set for rush and other samples; develop and improve systems for efficiency within SA; represent SA in communications with Technical Groups, Client Services, and other support areas; log-in samples.

**Ryan V. Nolt, B.S., Principal Chemist Group Leader, GC/MS Volatiles**

Education:

- B.S. Chemistry, Millersville University (1997)

Professional Experience:

- With Lancaster Laboratories since 1996
  - Clerk II, Sample Support (1996)
    - Responsibilities included performing ASRS operations, preserving incoming samples, homogenizing samples, packing bottle orders, and performing sample discard.
  - Senior Technician, ExpressLAB (1997)
    - Responsibilities included performing sample dilutions, preparing standards, prepping samples, and setting up new instruments.
  - Chemist, GC/MS Volatiles (1998)
    - Responsibilities included performing purge and trap and GC/MS maintenance; tuning and calibrating GC/MS system; analyzing samples; reviewing, working up, and assembling all supporting data; and preparing new standards.

Senior Chemist Coordinator, GC/MS Volatiles (2000)
Responsibilities included performing routine and non-routine laboratory analysis; diagnosing and solving technical problems; implementing improvements to maximize quality; maintaining and troubleshooting instruments; writing and revising standard operating procedures; validating new methods and equipment; assigning new work to instrument groups and monitoring productivity; and training new analysts.
Principal Chemist Group Leader, GC/MS Volatiles (2005)
Responsibilities include performing routine and non-routine laboratory analysis; diagnosing and solving technical problems; implementing improvements to maximize quality; maintaining and troubleshooting instruments; writing and revising standard operating procedures; validating new methods and equipment; assigning new work to instrument groups and monitoring productivity; and training new analysts.

**Timothy Oostdyk, Ph.D., President, Lancaster Laboratories**

Education:

B.A. Chemistry (cum laude), Franklin and Marshall College (1985)
Ph.D. Analytical Chemistry, Villanova University (1993)

Continuing Education:

ICP Seminar (1985)
ASMS Interpretation of Mass Spectra (1989)
Service Operations Process Optimization, Pennsylvania State University (1992)
Global Leadership Program, Thermo Fisher Scientific (2008)

Professional Experience:

Nabisco Brands Technology Center, Technician (Summer 1983)
With Lancaster Laboratories since 1985
Chemist/Coordinator (1986)
Group Leader (1988)
Manager (1990)
Director (1995)
Executive Vice President, COO (2000)
Responsibilities included supervising personnel and managing laboratory operations and financial resources
President (2011)
Responsibilities include presiding over all support and technical operations of Lancaster Laboratories; managing resources; establishing priorities to ensure the continued success of LL

Awards, Citations, Honorary Societies, and Publications:

Spirit of LL Award (1989)
Phi Beta Kappa, Franklin and Marshall College
Sigma Xi
10 scientific publications in analytical chemistry

**Heidi L. Ortenzi, B.S., Senior Chemist, Organic Extraction**

Education:

B.S. Environmental Science/Biology, Kutztown University (1996)

Continuing Education:

P.E. Spectroscopy Seminar, Perkin Elmer (1998)
Statistics, LLU (1999)
Pharm. Calc. Class, LLU (1999)
LLI Leadership Training (2000)
Practical Process Improvement Team Member Training (2008)
Practical Process Improvement Facilitator Training (2010)

Professional Experience:

M.J. Reider Associates, Lab Technician (1996-1997)
Responsibilities included organics prep/method development for HEM/various wet chemistry analyses.
With Lancaster Laboratories since 1997
Chemist, Metals (1998)
Responsibilities included performing metals analyses, maintenance of instruments, verification of analyses, analyzed GMP samples, administered quad studies, MDL studies, IDL studies.

Coordinator, Metals (1999)
Responsibilities included coordination of GFAA/FAA/Hg group, verification of analyses, instrument maintenance and operation, updating of SOPs, training records, quad studies, MDLs, and IDLs, performed GMP analyses.
Coordinator/Specialist, Environmental Client Services (2001)
Responsibilities included supervising Commercial Account Team and administrators, handle miscellaneous and homeowner calls, prepare bottle orders, audit sample paperwork, monitor sample progress, and handle client concerns.
Group Leader/Senior Specialist, Environmental Client Services (2005)
Responsibilities included supervising Account Management Team and administrator, work with team members on continual process improvement, manage several large client accounts, prepare bottle orders, audit sample paperwork, monitor sample progress, and handle client concerns.
Senior Chemist, Organic Extraction (2007)
Responsibilities include performing non-routine extractions, scheduling prep work, verification of prepped batches, processing MOS reports, managing projects for tobacco analyses, point person for project rollouts.

Awards, Citations, Honorary Societies, and Publications:

Senior Leadership Group Award, Lancaster Laboratories (2001, 2005, 2007)
Superlative Service Award, Lancaster Laboratories (2004, 2010)

Memberships and Appointments:

Ethics Committee, Lancaster Laboratories (1998)
MOS Process Improvement Team, Lancaster Laboratories (2005)

**Anneliese H. Owen, M.B.A., Manager, Environmental Sample Administration**

Education:

B.S. Molecular and Cell Biology, Pennsylvania State University (1986)
M.B.A. Pennsylvania State University (1993)

Professional Experience:

With Lancaster Laboratories since 1986
Coordinator (1987)
Client Services Specialist (1988)
Business Development Specialist (1990)
Group Leader, Environmental Sample Administration (1992)
Responsibilities included: supervise personnel; manage laboratory operations and financial resources; sample interpretation and entry; and monitor corrective action for quality issues.
Manager, Environmental Sample Administration (2005)
Responsibilities include: supervise personnel; manage laboratory operations and financial resources; sample interpretation and entry; and monitor corrective action for quality issues.

**Linda C. Pape, B.A., Senior Chemist, GC/MS Volatiles**

Education:

B.A. Business Administration, Milsaps College (1985)

Professional Experience:

Rite Aid Pharmacy, Store Manager (1985-1989)
Responsibilities included being responsible for overall maintenance and security of merchandise, store, and property; ordering and display of all merchandise; auditing daily cash and inventory reports; scheduling employees; payroll accounting; training of new and prospective personnel
With Lancaster Laboratories since 1993
Chemist, Volatiles by GC (1993)
Responsibilities included analyzing client-submitted samples and their associated quality control samples by purge-and-trap gas chromatography; reviewing and uploading the corresponding data in an efficient manner with a high degree of accuracy and quality; evaluating current organizational and analytical systems; suggesting and implementing necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; initiating and leading technical projects to a timely, accurate, and efficient conclusion while meeting client and/or regulatory requirements with a high degree of quality
Chemist, Water Quality (2000)
In addition to responsibilities listed above performed CN distillation, $PO_4$ digestion, and phenol distillation during a 3-month time frame

Senior Chemist, Volatiles by GC (2007)
Responsibilities included analyzing client-submitted samples and their associated quality control samples by purge-and-trap gas chromatography; reviewing and uploading the corresponding data in an efficient manner with a high degree of accuracy and quality; performing final review (verification) of data for clients (adding appropriate comments as necessary); evaluating current organizational and analytical systems; suggesting and implementing necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; initiating and leading technical projects to a timely, accurate, and efficient conclusion while meeting client and/or regulatory requirements with a high degree of quality; training new employees in Volatiles by GC soils
Senior Chemist, Volatiles by GC/MS (2008)
Responsibilities included analyzing client-submitted samples and their associated quality control samples by purge-and-trap gas chromatography/mass spectrometry; reviewing and uploading the corresponding data in an efficient manner with a high degree of accuracy and quality; performing final review (verification) of data for clients (adding appropriate comments as necessary); evaluating current organizational and analytical systems; suggesting and implementing necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; initiating and leading technical projects to a timely, accurate, and efficient conclusion while meeting client and/or regulatory requirements with a high degree of quality; training new employees
Senior Chemist, GC/MS Volatiles (2009)
Responsibilities include analyzing client-submitted samples and their associated quality control samples; reviewing and uploading the corresponding data in an efficient manner with a high degree of accuracy and quality; performing final review (verification) of data for clients (adding appropriate comments as necessary); evaluating current organizational and analytical systems; suggesting and implementing necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; initiating and leading technical projects to a timely, accurate, and efficient conclusion while meeting client and/or regulatory requirements with a high degree of quality; training new employees

**Jill M. Parker, B.S., Senior Specialist, Environmental Client Services**

Information not available at time of printing.

**James H. Place, B.S., Senior Chemist, Pesticide Residue Analysis**

Education:

B.S. Physical Science, York College of Pennsylvania (1997)

Professional Experience:

AMZ Corporation, Laboratory Technician (1998-2000)
Responsibilities included performing analysis and maintenance of chemical compositions pertaining to electroplating baths
Nichia America Co., Laboratory Technician (2000-2001)
Responsibilities included performing analysis of phosphorus for composition of pigments; performing sample screening and AA analysis
AMZ Corporation, Laboratory Technician (2001-2003)
Responsibilities included performing analysis and maintenance of chemical compositions pertaining to electroplating baths; conducting inventory and ordering chemicals
With Lancaster Laboratories since 2003
Chemist, Pesticide Residue Analysis (2003)
Responsibilities include performing routine and non-routine instrumental analyses of QC and clients' samples for pesticides, PCBs, herbicides, and other related compounds in accordance with departmental methods and SOPs; achieving quality results within the time-frame expected by our clients with minimal daily supervision; maintaining the GCs or HPLCs used for routine analyses; identifying and correcting common instrument or QC problems
Senior Chemist, Pesticide Residue Analysis (2008)
Responsibilities include performing routine and non-routine instrumental analyses of QC and clients' samples for pesticides, PCBs, herbicides, and other related compounds in accordance with departmental methods and SOPs; assisting in implementing special client requests; identifying and offering solutions to correct instrument problems and causes of QC problems; reviewing data for accuracy and completeness (for both routine and non-routine analyses, reports, or data packages); serving as a technical resource for the department

**Christine M. Ratcliff, B.S., Principal Specialist, Volatiles in Air**

Education:

B.S. Chemistry, Shippensburg University (1988)

Continuing Education:

Mass Spectral Interpretation, Finnigan MAT Institute (1990)

Professional Experience:

With Lancaster Laboratories since 1988
- Chemist (1991)
- Coordinator (1994)
- Group Leader (1996)
- Senior Chemist/Coordinator (1997)
- Senior Chemist (2002)
  - Responsibilities included reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data
- Senior Specialist, GC/MS Semivolatiles (2005)
  - Responsibilities included reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data
- Principal Specialist, GC/MS Semivolatiles (2009)
  - Responsibilities included reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data; performing technical audit of GC/MS semivolatiles data in a timely manner
- Principal Specialist, Volatiles in Air (2009)
  - Responsibilities include reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data; performing technical audit of Volatiles in Air, GC/MS semivolatiles, and GC/MS volatiles data in a timely manner
- Principal Specialist, Volatiles in Air (2009)
  - Responsibilities include reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data; performing technical audit of Volatiles in Air, GC/MS semivolatiles, GC/MS volatiles, and dioxans and furans data in a timely manner

**Mark A. Ratcliff, B.A., Senior Specialist, GC/MS Semivolatiles**

Education:

B.A. Physics, Franklin & Marshall College (1988)

Continuing Education:

Finnegan Mass Spectral Interpretation Course (1991)

Professional Experience:

With Lancaster Laboratories since 1989
- Chemist (1992)
- Senior Chemist (1996)
  - Responsibilities included: perform GC/MS semivolatiles testing; operate GC/MS instruments; data interpretation; calibrating and repairing instruments; prepare standards; revise and update SOPs; and train other analysts.
- Senior Specialist, GC/MS Semivolatiles (2005)
  - Responsibilities include: perform GC/MS semivolatiles testing; operate GC/MS instruments; data interpretation; calibrating and repairing instruments; prepare standards; revise and update SOPs; and train other analysts.

**Barbara F. Reedy, B.S., Senior Specialist, Quality Assurance**

Education:

B.S. Environmental Biology, Millersville University (1993)

Continuing Education:

Environmental GC Analysis Seminar, Restek (2001)
The Internet Audit A Quality Tool, PaAAEL (2001)
Advanced Gas Chromatography Mass Spectroscopy Seminar, PaAAEL (2002)
LC/MS/MS System Seminar, Applied Biosystems (2006)
Introduction to Root Cause Analysis, Patton Professional (2007)
When to Initiate Corrective Action, Patton Professional (2007)
Practical Process Improvement Training in the role of Team Member (2008)
GC Pesticide/PCB's Analysis Training Seminar (2008)
NY/PAAAEL Annual Meeting - Internal & Electronic Audits: Satisfying Regulatory Requirements, Corrective and Preventive Actions, Ethics and Data Integrity Training (2009)

Professional Experience:

Department of Environmental Resources, Division of Rivers and Wetlands, Scientific Intern (1993)
- Responsibilities included reviewing wetland permits applications; inspecting and photographing wetland mitigation sites; determining hydrology, soil type, and the consistency of the mitigation with the approved project plans; researching records of the sites

With Lancaster Laboratories since 1993
Associate Chemist/Chemist, Volatiles by GC (1993)
Responsibilities included calibrating Capillary, VOA, BTEX, and FID instruments; performing routine maintenance; interpreting, reviewing, and uploading data
Senior Chemist, Volatiles by GC (1999)
Responsibilities included being primary verifier for the majority of data for Volatiles by GC for the ELCD/PID and FID for both waters and soils; signing of analytical reports; generating statistically determined QC windows; training new analysts to review and upload data into the LIMS
Senior Specialist, Quality Assurance (2001)
Responsibilities include ensuring quality of data being produced in the laboratories by performing data review, auditing laboratories, and reviewing written procedures; ensuring laboratory adherence to government regulations and client requirements; reviewing client and government documents for requirements outside our usual laboratory practices; setup and testing new analysis in the laboratory sample management system as required by the departments

**Nelson H. Risser, M.B.A., Principal Chemist, Specialty Services Group**

Education:

B.A., Chemistry, Shippensburg University (1977)
M.B.A., Pennsylvania State University (1995)

Continuing Education:

Quality Management College, Philip Crosby Associates (1989)
Validation of Computerized Systems for the Pharmaceutical Industry, PDA (1995)
Lab Equipment Qualification and Validation, Barnett International Conference Group (1999)
PreCovery Disaster Recovery Software, SunGard (1999)
Practical Process Improvement – Team Member Training (2009)
TSQ Quantum Vantage Operations, Thermo Scientific Training Institute (2009)
DFS High Resolution Magnetic Sector Mass Spectrometer Operations, Thermo Scientific (2009)

Professional Experience:

Frederick Cancer Research Center, Analytical Chemist (1977-1979)
Responsibilities included developing analytical methods to support cancer research efforts
Lancaster Laboratories, Technical Associate-Director (1979-2007)
Responsibilities included performing a broad scope of analytical tests utilizing manual wet chemistry, atomic absorption, purge and trap concentration, gas chromatography, ion chromatography, mass spectrometry, and other instrumental analyzers; managing staff chemists in the Environmental Services Division in analyzing water and soil for volatile organics using gas chromatography/ mass spectrometry; supervising laboratory and support operations; supervising Computer Services staff performing software development and systems support; overseeing corporate computer operations in utilizing System Development Life Cycle processes to ensure validated computer systems are implemented and that a state of validation is maintained
With Lancaster Laboratories since 2008
Principal Chemist, Environmental Sciences (2008)
Responsibilities included performing sample analyses utilizing high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS)
Principal Chemist, Specialty Services Group, Environmental Sciences (2010)
Responsibilities include acting as technical resource within the environmental division; developing and validating analytical protocols; troubleshooting and solving analytical chemistry problems; optimizing instrument configuration and performance; evaluating and interpreting analytical results; writing SOPs; assisting in responding to and eliminating ICARs, assisting in optimizing procedures in prep lab; communicating effectively within department; performing routine work as required

Awards, Citations, Honorary Societies & Publications:

7 scientific papers on chemical analysis of carcinogens, solvent recovery, workforce scheduling

**Robin C. Runkle, B.S., Senior Specialist, GC/MS Volatiles**

Education:

B.S. Chemistry, State University of New York at Oneonta (1988)

Continuing Education:

Introduction to Mass Spectral Interpretation, Finnigan Mat (1991)
Gas Chromatography: Practical Theory and Applications for LL (1993)
HP5890 GC Troubleshooting and Maintenance, Hewlett-Packard (1993)
Technical Training, OI Analytical (1995)

Professional Experience:

With Lancaster Laboratories since 1989
Senior Chemist (1993)
Responsibilities included: sample preparation; perform GC/MS volatile testing; operate GC/MS instruments; data interpretation; review and approve data; developing and evaluating new methods; calibrating and repairing instruments; prepare standards; reagent preparation; revise and update SOPs and analytical methods; order supplies; train other analysts; and prepare and test trip blank water.
Senior Specialist, GC/MS Volatiles (2005)
Responsibilities include: data review and verification, review and sign reports, respond to and work on client inquiries and ATF requests.

**Stephanie A. Selis, B.S.E., Senior Chemist, GC/MS Volatiles**

Education:

B.S.E. Biology, Chemistry Minor, Millersville University (1996)

Professional Experience:

Access I, Access II, PC Focus (1997)
Emergency Evacuation Coordinator (1998)
Gas Chromatography Principles and Practices, Lancaster Laboratories University (1998)
GC/MS Theories and Applications, MDL Systems (1999)
Statistics, Lancaster Laboratories University (2000)

Professional Experience:

With Lancaster Laboratories since 1996
Chemist (1996)
Senior Chemist, Volatiles by GC (2000)
Responsibilities included: Sample analysis, troubleshooting and maintenance, system calibration, establish QC windows for soil analysis, write SOPs, data entry, prepare standards, sample verification, analyst training.
Senior Chemist, GC/MS Volatiles (2005)
Responsibilities include: Sample analysis, troubleshooting and maintenance, system calibration, establish QC windows for soil analysis, write SOPs, data entry, prepare standards, sample verification, analyst training.

**Richard A. Shober, B.S., Principal Chemist, Pesticide Residue Analysis**

Education:

B.S. Chemistry, Muhlenberg College (1984)

Continuing Education:

Inductively Coupled Plasma Spectroscopy, Allied Analytical (1985)
ACS Short Course, Analytical Chemistry of Contaminants in Surface and Groundwater (1986)
Gas Chromatography: Practical Theory & Application, Lancaster Laboratories (1994)
Mass Spectral Interpretation, Hewlett-Packard (1995)
Comprehensive HPLC, RESTEK (2010)

Professional Experience:

With Lancaster Laboratories since 1984
Principal Chemist, Pesticide Residue Analysis (1999)
Responsibilities include performing pesticide residue testing; operating gas chromatography instruments; interpreting data; repairing instruments; developing new methods for and operating LC/MS/MS; developing and maintaining computer systems/programs for lab use

Awards, Citations, Honorary Societies & Publications:

Poster paper on computer applications for analytical chemistry
Poster paper on tobacco specific nitrosamine analysis

Biographical Listings:

*Who's Who in Environmental Science*

**Michele J. Smith, B.S., Senior Specialist, Specialty Services Group**

Education:

B.S. Chemistry, St. Mary's College, Notre Dame, Indiana (1998)
22 credits master's study with Penn State University (2000-2002)

Continuing Education:

Gas Chromatography Principles and Practices, Lancaster Laboratories University (1999)
Statistics, Lancaster Laboratories University (2000)

Professional Experience:

St. Mary's College, Laboratory Teaching Assistant (1996-1998)
Responsibilities included: assisted professor in the laboratory—responsible for experiment demonstrations, answered student's questions, and graded lab reports.
With Lancaster Laboratories since 1998
Chemist (1998)
Responsibilities included: maintain GC/MS instrumentation, tune and calibrate GC/MS, analyze samples by GC/MS, review and assemble all supporting GC/MS data, review daily QC outliers.
Senior Chemist (2001)
Responsibilities included: maintain GC/MS instrumentation, tune and calibrate GC/MS, analyze samples by GC/MS, review and assemble all supporting GC/MS data, perform technical audit of GC/MS and HPLC, sign analysis reports, track samples to meet turn around time.
Senior Chemist Coordinator (2004)
Responsibilities included: maintain GC/MS instrumentation, tune and calibrate GC/MS, analyze samples by GC/MS, review and assemble all supporting GC/MS data, perform technical audit of GC/MS and HPLC, sign analysis reports, track samples to meet turn around time.
Senior Specialist Group Leader, GC/MS Semivolatiles (2005)
Responsibilities included: review and assemble GC/MS data, perform technical audit of GC/MS and HPLC, sign analysis reports, schedule and track samples to meet turn around time.
Senior Specialist, Environmental Client Services (2008)
Responsibilities included auditing sample paperwork; setting up standard forms; generating bottle orders; preparing quotes
Senior Specialist, Specialty Services Group (2011)
Responsibilities include maintaining instrumentation; tuning and calibrating instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; diagnosing complex problems and offering solutions with a high degree of independence; suggesting and implementing improvements to maximize quality and productivity; acting as technical resource for internal problems and projects; assisting in "brainstorming" client problems and projects; training new employees in all aspects of instrumentation; researching new and emerging technologies

Memberships and Appointments:

American Chemical Society (1998-2002)

**Max E. Snavely, B.S., Senior Specialist, Metals**

Education:

B.S. Chemistry, Lebanon Valley College (1977)

Continuing Education:

Inductively Coupled Plasma Spectroscopy, Thermo Jarrell Ash (1991)

Professional Experience:

Sterling Drug, Inc., Quality Control Chemist (1977-1980)
Andrew S. McCreath & Sons, Inc., Analytical Chemist (1980-1987)
With Lancaster Laboratories since 1987
Senior Chemist (1990)
Responsibilities included: operate ICP instruments; data interpretation; review and approve data; train other analysts; and coordinate performance evaluation samples.
Senior Specialist, Metals (2005)
Responsibilities include: operate ICP instruments; data interpretation; review and approve data; train other analysts; and coordinate performance evaluation samples.

**Sarah M. Snyder, B.S., Senior Specialist, Pesticide Residue Analysis**

Education:

B.S. Chemistry, Alvernia College (2004)
B.S. Forensic Science, Alvernia College (2004)

Professional Experience:

With Lancaster Laboratories since 2003
- Laboratory Technician, Organic Extraction (2003)
  - Responsibilities included prepping organic soil extractions of PCBs and tobaccos; washing glassware; running the Automated Solvent Extractor and nitrite instrument; prepping micro-extractions
- Chemist, EPH/Misc. GC (2005)
  - Responsibilities included maintaining and operating 5890 and 6890 FID-GC instrumentation; prepping standards; reading Diesel Range Organics and state specific samples; performing computer work
- Chemist, Pesticide Residue Analysis (2007)
  - Responsibilities included maintaining and operating 5890 and 6890 ECD-GC instrumentation; prepping standards; reading Herbicide and Organophosphate samples; performing computer work
- Specialist, Pesticide Residue Analysis (2007)
  - Responsibilities included reviewing data from all analyses; keeping track of department samples; signing reports; working with data package
- Senior Specialist, Pesticide Residue Analysis (2010)
  - Responsibilities include mentoring newer analysts; reviewing data from all analyses; keeping track of department samples; signing/reviewing reports; helping data packages with questions; helping with projects

**Tara M. Spaide, Senior Specialist, Environmental Client Services**

Continuing Education:

Algebra and Analytical Geometry, Pennsylvania State University (1993)
Chemistry, Pennsylvania State University (1993)

Professional Experience:

With Lancaster Laboratories since 1986
- Senior Specialist Coordinator, Organic Extraction (1997)
  - Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations; reviewing and approving data; and revising and updating analytical methods
- Senior Chemist Coordinator, Organic Extraction (2003)
  - Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations; reviewing and approving data; and revising and updating analytical methods
- Senior Chemist Group Leader, Organic Extraction (2005)
  - Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations; reviewing and approving data; and revising and updating analytical methods
- Senior Specialist, Environmental Client Services (2007)
  - Responsibilities include auditing sample paperwork; setting up standard forms; generating bottle orders; preparing quotes

**Dale R. Stoneroad, B.S., Senior Chemist, GC/MS Semivolatiles**

Education:

B.S. Science, Chowan University (1998)

Professional Experience:

Analytical Laboratory Services, Inc., Chemical Specialist (1998-2010)
- Responsibilities included analyzing 525, 527 529 8270, 625 EPA methods; training fellow employees how to use new instrumentation; operating HP 5971, HP5972, HP5973, and HP5975 instruments; being responsible for standard prep and inventory; assisting in sample collection and sample preparation; serving as a data reviewer for the GC/MS volatile group; organizing workloads by due dates and reporting data into a company LIMS to be released to clients; performing minor and major maintenance of all GC/MS equipment

With Lancaster Laboratories since 2010
- Senior Chemist, GC/MS Semivolatiles (2010)
  - Responsibilities include operating, maintaining, and troubleshooting GC/MS instrumentation; operating HP5890/6890 GCs, 5971, 5972, 5973, 5975 Mass Spec. Thermo DSQII MS/Trace GCs; reviewing and interpreting data of various analyses including but not limited to 8270C, Appendix IX, 625, CLP 3/90, and 2/88; preparing standards for various methods; interpreting data and assembling data packages of batch data; evaluating and reviewing system procedures; performing GC/MS analysis

Awards, Citations, Honorary Societies, and Publications:

Resident Assistant of the Year (1996)
Employee of the Quarter (2002)
Employee of the Year (2007)

**Andrew J. Strebel, Principal Chemist, GC/MS Semivolatiles**

Continuing Education:

Advanced Aquarius Programmers Course, Hewlett-Packard (1989)
Environmental Applications of GC/MS, Indiana University (1989)
Environmental GC-MS (DOS) Operation, Hewlett-Packard (1995)
Unix Module 1, Albright College (1995)
Unix Module 2, Albright College (1995)
Unix Shell Scripts, Albright College (1995)
Unix AWK Programming, Albright College (1995)
Target Training, Thru-Put Systems, Inc. (1995)
Report Writer Training, Thru-Put Systems, Inc. (1998)
HP-UX System Administration for HP 9000s, Hewlett Packard (1998)
HP-UX Troubleshooting for HP 9000s, Hewlett Packard (1998)
GC/MS Training Course, MDL Systems (1999)
LC/MS/MS 101 Training Course, Basic Mass Spec Solutions, Inc. (2001)

Professional Experience:

With Lancaster Laboratories since 1986
Technical Specialist (1991)
Chemist (1994)
Senior Chemist (1997)
Principal Chemist, GC/MS Semivolatiles (2001)
Responsibilities include: perform routine semivolatile testing; operate GC/MS semivolatile instruments; data interpretation; review and approve data; developing and evaluating new methods; calibrating and repairing instruments; prepare standards; revise and update SOPs and analytical methods; train other analysts; develop and maintain computer systems/programs for lab use; and computer validation testing.

**Robert Strocko, Jr., B.S., Manager, Metals**

Education:

B.S. Biology, York College of Pennsylvania (1988)

Continuing Education:

Thermo Jarrel l ASA ICP Course, Thermo Jarrell ASA (1993)

Professional Experience:

Springettsbury Waste Water Treatment Facility, Chemistry Technician (1986-1988)
Responsibilities included running NPDES tests on wastewater, % solids, NH4, pH, BOD, suspended solids, coliform, dissolved solids, temperature, and Hexa-Chrome testing
Penn Dairies, Laboratory Technician (1988-1989)
Responsibilities included testing raw milk for coliform bacteria for acceptance; performing milk-fat percent solids on milk products; calculating sugar content in sweetened milk
Pennsylvania Department of Environmental Resources, Chemistry Technician (1989-1992)
Responsibilities included receiving samples; logging data for analysis to computer; handling field sampling questions; operating flame AA; shipping cooler to field samples
With Lancaster Laboratories since 1992
Chemist, Metals (1992)
Responsibilities included setting up, pouring, and running samples on ICP; reviewing and verifying ICP data; performing instrument maintenance; calculating IDLs, MDLs, and linear ranges; writing SOPs
Chemist/Coordinator, Metals (1996)
Responsibilities included overseeing prep room personnel and work flow; scheduling work flow through prep room; writing job plans and job reviews; ordering standards and reagents; overchecking notebooks
Manager, Metals (1998)
Responsibilities include overseeing technical areas in ICP, low-level mercury, ICP-MS, and mercury; writing SOPs, ICARs, etc.; writing job plans and job reviews; handling technical questions for clients/client services; verifying ICP data; signing reports

**Christiane S. Sweigart, B.S., Senior Specialist, Electronic Data Deliverables**

Education:

B.S. Science, Elizabethtown College (1985)
Medical/Technology Degree, St. Joseph School of Medical Technology (1985)

Continuing Education:

The Principals of Gas Chromatography (1993)
Statistics Course (1993)
Creative Training Techniques Conference (1997)

Professional Experience:

With Lancaster Laboratories since 1985
- Chemist, GC/MS (1985)
  - Responsibilities included GC/MS operation targeting both VOA and BNA compounds, instrument maintenance, sample handling, and data handling (interpretation and documentation)
- Chemist, GC/VOA (1986)
  - Responsibilities included GC operation targeting both aromatic and halogenated compounds, FID operation, instrument maintenance, sample handling, and data handling (interpretation and documentation). Training of others on FID methods, development of training/reference manual for FID, development of internal Operating Manual, standard documentation, definition and maintenance of Statistically defined windows, and temporary coordinator in Department 25.
- Chemist Coordinator, GC/VOA (1993)
  - Responsibilities included coordination of sample analysis and data management; job plans and feedback for several personnel; communication both internal and external, and data handling (interpretation and documentation; and combination of existing department with another (personnel, instrumentation, sample volume).
- Senior Specialist, Human Resources (1997)
  - Responsibilities included recruiting, training, and professional development.
- Senior Specialist, Electronic Data Deliverables (2001)
  - Responsibilities include EDD generation, EDD content review, and communication (internal and external).

Awards, Citations, Honorary Societies & Publications:

Recognition for the implementation of a revamped New Hire Orientation (1999)
Recognition for the development and presentation of the Ethic's Refresher (2001)

Memberships & Appointments:

LCAHRM (1997-2001)

**Lawrence M. Taylor, B.S., Senior Specialist, GC/MS Volatiles**

Education:

B.S. Chemistry, Shippensburg University (1989)

Continuing Education:

QA Report Operator Training Course, Finnigan Mat Institute (1990)
Technical Training, OI Analytical (1995)
Mass Spectral Interpretation Course, Hewlett-Packard (1995)
Archon Training Course, PTS (1997)

Professional Experience:

With Lancaster Laboratories since 1989
- Senior Chemist (1992)
  - Responsibilities included GC/MS volatile data interpretation; review and approve data; verify sample results, and sign reports.
- Senior Specialist, GC/MS Volatiles (2005)
  - Responsibilities include GC/MS volatile data interpretation; review and approve data; verify sample results, and sign reports.

**Lauren C. Temple, B.S., Senior Chemist, GC/MS Volatiles**

Education:

B.S. Chemistry, Shippensburg University (2003)

Continuing Education:

Intro to Interpretation of Mass Spectra, Lancaster Laboratories University (2005)

Professional Experience:

With Lancaster Laboratories since 2003
Chemist, GC/MS Volatiles (2003)
Responsibilities included analyzing water and soil samples using purge and trap GC/MS; prepping samples and performing data review; performing maintenance as needed on purge and traps, GC/MS, and autosamplers
Senior Chemist, GC/MS Volatiles (2006)
Responsibilities include analyzing water and soil samples using purge and trap GC/MS; prepping samples and performing data review; performing maintenance as needed on purge and traps, GC/MS, and autosamplers; performing basic data review and audit; assisting in training new hires as needed

**Valerie L. Tomayko, B.S., Senior Specialist Group Leader, Volatiles by GC**

Education:

A.S. Chemical Engineering Technology, Pennsylvania State University (1977)
B.S. Human Resource Management, Geneva College (1993)

Professional Experience:

Hercules Inc., Laboratory Technician (1977-1983)
Antech Ltd., Associate Chemist, (1985-1989)
Quanterra (formerly Wadsworth/Alert), Chemist, (1989-1997)
UEC (United States Steel Engineering Consultants), Chemist (1997)
With Lancaster Laboratories since 1997
Senior Chemist, Pesticide Residue Analysis (1997)
Responsibilities included: data interpretation; review and approve data; review data packages; and generate statistical QC limits for Pesticide Residue Analysis and Extractable Petroleum Hydrocarbons/MBC GC and Nitrosamines departments.
Senior Chemist Coordinator, Pesticide Residue Analysis (2001)
Responsibilities included: Monitor turnaround time and status of samples and packages; coordinate work flow; track employees' progress; assist in implementing procedures/protocols for meeting QA requirements, data package requirements, and special client or project-specific requests. In addition to data interpretation; review and approve data; review data packages; and generate statistical QC limits for Pesticide Residue Analysis and Extractable Petroleum Hydrocarbons/MBC GC and Nitrosamines departments.
Senior Specialist Group Leader, Pesticide Residue Analysis (2005)
Responsibilities included: Monitor turnaround time and status of samples and packages; coordinate work flow; track employees' progress; assist in implementing procedures/protocols for meeting QA requirements, data package requirements, and special client or project-specific requests. In addition to data interpretation; review and approve data; review data packages; and generate statistical QC limits for Pesticide Residue Analysis and Extractable Petroleum Hydrocarbons/MBC GC and Nitrosamines departments.
Senior Specialist Group Leader, Volatiles by GC (2006)
Responsibilities include: Monitor turnaround time and status of samples; coordinate work flow; track employees' progress; assist in implementing procedures/protocols for meeting QA requirements, data package requirements, and special client or project-specific requests. In addition to data interpretation; review and approve data; review data packages; and generate statistical QC limits for GC Volatile analysis.

**Luz C. Torres, B.S., Senior Specialist Group Leader, Data Deliverables**

Education:

B.S. Secretarial Sciences, Catholic University of Puerto Rico (1982)

Continuing Education:

English as a Second Language, Spanish American Civic Association (1988)
Computer Literacy, Spanish American Civic Association (1989)

Professional Experience:

Dr. Jose Moro, Pediatrician, Administrative Secretary (1976-1986)
Responsibilities included customer service, answering phone, collecting payment, billing medical insurance, dictation, transcription, writing letters, filing, archiving, account receivables, ordering supplies.
With Lancaster Laboratories since 1988
Laboratory Assistant, Water Quality (1988)
Responsibilities included washing glassware, assisting technical staff by performing Odor and TDS analyses.
Clerk II, Data Deliverables (1991)
Responsibilities included data package assembly, tracking/preparing/sending QC summary reports, processing and sending data packages, generating and sending Lotus Text file disks, and DP content review.

Administrator I, II, III, Data Deliverables (1992)
Responsibilities included DP assembly, DP content review, review of analytical data, DP processing and sending, training new hires and current staff learning new tasks, DP corrections follow up.
Specialist Coordinator, Data Deliverables (1996)
Responsibilities included technical data review, package correction and problems investigation, Package TAT monitoring, oversee data package assembly, content review, and data package processing, documentation of departmental procedures, maintenance of database, interviewing, supervision of personnel
Senior Specialist Coordinator, Data Deliverables (2003)
Responsibilities included QA review, interviewing, supervision of personnel including writing job plan and performance evaluation, package correction and problems investigation, package TAT monitoring, documentation of departmental procedures, training new hires and cross-training employee from other areas, maintenance of method summary database, oversee data package assembly, content review, and data package processing.
Senior Specialist Group Leader, Data Deliverables (2005)
Responsibilities include QA review, interviewing, supervision of personnel including writing job plan and performance evaluation, package correction and problems investigation, package TAT monitoring, documentation of departmental procedures, training new hires and cross-training employee from other areas, maintenance of method summary database, oversee data package review and data package processing.

**Timothy J. Trees, A.A.S., Principal Chemist, Specialty Services Group**

Education:

Certificate, N.Y.S. Water/Wastewater Treatment Operations, Columbia Greene Community College (1985)
A.A.S. Environmental Control of Hazardous Waste/Water Quality, Ulster County Community College (1986)

Continuing Education:

Water Treatment Operations, NYS License Board (1984)
Wastewater Treatment Operations, NYS License Board (1986)
Varian AA Course (1992)
Service Operations Process Optimization, Pennsylvania State University (1992)
24-hour HAZWOPER (spill response) (1995)
Atomic Spectroscopy Workshop, Perkin-Elmer (1997)
Hitachi GFAA Workshop, Hitachi, CT (1994)

Professional Experience:

York Wastewater Management (1985-1986)
Rider Engineering (1986-1988)
With Lancaster Laboratories since 1988
Senior Technician, Metals (1988)
Responsibilities included: operation, maintenance, and sample preparation of mercury cold vapor and hydride generation instrumentation for the determination of mercury, arsenic, and selenium; data entry; troubleshooting instruments; repair of instrumentations' electronic system.
Chemist I, Metals (1990)
Responsibilities included: operation and maintenance of graphite furnace instrumentation; verification of mercury cold vapor and hydride generation data; coaching and training of personnel in the operation of mercury and hydride instrumentation; troubleshooting and repair of instrumentations' mechanical and electronic system.
Chemist I/Coordinator, Metals (1992)
Responsibilities included: operation and maintenance of graphite furnace instrumentation; ICP operation; verification of mercury cold vapor and hydride generation data; coaching and training of personnel in the operation of mercury, hydride, and graphite furnace instrumentation; troubleshooting and repair of instrumentations' mechanical and electronic system; systems operation optimization to increase production; scheduling of personnel for department operation; job plan and review with employees.
Chemist II/Coordinator, Metals (1993)
Responsibilities included: coaching and training of personnel in the operation of mercury, hydride, and graphite furnace instrumentation; assist clients with data interpretation and process improvement; ICP operation; verification of graphite furnace, mercury cold vapor, and hydride generation data; data package review; troubleshooting and repair of instrumentations' mechanical and electronic systems; system operations optimization to increase production; scheduling of personnel for department operation; job plan and review with employees.
Senior Chemist/Coordinator, Metals (1994)
Responsibilities included: operation, maintenance, repair, and troubleshooting of department graphite furnaces; flame atomic absorption, mercury cold vapor, hydride generation, and Inductively Coupled Plasma Instrumentation as well as computer systems used in the operation with these instruments; data qualification, interpretation, and verification of department workload; assist clients with interpretation of data, cause and effect; coaching and training of department personnel in areas of sample preparation, instrument setup, maintenance, and analysis using these instruments; job plan, review, and evaluation with employees; ordering of supplies; maintained operation of Metals Atomic Absorption for the department; method development for both environmental and pharmaceutical divisions for graphite furnace and ICP work; Set up and maintain, all SOPs and documentation for computer systems and instrumentation to comply with GMP regulations; data package review for metals analysis; review and verification of ICP data as needed.

Principal Chemist/Coordinator, Metals (1996)
Responsibilities included: operation, maintenance, repair, and troubleshooting of department graphite furnaces; flame atomic absorption, mercury cold vapor, hydride generation, and Inductively Coupled Plasma Instrumentation as well as computer systems used in the operation with these instruments; data qualification, interpretation, and verification of department workload; assist clients with interpretation of data, cause and effect; coaching and training of department personnel in areas of sample preparation, instrument setup, maintenance, and analysis using these instruments; job plan, review, and evaluation with employees; ordering of supplies; maintained operation of Metals Atomic Absorption for the department; method development for both environmental and pharmaceutical divisions for graphite furnace and ICP work; Set up and maintain, all SOPs and documentation for computer systems and instrumentation to comply with GMP regulations; data package review for metals analysis; review and verification of ICP data as needed.
Senior Chemist, GC/MS Semivolatiles (1998)
Responsibilities included: operation, maintenance, and troubleshooting of GC/MS instrumentation; HP5890, 6890 GC, 5971, 5972, 5973 Mass Spec; review and data interpretation of various analyses including but not limited to, 8270C, Appendix IX, 625, CLP 3/90, and 2/88; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures.
Principal Chemist, GC/MS Semivolatiles (2001)
Responsibilities included: operation, maintenance, and troubleshooting of GC/MS instrumentation; HP5890, 6890 GC, 5971,5972, 5973 Mass Spec; method development, research, and development of GC/MS procedures; review and data interpretation of various analyses including but not limited to 8270C, Appendix IX, 625, CLP 3/90 and 2/88; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures; analysis and troubleshooting of HPLC and analysis of PAHs; coaching and training of analysts to assist with troubleshooting; working in Pharmaceutical Method Development and Validation, operating LC/MS, LC/MS/MS, and GC/MS instrumentation, and performing instrument qualifications since June 2003.
Principal Chemist, Flexible Staffing (2006)
Responsibilities included working in GC/MS Volatiles in Air department; operation, maintenance, and troubleshooting GC/MS instrumentation; HP5890, 6890 GC, 5971, 5972, 5973 Mass Spec; method development, research, and development of GC/MS procedures; review and data interpretation of various analyses including but not limited to TO-15 and TO-14; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures; ability to operate a variety of instrumentation and data systems.
Principal Chemist, GC/MS Semivolatiles (2007)
Responsibilities included operating, performing maintenance on, and troubleshooting GC/MS instrumentation; HP5890, 6890 GC, 5971,5972, 5973, 5975 Mass Spec; setting up and performing method development of Thermo Fisher TRACE GC and DSQ II MS; performing method development using both EI and CI mode of analysis; method development, research, and development of GC/MS procedures; review and data interpretation of various analyses including, but not limited to, 8270C, Appendix IX, 625, CLP 3/90 and 2/88; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures; analysis and troubleshooting of HPLC and analysis of PAHs; coaching and training of analysts to assist with troubleshooting; Including working in GC/MS Volatiles in Air department; operation, maintenance, and troubleshooting GC/MS instrumentation; HP5890, 6890 GC, 5971, 5972, 5973 Mass Spec; method development, research, and development of GC/MS procedures; review and data interpretation of various analyses including but not limited to TO-15 and TO-14; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures; ability to operate a variety of instrumentation and data systems.
Principal Chemist, Specialty Services Group (2011)
Responsibilities include acting as technical resource within the environmental division; developing and validating analytical protocols; troubleshooting and solving analytical chemistry problems; optimizing instrument configuration and performance; evaluating and interpreting analytical results; writing SOPs; assisting in responding to and eliminating ICARs, assisting in optimizing procedures in prep lab; communicating effectively within department; performing routine work as required

**Abraham H. Uysal, M.S., Senior Data Review Specialist, GC/MS Volatiles**

Education:

B.S. Chemistry, M.E. Tech. University-Turkey (1979)
M.S. Chemistry, M.E. Tech. University-Turkey (1982)

Professional Experience:

Aerotek, Senior Chemist (1997-1998)
Responsibilities included analysis of semivolatiles by GC/MS and analysis of volatile organics by GC/PID/ELCD.
Wastex Inc., Lead Supervisor (1998-1999)
Responsibilities included analysis of semivolatiles by GC/MS and analysis of pesticides/PCBs by GC/ECD.
M.J. Reider Assoc. Inc., Senior Chemist (1999-005)
Responsibilities included analysis of pesticides and PCBs by GC/ECD: Preparation, analysis, and data review.
With Lancaster Laboratories since 2005
Senior Data Review Specialist, GC/MS Volatiles (2005)
Responsibilities include auditing GC/MS volatiles data for accuracy and integrity.

**Robert Todd Vincent, B.S., Principal Chemist, Organic Extraction**

Education:

B.S. Chemistry, West Virginia Wesleyan College (2001)

Professional Experience:

With Lancaster Laboratories since 2001
- Chemist, EPH/Misc. GC (2001)
  - Responsibilities included analyzing samples; performing equipment repair; GC method development
- Chemist, Organic Extraction (2005)
  - Responsibilities included performing method development; equipment repair
- Senior Chemist, Organic Extraction (2007)
  - Responsibilities included performing method development; equipment repair; vendor relations; technology evaluation
- Principal Chemist, Organic Extraction (2011)
  - Responsibilities include performing high level, difficult preps (with minimal supervision or guidance) following standard operating procedures (SOPs); self train in new techniques; entering information into computer; training new or existing employees in extraction techniques or use of equipment; using knowledge to actively improve current processes; developing, enhancing, and validating new extraction methods; keeping work area clean and organized; preparing spikes; repairing equipment; updating departmental SOPs and training manual; disposing of wastes in approved manner; assisting in incident prevention and remediation when necessary

**Heather E. Williams, B.S., Senior Chemist, EPH/Misc. GC**

Education:

B.S. Forensic and Investigative Science, West Virginia University (2004)

Continuing Education:

Principles of Gas Chromatography, LLU (2007)

Professional Experience:

With Lancaster Laboratories since 2006
- Chemist, EPH/Misc. GC (2006)
  - Responsibilities included analyzing routine samples and their associated QC by gas chromatography for extractable petroleum products such as DRO, TPH, and other related materials; reviewing, calculating, and reporting the corresponding data and results; maintaining, optimizing, and calibrating Gas Chromatographs in an efficient and accurate manner; assisting in organization of department work, track samples, and prepare samples and standards to consistently meet turn around time requirements
- Senior Chemist, EPH/Misc. GC (2008)
  - Responsibilities include analyzing routine samples and their associated QC by gas chromatography for extractable petroleum products such as DRO, TPH and other related materials; reviewing, interpreting, calculating, and reporting the corresponding data and results; maintaining, optimizing, and calibrating Gas Chromatographs in an efficient and accurate manner; assisting in organization of department work, track samples, prepare samples and standards to consistently meet turn around time requirements; verify sample data

**Donald E. Wyand, B.S., Director, Environmental Business Development/Sales**

Education:

B.S. Chemistry, Lebanon Valley College (1989)

Continuing Education:

Graduate Chemistry, Villanova University

Professional Experience:

With Lancaster Laboratories since 1989
- Client Services Specialist (1990)
- Business Development Specialist (1993)
- Principal Specialist/Account Manager (1995)

Principal Specialist/Sales (1998) Principal Specialist/Coordinator/Sales, Environmental Sciences (2001)
Responsibilities included: National Account Manager; project management; evaluating new methods; consult with clients regarding testing needs; develop long-term, mutually beneficial relationships with new and existing clients by maximizing our clients' efficiency and effectiveness in managing analytical projects; present relevant market information to senior management and technical operations staff to develop new services for our clients; organize and manage National Account teams; prepare, organize, and manage project planning for target accounts; present Lancaster Labs' capabilities through formal presentations, personal account visits, and marketing campaigns; develop and maintain marketing programs within assigned geographic territory; maintain and communicate knowledge of regulatory issues, analytical methodology, and industry requirements to new and existing clients; prepare proposals and quotations; advise clients on testing; communicate client requirements to lab areas; perform technical presentation to inform our clients of new environmental regulations; and lead client teams to offer analytical solutions to client problems.
Principal Specialist/Group Leader/Sales (2005)
Responsibilities included: National Account Manager; project management; evaluating new methods; consult with clients regarding testing needs; develop long-term, mutually beneficial relationships with new and existing clients by maximizing our clients' efficiency and effectiveness in managing analytical projects; present relevant market information to senior management and technical operations staff to develop new services for our clients; organize and manage National Account teams; prepare, organize, and manage project planning for target accounts; present Lancaster Labs' capabilities through formal presentations, personal account visits, and marketing campaigns; develop and maintain marketing programs within assigned geographic territory; maintain and communicate knowledge of regulatory issues, analytical methodology, and industry requirements to new and existing clients; prepare proposals and quotations; advise clients on testing; communicate client requirements to lab areas; perform technical presentation to inform our clients of new environmental regulations; and lead client teams to offer analytical solutions to client problems.
Director, Environmental Business Development/Sales (2006)
Responsibilities include: National Account Manager; project management; evaluating new methods; consult with clients regarding testing needs; develop long-term, mutually beneficial relationships with new and existing clients by maximizing our clients' efficiency and effectiveness in managing analytical projects; present relevant market information to senior management and technical operations staff to develop new services for our clients; organize and manage National Account teams; prepare, organize, and manage project planning for target accounts; present Lancaster Labs' capabilities through formal presentations, personal account visits, and marketing campaigns; develop and maintain marketing programs within assigned geographic territory; maintain and communicate knowledge of regulatory issues, analytical methodology, and industry requirements to new and existing clients; prepare proposals and quotations; advise clients on testing; communicate client requirements to lab areas; perform technical presentation to inform our clients of new environmental regulations; and lead client teams to offer analytical solutions to client problems.

Memberships & Appointments:

American Chemical Society
Society of American Military Engineers
Society of Environmental Toxicology and Chemistry

**Meng Yu, M.S., Principal Chemist, Specialty Services Group**

Education:

B.E. Analytical Chemistry, Zhejiang University of Technology (1986)
Post Graduate, Biogeography and Environmental Assessment, University of Saarland (1996)
M.S. Chemistry, Catholic University of Leuven (1998)

Professional Experience:

Setsco Service Ltd, Executive Chemist (1999-2002)
Responsibilities included setting up new analyses for pharmaceutical and food testing using USP, BP, and AOAC methods; performing pesticide residue analysis using all kinds of GC
Cantest Ltd, Research Chemist (2002-2008)
Responsibilities included performing pesticide and drug residue method validation as per USDA, EPA, CFIA methods; performing bioanalytical method development and validation; UPLCMSMS, LCMSMS, LCMS and GCMS operation and maintenance
Pharmanet Inc. HSP Laboratory, Research Scientist (2008-2010)
Responsibilities included performing bioanalytical method development and validation, LCMSMS operation, tuning, and maintenance
With Lancaster Laboratories since 2010
Principal Chemist, Specialty Services Group (2010)
Responsibilities include developing and validating new testing methods; operating and maintaining LCMSMS instruments; performing sample analyses

eurofins | Lancaster Laboratories

# Environmental Quality Policy Manual

# Appendix E
## SOPs and Analytical Methods

Current as of October 05, 2011
23 Total Pages (including this coversheet)

**NOTE: Current indices available from Document Control.**

## Index of Corporate Procedures

| Procedure No. | Title |
|---|---|
| Environmental Quality Policy Manual | Environmental Quality Policy Manual |
| Environmental Quality Policy Manual Appendix A | Procedure Cross Reference List |
| Environmental Quality Policy Manual Appendix B | Certifications, Accreditation, Registrations, and Contracts |
| Environmental Quality Policy Manual Appendix C | Organizational Charts Personnel to Sign Reports |
| Environmental Quality Policy Manual Appendix D | Personnel Qualifications and Responsibilities |
| Environmental Quality Policy Manual Appendix E | SOPs and Analytical Methods |
| Environmental Quality Policy Manual Appendix F | Instrument and Equipment List |
| Environmental Quality Policy Manual Appendix G | Preventative Maintenance Schedules |
| Environmental Quality Policy Manual Appendix H | Calibration Schedules |
| Environmental Quality Policy Manual Appendix I | NELAP Scope of Testing |
| Environmental Quality Policy Manual Appendix J | Quality Control Types, Frequency, and Corrective Action |
| Environmental Quality Policy Manual Appendix K | Microbiological Testing |
| LOM-SOP-ES-201 | Forensic Laboratory Services |
| LOM-SOP-ES-202 | Guidelines for Writing Technical Reports |
| LOM-SOP-ES-203 | Determining Method Detection Limits and Limits of Quantitation |
| LOM-SOP-ES-204 | Subcontracting Analytical Testing |
| LOM-SOP-ES-205 | Monitoring of the Volatile Organics Analysis (VOA) Storage Areas for Contamination |
| LOM-SOP-ES-206 | Sample Requisition |
| LOM-SOP-ES-207 | Establishing Control Limits |
| LOM-SOP-ES-208 | Thermometer Calibration |
| LOM-SOP-ES-209 | Investigation and Corrective Action of Noncompliant Data |
| LOM-SOP-ES-210 | Monitoring Temperatures in Refrigerators, Freezers, Incubators, and Ovens Using the Andover System |
| LOM-SOP-ES-211 | Quarantine Soils Procedures |
| LOM-SOP-ES-212 | Laboratory Sample Analysis Record (LSAR) Documentation |
| LOM-SOP-ES-213 | Quality Control Records |
| LOM-SOP-ES-214 | Composing and Maintaining Comments in Parallax |
| LOM-SOP-ES-215 | Subcontracting to Other Laboratories |
| LOM-SOP-ES-216 | Proficiency Test Samples |
| LOM-SOP-ES-218 | Final Review of Analytical Reports |
| LOM-SOP-ES-219 | Documentation for the Parallax Analysis Definition Function |
| LOM-SOP-ES-221 | Analytical Methods for Nonstandard Analyses |
| LOM-SOP-ES-222 | Instrument and Equipment Maintenance and Calibration |
| LOM-SOP-ES-223 | Missed Holding Time Reports |
| LOM-SOP-ES-224 | Data Rounding, Parallax Entry, Verification, and Reporting |
| LOM-SOP-ES-225 | Reagents and Standards |
| LOM-SOP-ES-226 | Validation and Authorization of Analytical Methods |
| LOM-SOP-ES-227 | Communicating Maximum Contaminant Level (MCL) Exceedances |

## Index of Corporate Procedures

| Procedure No. | Title |
|---|---|
| LOM-SOP-ES-230 | Investigation and Corrective Action Reporting for Laboratory Problems |
| LOM-SOP-ES-231 | Handling of Client Technical Complaints (Investigations and Response) |
| LOM-SOP-ES-232 | Chromatography Integration and Documentation |
| LOM-SOP-ES-233 | Obtaining a Representative Environmental Solid Sample Aliquot |
| LOM-SOP-ES-234 | Legal Chain-of-Custody Documentation |
| LOM-SOP-ES-235 | Certification of Syringes |
| LOM-SOP-ES-236 | HP-UX Target 3.5 Data System Accounts and Electronic Signature Security |
| LOM-SOP-ES-237 | Bay Area Service Center Dangerous Goods Shipping Procedure |
| LOM-SOP-HS-202 | Safety Glasses |
| LOM-SOP-HS-203 | Reporting Work Related Incidents |
| LOM-SOP-HS-204 | Respiratory Protection Program |
| LOM-SOP-HS-207 | Lockout/Tagout |
| LOM-SOP-HS-208 | Emergency Evacuation Plan |
| LOM-SOP-HS-209 | Environmental, Health, and Safety (EHS) Assessments |
| LOM-SOP-HS-210 | Hot Work Permit Program |
| LOM-SOP-HS-211 | Environmental Hazardous Sample Communication Procedure |
| LOM-SOP-HS-212 | Incident Response Plan |
| LOM-SOP-HS-213 | Radiation Safety Program |
| LOM-SOP-HS-214 | Disposal of Regulated Medical Waste |
| LOM-SOP-HS-215 | Automated External Defibrillator (AED) Program |
| LOM-SOP-HS-218 | Pharmaceutical Sample Handling |
| LOM-SOP-HS-219 | Management of Hazardous Wastes in the Laboratory |
| LOM-SOP-LAB-201 | Writing and Reviewing Lancaster Laboratories Policies and Operating Procedures |
| LOM-SOP-LAB-202 | Document Control |
| LOM-SOP-LAB-203 | Data and Record Storage, Security, Retention, Archival, and Disposal |
| LOM-SOP-LAB-204 | Regulatory Training |
| LOM-SOP-LAB-205 | E-Mail System |
| LOM-SOP-LAB-206 | Windows Network and Computer Accounts |
| LOM-SOP-LAB-207 | Utilizing the Services and Support of the Computer Systems Group |
| LOM-SOP-LAB-208 | Laboratory Balances |
| LOM-SOP-LAB-209 | Facility Change Control Procedure |
| LOM-SOP-LAB-211 | Client Credit Procedure |
| LOM-SOP-LAB-212 | Building Security |
| LOM-SOP-LAB-213 | Insect and Rodent Control |
| LOM-SOP-LAB-214 | Use and Maintenance of Reagent Water Supply |
| LOM-SOP-LAB-216 | Use of the Dixon Test to Evaluate Outlying Observations |
| LOM-SOP-LAB-218 | Procurement of Laboratory Supplies |
| LOM-SOP-LAB-219 | Review of Legal Matters |
| LOM-SOP-LAB-220 | Laboratory Notebooks, Logbooks, and Documentation |
| LOM-SOP-LAB-221 | Laboratory Housekeeping and Cleaning |
| LOM-SOP-LAB-223 | Facilities Operation Manual |
| LOM-SOP-LAB-224 | Compliance with Good Laboratory Practice Regulations |

## Index of Corporate Procedures

| Procedure No. | Title |
|---|---|
| LOM-SOP-LAB-225 | Position Qualification Descriptions (PQDs) and Essential Job Functions (EJFs) |
| LOM-SOP-LAB-226 | Guidelines for Analytical Decision Making |
| LOM-SOP-LAB-228 | Use of PreCovery for Disaster Recovery Planning |
| LOM-SOP-LAB-229 | Site Computer Control Guide |
| LOM-SOP-LAB-230 | Environmental Health and Safety Training |
| LOM-SOP-LAB-231 | Employee Training Program |
| Policy 0001 | Manual Integration |
| Policy 0006 | Computer Services Validation Master Plan (CSVMP) Policy |
| Policy 0007 | Laboratory Ethics and Data Integrity Policy |
| Policy 0010 | Preparedness, Prevention, and Contingency Plan |
| Policy 0011 | Exposure Control Plan for Bloodborne Pathogens |
| Policy 0012 | Corporate Change Control Policy for Lancaster Laboratories |
| Policy 0016 | Prevention of Cross-Contamination in the Biopharmaceutical Laboratories |
| Policy 0017 | Operation of the Viral Clearance Suites |

## Index of Environmental and Supporting Departmental Procedures

| Procedure No. | Title |
|---|---|
| ***Client Services*** | |
| SOP-CL-005 | Tracking and Communicating Rush Results |
| SOP-CL-006 | Phone Log and Email Documentation |
| SOP-CL-007 | Auditing Client Paperwork |
| SOP-CL-008 | Preparing Quotations |
| SOP-CL-010 | Scheduling and Pricing of Rush Samples |
| SOP-CL-012 | Daily or Weekly DEP Reporting |
| SOP-CL-013 | Monthly DEP Reporting |
| SOP-CL-014 | Sample Set-Up Form Creation Guide |
| SOP-CL-015 | Client Concern and ISPD Code Entry |
| SOP-CL-016 | Creating Bottle Orders |
| SOP-MK-104 | Client/Prospects Visits |
| SOP-MK-105 | Proposal Preparation |
| ***Computer Applications Development*** | |
| SOP-CS-018 | Configuration Management |
| SOP-CS-049 | Implementation of the Computer Services Division Validation Master Plan |
| SOP-CS-062 | Validation of Spreadsheets for Pharmaceutical Sciences Division using the Software Development Lifecycle |
| ***Computer Systems*** | |
| SOP-CS-026 | Oracle Database Installation Manual |
| SOP-CS-030 | System Administration for Oracle |
| SOP-CS-031 | Server Backup/Recovery Manual |
| SOP-CS-034 | Computer Services Procedures for Incident and Defect Tracking |
| SOP-CS-041 | Network Management |
| SOP-CS-048 | Service Request |
| SOP-CS-052 | Personal Computer Management and Disposal |
| SOP-CS-055 | Server Management |
| SOP-CS-057 | Processing of Cross Charges |
| SOP-CS-058 | Software Management |
| SOP-CS-061 | Standby Databases |
| SOP-CS-064 | Firewall Management |
| SOP-CS-065 | Configuration and Maintenance of EmailXtender |
| SOP-CS-066 | System Administration for IBM Servers |
| SOP-CS-070 | Account Administration |
| SOP-CS-071 | Computer Operating System and Software Patching |
| SOP-CS-072 | Information Systems Disaster Recovery Plan |
| TRN-CS-001 | Introduction to Software Quality |
| ***Data Deliverables*** | |
| SOP-DP-002 | Flow of Data Through the Data Deliverables Department |
| SOP-DP-007 | Processing and Sending Data Packages |
| SOP-DP-009 | Overchecking the Electronic Data Deliverable |
| SOP-DP-010 | Assembly/Content Review of Environmental Data Package |
| SOP-DP-011 | QA/QC Compliance Review of Environmental Data Packages |

## Index of Environmental and Supporting Departmental Procedures

| Procedure No. | Title |
|---|---|
| SOP-DP-013 | Maintenance of Bell+Howell Copiscan 8000 Spectrum Scanner |
| SOP-DP-014 | Preparation of Data Packages on CD ROM |
| SOP-DP-017 | GC/MS Volatiles Data Package Assembly |
| SOP-DP-021 | Dept 4038 Assembly of Instrumental Water Quality Data Packages |
| SOP-DP-022 | Archiving Department 4025 Raw Sample Data and Other Miscellaneous Data |
| SOP-DP-024 | Assembly of Inorganic Metals Data Packages |
| SOP-DP-027 | Assembly of Data Packages for Department 4025 |
| SOP-DP-028 | Tune File Folders Contents |
| SOP-DP-029 | Assembly of Department 4024 Data Packages |
| SOP-DP-030 | Assembly of GC/MS Semivolatile Data Packages |
| SOP-DP-031 | Assembly of Semivolatile Archive Batch Department 4026 |
| SOP-DP-032 | Raw Data Labeling for CLP Protocol |
| SOP-DP-033 | Assembly of Department 4032 Data Packages |
| SOP-DP-034 | Generation and Content Review of GLP Compliant Data Packages |
| SOP-DP-035 | Department 4029 Assembly |
| SOP-DP-036 | Assembly of Department 4030 Data Packages |
| ***Environmental Microbiology*** | |
| 0199, 11028 | Modification Fecal Coliform by Membrane Filtration |
| 0307, 4196 | Heterotrophic Plate Count Testing for Environmental Solid and Liquid Samples Pour Plate Method |
| 0308 | Free Chlorine Residual Data Records (Optional Total Chlorine Reading) |
| 0416 | Modification DPD Free Chlorine Residual In Water (Presence/Absence) |
| 6157, 6158 | Hydrocarbon Degrading Plate Count Study Waters and Solids |
| 6477, 6479, 8161 | Total Coliform and E. coli Analysis Potable Water (Presence/Absence), 6477 Swimming Pool Samples, 6479 Potable Water (Quantitative), 8161 |
| OMC-PM-078 | Quanti-Tray X Sealer |
| SOP-PM-041 | Quality Control/Quality Assurance Procedure for Environmental Microbiology |
| ***EPH/Misc. GC*** | |
| 0380 | Extraction of Solids/Soils for Analysis of Alcohols |
| 0497 | Silica Gel Fractionation for Hydrocarbons by GC in Soil and Water Matrices |
| 0969 | CCWE Water Miscible Solvents |
| 10318, 10319 | Determination of Terphenyls in Water and Soils Using Gas Chromatography with Flame Ionization Detection (GC-FID) |
| 10441 | Hydrocarbon Oil Index |
| 10442 | Hydrocarbon Oil Index Waters Procedure |
| 10581, 10584 | Amines by Gas Chromatography with Direct Injections |
| 10600, 10601 | TPH-DRO by GC-FID using 8015C in Water and Soil (Diesel Range Organics) |
| 10942, 11509 | Microwave Extraction for the Determination of Diesel Range Organics (DRO) and Saturated Hydrocarbons in a Solid Matrix |
| 11029WI | Extraction Procedure for Wisconsin DRO Soils and Solid Waste |
| 11507, 11554 | Total Saturated Hydrocarbons in Waters and Solids by Gas Chromatography using Flame Ionization Detection (GC/FID) |
| 11551 | Extraction of Soils/Solids for Glycol Analysis |
| 11599, 11600 | Alumina Column Cleanup of Solids |
| 11657 | Waste Dilution for the Determination of Saturated Hydrocarbons in an Oil Matrix |
| 11681 | 10g Silica Gel Cleanup for Hydrocarbons by GC in Soil and Water Matrices |

## Index of Environmental and Supporting Departmental Procedures

| Procedure No. | Title |
|---|---|
| 1464, 1469, 10007 | Analytical Method for the Determination of Total Extractable Hydrocarbons (TEH) by GC-FID |
| 2012, 2535 | Qualitative/Quantitative GC Fingerprint |
| 2099, 2100, 0347, 0359 | Analytical Method for the Determination of Petroleum Range Organics in Waters and Soils using FL-PRO |
| 2110, 2112 | Method for the Determination of Extractable Petroleum Hydrocarbons by GC/FID using OA-2 Iowa/Missouri Protocol for Waters and Soils |
| 2168MT | Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in a Solid Matrix by Montana Protocol |
| 2366, 2380 | PMI Volatile Organic Compounds by Direct Injection GC/FID |
| 2768, 2769 | TPH by CT ETPH |
| 4833 | Extraction Procedure for the Determination of GC Fingerprint on Petroleum Products in Soil or Solid Matrix by Sonic Disruption |
| 5256, 5260, 8734, 8735 | TPH by GC-FID and TPH by Custom 8015B |
| 5665, 5666 | WADOE- Method for the Determination of Volatile Petroleum Hydrocarbons (VPH) Fractions |
| 6624, 10501, 10603, 10604 | Water Miscible Solvents by GC-FID |
| 7001 | Determination of the Volatile Organic Concentration of Waste Samples by FID and ELCD |
| 7003, 11164, 11167, 11171, 11172, 11176, 11177, 11181, 11182, 11183, 11189, 11190, 11191, 11195, 11196, 11201 | Separatory Funnel Extraction Procedure for the Determination of Diesel Range Organics in a Water or Wastewater Matrix |
| 7004, 11204, 11205, 11209, 11210, 11215, 11216, 11219, 11220, 11221, 11224, 11225, 11228, 11229, 11232, 11233, 11236, 11237 | Extraction Procedure for the Determination of Diesel Range Organics in Soil or Solid Matrix |
| 7004ME | Extraction Procedure for the Determination of Total Petroleum Hydrocarbon Organics in Soil or Solid Matrix Maine Methodology |
| 7105, 10602 | Determination of Volatile Hydrocarbons in Water Using Headspace Sampling Techniques and Gas Chromatography with Flame Ionization Detection (GC-FID) |
| 7553, 7554 | Analysis for TPH-DRO (Diesel Range Organics) in Soils or Waters by Wisconsin DRO Methodology |
| 7645 | Silica Gel Cleanup for Hydrocarbons by GC in Soil and Water Matrices |
| 8093, 8107, 2500, 2516, 2729, 2740, 0071, 0072, 0965, 1020, 6631, 6635, 10199, 10365 | Analysis of Total Petroleum Hydrocarbons with Ranges by GC-FID |
| 8097 | Determination of Carbon Dioxide in Water Using Headspace Sampling Techniques and Gas Chromatography with Thermal Conductivity Detection (GC-TCD) |
| 8269, 8270, 1070, 1104, 1736, 1737, 2216, 2222, 2251, 2252, 8345, 8349, 6609, 6610, 5867, 5868, 6884, 6885, 6901, 6902, 6912, 6913, 10941 | TPH-DRO by 8015B (Diesel Range Organics) |
| 8271, 8272, 2211, 2214 | TPH by NWTPH-Dx (modified) in Waters and Soils using GC-FID |
| 8278, 11099 | Analysis of Glycols in Waters using GC-FID |

## Index of Environmental and Supporting Departmental Procedures

| Procedure No. | Title |
|---|---|
| 8283 | Analysis of Glycols in Soils by GC-FID |
| 8323, 8324, 6976, 7062 | Method for the Determination of Fractionated Extractable Petroleum Hydrocarbons using LA RECAP Ranges |
| SOP-EP-006 | Maintenance and Troubleshooting Procedures for GC-FID Instrumentation |
| SOP-EP-008 | Common Equations Used During Chromatographic Analyses |
| SOP-EP-009 | QC Data Acceptability and Corrective Action |
| SOP-EP-010 | Monitoring QC Data Acceptance Limits |
| SOP-EP-011 | Interpretation and Integration of Chromatographic Data |
| ***Field Sampling*** | |
| MC-FS-002 | Maintenance and Calibration of pH Probes and Meters |
| SOP-FS-002 | Wastewater Field Sampling Procedures |
| SOP-FS-003 | Soil Sampling Procedures |
| SOP-FS-004 | Collecting Potable Water Samples |
| SOP-FS-006 | Groundwater Monitoring Sampling Procedure |
| SOP-FS-008 | Direct Field Readings Using Orion Model 1230 Multi-Parameter Meter |
| SOP-FS-009 | Symphony Multi-Parameter Meter |
| SOP-FS-010 | Low Level Mercury Sampling |
| ***GC/MS Semivolatiles*** | |
| 0381, 10478, 10480, 10483, 10487L | Low-Level Sonic Probe Extraction Procedure for the Determination of Semivolatiles in a Solid Matrix |
| 0381DIL | Waste Dilution Procedure for the Determination of Acid Extractables and Base-Neutrals in a Non-Water Soluble Matrix |
| 0382, 1196 | Dioxin Screening of Water and Soils (Screening Procedure for 2,3,7,8-Tetrachlorodibenzo-p-Dioxin by Selective Ion Monitoring Gas Chromatography/Mass Spectrometry) |
| 0813, 11010, 11015, 10464, 10467, 10476 | Separatory Funnel Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables in a Wastewater Matrix by SW-846 Method 3510C |
| 0813THPA | Solid Phase Extraction Procedure for the Determination of THPA, THPI and PA in a Water Matrix |
| 0885, 0886, 0887, 0893, 7125 | Semivolatile Organics Tentatively Identified Compound Method |
| 0941, 0774, 0627 | Polynuclear Aromatic Hydrocarbons in Soils, Sludges, Water, and Wastewater |
| 0949, 1309, 1476, 1536, 1946, 1947, 1953, 2035, 2395, 4615, 4678, 4688, 6387, 6397, 7804, 7805, 10032, 10723, 10724, 10727, 10728, 11013 | Determination of Semivolatile Organic Compounds by Method 8270C |
| 10215 | The Determination of d-Limonene in Plastic by Gas Chromatography/Mass Spectrometry (GC/MS) |
| 10333 | Analysis of Semivolatile Compounds in Drinking Water by Method 525.2 |
| 10334, 2783 | Determination of Priority Pollutants by Method 625 |
| 10458 | Liquid/Liquid Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables in a Wastewater Matrix by Method 8270 |
| 10461, 10462, 10726 | Determination of Semivolatile Organic Compounds by Method 8270D |
| 10472 | Extraction Procedure for the Determination of Tetraethyl Lead in a Water or Wastewater Matrix |
| 10475 | Extraction Procedure for the Determination of 2-Chlorbenzalmalonotrile (CS) and 3-Quinuclidinyl Benzilate (BZ) in Water and Wastewater |

## Index of Environmental and Supporting Departmental Procedures

| Procedure No. | Title |
|---|---|
| 10479, 10484, 10489 | Sonic Probe Extraction Procedure for the Determination of Semivolatiles in a Solid Matrix by SIM |
| 10498, 10809, 10810, 10811, 10812, 10813, 10814, 11630 | Microwave Extraction Procedure for the Determination of Semivolatiles in a Solid Matrix |
| 10962, 11622 | Determination of N-Nitrosodimethylamine (NDMA) in Water and Soil by EPA 1625C |
| 11012, 10470, 10471SIM | Separatory Funnel Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables by SIM in a Wastewater Matrix |
| 11629 | Liquid/Liquid Extraction Procedure for the Determination of Neutral Extractables in a Wastewater Matrix |
| 1542, 2345 | Determination of cis-1,2,3,6-Tetrahydrophthalic anhydride (THPA), cis-1,2,3,6-tetrahydrophthalimide (THPI), Phthalic anhydride (PA) in Water/Wastewater by SPE and Soil by Sonic Probe Extraction with analysis by GC/MS |
| 2026 | Analysis of Chlorinated Herbicides in Water by Selective Ion Monitoring Gas Chromatography/Mass Spectroscopy (SIM/GC/MS) |
| 3337, 11150 | Separatory Funnel Extraction Procedure for the Determination of Polynuclear Aromatic Hydrocarbons (PAH) in Water and Wastewater |
| 3338 | Sonication Extraction Procedure for the Determination of Polynuclear Aromatic Hydrocarbons (PAH) in a Solid Matrix |
| 4220, 4221 | Determination of Tetraethyl Lead (TEL) and Tetramethyl Lead (TML) by GC/MS Analysis |
| 4372, 4438, 4722, 4723 | CLP Semivolatile Analysis of Waters and Soils by the OLM03.2 and/or the OLM04.3 Statement of Work |
| 4606 | Liquid-Liquid Extraction Procedure for the Determination of Target Compound List Analytes in a Water Matrix |
| 4607L | Low-Level Sonic Probe Extraction Procedure for the Determination of Target Compound List Analytes in a Solid Matrix |
| 4731 | Separatory Funnel Extraction Procedure for the Determination of Base Neutrals and Acid Extractables in a Toxicity Characteristic Leachate by SW-846 Method 3510C |
| 4731DIL | Waste Dilution Procedure for the Determination of Acid Extractables and Base-Neutrals in a Non-Water Soluble Leachate Matrix |
| 4894 | Extraction of Organic Compounds in Drinking Water By Method 525.2 |
| 6007 | Paraquat in Wastewater by HPLC |
| 6570 | The Determination of Semivolatiles by Large Volume Injection (LVI) Gas Chromatography/Mass Spectrometry (GC/MS) |
| 7325, 0089 | Determination of Benz(a)pyrene in Smokeless Tobacco by Selective Ion Monitoring Gas Chromatography/Mass Spectrometry (SIM/GC/MS) |
| 7806 | Low-Level Sonication Extraction Procedure for the Determination of Polynuclear Aromatic Hydrocarbons (PAHs) in a Solid Matrix by GC/MS |
| 7806AIR | Extraction Procedure for the Determination of Polycyclic Aromatic Hydrocarbons (PAHs) in an XAD Air Tube Sample |
| 7807 | Extraction Procedure for the Determination of Polynuclear Aromatic Hydrocarbons (PAH) in Water and Wastewater by GC/MS |
| 8108 | Separatory Funnel Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables in a Wastewater Matrix by Method 625 |
| 8108TJ | Sonic Probe Extraction Procedure for the Determination of Semivolatiles in a Complex Matrix |
| 8357, 2858, 0038, 0039, 10010, 10137, 10138, 10722, 10725 | The Determination of Semivolatiles by Selected Ion Monitoring (SIM) Gas Chromatography/Mass Spectrometry (GC/MS) |
| MC-EX-001 | GC/MS Preventative and Corrective Maintenance |
| MC-EX-003 | Preventative and Corrective HPLC Maintenance |
| MC-OE-003 | Semivolatile Extract Cleanup Using Gel Permeation Chromatography |
| SOP-EX-001 | Semivolatile Spiking and Calibration Standards |
| SOP-EX-006 | GC/MS Electronic Data Management and Handling |
| SOP-EX-008 | Quality Control Spike Mix Verification |
| SOP-EX-009 | GC/MS Audit Process |
| SOP-EX-019 | Semivolatile Run/Injection Log Generation |
| SOP-EX-020 | Monitoring QC Data Acceptance Limits |

## Index of Environmental and Supporting Departmental Procedures

| Procedure No. | Title |
|---|---|
| ***GC/MS Volatiles*** | |
| 0373 | Preparation of Oil Samples |
| 0527, 10326 | The Determination of 1,4-Dioxane by Gas Chromatography/Mass Spectrometry (GC/MS) using Isotope Dilution and Selective Ion Monitoring (SIM) |
| 0527, 10903, 10904, 10949, 10950 OH VAP | Volatile Compounds in Aqueous and Solid Samples by SW-846 8260B and 1,4-Dioxane in Aqueous Samples by SW-846 8260B Selective Ion Monitoring (SIM) |
| 0882, 0884 | Volatile Organics Tentatively Identified Compound Method (interpretive) |
| 0890, 0880 | Volatile Organics Tentatively Identified Compound Method |
| 10237, 10607, 10949, 10950, 10951 | Determination of Volatile Target Compounds and Gasoline Range Organics (GRO) by Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS) in Soils and Solids by Method 8260B |
| 10371 | Waters for Volatile Organic Compounds by Purge and Trap Gas Chromatography/Mass Spectrometry using EPA Method 624 |
| 10460 | Determination of Volatile Target Compounds by Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS) in Waters and Wastewaters by Method 6200B |
| 10903, 10904, 10949, 10950WI | Soils, Solids, and Waters from Wisconsin for Volatile Target Compounds by Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique |
| 11017 | The Determination of 1,2,3- Trichloropropane by Gas Chromatography/Mass Spectrometry (GC/MS) using Isotope Dilution and Selective Ion Monitoring (SIM) |
| 11660 | Targeted Library Search by GC/MS |
| 2394, 2417 | The Determination of Volatile Organic Compounds in Wastewater by Isotope Dilution and Gas Chromatography/Mass Spectrometry (GC/MS) |
| 2601, 3540 | Waters for Volatile OLM4.3 Target Compound List Compounds |
| 2657, 3596 | Soils for Volatile OLM04.3 Target Compound List Compounds |
| 2898, 10335, 10903, 10904, 10905, 10943, 10945 | Determination of Volatile Target Compounds and Gasoline Range Organics (GRO) by Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS) in Waters and Wastewaters by Method 8260B |
| 3636 | Toxicity Characteristic Leachate Procedure (TCLP); Analysis of Zero Headspace Extractions (ZHE) of Solid Waste, Soils, and other Matrices for Volatile Target Compounds by Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique |
| 3648 | Waters for Purgeable Organic Compounds by Capillary Column Gas Chromatography Mass Spectrometry |
| 4914 | Low Concentration Waters for Volatile Organic Analysis |
| 6008 | The Determination of Vinyl Chloride and Carbon Disulfide by Gas Chromatography/Mass Spectrometry (GC/MS) using Selective Ion Monitoring (SIM) |
| 6372, 6377 | The Determination of Ethylene Oxide and Crotonaldehyde by Gas Chromatography/Mass Spectrometry (GC/MS) in Water and Soil by SW-846 Method 8260B |
| 7126 | Volatile Organics Library Search Method for CLP |
| 7156 | Waters for Volatile OLM03.2 Target Compound List Compounds |
| 7157 | Soils and Solids for Volatile OLM03.2 Target Compound List Compounds |
| SOP-MS-001 | Glassware Cleaning |
| SOP-MS-002 | Preparation and Testing of Trip Blanks for GC/MS Volatile Analyses |
| SOP-MS-004 | GC/MS Instrumentation Maintenance |
| SOP-MS-005 | Preservation and Residual Chloride Checks of Samples for GC/MS Volatile Water Analysis |
| SOP-MS-006 | GC/MS Volatile Standards Traceability |
| SOP-MS-007 | Preparation and Analysis of Cleaning Blanks for GC and GC/MS Volatiles |
| SOP-MS-012 | GC/MS Volatiles Audit Process |
| SOP-MS-014 | Volatile Run/Injection Log Generation |
| SOP-MS-015 | Preparation and Testing of Storage Blanks for GC/MS Volatile Analysis |
| SOP-MS-016 | Use of 40-mL Vials for Volatile Organic Analyses |

## Index of Environmental and Supporting Departmental Procedures

| Procedure No. | Title |
|---|---|
| SOP-MS-017 | Level II Review of GS/MS Volatiles |
| ***Instrumental Water Quality*** | |
| 0217, 1511, 0223, 4235, 6165 | Automated Determination of Total Kjeldahl Nitrogen in Water, Wastewater, and Solids |
| 0219, 5991 | Nitrite Nitrogen in Water and Wastewater (Colorimetric, Automated) |
| 0220, 7882, 5992 | Nitrate Nitrogen in Water and Wastewater (Colorimetric, Automated Cadmium Reduction) |
| 0224, 0228, 0332, 0368, 1504, 1505, 1506, 7322, 7332, 7333, 7334, 7335, 7336, 7337, 7338 | Determination of Inorganic Anions by Ion Chromatography |
| 0227, 0345, 1546, 5893, 5894 | Determination of Total and Soluble Phosphorus in Water, Wastewater, and Soils (Colorimetric, Ascorbic Acid, Automated) |
| 0237, 1123, 1549, 5895, 5898, 8255, 0241, 4814, 0961, 0957, 0959 | Determination of Total and Amenable Cyanide in Water, Wastewater, and Soils, Free Cyanide in Water and Wastewater, Reactive Cyanide of Solids, and Weak and Dissociable Cyanide in Waters and Soils |
| 0273, 6090, 7547 | Determination of Total Organic Carbon, Dissolved Organic Carbon, and Inorganic Carbon in Water and Wastewater |
| 0354 | Determination of Total Organic Carbon in Water and Wastewater (Quadruplicate Studies) |
| 0370, 0371, 1105, 1106 | Determination of Nitrocellulose in Water and Soil |
| 0434, 2393, 5912 | Automated Determination of Phenols in Water, Wastewater, and Soils By Automated Flow Analyzer |
| 0491, 5911, 8123 | Phenol Distillation (as Preparation for Analysis on the Flow Analyzer) |
| 0492, 1548, 5896, 5897, 8256, 0956, 0958 | Total and Amenable Cyanide Distillation (As Preparation for Analysis on the Automatic Flow Analyzer) |
| 10704, 10705 | Determination of Total Cyanide in Water, Wastewater, and Soils (Department of Defense) |
| 11151 | Total Cyanide Analysis by Massachusetts Contingency Plan (MCP) |
| 1352, 10129 | Deionized Water Extraction (as Preparation for Analysis on the Ion Chromatograph or Autoanalyzer) |
| 1460 | Total Kjeldahl Nitrogen Digestion of Water and Wastewater (A Preparation for Analysis #0217) |
| 1465 | Total Kjeldahl Nitrogen Digestion of Solids and Soils (a preparation for Analysis #1511) |
| 1550 | Determination of Total Carbon in Water and Wastewater |
| 2079, 0383, 6623, 10065, 11356, 11763 | Determination of TOC and TC in Solids and Sludges by Combustion |
| 2111, 2118, 2121, 2553 | Moisture by Sartorius Moisture Analyzer/Moisture by Mettler Toledo HB43 |
| 3343, 5910, 5861, 5863 | Automated Determination of Total Cyanide in Water, Wastewater, and Soils by CLP Protocol |
| 3344, 5909, 5860, 5862 | Total Cyanide Distillation (As Preparation for Analysis on the Automated Analyzer) by CLP Protocol |
| 5892, 6467 | Determination of Hexavalent Chromium by Ion Chromatography in Solids and Waters |
| 6019, 10130, 10147 | Determination of Perchlorate by Ion Chromatography |
| 7528, 0960 | Weak and Dissociable Cyanide Distillation (as Preparation for Analysis on the Flow Analyzer) |
| 8261, 8262, 8263, 8264, 8895 | Digestion of Total and Soluble Phosphorus in Water, Wastewater, and Soils |
| MC-IC-001 | Adjustable Volume Handheld Pipettes |
| MC-IC-003 | pH Electrodes and Meters |
| MC-IC-005 | Maintenance and Calibration of A.I. Scientific AIM600 Digestor |
| MC-IC-006 | Maintenance of the OI Analytical Model 1030 Total Organic Carbon Analyzer |
| MC-IC-007 | Maintenance of Continuous Flow Analyzers |

## Index of Environmental and Supporting Departmental Procedures

| Procedure No. | Title |
|---|---|
| MC-IC-008 | Accusterilizer - Steam Sterilizer |
| MC-IC-009 | Automatic Pipette Dispensers |
| MC-IC-010 | DX-500, DX-320, ICS-1000, ICS 1100, and ICS-3000 Ion Chromatography Systems |
| SOP-IC-004 | Quality Control for Auto-Analyzer Analyses Performed in Instrumental Water Quality |
| SOP-IC-010 | Use of Cardy Compact Ion Meter to Prescreen Nitrate-Nitrogen Samples |
| SOP-IC-016 | Department 4027 Chemical Inventory and Review Procedures |
| SOP-IC-017 | Maintenance of the OI Analytical Total Organic Carbon Solids Analyzer |
| ***Leachate Preparation*** | |
| 0447 | Shake Extraction of Solid Waste with Water ASTM Method #D3987-85 |
| 0946, 2573, 0075 | Toxicity Characteristic Leaching Procedure TCLP Zero Headspace Leachates |
| 0947, 1339 | Toxicity Characteristic Leaching Procedure TCLP Nonvolatile Leachates |
| 1435, 1436 | Waste Extraction Test Leaching Procedure for Volatile and Non-volatile Analytes |
| 1567 | Synthetic Precipitation Leaching Procedure (SPLP) for Nonvolatile Leachates |
| 2487 | Food and Tissue Preparation |
| 2595 | Cation Exchange Capacity of Soils (Sodium Acetate) |
| 8792, 1339 | Synthetic Precipitation Leaching Procedure (SPLP) Zero Headspace Leachates |
| MC-TL-001 | pH Meters and Probes |
| MC-TL-002 | Calibration of the Leachate Tumblers |
| SOP-TL-001 | Glassware Cleaning for Leachate Extractions |
| SOP-TL-002 | Leachate Blank Evaluations |
| SOP-TL-003 | Subsampling and Preservation of Leachates |
| SOP-TL-004 | Manually Pressurized Zero Headspace Extractor (ZHE) |
| SOP-TL-005 | Procedure for Calculating and Reporting Weighted Average Results for TCLP Extracts |
| ***Metals*** | |
| 0259, 0159 | Mercury in Aqueous, Solid, and Tissue Samples by Cold Vapor AA |
| 0259, 0159.OH VAP | Mercury in Aqueous and Solid Samples by SW-846 Method 7470A (Aqueous) and 7471A (Solid) |
| 0494 | Sample Preparation of Soil, Sediment, and Sludge for Total Mercury Analysis by Atomic Absorption Cold Vapor Technique |
| 0576 | Langelier Index in Water |
| 0821, 5713, 5714 | Digestion of Aqueous Samples by SW-846 Method 7470A, EPA 254.1, CLP2.10, CLP4.0 and CLP 5.2. |
| 0821, 5713, 5714WB | Sample Preparation of Potable Water and Wastewater for Total Mercury Analysis by Cold Vapor Technique |
| 1015, 11355 | Sample Preparation of Oils for Analysis of Metals by Inductively Coupled Plasma Spectroscopy |
| 1573, 1574 | Mercury in Aqueous and Solid Samples by SW-846 Method 7470A (aqueous) and 7471A (solid) |
| 1848, 5720, 10635 | Sample Preparation of Waters for Analysis of Total Recoverable Metals by Inductively Coupled Plasma Atomic Emission Spectrometry |
| 1849 | Preparation of Soil, Sediment, and Sludge for Analysis of Metals by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES) |
| 2812, 10651 | 3030 C. Treatment for Acid-Extractable Metals for North Carolina Groundwater Samples |
| 4792 | Dilute/Run and AVS/SEM Sample Handling for Metals |
| 5281 | Undigested Sample Preparation of Potable Water for Analysis of Total Recoverable Metals by Inductively Coupled Plasma Atomic Emission Spectrometry |
| 5705, 10636 | Sample Preparation of Wastewater and Leachates for Analysis of Total Metals by Inductively Coupled Plasma Atomic Emission Spectrometry |
| 5708, 10637, 11026, 11027 | Sample Preparation of Sediments, Sludges, Soils, and Fish Tissue for Analysis of Metals by Inductively Coupled Plasma Atomic Emission Spectrometry and Inductively Coupled Plasma Mass Spectrometry |

## Index of Environmental and Supporting Departmental Procedures

| Procedure No. | Title |
|---|---|
| 5708, 10637, 11026, 11027OH VAP | Preparation of Solid Samples for Analysis of Metals by Inductively Coupled Plasma Atomic Emission Spectrometry |
| 5708II | Sample Preparation of Sediments, Sludges, and Soils for Analysis of Metals by Inductively Coupled Plasma Atomic Emission Spectrometry (5708) |
| 5711 OH VAP | Digestion of Solid Samples by SW-846 Method 7471A |
| 5711, 10638 | Sample Preparation of Soil, Sediment, Sludge, Oils, and Fish Tissue for Total Mercury Analysis by Atomic Absorption Cold Vapor Technique |
| 5713 OH VAP | Digestion of Aqueous Samples by SW-846 Method 7470A |
| 5716 | Sample Preparation of Potable Water, Groundwater, Surface Water, and Wastewater for Analysis of Total Recoverable Metals by Inductively Coupled Plasma Atomic Emission (5716) |
| 6050, 10639 | Sample Preparation of Leachates and Other Wastewater for Analysis of Total Metals by Inductively Coupled Plasma-Mass Spectrometer (ICP-MS) |
| 6051 | Undigested Sample Preparation of Potable Water for Analysis of Total Recoverable Metals by Inductively Coupled Plasma Mass Spectrometry [ICP-MS] |
| 6052 | Sample Preparation of Wastewater for Analysis of Total Recoverable Metals by Inductively Coupled Mass Spectrometer (ICP-MS) |
| 6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961,10145, 6955, 6944, 6936, 6969, 7968, 6970, 6925, 6971, 6972, 10146, 7066, 1743, 7035, 8014, 7046, 7047, 1750, 7049, 7052, 7051, 7053,... | Metals by Inductively Coupled Plasma Atomic Emission Spectroscopy for SW-846 Methods 6010A/B (aqueous, solid, tissue), CLP 2.1(water/solid/tissue), CLP 4.0(water/solid/tissue), CLP 5.2 (water/solid/tissue) and EPA 200.7(aqueous) |
| 7050 | Sample Preparation of Potable Water, Groundwater, Surface Water, and Wastewater for Analysis of Total Recoverable Metals by Inductively Coupled Plasma-Mass Spectrometry (7050) |
| MC-IO-003 | Fixed-Volume Hand-Held and Electronic Pipettes |
| MC-IO-017 | Maintenance and Calibration of HACH Model 2100N Laboratory Turbidimeter |
| MC-IO-019 | Bottletop Dispensers |
| SOP-IO-001 | Preservation, Storage Conditions, and Holding Times for Inorganic Samples |
| SOP-IO-005 | Quality Control Procedures for Mercury |
| SOP-IO-007 | Preparation of Standards and Solutions |
| SOP-IO-007, Section A | Reagents |
| SOP-IO-007, Section D | ICPMS Solutions |
| SOP-IO-007, Section E | Mercury Solutions |
| SOP-IO-007, Section G | Prep Room Solutions (Waters) |
| SOP-IO-007, Section H | Prep Room Solutions (Solids) |
| SOP-IO-011 | Inorganic Analysis Safety and Waste Handling Procedures |
| SOP-IO-012 | Calculations Used by the Inorganics Group |
| SOP-IO-013 | Glassware Cleaning |
| SOP-IO-033 | Maintenance for the Perkin Elmer Elan 9000 ICP-MS |
| SOP-IO-034 | Operation of and Analysis with the Perkin-Elmer Elan 9000 ICP-MS |
| SOP-IO-035 | Quality Control Procedures for ICP-MS |

## Index of Environmental and Supporting Departmental Procedures

| Procedure No. | Title |
|---|---|
| SOP-IO-036 | Metals Use of the LLENS System |
| SOP-IO-037 | Quality Control Procedures for Mercury by Cold Vapor Atomic Fluorescence Spectrometry |
| SOP-IO-038 | Maintenance for the Agilent 7500 ICP-MS and ESI SC-8 FAST Autosampler |
| SOP-IO-039 | Operation of the Agilent 7500 Series ICP-MS |
| ***Organic Extraction*** | |
| 0085 | Total Particulates in Air Not Otherwise Regulated |
| 10068 | Sampling Equipment Cleaning and Validation for Metals Analysis |
| 10500 | Pore Water Generation Procedure |
| 1948, 1949, 1950, 1951, 1952 | Soxhlet Extraction Procedure for Extractable Matter in Textiles |
| 4193ASE | Determination of Percentage Fat Using Accelerated Solvent Extraction (ASE) |
| MC-OE-002 | Ultrasonic Processor Maintenance and Tuning |
| MC-OE-007 | Steam Bath and N-Evap Usage. Calibration and Maintenance |
| MC-OE-008 | Refrigerated Recirculators |
| MC-OE-009 | Electrothermal Heating Mantles |
| MC-OE-010 | N-Evap |
| MC-OE-013 | Maintenance and Calibration of the Microwave Accelerated Reaction System |
| SOP-OE-002 | Solvent and Reagent Lot Testing for Organic Extractions |
| SOP-OE-004 | Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs) |
| SOP-OE-005 | pH Meters and Electrodes |
| SOP-OE-006 | Procedure for Containment and Clean Up of Hazardous Materials Spills in Organic Prep Lab |
| SOP-OE-007 | Determining QC Sample Volume for Organic Extractions |
| SOP-OE-008 | Scheduling Extraction Batches |
| SOP-OE-009 | Spike Solution Testing and Approval |
| SOP-OE-010 | Ultrasonic Probe Horn Cleaning |
| SOP-OE-011 | Routine Maintenance of Miele Glass Washers |
| SOP-OE-012 | Pesticide Extract Concentration Using a Zymark TurboVap II Concentration Workstation |
| SOP-OE-013 | Maintenance of Accelerated Solvent Extractor (ASE) and the Pressurized Solvent Extractor (PSE) |
| SOP-OE-014 | Glassware Cleaning using Automatic Washers for non-Organic Extraction Glassware |
| SOP-OE-015 | Semivolatile Extract Concentration Using a Zymark TurboVap II Concentration Workstation |
| SOP-OE-016 | Concentration Using a TurboVap LV Concentration Workstation |
| SOP-OE-017 | Organic Extraction Standards Storage and Handling |
| ***Pesticide Residue Analysis*** | |
| 0144, 0119 | Analysis of Polychlorinated Terphenyls in Solid and Aqueous Samples using Gas Chromatography with Electron Capture Detector |
| 0173, 6030, 7394, 2034, 10227 | Analysis of Polychlorinated Biphenyls (PCBs) in Aqueous Samples using Gas Chromatography with Electron Capture Detection (GC-ECD) |
| 0174 | Determination of PCBs in Oil |
| 0177, 0950, 0180, 1954 | Analysis of Pesticides in Aqueous Samples using GC-ECD |
| 0298 | Determination of Nitroglycerin in Water using Method 8332 |
| 0815 | Waste Dilution Procedure for the Determination of PCBs in Oil |
| 0816, 11110, 11111 | Extraction of Chlorinated Herbicides in a Water Matrix by SW-846 8151A |

## Index of Environmental and Supporting Departmental Procedures

| Procedure No. | Title |
|---|---|
| 0817, 6654, 10241, 11112, 11113, 11114, 11116, 11117, 11118, 11119, 11120, 11121, 11123, 11126 | Separatory Funnel Extraction Procedure for the Determination of Pesticides and PCBs in a Wastewater Matrix |
| 0817DIL | Waste Dilution Procedure for the Determination of Pesticides and PCBs in a Non-Water Soluble Leachate Matrix |
| 0817L, 6654 | Liquid/Liquid Extraction Procedure for the Determination of Organophosphorous Pesticides in a Wastewater Matrix |
| 0819, 11128, 11132, 11135 | Sonic Probe Extraction Procedure for the Determination of Polychlorinated Biphenyls (PCBs) in a Solid Matrix |
| 0819M | Medium Level Sonic Probe Extraction Procedure for the Determination of Pesticides and PCBs in a Solid Matrix |
| 0952, 5593, 5300, 10407 | Analysis of Chlorinated Herbicides in Water by Gas Chromatography (GC) with Electron Capture Detection (ECD) |
| 1013 | Extraction Procedure for the Determination of Formaldehyde and Aldehydes in a Water Matrix |
| 1034, 7934, 7879, 10187 | Analysis of Waters for EDB/DBCP and TCP Using Microextraction and Gas Chromatography with Electron Capture Detector |
| 10496 | Microwave Extraction Procedure for the Determination of Pesticides in a Solid Matrix |
| 10497 | Microwave Extraction Procedure for the Determination of PCBs in a Solid Matrix |
| 10589 | Analysis of Pesticides in Aqueous Samples using Gas Chromatography with Electron Capture Detection (GC-ECD) |
| 10590 | Analysis of Pesticides in Solid Samples using Gas Chromatography with Electron Capture Detection (GC-ECD) |
| 10591 | Analysis of Polychlorinated Biphenyls (PCBs) in Aqueous Samples by GC-ECD |
| 10592 | Analysis of Polychlorinated Biphenyls (PCBs) in Solid Samples by GC-ECD |
| 10709 | Determination of Picric Acid in Soil Samples by HPLC with UV |
| 11696 | Soxhlet Extraction Procedure for the Determination of Polychlorinated Biphenyls (PCBs) in a Solid Matrix |
| 1216, 7512, 8899, 0042, 5108, 6011, 1030, 2033, 10736, 10885 | Analysis of Polychlorinated Biphenyls (PCBs) by Gas Chromatography (GC) with Electron Capture Detector (ECD) in Solid Samples and Wipes |
| 1340 | N-Methylcarbamates in Groundwater and Drinking Water by High Performance Liquid Chromatography (HPLC) |
| 1363, 1420, 4225, 10738 | Analysis of Pesticides in Solid Samples using Gas Chromatography with Electron Capture Detection (GC-ECD) |
| 1509, 10597 | Analysis of Soil and Sediment for N-Methylcarbamate Pesticides |
| 1510, 11143 | Extraction Procedure for the Determination of Carbamate and Urea Pesticides in a Soil or Solid Waste Matrix |
| 1782, 1785 | Analysis of Acephate and Methamidophos using Gas Chromatography with Nitrogen Phosphorous Detection in Aqueous and Solid Samples |
| 1864 | Analysis of Chlorinated Acids in Water Using Capillary Gas Chromatography with an Electron Capture Detector |
| 1869 | Analysis of Aqueous Samples for Chlorinated Pesticides and PCBs by Gas Chromatography with an Electron Capture Detector |
| 1870 | Analysis of Aqueous Samples for Nitrogen- and Phosphorus-Containing Pesticides by Gas Chromatography with a Nitrogen-Phosphorus Detector |
| 2082, 2001 | Determination of m-Benzene disulfonic acid, p-Phenol sulfonic acid, Benzene sulfonic acid, and Resorcinol in Groundwater and Surface Water and Soil |
| 2127, 2144, 6271, 6272 | Determination of Didodecylbenzenesulfonic Acid (KSS) and Calcium Petronate (CP) in Groundwater and Surface Water and Soil |
| 2146 | Preparation of Soils for the Determination of Benzenesulfonic Acid (BSA) |
| 2147 | Preparation of Soils for the Determination of Didodecylbenzenesulfonic Acid (KSS) and Calcium Petronate |
| 2149 | Preparation of Soils for the Determination of Didodecylsulfonic Acid (KSS) |
| 2257, 2253 | Analysis of Captan and Captafol by Gas Chromatography with Electron Capture Detection of Waters and Solids |
| 2265 | Determination of Picric Acid in Water by High Performance Liquid Chromatography (HPLC) with Ultra-Violet (UV) Detection |

## Index of Environmental and Supporting Departmental Procedures

| Procedure No. | Title |
|---|---|
| 2726 | Determination of Dinitrosopentamethylenetetramine in Water by HPLC |
| 2727 | Determination of Azodicarbonamide in Water |
| 3342 | Separatory Funnel Extraction Procedure for the Determination of Pesticides/Aroclors (PCBs) in a Wastewater Matrix by the Contract Laboratory Protocol |
| 4144, 4173, 8044, 8045 | Analysis of Formaldehyde and other Aldehydes in Aqueous and Solid Samples by High Performance Liquid Chromatography (HPLC) |
| 4181 | Extraction of Chlorinated Herbicides in a Soil Matrix |
| 4185 | Sonic Probe Extraction Procedure for the Determination of Pesticides/Aroclors (PCBs) in a Solid Matrix by the Contract Laboratory Protocol |
| 4533, 4562 | Analysis of Water and Soil Samples for Pesticides/Aroclors (PCBs) by the Contract Laboratory Protocol |
| 5366, 10410, 10593 | Analysis of Organophosphorous Pesticides in Aqueous Samples by Gas Chromatography with a Nitrogen-Phosphorous Detector |
| 5367, 10408, 10594 | Analysis of Organophosphorous Pesticides in Solid Samples by Gas Chromatography with a Nitrogen-Phosphorous Detector |
| 5592, 10401 | Analysis of Chlorinated Herbicides in Soil by Gas Chromatography (GC) with Electron Capture Detection (ECD) |
| 5876, 11139 | Extraction Procedure for the Determination of Formaldehyde and Aldehydes in a Solid Matrix |
| 6006, 11129, 11131, 11134 | Sonic Probe Extraction Procedure for the Determination of Pesticides and Polychlorinated Biphenyls (PCBs) in a Solid Matrix |
| 6006SOX | Soxhlet Extraction Procedure for the Determination of Pesticides in a Solid Matrix |
| 6273 | Preparation of Waters for the Determination of Calcium Petronate (CP) |
| 6368 | Separatory Funnel Extraction Procedure for the Determination of Chlorinated Pesticides; Nitrogen and Phosphorus Containing Pesticides; and PCBs in a Drinking Water Matrix |
| 6369 | Extraction of Chlorinated Acids and Herbicides in Drinking Water |
| 6386, 6557 | Determination of Perchlorate in Aqueous Samples and Soil Samples by LC/MS/MS |
| 6550 | Extraction Procedure for the Determination of Carbamate and Urea Pesticides in a Water Matrix by EPA 632 |
| 6568 | Extraction Procedure for Perchlorate in Soil Samples by LC/MS/MS |
| 6677, 11130, 11133, 11142 | Soxhlet Extraction Procedure for the Determination of Triazine Herbicides and Organophosphorous Pesticides in a Solid Matrix |
| 6915, 11122, 11125 | Extraction of Nitroaromatics and Nitroamines in Water |
| 6916, 6918, 10595, 10596, 10412, 10131, 10132 | Determination of Nitroaromatics and Nitroamines in Water and Soil Samples by High Performance Liquid Chromatography (HPLC) with Ultra-Violet (UV) Detection |
| 6917 | Extraction of Nitroaromatics and Nitroamines in Soil |
| 6917DoD | Sonication Extraction of Nitroaromatics and Nitroamines in Soil (DoD) |
| 7153, 7154 | Analysis of Aldehydes and Ketones in Ambient Air by High Performance Liquid Chromatography (HPLC) |
| 7572 | Analysis of Pesticides and Polychlorinated Biphenyls (PCBs) in Aqueous Samples by Method 608 |
| 7786 | Microextraction of 1,2-Dibromoethane (EDB), 1,2-Dibromo-3-chloropropane (DBCP), and 1,2,3-Trichloropropane (TCP), in Water |
| 7799 | Extraction Procedure for the Determination of Ethylene Thiourea in Water by EPA 509 |
| 7800 | Ethylene Thiourea, EPA Method 509 |
| 8145, 8152 | Determination of Methyl Carbamates in Wastewater and Soil |
| 8843 | Organic Acids in Water by HPLC/UV |
| MC-OE-004 | Pesticide Extract Cleanup Using Gel Permeation Chromatography |
| SOP-PP-002 | QC Data Acceptability and Corrective Action |
| SOP-PP-003 | Standards Traceability and Monitoring |
| SOP-PP-011 | Interpretation of Chromatographic Data |
| SOP-PP-012 | Obtaining Acceptable Standards for OLM3.2 and OLM4.2 CLP Pesticide/PCB Analyses |
| SOP-PP-013 | Preventative and Corrective GC Maintenance |

## Index of Environmental and Supporting Departmental Procedures

| Procedure No. | Title |
|---|---|
| SOP-PP-021 | Standards Preparation, Coding, and Storage |
| SOP-PP-022 | Hard Disk Drive Maintenance Procedure |
| SOP-PP-023 | Data Audit Procedure for Department 4024 |
| SOP-PP-025 | Monitoring QC Data Acceptance Limits |
| SOP-PP-027 | Uploading Data to the LIMS |
| SOP-PP-029 | Preventative and Corrective HPLC Maintenance for the Pesticide Residue Analysis Department |
| SOP-PP-031 | Setting Up Single Component Initial Calibrations |
| SOP-PP-032 | Using "Datalog" Software for Data Acquisition of Multicomponent Pesticides/PCBs |
| SOP-PP-033 | Using "Datalog" Software for Single-component Data Acquisition |
| SOP-PP-035 | Setting Retention Time Windows |
| SOP-PP-036 | Creating Calibration Timed Events in Chrom Perfect |
| SOP-PP-037 | Setting Up Analysis Numbers in the Departmental Database |
| SOP-PP-040 | Common Equations Used During Chromatographic Analyses |
| SOP-PP-041 | Prescreening Water and Soil Samples for Pesticides and PCBs |
| SOP-PP-042 | Micromass Quattro Micro Tandem Mass Spectrometer with a Waters 2795 HPLC System (LC/MS/MS) |
| ***Physical Services*** | |
| SOP-MN-002 | Reagent Water System Maintenance |
| SOP-MN-003 | Testing of the Automatic Sprinkler System in Building B |
| SOP-MN-004 | Emergency Notification |
| SOP-MN-005 | CO2 Delivery System |
| ***Quality Control*** | |
| MC-WQ-003 | Andover System Probe Calibration |
| SOP-QC-003 | Blind Sample Guidelines |
| SOP-QC-006 | Performing Quality Assurance Audits |
| SOP-QC-007 | The Submittal and Reporting of Proficiency Test Samples (PTs) |
| SOP-QC-008 | Hosting Agency Audits |
| SOP-QC-009 | Quality Assurance Approval of Standard Operating Procedures and Analytical Methods |
| SOP-QC-010 | Hosting of Client Audits by Quality Assurance |
| SOP-QC-011 | Tracking and Filing of Procedures within the Quality Assurance Department |
| SOP-QC-013 | Maintaining the Environmental and Pharmaceutical Quality Policy Manuals |
| SOP-QC-014 | Training of QA Personnel |
| SOP-QC-021 | Monitoring Quality Assurance Audits |
| SOP-QC-022 | Quality Assurance Reviews |
| SOP-QC-023 | Environmental Quality Assurance Approval of Subcontractor Laboratories |
| SOP-QC-024 | Responsibilities of the Quality Assurance Department |
| SOP-QC-025 | Preparing Quality Assurance Reports for Management |
| SOP-QC-026 | Development and Use of Training Procedures in the QA Department |
| SOP-QC-027 | Quality Assurance Review of Pharmaceutical Exception Investigation Reports |
| SOP-QC-028 | Quality Assurance Review of End-of-Month QC Reports |
| SOP-QC-030 | Quality Assurance Review of Client Project and Bid Documents |
| SOP-QC-031 | Quality Assurance Review of Validation Documentation |
| SOP-QC-032 | Quality Assurance Functions for GLP Compliance |

## Index of Environmental and Supporting Departmental Procedures

| Procedure No. | Title |
|---|---|
| SOP-QC-034 | Final Review of Analytical Reports in Nautilus LIMS |
| SOP-QC-035 | Emergency Notification of Quality Assurance Personnel |
| SOP-QC-036 | Performing Electronic Data Audits using Mint Miner Software |
| SOP-QC-038 | Pharmaceutical Quality Assurance Evaluation of Subcontract Test Laboratories |
| SOP-QC-039 | Maintenance of Environmental Certifications and Accreditations |
| TRN-PS-006 | Nautilus - Exceptions System Overview |
| TRN-PS-012 | Writing Investigations in Nautilus |
| TRN-QC-002 | Procedure Review |
| TRN-QC-003 | Internal Audits |
| TRN-QC-004 | Training of the Quality Assurance Department to Perform GLP Support Functions |
| TRN-QC-005 | Training of Quality Assurance Staff for Review of Pharmaceutical Exception Reports |
| TRN-QC-006 | Training of the Quality Assurance and Environmental Data Package Departments to Perform QA Review of Environmental Data Packages |
| TRN-QC-007 | Training of the Quality Assurance Department to Review Environmental Division End-of-Month QC Reports |
| TRN-QC-009 | Training of the Quality Assurance Department to Review Project and Bid Documents |
| TRN-QC-010 | Training of the Quality Assurance Department to Review Validation Documentation |
| TRN-QC-011 | Reviewing and Releasing/Rejecting Pharmaceutical Nautilus Reports |
| TRN-QC-012 | External Audit Training |
| TRN-QC-013 | Training of Quality Assurance Personnel to Perform Laboratory Data Review |
| TRN-QC-014 | Training Quality Assurance Staff for Review of Stability Protocols |
| ***Sample Administration*** | |
| SOP-SA-101 | Environmental Sample Entry |
| SOP-SA-102 | Sample Receipt at Sample Receipt Desk |
| SOP-SA-103 | Environmental Sample Receipt and Unpacking |
| SOP-SA-107 | Filing of Sample Information |
| SOP-SA-119 | Assigning Sample Delivery Group Numbers and Five-Digit Sample Codes to Sample Groups |
| SOP-SA-129 | Entry of Environmental Samples Requiring Subcontracting |
| SOP-SA-138 | Taking the Temperature of Environmental Samples Upon Arrival at the Lab |
| ***Sample Bottles*** | |
| SOP-SB-003 | Bottle Preparation |
| SOP-SB-008 | Packing Bottle Orders |
| SOP-SB-012 | Preparation of Trip Blanks |
| SOP-SB-016 | Processing Bottle Orders |
| SOP-SB-017 | Preparation of Acid Dilutions |
| SOP-SB-019 | Pipette Dispenser Calibration Procedure |
| ***Sample Support*** | |
| 0111, 6111, 7611, 11624 | Moisture (Gravimetric) |
| 0374, 6646, 10445 | GC/MS - Bulk Solid Matrix Sample Preparation |
| 0388, 6119, 6169, 6647, 0405, 1169, 6171, 6172, 6173, 6645, 2392, 6176, 7579, 0069, 11014, 11764 | Preparation of Vials for Field Preservation of Soils for Volatile Analysis |

## Index of Environmental and Supporting Departmental Procedures

| Procedure No. | Title |
|---|---|
| 10445 OH VAP | Ohio Voluntary Action Program Bulk Solid Sample Preparation by SW-846 5035 |
| 1132 | GC - Bulk Methanolic Preparation of Soils and Solid Waste |
| 1150, 6170 | Preparation of Soil and Solid Samples for GC Volatile Analyses |
| 1353 | Moisture (non-EPA/CLP Protocol) |
| 6611 | Tobacco Moisture |
| 7116, 7119 | Water Content (Moisture) by ASTM D 2216 |
| 7400 | Total Residue |
| 8389, 8390, 6130, 6117, 6174, 7578, 7320 | Preparation of Soils for Volatile Analysis by EPA SW-846 Method 5035 |
| MC-SS-001 | Sample Support Ovens |
| MC-SS-002 | Maintenance of Desiccators |
| SOP-SS-002 | Liquid Sample Preservation |
| SOP-SS-006 | Automated Storage, Retrieval, and Discarding of Samples |
| SOP-SS-009 | Homogenization and Subsampling of Solid Waste Samples from Environmental Sources |
| SOP-SS-010 | Subsampling for Subcontracted Analyses |
| SOP-SS-015 | Hardware Procedures for ASRS |
| SOP-SS-017 | Preservation and Bottles Room Preservative Traceability |
| SOP-SS-018 | Pipette Dispenser Calibration Procedure |
| SOP-SS-019 | Automated Storage and Retrieval System (ASRS) Lockout/Tagout Procedure |
| SOP-SS-020 | Outlier Quality Control Data |
| SOP-SS-021 | Instructions for Collecting Data on the LLENS System |
| SOP-SS-022 | Non-Automated Storage, Retrieval, and Discarding of Samples |
| SOP-SS-023 | Prescreening Water and Soil Samples for Volatile Organic Compounds |
| SOP-SS-024 | ASRS Emergency Failure Procedure |
| SOP-SS-025 | Incremental Sampling of Soil/Solid Samples |
| SOP-SS-026 | Glassware Cleaning |
| ***Specialty Services*** | |
| 10342 | Determination of Hydrazine, Monomethylhydrazine and 1,1-Dimethylhydrazine in Aqueous Samples by LC/MS/MS |
| 10346 | Determination of Hydrazine, Monomethylhydrazine and 1,1-Dimethylhydrazine in Soil Samples by LC/MS/MS |
| 10914 | Separatory Funnel Extraction Procedure for the Determination of Dioxins/Furans (CDD/CDF) in a Water Matrix |
| 10915, 11031 | Determination of Tetra- Through Octa-Chlorinated Dioxins and Furans by HRGC/HRMS |
| 10954 | Determination of Selected Perfluorinated Alkyl Acids (PFAAs) in Aqueous Samples by LC/MS/MS |
| 11016 | Determination of Perfluorooctanoic Acid (PFOA) in Aqueous Samples by LC/MS/MS |
| 11030 | Dean Stark Soxhlet Extraction Procedure for the Determination of Dioxins/Furans (CDD/CDF) in a Solid Matrix |
| 11639 | Determination of Diuron, Fenuron and Monuron in Water Samples by SPE Extraction and LC/MS/MS |
| 11663 | Determination of Diuron, Fenuron and Monuron in Soil Samples by LC/MS/MS |
| 11688 | Determination of Endothall in Soil Samples by LCMSMS |
| MC-SP-001 | DFS HRGC/HRMS Preventative and Corrective Maintenance |
| SOP-SP-001 | Maintenance and Tuning for Thermo Scientific TSQ Quantum Access Tandem Mass Spectrometer with a Thermo Electron Accela HPLC System (LC/MS/MS) |
| SOP-SP-002 | Fix or Adjustable Volume Handheld Pipettes |
| SOP-SP-003 | Column Cleanup Procedure for Dioxins/Furans (CDD/CDF) Sample Extracts |

## Index of Environmental and Supporting Departmental Procedures

| Procedure No. | Title |
|---|---|
| SOP-SP-004 | Processing EPA 1613B PCDD/PCDF High Resolution Mass Spectrometry Data using TargetQuan 2.0 |
| ***Tobacco Analysis*** | |
| 0088 | Extraction of Nicotine from Tobacco Products Using the Centers for Disease Control Protocol |
| 0091 | CDC Tobacco Moisture |
| 0097 | Analysis of Nicotine in Tobacco by GC/FID for Smokeless Tobacco Products Using the CDC Method |
| 11067 | Drying and Grinding for Cyclopamine |
| 2145 | Extraction of Nicotine and Minor Alkaloid from Tobacco |
| 2264 | Nitrite in Tobacco Prep |
| 2266 | Nitrite Nitrogen Analysis in Tobacco |
| 2326LC | Extraction of Tobacco Specific N-Nitrosamines in Tobacco Filler |
| 2610 | Nitrate in Tobacco Prep |
| 2808 | Nitrate Nitrogen in Tobacco (Colorimetric, Automated Cadmium Reduction) |
| 4998 | Tobacco Drying and Grinding |
| 5102 | Analysis of Tobacco Specific Nitrosamines (TSNA) in Tobacco Leaf by LC/MS/MS |
| 6870 | Extraction of Nicotine from Tobacco and Tobacco Products |
| 6878 | Analysis of Nicotine in Tobacco by GC/FID Following Coresta 62 |
| 6883 | Extraction of Tobacco for Benzo[a]Pyrene |
| 6962 | Column Cleanup of Tobacco for TSNAs |
| ***Transportation*** | |
| SOP-TR-001 | Collecting Water Samples for Regulatory Purposes |
| SOP-TR-003 | Sampling Swimming Pool Water |
| SOP-TR-010 | What to Do in Case of Vehicular Accident or Breakdown |
| SOP-TR-018 | Sample Pick-Up, Transportation, and Delivery |
| SOP-TR-019 | Performing Free Chlorine Residual Readings |
| ***Volatiles by GC*** | |
| 10902, 8419, 8432, 8416, 8418 | Purgeable Halocarbons/Aromatics/Miscellaneous Organics in Water and Solid Samples |
| 1635, 1636, 1728, 1729, 2762, 2763, 8229, 8268, 10598 | Gasoline Range Organics (GRO) in Water Samples Using Purge and Trap Gas Chromatography |
| 1637, 1638, 1700, 1725, 1726, 2765, 2766, 5550, 5551, 10599 | Gasoline Range Organics (GRO) in Soils using Purge and Trap Gas Chromatography |
| 2005, 2006, 8273, 8274 | Determination of Volatile Gasoline Range Organics in Soil and Water - Northwest GX Method |
| 2102, 6464, 8806 | Purgeable Aromatics in Water Samples |
| 8179 | Purgeable Aromatics in High-Level Soils |
| 8230 | Tertiary Butylamine in Water Samples |
| 8241 | Purgeable Aromatics in Water Samples by Method 602 |
| 8465, 8466, 8467, 8470, 8476, 8478, 8482, 8464, 8893 | Purgeable Halocarbons/Aromatics in Water Samples by EPA 601 and EPA 602 |
| SOP-OR-020 | Statistical Calculations Used in the Analysis of Samples by EPA Methodology |
| SOP-OR-065 | Checking and Documenting of pH for Volatile Organic Samples |
| SOP-OR-070 | Glassware Cleaning |

## Index of Environmental and Supporting Departmental Procedures

| Procedure No. | Title |
|---|---|
| SOP-OR-075 | Calibrating the 1-uL Standard Delivery Groove on the Archon Model 5100A and O.I. 4660 Autosampler Systems |
| SOP-OR-077 | GC Routine and Nonroutine Maintenance |
| SOP-OR-080 | Use of 40-mL Vials for Volatile Organic Analyses |
| SOP-OR-081 (Client-Specific) | Client-Specific PE Sample Preparation |
| SOP-OR-082 | Using "Range Compound Analysis" Software for Range Data Acquisition |
| ***Volatiles in Air*** | |
| 0034 | Oxygen and Carbon Dioxide in Air |
| 10341 | Helium as a Tracer Gas |
| 10734 | The Automated Determination of Volatile Organic Compounds in Air Collected in Specially Treated Canisters Using Cryogenic Preconcentration and Gas Chromatography with Mass Selective Detection Using NJDEP Modified Low Level Method TO-15 |
| 5265, 5298, 0015, 0037, 7199, 7869 | The Automated Determination of Volatile Organic Compounds in Air Collected in Specially Treated Canisters or Tedlar Bags Using Cryogenic Preconcentration and Gas Chromatography with Mass Selective Detection Using EPA Method TO-14 or TO-15 |
| 6820 | Analysis of Air for Selected Volatile Organic Compounds by Gas Chromatography with Flame Ionization Detector and Photoionization Detector for Louisiana RECAP Vapor Evaluation |
| 7090 | Analysis of Air for Selected Volatile Organic Compounds by Gas Chromatography with Flame Ionization Detector and Photoionization Detector |
| 7345 | SIM Analysis of Low-Level Volatile Organic Compounds in Air Collected in Specially Treated Canisters or Tedlar Bags Using Cryogenic Preconcentration and Gas Chromatography with SIM Mass Selective Detection Using EPA Method TO-15 |
| MC-AL-002 | Calibration of Pressure Gauges |
| MC-AL-003 | Routine Instrument Maintenance for Volatiles in Air by GC and GC/MS |
| SOP-AL-001 | Cleaning and Handling of Summa Canisters |
| SOP-AL-002 | Cleaning and Handling of Flow Controllers |
| SOP-AL-003 | Volatiles in Air Audit Process |
| SOP-AL-004 | Procedure for Compositing Samples from a Tedlar Bag |
| SOP-AL-005 | Preparing Summa Can Order |
| ***Water Quality*** | |
| 0200, 10331 | pH (WW) (electrometric) |
| 0201, 0202 | Analysis #0201 Alkalinity to pH 8.3 (titrimetric) Analysis #0202 Alkalinity to pH 4.5 (titrimetric) |
| 0203 | Total Solids in Waters (Gravimetric) |
| 0204, 0205 | Total Fixed Solids (Gravimetric) (#0204) Total Volatile Solids (Gravimetric) (#205) |
| 0206 | Total Suspended Solids in Waters (Gravimetric) |
| 0207, 0208 | Fixed Suspended Solids (Gravimetric) (#207) Volatile Suspended Solids (Gravimetric) (#208) |
| 0209 | Total Dissolved Solids (Calculation) |
| 0210 | Fixed Dissolved Solids (Calculation) |
| 0211 | Volatile Dissolved Solids (Calculation) |
| 0212 | Total Dissolved Solids in Waters (Gravimetric) |
| 0215 | Settleable Solids |
| 0216 | Total Hardness (Titrimetric Determination) |
| 0221 | Ammonia-Nitrogen for Waters (Titrimetric Distillation Procedure) |
| 0225 | Methylene-Blue-Active Substances (MBAS) |
| 0226 | Orthophosphate |
| 0229 | Sulfite |
| 0230, 10293, 10499 | Colorimetric Sulfide in Waters (#0230) Sulfide as H2S (#10293 calculation) Dissolved Sulfide in Waters (#10499) |

## Index of Environmental and Supporting Departmental Procedures

| Procedure No. | Title |
|---|---|
| 0234 | Chemical Oxygen Demand (COD) (Dichromate Reflux Method) (Titrimetric, Mid-Level) |
| 0235 | Biochemical Oxygen Demand Determination in Waters by Incubation |
| 0238 | Free Carbon Dioxide (Calculation) |
| 0240 | Chlorine Residual |
| 0263, 2200 | (#0263) Fluoride by Ion Selective Electrode (ISE) (#2200) Distilled Fluoride by Ion Selective Electrode (ISE) |
| 0276, 10330 | Hexavalent Chromium (colorimetric) |
| 0277 | Color |
| 0279 | Turbidity (Nephelometric) |
| 0280 | Specific Conductance |
| 0394, 0496 | pH (SW) (Electrometric) |
| 0425, 7825, 2432 | Hexavalent Chromium in Solids (Alkaline Digestion and Analysis Methods) |
| 0428 | Dissolved Oxygen (Membrane Electrode) |
| 0430 | Determination of Flash Point for Liquids and Solids |
| 0475, 0476 | Acidity to pH 3.7 and pH 8.3 (titrimetric) |
| 0521 | Total Residue |
| 0522, 1029 | Volatile Residue (#0522) Total Fixed Residue/Ash (#1029) |
| 0541 | Soluble Biochemical Oxygen Demand Determination in Waters by Incubation |
| 0542 | Ignitability of Solids |
| 0559 | Dissolved Silica (Colorimetric) |
| 0573 | Ammonia-Nitrogen for Soils (Tritrimetric distillation procedure) |
| 10222, 10696 | Ammonia Nitrogen by Ion-selective Electrode Method (ISE) in Solids |
| 10695 | Ammonia - Nitrogen in Water by Ion-Selective Electrode Method (ISE) |
| 11145 | Hexavalent Chromium (Colorimetric) in Waters by MCP |
| 11146 | Hexavalent Chromium in Solids by MCP (Alkaline Digestion and Analysis Methods) |
| 1121 | Reactivity |
| 1122 | Reactive Sulfide |
| 1124 | Chloride (Titrimetric Determination) |
| 1125 | Sulfate (turbidimetric) in Waters |
| 1215 | Specific Conductance (Solids) |
| 1333 | Sulfide Titration for Water |
| 1364 | Carbonaceous Biochemical Oxygen Demand Determination in Waters by Incubation |
| 1441 | pH (CLP) (Electrometric) |
| 1443, 6569 | #1443 Specific Gravity #6569 Bulk Density |
| 1446 | Low-Level Hexavalent Chromium (colorimetric) |
| 1448 | Bellack Distillation for Fluoride in Waters and Solids |
| 1454, 1455, 1456 | Bicarbonate (#1454), Carbonate (#1455), Hydroxide (#1456) Alkalinity (Calculation) |
| 1553 | Chemical Oxygen Demand (COD) in Waters (Dichromate Reflux Method) (Titrimetric, Low-Level) |
| 1630 | Acid Volatile Sulfide in Solids |
| 1820 | Paint Filter Liquids Test (Free Liquids Test) |
| 1821 | Oxidation-Reduction Potential |
| 1962, 7825 | Hexavalent Chromium in Solids by CTRCP (Alkaline Digestion and Analysis Methods) |
| 1968 | Hexavalent Chromium (Colorimetric) in Waters by CTRCP |

## Index of Environmental and Supporting Departmental Procedures

| Procedure No. | Title |
|---|---|
| 2365 | Percent Solids for GC/MS |
| 2562, 6598 | n-Hexane Extractable Material (HEM) in Solids and Silica Gel Treated n-Hexane Extractable Material (SGT-HEM) |
| 4001 | Chemical Oxygen Demand (COD) (Dichromatic Reflux Method) (Colorimetric) |
| 4530 | Total Acidity for Wastewater |
| 6649 | Total Dissolved Solids (Gravimetric) in Waters |
| 6866 | Moisture (Gravimetric) |
| 6914, 4219, 2593 | (#6914) Ammonia – Nitrogen by Ion-Selective Electrode Method (ISE) (#4219) Ammonia Distillation (#2593) Un-ionized Ammonia |
| 7103, 11601, 11604 | Particle Size Distribution of Soils and Solids/Grain Size Classification |
| 7120 | UV254 |
| 8079, 8078, 0612 | Hexane Extractable Material (HEM) and Silica Gel Treated Hexane Extractable Materials (SGT-HEM) in Waters by EPA Method 1664A |
| 8344, 10328 | Ferrous Iron |
| MC-WQ-002 | Spectronic Genesys 2 Spectrophotometer |
| MC-WQ-004 | Accumet Model AB30 pH/Ion/Conductivity Meter |
| MC-WQ-006 | Equipment Incubators and Refrigerators |
| MC-WQ-007 | pH Probes and Meters |
| MC-WQ-009 | Equipment Muffle Furnaces and Ovens |
| MC-WQ-010 | Calibration of Hach 2100AN Turbidimeter |
| MC-WQ-012 | Maintenance of Desiccators |
| MC-WQ-013 | Fixed Volume Hand-Held Pipettes |
| MC-WQ-014 | Adjustable Volume Handheld Pipettes |
| MC-WQ-017 | Hach DR 2800 Spectrophotometer |
| MC-WQ-022 | Orion 960 Autotitration System |
| MC-WQ-023 | YSI Model 5100 Dissolved Oxygen Meter |
| MC-WQ-024 | Maintenance of Hot Plates |
| SOP-WQ-002 | Standardization of 0.02 and 0.1 Normal Sulfuric Acid |
| SOP-WQ-005 | Standardization of 0.02 Normal Sodium Hydroxide |
| SOP-WQ-006 | Water Quality Washroom Procedures |
| SOP-WQ-014 | Instructions for Collecting Data on the LLENS System |
| SOP-WQ-016 | Chemical Review |
| SOP-WQ-017 | Quality Control Data for Wet Chemistry |

eurofins | Lancaster Laboratories

# Environmental Quality Policy Manual

# Appendix F
## Instrument and Equipment List

Current as of October 05, 2011
4 Total Pages (including this coversheet)

**NOTE: Current lists available from technical departments.**

| Instrument | # of Units | Manufacturer/Model # |
|---|---|---|
| **Liquid Chromatography/Gas Chromatography/Mass Spectrometry (LC/GC/MS)** | | |
| LC/MS/MS | 3 | Waters 2795 LC with Micromass Quattro micro MS/MS and Waters 2996 Photodiode Array UV-Vis Detector |
| LC/MS/MS | 1 | Thermo Scientific TSQ Quantum Access with Acella LC |
| LC/MS/MS | 1 | Agilent 1200 LC with Agilent 6410 MS/MS |
| GC/MS | 1 | Agilent 5971 |
| GC/MS | 6 | Thermo Scientific DSQII |
| GC/MS | 1 | Agilent 5972 |
| GC/MS | 6 | Agilent 5973 |
| GC/MS | 3 | Agilent 5975 |
| GC/MS | 1 | Thermo Scientific ISQ |
| GC/MS/MS | 1 | Thermo Scientific TSQ with Ultra Trace GC |
| HRGC/HRMS | 3 | Thermo Scientific DFS |
| Gas Chromatograph | 23 | Agilent 5890 |
| Gas Chromatograph | 19 | Agilent 6890 |
| Gas Chromatograph | 5 | Agilent 7890 |
| Gas Chromatograph | 4 | Thermo Scientific |
| Gas Chromatograph | 1 | Varian 3400 |
| **Auxiliary Equipment for Gas Chromatographs** | | |
| Most of the GC/MS and GC systems include autosamplers and approximately half are fitted with purge and trap concentrators for analysis of volatiles. | | |
| Purge/Trap Concentrators | 13 | OI 4560/4660 |
| Autosamplers | 2 | Archon 5100/5100A |
| Autosamplers | 44 | Agilent 7683 |
| Autosamplers | 14 | Agilent 7693 |
| Autosamplers | 6 | OI 4551/4552 |
| Autosamplers | 11 | EST Centruion |
| Autosamplers | 7 | Thermo Scientific AS TriPlus |
| Autosamplers | 2 | CTC Combipal Headspace |
| Automated Sampling System (Tedlar Bags) | 1 | Tekmar 2016/2032/LSC2000 |
| Automated Sampling System (Summa Canisters) | 3 | Entech 7016CR Autosamplers |
| Automated Sampling System (Tedlar Bags/Summa Canisters) | 1 | Entech 7032A |
| Automated Concentrator | 3 | Entech 7100 |
| Detectors available for GC: Electron Capture, Flame Ionization, Pthooionization, Hall Electrolytic Conductivity, Nitrogen/Phosphorus, and Thermal Conductivity. All of the chromatographs are connected to electronic integration systems. | | |
| **High Performance Liquid Chromatography** | | |
| High Performance Liquid Chromatograph | 1 | Agilent 1100 LC |
| High Performance Liquid Chromatograph | 1 | Agilent 1200 HPLC |
| High Performance Liquid Chromatograph | 1 | Hitachi L7000 |
| High Performance Liquid Chromatograph | 1 | Shimadzu LC-10 |
| High Performance Liquid Chromatograph | 1 | Shimadzu LC-6A or 6B |
| **Gel Permeation Chromatography** | | |
| Gel Permeation Chromatograph | 3 | J2Scientific AccuPrep |
| **Ion Chromatography** | | |
| Ion Chromatograph | 1 | Dionex DX320 |
| Ion Chromatograph | 1 | Dionex ICS1000 |
| Ion Chromatograph | 1 | Dionex ICS3000 |

| Instrument | # of Units | Manufacturer/Model # |
|---|---|---|
| Ion Chromatograph | 1 | Dionex ICS2000 |
| Ion Chromatograph | 2 | Dionex ICS1100 |
| **Atomic Absorption/Emission Spectrophotometry** | | |
| ICAP™ 6000 Duo ICP Analyzer | 4 | Thermo |
| ICP/MS | 1 | P/E Sciex Elan 9000 |
| ICP/MS | 1 | Agilent 7500CC |
| Mercury Analyzer | 1 | Leeman Labs PS 200II |
| Mercury Analyzer | 1 | Leeman Labs Hydra II |
| Mercury Analyzer | 1 | Leeman Labs HYDRA $AF_{GOLD+}$ |
| Mercury Prep Station | 1 | Thomas Cain DEENA 60 |
| **UV Vis/IR Spectrophotometry:** | | |
| UV-Vis Spectrophotometer | 2 | Spectronic Genesys |
| UV-Vis Spectrophotomenter | 1 | Hach DR2800 |
| **Miscellaneous Chemistry Instrumentation** | | |
| Block Digestion Systems | 8 | Environmental Express SC150 |
| Block Digestion Systems | 6 | Environmental Express SC154 |
| Centrifuge | 6 | Various |
| Chilled water recirculators | 14 | Various |
| Closed Cup Flashpoint Apparatus, Pensky-Martin | 1 | Fisher Scientific TA6 |
| Cyanide Midi Distillation Kits | 4 | Various |
| Discrete Analyzer | 1 | Seal AQ2 |
| Dissolved Oxygen Meter | 1 | YSI Model 59 |
| Flow Solution Autoanalyzer | 2 | Alpkem |
| Glassware washer - automated | 4 | Miele – (2) PG8257 (1) G7827 (1) G7704 |
| Kjehldal Distillation Apparatus | 1 | Fisher |
| Microwave Extractors | 3 | CEM MarsXpress |
| pH meters | 8 | Various |
| Phenol Midi Distillation | 2 | Andrews Glass |
| Pressurized Solvent Extractor | 2 | Dionex ASE200 |
| Sonicators | 9 | Various |
| Total Organic Carbon Analyzer | 2 | O.I. Corp. 1030 |
| Total Organic Carbon Combustion Analyzer | 2 | O.I. Corp. 1010 |
| Turbidimeter | 1 | Hach 2100AN |
| Zero Headspace Extractor | 74 | Various Models |
| **Microbiology Equipment** | | |
| Autoclave | 2 | Steris – Amsco, |
| Balance | 5 | Mettler, PB 3002 |
| Balance | 1 | Mettler-Toledo, AT200 |
| Balance | 2 | Mettler-Toledo, PR2002 |
| Balance | 1 | Sartorius BP4100 |
| Biological Safety Cabinet | 4 | NuAire NU-425-600 Type A/B 3 |
| Biological Safety Cabinet | 1 | NuAire NU-435-600 Type B2 Fume Hood |
| Colony Counter | 3 | Quebec Dark Field |
| Incubator | 1 | PGC 9311-1127 |
| Incubator | 1 | PS WFY20SAWI |
| Microscope | 1 | Stereoscope with Zoom, AO Model 570 |
| Microscope | 1 | Zeiss |
| pH Meter | 2 | Orion Model 410A |
| Quanti-Tray Sealer | 1 | IDEXX Model 2X |
| Water Bath | 1 | Boekel Grant with Removal Heater Circulator |

| Instrument | # of Units | Manufacturer/Model # |
|---|---|---|
| Water Bath | 1 | Thermo Electron Corp. |
| Water Bath | 1 | Precision Coliform Incubator Bath |
| Water Bath | 1 | VWR 1275PC |
| UV Light | 2 | Spectronics |
| UV Sterilizer | 1 | Millipore |

## Computer Equipment

Our laboratories make extensive use of computers for business applications, technical operations (e.g., our sample management system), and QA Program (see section on Quality Assurance). The following is a list of the major components of our computer systems.

Numerous physical and virtual servers used to support the systems

Oracle systems run on IBM UNIX servers:

Five IBM P5-510 Servers running AIX UNIX 5.3L with 2-way 1.90GHz CPUs

One IBM P5-520 Server running AIX UNIX 5.3L with 4-way 1.90GHz CPUs

- 16-24 GB RAM in IBM servers
- 6.7+ Terra Bytes of disk storage and several SAN devices including DS4300, DS4100, and Clariion CX3-40
- Various tape backup systems
- On-line fail over databases are available for all corporate production Oracle databases.

**Networks/Telecommunication:**

- TCP/IP based network
- Ten Gigabit switch to accommodate company server farm
- Dual Cisco 6506E network cores

**Personal Computers/Servers:**

- 3 T1s for Internet access through Cisco ASDM firewall
- ArcServe backup server
- Microsoft Exchange server
- Dell PowerEdge file and print servers
- More than 30 Network File Servers
- More than 1000 Personal Computers

**Power Systems:**

- 3 Phase Uninterrupted Power System

eurofins | Lancaster Laboratories

# Environmental Quality Policy Manual

# Appendix G
## Preventative Maintenance Schedules

Current as of October 05, 2011
3 Total Pages (including this coversheet)

**NOTE: Current schedules available in technical departments.**

## Preventive Maintenance Schedule

| Instrument | Preventive Maintenance | Frequency |
|---|---|---|
| GC/MS | Change septum | AN* : Min. weekly |
| | Clean/replace injection port seal & liner | AN |
| | Check fans | Monthly |
| | Check cool flow | Monthly |
| | Clean source | Bimonthly or AN |
| | Change oil in diffusion pump | Annually |
| | Change oil in rough pump | Annually |
| GC Volatiles | Check propanol level in ELCD reservoir | AN: Min. semiweekly |
| | Check all liquid and gas flows | Prior to calib. or AN |
| | Clean ELCD cell, change reaction tube | AN |
| | Change ELCD Teflon line, resin tube | AN |
| | Replace adsorbent trap in concentrators | AN |
| | Change PID lamp | AN |
| | Precalibration instrument settings check | Prior to each calibration |
| GC | Septum change | Each run |
| | Column/injection port maintenance | AN |
| | Clean detector | AN |
| | Leak check ECDs | Semiannually |
| GC/HRMS | System bakeout | AN |
| | Replacing the Secondary Electron Multiplier (SEM) | AN |
| | Adjusting potentials on ion source | Daily |
| | Check sensitivity and resolution on ion source | Weekly |
| | Cleaning ion source | AN |
| | Replace filament on ion source | AN |
| | Cleaning reference inlet | AN |
| | Check oil level on forepumps | monthly |
| | Change oil on forepumps | Yearly or if oil is cloudy or discolored |
| | Exchange lubricant reservoir on turbopumps | Yearly or after 5000 hours of operation |
| | Replace injection port liner | AN |
| | Clip injection port end of column | AN |
| | Replace septum | AN |
| LC/MS/MS | Change rough pump (vacuum) oil | Semiannually |
| | Clean cones and spray chamber | As needed, before each calibration |
| | Clean source and ion lenses | Annually |
| | Check electrospray capillary | AN |
| | Empty waste liquid reservoir | AN |
| | Tune and calibrate MS | AN |

| Instrument | Preventive Maintenance | Frequency |
|---|---|---|
| HPLC | Pump lubrication | Annually |
| | Check pump seals | Annually |
| | Check-valves cleaned or rebuilt | AN |
| | Replace and/or adjust detector bulb | AN |
| | Clean detector flow cell | AN |
| | Replace Teflon lines | AN |
| | Autosampler septa replacement | AN |
| | In-line filter sonication/cleaning | AN |
| | System passivation | AN |
| | PCRS pump lubrication | AN |
| | Empty waste liquid reservoir | Daily |
| Cold Vapor AA and Cold Vapor AF | Replace pump tubing | AN |
| | Lubricate pump head & autosampler | AN |
| | Clean optical cells and windows | AN |
| ICP | Replace pump winding | AN |
| | Lubricate autosampler | AN |
| | Vacuum instrument airfilters and air intakes | AN |
| | Clean optics and lenses | AN |
| | Clean Torch and injector tip | AN |
| | Clean nebulizer and spray chamber | AN |
| ICP/MS | Change interface rough pump oil | Quarterly |
| | Change MS rough pump oil | Semiannually |
| | Clean cones and ion lenses | AN |
| | Clean Torch, injector tip, nebulizer and spray chamber | AN |
| | Change peristaltic tubing | AN |
| | Vacuum instrument airfilters and air intakes | AN |
| | Empty waste liquid reservoir | AN |
| Total Organic Carbon Analyzer | Check for leaks | AN |
| | Inspect rotary valve | AN |
| | Clean gas permeation tube | AN |
| | Check halide scrubber | AN |
| | Check dessicant tube | AN |
| | Dust back and clean circuit boards | AN |
| Autoanalyzer spectrophotometer | Clean sample probe | AN |
| | Clean proportioning pump | AN |
| | Inspect pump tubing, replace if worn | AN |
| | Clean wash receptacles | AN |

*AN = as needed. These actions may be performed more frequently as required by the instrument's operational response.

eurofins | Lancaster Laboratories

# Environmental Quality Policy Manual

# Appendix H
## Calibration Schedules

Current as of October 05, 2011
14 Total Pages (including this coversheet)

**NOTE: Current schedules available in technical departments.**

**Calibration Summary for SW-846 Methods**

| | Initial Calibration | | | Continuing Calibration Verification | | |
|---|---|---|---|---|---|---|
| Instrument | Frequency | # Std Conc | Acceptance Criteria | Frequency | # Std Conc | Acceptance Criteria |
| GC/MS Volatiles* | After C-cal fails | 6 | RF for SPCCs >0.300 for chlorobenzene and 1,1,2,2-tetrachloroethane, and >0.100 for 1,1-dichloroethene, bromoform and chloromethane<br>%RSD CCCs <30% | Every 12 hours | 1 | RF for SPCCs >0.300 for chlorobenzene and 1,1,2,2-tetrachloro-ethane, and >0.100 for 1,1-dichloroethene, bromoform and chloromethane<br>%Drift for CCCs <20 |
| GC/MS Semivolatiles (8270C)* | After C-cal fails | 6 | RF for SPCCs >0.050 Max<br>%RSD for CCCs <30% | Every 12 hours | 1 | RF for SPCCs 0.050<br>%Drift for CCCs <20 |
| GC/MS Semivolatiles (8270D)* | After C-cal fails | 6 | % RSD ≤ 20% for each compound, (no more than 10% of the compounds can exceed 20% RSD); alternate fit must be used for any analyte with RSD >20% (use linear fit if correlation coefficient is 0.990 or greater; if correlation coefficient is < 0.990 then quadratic fit can be used, but the coefficient of determination must be 0.990 or greater). If linear fit is used, it must pass a linear regression check (the low standard must be within 30% of its true concentration) | Every 12 hours | 1 | %Drift ± 20%; (no more than 20% of the compounds can exceed 20% drift, and all compounds that exceed 20% drift must be ≤ 50% drift) |
| GC/MS Semi-volatiles SIM | After C-cal Fails | 6 | % RSD for all compounds ≤20% | Every 12 hours | 1 | %Drift ± 20% |
| GC VOA | After C-cal fails | At least 5 | % RSD ≤20% for individual compounds.<br>Alternatively, if the average of the %RSDs of all compounds in the calibration standard is ≤20% then the average RF can be used for all compounds. | Every 10 samples | 1 | %Drift ± 15% for individual compounds or average % drift for all compounds in the standard ± 15% |

**Calibration Summary for SW-846 Methods**

| | Initial Calibration | | | Continuing Calibration Verification | | |
|---|---|---|---|---|---|---|
| Instrument | Frequency | # Std Conc | Acceptance Criteria | Frequency | # Std Conc | Acceptance Criteria |
| GC Pesticides | After C-cal fails | 5 | 20% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit. Degradation for DDT, endrin 15%<br>Alternatively, if the average of the %RSDs of all compounds in the calibration standard is ≤20%, then the AVG RF can be used for all compounds. | Every 10 samples<br>Every 20 samples or 12 hours for Method 8081A, 8082 | 1 | ≤15% drift from initial response for quantitation<br>C-cal - A CCV is also compliant if the average % difference is ≤15% for all compounds in the CCV standard.<br>DDT/Endrin breakdown check 15% every 12 hours or 20 injections (8081A) |
| Dioxins by HRGC/HRMS | After C-cal fails | 6 | If %RSD for native compounds <20% and for labeled compounds <35%, otherwise a calibration curve is used | Every 12 hours | 1 | <15% valley peak resolution for 2378-TCDD<br>All native and labeled compounds meet method defined recovery limits<br>RTs within ±15 secs of RT in ICAL |
| HPLC | Each new run or after C-cal fails | 5 | 20% RSD of RFs of initial calibration to use average RF, otherwise use curve fit<br>Alternatively, if the average of the %RSDs of all compounds in the calibration standard is ≤20%, then the AVG RF can be used for all compounds. | Every 10 samples | 1 | ≤15% drift from initial response for quantitation<br>C-cal - A CCV is also compliant if the average % difference is ≤15% for all compounds in the CCV standard. |
| GC TPH-GRO | After C-cal fails | At least 5 | % RSD of <20% to use the average CF, otherwise use calibration curve | Every 12 hours | 1 | %Drift ±15% |
| GC TPH-DRO | After C-cal fails | 5 | 20% RSD of RFs of initial calibration to use average RF, otherwise use curve fit. | Every 12 hours | 1 | % Drift ±15% |
| ICP/MS | Each new run | 1 | Independent calibration verification (ICV) within ±10% | Every 10 samples | 1 | ±10% of true value |
| ICP | Each new run | 1 | Independent calibration verification within ±10%, standards <5%RSD | Every 10 samples | 1 | Same as initial |

| Calibration Summary for SW-846 Methods | | | | | | |
|---|---|---|---|---|---|---|
| | Initial Calibration | | | Continuing Calibration Verification | | |
| Instrument | Frequency | # Std Conc | Acceptance Criteria | Frequency | # Std Conc | Acceptance Criteria |
| CVAA | Each new run | 5 | Independent calibration verification within ±10%<br>Correlation coefficient >0.995 | Every 10 samples | 1 | ±20% of true value |
| Autoanalyzer | Daily | 6 | Correlation coefficient >0.995 | Every 10 samples | 1 | ±10% of true value |
| TOC Analyzer | Monthly | Water – 6<br>Soil -4 | Corr. Coeff. > 0.995 | Every 10 samples | 1 | ±10% of true value |
| Balance | Daily | 4 | Top-loading ±.5%, Analytical ± .1% for weights >.1 g<br>50 mg ± .5%, 20 mg ± 1.0%<br>10 mg and 5 mg ± 2.0% | N/A | N/A | N/A |

*All compounds with %RSD >15 must use first or second order regression fit of the six calibration points. Alternatively, if average of the %RSD of all compounds in calibration standard is ≤15%, the AVG RF can be used for all compounds.

Abbreviations
# Std Conc - The number of standard concentrations used
%RSD - Percent Relative Standard Deviation CF – Calibration Factor
SPCCs - System Performance Check Compounds
CCCs - Calibration Check Compounds C-cal - Continuing Calibration
RF - Response factor
CVAA - Cold Vapor Atomic Absorption
ICP/MS - Inductively Coupled Plasma – Mass Spectrometry
ICP - Inductively Coupled Plasma spectrophotometer; ICP run also includes inter-element correction check standard (at beginning and end of run)

**Calibration Summary for CLP Methods**

| | Initial Calibration | | | Continuing Calibration Verification | | |
|---|---|---|---|---|---|---|
| Instrument | Frequency | # Std Conc | Acceptance Criteria | Frequency | # Std Conc | Acceptance Criteria |
| GC/MS Volatiles | After C-cal fails | 5 | Specified compounds must meet contract minimum RRF criteria and max %RSD of ≤20.5% | Every 12 hours | 1 | Specified compounds must meet contract minimum RRF criteria and max %D of ≤25% |
| GC/MS Semivolatiles | After C-cal fails | 5 | Specified compounds must meet contract minimum RRF criteria and max %RSD of ≤25%. Up to 4 compounds may fail, but must be <40%. | Every 12 hours | 1 | Specified compounds must meet contract minimum RRF criteria max %D of ≤ 25%. Up to four compounds may fail, but must be <40%. |
| GC Pesticides | After C-cal fails | 3 | %RSD for compounds ≤20% (alpha-BHC and delta-BHC ≤25%)<br><br>%RSD for surrogates ≤30% | Every 12 hours | 1 | IND A & B/PEM alternate every 12 hours with %D ≤25. Degradation for DDT, endrin ≤20%, combined ≤30% IBLK every 12 hours with CCV |
| Cold Vapor AA | Each new run | 5 | Independent calibration verification within ±20% | Every 10 samples | 1 | Same as initial |
| ICP | Each new run | 1 | Independent calibration verification within ±10% | Every 10 samples | 1 | Same as initial |
| ICP-MS | Each new run | 1 | Independent calibration verification within ±10% | Every 10 samples | 1 | Same as initial |
| Autoanalyzer (cyanide) | Daily | 5 | Correlation coefficient >0.995 | Every 10 samples | 1 | ±10% of original response |
| Balance | Daily | 4 | ±0.5% | N/A | N/A | N/A |

Abbreviations

RRF – Relative Response Factor
%RSD – Percent Relative Standard Deviation
%D – Percent difference IND – Individual standard mix
RPD – Relative Percent Difference PEM – Performance Evaluation Mix
C-cal – Continuing Calibration
ICP – Inductively Coupled Plasma spectrophotometer
ICP/MS - Inductively Coupled Plasma – Mass Spectrometry
IBLK – Instrument Blank
For volatiles, up to two compounds may be outside criteria providing the RRF is ≥0.010 and %RSD ≤40%.
For semivolatiles, up to four compounds may be outside criteria providing the RRF is ≥0.010 and %RSD ≤40%.
For both volatile and semivolatile compounds with no established RRF criteria, the minimum RRF is ≥0.010.
For pesticides, up to two target compounds may have %RSD >20% but ≤ 30%.

| GC/MS Tuning Criteria | | | |
|---|---|---|---|
| **BFB Key Ions and Ion Abundance Criteria:** | | | |
| **Mass** | **CLP Methods** | **Method 8260B** | **Method 524.2** |
| 50 | 8% to 40% of mass 95 | 15% to 40% of mass 95 | 15% to 40% of mass 95 |
| 75 | 30% to 66% of mass 95 | 30% to 60% of mass 95 | 30% to 80% of mass 95 |
| 95 | Base peak = 100% | Base peak = 100% | Base peak = 100% |
| 96 | 5% to 9% of mass 95 | 5% to 9% of mass 95 | 5% to 9% of mass 95 |
| 173 | <2% of mass 174 | <2% of mass 174 | <2% of mass 174 |
| 174 | 50% to 120% of mass 95 | >50% of mass 95 | >50% of mass 95 |
| 175 | 4% to 9% of mass 174 | 5% to 9% of mass 174 | 5% to 9% of mass 174 |
| 176 | 93% to 101% of mass 174 | >95% but <101% of mass 174 | >95% but <101% of mass 174 |
| 177 | 5% to 9% of mass 176 | 5% to 9% of mass 176 | 5% to 9% of mass 176 |
| **DFTPP Key Ions and Ion Abundance Critieria:** | | | |
| **Mass** | **Methods** 8270D & CLP | **Method 8270C** | **Method 525.2** |
| 51 | 30 % to 80 % of mass 198 | 30 % to 60 % of mass 198 | 10 % to 80 % of base peak |
| 68 | <2% of mass 69 | <2% of mass 69 | <2% of mass 69 |
| 69 | mass 69 relative abundance | mass 69 relative abundance | mass 69 relative abundance |
| 70 | <2% of mass 69 | <2% of mass 69 | <2% of mass 69 |
| 127 | 25 % to 75 % of mass 198 | 40% to 60 % of mass 198 | 10% to 80 % of base peak |
| 197 | <1% of mass 198 | <1% of mass 198 | <2% of mass 198 |
| 198 | Base Peak = 100% | Base Peak = 100% | Base peak or >50 % of mass 442 |
| 199 | 5% to 9% of mass 198 | 5% to 9% of mass 198 | 5% to 9% of mass 198 |
| 275 | 10% to 30% of mass 198 | 10% to 30% of mass 198 | 10% to 60% of base peak |
| 365 | >0.75% of mass 198 | >1% of mass 198 | >1% of base peak |
| 441 | 8270D: Present but < 24% mass 442<br>CLP: Present but < mass 443 | Present but < mass 443 | Present but < mass 443 |
| 442 | 8270D: >50% of mass 198<br>CLP: 40% to 110% of mass 198 | >40% of mass 198 | Base peak or >50% of mass 198 |
| 443 | 15% to 24% of mass 442 | 17% to 23% of mass 442 | 15% to 24% of mass 442 |

| Calibration Summary for Drinking Water Methods | | | | | | |
|---|---|---|---|---|---|---|
| | Initial Calibration | | | Continuing Calibration Verification | | |
| Instrument | Frequency | # Std Conc | Acceptance Criteria | Frequency | # Std Conc | Acceptance Criteria |
| **GC/MS** 525.2 | After C-cal fails | 6 | The RSD for each analyte mean RF must be ≤30%. Or a linear regression calibration curve may be used. | Every 12 hours | 1 | %D for RF must be ≤30%. If curve used, the point must fall on curve from I-cal. |
| **GC** 504.1 | Every new run | 5 | % RSD <20% to use Average RF, otherwise use calibration curve. | Every 10 samples or each batch if <10 samples | 1 | 70% to 130% of expected value |
| **GC/MS** 524.2 | After C-cal fails | 4 | % RSD <20% otherwise use calibration curve | Every 12 hours | 1 | %D for RF must be ≤30%. If curved used, the % recovery based on the concentration spiked must be 70% to 130% of expected value. |
| **GC** 507 508 515.1 | Each new run, or after C-cal fails | 3 | ≤20% RSD of RFs of Initial Calibration to use avg. RF, otherwise use curve fit. (Degradation for DDT, Endrin ≤20% initially - Method 508.) | Every 10 samples | 1 | ≤20% drift from initial response for both quantitation and confirmation. |
| **HPLC** 531.1 | Each new run, or after C-cal fails | 3 | ≤20% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit | Every 10 samples and/or blanks | 1 | ≤20% drift from initial response. |
| **Mercury auto-analyzer** | Each new run | 5 | Initial calibration verification with ±5% | Every 10 samples | 1 | ±10% of true value |
| **Auto-analyzer** | Daily | 6 | Correlation coefficient >0.995 | Every 10 samples | 1 | ±10% of true value |
| **Balance** | Daily | 4 | See SOP | N/A | N/A | N/A |
| **ICP** | Each new run | 1 | Initial calibration verification ±5% | Every 10 samples | 1 | ±10% of true value |
| **ICP-MS** | Each new run | 1 | Independent calibration verification within ±10% | Every 10 samples | 1 | ±15% of true value |

| Calibration Summary for Drinking Water Methods | | | | | | |
|---|---|---|---|---|---|---|
| | Initial Calibration | | | Continuing Calibration Verification | | |
| Instrument | Frequency | # Std Conc | Acceptance Criteria | Frequency | # Std Conc | Acceptance Criteria |
| **pH meter** | Daily | 3 | See SOP | Every 10 samples | 1 | Statistical limits |
| **IC** | Monthly | 5 | Correlation coefficient >0.995 | Every 10 samples | 1 | ±10% of true value |
| **ISE** | Every 3 months | 5 | Correlation coefficient >0.995 | Every 10 samples | 1 | ±10% of true value |

Abbreviations

# Std Conc - The number of standard concentrations used
SPCCs - System Performance Check Compounds
CCCs - Calibration Check Compounds
RF - Response Factor
%RSD - Percent Relative Standard Deviation
%D - Percent Difference
C-cal - Continuing Calibration
CVAF – Cold Vapor Atomic Fluorescence
HPLC - High Performance Liquid Chromatography
GC - Gas Chromatograph
GC/MS - Gas Chromatography/Mass Spectrometry
ICP - Inductively Coupled Plasma spectrophotometer
ICP/MS - Inductively Coupled Plasma – Mass Spectrometry
IC - Ion Chromatograph
ISE - Ion Specific Electrode

| Method 507<br><br>Laboratory Performance Check Solution<br>(analyzed prior to system calibration) | | | |
|---|---|---|---|
| Test | Analyte | Conc. µg/mL | Requirements |
| Sensitivity | Vernolate | 0.05 | Detection of analyte; S/N > 3 |
| Chromatographic performance | Bromacil | 5.0 | 0.80 < PGF[a] <1.20 |
| Column performance | Prometon<br><br>Atrazine | 0.30<br><br>0.15 | Resolution[b] > 0.7 |

[a]PGF - Peak Gaussian factor. Calculated using the equation:

$$PGF = \frac{1.83 \times W(1/2)}{W(1/10)}$$

Where W(1/2) is the peak width at half height and W(1/10) is the peak width at 10% peak height.

[b]Resolution between the two peaks as defined by the equation:

$$R = \frac{t}{W}$$

Where t is the difference in elution times between the two peaks and W is the average peak width, at the baseline, of the two peaks.

| Method 508<br><br>Laboratory Performance Check Solution<br>(analyzed prior to system calibration) | | | |
|---|---|---|---|
| Test | Analyte | Conc. µg/mL | Requirements |
| Sensitivity | Chlorpyrifos | 0.0020 | Detection of analyte; S/N > 3 |
| Chromatographic performance | DCPA | 0.0500 | 0.80 < PGF[a] < 1.15 |
| Column performance | Chlorothalonil<br><br>HCH-delta | 0.0500<br>0.0400 | Resolution[b] > 0.50 |

[a]PGF - Peak Gaussian factor. Calculated using the equation:

$$PGF = \frac{1.83 \times W(1/2)}{W(1/10)}$$

Where W(1/2) is the peak width at half height and W(1/10) is the peak width at 10% peak height.

[b]Resolution between the two peaks as defined by the equation:

$$R = \frac{t}{W}$$

Where t is the difference in elution times between the two peaks and W is the average peak width, at the baseline, of the two peaks.

| Method 515<br><br>Laboratory Performance Check Solution<br>(analyzed prior to system calibration) | | | |
|---|---|---|---|
| Test | Analyte | Conc. µg/mL | Requirements |
| Sensitivity | Dinoseb | 0.004 | Detection of analyte; S/N >3 |
| Chromatographic performance | 4-Nitrophenol | 1.6 | 0.70 < PGF[a] < 1.05 |
| Column performance | 3,5-Dichlorobenzoic acid<br><br>4-Nitrophenol | 0.6<br><br>1.6 | Resolution[b] >0.40 |

[a]PGF - Peak Gaussian factor. Calculated using the equation:

$$PGF = \frac{1.83 \times W(1/2)}{W(1/10)}$$

Where W(1/2) is the peak width at half height and W(1/10) is the peak width at tenth height.

[b]Resolution between the two peaks as defined by the equation:

$$R = \frac{t}{W}$$

Where t is the difference in elution times between the two peaks and W is the average peak width, at the baseline, of the two peaks.

| Calibration Summary for EPA 100, 200, 300, 600 & 1600 Series Methods | | | | | | |
|---|---|---|---|---|---|---|
| | Initial Calibration | | | Continuing Calibration Verification | | |
| Instrument | Frequency | # Std Conc | Acceptance Criteria | Frequency | # Std Conc | Acceptance Criteria |
| **GC/MS** Volatiles* | After C-cal fails | 5 | RSD ≤35% for all compounds*, or a linear regression may be used | Every 24 hours | 1 | All compounds must meet the QC acceptance criteria as stated in the method. Compounds not stated must meet a 65% -135% recovery criteria. |
| **GC/MS** Semivolatiles** | After C-cal fails | 5 | RSD ≤35% for all compounds**, or a linear regression may be used<br>Tailing factors:<br>Benzidine < 3<br>Pentachlorophenol < 5 | Every 24 hours | 1 | All compounds calibrating for <20 |
| **GC** Pesticides & PCBs (Method 608) | After C-cal fails | 5 | 10% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit. Degradation for DDT, Endrin 15% | Every 10 samples | 1 | ≤15% drift from initial response for quantitation |
| **GC** VOA Halocarbons and/or Aromatics | After C-cal fails | At least 5 | %RSD of ≤10% for individual compounds to use average RFs. If %RSD >10%, a quadratic fit type is used if correlation coefficient is >0.995. | Every 12 hours, or every 10 samples | 1 | Method defined limits |
| **HPLC** | Each new run or after C-cal fails | 5 | 10% RSD of RFs of initial calibration to use average RF, otherwise use curve fit | Every 10 samples | 1 | ≤15% difference from initial response for quantitation |
| **ICP/MS** | Each new run | 1 | Independent calibration verification (ICV) within ±10% | Every 10 samples | 1 | ±15% of true value |
| **ICP** | Each new run | 1 | Independent calibration verification within ±5%, standards <5%RSD | Every 10 samples | 1 | ±10% of true value |

| Calibration Summary for EPA 100, 200, 300, 600 & 1600 Series Methods | | | | | | |
|---|---|---|---|---|---|---|
| | Initial Calibration | | | Continuing Calibration Verification | | |
| Instrument | Frequency | # Std Conc | Acceptance Criteria | Frequency | # Std Conc | Acceptance Criteria |
| **CVAA** | Each new run | 5 | Independent calibration verification within ±5%<br>Correlation coefficient >0.995 | Every 10 samples | 1 | ±10% of true value |
| **CVAF** | Each new run | 5 | The RSD ≤ 15%, and the low standard recovers 75-125% of the true value | After the calibration and at the end of the analytical batch | 1 | ±23% of the true value |
| **Auto-analyzer** | Daily | 6 | Correlation coefficient >0.995 | Every 10 samples | 1 | ±10% of true value |
| **TOC** | Monthly | 6<br>5 | Corr. Coeff. > 0.995<br>Corr. Coeff. > 0.995 | Every 10 samples | 1 | ±10% of true value |
| **Balance** | Daily | 4 | Top-loading ±0.5%, Analytical ± 0.1% for weights >0.1 g<br>50 mg ± 0.5%, 20 mg ± 1.0%<br>10 mg and 5 mg ± 2.0% | N/A | N/A | N/A |

*All compounds with %RSD >35 must use first or second order regression fit of the five calibration points. The first order regression may only be used if the correlation coefficient r ≥0.990. The second order regression may only be used if the coefficient of determination $r^2 \geq 0.990$.

* * All compounds with % RSD >35 must use first order regression fit of the five calibration points. The first order regression may only be used if the correlation coefficient r ≥0.990.

Abbreviations
# Std Conc - The number of standard concentrations used
SPCCs - System Performance Check Compounds
CCCs - Calibration Check Compounds
RF - Response Factor
%RSD - Percent Relative Standard Deviation
C-cal - Continuing Calibration
CVAA - Cold Vapor Atomic Absorption spectrophotometer
HPLC - High Performance Liquid Chromatography
ICP - Inductively Coupled Plasma spectrophotometer; ICP run also includes inter-element correction check standard (beginning and end of run)
ICP/MS - Inductively Coupled Plasma – Mass Spectrometry

| Calibration Summary for EPA TO Series Methods | | | | | | |
|---|---|---|---|---|---|---|
| | Initial Calibration | | | Continuing Calibration Verification | | |
| Instrument | Frequency | # Std Conc | Acceptance Criteria | Frequency | # Std Conc | Acceptance Criteria |
| **GC/MS** Volatiles TO-15 | After C-cal fails | 5 | RSD ≤30% for all compounds, 2 allowed to be >30% as long as <40%. | Every 24 hours | 1 | All compounds ≤30 difference, 2 compounds allowed to be >30% as long as ≤40%. |
| **GC/MS** Volatiles TO-14A | After C-cal fails | 3 | RSD ≤30% for all compounds, 2 allowed to be >30% as long as <40%. | Every 24 hours | 1 | All compounds ≤30 difference, 2 compounds allowed to be >30% as long as ≤40%. |

eurofins | Lancaster Laboratories

# Environmental Quality Policy Manual

# Appendix I
## NELAP Scope of Testing

Current as of October 05, 2011
61 Total Pages (including this coversheet)

**NOTE: Current certificates maintained by QA Department.**

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Drinking Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 110.2 | Color | NELAP | PA | 4/4/2005 |
| EPA 150.1 | pH | NELAP | PA | 2/28/2002 |
| EPA 1613 | Dioxin | NELAP | PA | 10/5/2010 |
| EPA 1664 Rev A | Oil and grease | NELAP | PA | 5/24/2011 |
| EPA 180.1 | Turbidity | NELAP | PA | 4/4/2005 |
| EPA 200.7 | Aluminum | NELAP | PA | 4/4/2005 |
| EPA 200.7 | Barium | NELAP | PA | 1/22/2001 |
| EPA 200.7 | Beryllium | NELAP | PA | 6/2/2004 |
| EPA 200.7 | Cadmium | NELAP | PA | 1/22/2001 |
| EPA 200.7 | Calcium | NELAP | PA | 11/28/2001 |
| EPA 200.7 | Chromium | NELAP | PA | 1/22/2001 |
| EPA 200.7 | Cobalt | NELAP | PA | 10/16/2008 |
| EPA 200.7 | Copper | NELAP | PA | 1/22/2001 |
| EPA 200.7 | Iron | NELAP | PA | 4/4/2005 |
| EPA 200.7 | Magnesium | NELAP | PA | 12/4/2007 |
| EPA 200.7 | Manganese | NELAP | PA | 4/4/2005 |
| EPA 200.7 | Nickel | NELAP | PA | 1/22/2001 |
| EPA 200.7 | Potassium | NELAP | PA | 5/24/2011 |
| EPA 200.7 | Silver | NELAP | PA | 1/26/2001 |
| EPA 200.7 | Sodium | NELAP | PA | 1/22/2001 |
| EPA 200.7 | Strontium | NELAP | PA | 5/24/2011 |
| EPA 200.7 | Tin | NELAP | PA | 11/3/2008 |
| EPA 200.7 | Vanadium | NELAP | PA | 10/16/2008 |
| EPA 200.7 | Zinc | NELAP | PA | 4/4/2005 |
| EPA 200.8 | Antimony | NELAP | PA | 2/10/2005 |
| EPA 200.8 | Arsenic | NELAP | PA | 2/10/2005 |
| EPA 200.8 | Beryllium | NELAP | PA | 2/10/2005 |
| EPA 200.8 | Cadmium | NELAP | PA | 2/10/2005 |
| EPA 200.8 | Chromium | NELAP | PA | 2/10/2005 |
| EPA 200.8 | Copper | NELAP | PA | 3/9/2007 |
| EPA 200.8 | Lead | NELAP | PA | 2/10/2005 |
| EPA 200.8 | Nickel | NELAP | PA | 2/10/2005 |
| EPA 200.8 | Selenium | NELAP | PA | 2/10/2005 |
| EPA 200.8 | Thallium | NELAP | PA | 2/10/2005 |
| EPA 245.1 | Mercury | NELAP | PA | 8/29/2001 |
| EPA 300.0 | Chloride | NELAP | PA | 5/17/2005 |

**The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.**

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Drinking Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 300.0 | Fluoride | NELAP | PA | 1/22/2004 |
| EPA 300.0 | Nitrate | NELAP | PA | 10/31/2002 |
| EPA 300.0 | Nitrite | NELAP | PA | 10/31/2002 |
| EPA 300.0 | Sulfate | NELAP | PA | 7/7/2003 |
| EPA 314.0 | Perchlorate | NELAP | PA | 5/24/2007 |
| EPA 335.4 | Cyanide | NELAP | PA | 7/11/2006 |
| EPA 353.2 | Nitrate as N | NELAP | PA | 2/28/2002 |
| EPA 353.2 | Nitrite | NELAP | PA | 2/28/2002 |
| EPA 353.2 | Total nitrate-nitrite | NELAP | PA | 5/24/2011 |
| EPA 504.1 | 1,2,3-Trichloropropane (1,2,3-TCP) | NELAP | PA | 5/17/2005 |
| EPA 504.1 | 1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane) | NELAP | PA | 2/28/2002 |
| EPA 504.1 | 1,2-Dibromoethane (EDB, Ethylene dibromide) | NELAP | PA | 1/26/2001 |
| EPA 507 | Alachlor (Lasso) | NELAP | PA | 2/28/2002 |
| EPA 507 | Atrazine | NELAP | PA | 2/28/2002 |
| EPA 507 | Simazine | NELAP | PA | 2/28/2002 |
| EPA 508 | Aldrin (HHDN) | NELAP | PA | 5/18/2005 |
| EPA 508 | Aroclor-1016 (PCB-1016) | NELAP | PA | 4/24/2007 |
| EPA 508 | Aroclor-1221 (PCB-1221) | NELAP | PA | 4/24/2007 |
| EPA 508 | Aroclor-1232 (PCB-1232) | NELAP | PA | 4/24/2007 |
| EPA 508 | Aroclor-1242 (PCB-1242) | NELAP | PA | 4/24/2007 |
| EPA 508 | Aroclor-1248 (PCB-1248) | NELAP | PA | 4/24/2007 |
| EPA 508 | Aroclor-1254 (PCB-1254) | NELAP | PA | 4/24/2007 |
| EPA 508 | Aroclor-1260 (PCB-1260) | NELAP | PA | 4/24/2007 |
| EPA 508 | Chlordane (tech.) | NELAP | PA | 2/28/2002 |
| EPA 508 | Dieldrin | NELAP | PA | 1/3/2002 |
| EPA 508 | Endrin | NELAP | PA | 2/28/2002 |
| EPA 508 | Heptachlor | NELAP | PA | 2/28/2002 |
| EPA 508 | Heptachlor epoxide | NELAP | PA | 2/28/2002 |
| EPA 508 | Hexachlorobenzene | NELAP | PA | 2/28/2002 |
| EPA 508 | Hexachlorocyclopentadiene | NELAP | PA | 2/28/2002 |
| EPA 508 | Methoxychlor | NELAP | PA | 2/28/2002 |
| EPA 508 | Toxaphene (Chlorinated camphene) | NELAP | PA | 5/25/2007 |
| EPA 508 | gamma-BHC (Lindane, gamma-Hexachlorocyclohexane) | NELAP | PA | 2/28/2002 |
| EPA 515.1 | 2,4,5-TP (Silvex) | NELAP | PA | 1/24/2001 |
| EPA 515.1 | 2,4-D | NELAP | PA | 1/24/2001 |

**The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.**
**www.dep.state.pa.us** **Issue Date: 05/25/2011**

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Drinking Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 515.1 | Dalapon (2,2-Dichloropropionic acid) | NELAP | PA | 1/24/2001 |
| EPA 515.1 | Dicamba | NELAP | PA | 1/24/2001 |
| EPA 515.1 | Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP) | NELAP | PA | 1/24/2001 |
| EPA 515.1 | Pentachlorophenol (PCP) | NELAP | PA | 1/24/2001 |
| EPA 515.1 | Picloram (4-Amino-3,5,6-trichloro-2-pyridinecarboxylic acid) | NELAP | PA | 1/24/2001 |
| EPA 524.2 | 1,1,1,2-Tetrachloroethane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 1,1,1-Trichloroethane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 1,1,2,2-Tetrachloroethane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 1,1,2-Trichloroethane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 1,1-Dichloro-2-propanone (1,1-Dichloropropanone) | NELAP | PA | 5/17/2005 |
| EPA 524.2 | 1,1-Dichloroethane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 1,1-Dichloroethene (1,1-Dichloroethylene) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 1,1-Dichloropropene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 1,2,3-Trichlorobenzene | NELAP | PA | 4/4/2005 |
| EPA 524.2 | 1,2,3-Trichloropropane (1,2,3-TCP) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 1,2,4-Trichlorobenzene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 1,2,4-Trimethylbenzene | NELAP | PA | 4/4/2005 |
| EPA 524.2 | 1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane) | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 1,2-Dibromoethane (EDB, Ethylene dibromide) | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 1,2-Dichlorobenzene (o-Dichlorobenzene) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 1,2-Dichloroethane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 1,2-Dichloropropane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 1,3,5-Trimethylbenzene | NELAP | PA | 5/17/2005 |
| EPA 524.2 | 1,3-Dichlorobenzene (m-Dichlorobenzene) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 1,3-Dichloropropane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 1,4-Dichlorobenzene (p-Dichlorobenzene) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 1-Chlorobutane | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 2,2-Dichloropropane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 2-Butanone (Methyl ethyl ketone, MEK) | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 2-Chlorotoluene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 2-Hexanone | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 2-Nitropropane | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 4-Chlorotoluene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4-Isopropyltoluene (p-Isopropyltoluene) | NELAP | PA | 5/17/2005 |
| EPA 524.2 | 4-Methyl-2-pentanone (MIBK) | NELAP | PA | 5/24/2007 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Drinking Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 524.2 | Acetone | NELAP | PA | 5/24/2007 |
| EPA 524.2 | Acrylonitrile | NELAP | PA | 5/24/2007 |
| EPA 524.2 | Allyl chloride (3-Chloropropene) | NELAP | PA | 5/24/2007 |
| EPA 524.2 | Benzene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | Bromobenzene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | Bromochloromethane | NELAP | PA | 4/4/2005 |
| EPA 524.2 | Bromodichloromethane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | Bromoform | NELAP | PA | 10/31/2002 |
| EPA 524.2 | Carbon disulfide | NELAP | PA | 5/24/2007 |
| EPA 524.2 | Carbon tetrachloride | NELAP | PA | 10/31/2002 |
| EPA 524.2 | Chloroacetonitrile | NELAP | PA | 5/24/2007 |
| EPA 524.2 | Chlorobenzene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | Chloroethane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | Chloroform | NELAP | PA | 10/31/2002 |
| EPA 524.2 | Dibromochloromethane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | Dibromomethane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | Dichlorodifluoromethane (Freon 12) | NELAP | PA | 4/4/2005 |
| EPA 524.2 | Dichloromethane (DCM, Methylene chloride) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | Diethyl ether (Ethyl ether) | NELAP | PA | 5/24/2007 |
| EPA 524.2 | Ethyl methacrylate | NELAP | PA | 5/24/2007 |
| EPA 524.2 | Ethylbenzene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | Hexachlorobutadiene (1,3-Hexachlorobutadiene) | NELAP | PA | 4/4/2005 |
| EPA 524.2 | Hexachloroethane | NELAP | PA | 5/24/2007 |
| EPA 524.2 | Isopropylbenzene (Cumene) | NELAP | PA | 4/4/2005 |
| EPA 524.2 | Methacrylonitrile | NELAP | PA | 5/24/2007 |
| EPA 524.2 | Methyl bromide (Bromomethane) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | Methyl chloride (Chloromethane) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | Methyl iodide (Iodomethane) | NELAP | PA | 5/24/2007 |
| EPA 524.2 | Methyl tert-butyl ether (MTBE) | NELAP | PA | 4/4/2005 |
| EPA 524.2 | Methylacrylate | NELAP | PA | 5/24/2007 |
| EPA 524.2 | Methylmethacrylate | NELAP | PA | 5/24/2007 |
| EPA 524.2 | Naphthalene | NELAP | PA | 5/17/2005 |
| EPA 524.2 | Nitrobenzene | NELAP | PA | 5/17/2005 |
| EPA 524.2 | Pentachloroethane | NELAP | PA | 5/24/2007 |
| EPA 524.2 | Propionitrile (Ethyl cyanide) | NELAP | PA | 5/24/2007 |
| EPA 524.2 | Styrene | NELAP | PA | 10/31/2002 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Drinking Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 524.2 | Tetrachloroethene (PCE, Perchloroethylene) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | Tetrahydrofuran (THF) | NELAP | PA | 5/24/2007 |
| EPA 524.2 | Toluene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | Total trihalomethanes (TTHMs) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | Trichloroethene (TCE, Trichloroethylene) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | Trichlorofluoromethane (Freon 11) | NELAP | PA | 4/4/2005 |
| EPA 524.2 | Vinyl chloride (Chloroethene) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | Xylenes, total | NELAP | PA | 10/31/2002 |
| EPA 524.2 | cis-1,2-Dichloroethene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | cis-1,3-Dichloropropene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | n-Butylbenzene | NELAP | PA | 4/4/2005 |
| EPA 524.2 | n-Propylbenzene | NELAP | PA | 5/17/2005 |
| EPA 524.2 | sec-Butylbenzene | NELAP | PA | 4/4/2005 |
| EPA 524.2 | tert-Butylbenzene | NELAP | PA | 4/4/2005 |
| EPA 524.2 | trans-1,2-Dichloroethene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | trans-1,3-Dichloropropene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | trans-1,4-Dichloro-2-butene | NELAP | PA | 5/24/2007 |
| EPA 524.2-Extended | Allyl chloride (3-Chloropropene) | NELAP | PA | 7/3/2007 |
| EPA 524.2-Extended | Diisopropyl ether (DIPE) | NELAP | PA | 1/7/2010 |
| EPA 524.2-Extended | Ethyl tert-butyl ether (ETBE) | NELAP | PA | 1/24/2007 |
| EPA 524.2-Extended | tert-Amyl methyl ether (TAME) | NELAP | PA | 1/24/2007 |
| EPA 524.2-Extended | tert-Butyl alcohol (2-Methyl-2-propanol) | NELAP | PA | 5/24/2007 |
| EPA 525.2 | 2,3-Dichlorobiphenyl (BZ 5) | NELAP | PA | 5/17/2005 |
| EPA 525.2 | Acenaphthylene | NELAP | PA | 4/28/2010 |
| EPA 525.2 | Alachlor (Lasso) | NELAP | PA | 2/28/2002 |
| EPA 525.2 | Anthracene | NELAP | PA | 5/25/2007 |
| EPA 525.2 | Atrazine | NELAP | PA | 1/3/2002 |
| EPA 525.2 | Benzo[a]anthracene | NELAP | PA | 5/25/2007 |
| EPA 525.2 | Benzo[a]pyrene | NELAP | PA | 1/24/2001 |
| EPA 525.2 | Benzo[b]fluoranthene | NELAP | PA | 6/4/2007 |
| EPA 525.2 | Benzo[ghi]perylene | NELAP | PA | 7/3/2007 |
| EPA 525.2 | Benzo[k]fluoranthene | NELAP | PA | 6/4/2007 |
| EPA 525.2 | Benzyl butyl phthalate (Butyl benzyl phthalate) | NELAP | PA | 5/25/2007 |
| EPA 525.2 | Butachlor | NELAP | PA | 12/19/2002 |
| EPA 525.2 | Chrysene (Benzo[a]phenanthrene) | NELAP | PA | 5/25/2007 |
| EPA 525.2 | Di-n-butyl phthalate | NELAP | PA | 5/25/2007 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Drinking Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 525.2 | Dibenzo[a,h]anthracene | NELAP | PA | 5/25/2007 |
| EPA 525.2 | Dieldrin | NELAP | PA | 5/17/2005 |
| EPA 525.2 | Diethyl phthalate | NELAP | PA | 5/25/2007 |
| EPA 525.2 | Dimethyl phthalate | NELAP | PA | 5/25/2007 |
| EPA 525.2 | Endrin | NELAP | PA | 5/17/2005 |
| EPA 525.2 | Heptachlor | NELAP | PA | 5/17/2005 |
| EPA 525.2 | Heptachlor epoxide | NELAP | PA | 5/17/2005 |
| EPA 525.2 | Hexachlorobenzene | NELAP | PA | 2/11/2005 |
| EPA 525.2 | Hexachlorocyclopentadiene | NELAP | PA | 1/24/2001 |
| EPA 525.2 | Methoxychlor | NELAP | PA | 1/24/2001 |
| EPA 525.2 | Metolachlor | NELAP | PA | 12/19/2002 |
| EPA 525.2 | Metribuzin | NELAP | PA | 12/19/2002 |
| EPA 525.2 | Phenanthrene | NELAP | PA | 5/25/2007 |
| EPA 525.2 | Propachlor (Ramrod) | NELAP | PA | 1/24/2001 |
| EPA 525.2 | Pyrene | NELAP | PA | 5/25/2007 |
| EPA 525.2 | Simazine | NELAP | PA | 1/3/2002 |
| EPA 525.2 | bis(2-Ethylhexyl) adipate (di(2-Ethylhexyl) adipate) | NELAP | PA | 1/24/2001 |
| EPA 525.2 | bis(2-Ethylhexyl) phthalate (DEHP) | NELAP | PA | 1/24/2001 |
| EPA 525.2 | gamma-BHC (Lindane, gamma-Hexachlorocyclohexane) | NELAP | PA | 1/24/2001 |
| EPA 525.2-Extended | Acenaphthene | NELAP | PA | 5/25/2007 |
| EPA 531.1 | 3-Hydroxycarbofuran | NELAP | PA | 11/7/2006 |
| EPA 531.1 | Aldicarb (Temik) | NELAP | PA | 1/24/2001 |
| EPA 531.1 | Aldicarb sulfone | NELAP | PA | 1/24/2001 |
| EPA 531.1 | Aldicarb sulfoxide | NELAP | PA | 1/24/2001 |
| EPA 531.1 | Carbaryl (Sevin) | NELAP | PA | 10/9/2002 |
| EPA 531.1 | Carbofuran (Furadan) | NELAP | PA | 1/24/2001 |
| EPA 531.1 | Methomyl (Lannate) | NELAP | PA | 1/24/2001 |
| EPA 531.1 | Oxamyl (Vydate) | NELAP | PA | 1/24/2001 |
| EPA 8015-Extended | Ethane | NELAP | PA | 5/24/2011 |
| EPA 8015-Extended | Methane | NELAP | PA | 5/24/2011 |
| SM 2120 B | Color | NELAP | PA | 5/25/2005 |
| SM 2130 B | Turbidity | NELAP | PA | 5/17/2005 |
| SM 2320 B | Alkalinity as CaCO3 | NELAP | PA | 1/24/2001 |
| SM 2340 B | Total hardness as CaCO3 | NELAP | PA | 4/4/2005 |
| SM 2340 C | Total hardness as CaCO3 | NELAP | PA | 5/24/2011 |
| SM 2510 B | Conductivity | NELAP | PA | 5/17/2005 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*

Page 7 of 51

**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Drinking Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| SM 2540 C | Total dissolved solids (TDS) | NELAP | PA | 6/2/2004 |
| SM 2540 D | Residue, nonfilterable (TSS) | NELAP | PA | 5/24/2011 |
| SM 2550 B | Temperature, deg. C | NELAP | PA | 4/4/2005 |
| SM 4500-CN- E | Free cyanide | NELAP | PA | 5/24/2011 |
| SM 4500-Cl F | Total residual chlorine | NELAP | PA | 5/24/2011 |
| SM 4500-Cl G | Residual free chlorine | NELAP | PA | 1/7/2010 |
| SM 4500-F- C | Fluoride | NELAP | PA | 10/15/2003 |
| SM 4500-H+ B | pH | NELAP | PA | 5/16/2007 |
| SM 4500-P E | Orthophosphate as P | NELAP | PA | 6/12/2007 |
| SM 4500-SiO2 C (20th ed.) | Silica, dissolved | NELAP | PA | 5/24/2007 |
| SM 5540 C | Surfactants as MBAS | NELAP | PA | 5/24/2007 |
| SM 9215 B | Heterotrophic bacteria (Enumeration) | NELAP | PA | 2/5/2003 |
| SM 9223 B | Total coliform & E. coli | NELAP | PA | 1/26/2001 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| AK-101 | Gasoline-range organics (GRO) | NELAP | PA | 12/12/2005 |
| AK-102 | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| EPA 1010 | Ignitability | NELAP | PA | 12/12/2005 |
| EPA 130.2 | Hardness | NELAP | PA | 1/19/2005 |
| EPA 1311 | Toxicity characteristic leaching procedure (TCLP) | NELAP | PA | 12/12/2005 |
| EPA 1312 | Synthetic precipitation leaching procedure (SPLP) | NELAP | PA | 12/12/2005 |
| EPA 160.1 | Residue, filterable (TDS) | NELAP | PA | 1/19/2005 |
| EPA 160.4 | Residue, volatile | NELAP | PA | 1/19/2005 |
| EPA 1613 | 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD) | NELAP | PA | 6/30/2010 |
| EPA 1613 | 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF) | NELAP | PA | 6/30/2010 |
| EPA 1613 | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd) | NELAP | PA | 6/30/2010 |
| EPA 1613 | 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf) | NELAP | PA | 6/30/2010 |
| EPA 1613 | 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf) | NELAP | PA | 6/30/2010 |
| EPA 1613 | 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 6/30/2010 |
| EPA 1613 | 1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 1613 | 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 6/30/2010 |
| EPA 1613 | 1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 1613 | 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 6/30/2010 |
| EPA 1613 | 1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 1613 | 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD) | NELAP | PA | 6/30/2010 |
| EPA 1613 | 1,2,3,7,8-Pentachlorodibenzofuran (PeCDF) | NELAP | PA | 6/30/2010 |
| EPA 1613 | 2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 1613 | 2,3,4,7,8-Pentachlorodibenzofuran (PeCDF) | NELAP | PA | 6/30/2010 |
| EPA 1613 | 2,3,7,8-TCDD (Dioxin) | NELAP | PA | 6/30/2010 |
| EPA 1613 | 2,3,7,8-Tetrachlorodibenzofuran (TCDF) | NELAP | PA | 6/30/2010 |
| EPA 1613 | Total heptachlorodibenzo-p-dioxin (HpCDD) | NELAP | PA | 8/6/2010 |
| EPA 1613 | Total heptachlorodibenzofuran (HpCDF) | NELAP | PA | 8/6/2010 |
| EPA 1613 | Total hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 8/6/2010 |
| EPA 1613 | Total hexachlorodibenzofuran (HxCDF) | NELAP | PA | 8/6/2010 |
| EPA 1613 | Total pentachlorodibenzo-p-dioxin (PeCDD) | NELAP | PA | 8/6/2010 |
| EPA 1613 | Total pentachlorodibenzofuran (PeCDF) | NELAP | PA | 8/6/2010 |
| EPA 1613 | Total tetrachlorodibenzo-p-dioxin (TCDD) | NELAP | PA | 8/6/2010 |
| EPA 1613 | Total tetrachlorodibenzofuran (TCDF) | NELAP | PA | 8/6/2010 |
| EPA 1625 Rev C | N-Nitrosodimethylamine | NELAP | PA | 11/23/2010 |
| EPA 1631 | Mercury | NELAP | PA | 6/11/2007 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID:** 36-00037 **EPA Lab Code:** PA00009 (717) 656-2300

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program** Non-Potable Water

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 1664 Rev A | Non-polar material | NELAP | PA | 11/17/2006 |
| EPA 1664 Rev A | Oil and grease | NELAP | PA | 1/19/2005 |
| EPA 1666 Rev A | 2-Propanol (Isopropyl alcohol) | NELAP | PA | 12/2/2009 |
| EPA 1666 Rev A | 4-Methyl-2-pentanone (MIBK) | NELAP | PA | 12/12/2005 |
| EPA 1666 Rev A | Ethyl acetate | NELAP | PA | 1/19/2005 |
| EPA 1666 Rev A | Isobutyraldehyde | NELAP | PA | 1/19/2005 |
| EPA 1666 Rev A | Isopropyl acetate | NELAP | PA | 1/19/2005 |
| EPA 1666 Rev A | Isopropyl ether | NELAP | PA | 1/19/2005 |
| EPA 1666 Rev A | Methyl formate | NELAP | PA | 1/19/2005 |
| EPA 1666 Rev A | Tetrahydrofuran (THF) | NELAP | PA | 1/19/2005 |
| EPA 1666 Rev A | Xylenes, total | NELAP | PA | 1/19/2005 |
| EPA 1666 Rev A | n-Amyl acetate (n-Pentyl acetate) | NELAP | PA | 4/4/2005 |
| EPA 1666 Rev A | n-Amyl alcohol (1-Pentanol) | NELAP | PA | 4/4/2005 |
| EPA 1666 Rev A | n-Butyl acetate | NELAP | PA | 4/4/2005 |
| EPA 1666 Rev A | n-Heptane | NELAP | PA | 1/19/2005 |
| EPA 1666 Rev A | n-Hexane | NELAP | PA | 1/19/2005 |
| EPA 1666 Rev A | tert-Butyl alcohol (2-Methyl-2-propanol) | NELAP | PA | 4/4/2005 |
| EPA 1671 Rev A | Acetonitrile | NELAP | PA | 1/19/2005 |
| EPA 1671 Rev A | Diethylamine | NELAP | PA | 1/19/2005 |
| EPA 1671 Rev A | Dimethyl sulfoxide | NELAP | PA | 1/19/2005 |
| EPA 1671 Rev A | Ethanol | NELAP | PA | 1/19/2005 |
| EPA 1671 Rev A | Methanol | NELAP | PA | 1/19/2005 |
| EPA 1671 Rev A | Methyl cellosolve (2-Methoxyethanol) | NELAP | PA | 1/19/2005 |
| EPA 1671 Rev A | Triethylamine | NELAP | PA | 1/19/2005 |
| EPA 1671 Rev A | n-Propanol (1-Propanol) | NELAP | PA | 1/19/2005 |
| EPA 170.1 | Temperature, deg. C | NELAP | PA | 4/4/2005 |
| EPA 180.1 | Turbidity | NELAP | PA | 1/19/2005 |
| EPA 200.2 | Metals sample preparation | NELAP | PA | 1/24/2007 |
| EPA 200.7 | Aluminum | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Antimony | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Arsenic | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Barium | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Beryllium | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Boron | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Cadmium | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Calcium | NELAP | PA | 1/19/2005 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID:** 36-00037 **EPA Lab Code:** PA00009 **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program** Non-Potable Water

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 200.7 | Chromium | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Cobalt | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Copper | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Iron | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Lead | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Magnesium | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Manganese | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Molybdenum | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Nickel | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Potassium | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Selenium | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Silver | NELAP | PA | 4/4/2005 |
| EPA 200.7 | Sodium | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Strontium | NELAP | PA | 5/24/2011 |
| EPA 200.7 | Thallium | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Tin | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Titanium | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Vanadium | NELAP | PA | 1/19/2005 |
| EPA 200.7 | Zinc | NELAP | PA | 1/19/2005 |
| EPA 200.8 | Aluminum | NELAP | PA | 1/7/2010 |
| EPA 200.8 | Antimony | NELAP | PA | 4/4/2005 |
| EPA 200.8 | Arsenic | NELAP | PA | 4/4/2005 |
| EPA 200.8 | Barium | NELAP | PA | 4/4/2005 |
| EPA 200.8 | Beryllium | NELAP | PA | 4/4/2005 |
| EPA 200.8 | Cadmium | NELAP | PA | 4/4/2005 |
| EPA 200.8 | Chromium | NELAP | PA | 4/4/2005 |
| EPA 200.8 | Cobalt | NELAP | PA | 11/23/2010 |
| EPA 200.8 | Copper | NELAP | PA | 4/4/2005 |
| EPA 200.8 | Lead | NELAP | PA | 4/4/2005 |
| EPA 200.8 | Manganese | NELAP | PA | 11/23/2010 |
| EPA 200.8 | Molybdenum | NELAP | PA | 1/7/2010 |
| EPA 200.8 | Nickel | NELAP | PA | 4/4/2005 |
| EPA 200.8 | Selenium | NELAP | PA | 12/12/2005 |
| EPA 200.8 | Silver | NELAP | PA | 1/2/2007 |
| EPA 200.8 | Thallium | NELAP | PA | 5/31/2006 |
| EPA 200.8 | Vanadium | NELAP | PA | 1/7/2010 |

**The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.**

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 200.8 | Zinc | NELAP | PA | 1/18/2011 |
| EPA 200.8-Extended | Boron | NELAP | PA | 1/7/2010 |
| EPA 200.8-Extended | Calcium | NELAP | PA | 1/7/2010 |
| EPA 200.8-Extended | Iron | NELAP | PA | 11/23/2010 |
| EPA 200.8-Extended | Magnesium | NELAP | PA | 1/7/2010 |
| EPA 200.8-Extended | Potassium | NELAP | PA | 1/7/2010 |
| EPA 200.8-Extended | Sodium | NELAP | PA | 1/7/2010 |
| EPA 200.8-Extended | Strontium | NELAP | PA | 1/7/2010 |
| EPA 200.8-Extended | Tin | NELAP | PA | 1/7/2010 |
| EPA 200.8-Extended | Titanium | NELAP | PA | 1/7/2010 |
| EPA 218.6 | Chromium VI | NELAP | PA | 4/4/2005 |
| EPA 245.1 | Mercury | NELAP | PA | 1/19/2005 |
| EPA 300.0 | Bromide | NELAP | PA | 4/4/2005 |
| EPA 300.0 | Chloride | NELAP | PA | 1/19/2005 |
| EPA 300.0 | Fluoride | NELAP | PA | 5/25/2005 |
| EPA 300.0 | Nitrate as N | NELAP | PA | 1/19/2005 |
| EPA 300.0 | Nitrite as N | NELAP | PA | 1/19/2005 |
| EPA 300.0 | Orthophosphate as P | NELAP | PA | 11/23/2010 |
| EPA 300.0 | Sulfate | NELAP | PA | 1/19/2005 |
| EPA 3005A | Preconcentration under acid | NELAP | PA | 12/12/2005 |
| EPA 3010A | Hot plate acid digestion (HNO3 + HCl) | NELAP | PA | 12/12/2005 |
| EPA 3020A | Hot plate acid digestion (HNO3 only) | NELAP | PA | 12/12/2005 |
| EPA 305.2 | Acidity as CaCO3 | NELAP | PA | 1/24/2007 |
| EPA 3060A | Alkaline digestion of Cr(VI) | NELAP | PA | 1/24/2007 |
| EPA 314.0 | Perchlorate | NELAP | PA | 11/23/2009 |
| EPA 335.4 | Total cyanide | NELAP | PA | 1/19/2005 |
| EPA 351.2 | Kjeldahl nitrogen, total (TKN) | NELAP | PA | 1/19/2005 |
| EPA 3510C | Separatory funnel liquid-liquid extraction | NELAP | PA | 12/12/2005 |
| EPA 3520C | Continuous liquid-liquid extraction | NELAP | PA | 12/12/2005 |
| EPA 353.2 | Nitrate as N | NELAP | PA | 1/19/2005 |
| EPA 353.2 | Nitrite as N | NELAP | PA | 1/19/2005 |
| EPA 353.2 | Total nitrate-nitrite | NELAP | PA | 4/4/2005 |
| EPA 3620B | Florisil cleanup | NELAP | PA | 12/12/2005 |
| EPA 3630C | Silica gel cleanup | NELAP | PA | 12/12/2005 |
| EPA 3640A | Gel permeation cleanup (GPC) | NELAP | PA | 12/12/2005 |
| EPA 365.1 | Phosphorus, total | NELAP | PA | 4/4/2005 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 365.3 | Orthophosphate as P | NELAP | PA | 1/19/2005 |
| EPA 3660B | Sulfur cleanup | NELAP | PA | 12/12/2005 |
| EPA 375.4 | Sulfate | NELAP | PA | 4/4/2005 |
| EPA 410.1 | Chemical oxygen demand (COD) | NELAP | PA | 12/11/2006 |
| EPA 410.4 | Chemical oxygen demand (COD) | NELAP | PA | 4/1/2005 |
| EPA 415.1 | Total organic carbon (TOC) | NELAP | PA | 1/19/2005 |
| EPA 420.4 | Total phenolics | NELAP | PA | 4/17/2007 |
| EPA 425.1 | Surfactants as MBAS | NELAP | PA | 1/19/2005 |
| EPA 5030B | Aqueous-phase purge-and-trap | NELAP | PA | 12/12/2005 |
| EPA 524.2 | 1,2-Dichlorobenzene (o-Dichlorobenzene) | NELAP | PA | 1/18/2011 |
| EPA 524.2 | 1,2-Dichloroethane | NELAP | PA | 1/18/2011 |
| EPA 524.2 | 4-Methyl-2-pentanone (MIBK) | NELAP | PA | 5/24/2011 |
| EPA 524.2 | Acetone | NELAP | PA | 1/18/2011 |
| EPA 524.2 | Benzene | NELAP | PA | 1/18/2011 |
| EPA 524.2 | Chlorobenzene | NELAP | PA | 1/18/2011 |
| EPA 524.2 | Chloroform | NELAP | PA | 1/18/2011 |
| EPA 524.2 | Dichloromethane (DCM, Methylene chloride) | NELAP | PA | 5/24/2011 |
| EPA 524.2 | Tetrahydrofuran (THF) | NELAP | PA | 5/24/2011 |
| EPA 524.2 | Toluene | NELAP | PA | 1/18/2011 |
| EPA 524.2 | o-Xylene | NELAP | PA | 5/24/2011 |
| EPA 6010 | Aluminum | NELAP | PA | 12/12/2005 |
| EPA 6010 | Antimony | NELAP | PA | 12/12/2005 |
| EPA 6010 | Arsenic | NELAP | PA | 12/12/2005 |
| EPA 6010 | Barium | NELAP | PA | 12/12/2005 |
| EPA 6010 | Beryllium | NELAP | PA | 12/12/2005 |
| EPA 6010 | Boron | NELAP | PA | 12/12/2005 |
| EPA 6010 | Cadmium | NELAP | PA | 12/12/2005 |
| EPA 6010 | Calcium | NELAP | PA | 12/12/2005 |
| EPA 6010 | Chromium | NELAP | PA | 12/12/2005 |
| EPA 6010 | Cobalt | NELAP | PA | 12/12/2005 |
| EPA 6010 | Copper | NELAP | PA | 12/12/2005 |
| EPA 6010 | Iron | NELAP | PA | 12/12/2005 |
| EPA 6010 | Lead | NELAP | PA | 12/12/2005 |
| EPA 6010 | Lithium | NELAP | PA | 1/18/2011 |
| EPA 6010 | Magnesium | NELAP | PA | 12/12/2005 |
| EPA 6010 | Manganese | NELAP | PA | 12/12/2005 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 6010 | Molybdenum | NELAP | PA | 12/12/2005 |
| EPA 6010 | Nickel | NELAP | PA | 12/12/2005 |
| EPA 6010 | Potassium | NELAP | PA | 12/12/2005 |
| EPA 6010 | Selenium | NELAP | PA | 12/12/2005 |
| EPA 6010 | Silver | NELAP | PA | 12/12/2005 |
| EPA 6010 | Sodium | NELAP | PA | 12/12/2005 |
| EPA 6010 | Strontium | NELAP | PA | 12/12/2005 |
| EPA 6010 | Thallium | NELAP | PA | 12/12/2005 |
| EPA 6010 | Tin | NELAP | PA | 12/12/2005 |
| EPA 6010 | Titanium | NELAP | PA | 12/12/2005 |
| EPA 6010 | Vanadium | NELAP | PA | 12/12/2005 |
| EPA 6010 | Zinc | NELAP | PA | 12/12/2005 |
| EPA 602 | Benzene | NELAP | PA | 1/19/2005 |
| EPA 602 | Ethylbenzene | NELAP | PA | 1/19/2005 |
| EPA 602 | Methyl tert-butyl ether (MTBE) | NELAP | PA | 1/19/2005 |
| EPA 602 | Toluene | NELAP | PA | 1/19/2005 |
| EPA 602 | Xylenes, total | NELAP | PA | 1/19/2005 |
| EPA 602-Extended | Naphthalene | NELAP | PA | 1/18/2011 |
| EPA 602-Extended | Styrene | NELAP | PA | 6/24/2008 |
| EPA 602-Extended | m+p-Xylene | NELAP | PA | 1/18/2011 |
| EPA 602-Extended | o-Xylene | NELAP | PA | 1/18/2011 |
| EPA 6020 | Aluminum | NELAP | PA | 1/7/2010 |
| EPA 6020 | Antimony | NELAP | PA | 12/12/2005 |
| EPA 6020 | Arsenic | NELAP | PA | 12/12/2005 |
| EPA 6020 | Barium | NELAP | PA | 12/12/2005 |
| EPA 6020 | Beryllium | NELAP | PA | 12/12/2005 |
| EPA 6020 | Cadmium | NELAP | PA | 12/12/2005 |
| EPA 6020 | Calcium | NELAP | PA | 1/7/2010 |
| EPA 6020 | Chromium | NELAP | PA | 12/12/2005 |
| EPA 6020 | Cobalt | NELAP | PA | 11/23/2010 |
| EPA 6020 | Copper | NELAP | PA | 12/12/2005 |
| EPA 6020 | Iron | NELAP | PA | 11/23/2010 |
| EPA 6020 | Lead | NELAP | PA | 12/12/2005 |
| EPA 6020 | Magnesium | NELAP | PA | 1/7/2010 |
| EPA 6020 | Manganese | NELAP | PA | 11/23/2010 |
| EPA 6020 | Molybdenum | NELAP | PA | 1/7/2010 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 6020 | Nickel | NELAP | PA | 7/23/2008 |
| EPA 6020 | Potassium | NELAP | PA | 1/7/2010 |
| EPA 6020 | Selenium | NELAP | PA | 12/12/2005 |
| EPA 6020 | Silver | NELAP | PA | 1/12/2007 |
| EPA 6020 | Sodium | NELAP | PA | 1/7/2010 |
| EPA 6020 | Thallium | NELAP | PA | 12/12/2005 |
| EPA 6020 | Vanadium | NELAP | PA | 1/7/2010 |
| EPA 6020 | Zinc | NELAP | PA | 1/18/2011 |
| EPA 6020-Extended | Boron | NELAP | PA | 1/7/2010 |
| EPA 6020-Extended | Strontium | NELAP | PA | 1/7/2010 |
| EPA 6020-Extended | Tin | NELAP | PA | 1/7/2010 |
| EPA 6020-Extended | Titanium | NELAP | PA | 1/7/2010 |
| EPA 608 | 4,4'-DDD | NELAP | PA | 1/19/2005 |
| EPA 608 | 4,4'-DDE | NELAP | PA | 1/19/2005 |
| EPA 608 | 4,4'-DDT | NELAP | PA | 1/19/2005 |
| EPA 608 | Aldrin (HHDN) | NELAP | PA | 1/19/2005 |
| EPA 608 | Aroclor-1016 (PCB-1016) | NELAP | PA | 12/11/2006 |
| EPA 608 | Aroclor-1221 (PCB-1221) | NELAP | PA | 12/11/2006 |
| EPA 608 | Aroclor-1232 (PCB-1232) | NELAP | PA | 12/11/2006 |
| EPA 608 | Aroclor-1242 (PCB-1242) | NELAP | PA | 12/11/2006 |
| EPA 608 | Aroclor-1248 (PCB-1248) | NELAP | PA | 12/11/2006 |
| EPA 608 | Aroclor-1254 (PCB-1254) | NELAP | PA | 12/11/2006 |
| EPA 608 | Aroclor-1260 (PCB-1260) | NELAP | PA | 12/11/2006 |
| EPA 608 | Chlordane (tech.) | NELAP | PA | 1/19/2005 |
| EPA 608 | Dieldrin | NELAP | PA | 1/19/2005 |
| EPA 608 | Endosulfan I | NELAP | PA | 1/19/2005 |
| EPA 608 | Endosulfan II | NELAP | PA | 1/19/2005 |
| EPA 608 | Endosulfan sulfate | NELAP | PA | 1/19/2005 |
| EPA 608 | Endrin | NELAP | PA | 1/19/2005 |
| EPA 608 | Endrin aldehyde | NELAP | PA | 1/19/2005 |
| EPA 608 | Heptachlor | NELAP | PA | 1/19/2005 |
| EPA 608 | Heptachlor epoxide | NELAP | PA | 1/19/2005 |
| EPA 608 | Methoxychlor | NELAP | PA | 5/2/2006 |
| EPA 608 | Toxaphene (Chlorinated camphene) | NELAP | PA | 1/19/2005 |
| EPA 608 | alpha-BHC (alpha-Hexachlorocyclohexane) | NELAP | PA | 1/19/2005 |
| EPA 608 | beta-BHC (beta-Hexachlorocyclohexane) | NELAP | PA | 1/19/2005 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID:** 36-00037 **EPA Lab Code:** PA00009 (717) 656-2300

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program** Non-Potable Water

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 608 | delta-BHC (delta-Hexachlorocyclohexane) | NELAP | PA | 1/19/2005 |
| EPA 608 | gamma-BHC (Lindane, gamma-Hexachlorocyclohexane) | NELAP | PA | 1/19/2005 |
| EPA 610 | Acenaphthene | NELAP | PA | 1/2/2007 |
| EPA 610 | Acenaphthylene | NELAP | PA | 1/2/2007 |
| EPA 610 | Anthracene | NELAP | PA | 1/2/2007 |
| EPA 610 | Benzo[a]anthracene | NELAP | PA | 1/2/2007 |
| EPA 610 | Benzo[a]pyrene | NELAP | PA | 1/2/2007 |
| EPA 610 | Benzo[b]fluoranthene | NELAP | PA | 1/2/2007 |
| EPA 610 | Benzo[ghi]perylene | NELAP | PA | 1/2/2007 |
| EPA 610 | Benzo[k]fluoranthene | NELAP | PA | 1/2/2007 |
| EPA 610 | Chrysene (Benzo[a]phenanthrene) | NELAP | PA | 1/2/2007 |
| EPA 610 | Dibenzo[a,h]anthracene | NELAP | PA | 1/2/2007 |
| EPA 610 | Fluoranthene | NELAP | PA | 1/2/2007 |
| EPA 610 | Fluorene | NELAP | PA | 1/2/2007 |
| EPA 610 | Indeno(1,2,3-cd)pyrene | NELAP | PA | 1/2/2007 |
| EPA 610 | Naphthalene | NELAP | PA | 1/2/2007 |
| EPA 610 | Phenanthrene | NELAP | PA | 1/2/2007 |
| EPA 610 | Pyrene | NELAP | PA | 1/2/2007 |
| EPA 622 | Azinphos-methyl (Guthion) | NELAP | PA | 6/15/2009 |
| EPA 622 | Bolstar (Sulprofos) | NELAP | PA | 6/15/2009 |
| EPA 622 | Chlorpyrifos | NELAP | PA | 6/15/2009 |
| EPA 622 | Coumaphos | NELAP | PA | 6/15/2009 |
| EPA 622 | Demeton-O | NELAP | PA | 6/15/2009 |
| EPA 622 | Demeton-S | NELAP | PA | 6/15/2009 |
| EPA 622 | Diazinon (Spectracide) | NELAP | PA | 6/15/2009 |
| EPA 622 | Dichlorovos (DDVP, Dichlorvos) | NELAP | PA | 6/15/2009 |
| EPA 622 | Disulfoton | NELAP | PA | 6/15/2009 |
| EPA 622 | Ethoprop (Prophos) | NELAP | PA | 6/15/2009 |
| EPA 622 | Fensulfothion | NELAP | PA | 6/15/2009 |
| EPA 622 | Fenthion | NELAP | PA | 6/15/2009 |
| EPA 622 | Merphos | NELAP | PA | 6/15/2009 |
| EPA 622 | Methyl parathion (Parathion, methyl) | NELAP | PA | 6/15/2009 |
| EPA 622 | Mevinphos | NELAP | PA | 6/15/2009 |
| EPA 622 | Naled | NELAP | PA | 6/15/2009 |
| EPA 622 | Phorate (Thimet) | NELAP | PA | 6/15/2009 |
| EPA 622 | Ronnel | NELAP | PA | 6/15/2009 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 622 | Stirophos (Tetrachlorovinphos) | NELAP | PA | 6/15/2009 |
| EPA 622 | Tokuthion (Prothiophos) | NELAP | PA | 6/15/2009 |
| EPA 622 | Trichloronate | NELAP | PA | 6/15/2009 |
| EPA 622-Extended | Carbophenothion (Trithion) | NELAP | PA | 4/28/2010 |
| EPA 622-Extended | EPN (Santox) | NELAP | PA | 6/15/2009 |
| EPA 622-Extended | Ethion | NELAP | PA | 6/15/2009 |
| EPA 622-Extended | Famphur | NELAP | PA | 6/15/2009 |
| EPA 622-Extended | Malathion | NELAP | PA | 6/15/2009 |
| EPA 622-Extended | Parathion (Ethyl parathion) | NELAP | PA | 6/15/2009 |
| EPA 624 | 1,1,1,2-Tetrachloroethane | NELAP | PA | 1/19/2005 |
| EPA 624 | 1,1,1-Trichloroethane | NELAP | PA | 1/19/2005 |
| EPA 624 | 1,1,2,2-Tetrachloroethane | NELAP | PA | 1/19/2005 |
| EPA 624 | 1,1,2-Trichloroethane | NELAP | PA | 1/19/2005 |
| EPA 624 | 1,1-Dichloroethane | NELAP | PA | 1/19/2005 |
| EPA 624 | 1,1-Dichloroethene (1,1-Dichloroethylene) | NELAP | PA | 1/19/2005 |
| EPA 624 | 1,2-Dichlorobenzene (o-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 624 | 1,2-Dichloroethane | NELAP | PA | 1/19/2005 |
| EPA 624 | 1,2-Dichloropropane | NELAP | PA | 1/19/2005 |
| EPA 624 | 1,3-Dichlorobenzene (m-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 624 | 1,4-Dichlorobenzene (p-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 624 | 2-Chloroethyl vinyl ether | NELAP | PA | 1/19/2005 |
| EPA 624 | Acrolein (Propenal) | NELAP | PA | 1/19/2005 |
| EPA 624 | Acrylonitrile | NELAP | PA | 1/19/2005 |
| EPA 624 | Benzene | NELAP | PA | 1/19/2005 |
| EPA 624 | Bromodichloromethane | NELAP | PA | 1/19/2005 |
| EPA 624 | Bromoform | NELAP | PA | 1/19/2005 |
| EPA 624 | Carbon tetrachloride | NELAP | PA | 1/19/2005 |
| EPA 624 | Chlorobenzene | NELAP | PA | 1/19/2005 |
| EPA 624 | Chloroethane | NELAP | PA | 1/19/2005 |
| EPA 624 | Chloroform | NELAP | PA | 1/19/2005 |
| EPA 624 | Dibromochloromethane | NELAP | PA | 4/4/2005 |
| EPA 624 | Ethylbenzene | NELAP | PA | 1/19/2005 |
| EPA 624 | Methyl bromide (Bromomethane) | NELAP | PA | 1/19/2005 |
| EPA 624 | Methyl chloride (Chloromethane) | NELAP | PA | 1/19/2005 |
| EPA 624 | Methylene chloride (Dichloromethane) | NELAP | PA | 1/19/2005 |
| EPA 624 | Tetrachloroethene (PCE, Perchloroethylene) | NELAP | PA | 1/19/2005 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 624 | Toluene | NELAP | PA | 1/19/2005 |
| EPA 624 | Trichloroethene (TCE, Trichloroethylene) | NELAP | PA | 1/19/2005 |
| EPA 624 | Trichlorofluoromethane (Freon 11) | NELAP | PA | 1/19/2005 |
| EPA 624 | Vinyl chloride (Chloroethene) | NELAP | PA | 1/19/2005 |
| EPA 624 | Xylenes, total | NELAP | PA | 1/19/2005 |
| EPA 624 | cis-1,3-Dichloropropene | NELAP | PA | 1/19/2005 |
| EPA 624 | trans-1,2-Dichloroethene | NELAP | PA | 1/19/2005 |
| EPA 624 | trans-1,3-Dichloropropene | NELAP | PA | 1/19/2005 |
| EPA 624-Extended | 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113) | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | 1,1-Dichloropropene | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | 1,2,3-Trichlorobenzene | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | 1,2,3-Trichloropropane (1,2,3-TCP) | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | 1,2,3-Trimethylbenzene | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | 1,2,4-Trichlorobenzene | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | 1,2,4-Trimethylbenzene | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | 1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane) | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | 1,2-Dibromoethane (EDB, Ethylene dibromide) | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | 1,3,5-Trimethylbenzene | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | 1,3-Dichloropropane | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | 1,4-Dioxane (1,4-Diethyleneoxide) | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | 2,2-Dichloropropane | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | 2-Butanone (Methyl ethyl ketone, MEK) | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | 2-Chlorotoluene | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | 2-Hexanone | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | 4-Chloro-2-nitrophenol | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | 4-Chlorotoluene | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | 4-Isopropyltoluene (p-Isopropyltoluene) | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | Acetone | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | Acetonitrile | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | Allyl chloride (3-Chloropropene) | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | Bromobenzene | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | Bromochloromethane | NELAP | PA | 5/2/2006 |
| EPA 624-Extended | Carbon disulfide | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | Chloroprene (2-Chloro-1,3-butadiene) | NELAP | PA | 6/12/2009 |
| EPA 624-Extended | Cyclohexane | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | Dibromomethane | NELAP | PA | 7/3/2007 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| *Method* | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 624-Extended | Dichlorodifluoromethane (Freon 12) | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | Diisopropyl ether (DIPE) | NELAP | PA | 5/2/2006 |
| EPA 624-Extended | Ethyl methacrylate | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | Freon 113 (1,1,2-Trichloro-1,2,2-trifluoroethane) | NELAP | PA | 2/1/2011 |
| EPA 624-Extended | Freon-123A | NELAP | PA | 2/1/2011 |
| EPA 624-Extended | Isobutyl alcohol (2-Methyl-1-propanol) | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | Isopropylbenzene (Cumene) | NELAP | PA | 5/2/2006 |
| EPA 624-Extended | Methacrylonitrile | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | Methyl iodide (Iodomethane) | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | Methyl isobutyl ketone (MIBK, 4-Methyl-2-pentanone) | NELAP | PA | 5/2/2006 |
| EPA 624-Extended | Methyl tert-butyl ether (MTBE) | NELAP | PA | 12/12/2005 |
| EPA 624-Extended | Methylmethacrylate | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | Naphthalene | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | Pentachloroethane | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | Propionitrile (Ethyl cyanide) | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | Styrene | NELAP | PA | 5/2/2006 |
| EPA 624-Extended | Tetrahydrofuran (THF) | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | Vinyl acetate | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | cis-1,2-Dichloroethene | NELAP | PA | 6/12/2009 |
| EPA 624-Extended | n-Butylbenzene | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | n-Heptane | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | n-Hexane | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | n-Propylbenzene | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | sec-Butylbenzene | NELAP | PA | 7/3/2007 |
| EPA 624-Extended | tert-Amyl methyl ether (TAME) | NELAP | PA | 5/2/2006 |
| EPA 624-Extended | tert-Butyl alcohol (2-Methyl-2-propanol) | NELAP | PA | 5/2/2006 |
| EPA 624-Extended | tert-Butyl ethyl ether | NELAP | PA | 5/2/2006 |
| EPA 624-Extended | tert-Butylbenzene | NELAP | PA | 7/3/2007 |
| EPA 625 | 1,2,4-Trichlorobenzene | NELAP | PA | 1/19/2005 |
| EPA 625 | 1,2-Dichlorobenzene (o-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 625 | 1,3-Dichlorobenzene (m-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 625 | 1,4-Dichlorobenzene (p-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 625 | 2,4,5-Trichlorophenol | NELAP | PA | 7/3/2007 |
| EPA 625 | 2,4,6-Trichlorophenol | NELAP | PA | 1/19/2005 |
| EPA 625 | 2,4-Dichlorophenol | NELAP | PA | 1/19/2005 |
| EPA 625 | 2,4-Dimethylphenol | NELAP | PA | 1/19/2005 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 625 | 2,4-Dinitrophenol | NELAP | PA | 1/19/2005 |
| EPA 625 | 2,4-Dinitrotoluene (2,4-DNT) | NELAP | PA | 1/19/2005 |
| EPA 625 | 2,6-Dinitrotoluene (2,6-DNT) | NELAP | PA | 1/19/2005 |
| EPA 625 | 2-Chloronaphthalene | NELAP | PA | 1/19/2005 |
| EPA 625 | 2-Chlorophenol | NELAP | PA | 1/19/2005 |
| EPA 625 | 2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol) | NELAP | PA | 1/19/2005 |
| EPA 625 | 2-Methylphenol (o-Cresol) | NELAP | PA | 7/3/2007 |
| EPA 625 | 2-Nitrophenol | NELAP | PA | 1/19/2005 |
| EPA 625 | 3,3'-Dichlorobenzidine | NELAP | PA | 1/19/2005 |
| EPA 625 | 4-Bromophenyl phenyl ether | NELAP | PA | 1/19/2005 |
| EPA 625 | 4-Chloro-3-methylphenol | NELAP | PA | 1/19/2005 |
| EPA 625 | 4-Chlorophenyl phenyl ether | NELAP | PA | 1/19/2005 |
| EPA 625 | 4-Nitrophenol | NELAP | PA | 1/19/2005 |
| EPA 625 | Acenaphthene | NELAP | PA | 1/19/2005 |
| EPA 625 | Acenaphthylene | NELAP | PA | 1/19/2005 |
| EPA 625 | Acetophenone | NELAP | PA | 5/2/2006 |
| EPA 625 | Aniline | NELAP | PA | 5/2/2006 |
| EPA 625 | Anthracene | NELAP | PA | 4/4/2005 |
| EPA 625 | Benzidine | NELAP | PA | 1/19/2005 |
| EPA 625 | Benzo[a]anthracene | NELAP | PA | 1/19/2005 |
| EPA 625 | Benzo[a]pyrene | NELAP | PA | 1/19/2005 |
| EPA 625 | Benzo[b]fluoranthene | NELAP | PA | 1/19/2005 |
| EPA 625 | Benzo[ghi]perylene | NELAP | PA | 1/19/2005 |
| EPA 625 | Benzo[k]fluoranthene | NELAP | PA | 1/19/2005 |
| EPA 625 | Butyl benzyl phthalate (Benzyl butyl phthalate) | NELAP | PA | 1/19/2005 |
| EPA 625 | Carbazole | NELAP | PA | 5/2/2006 |
| EPA 625 | Chrysene (Benzo[a]phenanthrene) | NELAP | PA | 1/19/2005 |
| EPA 625 | Di-n-butyl phthalate | NELAP | PA | 1/19/2005 |
| EPA 625 | Di-n-octyl phthalate | NELAP | PA | 1/19/2005 |
| EPA 625 | Dibenzo[a,h]anthracene | NELAP | PA | 1/19/2005 |
| EPA 625 | Diethyl phthalate | NELAP | PA | 1/19/2005 |
| EPA 625 | Dimethyl phthalate | NELAP | PA | 1/19/2005 |
| EPA 625 | Fluoranthene | NELAP | PA | 1/19/2005 |
| EPA 625 | Fluorene | NELAP | PA | 1/19/2005 |
| EPA 625 | Hexachlorobenzene | NELAP | PA | 1/19/2005 |
| EPA 625 | Hexachlorobutadiene (1,3-Hexachlorobutadiene) | NELAP | PA | 1/19/2005 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 625 | Hexachlorocyclopentadiene | NELAP | PA | 1/19/2005 |
| EPA 625 | Hexachloroethane | NELAP | PA | 1/19/2005 |
| EPA 625 | Indeno(1,2,3-cd)pyrene | NELAP | PA | 1/19/2005 |
| EPA 625 | Isophorone | NELAP | PA | 1/19/2005 |
| EPA 625 | N-Nitrosodi-n-propylamine | NELAP | PA | 1/19/2005 |
| EPA 625 | N-Nitrosodimethylamine | NELAP | PA | 1/19/2005 |
| EPA 625 | N-Nitrosodiphenylamine | NELAP | PA | 1/19/2005 |
| EPA 625 | Naphthalene | NELAP | PA | 1/19/2005 |
| EPA 625 | Nitrobenzene | NELAP | PA | 1/19/2005 |
| EPA 625 | Pentachlorophenol (PCP) | NELAP | PA | 1/19/2005 |
| EPA 625 | Phenanthrene | NELAP | PA | 1/19/2005 |
| EPA 625 | Phenol | NELAP | PA | 1/19/2005 |
| EPA 625 | Pyrene | NELAP | PA | 1/19/2005 |
| EPA 625 | Pyridine | NELAP | PA | 5/2/2006 |
| EPA 625 | bis(2-Chloroethoxy)methane | NELAP | PA | 1/19/2005 |
| EPA 625 | bis(2-Chloroethyl) ether | NELAP | PA | 1/19/2005 |
| EPA 625 | bis(2-Chloroisopropyl) ether | NELAP | PA | 1/19/2005 |
| EPA 625 | bis(2-Ethylhexyl) phthalate (DEHP) | NELAP | PA | 1/19/2005 |
| EPA 625-Extended | 1,1'-Biphenyl (Biphenyl, Lemonene) | NELAP | PA | 7/3/2007 |
| EPA 625-Extended | 1,2,4,5-Tetrachlorobenzene | NELAP | PA | 5/2/2006 |
| EPA 625-Extended | 1,2-Diphenylhydrazine | NELAP | PA | 5/2/2006 |
| EPA 625-Extended | 1,4-Dioxane (1,4-Diethyleneoxide) | NELAP | PA | 7/3/2007 |
| EPA 625-Extended | 1-Methylphenanthrene | NELAP | PA | 5/2/2006 |
| EPA 625-Extended | 2,3,4,6-Tetrachlorophenol | NELAP | PA | 7/3/2007 |
| EPA 625-Extended | 2,3-Dichloroaniline | NELAP | PA | 5/2/2006 |
| EPA 625-Extended | 2,3-Dinitrotoluene | NELAP | PA | 7/3/2007 |
| EPA 625-Extended | 2,4,5-Trichlorophenol | NELAP | PA | 7/3/2007 |
| EPA 625-Extended | 2,6-Dichlorophenol | NELAP | PA | 7/3/2007 |
| EPA 625-Extended | 2-Methylnaphthalene | NELAP | PA | 7/3/2007 |
| EPA 625-Extended | 2-Methylphenol (o-Cresol) | NELAP | PA | 7/3/2007 |
| EPA 625-Extended | 2-Nitroaniline | NELAP | PA | 7/3/2007 |
| EPA 625-Extended | 3-Methylphenol (m-Cresol) | NELAP | PA | 7/3/2007 |
| EPA 625-Extended | 3-Nitroaniline | NELAP | PA | 7/3/2007 |
| EPA 625-Extended | 4-Chloroaniline | NELAP | PA | 7/3/2007 |
| EPA 625-Extended | 4-Methylphenol (p-Cresol) | NELAP | PA | 7/3/2007 |
| EPA 625-Extended | 4-Nitroaniline | NELAP | PA | 7/3/2007 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 625-Extended | Benzoic acid | NELAP | PA | 5/2/2006 |
| EPA 625-Extended | Benzyl alcohol | NELAP | PA | 7/3/2007 |
| EPA 625-Extended | Dibenzofuran | NELAP | PA | 7/3/2007 |
| EPA 625-Extended | Diphenyl ether | NELAP | PA | 7/3/2007 |
| EPA 625-Extended | N-Nitrosodi-n-butylamine | NELAP | PA | 5/2/2006 |
| EPA 625-Extended | N-Nitrosodiethylamine | NELAP | PA | 5/2/2006 |
| EPA 625-Extended | N-Nitrosopyrrolidine | NELAP | PA | 5/2/2006 |
| EPA 625-Extended | Pentachlorobenzene | NELAP | PA | 7/3/2007 |
| EPA 625-Extended | alpha-Terpineol | NELAP | PA | 5/2/2006 |
| EPA 625-Extended | n-Decane | NELAP | PA | 5/2/2006 |
| EPA 625-Extended | n-Docosane | NELAP | PA | 5/2/2006 |
| EPA 625-Extended | n-Dodecane | NELAP | PA | 5/2/2006 |
| EPA 625-Extended | n-Eicosane | NELAP | PA | 5/2/2006 |
| EPA 625-Extended | n-Hexadecane | NELAP | PA | 5/2/2006 |
| EPA 625-Extended | n-Octadecane | NELAP | PA | 5/2/2006 |
| EPA 625-Extended | n-Tetradecane | NELAP | PA | 5/2/2006 |
| EPA 625-Extended | o-Toluidine (2-Toluidine, 2-Methylaniline) | NELAP | PA | 7/3/2007 |
| EPA 6850 | Perchlorate | NELAP | PA | 1/19/2011 |
| EPA 7196A | Chromium VI | NELAP | PA | 4/6/2006 |
| EPA 7199 | Chromium VI | NELAP | PA | 1/4/2006 |
| EPA 7470 | Mercury | NELAP | PA | 11/21/2005 |
| EPA 8011 | 1,2-Dibromoethane (EDB, Ethylene dibromide) | NELAP | PA | 12/12/2005 |
| EPA 8011 | Dibromochloropropane (1,2-Dibromo-3-chloropropane, DBCP) | NELAP | PA | 5/2/2006 |
| EPA 8015 | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| EPA 8015 | Ethanol | NELAP | PA | 12/4/2007 |
| EPA 8015 | Ethylene glycol | NELAP | PA | 12/4/2007 |
| EPA 8015 | Gasoline-range organics (GRO) | NELAP | PA | 12/12/2005 |
| EPA 8015 | Isopropyl alcohol (2-Propanol) | NELAP | PA | 12/4/2007 |
| EPA 8015 | Methanol | NELAP | PA | 12/4/2007 |
| EPA 8015 | Total petroleum hydrocarbons (TPH) | NELAP | PA | 1/24/2007 |
| EPA 8015B-Extended | Ethane | NELAP | PA | 12/4/2007 |
| EPA 8015B-Extended | Ethene | NELAP | PA | 12/4/2007 |
| EPA 8015B-Extended | Methane | NELAP | PA | 12/4/2007 |
| EPA 8015B-Extended | Propane | NELAP | PA | 12/4/2007 |
| EPA 8021 | Benzene | NELAP | PA | 12/12/2005 |
| EPA 8021 | Ethylbenzene | NELAP | PA | 12/12/2005 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8021 | Isopropylbenzene (Cumene) | NELAP | PA | 12/12/2005 |
| EPA 8021 | Methyl tert-butyl ether (MTBE) | NELAP | PA | 2/11/2011 |
| EPA 8021 | Naphthalene | NELAP | PA | 6/24/2008 |
| EPA 8021 | Toluene | NELAP | PA | 12/12/2005 |
| EPA 8021 | Xylenes, total | NELAP | PA | 12/12/2005 |
| EPA 8021 | m-Xylene | NELAP | PA | 11/23/2009 |
| EPA 8021 | o-Xylene | NELAP | PA | 11/23/2009 |
| EPA 8021 | p-Xylene | NELAP | PA | 11/23/2009 |
| EPA 8081 | 4,4'-DDD | NELAP | PA | 2/10/2006 |
| EPA 8081 | 4,4'-DDE | NELAP | PA | 12/12/2005 |
| EPA 8081 | 4,4'-DDT | NELAP | PA | 12/12/2005 |
| EPA 8081 | Aldrin (HHDN) | NELAP | PA | 12/12/2005 |
| EPA 8081 | Chlordane (tech.) | NELAP | PA | 12/12/2005 |
| EPA 8081 | Dieldrin | NELAP | PA | 12/12/2005 |
| EPA 8081 | Endosulfan I | NELAP | PA | 2/10/2006 |
| EPA 8081 | Endosulfan II | NELAP | PA | 12/12/2005 |
| EPA 8081 | Endosulfan sulfate | NELAP | PA | 12/12/2005 |
| EPA 8081 | Endrin | NELAP | PA | 12/12/2005 |
| EPA 8081 | Endrin aldehyde | NELAP | PA | 12/12/2005 |
| EPA 8081 | Endrin ketone | NELAP | PA | 2/10/2006 |
| EPA 8081 | Heptachlor | NELAP | PA | 12/12/2005 |
| EPA 8081 | Heptachlor epoxide | NELAP | PA | 12/12/2005 |
| EPA 8081 | Kepone | NELAP | PA | 5/2/2006 |
| EPA 8081 | Methoxychlor | NELAP | PA | 12/12/2005 |
| EPA 8081 | Mirex | NELAP | PA | 12/12/2005 |
| EPA 8081 | Toxaphene (Chlorinated camphene) | NELAP | PA | 12/12/2005 |
| EPA 8081 | alpha-BHC (alpha-Hexachlorocyclohexane) | NELAP | PA | 2/10/2006 |
| EPA 8081 | alpha-Chlordane | NELAP | PA | 2/10/2006 |
| EPA 8081 | beta-BHC (beta-Hexachlorocyclohexane) | NELAP | PA | 2/10/2006 |
| EPA 8081 | delta-BHC (delta-Hexachlorocyclohexane) | NELAP | PA | 2/10/2006 |
| EPA 8081 | gamma-BHC (Lindane, gamma-Hexachlorocyclohexane) | NELAP | PA | 2/10/2006 |
| EPA 8081 | gamma-Chlordane | NELAP | PA | 2/10/2006 |
| EPA 8082 | Aroclor-1016 (PCB-1016) | NELAP | PA | 12/11/2006 |
| EPA 8082 | Aroclor-1221 (PCB-1221) | NELAP | PA | 12/11/2006 |
| EPA 8082 | Aroclor-1232 (PCB-1232) | NELAP | PA | 12/11/2006 |
| EPA 8082 | Aroclor-1242 (PCB-1242) | NELAP | PA | 12/11/2006 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8082 | Aroclor-1248 (PCB-1248) | NELAP | PA | 12/11/2006 |
| EPA 8082 | Aroclor-1254 (PCB-1254) | NELAP | PA | 12/11/2006 |
| EPA 8082 | Aroclor-1260 (PCB-1260) | NELAP | PA | 12/11/2006 |
| EPA 8082-Extended | Aroclor-1262 (PCB-1262) | NELAP | PA | 7/23/2008 |
| EPA 8082-Extended | Aroclor-1268 (PCB-1268) | NELAP | PA | 7/23/2008 |
| EPA 8141 | Atrazine | NELAP | PA | 12/12/2005 |
| EPA 8141 | Azinphos-methyl (Guthion) | NELAP | PA | 12/12/2005 |
| EPA 8141 | Bolstar (Sulprofos) | NELAP | PA | 12/12/2005 |
| EPA 8141 | Chlorpyrifos | NELAP | PA | 12/12/2005 |
| EPA 8141 | Coumaphos | NELAP | PA | 12/12/2005 |
| EPA 8141 | Demeton-O | NELAP | PA | 12/12/2005 |
| EPA 8141 | Demeton-S | NELAP | PA | 12/12/2005 |
| EPA 8141 | Diazinon (Spectracide) | NELAP | PA | 12/12/2005 |
| EPA 8141 | Dichlorovos (DDVP, Dichlorvos) | NELAP | PA | 12/12/2005 |
| EPA 8141 | Disulfoton | NELAP | PA | 12/12/2005 |
| EPA 8141 | EPN (Santox) | NELAP | PA | 12/12/2005 |
| EPA 8141 | Ethion | NELAP | PA | 12/12/2005 |
| EPA 8141 | Ethoprop (Prophos) | NELAP | PA | 12/12/2005 |
| EPA 8141 | Famphur | NELAP | PA | 12/12/2005 |
| EPA 8141 | Fensulfothion | NELAP | PA | 12/12/2005 |
| EPA 8141 | Fenthion | NELAP | PA | 12/12/2005 |
| EPA 8141 | Malathion | NELAP | PA | 12/12/2005 |
| EPA 8141 | Merphos | NELAP | PA | 12/12/2005 |
| EPA 8141 | Methyl parathion (Parathion, methyl) | NELAP | PA | 12/12/2005 |
| EPA 8141 | Mevinphos | NELAP | PA | 12/12/2005 |
| EPA 8141 | Naled | NELAP | PA | 12/12/2005 |
| EPA 8141 | Parathion, ethyl (Ethyl parathion, Parathion) | NELAP | PA | 12/12/2005 |
| EPA 8141 | Phorate (Thimet) | NELAP | PA | 12/12/2005 |
| EPA 8141 | Ronnel | NELAP | PA | 12/12/2005 |
| EPA 8141 | Simazine | NELAP | PA | 12/12/2005 |
| EPA 8141 | Stirophos (Tetrachlorovinphos) | NELAP | PA | 5/2/2006 |
| EPA 8141 | Tokuthion (Prothiophos) | NELAP | PA | 12/12/2005 |
| EPA 8141 | Trichloronate | NELAP | PA | 5/2/2006 |
| EPA 8141-Extended | Alachlor (Lasso) | NELAP | PA | 1/21/2009 |
| EPA 8141-Extended | Metolachlor | NELAP | PA | 1/24/2007 |
| EPA 8151 | 2,4,5-T | NELAP | PA | 12/12/2005 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8151 | 2,4,5-TP (Silvex) | NELAP | PA | 12/12/2005 |
| EPA 8151 | 2,4-D | NELAP | PA | 12/12/2005 |
| EPA 8151 | 2,4-DB (Butoxon) | NELAP | PA | 12/12/2005 |
| EPA 8151 | Dalapon (2,2-Dichloropropionic acid) | NELAP | PA | 12/12/2005 |
| EPA 8151 | Dicamba | NELAP | PA | 12/12/2005 |
| EPA 8151 | Dichloroprop (Dichlorprop) | NELAP | PA | 1/24/2007 |
| EPA 8151 | Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP) | NELAP | PA | 12/12/2005 |
| EPA 8151 | MCPA | NELAP | PA | 12/12/2005 |
| EPA 8151 | MCPP (Mecoprop) | NELAP | PA | 12/12/2005 |
| EPA 8151 | Pentachlorophenol (PCP) | NELAP | PA | 12/12/2005 |
| EPA 8151 | Picloram (4-Amino-3,5,6-trichloro-2-pyridinecarboxylic acid) | NELAP | PA | 12/12/2005 |
| EPA 8260 | 1,1,1,2-Tetrachloroethane | NELAP | PA | 12/12/2005 |
| EPA 8260 | 1,1,1-Trichloroethane | NELAP | PA | 12/12/2005 |
| EPA 8260 | 1,1,2,2-Tetrachloroethane | NELAP | PA | 12/12/2005 |
| EPA 8260 | 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113) | NELAP | PA | 12/12/2005 |
| EPA 8260 | 1,1,2-Trichloroethane | NELAP | PA | 12/12/2005 |
| EPA 8260 | 1,1-Dichloroethane | NELAP | PA | 12/12/2005 |
| EPA 8260 | 1,1-Dichloroethene (1,1-Dichloroethylene) | NELAP | PA | 12/12/2005 |
| EPA 8260 | 1,1-Dichloropropene | NELAP | PA | 12/12/2005 |
| EPA 8260 | 1,2,3-Trichlorobenzene | NELAP | PA | 12/12/2005 |
| EPA 8260 | 1,2,3-Trichloropropane (1,2,3-TCP) | NELAP | PA | 12/12/2005 |
| EPA 8260 | 1,2,4-Trichlorobenzene | NELAP | PA | 12/12/2005 |
| EPA 8260 | 1,2,4-Trimethylbenzene | NELAP | PA | 12/12/2005 |
| EPA 8260 | 1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane) | NELAP | PA | 5/2/2006 |
| EPA 8260 | 1,2-Dibromoethane (EDB, Ethylene dibromide) | NELAP | PA | 12/12/2005 |
| EPA 8260 | 1,2-Dichlorobenzene (o-Dichlorobenzene) | NELAP | PA | 12/12/2005 |
| EPA 8260 | 1,2-Dichloroethane | NELAP | PA | 12/12/2005 |
| EPA 8260 | 1,2-Dichloropropane | NELAP | PA | 12/12/2005 |
| EPA 8260 | 1,3,5-Trimethylbenzene | NELAP | PA | 12/12/2005 |
| EPA 8260 | 1,3-Dichlorobenzene (m-Dichlorobenzene) | NELAP | PA | 12/12/2005 |
| EPA 8260 | 1,3-Dichloropropane | NELAP | PA | 12/12/2005 |
| EPA 8260 | 1,4-Dichlorobenzene (p-Dichlorobenzene) | NELAP | PA | 12/12/2005 |
| EPA 8260 | 1,4-Dioxane (1,4-Diethyleneoxide) | NELAP | PA | 12/12/2005 |
| EPA 8260 | 2,2-Dichloropropane | NELAP | PA | 5/2/2006 |
| EPA 8260 | 2-Butanone (Methyl ethyl ketone, MEK) | NELAP | PA | 5/2/2006 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8260 | 2-Chloroethyl vinyl ether | NELAP | PA | 12/12/2005 |
| EPA 8260 | 2-Chlorotoluene | NELAP | PA | 12/12/2005 |
| EPA 8260 | 2-Hexanone | NELAP | PA | 12/12/2005 |
| EPA 8260 | 2-Nitropropane | NELAP | PA | 1/19/2011 |
| EPA 8260 | 2-Propanol (isopropyl alcohol) | NELAP | PA | 1/18/2011 |
| EPA 8260 | 4-Chlorotoluene | NELAP | PA | 12/12/2005 |
| EPA 8260 | 4-Methyl-2-pentanone (MIBK) | NELAP | PA | 12/12/2005 |
| EPA 8260 | Acetone | NELAP | PA | 12/12/2005 |
| EPA 8260 | Acetonitrile | NELAP | PA | 12/12/2005 |
| EPA 8260 | Acrolein (Propenal) | NELAP | PA | 12/12/2005 |
| EPA 8260 | Acrylonitrile | NELAP | PA | 12/12/2005 |
| EPA 8260 | Allyl chloride (3-Chloropropene) | NELAP | PA | 12/12/2005 |
| EPA 8260 | Benzene | NELAP | PA | 12/12/2005 |
| EPA 8260 | Benzyl chloride | NELAP | PA | 7/3/2007 |
| EPA 8260 | Bromobenzene | NELAP | PA | 12/12/2005 |
| EPA 8260 | Bromochloromethane | NELAP | PA | 12/12/2005 |
| EPA 8260 | Bromodichloromethane | NELAP | PA | 12/12/2005 |
| EPA 8260 | Bromoform | NELAP | PA | 12/12/2005 |
| EPA 8260 | Carbon disulfide | NELAP | PA | 12/12/2005 |
| EPA 8260 | Carbon tetrachloride | NELAP | PA | 12/12/2005 |
| EPA 8260 | Chlorobenzene | NELAP | PA | 12/12/2005 |
| EPA 8260 | Chloroethane | NELAP | PA | 12/12/2005 |
| EPA 8260 | Chloroform | NELAP | PA | 12/12/2005 |
| EPA 8260 | Chloroprene (2-Chloro-1,3-butadiene) | NELAP | PA | 7/3/2007 |
| EPA 8260 | Dibromochloromethane | NELAP | PA | 12/12/2005 |
| EPA 8260 | Dibromochloropropane (1,2-Dibromo-3-chloropropane, DBCP) | NELAP | PA | 12/12/2005 |
| EPA 8260 | Dibromomethane | NELAP | PA | 5/2/2006 |
| EPA 8260 | Dichlorodifluoromethane (Freon 12) | NELAP | PA | 12/12/2005 |
| EPA 8260 | Diethyl ether (Ethyl ether) | NELAP | PA | 2/1/2011 |
| EPA 8260 | Epichlorohydrin (1-Chloro-2,3-epoxypropane) | NELAP | PA | 4/17/2009 |
| EPA 8260 | Ethylbenzene | NELAP | PA | 12/12/2005 |
| EPA 8260 | Hexachlorobutadiene (1,3-Hexachlorobutadiene) | NELAP | PA | 12/12/2005 |
| EPA 8260 | Isobutyl alcohol (2-Methyl-1-propanol) | NELAP | PA | 7/3/2007 |
| EPA 8260 | Isopropylbenzene (Cumene) | NELAP | PA | 5/2/2006 |
| EPA 8260 | Methacrylonitrile | NELAP | PA | 7/3/2007 |
| EPA 8260 | Methyl bromide (Bromomethane) | NELAP | PA | 12/12/2005 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8260 | Methyl chloride (Chloromethane) | NELAP | PA | 12/12/2005 |
| EPA 8260 | Methyl tert-butyl ether (MTBE) | NELAP | PA | 12/12/2005 |
| EPA 8260 | Methylene chloride (Dichloromethane) | NELAP | PA | 12/12/2005 |
| EPA 8260 | Methylmethacrylate | NELAP | PA | 5/25/2007 |
| EPA 8260 | Naphthalene | NELAP | PA | 12/12/2005 |
| EPA 8260 | Propionitrile (Ethyl cyanide) | NELAP | PA | 12/12/2005 |
| EPA 8260 | Styrene | NELAP | PA | 12/12/2005 |
| EPA 8260 | Tetrachloroethene (PCE, Perchloroethylene) | NELAP | PA | 12/12/2005 |
| EPA 8260 | Toluene | NELAP | PA | 12/12/2005 |
| EPA 8260 | Trichloroethene (TCE, Trichloroethylene) | NELAP | PA | 12/12/2005 |
| EPA 8260 | Trichlorofluoromethane (Freon 11) | NELAP | PA | 12/12/2005 |
| EPA 8260 | Vinyl acetate | NELAP | PA | 12/12/2005 |
| EPA 8260 | Vinyl chloride (Chloroethene) | NELAP | PA | 12/12/2005 |
| EPA 8260 | Xylenes, total | NELAP | PA | 12/12/2005 |
| EPA 8260 | cis-1,2-Dichloroethene | NELAP | PA | 12/12/2005 |
| EPA 8260 | cis-1,3-Dichloropropene | NELAP | PA | 12/12/2005 |
| EPA 8260 | m+p-Xylene | NELAP | PA | 4/17/2009 |
| EPA 8260 | n-Butyl alcohol (n-Butanol, 1-Butanol) | NELAP | PA | 4/17/2009 |
| EPA 8260 | n-Butylbenzene | NELAP | PA | 12/12/2005 |
| EPA 8260 | n-Propylamine | NELAP | PA | 12/12/2005 |
| EPA 8260 | o-Xylene | NELAP | PA | 4/17/2009 |
| EPA 8260 | sec-Butylbenzene | NELAP | PA | 12/12/2005 |
| EPA 8260 | tert-Butyl alcohol (2-Methyl-2-propanol) | NELAP | PA | 12/12/2005 |
| EPA 8260 | tert-Butylbenzene | NELAP | PA | 12/12/2005 |
| EPA 8260 | trans-1,2-Dichloroethene | NELAP | PA | 12/12/2005 |
| EPA 8260 | trans-1,3-Dichloropropene | NELAP | PA | 12/12/2005 |
| EPA 8260 | trans-1,4-Dichloro-2-butene | NELAP | PA | 7/3/2007 |
| EPA 8260 SIM | 1,4-Dioxane (1,4-Diethyleneoxide) | NELAP | PA | 12/4/2007 |
| EPA 8260-Extended | 3,3'-Dimethyl-1-butanol | NELAP | PA | 4/17/2009 |
| EPA 8260-Extended | Ethyl tert-butyl ether (ETBE) | NELAP | PA | 1/24/2007 |
| EPA 8260-Extended | Gasoline-range organics (GRO) | NELAP | PA | 6/8/2006 |
| EPA 8260-Extended | Methyl acetate | NELAP | PA | 1/24/2007 |
| EPA 8260-Extended | Methyl iodide (Iodomethane) | NELAP | PA | 5/25/2007 |
| EPA 8260-Extended | Methylcyclohexane | NELAP | PA | 1/21/2009 |
| EPA 8260-Extended | Tetrahydrofuran (THF) | NELAP | PA | 1/18/2011 |
| EPA 8260-Extended | tert-Amyl alcohol (2-Methyl-2-butanol) | NELAP | PA | 4/17/2009 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8260-Extended | tert-Amyl methyl ether (TAME) | NELAP | PA | 1/24/2007 |
| EPA 8260-Extended | tert-Butyl formate | NELAP | PA | 4/17/2009 |
| EPA 8260B | 4-Isopropyltoluene (p-Isopropyltoluene) | NELAP | PA | 1/24/2007 |
| EPA 8260B | Ethanol | NELAP | PA | 1/24/2007 |
| EPA 8260B | Ethyl acetate | NELAP | PA | 1/24/2007 |
| EPA 8260B | Ethyl methacrylate | NELAP | PA | 1/24/2007 |
| EPA 8260B | Isobutyl alcohol (2-Methyl-1-propanol) | NELAP | PA | 1/24/2007 |
| EPA 8260B | Pentachloroethane | NELAP | PA | 1/24/2007 |
| EPA 8260B | n-Propylbenzene | NELAP | PA | 1/24/2007 |
| EPA 8260B-Extended | Cyclohexane | NELAP | PA | 7/3/2007 |
| EPA 8260B-Extended | Diisopropyl ether (DIPE) | NELAP | PA | 7/3/2007 |
| EPA 8270 | 1,2,4,5-Tetrachlorobenzene | NELAP | PA | 12/12/2005 |
| EPA 8270 | 1,2,4-Trichlorobenzene | NELAP | PA | 12/12/2005 |
| EPA 8270 | 1,2-Dichlorobenzene (o-Dichlorobenzene) | NELAP | PA | 12/12/2005 |
| EPA 8270 | 1,2-Diphenylhydrazine | NELAP | PA | 12/12/2005 |
| EPA 8270 | 1,3,5-Trinitrobenzene (1,3,5-TNB) | NELAP | PA | 12/12/2005 |
| EPA 8270 | 1,3-Dichlorobenzene (m-Dichlorobenzene) | NELAP | PA | 12/12/2005 |
| EPA 8270 | 1,3-Dinitrobenzene (1,3-DNB) | NELAP | PA | 12/12/2005 |
| EPA 8270 | 1,4-Dichlorobenzene (p-Dichlorobenzene) | NELAP | PA | 12/12/2005 |
| EPA 8270 | 1,4-Dinitrobenzene (1,4-DNB) | NELAP | PA | 4/17/2009 |
| EPA 8270 | 1,4-Naphthoquinone | NELAP | PA | 12/12/2005 |
| EPA 8270 | 1,4-Phenylenediamine | NELAP | PA | 12/12/2005 |
| EPA 8270 | 1-Chloronaphthalene | NELAP | PA | 12/12/2005 |
| EPA 8270 | 1-Naphthylamine (alpha-Naphthylamine) | NELAP | PA | 12/12/2005 |
| EPA 8270 | 2,3,4,6-Tetrachlorophenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | 2,4,5-Trichlorophenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | 2,4,6-Trichlorophenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | 2,4-Dichlorophenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | 2,4-Dimethylphenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | 2,4-Dinitrophenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | 2,4-Dinitrotoluene (2,4-DNT) | NELAP | PA | 12/12/2005 |
| EPA 8270 | 2,6-Dichlorophenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | 2,6-Dinitrotoluene (2,6-DNT) | NELAP | PA | 12/12/2005 |
| EPA 8270 | 2-Acetylaminofluorene | NELAP | PA | 12/12/2005 |
| EPA 8270 | 2-Chloronaphthalene | NELAP | PA | 12/12/2005 |
| EPA 8270 | 2-Chlorophenol | NELAP | PA | 12/12/2005 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8270 | 2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol) | NELAP | PA | 12/12/2005 |
| EPA 8270 | 2-Methylnaphthalene | NELAP | PA | 12/12/2005 |
| EPA 8270 | 2-Methylphenol (o-Cresol) | NELAP | PA | 12/12/2005 |
| EPA 8270 | 2-Naphthylamine (beta-Naphthylamine) | NELAP | PA | 12/12/2005 |
| EPA 8270 | 2-Nitroaniline | NELAP | PA | 12/12/2005 |
| EPA 8270 | 2-Nitrophenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | 2-Picoline (2-Methylpyridine) | NELAP | PA | 5/2/2006 |
| EPA 8270 | 3,3'-Dichlorobenzidine | NELAP | PA | 12/12/2005 |
| EPA 8270 | 3,3'-Dimethylbenzidine | NELAP | PA | 7/3/2007 |
| EPA 8270 | 3-Methylcholanthrene | NELAP | PA | 12/12/2005 |
| EPA 8270 | 3-Methylphenol (m-Cresol) | NELAP | PA | 5/2/2006 |
| EPA 8270 | 3-Nitroaniline | NELAP | PA | 12/12/2005 |
| EPA 8270 | 4,4'-Methylenebis(2-chloroaniline) | NELAP | PA | 12/12/2005 |
| EPA 8270 | 4-Aminobiphenyl | NELAP | PA | 12/12/2005 |
| EPA 8270 | 4-Bromophenyl phenyl ether | NELAP | PA | 12/12/2005 |
| EPA 8270 | 4-Chloro-3-methylphenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | 4-Chloroaniline | NELAP | PA | 12/12/2005 |
| EPA 8270 | 4-Chlorophenyl phenyl ether | NELAP | PA | 12/12/2005 |
| EPA 8270 | 4-Methylphenol (p-Cresol) | NELAP | PA | 12/12/2005 |
| EPA 8270 | 4-Nitroaniline | NELAP | PA | 12/12/2005 |
| EPA 8270 | 4-Nitrophenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | 5-Nitro-o-toluidine | NELAP | PA | 12/12/2005 |
| EPA 8270 | 7,12-Dimethylbenz(a)anthracene | NELAP | PA | 12/12/2005 |
| EPA 8270 | Acenaphthene | NELAP | PA | 12/12/2005 |
| EPA 8270 | Acenaphthylene | NELAP | PA | 12/12/2005 |
| EPA 8270 | Acetophenone | NELAP | PA | 12/12/2005 |
| EPA 8270 | Aniline | NELAP | PA | 12/12/2005 |
| EPA 8270 | Anthracene | NELAP | PA | 12/12/2005 |
| EPA 8270 | Aramite | NELAP | PA | 12/12/2005 |
| EPA 8270 | Benzidine | NELAP | PA | 12/12/2005 |
| EPA 8270 | Benzo[a]anthracene | NELAP | PA | 12/12/2005 |
| EPA 8270 | Benzo[a]pyrene | NELAP | PA | 12/12/2005 |
| EPA 8270 | Benzo[b]fluoranthene | NELAP | PA | 12/12/2005 |
| EPA 8270 | Benzo[ghi]perylene | NELAP | PA | 12/12/2005 |
| EPA 8270 | Benzo[k]fluoranthene | NELAP | PA | 12/12/2005 |
| EPA 8270 | Benzoic acid | NELAP | PA | 12/12/2005 |

Pennsylvania Department of Environmental Protection

*Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID:** 36-00037 **EPA Lab Code:** PA00009 (717) 656-2300

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program** Non-Potable Water

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8270 | Benzyl alcohol | NELAP | PA | 12/12/2005 |
| EPA 8270 | Butyl benzyl phthalate (Benzyl butyl phthalate) | NELAP | PA | 12/12/2005 |
| EPA 8270 | Chlorobenzilate | NELAP | PA | 12/12/2005 |
| EPA 8270 | Chrysene (Benzo[a]phenanthrene) | NELAP | PA | 12/12/2005 |
| EPA 8270 | Di-n-butyl phthalate | NELAP | PA | 12/12/2005 |
| EPA 8270 | Di-n-octyl phthalate | NELAP | PA | 12/12/2005 |
| EPA 8270 | Diallate (cis or trans) | NELAP | PA | 12/12/2005 |
| EPA 8270 | Dibenz[a,j]acridine | NELAP | PA | 12/12/2005 |
| EPA 8270 | Dibenzo[a,h]anthracene | NELAP | PA | 12/12/2005 |
| EPA 8270 | Dibenzofuran | NELAP | PA | 12/12/2005 |
| EPA 8270 | Diethyl phthalate | NELAP | PA | 12/12/2005 |
| EPA 8270 | Dimethoate | NELAP | PA | 12/12/2005 |
| EPA 8270 | Dimethyl phthalate | NELAP | PA | 12/12/2005 |
| EPA 8270 | Dimethylaminoazobenzene (4-Dimethylaminoazobenzene) | NELAP | PA | 5/2/2006 |
| EPA 8270 | Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP) | NELAP | PA | 12/12/2005 |
| EPA 8270 | Diphenylamine | NELAP | PA | 12/12/2005 |
| EPA 8270 | Disulfoton | NELAP | PA | 12/12/2005 |
| EPA 8270 | Ethyl methanesulfonate | NELAP | PA | 12/12/2005 |
| EPA 8270 | Famphur | NELAP | PA | 12/12/2005 |
| EPA 8270 | Fluoranthene | NELAP | PA | 12/12/2005 |
| EPA 8270 | Fluorene | NELAP | PA | 12/12/2005 |
| EPA 8270 | Hexachlorobenzene | NELAP | PA | 12/12/2005 |
| EPA 8270 | Hexachlorobutadiene (1,3-Hexachlorobutadiene) | NELAP | PA | 12/12/2005 |
| EPA 8270 | Hexachlorocyclopentadiene | NELAP | PA | 12/12/2005 |
| EPA 8270 | Hexachloroethane | NELAP | PA | 12/12/2005 |
| EPA 8270 | Hexachloropropene | NELAP | PA | 12/12/2005 |
| EPA 8270 | Indeno(1,2,3-cd)pyrene | NELAP | PA | 12/12/2005 |
| EPA 8270 | Isodrin | NELAP | PA | 12/12/2005 |
| EPA 8270 | Isophorone | NELAP | PA | 12/12/2005 |
| EPA 8270 | Isosafrole | NELAP | PA | 12/12/2005 |
| EPA 8270 | Kepone | NELAP | PA | 12/12/2005 |
| EPA 8270 | Methapyrilene | NELAP | PA | 12/12/2005 |
| EPA 8270 | Methyl methanesulfonate | NELAP | PA | 12/12/2005 |
| EPA 8270 | Methyl parathion (Parathion, methyl) | NELAP | PA | 5/25/2007 |
| EPA 8270 | N-Nitrosodi-n-butylamine | NELAP | PA | 12/12/2005 |
| EPA 8270 | N-Nitrosodi-n-propylamine | NELAP | PA | 12/12/2005 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8270 | N-Nitrosodiethylamine | NELAP | PA | 12/12/2005 |
| EPA 8270 | N-Nitrosodimethylamine | NELAP | PA | 12/12/2005 |
| EPA 8270 | N-Nitrosodiphenylamine | NELAP | PA | 12/12/2005 |
| EPA 8270 | N-Nitrosomethylethylamine | NELAP | PA | 12/12/2005 |
| EPA 8270 | N-Nitrosomorpholine | NELAP | PA | 12/12/2005 |
| EPA 8270 | N-Nitrosopiperidine | NELAP | PA | 12/12/2005 |
| EPA 8270 | N-Nitrosopyrrolidine | NELAP | PA | 12/12/2005 |
| EPA 8270 | Naphthalene | NELAP | PA | 12/12/2005 |
| EPA 8270 | Nitrobenzene | NELAP | PA | 12/12/2005 |
| EPA 8270 | Nitroquinoline-1-oxide | NELAP | PA | 7/3/2007 |
| EPA 8270 | O,O,O-Triethyl phosphorothioate | NELAP | PA | 12/12/2005 |
| EPA 8270 | Parathion, ethyl (Ethyl parathion, Parathion) | NELAP | PA | 5/25/2007 |
| EPA 8270 | Pentachlorobenzene | NELAP | PA | 12/12/2005 |
| EPA 8270 | Pentachloronitrobenzene (PCNB) | NELAP | PA | 12/12/2005 |
| EPA 8270 | Pentachlorophenol (PCP) | NELAP | PA | 12/12/2005 |
| EPA 8270 | Phenacetin | NELAP | PA | 12/12/2005 |
| EPA 8270 | Phenanthrene | NELAP | PA | 12/12/2005 |
| EPA 8270 | Phenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | Phorate (Thimet) | NELAP | PA | 12/12/2005 |
| EPA 8270 | Phthalic anhydride | NELAP | PA | 1/21/2009 |
| EPA 8270 | Pronamide (Kerb) | NELAP | PA | 12/12/2005 |
| EPA 8270 | Pyrene | NELAP | PA | 12/12/2005 |
| EPA 8270 | Pyridine | NELAP | PA | 12/12/2005 |
| EPA 8270 | Safrole | NELAP | PA | 12/12/2005 |
| EPA 8270 | Tetraethyl dithiopyrophosphate | NELAP | PA | 4/17/2009 |
| EPA 8270 | Thionazine (Thionazin, Zinophos) | NELAP | PA | 12/12/2005 |
| EPA 8270 | a,a-Dimethylphenethylamine (Phentermine) | NELAP | PA | 12/12/2005 |
| EPA 8270 | bis(2-Chloroethoxy)methane | NELAP | PA | 12/12/2005 |
| EPA 8270 | bis(2-Chloroethyl) ether | NELAP | PA | 12/12/2005 |
| EPA 8270 | bis(2-Chloroisopropyl) ether | NELAP | PA | 12/12/2005 |
| EPA 8270 | bis(2-Ethylhexyl) phthalate (DEHP) | NELAP | PA | 12/12/2005 |
| EPA 8270 | o-Toluidine (2-Toluidine, 2-Methylaniline) | NELAP | PA | 12/12/2005 |
| EPA 8270 | tris-(2,3-Dibromopropyl) phosphate (tris-BP) | NELAP | PA | 4/17/2009 |
| EPA 8270 SIM | Acenaphthene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Acenaphthylene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Anthracene | NELAP | PA | 12/4/2007 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8270 SIM | Benzo[a]anthracene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Benzo[a]pyrene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Benzo[b]fluoranthene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Benzo[ghi]perylene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Benzo[k]fluoranthene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Chrysene (Benzo[a]phenanthrene) | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Dibenzo[a,h]anthracene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Fluoranthene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Fluorene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Indeno(1,2,3-cd)pyrene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Naphthalene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Phenanthrene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Pyrene | NELAP | PA | 12/4/2007 |
| EPA 8270-Extended | 1,1'-Biphenyl (Biphenyl, Lemonene) | NELAP | PA | 4/17/2009 |
| EPA 8270-Extended | 1,2,3,4-Tetrachlorobenzene | NELAP | PA | 7/3/2007 |
| EPA 8270-Extended | 1,2,3,4-Tetrahydronaphthalene | NELAP | PA | 4/17/2009 |
| EPA 8270-Extended | 1,2,3,5-Tetrachlorobenzene | NELAP | PA | 7/3/2007 |
| EPA 8270-Extended | 1,4-Dioxane (1,4-Diethyleneoxide) | NELAP | PA | 4/17/2009 |
| EPA 8270-Extended | 1-Methylnaphthalene | NELAP | PA | 4/17/2009 |
| EPA 8270-Extended | 2,2'-Oxybis(1-chloropropane) (bis(2-Chloro-1-methylethyl) ether) | NELAP | PA | 1/19/2011 |
| EPA 8270-Extended | 6-Methylchrysene | NELAP | PA | 1/19/2011 |
| EPA 8270-Extended | Atrazine | NELAP | PA | 1/22/2007 |
| EPA 8270-Extended | Benzaldehyde | NELAP | PA | 4/17/2009 |
| EPA 8270-Extended | Benzenethiol | NELAP | PA | 4/17/2009 |
| EPA 8270-Extended | Caprolactam | NELAP | PA | 4/17/2009 |
| EPA 8270-Extended | Carbazole | NELAP | PA | 12/12/2005 |
| EPA 8270-Extended | Dibenz[a,h]acridine | NELAP | PA | 4/17/2009 |
| EPA 8270-Extended | Indene | NELAP | PA | 4/17/2009 |
| EPA 8270-Extended | N,N-Dimethylacetamide | NELAP | PA | 4/17/2009 |
| EPA 8270-Extended | N,N-Dimethylformamide | NELAP | PA | 4/17/2009 |
| EPA 8270-Extended | Quinoline | NELAP | PA | 4/17/2009 |
| EPA 8270-Extended | a-Methylstyrene | NELAP | PA | 4/17/2009 |
| EPA 8270-Extended | bis(2-Chloromethyl) ether | NELAP | PA | 1/21/2009 |
| EPA 8270-Extended | p-(Dimethylamino)azobenzene | NELAP | PA | 4/17/2009 |
| EPA 8290 | 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF) | NELAP | PA | 6/30/2010 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8290 | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 8/6/2010 |
| EPA 8290 | 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 1,2,3,7,8-Pentachlorodibenzofuran (PeCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 2,3,4,7,8-Pentachlorodibenzofuran (PeCDF) | NELAP | PA | 8/6/2010 |
| EPA 8290 | 2,3,7,8-TCDD (Dioxin) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 2,3,7,8-Tetrachlorodibenzofuran (TCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | Total TCDD | NELAP | PA | 6/30/2010 |
| EPA 8290 | Total TCDF | NELAP | PA | 6/30/2010 |
| EPA 8290 | Total heptachlorodibenzo-p-dioxin (HpCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | Total heptachlorodibenzofuran (HpCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | Total hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | Total hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | Total pentachlorodibenzo-p-dioxin (PeCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | Total pentachlorodibenzofuran (PeCDF) | NELAP | PA | 6/30/2010 |
| EPA 8310 | Acenaphthene | NELAP | PA | 1/2/2007 |
| EPA 8310 | Acenaphthylene | NELAP | PA | 1/2/2007 |
| EPA 8310 | Anthracene | NELAP | PA | 1/2/2007 |
| EPA 8310 | Benzo[a]anthracene | NELAP | PA | 1/2/2007 |
| EPA 8310 | Benzo[a]pyrene | NELAP | PA | 1/2/2007 |
| EPA 8310 | Benzo[b]fluoranthene | NELAP | PA | 1/2/2007 |
| EPA 8310 | Benzo[ghi]perylene | NELAP | PA | 1/2/2007 |
| EPA 8310 | Benzo[k]fluoranthene | NELAP | PA | 1/2/2007 |
| EPA 8310 | Chrysene (Benzo[a]phenanthrene) | NELAP | PA | 1/2/2007 |
| EPA 8310 | Dibenzo[a,h]anthracene | NELAP | PA | 1/2/2007 |
| EPA 8310 | Fluoranthene | NELAP | PA | 1/2/2007 |
| EPA 8310 | Fluorene | NELAP | PA | 1/2/2007 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8310 | Indeno(1,2,3-cd)pyrene | NELAP | PA | 1/2/2007 |
| EPA 8310 | Naphthalene | NELAP | PA | 1/2/2007 |
| EPA 8310 | Phenanthrene | NELAP | PA | 1/2/2007 |
| EPA 8310 | Pyrene | NELAP | PA | 1/2/2007 |
| EPA 8315 | 1,2-Tolualdehyde (o-Tolualdehyde) | NELAP | PA | 1/24/2007 |
| EPA 8315 | 1,3-Tolualdehyde (m-Tolualdehyde) | NELAP | PA | 5/2/2006 |
| EPA 8315 | 1,4-Tolualdehyde (p-Tolualdehyde) | NELAP | PA | 1/24/2007 |
| EPA 8315 | 2,5-Dimethylbenzaldehyde | NELAP | PA | 12/12/2005 |
| EPA 8315 | Acetaldehyde | NELAP | PA | 12/12/2005 |
| EPA 8315 | Acrolein (Propenal) | NELAP | PA | 12/12/2005 |
| EPA 8315 | Benzaldehyde | NELAP | PA | 12/12/2005 |
| EPA 8315 | Butanal (Butyraldehyde) | NELAP | PA | 5/2/2006 |
| EPA 8315 | Crotonaldehyde | NELAP | PA | 12/12/2005 |
| EPA 8315 | Formaldehyde | NELAP | PA | 12/12/2005 |
| EPA 8315 | Hexanal (Hexaldehyde) | NELAP | PA | 1/21/2009 |
| EPA 8315 | Isovaleraldehyde | NELAP | PA | 12/12/2005 |
| EPA 8315 | Pentanal (Valeraldehyde) | NELAP | PA | 12/12/2005 |
| EPA 8315 | Propanal (Propionaldehyde) | NELAP | PA | 1/21/2009 |
| EPA 8330 | 1,3,5-Trinitrobenzene (1,3,5-TNB) | NELAP | PA | 12/12/2005 |
| EPA 8330 | 1,3-Dinitrobenzene (1,3-DNB) | NELAP | PA | 12/12/2005 |
| EPA 8330 | 2,4,6-Trinitrotoluene (2,4,6-TNT) | NELAP | PA | 12/12/2005 |
| EPA 8330 | 2,4-Dinitrotoluene (2,4-DNT) | NELAP | PA | 6/11/2007 |
| EPA 8330 | 2,6-Dinitrotoluene (2,6-DNT) | NELAP | PA | 6/11/2007 |
| EPA 8330 | 2-Amino-4,6-dinitrotoluene (2-Am-DNT) | NELAP | PA | 12/12/2005 |
| EPA 8330 | 2-Nitrotoluene | NELAP | PA | 12/12/2005 |
| EPA 8330 | 3-Nitrotoluene | NELAP | PA | 12/12/2005 |
| EPA 8330 | 4-Amino-2,6-dinitrotoluene (4-Am-DNT) | NELAP | PA | 12/12/2005 |
| EPA 8330 | 4-Nitrotoluene | NELAP | PA | 12/12/2005 |
| EPA 8330 | Nitrobenzene | NELAP | PA | 6/11/2007 |
| EPA 8330 | Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) | NELAP | PA | 12/12/2005 |
| EPA 8330 | RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine) | NELAP | PA | 12/12/2005 |
| EPA 8330 | Tetryl (2,4,6-Trinitrophenylmethylnitramine) | NELAP | PA | 12/12/2005 |
| EPA 8330-Extended | Nitroglycerin | NELAP | PA | 1/24/2007 |
| EPA 8330-Extended | Pentaerythritol tetranitrate (PETN) | NELAP | PA | 5/2/2006 |
| EPA 8332 | Nitroglycerin | NELAP | PA | 12/12/2005 |
| EPA 9012 | Total cyanide | NELAP | PA | 12/12/2005 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 9040 | pH | NELAP | PA | 12/12/2005 |
| EPA 9045 | Corrosivity (pH) | NELAP | PA | 4/17/2009 |
| EPA 9050 | Conductivity | NELAP | PA | 12/12/2005 |
| EPA 9056 | Bromide | NELAP | PA | 12/12/2005 |
| EPA 9056 | Chloride | NELAP | PA | 12/12/2005 |
| EPA 9056 | Fluoride | NELAP | PA | 12/12/2005 |
| EPA 9056 | Nitrate | NELAP | PA | 12/12/2005 |
| EPA 9056 | Nitrite | NELAP | PA | 1/19/2005 |
| EPA 9056 | Orthophosphate as P | NELAP | PA | 11/23/2010 |
| EPA 9056 | Sulfate | NELAP | PA | 12/12/2005 |
| EPA 9060 | Total organic carbon (TOC) | NELAP | PA | 12/12/2005 |
| EPA 9066 | Total phenolics | NELAP | PA | 12/12/2005 |
| EPA 9095A | Paint filter liquids test | NELAP | PA | 1/24/2007 |
| FL-PRO | Total petroleum hydrocarbons (TPH) | NELAP | PA | 12/12/2005 |
| MA DEP EPH | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| MA DEP VPH | Gasoline-range organics (GRO) | NELAP | PA | 12/12/2005 |
| NWTPH-Dx | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| NWTPH-Gx | Gasoline-range organics (GRO) | NELAP | PA | 12/12/2005 |
| NWTPH-HCID | GRO/DRO/HRO Screen | NELAP | PA | 10/16/2008 |
| OA-1 | Gasoline-range organics (GRO) | NELAP | PA | 12/12/2005 |
| OA-2 | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| RSK-175 | Ethane | NELAP | PA | 6/29/2010 |
| RSK-175 | Ethene | NELAP | PA | 6/29/2010 |
| RSK-175 | Methane | NELAP | PA | 6/29/2010 |
| RSK-175 | Propane | NELAP | PA | 6/29/2010 |
| SM 2120 B | Color | NELAP | PA | 4/17/2007 |
| SM 2310 B | Acidity as CaCO3 | NELAP | PA | 4/17/2007 |
| SM 2320 B | Alkalinity as CaCO3 | NELAP | PA | 1/19/2005 |
| SM 2340 B | Total hardness as CaCO3 | NELAP | PA | 1/24/2007 |
| SM 2340 C | Total hardness as CaCO3 | NELAP | PA | 4/17/2007 |
| SM 2510 B | Conductivity | NELAP | PA | 12/12/2005 |
| SM 2540 B | Residue, total | NELAP | PA | 4/17/2007 |
| SM 2540 C | Residue, filterable (TDS) | NELAP | PA | 4/17/2007 |
| SM 2540 D | Residue, nonfilterable (TSS) | NELAP | PA | 4/17/2007 |
| SM 2540 F | Residue, settleable | NELAP | PA | 4/17/2007 |
| SM 3500-Cr B (20th ed.) | Chromium VI | NELAP | PA | 5/24/2007 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Non-Potable Water**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| SM 3500-Fe B (20th ed.) | Ferrous iron | NELAP | PA | 6/15/2009 |
| SM 4500-CN- C | Cyanide | NELAP | PA | 12/12/2005 |
| SM 4500-CN- E | Cyanide | NELAP | PA | 12/12/2005 |
| SM 4500-CN- G | Amenable cyanide | NELAP | PA | 5/24/2007 |
| SM 4500-CO2 D | Free carbon dioxide | NELAP | PA | 6/29/2010 |
| SM 4500-Cl F | Total residual chlorine | NELAP | PA | 4/17/2007 |
| SM 4500-Cl- C | Chloride | NELAP | PA | 4/17/2007 |
| SM 4500-F- B | Preliminary distillation of fluoride | NELAP | PA | 4/28/2010 |
| SM 4500-F- C | Fluoride | NELAP | PA | 1/19/2005 |
| SM 4500-H+ B | pH | NELAP | PA | 4/17/2007 |
| SM 4500-NH3 B | Ammonia distillation | NELAP | PA | 4/17/2007 |
| SM 4500-NH3 C | Ammonia as N | NELAP | PA | 4/17/2007 |
| SM 4500-NH3 D | Ammonia as N | NELAP | PA | 4/17/2007 |
| SM 4500-O G | Oxygen (dissolved) | NELAP | PA | 4/17/2007 |
| SM 4500-P B | Phosphorus, total | NELAP | PA | 4/28/2010 |
| SM 4500-P E | Orthophosphate as P | NELAP | PA | 12/12/2005 |
| SM 4500-P F | Phosphorus, total | NELAP | PA | 4/28/2010 |
| SM 4500-S D | Sulfide | NELAP | PA | 4/17/2007 |
| SM 4500-S F | Sulfide | NELAP | PA | 4/17/2007 |
| SM 4500-SO3 B | Sulfite, SO3 | NELAP | PA | 4/17/2007 |
| SM 4500-SiO2 C (20th ed.) | Silica, as SiO2 | NELAP | PA | 5/25/2007 |
| SM 4500-SiO2 C (20th ed.) | Silica, dissolved | NELAP | PA | 5/24/2007 |
| SM 5210 B | Biochemical oxygen demand (BOD) | NELAP | PA | 4/4/2005 |
| SM 5210 B | Carbonaceous BOD (CBOD) | NELAP | PA | 1/19/2005 |
| SM 5310 B | Total organic carbon (TOC) | NELAP | PA | 4/17/2007 |
| SM 5310 C | Total organic carbon (TOC) | NELAP | PA | 5/24/2007 |
| SM 5540 C | Surfactants as MBAS | NELAP | PA | 4/17/2007 |
| SM 9222 D | Fecal coliforms | NELAP | PA | 7/6/2007 |
| TX1005 (TNRCC) | Total petroleum hydrocarbons (TPH) | NELAP | PA | 12/12/2005 |
| TX1006 (TNRCC) | Total petroleum hydrocarbons (TPH) | NELAP | PA | 12/12/2005 |
| WA-EPH | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| WA-VPH | Gasoline-range organics (GRO) | NELAP | PA | 12/12/2005 |
| WI-DRO | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| WI-GRO | Gasoline-range organics (GRO) | NELAP | PA | 12/12/2005 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

*Lancaster Laboratories Inc*
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Solid and Chemical Materials**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| AK-101 | Gasoline-range organics (GRO) | NELAP | PA | 12/12/2005 |
| AK-102 | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| AK-103 | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| EPA 1010 | Ignitability | NELAP | PA | 1/19/2005 |
| EPA 1311 | Toxicity characteristic leaching procedure (TCLP) | NELAP | PA | 12/12/2005 |
| EPA 1312 | Synthetic precipitation leaching procedure (SPLP) | NELAP | PA | 12/12/2005 |
| EPA 3005A | Preconcentration under acid | NELAP | PA | 4/4/2005 |
| EPA 3010A | Hot plate acid digestion (HNO3 + HCl) | NELAP | PA | 4/4/2005 |
| EPA 3020A | Hot plate acid digestion (HNO3 only) | NELAP | PA | 4/4/2005 |
| EPA 3050B | Acid digestion of solids | NELAP | PA | 4/4/2005 |
| EPA 3060A | Alkaline digestion of Cr(VI) | NELAP | PA | 4/4/2005 |
| EPA 3510C | Separatory funnel liquid-liquid extraction | NELAP | PA | 4/4/2005 |
| EPA 3540C | Soxhlet extraction | NELAP | PA | 4/4/2005 |
| EPA 3546 | Microwave extraction | NELAP | PA | 9/25/2009 |
| EPA 3550B | Ultrasonic extraction | NELAP | PA | 4/4/2005 |
| EPA 3620B | Florisil cleanup | NELAP | PA | 4/4/2005 |
| EPA 3630C | Silica gel cleanup | NELAP | PA | 4/4/2005 |
| EPA 3640A | Gel permeation cleanup (GPC) | NELAP | PA | 4/4/2005 |
| EPA 3660B | Sulfur cleanup | NELAP | PA | 4/4/2005 |
| EPA 3665A | Sulfuric acid/permanganate clean-up | NELAP | PA | 4/4/2005 |
| EPA 5030 | Bulk purge-and-trap (methanol) | NELAP | PA | 12/4/2007 |
| EPA 5035 | Closed-system purge-and-trap (bisulfate option) | NELAP | PA | 12/12/2005 |
| EPA 5035 | Closed-system purge-and-trap (methanol option) | NELAP | PA | 4/4/2005 |
| EPA 5035 | Closed-system purge-and-trap (unpreserved) | NELAP | PA | 4/4/2005 |
| EPA 6010 | Aluminum | NELAP | PA | 1/19/2005 |
| EPA 6010 | Antimony | NELAP | PA | 1/19/2005 |
| EPA 6010 | Arsenic | NELAP | PA | 1/19/2005 |
| EPA 6010 | Barium | NELAP | PA | 1/19/2005 |
| EPA 6010 | Beryllium | NELAP | PA | 1/19/2005 |
| EPA 6010 | Boron | NELAP | PA | 1/19/2005 |
| EPA 6010 | Cadmium | NELAP | PA | 1/19/2005 |
| EPA 6010 | Calcium | NELAP | PA | 1/19/2005 |
| EPA 6010 | Chromium | NELAP | PA | 1/19/2005 |
| EPA 6010 | Cobalt | NELAP | PA | 1/19/2005 |
| EPA 6010 | Copper | NELAP | PA | 1/19/2005 |
| EPA 6010 | Iron | NELAP | PA | 1/19/2005 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID:** 36-00037 **EPA Lab Code:** PA00009 (717) 656-2300

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program** Solid and Chemical Materials

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 6010 | Lead | NELAP | PA | 1/19/2005 |
| EPA 6010 | Magnesium | NELAP | PA | 1/19/2005 |
| EPA 6010 | Manganese | NELAP | PA | 1/19/2005 |
| EPA 6010 | Molybdenum | NELAP | PA | 1/19/2005 |
| EPA 6010 | Nickel | NELAP | PA | 1/19/2005 |
| EPA 6010 | Potassium | NELAP | PA | 1/19/2005 |
| EPA 6010 | Selenium | NELAP | PA | 1/19/2005 |
| EPA 6010 | Silver | NELAP | PA | 1/19/2005 |
| EPA 6010 | Sodium | NELAP | PA | 1/19/2005 |
| EPA 6010 | Strontium | NELAP | PA | 1/19/2005 |
| EPA 6010 | Thallium | NELAP | PA | 1/19/2005 |
| EPA 6010 | Tin | NELAP | PA | 1/19/2005 |
| EPA 6010 | Titanium | NELAP | PA | 1/19/2005 |
| EPA 6010 | Vanadium | NELAP | PA | 1/19/2005 |
| EPA 6010 | Zinc | NELAP | PA | 1/19/2005 |
| EPA 6020 | Aluminum | NELAP | PA | 4/29/2010 |
| EPA 6020 | Antimony | NELAP | PA | 1/19/2005 |
| EPA 6020 | Arsenic | NELAP | PA | 1/19/2005 |
| EPA 6020 | Beryllium | NELAP | PA | 1/19/2005 |
| EPA 6020 | Cadmium | NELAP | PA | 1/19/2005 |
| EPA 6020 | Calcium | NELAP | PA | 4/29/2010 |
| EPA 6020 | Chromium | NELAP | PA | 1/19/2005 |
| EPA 6020 | Cobalt | NELAP | PA | 4/29/2010 |
| EPA 6020 | Copper | NELAP | PA | 1/19/2005 |
| EPA 6020 | Iron | NELAP | PA | 4/29/2010 |
| EPA 6020 | Lead | NELAP | PA | 1/19/2005 |
| EPA 6020 | Magnesium | NELAP | PA | 4/29/2010 |
| EPA 6020 | Manganese | NELAP | PA | 4/29/2010 |
| EPA 6020 | Nickel | NELAP | PA | 4/4/2005 |
| EPA 6020 | Potassium | NELAP | PA | 4/29/2010 |
| EPA 6020 | Selenium | NELAP | PA | 4/4/2005 |
| EPA 6020 | Silver | NELAP | PA | 2/23/2010 |
| EPA 6020 | Sodium | NELAP | PA | 4/29/2010 |
| EPA 6020 | Strontium | NELAP | PA | 4/29/2010 |
| EPA 6020 | Thallium | NELAP | PA | 1/19/2005 |
| EPA 6020 | Tin | NELAP | PA | 4/29/2010 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Solid and Chemical Materials**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 6020 | Vanadium | NELAP | PA | 1/7/2010 |
| EPA 6020 | Zinc | NELAP | PA | 2/1/2011 |
| EPA 6020-Extended | Boron | NELAP | PA | 4/29/2010 |
| EPA 6020-Extended | Titanium | NELAP | PA | 4/29/2010 |
| EPA 6850 | Perchlorate | NELAP | PA | 1/19/2011 |
| EPA 7.3.3.2 | Reactive cyanide | NELAP | PA | 12/12/2005 |
| EPA 7.3.4.2 | Reactive sulfide | NELAP | PA | 12/12/2005 |
| EPA 7196 | Chromium VI | NELAP | PA | 1/19/2005 |
| EPA 7199 | Chromium VI | NELAP | PA | 5/2/2006 |
| EPA 7471 | Mercury | NELAP | PA | 10/17/2007 |
| EPA 8015 | Ethanol | NELAP | PA | 1/19/2005 |
| EPA 8015 | Ethylene glycol | NELAP | PA | 12/4/2007 |
| EPA 8015 | Isopropyl alcohol (2-Propanol) | NELAP | PA | 12/4/2007 |
| EPA 8015 | Methanol | NELAP | PA | 1/19/2005 |
| EPA 8015 | tert-Butyl alcohol (2-Methyl-2-propanol) | NELAP | PA | 1/12/2007 |
| EPA 8015B | Diesel-range organics (DRO) | NELAP | PA | 4/4/2005 |
| EPA 8015B | Gasoline-range organics (GRO) | NELAP | PA | 4/4/2005 |
| EPA 8021 | Benzene | NELAP | PA | 1/19/2005 |
| EPA 8021 | Ethylbenzene | NELAP | PA | 1/19/2005 |
| EPA 8021 | Isopropylbenzene (Cumene) | NELAP | PA | 1/24/2007 |
| EPA 8021 | Methyl tert-butyl ether (MTBE) | NELAP | PA | 5/2/2006 |
| EPA 8021 | Naphthalene | NELAP | PA | 12/4/2007 |
| EPA 8021 | Toluene | NELAP | PA | 1/19/2005 |
| EPA 8021 | Xylenes, total | NELAP | PA | 1/19/2005 |
| EPA 8021 | m-Xylene | NELAP | PA | 1/24/2007 |
| EPA 8021 | o-Xylene | NELAP | PA | 1/24/2007 |
| EPA 8021 | p-Xylene | NELAP | PA | 1/24/2007 |
| EPA 8081 | 4,4'-DDD | NELAP | PA | 1/19/2005 |
| EPA 8081 | 4,4'-DDE | NELAP | PA | 1/19/2005 |
| EPA 8081 | 4,4'-DDT | NELAP | PA | 1/19/2005 |
| EPA 8081 | Aldrin (HHDN) | NELAP | PA | 1/19/2005 |
| EPA 8081 | Chlordane (tech.) | NELAP | PA | 1/19/2005 |
| EPA 8081 | Dieldrin | NELAP | PA | 1/19/2005 |
| EPA 8081 | Endosulfan I | NELAP | PA | 1/19/2005 |
| EPA 8081 | Endosulfan II | NELAP | PA | 1/19/2005 |
| EPA 8081 | Endosulfan sulfate | NELAP | PA | 1/19/2005 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Solid and Chemical Materials**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8081 | Endrin | NELAP | PA | 1/19/2005 |
| EPA 8081 | Endrin aldehyde | NELAP | PA | 1/19/2005 |
| EPA 8081 | Endrin ketone | NELAP | PA | 1/19/2005 |
| EPA 8081 | Heptachlor | NELAP | PA | 1/19/2005 |
| EPA 8081 | Heptachlor epoxide | NELAP | PA | 1/19/2005 |
| EPA 8081 | Kepone | NELAP | PA | 1/19/2005 |
| EPA 8081 | Methoxychlor | NELAP | PA | 1/19/2005 |
| EPA 8081 | Mirex | NELAP | PA | 1/19/2005 |
| EPA 8081 | Toxaphene (Chlorinated camphene) | NELAP | PA | 1/19/2005 |
| EPA 8081 | alpha-BHC (alpha-Hexachlorocyclohexane) | NELAP | PA | 1/19/2005 |
| EPA 8081 | alpha-Chlordane | NELAP | PA | 4/4/2005 |
| EPA 8081 | beta-BHC (beta-Hexachlorocyclohexane) | NELAP | PA | 1/19/2005 |
| EPA 8081 | delta-BHC (delta-Hexachlorocyclohexane) | NELAP | PA | 1/19/2005 |
| EPA 8081 | gamma-BHC (Lindane, gamma-Hexachlorocyclohexane) | NELAP | PA | 1/19/2005 |
| EPA 8081 | gamma-Chlordane | NELAP | PA | 4/4/2005 |
| EPA 8082 | Aroclor-1016 (PCB-1016) | NELAP | PA | 1/2/2007 |
| EPA 8082 | Aroclor-1016 (in oil) | NELAP | PA | 5/24/2011 |
| EPA 8082 | Aroclor-1221 (PCB-1221) | NELAP | PA | 1/2/2007 |
| EPA 8082 | Aroclor-1221 (in oil) | NELAP | PA | 5/24/2011 |
| EPA 8082 | Aroclor-1232 (PCB-1232) | NELAP | PA | 1/2/2007 |
| EPA 8082 | Aroclor-1232 (in oil) | NELAP | PA | 5/24/2011 |
| EPA 8082 | Aroclor-1242 (PCB-1242) | NELAP | PA | 1/2/2007 |
| EPA 8082 | Aroclor-1242 (in oil) | NELAP | PA | 5/24/2011 |
| EPA 8082 | Aroclor-1248 (PCB-1248) | NELAP | PA | 1/2/2007 |
| EPA 8082 | Aroclor-1248 (in oil) | NELAP | PA | 5/24/2011 |
| EPA 8082 | Aroclor-1254 (PCB-1254) | NELAP | PA | 1/2/2007 |
| EPA 8082 | Aroclor-1254 (in oil) | NELAP | PA | 5/24/2011 |
| EPA 8082 | Aroclor-1260 (PCB-1260) | NELAP | PA | 1/2/2007 |
| EPA 8082 | Aroclor-1260 (in oil) | NELAP | PA | 5/24/2011 |
| EPA 8082-Extended | Aroclor-1262 (PCB-1262) | NELAP | PA | 7/23/2008 |
| EPA 8082-Extended | Aroclor-1268 (PCB-1268) | NELAP | PA | 7/23/2008 |
| EPA 8141 | Atrazine | NELAP | PA | 1/19/2005 |
| EPA 8141 | Bolstar (Sulprofos) | NELAP | PA | 1/19/2005 |
| EPA 8141 | Coumaphos | NELAP | PA | 1/19/2005 |
| EPA 8141 | Demeton-O | NELAP | PA | 1/19/2005 |
| EPA 8141 | Demeton-S | NELAP | PA | 1/19/2005 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 069, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Solid and Chemical Materials**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8141 | Diazinon (Spectracide) | NELAP | PA | 1/19/2005 |
| EPA 8141 | Dichloroyos (DDVP, Dichlorvos) | NELAP | PA | 1/19/2005 |
| EPA 8141 | Disulfoton | NELAP | PA | 1/19/2005 |
| EPA 8141 | EPN (Santox) | NELAP | PA | 1/19/2005 |
| EPA 8141 | Ethion | NELAP | PA | 1/19/2005 |
| EPA 8141 | Ethoprop (Prophos) | NELAP | PA | 1/19/2005 |
| EPA 8141 | Famphur | NELAP | PA | 1/19/2005 |
| EPA 8141 | Fensulfothion | NELAP | PA | 1/19/2005 |
| EPA 8141 | Fenthion | NELAP | PA | 4/4/2005 |
| EPA 8141 | Malathion | NELAP | PA | 1/19/2005 |
| EPA 8141 | Merphos | NELAP | PA | 1/19/2005 |
| EPA 8141 | Methyl parathion (Parathion, methyl) | NELAP | PA | 5/25/2005 |
| EPA 8141 | Mevinphos | NELAP | PA | 1/19/2005 |
| EPA 8141 | Naled | NELAP | PA | 1/19/2005 |
| EPA 8141 | Parathion, ethyl (Ethyl parathion, Parathion) | NELAP | PA | 1/19/2005 |
| EPA 8141 | Phorate (Thimet) | NELAP | PA | 1/19/2005 |
| EPA 8141 | Ronnel | NELAP | PA | 1/19/2005 |
| EPA 8141 | Simazine | NELAP | PA | 1/4/2006 |
| EPA 8141 | Stirophos (Tetrachlorovinphos) | NELAP | PA | 1/19/2005 |
| EPA 8141 | Tokuthion (Prothiophos) | NELAP | PA | 1/19/2005 |
| EPA 8141 | Trichloronate | NELAP | PA | 1/19/2005 |
| EPA 8141-Extended | Alachlor (Lasso) | NELAP | PA | 1/21/2009 |
| EPA 8141A | Azinphos-methyl (Guthion) | NELAP | PA | 4/4/2005 |
| EPA 8141A | Chlorpyrifos | NELAP | PA | 4/4/2005 |
| EPA 8151 | 2,4,5-T | NELAP | PA | 1/19/2005 |
| EPA 8151 | 2,4,5-TP (Silvex) | NELAP | PA | 1/19/2005 |
| EPA 8151 | 2,4-D | NELAP | PA | 1/19/2005 |
| EPA 8151 | 2,4-DB (Butoxon) | NELAP | PA | 4/4/2005 |
| EPA 8151 | Dalapon (2,2-Dichloropropionic acid) | NELAP | PA | 1/19/2005 |
| EPA 8151 | Dicamba | NELAP | PA | 1/19/2005 |
| EPA 8151 | Dichloroprop (Dichlorprop) | NELAP | PA | 1/19/2005 |
| EPA 8151 | Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP) | NELAP | PA | 1/19/2005 |
| EPA 8151 | MCPA | NELAP | PA | 1/19/2005 |
| EPA 8151 | MCPP (Mecoprop) | NELAP | PA | 5/2/2006 |
| EPA 8151 | Pentachlorophenol (PCP) | NELAP | PA | 1/19/2005 |
| EPA 8151 | Picloram (4-Amino-3,5,6-trichloro-2-pyridinecarboxylic acid) | NELAP | PA | 1/19/2005 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Solid and Chemical Materials**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8260 | 1,1,1,2-Tetrachloroethane | NELAP | PA | 1/19/2005 |
| EPA 8260 | 1,1,1-Trichloroethane | NELAP | PA | 1/19/2005 |
| EPA 8260 | 1,1,2,2-Tetrachloroethane | NELAP | PA | 1/19/2005 |
| EPA 8260 | 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113) | NELAP | PA | 5/2/2006 |
| EPA 8260 | 1,1,2-Trichloroethane | NELAP | PA | 1/19/2005 |
| EPA 8260 | 1,1-Dichloroethane | NELAP | PA | 1/19/2005 |
| EPA 8260 | 1,1-Dichloroethene (1,1-Dichloroethylene) | NELAP | PA | 1/19/2005 |
| EPA 8260 | 1,1-Dichloropropene | NELAP | PA | 1/19/2005 |
| EPA 8260 | 1,2,3-Trichlorobenzene | NELAP | PA | 1/19/2005 |
| EPA 8260 | 1,2,3-Trichloropropane (1,2,3-TCP) | NELAP | PA | 1/19/2005 |
| EPA 8260 | 1,2,4-Trichlorobenzene | NELAP | PA | 1/19/2005 |
| EPA 8260 | 1,2,4-Trimethylbenzene | NELAP | PA | 1/19/2005 |
| EPA 8260 | 1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane) | NELAP | PA | 5/25/2005 |
| EPA 8260 | 1,2-Dibromoethane (EDB, Ethylene dibromide) | NELAP | PA | 1/19/2005 |
| EPA 8260 | 1,2-Dichlorobenzene (o-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 8260 | 1,2-Dichloroethane | NELAP | PA | 1/19/2005 |
| EPA 8260 | 1,2-Dichloropropane | NELAP | PA | 1/19/2005 |
| EPA 8260 | 1,3,5-Trimethylbenzene | NELAP | PA | 1/19/2005 |
| EPA 8260 | 1,3-Dichlorobenzene (m-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 8260 | 1,3-Dichloropropane | NELAP | PA | 1/19/2005 |
| EPA 8260 | 1,4-Dichlorobenzene (p-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 8260 | 1,4-Dioxane (1,4-Diethyleneoxide) | NELAP | PA | 1/19/2005 |
| EPA 8260 | 2,2-Dichloropropane | NELAP | PA | 1/19/2005 |
| EPA 8260 | 2-Butanone (Methyl ethyl ketone, MEK) | NELAP | PA | 1/19/2005 |
| EPA 8260 | 2-Chloroethyl vinyl ether | NELAP | PA | 1/19/2005 |
| EPA 8260 | 2-Chlorotoluene | NELAP | PA | 5/2/2006 |
| EPA 8260 | 2-Hexanone | NELAP | PA | 1/19/2005 |
| EPA 8260 | 4-Chlorotoluene | NELAP | PA | 1/19/2005 |
| EPA 8260 | 4-Isopropyltoluene (p-Isopropyltoluene) | NELAP | PA | 1/24/2007 |
| EPA 8260 | 4-Methyl-2-pentanone (MIBK) | NELAP | PA | 1/19/2005 |
| EPA 8260 | Acetone | NELAP | PA | 1/19/2005 |
| EPA 8260 | Acetonitrile | NELAP | PA | 1/4/2006 |
| EPA 8260 | Acrolein (Propenal) | NELAP | PA | 1/19/2005 |
| EPA 8260 | Acrylonitrile | NELAP | PA | 1/19/2005 |
| EPA 8260 | Allyl chloride (3-Chloropropene) | NELAP | PA | 1/19/2005 |
| EPA 8260 | Benzene | NELAP | PA | 1/19/2005 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Solid and Chemical Materials**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8260 | Benzyl chloride | NELAP | PA | 1/4/2006 |
| EPA 8260 | Bromobenzene | NELAP | PA | 1/19/2005 |
| EPA 8260 | Bromochloromethane | NELAP | PA | 1/19/2005 |
| EPA 8260 | Bromodichloromethane | NELAP | PA | 1/19/2005 |
| EPA 8260 | Bromoform | NELAP | PA | 1/19/2005 |
| EPA 8260 | Carbon disulfide | NELAP | PA | 1/19/2005 |
| EPA 8260 | Carbon tetrachloride | NELAP | PA | 1/19/2005 |
| EPA 8260 | Chlorobenzene | NELAP | PA | 1/19/2005 |
| EPA 8260 | Chloroethane | NELAP | PA | 1/19/2005 |
| EPA 8260 | Chloroform | NELAP | PA | 1/19/2005 |
| EPA 8260 | Chloroprene (2-Chloro-1,3-butadiene) | NELAP | PA | 4/17/2009 |
| EPA 8260 | Cyclohexane | NELAP | PA | 6/29/2010 |
| EPA 8260 | Dibromochloromethane | NELAP | PA | 1/19/2005 |
| EPA 8260 | Dibromochloropropane (1,2-Dibromo-3-chloropropane, DBCP) | NELAP | PA | 1/19/2005 |
| EPA 8260 | Dibromomethane | NELAP | PA | 1/19/2005 |
| EPA 8260 | Dichlorodifluoromethane (Freon 12) | NELAP | PA | 1/19/2005 |
| EPA 8260 | Epichlorohydrin (1-Chloro-2,3-epoxypropane) | NELAP | PA | 1/4/2006 |
| EPA 8260 | Ethanol | NELAP | PA | 1/4/2006 |
| EPA 8260 | Ethyl acetate | NELAP | PA | 1/4/2006 |
| EPA 8260 | Ethyl methacrylate | NELAP | PA | 1/4/2006 |
| EPA 8260 | Ethylbenzene | NELAP | PA | 1/19/2005 |
| EPA 8260 | Hexachlorobutadiene (1,3-Hexachlorobutadiene) | NELAP | PA | 1/19/2005 |
| EPA 8260 | Isobutyl alcohol (2-Methyl-1-propanol) | NELAP | PA | 1/24/2007 |
| EPA 8260 | Isopropyl alcohol (2-Propanol) | NELAP | PA | 1/19/2005 |
| EPA 8260 | Isopropylbenzene (Cumene) | NELAP | PA | 8/7/2005 |
| EPA 8260 | Methacrylonitrile | NELAP | PA | 1/24/2007 |
| EPA 8260 | Methyl bromide (Bromomethane) | NELAP | PA | 1/19/2005 |
| EPA 8260 | Methyl chloride (Chloromethane) | NELAP | PA | 1/19/2005 |
| EPA 8260 | Methyl tert-butyl ether (MTBE) | NELAP | PA | 1/19/2005 |
| EPA 8260 | Methylene chloride (Dichloromethane) | NELAP | PA | 1/19/2005 |
| EPA 8260 | Methylmethacrylate | NELAP | PA | 5/2/2006 |
| EPA 8260 | Naphthalene | NELAP | PA | 1/19/2005 |
| EPA 8260 | Pentachloroethane | NELAP | PA | 1/24/2007 |
| EPA 8260 | Propionitrile (Ethyl cyanide) | NELAP | PA | 1/24/2007 |
| EPA 8260 | Styrene | NELAP | PA | 1/19/2005 |
| EPA 8260 | Tetrachloroethene (PCE, Perchloroethylene) | NELAP | PA | 1/19/2005 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Solid and Chemical Materials**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8260 | Toluene | NELAP | PA | 1/19/2005 |
| EPA 8260 | Trichloroethene (TCE, Trichloroethylene) | NELAP | PA | 1/19/2005 |
| EPA 8260 | Trichlorofluoromethane (Freon 11) | NELAP | PA | 1/19/2005 |
| EPA 8260 | Vinyl acetate | NELAP | PA | 1/19/2005 |
| EPA 8260 | Vinyl chloride (Chloroethene) | NELAP | PA | 1/19/2005 |
| EPA 8260 | Xylenes, total | NELAP | PA | 1/19/2005 |
| EPA 8260 | cis-1,2-Dichloroethene | NELAP | PA | 1/19/2005 |
| EPA 8260 | cis-1,3-Dichloropropene | NELAP | PA | 1/19/2005 |
| EPA 8260 | m+p-Xylene | NELAP | PA | 1/24/2007 |
| EPA 8260 | n-Butyl alcohol (n-Butanol, 1-Butanol) | NELAP | PA | 1/19/2005 |
| EPA 8260 | n-Butylbenzene | NELAP | PA | 1/19/2005 |
| EPA 8260 | n-Propylbenzene | NELAP | PA | 1/4/2006 |
| EPA 8260 | o-Xylene | NELAP | PA | 1/24/2007 |
| EPA 8260 | sec-Butylbenzene | NELAP | PA | 1/19/2005 |
| EPA 8260 | tert-Butyl alcohol (2-Methyl-2-propanol) | NELAP | PA | 1/19/2005 |
| EPA 8260 | tert-Butyl ethyl ether | NELAP | PA | 5/25/2007 |
| EPA 8260 | tert-Butylbenzene | NELAP | PA | 1/19/2005 |
| EPA 8260 | trans-1,2-Dichloroethene | NELAP | PA | 1/19/2005 |
| EPA 8260 | trans-1,3-Dichloropropene | NELAP | PA | 1/19/2005 |
| EPA 8260 | trans-1,4-Dichloro-2-butene | NELAP | PA | 1/24/2007 |
| EPA 8260 SIM | 1,4-Dioxane (1,4-Diethyleneoxide) | NELAP | PA | 4/17/2009 |
| EPA 8260-Extended | 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113) | NELAP | PA | 5/2/2006 |
| EPA 8260-Extended | 3,3'-Dimethyl-1-butanol | NELAP | PA | 4/17/2009 |
| EPA 8260-Extended | 4-Chloro-2-nitrophenol | NELAP | PA | 5/2/2006 |
| EPA 8260-Extended | Cyclohexanone | NELAP | PA | 7/3/2007 |
| EPA 8260-Extended | Diisopropyl ether (DIPE) | NELAP | PA | 7/3/2007 |
| EPA 8260-Extended | Ethyl tert-butyl ether (ETBE) | NELAP | PA | 7/3/2007 |
| EPA 8260-Extended | Gasoline-range organics (GRO) | NELAP | PA | 6/8/2006 |
| EPA 8260-Extended | Isobutyl alcohol (2-Methyl-1-propanol) | NELAP | PA | 7/3/2007 |
| EPA 8260-Extended | Methyl acetate | NELAP | PA | 6/29/2010 |
| EPA 8260-Extended | Methyl iodide (Iodomethane) | NELAP | PA | 5/2/2006 |
| EPA 8260-Extended | Methylcyclohexane | NELAP | PA | 1/21/2009 |
| EPA 8260-Extended | tert-Amyl alcohol (2-Methyl-2-butanol) | NELAP | PA | 4/17/2009 |
| EPA 8260-Extended | tert-Amyl methyl ether (TAME) | NELAP | PA | 7/3/2007 |
| EPA 8260-Extended | tert-Butyl formate | NELAP | PA | 4/17/2009 |
| EPA 8260-Extended | trans-1,4-Dichloro-2-butene | NELAP | PA | 7/3/2007 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Solid and Chemical Materials**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8270 | 1,2,4,5-Tetrachlorobenzene | NELAP | PA | 4/4/2005 |
| EPA 8270 | 1,2,4-Trichlorobenzene | NELAP | PA | 1/19/2005 |
| EPA 8270 | 1,2-Dichlorobenzene (o-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 8270 | 1,2-Dinitrobenzene (1,2-DNB) | NELAP | PA | 1/19/2005 |
| EPA 8270 | 1,2-Diphenylhydrazine | NELAP | PA | 5/2/2006 |
| EPA 8270 | 1,3,5-Trichlorobenzene | NELAP | PA | 1/19/2005 |
| EPA 8270 | 1,3,5-Trinitrobenzene (1,3,5-TNB) | NELAP | PA | 1/4/2006 |
| EPA 8270 | 1,3-Dichlorobenzene (m-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 8270 | 1,3-Dinitrobenzene (1,3-DNB) | NELAP | PA | 1/19/2005 |
| EPA 8270 | 1,4-Dichlorobenzene (p-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 8270 | 1,4-Dinitrobenzene (1,4-DNB) | NELAP | PA | 5/2/2006 |
| EPA 8270 | 1,4-Naphthoquinone | NELAP | PA | 1/19/2005 |
| EPA 8270 | 1,4-Phenylenediamine | NELAP | PA | 1/19/2005 |
| EPA 8270 | 1-Chloronaphthalene | NELAP | PA | 1/4/2006 |
| EPA 8270 | 1-Naphthylamine (alpha-Naphthylamine) | NELAP | PA | 4/4/2005 |
| EPA 8270 | 2,3,4,6-Tetrachlorophenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | 2,4,5-Trichlorophenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | 2,4,6-Trichlorophenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | 2,4-Dichlorophenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | 2,4-Dimethylphenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | 2,4-Dinitrophenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | 2,4-Dinitrotoluene (2,4-DNT) | NELAP | PA | 1/19/2005 |
| EPA 8270 | 2,6-Dichlorophenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | 2,6-Dinitrotoluene (2,6-DNT) | NELAP | PA | 1/19/2005 |
| EPA 8270 | 2-Acetylaminofluorene | NELAP | PA | 1/19/2005 |
| EPA 8270 | 2-Chloronaphthalene | NELAP | PA | 1/19/2005 |
| EPA 8270 | 2-Chlorophenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | 2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol) | NELAP | PA | 1/19/2005 |
| EPA 8270 | 2-Methylnaphthalene | NELAP | PA | 1/19/2005 |
| EPA 8270 | 2-Methylphenol (o-Cresol) | NELAP | PA | 1/19/2005 |
| EPA 8270 | 2-Naphthylamine (beta-Naphthylamine) | NELAP | PA | 5/17/2005 |
| EPA 8270 | 2-Nitroaniline | NELAP | PA | 4/4/2005 |
| EPA 8270 | 2-Nitrophenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | 2-Picoline (2-Methylpyridine) | NELAP | PA | 1/19/2005 |
| EPA 8270 | 3,3'-Dichlorobenzidine | NELAP | PA | 1/19/2005 |
| EPA 8270 | 3,3'-Dimethoxybenzidine | NELAP | PA | 4/17/2009 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Solid and Chemical Materials**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8270 | 3,3'-Dimethylbenzidine | NELAP | PA | 1/19/2005 |
| EPA 8270 | 3-Methylcholanthrene | NELAP | PA | 1/19/2005 |
| EPA 8270 | 3-Methylphenol (m-Cresol) | NELAP | PA | 1/4/2006 |
| EPA 8270 | 3-Nitroaniline | NELAP | PA | 1/19/2005 |
| EPA 8270 | 4,4'-Methylenebis(2-chloroaniline) | NELAP | PA | 1/19/2005 |
| EPA 8270 | 4-Aminobiphenyl | NELAP | PA | 1/19/2005 |
| EPA 8270 | 4-Bromophenyl phenyl ether | NELAP | PA | 1/19/2005 |
| EPA 8270 | 4-Chloro-3-methylphenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | 4-Chloroaniline | NELAP | PA | 1/19/2005 |
| EPA 8270 | 4-Chlorophenyl phenyl ether | NELAP | PA | 1/19/2005 |
| EPA 8270 | 4-Methylphenol (p-Cresol) | NELAP | PA | 1/19/2005 |
| EPA 8270 | 4-Nitroaniline | NELAP | PA | 4/4/2005 |
| EPA 8270 | 4-Nitrophenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | 5-Nitro-o-toluidine | NELAP | PA | 4/4/2005 |
| EPA 8270 | 7,12-Dimethylbenz(a)anthracene | NELAP | PA | 1/19/2005 |
| EPA 8270 | Acenaphthene | NELAP | PA | 1/19/2005 |
| EPA 8270 | Acenaphthylene | NELAP | PA | 1/19/2005 |
| EPA 8270 | Acetophenone | NELAP | PA | 1/19/2005 |
| EPA 8270 | Aniline | NELAP | PA | 1/19/2005 |
| EPA 8270 | Anthracene | NELAP | PA | 1/19/2005 |
| EPA 8270 | Aramite | NELAP | PA | 5/17/2005 |
| EPA 8270 | Benzidine | NELAP | PA | 1/19/2005 |
| EPA 8270 | Benzo[a]anthracene | NELAP | PA | 1/19/2005 |
| EPA 8270 | Benzo[a]pyrene | NELAP | PA | 1/19/2005 |
| EPA 8270 | Benzo[b]fluoranthene | NELAP | PA | 1/19/2005 |
| EPA 8270 | Benzo[ghi]perylene | NELAP | PA | 1/19/2005 |
| EPA 8270 | Benzo[k]fluoranthene | NELAP | PA | 1/19/2005 |
| EPA 8270 | Benzoic acid | NELAP | PA | 1/19/2005 |
| EPA 8270 | Benzyl alcohol | NELAP | PA | 1/19/2005 |
| EPA 8270 | Butyl benzyl phthalate (Benzyl butyl phthalate) | NELAP | PA | 5/17/2005 |
| EPA 8270 | Chlorobenzilate | NELAP | PA | 5/2/2006 |
| EPA 8270 | Chrysene (Benzo[a]phenanthrene) | NELAP | PA | 1/19/2005 |
| EPA 8270 | Di-n-butyl phthalate | NELAP | PA | 1/19/2005 |
| EPA 8270 | Di-n-octyl phthalate | NELAP | PA | 1/19/2005 |
| EPA 8270 | Dialfate (cis or trans) | NELAP | PA | 5/2/2006 |
| EPA 8270 | Dibenz[a,j]acridine | NELAP | PA | 5/17/2005 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Solid and Chemical Materials**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8270 | Dibenzo[a,h]anthracene | NELAP | PA | 1/19/2005 |
| EPA 8270 | Dibenzofuran | NELAP | PA | 1/19/2005 |
| EPA 8270 | Diethyl phthalate | NELAP | PA | 1/19/2005 |
| EPA 8270 | Dimethoate | NELAP | PA | 5/2/2006 |
| EPA 8270 | Dimethyl phthalate | NELAP | PA | 1/19/2005 |
| EPA 8270 | Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP) | NELAP | PA | 5/2/2006 |
| EPA 8270 | Disulfoton | NELAP | PA | 7/1/2007 |
| EPA 8270 | Ethyl methanesulfonate | NELAP | PA | 1/19/2005 |
| EPA 8270 | Famphur | NELAP | PA | 5/2/2006 |
| EPA 8270 | Fluoranthene | NELAP | PA | 1/19/2005 |
| EPA 8270 | Fluorene | NELAP | PA | 1/19/2005 |
| EPA 8270 | Hexachlorobenzene | NELAP | PA | 1/19/2005 |
| EPA 8270 | Hexachlorobutadiene (1,3-Hexachlorobutadiene) | NELAP | PA | 1/19/2005 |
| EPA 8270 | Hexachlorocyclopentadiene | NELAP | PA | 1/19/2005 |
| EPA 8270 | Hexachloroethane | NELAP | PA | 1/19/2005 |
| EPA 8270 | Hexachloropropene | NELAP | PA | 1/19/2005 |
| EPA 8270 | Indeno(1,2,3-cd)pyrene | NELAP | PA | 1/19/2005 |
| EPA 8270 | Isodrin | NELAP | PA | 5/2/2006 |
| EPA 8270 | Isophorone | NELAP | PA | 1/19/2005 |
| EPA 8270 | Isosafrole | NELAP | PA | 1/19/2005 |
| EPA 8270 | Kepone | NELAP | PA | 5/2/2006 |
| EPA 8270 | Methapyrilene | NELAP | PA | 1/19/2005 |
| EPA 8270 | Methyl methanesulfonate | NELAP | PA | 1/19/2005 |
| EPA 8270 | Methyl parathion (Parathion, methyl) | NELAP | PA | 5/25/2007 |
| EPA 8270 | N-Nitrosodi-n-butylamine | NELAP | PA | 1/19/2005 |
| EPA 8270 | N-Nitrosodi-n-propylamine | NELAP | PA | 1/19/2005 |
| EPA 8270 | N-Nitrosodiethylamine | NELAP | PA | 1/19/2005 |
| EPA 8270 | N-Nitrosodimethylamine | NELAP | PA | 1/19/2005 |
| EPA 8270 | N-Nitrosodiphenylamine | NELAP | PA | 1/19/2005 |
| EPA 8270 | N-Nitrosomethylethylamine | NELAP | PA | 1/19/2005 |
| EPA 8270 | N-Nitrosomorpholine | NELAP | PA | 1/19/2005 |
| EPA 8270 | N-Nitrosopiperidine | NELAP | PA | 1/19/2005 |
| EPA 8270 | N-Nitrosopyrrolidine | NELAP | PA | 1/19/2005 |
| EPA 8270 | Naphthalene | NELAP | PA | 1/19/2005 |
| EPA 8270 | Nitrobenzene | NELAP | PA | 1/4/2006 |
| EPA 8270 | O,O,O-Triethyl phosphorothioate | NELAP | PA | 5/2/2006 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID:** 36-00037 **EPA Lab Code:** PA00009 (717) 656-2300

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program** Solid and Chemical Materials

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8270 | Parathion, ethyl (Ethyl parathion, Parathion) | NELAP | PA | 5/25/2007 |
| EPA 8270 | Pentachlorobenzene | NELAP | PA | 1/19/2005 |
| EPA 8270 | Pentachloronitrobenzene (PCNB) | NELAP | PA | 1/19/2005 |
| EPA 8270 | Pentachlorophenol (PCP) | NELAP | PA | 1/19/2005 |
| EPA 8270 | Phenacetin | NELAP | PA | 1/19/2005 |
| EPA 8270 | Phenanthrene | NELAP | PA | 1/19/2005 |
| EPA 8270 | Phenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | Phorate (Thimet) | NELAP | PA | 5/2/2006 |
| EPA 8270 | Phthalic anhydride | NELAP | PA | 1/21/2009 |
| EPA 8270 | Pronamide (Kerb) | NELAP | PA | 1/19/2005 |
| EPA 8270 | Pyrene | NELAP | PA | 1/19/2005 |
| EPA 8270 | Pyridine | NELAP | PA | 4/4/2005 |
| EPA 8270 | Safrole | NELAP | PA | 1/19/2005 |
| EPA 8270 | Thionazine (Thionazin, Zinophos) | NELAP | PA | 5/2/2006 |
| EPA 8270 | a,a-Dimethylphenethylamine (Phentermine) | NELAP | PA | 5/2/2006 |
| EPA 8270 | bis(2-Chloroethoxy)methane | NELAP | PA | 1/19/2005 |
| EPA 8270 | bis(2-Chloroethyl) ether | NELAP | PA | 1/19/2005 |
| EPA 8270 | bis(2-Chloroisopropyl) ether | NELAP | PA | 1/4/2006 |
| EPA 8270 | bis(2-Ethylhexyl) phthalate (DEHP) | NELAP | PA | 1/19/2005 |
| EPA 8270 | o-Toluidine (2-Toluidine, 2-Methylaniline) | NELAP | PA | 1/19/2005 |
| EPA 8270 | tris-(2,3-Dibromopropyl) phosphate (tris-BP) | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Acenaphthene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Acenaphthylene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Anthracene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Benzo[a]anthracene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Benzo[a]pyrene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Benzo[b]fluoranthene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Benzo[ghi]perylene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Benzo[k]fluoranthene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Chrysene (Benzo[a]phenanthrene) | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Dibenzo[a,h]anthracene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Fluoranthene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Fluorene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Indeno(1,2,3-cd)pyrene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Naphthalene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | Phenanthrene | NELAP | PA | 12/4/2007 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID:** 36-00037 **EPA Lab Code:** PA00009 (717) 656-2300

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program** Solid and Chemical Materials

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8270 SIM | Pyrene | NELAP | PA | 12/4/2007 |
| EPA 8270-Extended | 1,1'-Biphenyl (Biphenyl, Lemonene) | NELAP | PA | 12/4/2007 |
| EPA 8270-Extended | 1,2,3,4-Tetrachlorobenzene | NELAP | PA | 7/3/2007 |
| EPA 8270-Extended | 1,2,3,4-Tetrahydronaphthalene | NELAP | PA | 12/4/2007 |
| EPA 8270-Extended | 1,2,3,5-Tetrachlorobenzene | NELAP | PA | 7/3/2007 |
| EPA 8270-Extended | 1,4-Dioxane (1,4-Diethyleneoxide) | NELAP | PA | 12/4/2007 |
| EPA 8270-Extended | 1-Methylnaphthalene | NELAP | PA | 12/4/2007 |
| EPA 8270-Extended | 6-Methylchrysene | NELAP | PA | 12/4/2007 |
| EPA 8270-Extended | Acrylamide | NELAP | PA | 1/21/2009 |
| EPA 8270-Extended | Atrazine | NELAP | PA | 1/12/2007 |
| EPA 8270-Extended | Benzaldehyde | NELAP | PA | 12/4/2007 |
| EPA 8270-Extended | Benzenethiol | NELAP | PA | 12/4/2007 |
| EPA 8270-Extended | Caprolactam | NELAP | PA | 12/4/2007 |
| EPA 8270-Extended | Carbazole | NELAP | PA | 1/19/2005 |
| EPA 8270-Extended | Dibenz[a,h]acridine | NELAP | PA | 12/4/2007 |
| EPA 8270-Extended | Indene | NELAP | PA | 12/4/2007 |
| EPA 8270-Extended | N,N-Dimethylacetamide | NELAP | PA | 12/4/2007 |
| EPA 8270-Extended | N,N-Dimethylformamide | NELAP | PA | 12/4/2007 |
| EPA 8270-Extended | Nitroquinoline-1-oxide | NELAP | PA | 7/3/2007 |
| EPA 8270-Extended | Quinoline | NELAP | PA | 12/4/2007 |
| EPA 8270-Extended | Tetraethyl dithiopyrophosphate | NELAP | PA | 12/4/2007 |
| EPA 8270-Extended | bis(2-Chloromethyl) ether | NELAP | PA | 1/21/2009 |
| EPA 8270-Extended | bis(2-Ethylhexyl) adipate (di(2-Ethylhexyl) adipate) | NELAP | PA | 1/21/2009 |
| EPA 8270-Extended | p-(Dimethylamino)azobenzene | NELAP | PA | 5/2/2006 |
| EPA 8270-Extended | p-Chloronitrobenzene | NELAP | PA | 1/21/2009 |
| EPA 8270C | Diphenylamine | NELAP | PA | 5/2/2006 |
| EPA 8290 | 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 8/6/2010 |
| EPA 8290 | 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID:** 36-00037 **EPA Lab Code:** PA00009 **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program** Solid and Chemical Materials

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8290 | 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 1,2,3,7,8-Pentachlorodibenzofuran (PeCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 2,3,4,7,8-Pentachlorodibenzofuran (PeCDF) | NELAP | PA | 8/6/2010 |
| EPA 8290 | 2,3,7,8-TCDD (Dioxin) | NELAP | PA | 6/30/2010 |
| EPA 8290 | 2,3,7,8-Tetrachlorodibenzofuran (TCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | Total TCDD | NELAP | PA | 6/30/2010 |
| EPA 8290 | Total TCDF | NELAP | PA | 6/30/2010 |
| EPA 8290 | Total heptachlorodibenzo-p-dioxin (HpCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | Total heptachlorodibenzofuran (HpCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | Total hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | Total hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | Total pentachlorodibenzo-p-dioxin (PeCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | Total pentachlorodibenzofuran (PeCDF) | NELAP | PA | 6/30/2010 |
| EPA 8310 | Acenaphthene | NELAP | PA | 1/19/2005 |
| EPA 8310 | Acenaphthylene | NELAP | PA | 1/23/2007 |
| EPA 8310 | Anthracene | NELAP | PA | 1/19/2005 |
| EPA 8310 | Benzo[a]anthracene | NELAP | PA | 1/19/2005 |
| EPA 8310 | Benzo[a]pyrene | NELAP | PA | 1/19/2005 |
| EPA 8310 | Benzo[b]fluoranthene | NELAP | PA | 1/19/2005 |
| EPA 8310 | Benzo[ghi]perylene | NELAP | PA | 1/19/2005 |
| EPA 8310 | Benzo[k]fluoranthene | NELAP | PA | 1/19/2005 |
| EPA 8310 | Chrysene (Benzo[a]phenanthrene) | NELAP | PA | 1/19/2005 |
| EPA 8310 | Dibenzo[a,h]anthracene | NELAP | PA | 1/19/2005 |
| EPA 8310 | Fluoranthene | NELAP | PA | 1/19/2005 |
| EPA 8310 | Fluorene | NELAP | PA | 5/25/2005 |
| EPA 8310 | Indeno(1,2,3-cd)pyrene | NELAP | PA | 1/19/2005 |
| EPA 8310 | Naphthalene | NELAP | PA | 1/19/2005 |
| EPA 8310 | Phenanthrene | NELAP | PA | 1/19/2005 |
| EPA 8310 | Pyrene | NELAP | PA | 1/19/2005 |
| EPA 8315 | 2,5-Dimethylbenzaldehyde | NELAP | PA | 1/21/2009 |
| EPA 8315 | Acetaldehyde | NELAP | PA | 1/21/2009 |
| EPA 8315 | Acrolein (Propenal) | NELAP | PA | 1/21/2009 |
| EPA 8315 | Benzaldehyde | NELAP | PA | 1/21/2009 |

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Solid and Chemical Materials**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 8315 | Butanal (Butyraldehyde) | NELAP | PA | 1/21/2009 |
| EPA 8315 | Crotonaldehyde | NELAP | PA | 1/21/2009 |
| EPA 8315 | Formaldehyde | NELAP | PA | 1/19/2005 |
| EPA 8315 | Hexanal (Hexaldehyde) | NELAP | PA | 1/21/2009 |
| EPA 8315 | Isovaleraldehyde | NELAP | PA | 1/21/2009 |
| EPA 8315 | Pentanal (Valeraldehyde) | NELAP | PA | 1/21/2009 |
| EPA 8315 | Propanal (Propionaldehyde) | NELAP | PA | 1/21/2009 |
| EPA 8315 | m-Tolualdehyde (1,3-Tolualdehyde) | NELAP | PA | 1/21/2009 |
| EPA 8315 | o-Tolualdehyde (1,2-Tolualdehyde) | NELAP | PA | 1/21/2009 |
| EPA 8315 | p-Tolualdehyde (1,4-Tolualdehyde) | NELAP | PA | 1/21/2009 |
| EPA 8318 | 3-Hydroxycarbofuran | NELAP | PA | 4/4/2005 |
| EPA 8318 | Aldicarb (Temik) | NELAP | PA | 4/4/2005 |
| EPA 8318 | Aldicarb sulfone | NELAP | PA | 4/4/2005 |
| EPA 8318 | Carbaryl (Sevin) | NELAP | PA | 4/4/2005 |
| EPA 8318 | Carbofuran (Furadan) | NELAP | PA | 4/4/2005 |
| EPA 8318 | Methiocarb (Mesurol) | NELAP | PA | 4/4/2005 |
| EPA 8318 | Methomyl (Lannate) | NELAP | PA | 4/4/2005 |
| EPA 8318 | Propoxur (Baygon) | NELAP | PA | 4/4/2005 |
| EPA 8318-Extended | Aldicarb sulfoxide | NELAP | PA | 12/12/2005 |
| EPA 8318-Extended | Oxamyl (Vydate) | NELAP | PA | 12/12/2005 |
| EPA 8330 | 1,3,5-Trinitrobenzene (1,3,5-TNB) | NELAP | PA | 1/19/2005 |
| EPA 8330 | 1,3-Dinitrobenzene (1,3-DNB) | NELAP | PA | 1/19/2005 |
| EPA 8330 | 2,4,6-Trinitrotoluene (2,4,6-TNT) | NELAP | PA | 1/19/2005 |
| EPA 8330 | 2,4-Dinitrotoluene (2,4-DNT) | NELAP | PA | 1/19/2005 |
| EPA 8330 | 2,6-Dinitrotoluene (2,6-DNT) | NELAP | PA | 1/19/2005 |
| EPA 8330 | 2-Amino-4,6-dinitrotoluene (2-Am-DNT) | NELAP | PA | 1/19/2005 |
| EPA 8330 | 2-Nitrotoluene | NELAP | PA | 1/19/2005 |
| EPA 8330 | 3-Nitrotoluene | NELAP | PA | 1/19/2005 |
| EPA 8330 | 4-Amino-2,6-dinitrotoluene (4-Am-DNT) | NELAP | PA | 1/19/2005 |
| EPA 8330 | 4-Nitrotoluene | NELAP | PA | 1/19/2005 |
| EPA 8330 | Nitrobenzene | NELAP | PA | 1/19/2005 |
| EPA 8330 | Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) | NELAP | PA | 1/24/2006 |
| EPA 8330 | RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine) | NELAP | PA | 1/19/2005 |
| EPA 8330 | Tetryl (2,4,6-Trinitrophenylmethylnitramine) | NELAP | PA | 1/19/2005 |
| EPA 8330-Extended | Pentaerythritol tetranitrate (PETN) | NELAP | PA | 11/21/2005 |
| EPA 9012 | Total cyanide | NELAP | PA | 1/19/2005 |

**The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.**

Pennsylvania Department of Environmental Protection

## *Laboratory Scope of Accreditation*



**Attachment to Certificate of Accreditation 009, expiration date January 31, 2012. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**State Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **(717) 656-2300**

**Lancaster Laboratories Inc**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**Program Solid and Chemical Materials**

| Method | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|
| EPA 9040 | Corrosivity (pH) | NELAP | PA | 5/17/2005 |
| EPA 9040 | pH | NELAP | PA | 1/19/2005 |
| EPA 9045 | pH | NELAP | PA | 11/19/2008 |
| EPA 9050 | Conductivity | NELAP | PA | 5/17/2005 |
| EPA 9060 | Total organic carbon (TOC) | NELAP | PA | 1/19/2005 |
| EPA 9066 | Total phenolics | NELAP | PA | 4/4/2005 |
| EPA 9071B | Oil and grease | NELAP | PA | 1/19/2005 |
| EPA 9081 | Cation exchange capacity of soils (Ammonium acetate) | NELAP | PA | 5/25/2005 |
| EPA 9095A | Paint filter liquids test | NELAP | PA | 1/24/2007 |
| FL-PRO | Total petroleum hydrocarbons (TPH) | NELAP | PA | 12/12/2005 |
| MA DEP EPH | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| MA DEP VPH | Gasoline-range organics (GRO) | NELAP | PA | 12/12/2005 |
| NWTPH-Dx | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| NWTPH-Gx | Gasoline-range organics (GRO) | NELAP | PA | 12/12/2005 |
| NWTPH-HCID | GRO/DRO/HRO Screen | NELAP | PA | 10/16/2008 |
| OA-1 | Gasoline-range organics (GRO) | NELAP | PA | 12/12/2005 |
| OA-2 | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| TX1005 (TNRCC) | Total petroleum hydrocarbons (TPH) | NELAP | PA | 12/12/2005 |
| TX1006 (TNRCC) | Total petroleum hydrocarbons (TPH) | NELAP | PA | 12/12/2005 |
| WA-EPH | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| WA-VPH | Gasoline-range organics (GRO) | NELAP | PA | 12/12/2005 |
| WI-DRO | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| WI-GRO | Gasoline-range organics (GRO) | NELAP | PA | 12/12/2005 |

**The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized accrediting authority. Customers are urged to verify the laboratory's current accreditation standing.**
**www.dep.state.pa.us** **Issue Date: 05/25/2011**

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

## ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 11/30/2010 until 06/30/2011

Laboratory Name: LANCASTER LABORATORIES, INC Laboratory Number: PA011 Activity ID: NLC100005
2425 NEW HOLLAND PK
LANCASTER, PA 17601-5994

Category: CAP03 – Atmospheric Organic Parameters

| Status | Eligible to Report NJ Data | State | Code | Matrix | Technique Description | Approved Method | Parameter Description |
|---|---|---|---|---|---|---|---|
| Applied | No | NJ | CAP03.00015 | AE | FID | [EPA 25] | Non-Methane Organic Compounds |
| Applied | No | NJ | CAP03.00040 | AE | GC | [EPA 18] | Volatile organics |
| Certified | Yes | NJ | CAP03.00184 | AE | GC/MS, Canisters | [EPA TO-15] | Acetone |
| Certified | Yes | NJ | CAP03.00185 | AE | GC/MS, Canisters | [EPA TO-15] | Acetonitrile |
| Certified | Yes | NJ | CAP03.00195 | AE | GC/MS, Canisters | [EPA TO-15] | Acrolein |
| Certified | Yes | NJ | CAP03.00210 | AE | GC/MS, Canisters | [EPA TO-15] | Acrylonitrile |
| Certified | Yes | NJ | CAP03.00215 | AE | GC/MS, Canisters | [EPA TO-15] | Allyl chloride |
| Certified | Yes | NJ | CAP03.00225 | AE | GC/MS, Canisters | [EPA TO-15] | Benzene |
| Certified | Yes | NJ | CAP03.00250 | AE | GC/MS, Canisters | [EPA TO-15] | Bromodichloromethane |
| Certified | Yes | NJ | CAP03.00255 | AE | GC/MS, Canisters | [EPA TO-15] | Bromoform |
| Certified | Yes | NJ | CAP03.00260 | AE | GC/MS, Canisters | [EPA TO-15] | Bromomethane |
| Certified | Yes | NJ | CAP03.00265 | AE | GC/MS, Canisters | [EPA TO-15] | Butadiene (1,3-) |
| Certified | Yes | NJ | CAP03.00270 | AE | GC/MS, Canisters | [EPA TO-15] | Carbon disulfide |
| Certified | Yes | NJ | CAP03.00275 | AE | GC/MS, Canisters | [EPA TO-15] | Carbon tetrachloride |
| Certified | Yes | NJ | CAP03.00300 | AE | GC/MS, Canisters | [EPA TO-15] | Chlorobenzene |
| Certified | Yes | NJ | CAP03.00305 | AE | GC/MS, Canisters | [EPA TO-15] | Chloroethane |
| Certified | Yes | NJ | CAP03.00310 | AE | GC/MS, Canisters | [EPA TO-15] | Chloroform |
| Certified | Yes | NJ | CAP03.00315 | AE | GC/MS, Canisters | [EPA TO-15] | Chloromethane |
| Certified | Yes | NJ | CAP03.00325 | AE | GC/MS, Canisters | [EPA TO-15] | Chlorotoluene (2-) |
| Certified | Yes | NJ | CAP03.00335 | AE | GC/MS, Canisters | [EPA TO-15] | Cyclohexane |
| Certified | Yes | NJ | CAP03.00342 | AE | GC/MS, Canisters | [EPA TO-15] | Dibromochloromethane |
| Certified | Yes | NJ | CAP03.00350 | AE | GC/MS, Canisters | [EPA TO-15] | Dibromoethane (1,2-) (EDB) |
| Certified | Yes | NJ | CAP03.00355 | AE | GC/MS, Canisters | [EPA TO-15] | Dichlorobenzene (1,2-) |
| Certified | Yes | NJ | CAP03.00360 | AE | GC/MS, Canisters | [EPA TO-15] | Dichlorobenzene (1,3-) |
| Certified | Yes | NJ | CAP03.00365 | AE | GC/MS, Canisters | [EPA TO-15] | Dichlorobenzene (1,4-) |
| Certified | Yes | NJ | CAP03.00368 | AE | GC/MS, Canisters | [EPA TO-15] | Dichlorodifluoromethane |
| Certified | Yes | NJ | CAP03.00370 | AE | GC/MS, Canisters | [EPA TO-15] | Dichloroethane (1,1-) |
| Certified | Yes | NJ | CAP03.00375 | AE | GC/MS, Canisters | [EPA TO-15] | Dichloroethane (1,2-) |
| Certified | Yes | NJ | CAP03.00380 | AE | GC/MS, Canisters | [EPA TO-15] | Dichloroethene (1,1-) |
| Certified | Yes | NJ | CAP03.00384 | AE | GC/MS, Canisters | [EPA TO-15] | Dichloroethene (cis-1,2-) |
| Certified | Yes | NJ | CAP03.00385 | AE | GC/MS, Canisters | [EPA TO-15] | Dichloroethene (trans-1,2-) |

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

## ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 11/30/2010 until 06/30/2011

Laboratory Name: LANCASTER LABORATORIES, INC Laboratory Number: PA011 Activity ID: NLC100005
2425 NEW HOLLAND PK
LANCASTER, PA 17601-5994

Category: CAP03 – Atmospheric Organic Parameters

| Status | Eligible to Report NJ Data | State | Code | Matrix | Technique Description | Approved Method | Parameter Description |
|---|---|---|---|---|---|---|---|
| Certified | Yes | NJ | CAP03.00390 | AE | GC/MS, Canisters | [EPA TO-15] | Dichlorofluoromethane |
| Certified | Yes | NJ | CAP03.00395 | AE | GC/MS, Canisters | [EPA TO-15] | Dichloropropane (1,2-) |
| Certified | Yes | NJ | CAP03.00400 | AE | GC/MS, Canisters | [EPA TO-15] | Dichloropropene (cis-1,3-) |
| Certified | Yes | NJ | CAP03.00401 | AE | GC/MS, Canisters | [EPA TO-15] | Dichloropropene (trans-1,3-) |
| Certified | Yes | NJ | CAP03.00405 | AE | GC/MS, Canisters | [EPA TO-15] | Dichlorotetrafluoroethane (1,2-) |
| Certified | Yes | NJ | CAP03.00440 | AE | GC/MS, Canisters | [EPA TO-15] | Dioxane (1,4-) |
| Certified | Yes | NJ | CAP03.00455 | AE | GC/MS, Canisters | [EPA TO-15] | Ethyl acrylate |
| Certified | Yes | NJ | CAP03.00465 | AE | GC/MS, Canisters | [EPA TO-15] | Ethylbenzene |
| Certified | Yes | NJ | CAP03.00480 | AE | GC/MS, Canisters | [EPA TO-15] | Ethyltoluene (4-) |
| Certified | Yes | NJ | CAP03.00490 | AE | GC/MS, Canisters | [EPA TO-15] | Hexachlorobutadiene (1,3-) |
| Certified | Yes | NJ | CAP03.00495 | AE | GC/MS, Canisters | [EPA TO-15] | Hexachloroethane |
| Certified | Yes | NJ | CAP03.00498 | AE | GC/MS, Canisters | [EPA TO-15] | Hexanone (2-) |
| Certified | Yes | NJ | CAP03.00500 | AE | GC/MS, Canisters | [EPA TO-15] | Heptane (n-) |
| Certified | Yes | NJ | CAP03.00505 | AE | GC/MS, Canisters | [EPA TO-15] | Hexane (n-) |
| Certified | Yes | NJ | CAP03.00515 | AE | GC/MS, Canisters | [EPA TO-15] | Isopropylbenzene |
| Certified | Yes | NJ | CAP03.00525 | AE | GC/MS, Canisters | [EPA TO-15] | Methyl ethyl ketone |
| Certified | Yes | NJ | CAP03.00530 | AE | GC/MS, Canisters | [EPA TO-15] | Methyl iodide |
| Certified | Yes | NJ | CAP03.00535 | AE | GC/MS, Canisters | [EPA TO-15] | Methyl isobutyl ketone (MIBK) |
| Certified | Yes | NJ | CAP03.00545 | AE | GC/MS, Canisters | [EPA TO-15] | Methyl methacrylate |
| Certified | Yes | NJ | CAP03.00550 | AE | GC/MS, Canisters | [EPA TO-15] | Methyl tert-butyl ether |
| Certified | Yes | NJ | CAP03.00555 | AE | GC/MS, Canisters | [EPA TO-15] | Methylene chloride (Dichloromethane) |
| Certified | Yes | NJ | CAP03.00567 | AE | GC/MS, Canisters | [EPA TO-15] | Naphthalene |
| Certified | Yes | NJ | CAP03.00612 | AE | GC/MS, Canisters | [EPA TO-15] | Propylene |
| Certified | Yes | NJ | CAP03.00625 | AE | GC/MS, Canisters | [EPA TO-15] | Styrene |
| Certified | Yes | NJ | CAP03.00635 | AE | GC/MS, Canisters | [EPA TO-15] | Trichlorobenzene (1,2,4-) |
| Certified | Yes | NJ | CAP03.00640 | AE | GC/MS, Canisters | [EPA TO-15] | Trimethylbenzene (1,3,5-) |
| Certified | Yes | NJ | CAP03.00645 | AE | GC/MS, Canisters | [EPA TO-15] | Trimethylbenzene (1,2,4-) |
| Certified | Yes | NJ | CAP03.00650 | AE | GC/MS, Canisters | [EPA TO-15] | Trimethylpentane (2,2,4-) |
| Certified | Yes | NJ | CAP03.00652 | AE | GC/MS, Canisters | [EPA TO-15] | Tert-butyl alcohol |
| Certified | Yes | NJ | CAP03.00655 | AE | GC/MS, Canisters | [EPA TO-15] | Tetrachloromethane (1,1,2,2-) |
| Certified | Yes | NJ | CAP03.00660 | AE | GC/MS, Canisters | [EPA TO-15] | Tetrachloroethene |
| Certified | Yes | NJ | CAP03.00665 | AE | GC/MS, Canisters | [EPA TO-15] | Toluene |

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

## ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 11/30/2010 until 06/30/2011

Laboratory Name: LANCASTER LABORATORIES, INC Laboratory Number: PA011 Activity ID: NLC100005
2425 NEW HOLLAND PK
LANCASTER, PA 17601-5994

Category: CAP03 – Atmospheric Organic Parameters

| Status | Eligible to Report NJ Data | State | Code | Matrix | Technique Description | Approved Method | Parameter Description |
|---|---|---|---|---|---|---|---|
| Certified | Yes | NJ | CAP03.00670 | AE | GC/MS, Canisters | [EPA TO-15] | Trichloroethane (1,1,1-) |
| Certified | Yes | NJ | CAP03.00675 | AE | GC/MS, Canisters | [EPA TO-15] | Trichloroethane (1,1,2-) |
| Certified | Yes | NJ | CAP03.00680 | AE | GC/MS, Canisters | [EPA TO-15] | Trichloroethene |
| Certified | Yes | NJ | CAP03.00684 | AE | GC/MS, Canisters | [EPA TO-15] | Trichlorofluoromethane |
| Certified | Yes | NJ | CAP03.00685 | AE | GC/MS, Canisters | [EPA TO-15] | Trichloro (1,1,2-) trifluoroethane (1,2,2-) |
| Certified | Yes | NJ | CAP03.00700 | AE | GC/MS, Canisters | [EPA TO-15] | Vinyl acetate |
| Certified | Yes | NJ | CAP03.00705 | AE | GC/MS, Canisters | [EPA TO-15] | Vinyl bromide |
| Certified | Yes | NJ | CAP03.00710 | AE | GC/MS, Canisters | [EPA TO-15] | Vinyl chloride |
| Certified | Yes | NJ | CAP03.00715 | AE | GC/MS, Canisters | [EPA TO-15] | Xylene (m-) |
| Certified | Yes | NJ | CAP03.00720 | AE | GC/MS, Canisters | [EPA TO-15] | Xylene (o-) |
| Certified | Yes | NJ | CAP03.00725 | AE | GC/MS, Canisters | [EPA TO-15] | Xylene (p-) |
| Certified | Yes | NJ | CAP03.00730 | AE | GC/MS, Canisters | [EPA TO-15] | Xylenes (total) |
| Certified | Yes | NJ | CAP03.06430 | AE | GC/MS, Canisters | [EPA TO-14A] | Benzene |
| Certified | Yes | NJ | CAP03.06443 | AE | GC/MS, Canisters | [EPA TO-14A] | Bromodichloromethane |
| Certified | Yes | NJ | CAP03.06447 | AE | GC/MS, Canisters | [EPA TO-14A] | Bromoform |
| Certified | Yes | NJ | CAP03.06450 | AE | GC/MS, Canisters | [EPA TO-14A] | Bromomethane |
| Certified | Yes | NJ | CAP03.06457 | AE | GC/MS, Canisters | [EPA TO-14A] | Carbon disulfide |
| Certified | Yes | NJ | CAP03.06460 | AE | GC/MS, Canisters | [EPA TO-14A] | Carbon tetrachloride |
| Certified | Yes | NJ | CAP03.06470 | AE | GC/MS, Canisters | [EPA TO-14A] | Chlorobenzene |
| Certified | Yes | NJ | CAP03.06480 | AE | GC/MS, Canisters | [EPA TO-14A] | Chloroethane |
| Certified | Yes | NJ | CAP03.06490 | AE | GC/MS, Canisters | [EPA TO-14A] | Chloroform |
| Certified | Yes | NJ | CAP03.06500 | AE | GC/MS, Canisters | [EPA TO-14A] | Chloromethane |
| Certified | Yes | NJ | CAP03.06510 | AE | GC/MS, Canisters | [EPA TO-14A] | Dibromoethane (1,2-) (EDB) |
| Certified | Yes | NJ | CAP03.06520 | AE | GC/MS, Canisters | [EPA TO-14A] | Dichlorobenzene (1,2-) |
| Certified | Yes | NJ | CAP03.06530 | AE | GC/MS, Canisters | [EPA TO-14A] | Dichlorobenzene (1,3-) |
| Certified | Yes | NJ | CAP03.06540 | AE | GC/MS, Canisters | [EPA TO-14A] | Dichlorobenzene (1,4-) |
| Certified | Yes | NJ | CAP03.06550 | AE | GC/MS, Canisters | [EPA TO-14A] | Dichlorodifluoromethane |
| Certified | Yes | NJ | CAP03.06560 | AE | GC/MS, Canisters | [EPA TO-14A] | Dichloroethane (1,1-) |
| Certified | Yes | NJ | CAP03.06570 | AE | GC/MS, Canisters | [EPA TO-14A] | Dichloroethane (1,2-) |
| Certified | Yes | NJ | CAP03.06580 | AE | GC/MS, Canisters | [EPA TO-14A] | Dichloroethene (1,1-) |
| Certified | Yes | NJ | CAP03.06590 | AE | GC/MS, Canisters | [EPA TO-14A] | Dichloroethene (cis-1,2-) |
| Certified | Yes | NJ | CAP03.06591 | AE | GC/MS, Canisters | [EPA TO-14A] | Dichloroethene (trans-1,2-) |

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

# ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 11/30/2010 until 06/30/2011

Laboratory Name: LANCASTER LABORATORIES, INC Laboratory Number: PA011 Activity ID: NLC100005
2425 NEW HOLLAND PK
LANCASTER, PA 17601-5994

Category: CAP03 – Atmospheric Organic Parameters

| Status | Eligible to Report NJ Data | State | Code | Matrix | Technique Description | Approved Method | Parameter Description |
|---|---|---|---|---|---|---|---|
| Certified | Yes | NJ | CAP03.06595 | AE | GC/MS, Canisters | [EPA TO-14A] | Dichlorofluoromethane |
| Certified | Yes | NJ | CAP03.06600 | AE | GC/MS, Canisters | [EPA TO-14A] | Methylene chloride (Dichloromethane) |
| Certified | Yes | NJ | CAP03.06610 | AE | GC/MS, Canisters | [EPA TO-14A] | Dichloropropane (1,2-) |
| Certified | Yes | NJ | CAP03.06620 | AE | GC/MS, Canisters | [EPA TO-14A] | Dichloropropene (cis-1,3-) |
| Certified | Yes | NJ | CAP03.06630 | AE | GC/MS, Canisters | [EPA TO-14A] | Dichloropropene (trans-1,3-) |
| Certified | Yes | NJ | CAP03.06640 | AE | GC/MS, Canisters | [EPA TO-14A] | Dichlorotetrafluoroethane (1,2-) |
| Certified | Yes | NJ | CAP03.06650 | AE | GC/MS, Canisters | [EPA TO-14A] | Ethylbenzene |
| Certified | Yes | NJ | CAP03.06660 | AE | GC/MS, Canisters | [EPA TO-14A] | Hexachlorobutadiene (1,3-) |
| Certified | Yes | NJ | CAP03.06670 | AE | GC/MS, Canisters | [EPA TO-14A] | Styrene |
| Certified | Yes | NJ | CAP03.06674 | AE | GC/MS, Canisters | [EPA TO-14A] | Methyl ethyl ketone |
| Certified | Yes | NJ | CAP03.06676 | AE | GC/MS, Canisters | [EPA TO-14A] | Methyl isobutyl ketone (MIBK) |
| Certified | Yes | NJ | CAP03.06678 | AE | GC/MS, Canisters | [EPA TO-14A] | Methyl tert-butyl ether |
| Certified | Yes | NJ | CAP03.06680 | AE | GC/MS, Canisters | [EPA TO-14A] | Tetrachloroethane (1,1,2,2-) |
| Certified | Yes | NJ | CAP03.06690 | AE | GC/MS, Canisters | [EPA TO-14A] | Tetrachloroethene |
| Certified | Yes | NJ | CAP03.06700 | AE | GC/MS, Canisters | [EPA TO-14A] | Toluene |
| Certified | Yes | NJ | CAP03.06710 | AE | GC/MS, Canisters | [EPA TO-14A] | Trichlorobenzene (1,2,4-) |
| Certified | Yes | NJ | CAP03.06720 | AE | GC/MS, Canisters | [EPA TO-14A] | Trichloroethane (1,1,1-) |
| Certified | Yes | NJ | CAP03.06721 | AE | GC/MS, Canisters | [EPA TO-14A] | Trichloroethane (1,1,2-) |
| Certified | Yes | NJ | CAP03.06730 | AE | GC/MS, Canisters | [EPA TO-14A] | Trichloroethene |
| Certified | Yes | NJ | CAP03.06740 | AE | GC/MS, Canisters | [EPA TO-14A] | Trichlorofluoromethane |
| Certified | Yes | NJ | CAP03.06750 | AE | GC/MS, Canisters | [EPA TO-14A] | Trichloro (1,1,2-) trifluoroethane (1,2,2-) |
| Certified | Yes | NJ | CAP03.06760 | AE | GC/MS, Canisters | [EPA TO-14A] | Trimethylbenzene (1,2,4-) |
| Certified | Yes | NJ | CAP03.06770 | AE | GC/MS, Canisters | [EPA TO-14A] | Trimethylbenzene (1,3,5-) |
| Certified | Yes | NJ | CAP03.06780 | AE | GC/MS, Canisters | [EPA TO-14A] | Vinyl chloride |
| Certified | Yes | NJ | CAP03.06785 | AE | GC/MS, Canisters | [EPA TO-14A] | Xylenes (total) |
| Certified | Yes | NJ | CAP03.06790 | AE | GC/MS, Canisters | [EPA TO-14A] | Xylene (o-) |
| Certified | Yes | NJ | CAP03.06800 | AE | GC/MS, Canisters | [EPA TO-14A] | Xylene (m-) |
| Certified | Yes | NJ | CAP03.06810 | AE | GC/MS, Canisters | [EPA TO-14A] | Xylene (p-) |
| Applied | No | NJ | CAP03.06850 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Acetone |
| Applied | No | NJ | CAP03.06852 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Allyl chloride |
| Applied | No | NJ | CAP03.06854 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Benzene |
| Applied | No | NJ | CAP03.06856 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Bromodichloromethane |

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

## ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 11/30/2010 until 06/30/2011

Laboratory Name: LANCASTER LABORATORIES, INC Laboratory Number: PA011 Activity ID: NLC100005
2425 NEW HOLLAND PK
LANCASTER, PA 17601-5994

Category: CAP03 – Atmospheric Organic Parameters

| Status | Eligible to Report NJ Data | State | Code | Matrix | Technique Description | Approved Method | Parameter Description |
|---|---|---|---|---|---|---|---|
| Applied | No | NJ | CAP03.06858 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Bromoform |
| Applied | No | NJ | CAP03.06860 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Bromomethane |
| Applied | No | NJ | CAP03.06862 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Butadiene (1,3-) |
| Applied | No | NJ | CAP03.06864 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Carbon disulfide |
| Applied | No | NJ | CAP03.06866 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Carbon tetrachloride |
| Applied | No | NJ | CAP03.06868 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Chlorobenzene |
| Applied | No | NJ | CAP03.06870 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Chloroethane |
| Applied | No | NJ | CAP03.06872 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Chloroform |
| Applied | No | NJ | CAP03.06874 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Chloromethane |
| Applied | No | NJ | CAP03.06876 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Chlorotoluene (2-) |
| Applied | No | NJ | CAP03.06878 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Cyclohexane |
| Applied | No | NJ | CAP03.06880 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Dibromochloromethane |
| Applied | No | NJ | CAP03.06882 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Dibromoethane (1,2-) (EDB) |
| Applied | No | NJ | CAP03.06884 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Dichlorobenzene (1,2-) |
| Applied | No | NJ | CAP03.06886 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Dichlorobenzene (1,3-) |
| Applied | No | NJ | CAP03.06888 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Dichlorobenzene (1,4-) |
| Applied | No | NJ | CAP03.06890 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Dichlorodifluoromethane |
| Applied | No | NJ | CAP03.06892 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Dichloroethane (1,1-) |
| Applied | No | NJ | CAP03.06894 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Dichloroethane (1,2-) |
| Applied | No | NJ | CAP03.06896 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Dichloroethene (1,1-) |
| Applied | No | NJ | CAP03.06898 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Dichloroethene (cis-1,2-) |
| Applied | No | NJ | CAP03.06900 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Dichloroethene (trans-1,2-) |
| Applied | No | NJ | CAP03.06902 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Dichloropropane (1,2-) |
| Applied | No | NJ | CAP03.06904 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Dichloropropene (cis-1,3-) |
| Applied | No | NJ | CAP03.06906 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Dichloropropene (trans-1,3-) |
| Applied | No | NJ | CAP03.06908 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Dichlorotetrafluoroethane (1,2-) |
| Applied | No | NJ | CAP03.06910 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Dioxane (1,4-) |
| Applied | No | NJ | CAP03.06912 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Ethanol |
| Applied | No | NJ | CAP03.06914 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Ethylbenzene |
| Applied | No | NJ | CAP03.06916 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Ethyltoluene (4-) |
| Applied | No | NJ | CAP03.06918 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Heptane (n-) |
| Applied | No | NJ | CAP03.06920 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Hexachlorobutadiene (1,3-) |

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

New Jersey Department of Environmental Protection
National Environmental Laboratory Accreditation Program
## ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS
Effective as of 11/30/2010 until 06/30/2011

Laboratory Name: LANCASTER LABORATORIES, INC Laboratory Number: PA011 Activity ID: NLC100005
2425 NEW HOLLAND PK
LANCASTER, PA 17601-5994

Category: CAP03 – Atmospheric Organic Parameters

| Status | Eligible to Report NJ Data | State | Code | Matrix | Technique Description | Approved Method | Parameter Description |
|---|---|---|---|---|---|---|---|
| Applied | No | NJ | CAP03.06922 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Hexane (n-) |
| Applied | No | NJ | CAP03.06924 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Isopropanol |
| Applied | No | NJ | CAP03.06926 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Methylene chloride (Dichloromethane) |
| Applied | No | NJ | CAP03.06928 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Methyl ethyl ketone |
| Applied | No | NJ | CAP03.06930 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Methyl isobutyl ketone (MIBK) |
| Applied | No | NJ | CAP03.06932 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Methyl methacrylate |
| Applied | No | NJ | CAP03.06934 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Methyl tert-butyl ether |
| Applied | No | NJ | CAP03.06936 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Styrene |
| Applied | No | NJ | CAP03.06938 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Tert-butyl alcohol |
| Applied | No | NJ | CAP03.06940 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Tetrachloroethane (1,1,2,2-) |
| Applied | No | NJ | CAP03.06942 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Tetrachloroethene |
| Applied | No | NJ | CAP03.06944 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Tetrahydrofuran |
| Applied | No | NJ | CAP03.06946 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Toluene |
| Applied | No | NJ | CAP03.06948 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Trichlorobenzene (1,2,4-) |
| Applied | No | NJ | CAP03.06950 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Trichloroethane (1,1,1-) |
| Applied | No | NJ | CAP03.06952 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Trichloroethane (1,1,2-) |
| Applied | No | NJ | CAP03.06954 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Trichloroethene |
| Applied | No | NJ | CAP03.06956 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Trichlorofluoromethane |
| Applied | No | NJ | CAP03.06958 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Trichloro (1,1,2-) trifluoroethane (1,2,2-) |
| Applied | No | NJ | CAP03.06960 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Trimethylbenzene (1,2,4-) |
| Applied | No | NJ | CAP03.06962 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Trimethylbenzene (1,3,5-) |
| Applied | No | NJ | CAP03.06964 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Trimethylpentane (2,2,4-) |
| Applied | No | NJ | CAP03.06966 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Vinyl bromide |
| Applied | No | NJ | CAP03.06968 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Vinyl chloride |
| Applied | No | NJ | CAP03.06970 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Xylene (m- + p-) |
| Applied | No | NJ | CAP03.06972 | AE | GC/MS, Canisters | [OTHER NJDEP-LLTO-15-3/2009] | Xylene (o-) |

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

# Texas Commission on Environmental Quality

## NELAP - Recognized Laboratory Fields of Accreditation

Certificate: T104704194-10-4
Expiration Date: 8/31/2011
Issue Date: 10/15/2010

Lancaster Laboratories Inc.

2425 New Holland Pike
Lancaster, PA 17601-5994

**These fields of accreditation supercedeall previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.**

**Matrix:** *Tissue*

**Method** EPA 6010

| Analyte | AB | Analyte ID | Method ID |
|---|---|---|---|
| Aluminum | TX | 1000 | 10155609 |
| Antimony | TX | 1005 | 10155609 |
| Arsenic | TX | 1010 | 10155609 |
| Barium | TX | 1015 | 10155609 |
| Beryllium | TX | 1020 | 10155609 |
| Boron | TX | 1025 | 10155609 |
| Cadmium | TX | 1030 | 10155609 |
| Calcium | TX | 1035 | 10155609 |
| Chromium | TX | 1040 | 10155609 |
| Cobalt | TX | 1050 | 10155609 |
| Copper | TX | 1055 | 10155609 |
| Iron | TX | 1070 | 10155609 |
| Lead | TX | 1075 | 10155609 |
| Magnesium | TX | 1085 | 10155609 |
| Manganese | TX | 1090 | 10155609 |
| Molybdenum | TX | 1100 | 10155609 |
| Nickel | TX | 1105 | 10155609 |
| Potassium | TX | 1125 | 10155609 |
| Selenium | TX | 1140 | 10155609 |
| Silver | TX | 1150 | 10155609 |
| Sodium | TX | 1155 | 10155609 |
| Strontium | TX | 1160 | 10155609 |
| Thallium | TX | 1165 | 10155609 |
| Tin | TX | 1175 | 10155609 |
| Titanium | TX | 1180 | 10155609 |
| Vanadium | TX | 1185 | 10155609 |
| Zinc | TX | 1190 | 10155609 |

**Method** EPA 6020

| Analyte | AB | Analyte ID | Method ID |
|---|---|---|---|

# Texas Commission on Environmental Quality

## NELAP - Recognized Laboratory Fields of Accreditation

**Certificate:** T104704194-10-4
**Expiration Date:** 8/31/2011
**Issue Date:** 10/15/2010

**Lancaster Laboratories Inc.**
**2425 New Holland Pike**
**Lancaster, PA 17601-5994**

**These fields of accreditation supercedeall previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.**

**Matrix: *Tissue***

| | | | |
|---|---|---|---|
| Antimony | TX | 1005 | 10156204 |
| Arsenic | TX | 1010 | 10156204 |
| Beryllium | TX | 1020 | 10156204 |
| Cadmium | TX | 1030 | 10156204 |
| Chromium | TX | 1040 | 10156204 |
| Copper | TX | 1055 | 10156204 |
| Lead | TX | 1075 | 10156204 |
| Nickel | TX | 1105 | 10156204 |
| Selenium | TX | 1140 | 10156204 |
| Thallium | TX | 1165 | 10156204 |

**Method** EPA 7471

| **Analyte** | **AB** | **Analyte ID** | **Method ID** |
|---|---|---|---|
| Mercury | TX | 1095 | 10166208 |

**Method** EPA 8081

| **Analyte** | **AB** | **Analyte ID** | **Method ID** |
|---|---|---|---|
| 4,4'-DDD | TX | 7355 | 10178606 |
| 4,4'-DDE | TX | 7360 | 10178606 |
| 4,4'-DDT | TX | 7365 | 10178606 |
| Aldrin | TX | 7025 | 10178606 |
| alpha-BHC (alpha-Hexachlorocyclohexane) | TX | 7110 | 10178606 |
| beta-BHC (beta-Hexachlorocyclohexane) | TX | 7115 | 10178606 |
| Chlordane (tech.) | TX | 7250 | 10178606 |
| delta-BHC (delta-Hexachlorocyclohexane) | TX | 7105 | 10178606 |
| Dieldrin | TX | 7470 | 10178606 |
| gamma-BHC (Lindane, gamma-Hexachlorocyclohexane) | TX | 7120 | 10178606 |
| Heptachlor | TX | 7685 | 10178606 |
| Heptachlor epoxide | TX | 7690 | 10178606 |
| Mirex | TX | 7870 | 10178606 |
| Toxaphene (Chlorinated camphene) | TX | 8250 | 10178606 |

**Method** EPA 8082

| **Analyte** | **AB** | **Analyte ID** | **Method ID** |
|---|---|---|---|

# Texas Commission on Environmental Quality

## NELAP - Recognized Laboratory Fields of Accreditation

Certificate: T104704194-10-4
Expiration Date: 8/31/2011
Issue Date: 10/15/2010

Lancaster Laboratories Inc.

2425 New Holland Pike
Lancaster, PA 17601-5994

**These fields of accreditation supercedeall previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.**

**Matrix:** *Tissue*

| | | | |
|---|---|---|---|
| Aroclor-1016 (PCB-1016) | TX | 8880 | 10179007 |
| Aroclor-1221 (PCB-1221) | TX | 8885 | 10179007 |
| Aroclor-1232 (PCB-1232) | TX | 8890 | 10179007 |
| Aroclor-1242 (PCB-1242) | TX | 8895 | 10179007 |
| Aroclor-1248 (PCB-1248) | TX | 8900 | 10179007 |
| Aroclor-1254 (PCB-1254) | TX | 8905 | 10179007 |
| Aroclor-1260 (PCB-1260) | TX | 8910 | 10179007 |

**Method** EPA 8270

| Analyte | AB | Analyte ID | Method ID |
|---|---|---|---|
| 1,2,4,5-Tetrachlorobenzene | TX | 6715 | 10185805 |
| 2-Methylphenol (o-Cresol) | TX | 6400 | 10185805 |
| 3-Methylphenol (m-Cresol) | TX | 6405 | 10185805 |
| 4-Methylphenol (p-Cresol) | TX | 6410 | 10185805 |
| Benzidine | TX | 5595 | 10185805 |
| Benzo(a)anthracene | TX | 5575 | 10185805 |
| Benzo(a)pyrene | TX | 5580 | 10185805 |
| Chrysene | TX | 5855 | 10185805 |
| Hexachlorobenzene | TX | 6275 | 10185805 |
| Hexachlorobutadiene | TX | 4835 | 10185805 |
| Hexachlorocyclopentadiene | TX | 6285 | 10185805 |
| Hexachloroethane | TX | 4840 | 10185805 |
| Hexachlorophene | TX | 6290 | 10185805 |
| n-Nitrosodiethylamine | TX | 6525 | 10185805 |
| n-Nitroso-di-n-butylamine | TX | 5025 | 10185805 |
| Pentachlorobenzene | TX | 6590 | 10185805 |
| Pentachlorophenol | TX | 6605 | 10185805 |
| Pyridine | TX | 5095 | 10185805 |

eurofins | Lancaster Laboratories

# Environmental Quality Policy Manual

# Appendix J
## Quality Control Types, Frequency, and Corrective Action

Current as of October 05, 2011
32 Total Pages (including this coversheet)

**NOTE: Current information available in technical departments.**

| SW - 846<br>Quality Control<br>GC/MS Volatiles Method 8260B | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogates:**<br>Toluene-$d_8$<br>Bromofluorobenzene<br>1,2-Dichloroethane-$d_4$<br>Dibromofluoromethane | Each sample, MS, MSD, LCS, and blank | Reanalyze sample if outside limits; if reanalysis confirms original, document on report and/or case narrative |
| **Matrix Spikes:**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Laboratory Control Samples:**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Reanalyze LCS and associated samples for compounds outside acceptance limits that are also outside MS/MSD acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported. |
| **Matrix Spike Duplicates (RPD):**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Evaluated by analyst in relationship to other QC results |
| **Blanks:** | Once for each 12-hour time period or ≤20 samples | Reanalyze blank and associated samples if blank outside limits |
| **Internal Standards (ISTD):**<br>Fluorobenzene<br>Chlorobenzene-$d_5$<br>1,4-Dichlorobenzene-$d_4$ | Each sample, MS, MSD, LCS, and blank | Reanalyze samples; if reanalysis confirms original, document on report or case narrative |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

| SW - 846<br>Quality Control<br>GC/MS Semivolatiles Method 8270C | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogate:**<br>Nitrobenzene-$d_5$<br>2-Fluorobiphenyl<br>Terphenyl-$d_{14}$<br>Phenol-$d_6$<br>2-Fluorophenol<br>2,4,6-Tribromophenol | Each sample, MS, MSD, LCS, and blank | Repeat extraction and analysis; if reanalysis confirms original, document on report and/or case narrative |
| **Matrix Spikes:**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Laboratory Control Sample:**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported. |
| ***Matrix Spike Duplicates* (RPD):**<br>Same as for matrix spikes | *Each group (≤20) of* samples per matrix/level | Evaluated by analyst in relationship to other QC results |
| **Blanks:** | Once per extraction group (≤20) of samples, *each matrix, level* | Re-extract and reanalyze blank and associated samples |
| **Internal Standards (ISTD):**<br>1,4-Dichlorobenzene-$d_4$<br>Naphthalene-$d_8$<br>Acenaphthene-$d_{10}$<br>Phenanthrene-$d_{10}$<br>Chrysene-$d_{12}$<br>Perylene-$d_{12}$ | Each sample, MS, MSD, LCS, and blank | Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

| SW - 846<br>Quality Control<br>GC/MS Semivolatiles Method 8270C SIM | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogate:**<br>Nitrobenzene-$d_5$<br>2-Fluorobiphenyl<br>Terphenyl-$d_{14}$ | Each sample, MS, MSD, LCS, and blank | Repeat extraction and analysis; if reanalysis confirms original, document on report and/or case narrative |
| **Matrix Spikes:**<br><br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Laboratory Control Sample:**<br><br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported. |
| **Matrix Spike Duplicates (RPD):**<br><br>Same as for matrix spikes | Each group (≤20) of samples per matrix/level | Evaluated by analyst in relationship to other QC results |
| **Blanks:** | Once per extraction group (≤20) of samples, each matrix, level | Re-extract and reanalyze blank and associated samples |
| **Internal Standards (ISTD):**<br>1,4-Dichlorobenzene-$d_4$<br>Naphthalene-$d_8$<br>Acenaphthene-$d_{10}$<br>Phenanthrene-$d_{10}$<br>Chrysene-$d_{12}$<br>Perylene-$d_{12}$ | Each sample, MS, MSD, LCS, and blank | Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

| SW - 846<br>Quality Control<br>GC/MS Volatiles Method 8290 | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogates:**<br>13C Labeled Isotope of each of 17 Toxic PCDD/PCDF | Each sample, MS, MSD, LCS, and blank | Repeat extraction and analysis; if reanalysis confirms original, document on report and/or case narrative |
| **Matrix Spikes:**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Laboratory Control Samples:**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Reanalyze LCS and associated samples for compounds outside acceptance limits that are also outside MS/MSD acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported. |
| **Matrix Spike Duplicates (RPD):**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Evaluated by analyst in relationship to other QC results |
| **Blanks:** | Once for each 12-hour time period or ≤20 samples | Reanalyze blank and associated samples if blank outside limits |
| **Internal Standards (ISTD):**<br>13C12-1234-TCDD<br>13C12-123468-HxCDD | Each sample, MS, MSD, LCS, and blank | RT ± 15 secs of retention time in initial calibration. |

| SW-846<br>Quality Control<br>Pesticides/PCBs Methods 8081; 8082; 8141; 8151 | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogate:**<br>Organochlorine Pesticides & PCBs<br>Decachlorobiphenyl (DCB)<br>Tetrachloro-*m*-xylene (TCMX)<br><br>Herbicides:<br>Dichloroacetic acid (DCAA)<br><br>Organophosphorous Pesticides:<br>2-nitro-*m*-xylene (2NMX) | Added to each sample, MS/MSD, blank, LCS/LCSD during the extraction phase | Repeat extraction and analysis. If reanalysis confirms original result, report results and comment in case narrative |
| **Matrix Spikes:**<br>Organochlorine Pesticides:<br>Spike all compounds of interest, except PCBs, chlordane, and toxaphene<br><br>Herbicides & Organophosphorous Pesticides:<br>all compounds of interest<br><br>PCBs: Aroclor 1016 & Aroclor 1260 | Each extraction group (≤20) of samples per matrix/level | Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Laboratory Control Sample:**<br><br>Organochlorine Pesticides: Spike all compounds of interest, except PCBs, chlordane, and toxaphene<br><br>Herbicides & Organophosphorous Pesticides: all compounds of interest<br><br>PCBs: Aroclor 1016 & Aroclor 1260 | Each group (≤20) when MS/MSD falls outside established limits | Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples can be reported. |

| SW-846<br>Quality Control<br>Pesticides/PCBs Methods 8081; 8082; 8141; 8151<br>(continued) | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Matrix Spike Duplicates (RPD):**<br><br>Organochlorine Pesticides: Spike all compounds of interest, except PCBs, chlordane, and toxaphene<br><br>Herbicides & Organophosphorous Pesticides: all compounds of interest<br><br>PCBs: Aroclor 1016 & Aroclor 1260 | Each extraction group (≤20) of samples per matrix/level | Evaluated in conjunction with acceptable LCS.<br><br>Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Blanks:** | Once per extraction group (≤20) of samples, each matrix, level | Inject a hexane or solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be reextracted. |
| **Internal Standards (ISTD):**<br>Herbicides: 4,4'-dibromo octafluorobiphenyl(DBOB)<br><br>OP Pesticides: 1-bromo-2-nitrobenzene | Each sample, MS, MSD, LCS, and blank | Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

| SW-846<br>Quality Control<br>Volatiles by GC<br>8021 | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogates:**<br>Aromatics;<br>1-Bromo-4-chlorobenzene (PID) | Each sample, MS, MSD, LCS and blank | Reanalyze if the surrogate recovery is outside the limits unless matrix-related problems are evident. |
| **Matrix Spikes:**<br>Spike all compounds of interest | Each group of samples (≤20) of similar matrix/level each method | Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Laboratory Control Sample:**<br>Spike all compounds of interest | Each group (≤20); LCSD is analyzed if sufficient volume is not available for MS/MSD | Reanalyze LCS and associated samples for compounds outside of acceptance limits. Compounds that fail high in the LCS and are ND in the samples can be reported. |
| **Internal Standard (ISTD):**<br>Aromatics;<br>1-chloro-3-fluorobenzene | Each sample, LCS , MS, MSD, blank, and standard | Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative. In cases where the sample matrix is elevating the ISTD recovery, a dilution and reanalysis may be performed. |
| **Matrix Spike Duplicate (RPD):**<br>Same compounds as matrix spikes | Each group (≤20) of samples per matrix/level | Evaluated by analyst in relationship to other QC results |
| **Blanks:** | At least once per batch (≤20 samples) and once per 24 hours | Reanalyze blank and associated samples if blank is outside limits |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

| SW-846<br>Quality Control<br>Petroleum Analysis | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogate:**<br>α,α,α-Trifluorotoluene (PID) | Each sample, MS, MSD, LCS, and blank | Reanalyze if the surrogate recovery is outside the limits unless matrix-related problems are evident. |
| **Matrix Spike:**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Laboratory Control Sample:**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level. LCSD analyzed if sufficient volume is not available for MS/MSD | Reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high and are ND in the samples can be reported. |
| **Matrix Spike Duplicates (RPD):** | Each group (≤20) of samples per matrix/level | Evaluated by an analyst in relationship to other QC results |
| **Blanks:** | At least once per batch (≤20 samples) and once per 24 hours | Reanalyze blank and associated samples if blank is outside limits |
| **Internal Standards (ISTD):**<br>1-Chloro-3-fluorobenzene (PID) | Each sample, MS, MSD, LCS, and blank analyzed on the PID | Reanalyze samples; if reanalysis confirms original result, document on report or case narrative. In cases where the sample matrix is elevating the ISTD recovery, a dilution and reanalysis may be performed. |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

| SW-846<br>Quality Control<br>PAHs by HPLC Method 8310 | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogate:**<br>Nitrobenzene and Triphenylene | Added to each sample, MS/MSD, blank, LCS/LCSD prior to extraction | Re-extract and reanalyze. If re-extraction and reanalysis confirms then comment on report and/or case narrative. Re-extraction may not be needed if matrix related problems are evident. Comment in case narrative. |
| **Matrix Spike:**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Laboratory Control Sample:**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples can be reported. |
| **Matrix Spike Duplicates (RPD):**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Evaluated by analyst in relationship to other QC results |
| **Blanks:** | Once per extraction group (≤20 samples), per matrix/level | Inject a solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected, if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be re-extracted. |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

| SW-846<br>Quality Control<br>TPH-DRO<br>8015B | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogate:**<br><br>*o*-Terphenyl | Added to each sample, MS/MSD, blank, LCS/LCSD during the extraction phase | Repeat extraction and analysis. If reanalysis confirms original result. report results and comment in case narrative. |
| **Matrix Spike:**<br># 2 Fuel | Each group (≤20) of samples per matrix/level | Reinject if surrogates appear low. If still out of spec, evaluate for matrix effect. If matrix effect, accept based on LCS data. If no matrix effect, repeat batch. |
| **Laboratory Control Sample:**<br># 2 Fuel | Each group (≤20) of samples per matrix/level | Reinject if surrogates appear low. If still out of spec, reextract batch. LCS that fails high and DRO is ND in the samples can be reported. |
| **Laboratory Control Duplicates (RPD):**<br><br># 2 Fuel | Each group (≤20) of samples per matrix/level | Evaluated by analyst in relationship to other QC results |
| **Blanks:** | Once per extraction group (≤20) of samples, each matrix, level | Inject a solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected, if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be re-extracted. |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

| SW-846<br>Quality Control<br>TPH-GRO<br>8015B | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogate:**<br>Trifluorotoluene (FID) | Each sample, MS/MSD, LCS, and blank | Reanalyze if the surrogate recovery is outside the limits unless matrix-related problems are evident |
| **Matrix Spike:**<br>Gasoline standard | Each group of samples of similar matrix/level (≤20) each method | Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Laboratory Control Sample**<br>Gasoline standard | Each group (≤20) of samples. LCSD analyzed if sufficient volume is not available for MS/MSD. | Reanalyze LCS and associated samples. LCS that fails high and GRO is ND in the samples can be reported. |
| **Matrix Spike Duplicate (RPD):**<br>Same compounds as matrix spikes | Each group (≤20) of samples per matrix/level | Evaluated by analyst in relationship to other QC results |
| **Blanks:** | At least one per 20 samples and at least once per 24 hours. | Reanalyze blank and associated samples if blank is outside limits |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change

| SW-846<br>Quality Control*<br>Inorganics (Metals) | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Internal Standard (ICP & ICP/MS only):** | Each sample, standard and QC (Unspiked, Dup., MS, MSD, LCS, dilution, post digestion spike and blank) | If the internal standard response falls outside the specified range, then the samples would be reanalyzed. |
| **Matrix Spikes:** | Each group of samples of similar matrix/level (≤20) each method | Analyze post-digestion spike sample |
| **Matrix Spike Duplicate (RPD):** | Each group of samples of similar matrix/level ( 20) each method | Analyze post-digestion spike sample if not already run for MS, flag the data |
| **Duplicates (RPD):** | Each group of samples of similar matrix/level (≤20) each method | Flag the data |
| **Blanks:**<br>Initial Calibration (ICB)<br>Continuing Calibration (CCB) | Each element immediately after calibration verification at 10% frequency or every 2 hours (beginning and end of run min.) | Correct problem, recalibrate, and rerun |
| Preparation Blank | Each SDG or batch (≤20 samples) | Redigest and reanalyze blank and associated samples if sample result is greater than the LOQ and <20× blank result |
| **Serial Dilutions (ICP, ICP/MS only):** | Each group of (≤20) of similar matrix/level | Flag the data |
| **Interference Check Sample (ICP, ICP/MS only):** | Each element after Initial Calibration Verification at beginning and end of the run or min. of 2× per 8 hour | Correct for interference, recalibrate the instrument |
| **Laboratory Control Sample:** | Each SDG or batch (≤20 samples), each method | Redigest and reanalyze LCS and associated samples. Elements in the LCS that fail high and are ND in the samples can be reported. |
| **Post Digestion Spike:** | When matrix spikes are outside 75 % - 125% range, or the statistical window (whichever is tighter). | Flag the data |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

| QC Table for SW-846 Miscellaneous Water Tests | | | |
|---|---|---|---|
| **Test** | **QC Type** | **Frequency** | **Corrective Action** |
| Sulfide | Blank | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze. |
| | Laboratory Control Sample | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze. LCSs that fail high (and associated samples are ND) can be reported. |
| | Duplicate | Each group of samples of similar matrix (≤20) | Ensure that LCS meets acceptance criteria. |
| | Matrix Spike/ Matrix Spike Duplicate | Each group of samples of similar matrix (≤20) | Ensure that LCS meets acceptance criteria. |
| Bromide (IC)<br>Chloride (IC)<br>Cyanide (total)<br>Fluoride (IC)<br>Nitrate/Nitrite (IC)<br>Sulfate (IC) | Blank | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze. |
| | Laboratory Control Sample | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze. LCSs that fail high (and associated samples are ND) can be reported. |
| | Duplicate | Each group of samples of similar matrix (≤10) | Ensure that LCS meets acceptance criteria. |
| | Matrix Spike | Each group of samples of similar matrix (≤10) | Ensure that LCS meets acceptance criteria. |
| Phenols<br>TOC Quad | Blank | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze. |
| | Laboratory Control Sample | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze. LCSs that fail high (and associated samples are ND) can be reported. |
| | Matrix Spike/ Matrix Spike Duplicate | Each group of samples of similar matrix (≤10) | Ensure that LCS meets acceptance criteria. |
| pH<br>Moisture | Laboratory Control Sample | Each group of samples of similar matrix (≤20) | Re-analyze samples. |
| | Duplicate | Each group of samples of similar matrix (≤10) | Ensure that LCS meets acceptance criteria. |
| Microbiology | Organism control | Each lot of media (minimum of one per month) | Investigate cause |
| | Negative control | Each lot of media (minimum of one per month) | Investigate cause |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

| CLP<br>Quality Control<br>GC/MS Volatiles | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogates:**<br>Toluene-$d_8$<br>Bromofluorobenzene<br>1,2-Dichloroethane-$d_4$ | Each sample, MS, MSD, and blank | Reanalyze sample if outside limits; if reanalysis confirms original, document on report and/or case narrative |
| **Matrix Spikes:**<br>1,1-Dichloroethene<br>Trichloroethene<br>Benzene<br>Toluene<br>Chlorobenzene | Each group of samples (≤20) per matrix/level | Advisory Only<br><br>Evaluated by analyst in relationship to other QC results |
| **Matrix Spike Duplicates (RPD):**<br>1,1-Dichloroethene<br>Trichloroethene<br>Benzene<br>Toluene<br>Chlorobenzene | Each group of samples (≤20) per matrix/level | Advisory Only<br><br>Evaluated by analyst in relationship to other QC results |
| **Blanks:** | Once for each 12-hour time period or ≤20 samples | Reanalyze blank and associated samples if blank outside limits |
| **Internal Standards (ISTD):**<br><br>Bromochloromethane<br>1,4-Difluorobenzene<br>Chlorobenzene-$d_5$ | Each sample, MS, MSD, and blank | Reanalyze samples; if reanalysis confirms original, document on report or case narrative |

Some of the CLP recovery limits are advisory limits only. If in the opinion of the analyst, a problem other than the matrix exists, the samples will be reanalyzed.

| CLP<br>Quality Control<br>GC/MS Semivolatiles | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogate:**<br><br>Nitrobenzene-$d_5$<br>2-Fluorobiphenyl<br>Terphenyl-$d_{14}$<br>Phenol-$d_5$<br>2-Fluorophenol<br>2,4,6-Tribromophenol<br>2-Chlorophenol-$d_4$<br>1,2-dichlorobenzene-$d_4$ | Each sample, MS, MSD, and blank<br><br><br><br><br><br><br>(Advisory)<br>(Advisory) | Re-extract and reanalyze if more than one surrogate out per fraction (acid/base) or any recovery <10%; if re-extraction and reanalysis confirms originals, document on report and/or case narrative |
| **Matrix Spikes & Matrix Spike Duplicates (RPD):**<br><br>Phenol<br>2-Chlorophenol<br>1,4-Dichlorobenzene<br>N-Nitroso-di-n-propylamine<br>1,2,4-Trichlorobenzene<br>4-Chloro-3-methylphenol<br>Acenaphthene<br>4-Nitrophenol<br>2,4-Dinitrotoluene<br>Pentachlorophenol<br>Pyrene | Each group (≤20) of samples per matrix/level | Advisory Only<br><br>Evaluated by analyst in relationship to other QC results |
| **Blanks:** | Once per extraction group (≤20) of samples, each matrix, level, instrument | Reextract and reanalyze blank and associated samples, except for phthalate contamination, which is allowed to be present at levels up to 5 times the CRQL. |
| **Internal Standards (ISTD):**<br><br>1,4-Dichlorobenzene-$d_4$<br>Naphthalene-$d_8$<br>Acenaphthene-$d_{10}$<br>Phenanthrene-$d_{10}$<br>Chrysene-$d_{12}$<br>Perylene-$d_{12}$ | Each sample, MS, MSD, and blank | Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative |

Some of the CLP recovery limits are advisory limits only. If in the opinion of the analyst, a problem exists other than matrix, the sample will be reanalyzed.

| CLP<br>Quality Control<br>Pesticides/PCBs | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogates:**<br><br>Tetrachloro-*m*-xylene (TCMX)<br>Decachlorobiphenyl (DCB) | Added to each sample, MS/MSD, and blank during the extraction phase | Advisory Only for Samples<br><br>For Blank, reinject; if still out reextract and reanalyze blank and associated samples |
| **Matrix Spikes & Matrix Spike Duplicates (RPD):**<br><br>gamma-BHC (Lindane)<br>Heptachlor<br>Aldrin<br>Dieldrin<br>Endrin<br>4,4'-DDT | Each extraction group (≤20) of samples per matrix/level | Advisory Only<br><br>Evaluated by analyst in relationship to other QC results |
| **Blanks:** | Once per extraction group (≤20) of samples, each matrix, level | Inject a hexane or solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be reprepped. |

Some of the CLP recovery limits are advisory limits only. If in the opinion of the analyst, a problem exists other than matrix, the sample will be reanalyzed.

| CLP<br>Quality Control<br>Inorganics | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Internal Standard (ICP & ICP/MS only):** | Each sample, standard and QC (Unspiked, Dup., MS, , LCS, dilution, post digestion spike and blank) | If the internal standard response falls outside the specified range, then the samples would be reanalyzed. |
| **Matrix Spikes:** | Each group of samples of similar matrix/level (≤20) each method | Analyze post-digestion spike sample |
| **Duplicates (RPD):** | Each group of samples of similar matrix/level (≤20) each method | Flag the data |
| **Blanks:**<br><br>Initial Calibration (ICB) Continuing Calibration (CCB)<br><br>Preparation Blank | Each wavelength immediately after calibration verification at 10% frequency or every 2 hours (beginning and end of run min.)<br><br>Each SDG or batch (≤20 samples) | Correct problem, recalibrate, and rerun<br><br>Redigest and reanalyze blank and associated samples if sample result is greater than the LOQ and <20× blank result |
| **Serial Dilutions (ICP, ICP/MS only):** | Each group of (≤20) of similar matrix/level | Flag the data |
| **Interference Check Sample:** | Each wavelength after Initial Calibration Verification at beginning and end of the run and per 20 samples | Correct for interference, recalibrate the instrument |
| **Laboratory Control Sample:** | Each SDG or batch (≤20 samples), each method | Redigest and reanalyze LCS and associated samples |
| **Post Digestion Spike:** | When matrix spikes are outside 75% to 125% range | Flag the data |

Some of the CLP recovery limits are advisory limits only. If in the opinion of the analyst, a problem exists other than matrix, the sample will be reanalyzed.

| Drinking Water<br>Quality Control<br>Inorganics (Metals) | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Internal Standard (ICP & ICP/MS only):** | Each sample, standard and QC (Unspiked, Dup., MS, MS, LFB, Post Digestion Spike, dilution and blank) | If the internal standard response falls outside the specified range, then the samples would be reanalyzed. |
| **Matrix Spikes:** | Each group of samples of similar matrix/level (≤10) each method | Analyze post-digestion spike sample |
| **Duplicates (RPD):** | Each group of samples of similar matrix/level (≤10) each method | Flag the data |
| **Blanks:**<br>Initial Calibration (ICB)<br>Continuing Calibration (CCB) | Each wavelength immediately after calibration verification at 10% frequency | Correct problem, recalibrate, and rerun |
| Preparation Blank | Each batch (≤10 samples) | Redigest and reanalyze blank and associated samples if sample result <10 times blank result or >LOQ |
| **Laboratory Fortified Blank (LFB):** | Each batch (≤10 samples) | Redigest and reanalyze LFB and associated samples. Elements that fail high in the LFB and are ND in the samples can be reported. |
| **Post Digestion Spike:** | When matrix spikes are outside range | Flag the data |

| Drinking Water<br>EPA Method 525.2<br>Quality Control | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Lab Reagent Blank (LRB):** | One per extraction batch of (≤20) samples | Re-extract and reanalyze blank and associated samples |
| **Lab Fortified Blank (LFB):**<br>Spike all compounds of interest | One per extraction batch of (≤20) samples | Re-extract and reanalyze LFB and associated samples for compounds outside acceptance limits. Compounds that fail high in the LFB and are ND in the samples can be reported. |
| **Matrix Spike/Matrix Spike Duplicate (MS/MSD):**<br>Spike all compounds of interest | One per extraction batch of (≤20) samples | Recoveries for LFB must be within criteria. If there is insufficient sample for MSD, then a duplicate (extraction and analysis) of another sample in the batch must be performed. |
| **Surrogates:**<br>1,3-Dimethyl-2-nitrobenzene<br>Perylene-$d_{12}$<br>Triphenylphosphate | Each sample, LFB, MS, MSD, and blank | Re-extract and reanalyze the sample |
| **Internal Standards (ISTD):**<br>Acenaphthene-$d_{10}$<br>Phenanthrene-$d_{10}$<br>Chrysene-$d_{12}$ | Each sample, LFB, MS, MSD, and blank | Reanalyze samples |

| QC Table for Miscellaneous Water Tests | | | |
|---|---|---|---|
| **Test** | **QC Type** | **Frequency** | **Corrective Action** |
| **Alkalinity**<br>**Ammonia (ISE)**<br>**Ammonia (Distill)**<br>**Dissolved Solids**<br>**Fluoride (ISE)**<br>**Hardness**<br>**Sulfate (TURB)**<br>**Sulfide**<br>**Total Solids**<br>**Turbidity** | Blank | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze. |
| | Laboratory Fortified Blank | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze.* |
| | Duplicate | Each group of samples of similar matrix (≤20)<br>Alkalinity, Dissolved Solids, Total Solids, Turbidity each group of similar matrix (≤10) | Ensure that LFB meets acceptance criteria. |
| | Matrix Spike/<br>Matrix Spike Duplicate | Each group of samples of similar matrix (≤20)<br><br>(not for Turbidity) | Ensure that LFB meets acceptance criteria. |
| **Bromide (IC)**<br>**Chloride (IC)**<br>**Cyanide (total & free )**<br>**Fluoride (IC)**<br>**Nitrogen (TKN)**<br>**Nitrate/Nitrite**<br>**Sulfate (IC)**<br>**Total Phosphorus**<br>**TOC** | Blank | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze. |
| | Laboratory Fortified Blank | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze.* |
| | Duplicate | Each group of samples of similar matrix (≤10) | Ensure that LFB meets acceptance criteria. |
| | Matrix Spike | Each group of samples of similar matrix (≤10) | Ensure that LFB meets acceptance criteria. |
| **Phenols** | Blank | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze. |
| | Laboratory Fortified Blank/Laboratory Control Sample | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze.* |
| | Matrix Spike/<br>Matrix Spike Duplicate | Each group of samples of similar matrix (≤10) | Ensure that LFB meets acceptance criteria. |
| **pH**<br>**Moisture** | Laboratory Fortified Blank | Each group of samples of similar matrix (≤20) | Re-analyze samples. |
| | Duplicate | Each group of samples of similar matrix (≤10) | Ensure that LFB meets acceptance criteria. |
| **Microbiology** | Organism control ( + ) | Each lot of media (minimum of one per month) | Investigate cause |
| | Negative control ( - ) | Each lot of media (minimum of one per month) | Investigate cause |

*LFBs that fail high and associated samples are ND can be reported.

| QC Table for Drinking Water Methods: 507, 508, 515.1, 531.1 | | |
|---|---|---|
| **Type of QC** | **Frequency** | **Corrective Action** |
| **Blank** | Each batch of (≤20) samples | Inject a solvent blank to check for analytical system contamination. Re-inject the blank. If the re-injected blank is acceptable then any samples with positive results must be re-injected. If the re-injected blank is unacceptable, all associated samples must be re-extracted. |
| **Surrogate** | Added to each field and QC sample during the extraction. | Recovery must be within specifications unless matrix-related problems are evident, in which case report results and comment. |
| **Matrix Spike/Matrix Spike Duplicate**<br><br>Spike all compounds of interest, except multipeak compounds | Each batch (≤20) of samples if sample volume is available. | Evaluate in conjunction with the LFB. |
| **Laboratory Fortified Blank (LFB)**<br><br>Spike all compounds of interest, rotate multipeak compounds | Each batch of (≤20) samples. LCSD may be used if insufficient sample for MS/MSD is submitted. | If LFB compounds are outside of acceptance limits, re-extract and re-analyze the batch. Compounds that fail high in the LFB and are ND in the samples can be reported. |

| QC Table for Drinking Water Method: 524.2 | | |
|---|---|---|
| **Type of QC** | **Frequency** | **Corrective Action** |
| **Blank** | One blank for each 12-hour period or batch of ≤20 samples | Reanalyze blank and associated samples if blank is unacceptable. |
| **Surrogate**<br><br>4-Bromofluorobenzene<br>1,2-Dichlorobenzene-$d_4$ | Added to each field and QC sample prior to analysis | Reanalyze sample if outside limits. If reanalysis confirms original, document on report. |
| **Matrix Spike/Matrix Spike Duplicate**<br><br>Spike all compounds of interest | At client request. | Evaluate in conjunction with the LFB. |
| **Laboratory Fortified Blank (LFB)**<br><br>Spike all compounds of interest | One LFB for each 12 hour period. | If target compounds are outside of acceptance limits, re-analyze the LFB. If second LFB fails, recalibrate instrument, re-analyze LFB and any associated samples. Compounds that fail high in the LFB and are ND in the samples can be reported. |
| **Internal standard (ISTD)**<br><br>Fluorobenzene | Added to each field and QC sample prior to analysis | Reanalyze sample if outside limits. If reanalysis confirms original, document on report. |

| EPA 624<br>Quality Control<br>GC/MS Volatiles | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogates:**<br>4-Bromofluorobenzene<br>1,2-Dichloroethane-$d_4$<br>Fluorobenzene | Each sample, MS, MSD, LCS, and blank | Reanalyze sample if outside limits; if reanalysis is within limits, the reanalysis data is reported. If surrogates confirm original, document on report and/or case narrative |
| **Matrix Spikes:**<br>Spike all compounds of interest | Each batch (≤20) of samples | Evaluated by analyst in conjunction with the LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Laboratory Control Samples:**<br>Spike all compounds of interest | Each batch (≤20) of samples | Reanalyze LCS and associated samples for compounds outside acceptance limits that are also outside MS/MSD acceptance limits. Compounds that fail high in the LCS and are ND in the samples can be reported. |
| **Matrix Spike Duplicates (RPD):**<br>Spike all compounds of interest | Each batch (≤20) of samples | Evaluated by analyst in relationship to other QC results |
| **Blanks:** | Once every 24-hour tune period and/or 20 samples, which ever comes first | Reanalyze blank and associated samples if blank outside QC limits |
| **Internal Standards (ISTD):**<br>Bromochloromethane<br>2-Bromo-1-chloropropane<br>1,4-Difluorobenzene | Each sample, MS, MSD, LCS, and blank | Reanalyze sample if outside limits; if reanalysis is within limits, the reanalysis data is reported. If internals confirm original, document on report and/or case narrative |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

| EPA 625<br>Quality Control<br>GC/MS Semivolatiles | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogate:**<br>Nitrobenzene-$d_5$<br>2-Fluorobiphenyl<br>Terphenyl-$d_{14}$<br>Phenol-$d_6$<br>2-Fluorophenol<br>2,4,6-Tribromophenol | Each sample, MS, MSD, LCS, and blank | Re-extract and reanalyze if more than one surrogate out per fraction (acid/base) or any recovery <10%; if re-extraction and reanalysis confirms originals, document on report and/or case narrative |
| **Matrix Spikes:**<br><br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Evaluate in conjunction with the LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Laboratory Control Sample:**<br><br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples can be reported. |
| **Matrix Spike Duplicates (RPD):**<br><br>Same as for matrix spikes | Each group (≤20) of samples per matrix/level | Evaluated by analyst in relationship to other QC results |
| **Blanks:** | Once per extraction group (≤20) of samples, each matrix, level, instrument | Re-extract and reanalyze blank and associated samples |
| **Internal Standards (ISTD):**<br>1,4-Dichlorobenzene-$d_4$<br>2-Fluoronaphthalene<br>Acenaphthene-$d_{10}$<br>Phenanthrene-$d_{10}$<br>Chrysene-$d_{12}$<br>Perylene-$d_{12}$ | Each sample, MS, MSD, LCS, and blank | Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

| EPA 608<br>Quality Control<br>Pesticides/PCBs | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogate:**<br>Organochlorine Pesticides & PCBs<br>DCB<br>TCMX | Each sample, MS, MSD, LCS, and blank | Repeat extraction and analysis if reanalysis confirms original report results and comment in case narrative |
| **Matrix Spikes:**<br>Organochlorine Pesticides: Spike all compounds of interest, except PCBs, chlordane, and toxaphene<br>PCBs: Aroclor 1016 and Aroclor 1260 | Each batch (≤20) of samples | Evaluate in conjunction with LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Matrix Spike Duplicates (RPD):**<br>Organochlorine Pesticides: Spike all compounds of interest, except PCBs, chlordane, and toxaphene<br>PCBs: Aroclor 1016 and Aroclor 1260 | Each batch (≤20) of samples | Evaluated by analyst in relationship to other QC results |
| **Laboratory Control Sample:**<br>Organochlorine Pesticides: Spike all compounds of interest, except PCBs, chlordane, and toxaphene<br>PCBs: Aroclor 1016 and Aroclor 1260 | Each batch (≤20) of samples | Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds in the LCS that fail high and are ND in the samples can be reported. |
| **Blanks:** | Each batch (≤20) of samples | Inject a hexane or solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be reextracted. |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

| EPA Method 602<br>Petroleum Analysis<br>Acceptance Criteria | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogate:**<br>α,α,α-Trifluorotoluene (PID) | Each sample, MS, MSD, LCS, and blank | Reanalyze if the surrogate recovery is outside the limits unless matrix-related problems are evident. |
| **Matrix Spike:**<br>Spike all compounds of interest | Each group (≤20) of samples | Evaluate in conjunction with LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Laboratory Control Sample:**<br>Spike all compounds of interest | Each group (≤20) of samples. LCSD analyzed if sufficient volume is not available for MS/MSD | Reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds in the LCS that fail high and are ND in the samples can be reported. |
| **Matrix Spike Duplicates (RPD):**<br>Same compounds as the matrix spike | Each group (≤20) of samples | Evaluated by an analyst in relationship to other QC results |
| **Blanks:** | At least once per 24 hours | Reanalyze blank and associated samples if blank is outside limits |
| **Internal Standards (ISTD):**<br>1-Chloro-3-fluorobenzene (PID) | Each sample, MS, MSD, LCS, and blank | Reanalyze samples; if reanalysis confirms original result, document on report or case narrative. In cases where the sample matrix is elevating the ISTD recovery, a dilution and reanalysis may be performed. |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change

| EPA 610<br>Quality Control<br>PAHs by HPLC | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogate:**<br>Nitrobenzene<br>Triphenylene | Each sample, MS, MSD, LCS, and blank | Re-extract and reanalyze. If re-extraction and reanalysis confirms then comment on report and/or case narrative. Re-extraction may not be needed if matrix related problems are evident. Comment in case narrative. |
| **Matrix Spike:**<br>Spike all compounds of interest | Each batch (≤20) of samples | Evaluate in conjunction with LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Laboratory Control Sample:**<br>Spike all compounds of interest | Each batch (≤20) of samples | Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds in the LCS that fail high and are ND in the samples can be reported. |
| **Matrix Spike Duplicates (RPD):**<br>Spike all compounds of interest | Each batch (≤20) of samples | Evaluated by analyst in relationship to other QC results |
| **Blanks:** | Each batch (≤20) of samples | Inject a solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected, if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be re-extracted. |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

| EPA Method 600 Series (Method 200.8 for ICP/MS)<br>Quality Control<br>Inorganics (Metals) | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Internal Standard:** | Each sample, standard and QC (Unspiked, Dup., MS, LCS, dilution, Post Digestion Spike and blank) | If the internal standard response falls outside the specified range, then the samples would be reanalyzed. |
| **Matrix Spikes:** | Each group of samples of similar matrix/level (≤10) each method | Analyze post-digestion spike sample |
| **Matrix Spike Duplicate (RPD):** | Not required | N/A |
| **Duplicates (RPD):** | Each group of samples of similar matrix/level (≤10) each method | Flag the data |
| **Blanks:**<br><br>Initial Calibration (ICB)<br>Continuing Calibration (CCB)<br><br>Preparation Blank | Each wavelength immediately after calibration verification at 10% frequency or every 2 hours (beginning and end of run min.)<br><br>Each SDG or batch (≤10 samples) | Correct problem, recalibrate, and rerun<br><br>Redigest and reanalyze blank and associated samples if sample result is greater than the LOQ and <20× blank result |
| **Serial Dilutions:** | Each group of (≤10) of similar matrix/level | Flag the data |
| **Interference Check Sample:** | Each wavelength after Initial Calibration Verification at beginning and end of the run or min. of 2 times per 8 hour | Correct for interference, recalibrate the instrument |
| **Laboratory Control Sample:** | Each SDG or batch (≤10 samples), each method | Redigest and reanalyze LCS and associated samples. Elements in the LCS that fail high and are ND in the samples can be reported. |
| **Post Digestion Spike:** | When matrix spikes are outside 70% to 130% range or within the statistical window (whichever is tighter) | Flag the data |
| **Analytical Spike:** | One per 10 field samples | ICP-MS – flag the data |

| Quality Control for Miscellaneous 600 Series Water Tests | | | |
|---|---|---|---|
| **Test** | **QC Type** | **Frequency** | **Corrective Action** |
| **Alkalinity**<br>**Ammonia (ISE)**<br>**Ammonia (Distill.)**<br>**Dissolved Solids**<br>**Fluoride (ISE)**<br>**Hardness**<br>**Sulfate (turb)**<br>**Sulfide**<br>**Total Solids**<br>**Turbidity** | Blank | Each batch (≤20) of samples | Prepare the entire batch again and re-analyze. |
| | Laboratory Control Sample | Each batch (≤20) of samples | Prepare the entire batch again and re-analyze.* |
| | Duplicate | Each batch (≤20) of samples | Ensure that LCS meets acceptance criteria. |
| | Matrix Spike/ Matrix Spike Duplicate | Each batch (≤20) of samples<br><br>(not for turbidity) | Ensure that LCS meets acceptance criteria. |
| **Bromide (IC)**<br>**Chloride (IC)**<br>**Sulfate (IC)**<br>**Cyanide (total & free)**<br>**Fluoride (IC)**<br>**Nitrogen (TKN)**<br>**Nitrate/Nitrite**<br>**Total Phosphorus**<br>**TOC** | Blank | Each batch (≤20) of samples | Prepare the entire batch again and re-analyze. |
| | Laboratory Control Sample | Each batch (≤20) of samples | Prepare the entire batch again and re-analyze.* |
| | Duplicate | Each batch (≤10) of samples | Ensure that LCS meets acceptance criteria. |
| | Matrix Spike | Each batch (≤10) of samples | Ensure that LCS meets acceptance criteria. |
| **Phenols** | Blank | Each batch (≤20) of samples | Prepare the entire batch again and re-analyze. |
| | Laboratory Control Sample | Each batch (≤20) of samples | Prepare the entire batch again and re-analyze.* |
| | Matrix Spike/ Matrix Spike Duplicate | Each batch (≤10) of samples | Ensure that LCS meets acceptance criteria. |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

*LCSs that fail high and associated samples are ND can be reported.

| TO-15<br>Volatile Organics in Air | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Laboratory Control Sample:**<br><br>Spike all compounds of interest | Each group (≤20) of samples | Reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported. |
| **Blanks:** | Once for each 24-hour time period or ≤20 samples | Reanalyze blank and associated samples if blank outside limits |
| **Internal Standards (ISTD):**<br>Bromochloromethane<br>1,4-Difluorobenzene<br>Chlorobenzene-$d_5$ | Each sample, LCS, and blank | Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

| TO-14A<br>Volatile Organics in Air | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Laboratory Control Sample:**<br><br>Spike all compounds of interest | Each group (≤20) of samples | Reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported. |
| **Blanks:** | Once for each 24-hour time period or ≤20 samples | Reanalyze blank and associated samples if blank outside limits |
| **Internal Standards (ISTD):**<br>Bromochloromethane<br>1,4-Difluorobenzene<br>Chlorobenzene-$d_5$ | Each sample, LCS, and blank | Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

eurofins | Lancaster Laboratories

# Environmental Quality Policy Manual

# Appendix K
## Microbiological Testing

Current as of October 05, 2011
5 Total Pages (including this coversheet)

Lancaster Laboratories, Inc. • 2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681

# MICROBIOLOGICAL TESTING

## 1. MICROBIOLOGICAL SAMPLE HANDLING

### 1.1. Microbiological Sample Collection

The containers for environmental microbiology are typically sterile, screw-cap plastic bottles. A minimum of 100 mL of sample is required. The sampling containers are purchased with a sterility certification. The sterility, absence of autofluoresence, and volume of each purchased lot of containers is verified by randomly selecting a container from each purchased lot and inoculating it with approximately 100 mL of sterile tryptic soy broth and placing it in incubation for 24 hours at 35° ± 0.5°C. Each lot of bottles is also checked for absence of autofluoresence with a 366-nm UV light with a 6-Watt bulb. The 100-mL calibration line on the container is verified using a 100-mL Class A graduated cylinder to 2.5% tolerance.

Samples collected for microbiological analyses must follow a specific protocol:

- The sampling taps are to be free of aerators, strainers, hose attachments, and purification devices; they should not be mixing type faucets, and avoid leaky faucets.
- Maintain a steady water flow for 3 to 5 minutes before collecting the sample.
- Using aseptic techniques, fill the container to just above the 100-mL mark on the container. This will allow for mixing and chlorine residual analysis.
- Do not overfill the container.
- If another environmental microbial analysis is required, or if the water is discolored (to act as a color standard), a separate container will be required.

### 1.2. Microbiological Sample Storage

Because sample integrity can be compromised by improper storage, the environmental microbiology samples are refrigerated with the temperature monitored until requested by the microbiologist for analysis.

Holding times for samples are monitored and analysis is scheduled accordingly. For SDWA compliance purposes, no sample (for total coliform analysis) with over 30 hours elapsed time from collection will be analyzed. HPC samples from SDWA surface water systems must be tested within 8 hours of collection. Fecal coliform tests on effluents for NPDES compliance purposes must be transported to the laboratory within 6 hours of collection. Samples that arrive past 6 hours of when they were collected can not be tested. Whenever possible, the sample should be tested within 2 hours of receipt.

### 1.3. Microbiological Sample Return/Disposal

All solid wastes generated from the microbiological analyses are disposed of in bags designated as "BioHazard", sterilized via autoclave and disposed of by incineration. Lancaster Laboratories uses a sophisticated, computerized sample management system (CSMS), which includes programming to assist in the identification of hazardous wastes at time of discard. In most cases, a sample for coliform testing is collected in a container that will also be the test vessel. These samples are assigned a discard location. If a sample is being tested for an analysis other than microbiology, it will be assigned a storage location.

## 2. MICROBIOLOGICAL TECHNICAL REQUIREMENTS AND TRACEABILITY OF MEASUREMENTS

### 2.1. Media

- Within the microbiology laboratory, procedures are in place to address preparation, labeling, storage, expiration, documentation, and quality/sterility evaluation requirements for these materials. Only commercially prepared or manufactured dehydrated media is used for SDWA water work. Media may not be formulated from basic ingredients. Each new lot of dehydrated or commercially prepared medium is checked against positive and negative culture controls. Each purchased lot of MMO-MUG media is tested for performance using *E. coli*, *K. pneumoniae*, and *Ps. aeruginosa*, or equivalent organisms following a standard operating procedure. The positive/negative organism check is performed on each new lot of purchased or prepared media for QC purposes.

- Each analytical method includes a list of media needed for the test. These are fully described, including name, purity, and description of preparation. Where applicable, shelf life and storage conditions are also listed.

- The Microbiology Department is responsible for maintaining an inventory of the media needed. New supplies of media are checked by the Purchasing Department to ensure that they match the purchase order. The laboratory is responsible for checking that new supplies meet the method requirements.

- In addition to the name and concentration, the media containers are labeled with the storage conditions, the date opened, and an expiration or re-evaluation date. Subsequent media preparations at the laboratory are fully documented in a logbook and are traceable to, or labeled to include:

    1. Name of media
    2. Concentration, as appropriate
    3. Date prepared
    4. Name of analyst preparing or reference to logbook
    5. Storage conditions
    6. Expiration/re-evaluation date
    7. Manufacturer name and lot #
    8. Sterilization time and temperature
    9. Final pH, where required
    10. Sterility check result

### 2.2. Microbiological Standard Sources, Calibration, and Preparation

Microbial Control Species - Where required, laboratory cultures are obtained from the American Type Culture Collection (ATCC). Cultures used in testing are no more than five transfers from ATCC freeze-dried cultures.

### 2.3. Microbiological Equipment Maintenance

Equipment maintenance and calibration is addressed in instrument-specific Operation, Maintenance, and Calibration Procedures (OMC) or instrument-specific instruction manuals located within the department.

The general process for sterilization procedures are outlined below:

2.3.1. All autoclaving is done at 121° ± 1°C, with times as specified below (in minutes):

| | |
|---|---|
| Carbohydrate media | 25 |
| Rinse water | 60 |
| Contaminated materials | minimum of 70 |

2.3.2. Sterile disposable single use membrane filter units or sterile glass filter funnels are used for methods that require filtration.

### 2.4. Microbiological Labware Cleaning

Sterile disposable plasticware is primarily used for microbiological analysis. However, procedures are in place to outline the washing process for each type of labware used in the laboratory. Most glassware is machine-washed. Labware that is washed by hand is either air dried or dried in specifically designed ovens and sterilized appropriately. Each new lot, or at least annually, of detergents used to wash glassware for Environmental Microbiology labware, is tested using the Inhibitory Residue Test, as outlined in SM20 9020.B.4.a.2).

## MICROBIOLOGICAL INTERNAL QUALITY CONTROL CHECKS

### 2.5. Microbiological Laboratory Quality Control Samples and Acceptance Criteria

Quality control (QC) samples are analyzed with each batch of samples or new lot of reagents, as required by the procedures, to demonstrate that all aspects of the analysis are in control within established limits of precision and accuracy. Chromofluorogenic media QC tests are lot-specific and performed on each newly received lot.

As required in the procedure on written methods, each analytical method specifies (or cross-references another procedure) the type of QC sample, frequency of analysis, acceptance criteria for QC sample results, and corrective action to be taken if QC sample results fall outside of the acceptable range.

The handling of QC data is described in the procedure addressing, "Quality Control Records." The types of QC samples and the information each provides are discussed in the following paragraphs.

2.5.1. Negative System Control - The QC on this is method specific and can be found in the Quality Control/Quality Assurance Procedure.

2.5.2. Positive and Negative Organism Controls - Each lot/batch of media is tested using positive and negative organism controls.

2.5.3. Duplicate Counting (Test Variability/Reproducibility) - duplicate counting is performed monthly on HPC and fecal MF plates. Each analyst who counted samples for a month, counts the plates and their results are evaluated. Counts must be within 10% difference of the total average for all analysts to be acceptable.

2.5.4. Duplicates - For heterotrophic plate count samples, a duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test. The plate counts are averaged.

2.5.5. Serial Dilutions - Fecal coliform, biosolids analyses, and heterotrophic plate counts may require serial dilution of the sample.

## 2.6. Microbiological Quality Control Sample Frequency and Corrective Action

Each analytical method defines the frequency for the required QC samples, where appropriate. The corrective action required when a QC result fails to meet the acceptance criteria is also given, where appropriate.

The QC acceptance criteria are available to analysts in the laboratory. If the results are not within the acceptance criteria, corrective action suitable to the situation must be taken. This may include, but is not limited to, checking calculations, examining other quality control analyzed with the same batch of samples, qualifying results with a comment stating the observed deviation, and invalidating results. It should be noted that resampling may be required in the case of invalidated results for SDWA, EPA, DEP, or DOH compliance samples due to the short hold-times in microbiological analysis.

## 2.7. Microbiological Water Systems

Laboratory Reagent Water Suitability Testing - On an annual basis, a sample is sent to a PADEP certified laboratory for suitability analyses. These serve as confirmation of our analyses, as well as to supply additional data on the water suitability.

## 2.8. Microbiological Reporting Limits

For microbiological analysis, the limits are method-specified and/or project-specific. This information is programmed into the LIMS for reporting purposes.

**APPENDIX II**

**Sample Collection Field Sheet Template**

# SOIL SAMPLE COLLECTION FIELD SHEET

**GENERAL INFORMATION**

SITE NAME: _____ PROJECT NO. _____

SAMPLE NO. _____ BORING NO. _____

DATE/TIME COLLECTED: _____ PERSONNEL: _____

SAMPLE METHOD / DEPTH: _____

SAMPLE MEDIA: SOIL SEDIMENT SLUDGE

SAMPLE QA SPLIT: YES NO SPLIT SAMPLE NO. _____

SAMPLE QC DUPLICATE: YES NO DUPLICATE SAMPLE NO. _____

MS/MSD REQUESTED: YES NO

**SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS**

| Sample Container | Preservative | Analysis Requested |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

**OVA MEASUREMENTS**

Background _____

Breathing zone _____

Boring _____

Headspace _____

**SAMPLE DESCRIPTION**

| DEPTH: | DESCRIPTION: |
|---|---|
| | |
| | |
| | |
| | |

**GENERAL COMMENTS**

**LEGGETTE, BRASHEARS & GRAHAM, INC.**
**Professional Ground-Water and Environmental Engineering Services**

**110 Corporate Park Drive, Suite 112**
**White Plains, New York 10604**
**(914) 694-5711**
**Fax: (914) 694-5744**

**Client:**

**Location:**

**Date:**

**Professional:**

**Weather/Comments:**

| Well | Hour | Ref. Pt. (feet) | Meas. Pt. (feet) | D.T.W. (feet) | T.D. (feet) | Gal Evac | D.O. | | Temp (EF) | pH | Cond. | ORP | Time Sampled |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Actual | mg/l | % | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | |

# WATER SAMPLE COLLECTION FIELD SHEET

**GENERAL INFORMATION**

SITE NAME _____ PROJECT NO. _____

SAMPLE NO. _____ WELL NO. _____

DATE/TIME COLLECTED _____ PERSONNEL _____

SAMPLE METHOD _____

| | | | |
|---|---|---|---|
| SAMPLE MEDIA: | Groundwater | Surface Water | |
| SAMPLE QA SPLIT: | YES | NO | SPLIT SAMPLE NO. _____ |
| SAMPLE QC DUPLICATE: | YES | NO | DUPLICATE SAMPLE NO. _____ |
| MS/MSD REQUESTED | YES | NO | |

**SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS**

| Sample Container | Preservative | Analysis Requested |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |

**WELL PURGING DATA**

| | | | |
|---|---|---|---|
| Date | | Well Depth (ft. BTOC) | |
| Time Started | | Depth to Water (ft BTOC) | |
| Time Completed | | Water Column Length | |
| Hnu Measurements | | Volume of Water in Well (gal) | |
| Background | | Casing Volumes to Purge | |
| Breathing Zone | | Minimum to Purge (gal) | |
| Well Head | | Actual Purge (gal) | |

**FIELD MEASUREMENTS**

| Time | Amount Purged (gal) | pH | Temperature (ºC) | Conductivity (mS/cm) | Dissolved Oxygen (mg/L) | ORP (mV) | Turbidity (NTU's) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**FIELD EQUIPMENT AND CALIBRATION**

| | Model | Calibration |
|---|---|---|
| Water Level Probe | | |
| Water Quality Meter | | |

**GENERAL COMMENTS**

_____

_____

_____

# Leggette, Brashears & Graham, Inc.

PAGE: _____ OF _____

SAMPLE DATE:

## Low-Flow Sampling Log

TOTAL # WELLS: _____

Client Name: _____ Sample Pump: _____

Project Location: _____ Tubing Type: _____

Sampler(s): _____ Monitoring Equipment: _____

Well I.D. _____ Screen Setting (ft btoc): _____ to _____

Well Diameter (inches): Inches Tubing Intake (ft btoc): _____.

Total Depth (ft btoc): _____ Comments: Purged well for approx. _____ minutes .

Depth to Water (ft btoc): _____ before recording parameters

| Time | | Depth to Water (ft btoc) | Evacuation Rate (ml/min) | Water-Quality Monitoring Parameters | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| # | hour | | | pH | Conductivity (mS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/l) | Temperature ($^0$C) | ORP (mv) |
| 1 | | | | | | | | | |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | | | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |

Stabilazation of Parameters (**Stabilization Achieved for three consecutive measurements**)

| Time # | | Change in Head (ft btoc) | Evacuation Rate (ml/min) | pH | Conductivity (uS/cm) | Turbidity (NTU) | Dissolved Oxygen (mg/l) | Temperature ($^0$C) | ORP (mv) |
|---|---|---|---|---|---|---|---|---|---|
| From | To | | | | | | | | |
| 1 | 2 | | | | | | | | |
| 2 | 3 | | | | | | | | |
| 3 | 4 | | | | | | | | |
| 4 | 5 | | | | | | | | |
| 5 | 6 | | | | | | | | |
| 6 | 7 | | | | | | | | |
| 7 | 8 | | | | | | | | |
| 8 | 9 | | | | | | | | |
| 9 | 10 | | | | | | | | |
| Recommended Stabilization | | 0.3 | (100 - 500) | 0.1 | 3% | 10% | 10% | 3% | 10 |
| Stabilization: (Yes/No) | | | | | | | | | |

Sample Time: _____ Reviewed By: _____

ft btoc feet below top of casing
ml/min millimeters per minute
mS/cm milliseimons per centimeter
NTU Nephelometric Turbidity Units
mg/l milligrams per liter
$^0$C degrees Celcius
mv millivolts

| GEOLOGIC LOG<br>LEGGETTE, BRASHEARS & GRAHAM, INC.<br>WHITE PLAINS, NEW YORK | OWNER:<br>WELL NO.:<br>PAGE: OF PAGE |
|---|---|
| SITE LOCATION: | SCREEN SIZE & TYPE:<br>SLOT NO.: SETTING: |
| DATE COMPLETED: | SAND PACK SIZE & TYPE: |
| DRILLING COMPANY: | SETTING: |
| | CASING SIZE & TYPE: |
| DRILLING METHOD: | SETTING: |
| SAMPLING METHOD: | SEAL TYPE: |
| OBSERVER: | SETTING: |
| REFERENCE POINT (RP): | BACKFILL TYPE: |
| ELEVATION OF RP: | STATIC WATER LEVEL: |
| STICK-UP: | DEVELOPMENT METHOD: |
| SURFACE COMPLETION: | DURATION: YIELD: |
| REMARKS: | |
| ABBREVIATIONS: SS = split spoon W = wash C = cuttings G = grab ST = shelby tube<br>MC = Macrocore REC = Recovery PPM = parts per million | |

| DEPTH (FEET) | | SAMPLE TYPE | BLOW COUNT | REC. (FEET) | PID READING (PPM) | DESCRIPTION |
|---|---|---|---|---|---|---|
| FROM | TO | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

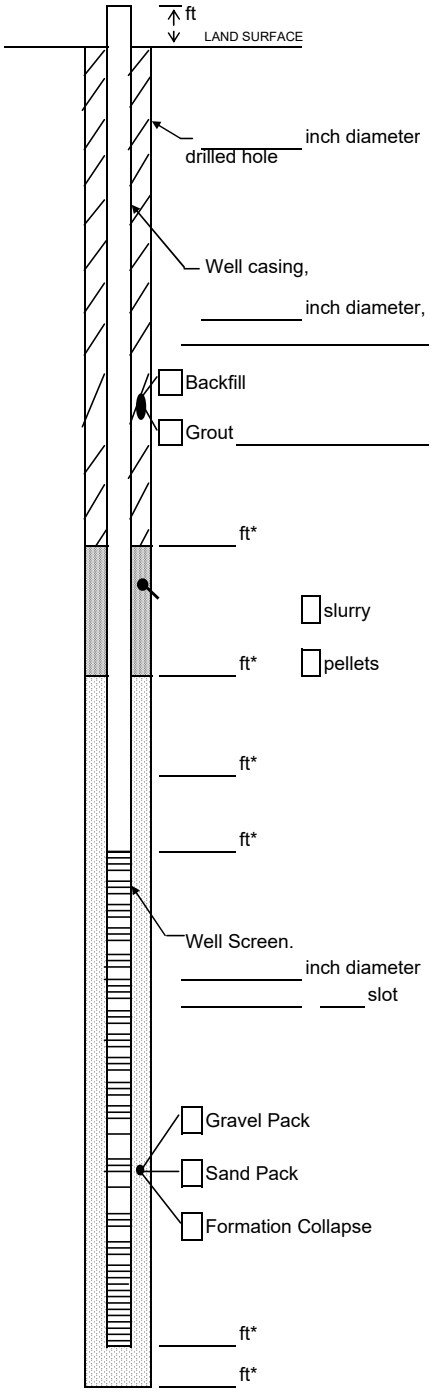
**OWNER:**

**WELL NO.:** **PAGE: OF PAGES**

| DEPTH (FEET) | | SAMPLE TYPE | BLOW COUNT | REC. (FEET) | PID READING (ppm) | DESCRIPTION |
|---|---|---|---|---|---|---|
| FROM | TO | | | | | |
| | | | | | | |
| | | | | | | |
| |

# Well Construction Log

(Unconsolidated)




Measuring Point is
Top of Well Casing
Unless Otherwise Noted.

* Depth Below Land Surface

Project _____ Well _____

Town/City _____

County _____ State _____

Permit No. _____

Land-Surface Elevation and Datum:

_____ feet ☐ Surveyed

☐ Estimated

Installation Date(s) _____

Drilling Method _____

Drilling Contractor _____

Drilling Fluid _____

_____

Development Technique(s) and Date(s)

_____

_____

_____

Fluid Loss During Drilling _____ gallons

Water Removed During Development _____ gallons

Static Depth to Water _____ feet below M.P.

Pumping Depth to Water _____ feet below M.P.

Pumping Duration _____ hours

Yield _____ gpm Date _____

Specific Capacity _____ gpm/ft

Well Purpose _____

_____

_____

Remarks _____

_____

_____

_____

_____

Prepared by _____

**GOWANUS VILLAGE I, LLC.**
**322 3rd AVENUE**
**BROOKLYN, KINGS COUNTY, NEW YORK**
**NYSDEC BCP SITE NO. C224099**
**INDEX NO. W2-1069-0506**

---

**Sample Collection Log**

| Field Sample ID | Lab Sample ID | Sample Matrix | Sample Depth | Sample Device | Stratigraphic Unit | Geo-Reference | | Alpha Numeric Grid Location | | QA/QC Descriptor | | | Sample Rationale | Analyses/Parameter | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Latitude | Longitude | Letter | Number | Field Duplicate | Matrix Spike | Matrix Spike Duplicate | | VOCs | SVOCs | PCBs | Total Metals | Pesticides | Herbicides | Reactivity | Ignitability | Corrosivity | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |

**APPENDIX III**

**Sample Chain-of-Custody Form**

**AMRO Environmental Lab Corp.**

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054

# CHAIN-OF-CUSTODY RECORD

60870

Office: (603) 424-2022
Fax: (603) 429-8496
web: www.amrolabs.com

| Project No.: | Project Name: | Project State: | Project Manager: | Samplers (Signature): | AMRO Project No.: |
|---|---|---|---|---|---|
| | | | | | |

| P.O.#: | Results Needed by: |
|---|---|
| | |
| | |
| QUOTE #: | Seal Intact? Yes No N/A |
| Sample ID.: | Date/Time Sampled |

| Matrix | Total # of Cont. & Size | Comp. | Grab | REQUESTED ANALYSES | Remarks |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| Preservative: Cl-HCl, MeOH, N-HN03, S-H2SO4, Na-NaOH, O- Other | | | | | |

Send Results To:

PRIORITY TURNAROUND TIME AUTHORIZATION
Before submitting samples for expedited TAT, you must *have a coded AUTHORIZATION NUMBER*
AUTHORIZATION No.: BY:

METALS 8 RCRA ☐ 13 PP ☐ 23 TAL ☐ 14 MCP ☐
Method: 6010 ☐ 200.7 ☐ Other Metals:
Dissolved Metals Field Filtered? YES ☐ NO ☐

PHONE #: FAX #:
E-mail:

MCP Presumptive Certainty Required? YES ☐ NO ☐

MCP Methods Needed: YES ☐ NO ☐

Required Reporting Limits:
S-1 ☐ GW-1 ☐
S-2 ☐ GW-2 ☐
S-3 ☐ GW-3 ☐
Other:

| Relinquished By: | Date/Time | Received By |
|---|---|---|
| | | |
| | | |
| | | |

AMRO report package level needed:

EDD required:

Please print clearly, legibly and completely. Samples can not be logged in and the turnaround time clock will not start until any ambiguities are resolved.

*Samples arriving after 12:00 noon will be tracked and billed as received on the following day.*

*AMRO policy requires notification in writing to the laboratory in cases where the samples were collected from highly contaminated sites.*

KNOWN SITE CONTAMINATION:

White: Lab Copy Yellow: Client Copy

SHEET OF

**Eurofins Lancaster Laboratories**

**LBG ENGINEERING SERVICES, P.C.**

# Environmental Analysis Request/Chain of Custody

eurofins | Lancaster Laboratories Environmental

Acct. # _____ Group # _____ Sample # _____

| | | |

# APPENDIX I

Site Management Forms

**ROUX ASSOCIATES, INC. / REMEDIAL ENGINEERING, P.C.**

**SITE-WIDE MONITORING, INSPECTION AND MAINTENANCE FORM**

Client: **Gemini Arts Initiative, Inc.**

Location: **153 2nd Street, Brooklyn, New York**

Inspector: _____

Date: _____

_____

**Site Observations: Performed by ( ) on ( )**

| Yes | No | |
|---|---|---|
| [ ] | [ ] | Have any Site improvements been made since last inspection? |
| [ ] | [ ] | Has there been any maintenance activity impacting engineering controls? |
| [ ] | [ ] | Are monitoring wells intact? |
| | | -Include sketches or photos of observations |

**Inspection of RCA Cap: Performed by ( ) on ( )**

| Yes | No | |
|---|---|---|
| [ ] | [ ] | Underlying demarcation barrier exposed? |
| [ ] | [ ] | Are soil caps sloped to allow for drainage away from the peak? |

**Inspection of Asphalt/Concrete Caps: Performed by ( ) on ( )**

| Yes | No | |
|---|---|---|
| [ ] | [ ] | Significant cracks observed? |
| [ ] | [ ] | Other damage observed? If yes, refer to Page 2 for additional clarification. |
| | | -Include sketches or photos of observations |

**Inspection of Building Covers: Performed by ( ) on ( )**

| Yes | No | |
|---|---|---|
| [ ] | [ ] | Were all buildings inspected? |
| [ ] | [ ] | Significant cracks observed? |
| [ ] | [ ] | Other damage observed? If yes, refer to Page 2 for additional clarification. |
| [ ] | [ ] | Any new slab penetrations observed? If yes, include description on page 2. |
| | | -Include sketched or photos of observations |

**Inspection of LNAPL Recovery System : Performed by ( ) on ( )**

| Yes | No | |
|---|---|---|
| [ ] | [ ] | Was the one (1) Recovery well intact? |
| [ ] | [ ] | Was the one (1) Spill Buster seeker operating properly? |
| [ ] | [ ] | Were there any signs of corrosion on the 55 gallon drum? |
| [ ] | [ ] | Were the fill alarm and spill alarms operating properly? |
| [ ] | [ ] | Was the secondary containment pallet intact? |
| [ ] | [ ] | Is the Spill Buster control panel intact? |

**ROUX ASSOCIATES, INC. / REMEDIAL ENGINEERING, P.C.**

**SITE-WIDE MONITORING, INSPECTION AND MAINTENANCE FORM**

Client: **Gemini Arts Initiative, Inc.**

Location: **153 2nd Street, Brooklyn, NY**

Inspector:

Date:

**Site Observations**

**Additional Comments or Clarification Where Corrective Actions May Be Required:**

**NAPL Recovery System Monitoring Log, GOWANUS VILLAGE I, LLC, 153 2nd Street, Brooklyn, New York**

| Source of Reading | Value | Unit | Comments |
|---|---|---|---|
| **Recovery Well Network -Presence of Product** | Product Present? | Ft in RW | |
| Recovery Well MW-3 | Y/N | | |
| **Product Volume in Recovery Drum** | | | |
| 0-55 gallons in Recovery Drum | | Gallons | |

Is the system operating within the acceptable conditions? _____

If no, was the condition corrected and how? _____

_____

_____

Form Completed By: Signature: Date and Time:

_____ _____ _____

**Groundwater Gauging GOWANUS VILLAGE I, LLC**
**153 2nd Street, Brooklyn, New York**

| Date | Well | Depth to Product (ft) | Depth to Water (ft) | Well Diameter (inch) | PID (ppm) | Product Thickness (ft) | Purged (g) | Cumulative (g) |
|---|---|---|---|---|---|---|---|---|
| | MW-1 | | | | | | | |
| | MW-2 | | | | | | | |
| | MW-3 | | | | | | | |
| | MW-4 | | | | | | | |
| | MW-5 | | | | | | | |
| | MW-6 | | | | | | | |
| | MW-7 | | | | | | | |
| | MW-8 | | | | | | | |
| | MW-9 | | | | | | | |
| | MW-26S | | | | | | | |
| | | | | | | | **Total** | **0.00** |

Notes:

PID - Photo ionization detector (well headspace reading)
ft - Feet
ppm - Parts per million
g - Gallons
ND - Not detected
NG - Not gauged
NM - Not measured
NA - Not applicable

**Low Flow Sampling Form GOWANUS VILLAGE I, LLC**
**153 2nd Street, Brooklyn, New York**

**SITE NAME:** **BRT Powerhouse** **Project Number:** **2705.0001Y000**

Weather: _____ Date: _____

Well ID: _____ Intake depth: _____

DTW: _____ Vol Purged: _____

DTB: _____

Sampler: _____

Purge Start: _____ Purge End Time: _____

Purge WaterDescription: _____

| Time | DTW (ft bls) (+/- 0.3 ft) | Flow Rate (ml/Min) | Temp (Degree C) (+/- 3%) | Conductivity (mS/cm) (+/- 3%) | DO (mg/L) (+/- 10%) | Ph (+/- 0.1 SU) | ORP (mV) (+/- 10) | Turbidity (NTU) (+/- 10%) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

# APPENDIX J

Field Sampling Plan

**July 15, 2017**

# FIELD SAMPLING PLAN

**Gowanus Village I, LLC**
**NYSDEC Site Number C224099**
**153 2nd Street**
**Brooklyn, New York**

***Prepared for***

**GEMINI ARTS INITIATIVE, INC.**
**153 2nd Street**
**Brooklyn, New York**


**ROUX ASSOCIATES, INC.**

*Environmental Consulting & Management*

ROUX

*209 Shafter Street, Islandia, New York 11749 ♦ 631-232-2600*

## TABLE OF CONTENTS

1.0 INTRODUCTION ..... 1

2.0 SAMPLING OBJECTIVES ..... 2

3.0 SAMPLE MEDIA, LOCATIONS, ANALYTICAL SUITES, AND FREQUENCY ..... 3

3.1 Soil Sampling ..... 3

3.2 Groundwater Sampling ..... 4

3.3 Concrete Sampling ..... 4

3.4 Effluent Water Sampling ..... 5

3.5 Decontamination Rinse Water Sampling ..... 5

4.0 FIELD INVESTIGATION PROCEDURES ..... 7

4.1 Soil Waste Characterization Samples ..... 7

4.2 Groundwater Sampling ..... 7

4.3 Concrete Sampling ..... 8

4.4 Effluent Water Sampling ..... 8

4.5 Decontamination Rinse Water Sampling ..... 8

4.6 Wipe Test Sampling ..... 9

5.0 SAMPLE HANDLING AND ANALYSIS ..... 10

5.1 Field Sample Handling ..... 10

5.2 Sample Custody Documentation ..... 10

5.3 Sample Shipment ..... 11

6.0 SITE CONTROL PROCEDURES ..... 13

6.1 Decontamination ..... 13

## TABLE OF CONTENTS

**(Continued)**

### TABLES

1. Remedial Investigation Field and Quality Control Sampling Summary

2. Preservation, Holding Times and Sample Containers

### ATTACHMENTS

1. Roux Associates' Standard Operating Procedure for Tasks Described in this Field Sampling Plan

2. Chain of Custody Form

3. Low Stress (Low Flow) Purging and Sampling Procedures for the Collection of Groundwater Samples From Monitoring Wells

## 1.0 INTRODUCTION

Roux Associates, Inc. (Roux Associates) has continued remediation under the Remedial Action Work Plan (RAWP), dated June 2014, and developed a Sampling Plan to further determine the extent and remedy of potential environmental impacts at 153 2nd Street, Brooklyn, New York (Site). This Field Sampling Plan (FSP) was developed to describe in detail the methods and procedures to be followed by field personnel during the implementation of the fieldwork associated with the Site Management Plan (SMP).

The FSP was prepared in accordance with directives provided in the DER-10 Technical Guidance for Site Investigation and Remediation (May 2010) issued by the New York State Department of Environmental Conservation (NYSDEC), as well as relevant NYSDEC Technical and Administrative Guidance Memoranda (TAGMs), and provides guidelines and procedures to be followed by field personnel during performance of the SMP. Information contained in this FSP relates to sampling objectives, sampling locations, sampling frequencies, sample designations, sampling equipment, sample handling, sample analysis, and decontamination.

## 2.0 SAMPLING OBJECTIVES

This FSP was developed based upon a detailed review of available information obtained during previous investigations and ongoing remediation and is designed to obtain the additional data necessary to achieve the objectives of the SMP. This FSP describes in detail the sampling and data gathering methods to be used during implementation of the SMP.

The sampling procedures associated with tasks outlined in the SMP are discussed in detail in Section 4 of this FSP. A discussion of the data quality objectives (DQOs) is provided in the Quality Assurance Project Plan (QAPP) located in Appendix I of the RAWP.

## 3.0 SAMPLE MEDIA, LOCATIONS, ANALYTICAL SUITES, AND FREQUENCY

The media to be sampled during the Remediation include soil, concrete, water, decontamination rinse water, and wipe test samples. Sampling locations, analytical suites, and frequency vary by medium. A discussion of the sampling method for each medium is provided below, while the assumed number of field samples to be collected for each medium, including quality control (QC) samples, is shown in Table 1. Specifics regarding the collection of samples at each location and for each task are provided in Section 4 of this FSP.

### 3.1 Soil Sampling

Waste characterization soil samples will need to be collected, during excavation and trenching for utilities during redevelopment construction. In the event these need to be collected, samples will be analyzed for:

- Target Compound List (TCL) VOCs;
- TCL SVOCs;
- PCBs;
- Herbicides;
- TCL Pesticides;
- Total Cyanide;
- Paint Filter;
- Toxicity Characteristics Leaching Procedure (TCLP) Resource Conservation and Recovery Act (RCRA) Metals;
- TCLP Mercury; and
- RCRA Characteristics.

All soil samples will be analyzed at a laboratory with a current New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) Contract Laboratory Protocol (CLP) certification for each of the parameters noted above. Samples will be analyzed on a standard (5-day) turnaround time. Analytical results will be reported as Category B data deliverables.

### 3.2 Groundwater Sampling

There are six (6) monitoring wells at the Site, and five (5) additional monitoring wells are proposed to be installed during remediation. All wells will be gauged using an electronic interface probe capable of detecting Non-Aqueous Phase Liquid (NAPL) with an accuracy of +/- 0.01 feet. If sampling is necessary, groundwater samples will be collected from those wells that do not exhibit any signs of NAPL. Groundwater samples will be analyzed for:

- TCL VOCs;
- TCL SVOCs;
- TAL Metals;
- PCBs;
- TCL Pesticides; and
- Total Cyanide.

Field parameters, including temperature, pH, conductivity, redox potential, dissolved oxygen, and turbidity will also be measured.

All Groundwater samples will be analyzed at a laboratory with a current NYSDOH ELAP CLP certification for each of the parameters noted above. Samples will be analyzed on a standard turnaround time and will be reported as Category B data deliverables.

### 3.3 Concrete Sampling

The Site subsurface is known to contain historic fill containing large pieces of concrete debris and concrete slabs. Due to the large volume of concrete expected to be encountered, concrete samples will need to be collected to determine suitability for reuse or offsite disposal. All concrete samples will be analyzed for:

- Part 375 VOCs;
- Part 375 SVOCs;
- Part 375 Metals;
- Part 375 Pesticides;

- PCBs;
- Total Cyanide;
- Silvex; and
- Hex/Tri Chromium.

All concrete samples will be analyzed at a laboratory with a current NYSDOH ELAP CLP certification for each of the parameters noted above. Samples will be analyzed on a standard turnaround time and will be reported as Category B data deliverables.

### 3.4 Effluent Water Sampling

Excavation may reach beyond the water table and dewatering will be necessary. Groundwater will be pumped from excavations, processed through onsite WTS, and discharged to onsite dry well. An effluent water sample will be collected once a week, during periods of high dewatering volume. Each water sample will be analyzed for:

- TCL VOCs;
- TCL SVOCs;
- TAL Metals;
- PCBs;
- TCL Pesticides; and
- Total Cyanide.

All water samples will be analyzed at a laboratory with a current NYSDOH ELAP CLP certification for each of the parameters noted above. Samples will be analyzed on a standard turnaround time and will be reported as Category B data deliverables.

### 3.5 Decontamination Rinse Water Sampling

Decontamination of onsite equipment prior to demobilization offsite will include a cleaning solvent or diesel spray and high-powered pressure washer. All rinse water generated during decontamination activities will be containerized into 55-gallon drums and one composite sample will be collected at a frequency of 1 per 20 drums. All equipment decontamination rinse water samples will be analyzed for PCBs.

All water samples will be analyzed at a laboratory with a current NYSDOH ELAP CLP certification for each of the parameters noted above. Samples will be analyzed on a standard turnaround time and will be reported as Category B data deliverables.

## 4.0 FIELD INVESTIGATION PROCEDURES

This section provides a detailed discussion of the field procedures to be followed during the sampling of each media described in Section 3.0 of the FSP.

Roux Associates' Standard Operating Procedures (SOPs) that are relevant to this scope of work are included in Attachment 1 and will be referenced where applicable. Additional information regarding QA/QC protocols and methods may be found in the QAPP (Appendix I of the RAWP).

### 4.1 Soil Waste Characterization Samples

Procedures for the collection of soil waste characterization samples are provided below.

One waste characterization sample will be collected per 500 cubic yards (CY) of soil excavated for redevelopment purposes. Waste characterization sample will be collected as a 5-point composite to ensure a representative sample is collected. Each sample, upon collection, will immediately be placed into a Zip-loc™ bag. After a minimum of 15 minutes for equilibration with the headspace in the Zip-loc™ bag, the soil was screened for VOCs using a PID. Following PID screening, soil samples will be placed into pre-cleaned sample jars and placed on ice in a cooler at 4°C.

Additional details regarding soil sampling protocols are described in Roux Associates' Standard Operating Procedure for the Collection of Soil Samples for Laboratory Analysis, which is provided in Attachment 1.

### 4.2 Groundwater Sampling

To characterize groundwater flow and quality conditions, following well installation and development, the entire network of monitoring wells will be gauged. If needed, groundwater samples will be collected no sooner than two weeks following development of the wells. As part of the gauging event, water-level measurements will be recorded for all monitoring wells to further define groundwater flow patterns beneath the Site. The wells will be gauged using an electronic oil/water interface probe capable of detecting an LNAPL thickness of 0.01 feet.

Groundwater samples will be collected from all wells that do not contain NAPL or NAPL sheen. To ensure groundwater samples collected are representative of the conditions in the surrounding

aquifer, monitoring wells will be purged prior to sample collection using low flow sampling procedures as outlined in USEPA document titled "Low Stress (Low Flow) Purging and Sampling Procedures for the Collection of Groundwater Samples From Monitoring Wells" (USEPA, 2010) (Attachment 3). Additional details for the collection of groundwater samples are included in Roux Associates SOPs (Attachment 1).

### 4.3 Concrete Sampling

Procedures for the collection of concrete samples from concrete debris uncovered during excavation are outlined below.

Concrete debris is expected to be uncovered during redevelopment and upon receipt of acceptable sample results and NYSDEC approval, may be crushed and reused onsite. To collected a composite concrete sample, pieces will be broken off larger concrete debris with a decontaminated chisel and hammer. For all analyses, other than VOCs, pieces of concrete will be double bagged in Zip-loc™ bags and placed on ice in a cooler at 4°C. Concrete will be milled in the lab prior to analysis. For VOC analysis, concrete will be broken into pieces smaller than 0.25 inches, to prevent the need for lab milling and the volatilization of any potential VOCs. Concrete for VOC analysis will be placed into 8-oz pre-cleaned sample jars and placed on ice in a cooler at 4°C. Chisel and hammer will be decontaminated between each sample.

### 4.4 Effluent Water Sampling

Effluent water samples will be collected during dewatering activities. Water samples will be collected from an effluent spout located at the end of the WTS, before discharge. Samples will be collected in pre-cleaned sample jars and placed on ice in a cooler at 4°C.

### 4.5 Decontamination Rinse Water Sampling

Decontamination rinse water equipment decontamination, will be containerized into 55-gallon drums for disposal. Once water is transferred into drums, a composite sample will be collected from five drums. To ensure a representative sample is collected, samples will be collected via bailer. Samples will be collected in pre-cleaned sample jars and placed in a cooler at 4°C.

### 4.6 Wipe Test Sampling

After decontamination and prior to demobilization of WTS equipment, one wipe test sample will be collected from each tank or vessel, in the area showing greatest sign of contamination. Wipe test sample will be completed used a sterile gauze pad, dipped in a solvent of acetone and hexane. Gauze pad will wipe an area of 100 $cm^2$, with the use of a lab provided template guide. Once the target area has been sufficiently wiped, gauze pad is placed into pre-cleaned 8-oz sample jar and place into a cooler at 4°C.

## 5.0 SAMPLE HANDLING AND ANALYSIS

To ensure quality data acquisition and collection of representative samples, there are selective procedures to minimize sample degradation or contamination. These include procedures for preservation of the samples as well as sample packaging and shipping procedures.

### 5.1 Field Sample Handling

A detailed discussion of the number and types of samples to be collected during each task, as well as the analyses to be performed can be found in Section 3.0 of this FSP. The types of containers, volumes needed, and preservation techniques for the aforementioned testing parameters are presented in Table 2.

### 5.2 Sample Custody Documentation

The purpose of documenting sample custody is to confirm that the integrity and handling of the samples is not subject to question. Sample custody will be maintained from the point of sampling through the analysis. Specific procedures regarding sample tracking from the field to the laboratory are described in Roux Associates' SOP for Sample Handling (Attachment 1).

Each individual collecting samples is personally responsible for the care and custody of the samples. All sample labels should be pre-printed or filled out using waterproof ink. The technical staff will review all field activities with the Field Team Leader to determine whether proper custody procedures were followed during the fieldwork and to decide if additional samples are required.

All samples being shipped off-site for analysis must be accompanied by a properly completed chain of custody form (Attachment 2). The sample numbers will be listed on the chain of custody form. When transferring the possession of samples, individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to/from a secure storage area, and to the laboratory.

Samples will be packaged for laboratory pick up and/or shipment with a separate signed custody record enclosed in each sample box or cooler. Shipping containers will be locked and/or secured with strapping tape in at least two locations for shipment to the laboratory.

### 5.3 Sample Shipment

Laboratory courier services will be used for the majority of sample transport on this project. However, in the event that samples are shipped to the laboratory the following procedures will apply. Sample packaging and shipping procedures are based upon USEPA specifications, as well as U.S. Department of Transportation (DOT) regulations. The procedures vary according to potential sample analytes, concentration, and matrix, and are designed to provide optimum protection for the samples and the public. Sample packaging and shipment must be performed using the general outline described below. Additional information regarding sample handling is provided in Roux Associates' SOP for Sample Handling (Attachment 1).

All samples will be shipped within 12 hours of collection (when possible) and will be preserved appropriately from the time of sample collection. A description of the sample packing and shipping procedures is presented below:

1. Prepare cooler(s) for shipment.
    - Tape drain(s) of cooler shut;
    - Affix "This Side Up" arrow labels and "Fragile" labels on each cooler; and
    - Place mailing label with laboratory address on top of cooler(s).
2. Arrange sample containers in groups by sample number or analyte.
3. Ensure that all bottle labels are completed correctly. Place clear tape over bottle labels to prevent moisture accumulation from causing the label to peel off.
4. Arrange containers in front of assigned coolers.
5. Place packaging material at the bottom of the cooler to act as a cushion for the sample containers.
6. Arrange containers in the cooler so that they are not in contact with the cooler or other samples.
7. Fill remaining spaces with packaging material.
8. Ensure all containers are firmly packed with packaging material.
9. If ice is required to preserve the samples, ice cubes should be repackaged in double Zip-Lock™ bags, and placed on top of the packaging material.

10. Sign chain of custody form (or obtain signature) and indicate the time and date it was relinquished to Federal Express or other carrier, as appropriate.

11. Separate chain of custody forms. Seal proper copies within a large Zip-Lock™ bag and tape to cooler. Retain copies of all forms.

12. Close lid and latch.

13. Secure each cooler using custody seals.

14. Tape cooler shut on both ends.

15. Relinquish to Federal Express or other courier service as appropriate. Retain airbill receipt for project records. (Note: All samples will be shipped for "NEXT A.M." delivery).

16. Telephone laboratory contact and provide him/her with the following shipment information:

    - sampler's name;
    - project name;
    - number of samples sent according to matrix and concentration; and
    - airbill number.

## 6.0 SITE CONTROL PROCEDURES

Site control procedures, including decontamination and waste handling and disposal, are discussed below.

### 6.1 Decontamination

In an attempt to avoid the spread of contamination, all sampling equipment must be decontaminated at a reasonable frequency in a properly designed and located decontamination area. Detailed procedures for the decontamination of field and sampling equipment are included in Roux Associates' SOPs for the Decontamination of Field Equipment, which is provided in Attachment 1. The location of the decontamination area will be determined prior to the start of field operations. The decontamination area will be constructed to ensure that all wash water generated during decontamination can be collected and containerized for proper disposal.

Table 1. Remedial Investigation Field and Quality Control Sampling Summary, Field Sampling Plan, Revised Remedial Investigation Work Plan
Former Paragon Paint Manufacturing Facility, Long Island City, NY

| Sample Medium | Target Analytes | Field Samples | Replicates[1] | Trip Blanks[2] | Field Blanks[3] | Matrix Spikes[1] | Spike Duplicates[1] | Total No. of Samples |
|---|---|---|---|---|---|---|---|---|
| Endpoint Confirmation/RMZ | Part 375 VOCs | 15 | 1 | 7 | 7 | 1 | 1 | 32 |
| | Part 375 SVOCs | 15 | 1 | NA | 7 | 1 | 1 | 25 |
| | Part 375 Metals | 15 | 1 | NA | 7 | 1 | 1 | 25 |
| | Part 375 Pesticides | 15 | 1 | NA | 7 | 1 | 1 | 25 |
| | PCBs | 41 | 3 | NA | 11 | 3 | 3 | 61 |
| | Total Cyanide | 15 | 1 | NA | 7 | 1 | 1 | 25 |
| | Silvex | 15 | 1 | NA | 7 | 1 | 1 | 25 |
| | Hex/Tri Chromium | 15 | 1 | NA | 7 | 1 | 1 | 25 |
| Waste Characterization | TCL VOCs | 7 | 1 | 5 | 3 | 1 | 1 | 18 |
| | TCL SVOCs | 7 | 1 | NA | 3 | 1 | 1 | 13 |
| | PCBs | 7 | 1 | NA | 3 | 1 | 1 | 13 |
| | Herbicides | 7 | 1 | NA | 3 | 1 | 1 | 13 |
| | TCL Pesticides | 7 | 1 | NA | 3 | 1 | 1 | 13 |
| | Total Cyanide | 7 | 1 | NA | 3 | 1 | 1 | 13 |
| | TCLP Metals | 7 | 1 | NA | 3 | 1 | 1 | 13 |
| | TCLP Mercury | 7 | 1 | NA | 3 | 1 | 1 | 13 |
| | RCRA Characteristics | 7 | 1 | NA | 3 | 1 | 1 | 13 |
| Concrete | Part 375 VOCs | 28 | 2 | 2 | 4 | 2 | 2 | 40 |
| | Part 375 SVOCs | 28 | 2 | NA | 4 | 2 | 2 | 38 |
| | Part 375 Metals | 28 | 2 | NA | 4 | 2 | 2 | 38 |
| | Part 375 Pesticides | 28 | 2 | NA | 4 | 2 | 2 | 38 |

Table 1. Remedial Investigation Field and Quality Control Sampling Summary, Field Sampling Plan, Revised Remedial Investigation Work Plan
Former Paragon Paint Manufacturing Facility, Long Island City, NY

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Concrete | PCBs | 28 | 2 | NA | 4 | 2 | 2 | 38 |
| | Total Cyanide | 28 | 2 | NA | 4 | 2 | 2 | 38 |
| | Silvex | 28 | 2 | NA | 4 | 2 | 2 | 38 |
| | Hex/Tri Chromium | 28 | 2 | NA | 4 | 2 | 2 | 38 |
| Effluent Water | TCL VOCs | 14 | NA | NA | NA | NA | NA | 14 |
| | TCL SVOCs | 14 | NA | NA | NA | NA | NA | 14 |
| | TAL Metals | 14 | NA | NA | NA | NA | NA | 14 |
| | PCBs | 14 | NA | NA | NA | NA | NA | 14 |
| | TCL Pesticides | 14 | NA | NA | NA | NA | NA | 14 |
| | Total Cyanide | 14 | NA | NA | NA | NA | NA | 14 |
| Decontamination Rinse Water and WTS Media | PCBs | 15 | NA | NA | NA | NA | NA | 15 |
| | Arsenic | 10 | NA | NA | NA | NA | NA | 10 |
| Wipe Test | PCBs | 20 | NA | NA | NA | NA | NA | 20 |

Notes:

[1] Based on 1 per 20 samples

[2] Based on 1 cooler per day

[3] Based on 1 per day

TCL - USEPA Contract Laboratory Program Target Compound List

VOCs - Volatile Organic Compounds

SVOCs - Semivolatile Organic Compounds

PCBs - Polychlorinated Biphenyls

TAL - USEPA Contract Laboratory Program Target Analyte List

NA - Not applicable

Table 2. Preservation, Holding Times and Sample Containers, Field Sampling Plan, Revised Remedial Investigation Work Plan
Former Paragon Paint Manufacturing Facility, Long Island City, NY

| Analysis | Sample Medium | Bottle Type | Preservation[(a)] | Holding Time[(b)] |
|---|---|---|---|---|
| Part 375/TCL VOCs | Soil | En Core® Sampler | Cool to 4°C | 14 days from sample collection |
| | Water | 3- 40 ml glass, Teflon lined cap | Cool to 4°C, HCL | 14 days from sample collection |
| | Concrete | 8 oz wide mouth glass, Teflon lined cap | Cool to 4°C | 14 days from sample collection |
| Part 375/TCL SVOCs | Soil | 8 oz wide mouth glass, Teflon lined cap | Cool to 4°C | 14 days to extract, 40 days to analysis |
| | Water | 2- 1 liter amber glass, Teflon lined cap | Cool to 4°C | 7 days to extract, 40 days to analysis |
| | Concrete | Zip-loc™ bag | Cool to 4°C | 14 days to extract, 40 days to analysis |
| Part 375/TAL Metals | Soil | 8 oz wide mouth glass, Teflon lined cap | Cool to 4°C | 180 days, Hg 28 days |
| | Water | 500 ml plastic, Teflon lined cap | Cool to 4°C, Nitric Acid | 180 days, Hg 28 days |
| | Concrete | Zip-loc™ bag | Cool to 4°C | 180 days, Hg 28 days |
| PCBs | Soil | 8 oz wide mouth glass, Teflon lined cap | Cool to 4°C | 14 days to extract, 40 days to analysis |
| | Water | 2- 1 liter amber glass, Teflon lined cap | Cool to 4°C | 7 days to extract, 40 days to analysis |
| | Concrete | Zip-loc™ bag | Cool to 4°C | 14 days to extract, 40 days to analysis |
| | Wipe | 8 oz wide mouth glass, Teflon lined cap | Cool to 4°C | 14 days to extract, 40 days to analysis |
| | Soil | 8 oz wide mouth glass, Teflon lined cap | Cool to 4°C | 14 days to extract, 40 days to analysis |

Table 2. Preservation, Holding Times and Sample Containers, Field Sampling Plan, Revised Remedial Investigation Work Plan
Former Paragon Paint Manufacturing Facility, Long Island City, NY

| | | | | |
|---|---|---|---|---|
| Part 375/TCL Pesticides | Water | 2- 1 liter amber glass, Teflon lined cap | Cool to 4°C | 7 days to extract, 40 days to analysis |
| | Concrete | Zip-loc™ bag | Cool to 4°C | 14 days to extract, 40 days to analysis |
| Total Cyanide | Soil | 8 oz wide mouth glass, Teflon lined cap | Cool to 4°C | 14 days from sample collection |
| | Water | 250 mL Plastic | Cool to 4°C, Sodium Hydroxide | 14 days from sample collection |
| | Concrete | Zip-loc™ bag | Cool to 4°C | 14 days from sample collection |
| Herbicides/Silvex | Soil | 8 oz wide mouth glass, Teflon lined cap | Cool to 4°C | 14 days to extract, 40 days to analysis |
| | Concrete | Zip-loc™ bag | Cool to 4°C | 14 days to extract, 40 days to analysis |
| Hex/Tri Chromium | Soil | 8 oz wide mouth glass, Teflon lined cap | Cool to 4°C | 180 days |
| | Concrete | Zip-loc™ bag | Cool to 4°C | 30 days to extract, 7 days to analysis |

Notes:

[a] All soil and groundwater samples to be preserved in ice immediately after collection and during transport

[b] Days from date of sample collection.

TAL - Target analyte List

TCL - Target Compound List

oz - Ounces

ml - Milliliters

HCL - Hydrochloric acid

**Attachment 1**

# Roux Associates' Standard Operating Procedure for Tasks Described in this Field Sampling Plan

Date: May 5, 2000

## 1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to explain the quality control (QC) measures taken to ensure the integrity of the samples collected and to establish the guidelines for the collection of QC samples. The objective of the QC program is to ensure that water-quality data of known and reliable quality are developed.

Because valid water-chemistry data are integral to a hydrogeologic investigation that characterizes water-quality conditions, the data will be confirmed by QC samples. Without checks on the sampling and analytical procedures, the potential exists for contradictory or incorrect results. The acceptance of water-quality data by regulatory agencies and in litigation-support investigations depends heavily on the proper QC program to justify the results presented. The QC sampling requirements must be determined by the project manager and be clearly defined in the work plan. If data validation (for in-house purposes or for compliance with the United States Environmental Protection Agency [USEPA] regulations) is stipulated as part of the hydrogeologic investigation, QC sampling must be conducted.

## 2.0 QUALITY CONTROL SAMPLES

2.1 Samples taken for analysis of compounds require the use of quality control samples to monitor sampling activities and laboratory performance. Types of quality control samples may include replicate and/or replicate split, trip blank, field equipment blank, matrix spike and matrix spike duplicate, and fortification. A discussion pertaining to each quality control sample follows:

a. Replicate and Replicate Split - Replicate sample analysis is done to check on the reproducibility of results either within a laboratory or between laboratories. A replicate sample is called a split sample when it is collected with or turned over to a second party (e.g., regulatory agency, consulting firm) for an independent analysis. Replicate samples are aliquots (equal portions) from a sample in a common container.

To collect a replicate sample, water from the bailer or pump will be distributed first to fill one container and then to fill the second container. Adequate water should be available to fill the bottles completely before they are capped. If the water is insufficient to fill all the bottles at once, then incrementally fill each bottle with water from two or more bailer volumes or pump cycles.

For some test substances, water may have to be accumulated in a common container and then decanted slowly into the sample bottles. The work plan should be checked for a description of how replicate samples are to be collected. Additionally, in the case of wells that recover slowly and produce insufficient water to fill all the replicate sample containers, the

containers should be filled incrementally and kept on ice in the cooler in between filling periods.

b. Trip Blank - A trip blank sample is a sample bottle that is filled with "clean" (e.g., distilled/deionized) water in the laboratory, and travels unopened with the sample bottles. (The USEPA now uses the phrase "demonstrated analyte free water.") It is opened in the laboratory and analyzed along with the field samples for the constituent(s) of interest to detect if contamination has occurred during field handling, shipment, or in the laboratory. Trip blanks are primarily used to check for "artificial" contamination of the sample caused by airborne volatile organic compounds (VOCs) but may also be used to check for "artificial" contamination of the sample by a test substance or other analyte(s). One trip blank per cooler containing VOC samples, or test substance of other analyte(s) of interest would accompany each day's samples.

c. Field Equipment Blank - A field equipment blank (field blank) sample is collected to check on the sampling procedures implemented in the field. A field blank is made with "clean" (e.g., distilled/deionized/demonstrated analyte free) water by exposing it to sampling processes (i.e., the clean water must pass through the actual sampling equipment). For example, if samples are being collected with a bailer, the field blank would be made by pouring the clean water into a bailer which has been decontaminated and is ready for sampling, and then pouring from the bailer into the sample containers. If a metals equipment blank is to be made, and the water was filtered, then the sample must be filtered (i.e., exposed to the sampling process). One equipment blank would be incorporated into the sampling program for each day's collection of samples and analyzed for the identical suite of constituents as the sample. In some situations one equipment blank will be required for each type of sampling procedure (e.g., split-spoon, bailer, hand auger).

A special type of field blank may be needed where ambient air quality may be poor. This field blank sample would be taken to determine if airborne contaminants will interfere with constituent identification or quantification. This field blank sample is a sample bottle that is filled and sealed with "clean" (e.g., distilled/deionized/demonstrated analyte free) water in the analytical laboratory, and travels unopened with the sample bottles. It is opened in the field and exposed to the air at a location(s) to check for potential atmospheric interference(s). The field blank is resealed and shipped to the contract laboratory for analysis.

d. Matrix Spike and Matrix Spike Duplicate - Spikes of compounds (e.g., standard compound, test substance, etc.) may be added to samples in the laboratory to determine if the ground-water matrix is interfering with constituent identification or quantification, as well as a check for systematic errors and lack of sensitivity of analytical equipment. Samples

for spikes are collected in the identical manner as for standard analysis, and shipped to the laboratory for spiking. Matrix spike duplicate sample collection, and laboratory spiking and analysis is done to check on the reproducibility of matrix spike results.

e. Fortification - A fortification, which is performed in the field, is used to check on the laboratory's ability to recover the test substance (analyte) added as well as its stability between fortification and analysis.

A field fortification (spike) is prepared by filling the container(s) with field or distilled/deionized/demonstrated analyte free water (as specified by the laboratory) to a predetermined volume (as specified by the laboratory) and adding the spike (supplied by the laboratory). The predetermined volume of water is measured with a clean (decontaminated) graduated cylinder. Field spikes will be prepared following the collection, labeling, and sealing of nonspiked samples in a separate cooler. The spike is kept at a safe distance from the sampling point (e.g., in the hotel room).

2.2 The work plan must be referred to for details regarding the type of QC samples to be collected and the QC sample collection method.

## 3.0 PROCEDURE

3.1 Implement QC sampling as outlined above, depending on the type of QC sample(s) specified in the work plan.

3.2 Ensure unbiased handling and analysis of replicate and blank QC samples by concealing their identity by means of coding so that the analytical laboratory cannot determine which samples are included for QC purposes. Attempt to use a code that will not cause confusion if additional samples are collected or additional monitoring wells are installed. For example, if there are three existing monitoring wells (MW-1, 2 and 3), do not label the QC blank MW-4. If an additional monitoring well were installed, confusion could result.

3.3 Label matrix spike and field fortification (spike) QC samples so that the analytical laboratory knows which samples are to be spiked in the laboratory and which samples were fortified (spiked) in the field, respectively. In certain situations, the field fortification will be "blind" or undisclosed to the laboratory to independently verify their analytical ability.

3.4 Verify that each sample is placed in an individual "zip-lock" bag, wrapped with "bubble wrap," and placed in its appropriate container (holder) in the cooler, and that the cooler has sufficient ice (wet ice or blue packs) to preserve the samples for transportation to the analytical laboratory. Consult the site work plan to determine if a particular ice is specified as the preservative for transportation (e.g., the USEPA prefers the use of wet ice because they claim that blue ice will not hold the samples at 4° Centigrade/Celsius).

3.5 Document the QC samples on the appropriate field form and in the field notebook. On the chain-of-custody form, replicate and blank QC samples will be labeled using the codes (Number 3.2, above), and matrix spike and field fortification QC samples will be identified as such (Number 3.3, above).

3.6 Follow standard shipping procedures for samples (i.e., retain one copy of the chain-of-custody form, secure the cooler with sufficient packing tape and a custody seal, forward the samples via overnight [express] mail or hand deliver to the designated analytical laboratory preferably within 24 hours but no later than 48 hours after sampling). However, check the site work plan for information on the analyte(s), as some have to be analyzed immediately (e.g., CN).

END OF PROCEDURE

Date: May 5, 2000
Revision: April 7, 2015

## 1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide procedures and standards for record keeping and maintenance, for all field activities conducted by Roux Associates, Inc. (Roux Associates).

Strict quality assurance/quality control (QA/QC) is necessary to properly and accurately document and preserve all project-related information. Quality assurance is implemented to corroborate that quality control procedures are followed. Quality control provides a means to monitor investigation activities (e.g., sampling and laboratory performance) as a check on the quality of the data.

Valid data and information are integral to all aspects of Roux Associates' field activities. These aspects include, but are not necessarily limited to, activities that involve: drilling; sediment, sludge, and soil sampling (lithologic, and soil-quality and analysis); well construction and development; aquifer testing and analysis; water-quality sampling and analysis (surface water and ground water); free-product sampling and analysis; air-quality sampling and analysis; geophysical testing; demolition activities; waste removal operations; engineering installations; etc. The data will be confirmed by QA/QC methods established and set forth in the work plan/scope of work. Without checks on the field and analytical procedures, the potential exists for contradictory results, and associated incomplete or incorrect results from the interpretation of potentially questionable data.

Documentation will be entered in a bound field notebook and must be transcribed with extreme care, in a clear and concise manner, as the information recorded will become part of the permanent legal record. Field notes are considered the legal record of site activities, and as such they must be taken in a standard and consistent manner. If abbreviations are used, then they must first be spelled out for clarity (i.e., to avoid ambiguity and misunderstanding). All entries must be dated and initialed, and the time (military time) of the entry included. Field notebooks and forms must be assigned to an individual project and properly identified (i.e., client name, project number, location and name of site, individual recording information, dates, times, etc.). Change of possession of field notebooks or forms must be documented with the date and time, and initialed by both individuals. Following each day's entries, the field notebook or form must be photocopied in the event that the original documentation is lost or stolen. All field notebooks must have the company name and address legibly printed in indelible ink along with the message "If found, then please forward to Roux Associates, Inc. at the above address - REWARD OFFERED."

Information must be recorded while onsite because it may be difficult to recall details at a later date. Furthermore, information must be documented immediately as it provides unbiased information which will be used for writing the report when the field activities are completed. Project-related documentation is an irreplaceable, important record for

other individuals who may become involved in the project, and provides the project manager with a complete history of project-related activities. Written information must be accompanied by maps, sketches, and photographs where appropriate, especially if these supplemental sources of information assist in the documentation process. A new page must be used in the field notebook for each new day's entries (i.e., unused portions of a previous page must have an "X" placed through it). The end of the day's records must be initialed and dated.

As part of record keeping and QA/QC activities, state and federal regulatory agencies should be contacted to check if special or different protocols are required and/or if particular or unconventional methods are required for the given field activity. Thus, the record keeping and QA/QC activities implemented by Roux Associates are based on technically sound standard practices and incorporate Roux Associates own, extensive experience in conducting environmental field activities.

## 2.0 MATERIALS

In order to track investigation activities, specific materials are required. These materials include the following:

a. A bound, waterproof field notebook.

b. Appropriate Roux Associates' or project-specific forms (e.g., daily log, geologic log, monitoring well construction log, well sampling data form, location sketch, chain of custody, telephone conversation record, meeting notes, etc.).

c. Appropriate labels (e.g., sample, Roux Associates' Custody Seal, etc.)

d. Approved work plan/scope of work.

e. Health and safety plan (HASP).

f. Appropriate Roux Associates' SOPs.

g. Black pens, and indelible markers.

h. Digital camera.

## 3.0 DOCUMENTATION

3.1 Before the Roux Associates personnel leave the field, they must ensure that their field notes include comprehensive descriptions of the hydrogeologic conditions, and all investigation-related activities and results (onsite and offsite). This will safeguard against the inability to reconstruct and comprehend all aspects of the field investigation after its completion, and will serve to facilitate the writing of an accurate report. Properly documented information provides the QA/QC tracking (back-up) required for all Roux Associates' projects. General types of information

that must be recorded (where pertinent to the investigation being conducted) include, but may not necessarily be limited to, the following:

a. List of Roux Associates personnel on site.

b. Name, date, and time of arrival on site by Roux Associates personnel, including temporary departures from, and returns to, the site during the work day.

c. Client and project number.

d. Name and location of study area.

e. Date and time of arrival on site by non-Roux Associates personnel (names and affiliation) and equipment (e.g., subcontractors and facility personnel, and drilling equipment, respectively, etc.), including temporary departures from, and returns to, the site during the work day, and departure at the end of the work day.

f. List of non-Roux Associates personnel (e.g. subcontractors, client representatives) on site.

g. Weather conditions at the beginning of the day as well as any changes in weather that occur during the working day.

h. Health and safety procedures including level of protection, monitoring of vital signs, frequency of air monitoring, and any change (i.e., downgrade or upgrade) in the level of protection for Roux Associates and other on-site personnel (e.g., subcontractors, facility personnel, etc.).

i. Health and safety procedures not in compliance with the HASP (for all on-site personnel).

j. Site reconnaissance information (e.g., topographic features, geologic features, surface-water bodies, seeps, areas of apparent contamination, facility/plant structures, etc.).

k. Air monitoring results (i.e., photoionization detector [PID], etc. measurements).

l. Task designation and work progress.

m. Work-related and site-related discussions with subcontractors, regulatory agency personnel, facility personnel, the general public, and Roux Associates personnel.

n. Delays, unusual situations, problems and accidents.

o. Field work not conducted in accordance with the work plan/scope of work, and rationale and justification for any change(s) in field procedures including discussions with personnel regarding the change(s) and who authorized the change(s).

p. QA/QC procedures not conducted in accordance with the QA/QC procedures established in the work plan/scope of work and rationale and justification for any change(s) in QA/QC procedures including discussions with personnel regarding the change(s) and who authorized the change(s).

q. Equipment and instrument calibration information, results and/or problems.

r. Decontamination and calibration procedures.

s. Activities in and around the site and work area by any and all on-site personnel which may impact field activities.

t. Sketches, maps, and/or photographs (with dates and times) of the site, structures, equipment, etc. that would facilitate explanations of site conditions.

u. Contamination evidenced as a result of work-related activities (e.g., visible contaminants [sheen] in drilling fluids or on drilling equipment; sheen on, or staining of, sediments; color of, or separate [nonaqueous] phase on, water from borehole or well; vapors or odors emanating from a borehole or well; etc.). Logbook entries should be objective, factual, and free of personal feelings or other terminology which might prove inappropriate. Avoid using nontechnical or subjective terms (e.g., , oily, strong-smelling).

v. Date and time of final departure from the site of all personnel at the end of the work day.

3.2 Pens with permanent ink will be used to record all data. Data or other information that has been entered incorrectly will be corrected by drawing a line through the incorrect entry and **initialing and dating** the linedthrough entry. Under no circumstances should the incorrect material be erased, made illegible or obscured so that it cannot be read.

3.3 In addition to the general types of information that must be recorded (as presented in Section 3.1), task-specific information must also be properly documented. Task-specific information which is required is provided in each respective task-oriented SOP, and the documentation procedures outlined in each SOP must be followed.

END OF PROCEDURE

Date: May 5, 2000
Revision: April 16, 2015

# 1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for sample handling and management which will allow consistent and accurate results. Valid chemistry data are integral to investigations that characterize media-quality conditions. This SOP is designed to ensure that once samples are collected, they are preserved, packed and delivered in a manner which will maintain sample integrity. The procedures outlined are applicable to most sampling events and any required modifications must be clearly described in the work plan.

# 2.0 CONSIDERATIONS

Sample containers, sampling equipment decontamination, quality assurance/quality control (QA/QC), sample preservation, and sample handling are all components of this SOP.

## 2.1 Sample Containers

Prior to collection of a sample, considerations must be given to the type of container that will be used to store and transport the sample. The type and number of containers selected is usually based on factors such as sample matrix, potential contaminants to be encountered, analytical methods requested, and the laboratory's internal quality assurance requirements. In most cases, the overriding considerations will be the analytical methodology, or the state or federal regulatory requirements because these regulations generally encompass the other factors. The sample container selected is usually based on some combination of the following criteria:

a. Reactivity of Container Material with Sample

Choosing the proper composition of sample containers will help to ensure that the chemical and physical integrity of the sample is maintained. For sampling potentially hazardous material, glass is the recommended container type because it is chemically inert to most substances. Plastic containers are not recommended for most hazardous wastes because the potential exists for contaminants to adsorb to the surface of the plastic or for the plasticizer to leach into the sample.

In some instances, however, the sample characteristics or analytes of interest may dictate that plastic containers be used instead of glass. Because some metals species will adhere to the sides of the glass containers in an aqueous matrix, plastic bottles (e.g., nalgene) must be used for samples collected for metals analysis. A separate, plastic container should accompany glass containers if metals analysis is to be

performed along with other analyses. Likewise, other sample characteristics may dictate that glass cannot be used. For example, in the case of a strong alkali waste or hydrofluoric solution, plastic containers may be more suitable because glass containers may be etched by these compounds and create adsorptive sites on the container's surface.

b. Volume of the Container

The volume of sample to be collected will be dictated by the analysis being performed and the sample matrix. The laboratory must supply bottles of sufficient volume to perform the required analysis. In most cases, the methodology dictates the volume of sample material required to complete the analysis. However, individual laboratories may provide larger volume containers for various analytes to ensure sufficient quantities for duplicates or other QC checks.

To facilitate transfer of the sample from the sampler into the container and to minimize spillage and sample disturbance, wide-mouth containers are recommended when not precluded by method requirements. Aqueous volatile organic samples must be placed into 40-milliliter (ml) glass vials with polytetrafluoroethylene (PTFE) (e.g., TeflonTM) septums. Non-aqueous volatile organic samples for "low-level" volatile analysis should be collected in the same type of vials or using EnCore samplers provided by the laboratory. Non-aqueous volatile organic samples for "mid or high-level" volatile analysis may be collected in 4-ounce (oz) wide-mouth jars provided by the laboratory. These jars should have PTFE-lined screw caps.

c. Color of Container

Whenever possible, amber glass containers should be used to prevent photodegradation of the sample, except when samples are being collected for metals analysis. If amber containers are not available, then containers holding samples should be protected from light (i.e., place in cooler with ice immediately after filling).

d. Container Closures

Container closures must screw on and off the containers and form a leak-proof seal. Container caps must not be removed until the container is ready to be filled with the sample, and the container cap must be replaced (securely) immediately after filling it. Closures should be constructed of a material which is inert with respect to the sampled material, such as PTFE (e.g., TeflonTM). Alternately, the closure may be separated from the sample by a closure liner that is inert to the sample material such as PTFE sheeting. If soil or sediment samples are being collected, the threads of the

container must be wiped clean with a dedicated paper towel or cloth so the cap can be threaded properly.

e. Decontamination of Sample Containers

Sample containers must be laboratory cleaned by the laboratory performing the analysis. The cleaning procedure is dictated by the specific analysis to be performed on the sample. Sample containers must be carefully examined to ensure that all containers appear clean. Do not mistake the preservative as unwanted residue. The bottles should not be field cleaned. If there is any question regarding the integrity of the bottle, then the laboratory must be contacted immediately and the bottle(s) replaced.

f. Sample Bottle Storage and Transport

No matter where the sample bottles are, whether at the laboratory waiting to be packed for shipment or in the field waiting to be filled with sample, care must be taken to avoid contamination. Sample shuttles or coolers, and sample bottles must be stored and transported in clean environments. Sample bottles and clean sampling equipment must never be stored near solvents, gasoline, or other equipment that is a potential source of cross-contamination. When under chain of custody, sample bottles must be secured in locked vehicles, and custody sealed in shuttles or in the presence of authorized personnel. Information which documents that proper storage and transport procedures have been followed must be included in the field notebook and on appropriate field forms.

2.2 Decontamination of Sampling Equipment

Proper decontamination of all re-usable sampling equipment is critical for all sampling episodes. The SOP for Decontamination of Field Equipment and SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for decontamination of various types of equipment.

2.3 Quality Assurance/Quality Control Samples

QA/QC samples are intended to provide control over the proper collection and tracking of environmental measurements, and subsequent review, interpretation and validation of generated analytical data. The SOPs for Collection of Quality Control Samples, for Evaluation and Validation of Data, and for Field Record Keeping and Quality Assurance/Quality Control must be referred to for detailed guidance regarding these respective procedures. SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for QA/QC procedures.

2.4 Sample Preservation Requirements

Certain analytical methodologies for specific analytes require chemical additives in order to stabilize and maintain sample integrity. Generally, this is accomplished under the following two scenarios:

a. Sample bottles are preserved at the laboratory prior to shipment into the field.

b. Preservatives are added in the field immediately after the samples are collected.

Many laboratories provide pre-preserved bottles as a matter of convenience and to help ensure that samples will be preserved immediately upon collection. A problem associated with this method arises if not enough sample could be collected, resulting in too much preservative in the sample. More commonly encountered problems with this method include the possibility of insufficient preservative provided to achieve the desired pH level or the need for additional preservation due to chemical reactions caused by the addition of sample liquids to pre-preserved bottles. The use of pre-preserved bottles is acceptable; however, field sampling teams must always be prepared to add additional preservatives to samples if the aforementioned situations occur. Furthermore, care must be exercised not to overfill sample bottles containing preservatives to prevent the sample and preservative from spilling and therefore diluting the preservative (i.e., not having enough preservative for the volume of sample).

When samples are preserved after collection, special care must be taken. The transportation and handling of concentrated acids in the field requires additional preparation and adherence to appropriate preservation procedures. All preservation acids used in the field should be trace-metal or higher-grade.

2.5 Sample Handling

After the proper sample bottles have been received under chain-of-custody, properly decontaminated equipment has been used to collect the sample, and appropriate preservatives have been added to maintain sample integrity, the final step for the field personnel is checking the sample bottles prior to proper packing and delivery of the samples to the laboratory.

All samples should be organized and the labels checked for accuracy. The caps should be checked for tightness and any 40-ml volatile organic compound (VOC) bottles must be checked for bubbles. This can be achieved by gently tapping the bottom of the voa to dislodge potential air bubbles. Each sample bottle must be placed in an individual "zip-lock" bag to protect the label, and placed on ice. Clear packing tape may also be used to protect the integrity of the sample label. The bottles must be carefully packed to prevent breakage during transport. Use of bubble wrap is recommended. When several bottles have been collected for an

individual sample, they should not be placed adjacent to each other in the cooler to prevent possible breakage of all bottles for a given sample. If there are any samples which are known or suspected to be highly contaminated, these should be placed in an individual cooler under separate chain-of-custody to prevent possible cross contamination. Sufficient ice (wet or blue packs) should be placed in the cooler to maintain the temperature at 4 degrees Celsius (°C) until delivery at the laboratory.

Consult the work plan to determine if a particular ice is specified as the preservation for transportation (e.g., the United States Environmental Protection Agency does not like the use of blue packs because they claim that the samples will not hold at 4°C). If additional coolers are required, then they should be purchased.

The chain-of-custody form should be properly completed, placed in a "zip-lock" bag, and placed in the cooler. One copy must be maintained for the project files. The cooler should be sealed with packing tape and a custody seal. The custody seal number should be noted in the field book. Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time. If overnight mail is utilized, then the shipping bill must be maintained for the files and the laboratory must be called the following day to confirm receipt.

## 3.0 EQUIPMENT AND MATERIALS

3.1 General equipment and materials may include, but not necessarily be limited to, the following:

a. Sample bottles of proper size and type with labels.

b. Cooler with ice (wet or blue pack).

c. Field notebook, appropriate field form(s), chain-of-custody form(s), custody seals.

d. Black pen and indelible marker.

e. Packing tape, "bubble wrap", and "zip-lock" bags.

f. Overnight (express) mail forms, and laboratory addres or courier contact information

g. Health and safety plan (HASP).

h. Work plan/scope of work.

i. Pertinent SOPs for specified tasks and their respective equipment and materials.

3.2 Preservatives for specific samples/analytes as specified by the laboratory. Preservatives must be stored in secure, spillproof glass containers with their content, concentration, and date of preparation and expiration clearly labeled.

3.3 Miscellaneous equipment and materials including, but not necessarily limited to, the following:

a. Graduated pipettes.

b. Pipette bulbs.

c. Litmus paper.

d. Glass stirring rods.

e. Protective goggles.

f. Disposable gloves.

g. Lab apron.

h. First aid kit.

i. Portable eye wash station.

j. Water supply for immediate flushing of spillage, if appropriate.

k. Shovel and container for immediate containerization of spillage-impacted soils, if appropriate.

## 4.0 PROCEDURE

4.1 Examine all bottles and verify that they are clean and of the proper type, number, and volume for the sampling to be conducted.

4.2 Label bottles carefully and clearly with project name and number, site location, sample identification, date, time, and the sampler's initials using an indelible marker.

4.3 Collect samples in the proper manner (refer to specific sampling SOPs).

4.4 Conduct preservation activities as required after each sample has been collected. Field preservation must be done immediately and must not be done later than 30 minutes after sample collection.

4.5 Conduct QC sampling, as required.

4.6 Seal each container carefully and place in an individual "zip lock" bag.

4.7 Organize and carefully pack all samples in the cooler immediately after collection (e.g., bubble wrap). Insulate samples so that breakage will not occur.

4.8 Complete and place the chain-of-custody form in the cooler after all samples have been collected. Maintain one copy for the project file. If the cooler is to be transferred several times prior to shipment or delivery to the laboratory, it may be easier to tape the chain-of-custody to the exterior of the sealed cooler. When exceptionally hazardous samples are known or suspected to be present, this should be identified on the chain-of-custody as a courtesy to the laboratory personnel.

4.9 Add additional ice as necessary to ensure that it will last until receipt by the laboratory.

4.10 Seal the cooler with packing tape and a custody seal. Record the number of the custody seal in the field notebook and on the field form. If there are any exceptionally hazardous samples, then shipping regulations should be examined to ensure that the sample containers and coolers are in compliance and properly labeled.

4.11 Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time.

4.12 Maintain the shipping bill for the project files if overnight mail is utilized and call the laboratory the following day to confirm receipt.

END OF PROCEDURE

Date: May 5, 2000

## 1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for using m-scopes. A m-scope is an electronic sounding device used to measure the depth to ground water below an established (surveyed) measuring point (MP). Measuring the depth to water (DTW) below the surveyed MP provides information for calculating ground-water elevations needed to construct ground-water elevation maps and determine the direction of ground-water flow.

M-scopes can be less accurate than a steel tape because the wire can kink, measurement increment marks can shift, and the tip may have been cut off and replaced without proper documentation. Thus, it is mandatory that a m-scope be calibrated before use.

## 2.0 DECONTAMINATION

The m-scope must be pre-cleaned (decontaminated) using a non-phosphate, laboratory-grade solution and rinsed with copious amounts of distilled or deionized water. This process is repeated before each measurement and following the final measurement.

## 3.0 CALIBRATION

The m-scope must be calibrated before being used to measure water levels. Calibration is accomplished by measuring the water level with the m-scope followed by a measurement using a steel tape. This dual measurement procedure is continued until the individual is confident that measurements taken using both devices are similar and the m-scope is reliable. The calibration procedure is documented in the field notebook or on an appropriate field form, and initialed and dated.

## 4.0 PROCEDURE

4.1 If the well is not vented, then remove the cap and wait several minutes for the water level to equilibrate. Take several measurements to ensure that the water level measured is in equilibrium with the aquifer (i.e., not changing substantially).

4.2 The manufacturer's model must be noted because some have switches, lights, beepers, or a combination of the above.

4.3 The 1-foot or 5-foot marked intervals on the electrical line must be checked to ensure that they have not shifted, and the bottom of the probe has not been cut. Check on a periodic basis that the cord has not kinked.

4.4 The water-level measurement is taken by lowering the probe into the well until the instrument-specific detection method (e.g., light, beeper, or both) is activated by contacting the water.

4.5 The electrical line is held at the MP and, using a ruler (e.g., carpenter's folding ruler) or an engineer's scale, the distance from the "held" point to the nearest marked interval is measured. The distance measured is added to, or subtracted from, the marked interval reading. The result is the DTW.

4.6 Measurements will be taken accurately and to the nearest 0.01 foot.

4.7 After measuring all wells in an area, always re-measure at least one well, preferably the first well measured, to see if the static water level has changed (e.g., due to pumping in the area, tidal effects, etc.). If a significant change has occurred, it may be necessary to re-measure other wells.

4.8 If there are previous water-level measurements available for the wells, then have these data available to compare the measurements with those just taken. Use these data to see if water levels are similar or if they have changed. If water levels have changed, then check if the changes are consistent (i.e., all up or all down) and make sense.

4.9 Water-level elevations are calculated by subtracting the DTW from the MP and a water-elevation map is constructed (contoured) on a well location map. This also provides a check to evaluate if the water levels make sense (or anomalies are evidenced). Re-measure the well(s) where anomalies are found as a check on the initial measurement(s).

4.10 If anomalies persist or water-level trends are different from the historical database, then check to see if hydrogeologic conditions and/or stresses have changed (e.g., discharge areas, pumping and/or injection wells, etc.).

4.11 All pertinent data will be documented in the field notebook, and initialed and dated.

END OF PROCEDURE

Date: May 5, 2000

## 1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for purging a well prior to the collection of a ground-water sample. Purging (evacuating) a well involves the removal of the standing column of water in the well to allow "fresh" (representative) formation water to enter the well. Two conventionally used methods for well purging include: 1) discharge of a specified number of casing volumes of water (which is more commonly used); and 2) pumping until specific indicator parameters (e.g., specific conductance, pH, temperature) stabilize. Wells must be purged prior to sampling to ensure the collection of representative formation ground water for water-quality analysis.

For accepted, existing sampling and analysis programs, the same purging method will be used each time to maintain consistency. For new sampling and analysis programs, the basis for the purging technique(s) will be site-specific field conditions, client input, the experience of Roux Associates, Inc. and regulatory agency(ies) guidelines (e.g., some states permit purging a low-yield well to dryness while others insist that some water remains in the well).

## 2.0 EQUIPMENT AND MATERIALS

2.1 The following equipment may be needed to purge a monitoring well before sampling:

a. Bailers.

b. Centrifugal pumps.

c. Electrical submersible pumps.

d. Peristaltic pumps.

e. Positive gas-displacement devices.

f. Bladder pumps.

g. Hand-operated diaphragm or bilge pump(s).

h. Teflon™ tape, electrical tape.

i. Tape measure (stainless steel, steel, fiberglass) with 0.01-foot measurement increments and chalk (e.g., blue carpenter's) or m-scope.

j. Appropriate discharge hose and valves.

k. Appropriate discharge tubing (e.g., polypropylene) if using a peristaltic pump.

l. Appropriate compressed gas if using bladder-type or gas-displacement device.

m. Extension cord(s) or portable generator (and fuel) if using an electric submersible pump.

n. Non-absorbent cord (e.g., polypropylene, etc.), cotton (absorbent) cord.

o. Tripod(s).

p. Water Well Handbook.

q. Explosimeter.

r. Flow meter.

2.2 Bailers or centrifugal pumps are recommended for shallow, small diameter monitoring wells. For deep wells, or large diameter wells, a submersible pump is recommended.

## 3.0 DECONTAMINATION

Each piece of equipment that is used to evacuate wells (e.g., bailers, pumps, hoses) will be decontaminated thoroughly prior to the introduction of the equipment into the well and prior to leaving the site. Additionally, disposable items (e.g., cord, tubing) will be changed between each well purged and discarded in an appropriate manner.

## 4.0 PROCEDURE

4.1 The depth to water (DTW) is measured and subtracted from the sounded (total) depth of the well to calculate the length of the column of standing water in the well (in feet).

4.2 The volume of the standing water in the well is calculated by multiplying the length of standing water by a coefficient which equates the diameter of the well to gallons per linear foot. (Refer to the attached table from the Water Well Handbook for the coefficient or use the following equation [V=(7.48 gal/ft3)(r2h), where V is volume of water in gallons, r is the radius of the well casing in feet, and h is the height of the water column in the well in feet].)

4.3 If purging is performed by evacuating a specified number of casing volumes, then three to five volumes are purged (typical regulatory agency requirement).

4.4 If wells are screened in low permeability formations, then the well may go dry prior to removing the specified volume of water. If the recovery rate is fairly rapid and time allows, then remove more than one casing volume; otherwise, the

evacuation of one casing volume may suffice. (Refer to the site sampling and analysis plan [SAP] for details of purging a low-yield well.)

4.5 Evacuation will occur from the top of the water column in the well to ensure that "fresh" formation water enters the bottom of the well through the screen, moves up as standing water is removed from the top, and all standing water is removed (i.e., only representative formation water is in the well).

4.6 The volume of water purged from the well must be measured and can be calculated directly by discharging into containers of known volume or can be calculated by multiplying rate of flow by time.

4.7 If a submersible or centrifugal pump is used, then the intake is set just below the dynamic (pumping) water level in the well. The rate of flow in gallons per minute (gpm) can be measured using a calibrated bucket (e.g., 5-gallon) if the rate is relatively low, or a 55-gallon drum if the rate is relatively high, and a watch capable of measuring time in second intervals. A precalibrated flow meter may also be used if available.

4.8 After the specified number of casing volumes have been evacuated from the well, the pump intake is lifted slowly until it breaks suction to confirm that any standing water above the intake has been purged.

4.9 If a bailer is used, then the bailer is lowered only deep enough to remove water from the top of the water column and a 5-gallon bucket is used to measure the volume of water evacuated.

4.10 If purging is not executed by evacuating a specified number of well volumes, then purging is performed by pumping or bailing the well until specific indicator parameters (e.g., specific conductance, pH, temperature) stabilize. The volume of water removed is documented on an appropriate field form or in the field notebook.

4.11 Water purged from the well will be disposed of in accordance with the appropriate method outlined in the site SAP.

4.12 If historic site data indicate that explosive gases could be present and accumulate in the well, then an explosimeter will be used to check vapor concentrations in wells at the site prior to beginning the purging procedure. Vapor concentrations in a well that exceed the 25 percent lower explosive limit (LEL) will require specific precautionary measures to allow purging the well without danger of explosion or fire (e.g., use of cotton cord for bailers or lowering pumping devices, non-electric powered pumps). These conditions will be addressed in the site health and safety plan (HASP) and/or SAP.

END OF PROCEDURE

Date: May 5, 2000

## 1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for the sampling of ground-water monitoring wells for dissolved constituents. As part of the SOP for the sampling of ground-water monitoring wells, sample collection equipment and devices must be considered, and equipment decontamination and pre-sampling procedures (e.g., measuring water levels, sounding wells, and purging wells) must be implemented. Sampling objectives must be firmly established in the work plan before considering the above.

Valid water-chemistry data are integral to a hydrogeologic investigation that characterizes ground-water quality conditions. Water-quality data are used to evaluate both current and historic aquifer chemistry conditions, as well as to estimate future conditions (e.g., trends, migration pathways). Water-quality data can be used to construct ground-water quality maps to illustrate chemical conditions within the flow system, to generate water-quality plots to depict conditions with time and trends, and to perform statistical analyses to quantify data variability, trends, and cleanup levels.

## 2.0 EQUIPMENT AND MATERIALS

2.1 In order to sample ground water from monitoring wells, specific equipment and materials are required. The equipment and materials list may include, but not necessarily be limited to, the following:

a. Bailers (Teflon™ or stainless steel).

b. Pumps (centrifugal, peristaltic, bladder, electric submersible, bilge, hand-operated diaphragm, etc.).

c. Gas-displacement device(s).

d. Air-lift device(s).

e. Teflon™ tape, electrical tape.

f. Appropriate discharge hose.

g. Appropriate discharge tubing (e.g., polypropylene, teflon, etc.) if using a peristaltic pump.

h. Appropriate compressed gas if using bladder-type or gas-displacement device.

i. Portable generator and gasoline or alternate power supply if using an electric submersible pump.

j. Non-absorbent cord (e.g., polypropylene, etc.).

k. Plastic sheeting.

l. Tape measure (stainless steel, steel, fiberglass) with 0.01-foot measurement increments and chalk (blue carpenter's).

m. Electronic water-level indicators (e.g., m-scope, etc.) or electric water-level/product level indicators.

n. Non-phosphate, laboratory-grade detergent.

o. Distilled/Deionized water.

p. Potable water.

q. Paper towels, clean rags.

r. Roux Associates' field forms (e.g., daily log, well inspection checklist, sampling, etc.) and field notebook.

s. Well location and site map.

t. Well keys.

u. Stop watch, digital watch with second increments, or watch with a second hand.

v. Water Well Handbook.

w. Calculator.

x. Black pen and water-proof marker.

y. Tools (e.g., pipe wrenches, screwdrivers, hammer, pliers, flashlight, pen knife, etc.).

z. Appropriate health and safety equipment, as specified in the site health and safety plan (HASP).

aa. pH meter(s) and buffers.

bb. Conductivity meter(s) and standards.

cc. Thermometer(s).

dd. Extra batteries (meters, thermometers, flashlight).

ee. Filtration apparatus, filters, pre-filters.

ff. Plasticware (e.g., premeasured buckets, beakers, flasks, funnels).

gg. Disposable gloves.

hh. Water jugs.

ii. Laboratory-supplied sample containers with labels.

jj. Cooler(s).

kk. Ice (wet, blue packs).

ll. Masking, duct, and packing tape.

mm. Chain-of-custody form(s) and custody seal(s).

nn. Site sampling and analysis plan (SAP).

oo. Site health and safety plan (HASP).

pp. Packing material (e.g., bubble wrap)

qq. "Zip-lock" plastic bags.

rr. Overnight (express) mail forms.

## 3.0 DECONTAMINATION

3.1 Make sure all equipment is decontaminated and cleaned before use (refer to the SOP for Decontamination of Field Equipment for detailed decontamination methods, summaries for bailers and pumps are provided below). Use new, clean materials when decontamination is not appropriate (e.g., non-absorbent cord, disposable gloves). Document, and initial and date the decontamination procedures on the appropriate field form and in the field notebook.

a. Decontaminate a bailer by: 1) wearing disposable gloves, 2) disassembling (if appropriate) and scrubbing in a non-phosphate, laboratory-grade detergent and distilled/deionized water solution, and 3) rinsing first with potable water and then distilled/deionized water.

b. Decontaminate a pump by: 1) wearing disposable gloves, 2) flushing the pump and discharge hose (if not disposable) first with a non-phosphate, laboratory-grade detergent and potable water solution in an appropriate container (clean bucket, garbage can, or 55-gallon drum) and then with

distilled/deionized water or potable water, and 3) wiping pump-related equipment (e.g., electrical lines, cables, discharge hose) first with a clean cloth and detergent solution and then rinsing or wiping with a clean cloth and distilled/deionized water or potable water.

3.2 Note that the decontamination procedures for bailers and pumps are the minimum that must be performed. Check the work plan to determine if chemicals specified by individual state regulatory agencies must also be used for decontamination procedures (e.g., hexane, nitric acid, acetone, isopropanol, etc.).

## 4.0 CALIBRATION OF FIELD ANALYSIS EQUIPMENT

Calibrate field analysis equipment before use (e.g., thermometers, pH and conductivity meters, etc.). Refer to the specific SOP for field analysis for each respective piece of equipment. Document, and initial and date the calibration procedures on the appropriate field form, in the field notebook, and in the calibration log book.

## 5.0 PROCEDURE

5.1 Document, and initial and date well identification, pre-sampling information, and problems encountered on the appropriate field form and in the field notebook as needed.

5.2 Inspect the protective casing of the well and the well casing, and note any items of concern such as a missing lock, or bent or damaged casing(s).

5.3 Place plastic sheeting around the well to protect sampling equipment from potential cross contamination.

5.4 Remove the well cap or plug and, if necessary, clean the top of the well off with a clean rag. Place the cap or plug on the plastic sheeting. If the well is not vented, allow several minutes for the water level in the well to equilibrate. If fumes or gases are present, then diagnose these with the proper safety equipment. Never inhale the vapors.

5.5 Measure the depth to water (DTW) from the measuring point (MP) on the well using a steel tape and chalk or an electronic sounding device (m-scope). Refer to the specific SOPs for details regarding the use of a steel tape or a m-scope for measuring water levels. Calculate the water-level elevation. Document, and initial and date the information on the appropriate field form and in the field notebook.

5.6 Measuring the total depth of the well from the MP with a weighted steel tape. Calculate and record the volume of standing water in the well casing on the appropriate field form and in the field notebook.

5.7 Decontaminate the equipment used to measure the water level and sound the well with a non-phosphate, laboratory-grade detergent solution followed by a distilled/deionized water rinse.

5.8 Purge the well prior to sampling (refer to the SOP for Purging a Well). The well should be pumped or bailed to remove the volume of water specified in the work plan. Usually three to five casing volumes are removed if the recharge rate is adequate to accomplish this within a reasonable amount of time.

If the formation cannot produce enough water to sustain purging, then one of two options must be followed. These include: 1) pumping or bailing the well dry, or 2) pumping or bailing the well to "near-dry" conditions (i.e., leaving some water in the well). The option employed must be specified in the work plan and be in accordance with regulatory requirements.

If the well is purged dry, then all the standing water has been removed and upon recovery the well is ready for sampling. However, depending on the rate of recovery and the time needed to complete the sampling round, one of the following procedures may have to be implemented: 1) the well may have to be sampled over a period of more than one day; 2) the well may not yield enough water to collect a complete suite of samples and only select (most important) samples will be collected; or 3) the well may not recover which will preclude sampling. Regardless of the option that must be followed, the sampling procedure must be fully documented. When preparing to conduct a sampling round, review drilling, development and previous sampling information (if available) to identify low-yielding wells in order to purge them first, and potentially allow time for the well to recover for sampling.

5.9 Record the physical appearance of the water (i.e., color, turbidity, odor, etc.) on the appropriate field form and in the field notebook, as it is purged. Note any changes that occur during purging.

5.10 If a bailer is used to collect the sample, then:

a. Flush the decontaminated bailer three times with distilled/deionized water.

b. Tie the non-absorbent cord (polypropylene) to the bailer with a secure knot and then tie the free end of the bailer cord to the protective casing or, if possible, some nearby structure to prevent losing the bailer and cord down the well.

c. Lower the bailer slowly down the well and into the water column to minimize disturbance of the water surface. If a bottom-filling bailer is used, then do not submerge the top of the bailer; however, if a top-filling bailer is used, then submerge the bailer several feet below the water surface.

d. Remove and properly discard one bailer volume from the well to rinse the bailer with well water before sampling. Again, lower the bailer slowly down the well to the appropriate depth depending on the bailer type (as discussed above in 5.11 c). When removing the bailer from the well, do not allow the bailer cord to rest on the ground but coil it on the protective plastic sheeting placed around the well. Certain regulatory agencies require that the first bailer volume collected be utilized for the samples.

5.11 If a pump is used to collect the sample, then use the same pump used to purge the well and, if need be, reduce the discharge rate to facilitate filling sample containers and to avoid problems that can occur while filling sample containers (as listed in Number 5.14, below). Alternately, the purge pump may be removed and a thoroughly decontaminated bailer can be used to collect the sample.

5.12 Remove each appropriate container's cap only when ready to fill each with the water sample, and then replace and secure the cap immediately.

5.13 Fill each appropriate, pre-labeled sample container carefully and cautiously to prevent: 1) agitating or creating turbulence; 2) breaking the container; 3) entry of, or contact with, any other medium; and 4) spilling/splashing the sample and exposing the sampling team to contaminated water. Immediately place the filled sample container in a ice-filled (wet ice or blue pack) cooler for storage. If wet ice is used it is recommended that it be repackaged in zip-lock bags to help keep the cooler dry and the sample labels secure. Check the work plan as to whether wet ice or blue packs are specified for cooling the samples because certain regulatory agencies may specify the use of one and not the other.

5.14 "Top-off" containers for volatile organic compounds (VOCs) and tightly seal with Teflon™-lined septums held in place by open-top screw caps to prevent volatilization. Ensure that there are no bubbles by turning the container upside down and tapping it gently.

5.15 Filter water samples (Procedure 4.6) collected for dissolved metals analysis prior to preservation to remove the suspended sediment from the sample. If water samples are to be collected for total metals analysis, then collect a second set of samples without field filtering.

In the event that the regulatory agency(ies) want unfiltered samples for metals analysis, a second set of filtered samples should also be collected. Because unfiltered samples are indications of total metals (dissolved and suspended) they are not representative of aquifer conditions because ground water does not transport sediment (except in some rare cases). Thus, the results for dissolved metals in ground water should be based on filtered samples even if both filtered and unfiltered sets are presented in a report.

5.16 Add any necessary preservative(s) to the appropriate container(s) prior to, or after (preferred), the collection of the sample, unless the appropriate preservative(s) have already been added by the laboratory before shipment.

5.17 Collect quality control (QC) samples as required in the work plan to monitor sampling and laboratory performance. Refer to the SOP for Collection of Quality Control Samples.

5.18 Conduct field analyses after sample collection is complete by measuring and recording the temperature, conductivity, pH, etc. (as called for in the work plan). Note and record the "final" physical appearance of the water (after purging and sampling) on an appropriate field form and in the field notebook.

5.19 Wipe the well cap with a clean rag, replace the well cap and protective cover (if present). Lock the protective cover.

5.20 Verify that each sample is placed in an individual "zip-lock" bag, wrapped with "bubble wrap," placed in the cooler, and that the cooler has sufficient ice (wet ice or blue packs) to preserve the samples for transportation to the analytical laboratory.

5.21 Decontaminate bailers, hoses, and pumps as discussed in the decontamination SOP. Wrap decontaminated equipment with a suitable material (e.g., clean plastic bag or aluminum foil). Discard cords, rags, gloves, etc. in a manner consistent with site conditions.

5.22 Complete all necessary field forms, field notebook entries, and the chain-of-custody forms. Retain one copy of each chain-of-custody form. Secure the cooler with sufficient packing tape and a custody seal.

5.23 Samples collected from Monday through Friday will be delivered within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Consult the work plan to determine if any of the analytes require a shorter delivery time.

END OF PROCUDURE

Date: May 5, 2000

## 1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for measuring the thickness of floating separate-phase organic liquids in a well, tank or drum. Measuring the thickness of floating, separate-phase organic liquids requires special health and safety considerations, equipment, and procedures.

Separate-phase layers can either be "floaters" or "sinkers". "Floaters" (non-aqueous phase liquids [NAPLs]) are separate-phase liquids that are less dense than water and float on the ground-water surface. "Sinkers" (dense non-aqueous phase liquids [DNAPLs]) are separate-phase liquids that are more dense than water and tend to migrate downward through aquifers due to gravitational forces until a low permeability layer is encountered (i.e., they accumulate at the bottom of the aquifer). For the purpose of this SOP, only measuring the thickness of floating separate-phase liquids will be addressed.

The objectives for measuring separate-phase organic liquids may include the following: 1) determination of the thickness of the free product in a well, tank or drum; 2) estimation of the volume of free product to be removed from a well before sampling, or from a tank or drum before removal; and 3) calculation of the "true" (non-free product depressed) elevation of the water table.

## 2.0 CONSIDERATIONS

The primary considerations when measuring the thickness of floating separate-phase liquids are health and safety, and proper equipment selection.

### 2.1 Health and Safety

All separate-phase products must be assumed to possess health and safety hazards equivalent to the most hazardous suspected on-site source. For example, if fuel oil is being measured in wells where polychlorinated biphenyls (PCBs) are known (or suspected) to be present, then the potential for PCBs to be present in the fuel oil must be considered. When measuring the thickness of flammable materials, it is imperative that all possible sources of ignition be eliminated. Minimum requirements include (NO EXCEPTIONS) no smoking or open flames, use of intrinsically safe downhole monitoring equipment, use of static free bailing cord (e.g., absorbent cord [cotton]), and use of properly vented and grounded product collection containers. When product collection containers will be stored onsite, the local fire code official must be consulted regarding product storage requirements (e.g. venting, grounding, labeling, permits, secondary containment, etc.). A detailed, comprehensive explanation of health and safety procedures must be outlined in the site health and safety plan (HASP).

2.2 Equipment Selection

There are several methods which may be employed to measure the thickness of separate-phase petroleum product in a monitoring well, tank or drum. The actual method to be utilized should be outlined in the work plan. Considerations in selecting a method shall include: the type and consistency of the product; the level of accuracy desired; the expected depth and thickness of the product; and the diameter of the well or port.

Measurements of floating separate-phase product thicknesses can be performed using 1) an electronic oil/water interface probe; 2) a graduated, clear acrylic bailer; or 3) a weighted steel measuring tape (or graduated "stick") in conjunction with oil and water paste.

An oil/water interface probe is capable of providing rapid and accurate (±0.01 foot) results under most field situations. However, viscous product or oil/water emulsions may interfere with performance by coating the probe and/or disguising the interface. In these situations, a clear, acrylic bailer may be used in wells, or oil and water paste in a tank or drum.

A clear, acrylic bailer may be used if simply the presence or absence of product or an approximate product thickness is desired. In certain situations (e.g., viscous product or product/water emulsions) a clear acrylic bailer may be the best available method. However, when product thicknesses are greater than approximately three feet, a bailer will be unable to provide approximate product thickness measurements. If the oil/water interface probe will not work, and the product thickness is too great to be measured by a bailer, then the best available technique may be oil and water paste.

A graduated "stick" or weighted steel tape in conjunction with oil and water paste may be appropriate for measuring residual water or product in a tank or drum. This method is not recommended for use in monitoring wells because of possible cross-contamination from the paste itself. In certain situations where no other method can provide the necessary data, oil and water paste may be used in monitoring wells containing product. This method is less accurate than an oil/water interface probe, but frequently more accurate than a clear, acrylic bailer.

It should be noted that erroneous data may be collected by all three methods when measurements are collected through the fill ports of tanks which are equipped with drop tubes. Whenever possible, product thickness measurements should be collected from ports with unobstructed access to the tank contents. When measurements must be collected from a fill port with a drop tube, it should be understood that there may be significant differences between the drop tube measurements and the actual thicknesses of the water and product in the tank.

## 3.0 CALIBRATION

### 3.1 Oil/Water Interface Probe

There is no specific calibration procedure for an oil/water interface probe. However, you should verify that the unit operates properly prior to taking it out in the field by testing it in a jar containing product and water. This jar should be stored in a flammable liquid cabinet and be dedicated to oil/water interface probe testing. Since most oil/water interface probes have a heavy probe assembly and a rigid graduated tape, kinking, stretching or twisting of the tape is not a significant concern. In order to ensure proper operation, the unit should be kept warm prior to use (e.g. hotel room or cab of truck).

### 3.2 Clear Acrylic Bailer

There is no specific calibration procedure for an acrylic bailer. However, since you only get one chance to measure the thickness correctly, you should verify that the check valve operates properly with distilled water. Based on previous data, if available, you should ensure that the length of the bailer is sufficient to measure the entire thickness of the product.

### 3.3 Oil/Water Paste

There is no specific calibration procedure for using oil and water paste. However, these pastes may not behave reliably if they are old or have been exposed to extreme temperatures. The pastes should be tested prior to taking them out in the field to confirm they work. The stick measure or weighted steel tape should be carefully examined to confirm that it is properly graduated and has not been damaged or modified.

## 4.0 DECONTAMINATION

4.1 Complete decontamination of a clear acrylic bailer which is dedicated to the measurement of separate-phase product thicknesses can be very difficult. Decontamination should involve removal of gross contamination before entering and exiting the site or moving to different areas of separate-phase product accumulation. Special care must be taken to make sure that a “product bailer” never enters a “clean” well which does not contain separate-phase product. This can be ensured by measuring separate-phase thickness in all wells before starting bailing operations. The oil/water interface probe must be thoroughly cleaned according to the field equipment decontamination SOP before entering each well. If historical data are available, then the order of measuring separate-phase thickness should be from the cleanest well to the dirtiest well to further reduce the potential for cross-contamination. If samples are also being collected for constituent or characterization analysis, then a disposable, dedicated bailer may be necessary for product collection.

## 5.0 EQUIPMENT AND MATERIALS

Depending on the method used to measure the thickness of separate-phase organic liquids, both method-specific and general equipment and materials are needed.

5.1 Regardless of the method used, general equipment and materials will include, but may not necessarily be limited to, the following:

a. Site Health and Safety Plan (HASP).

b. Appropriate health and safety equipment, as specified in the HASP.

c. Roux Associates' field forms and field notebook.

d. Non-phosphate, laboratory-grade detergent.

e. Distilled/deionized water.

f. Potable water.

g. Paper towels, clean rags.

h. Plastic sheeting.

i. Sorbent pads.

j. Well location and site map.

k. Well keys.

l. Disposable gloves.

m. Calculator.

n. Black pen and indelible marker.

o. Tools (e.g., pipe wrench, screw drivers, hammer, pliers, flashlight, pen knife, etc.).

p. Buckets for decontamination.

5.2 Clear Acrylic Bailer - the following will also be needed:

a. Clear acrylic bailer

b. Non-static cotton cord

c. Steel tape (10 foot)

5.3 Oil/Water Interface Probe - the following will also be needed:

a. Oil/water interface probe

5.4 Oil/Water Paste - the following will also be needed:

a. Oil paste

b. Water paste

c. Graduated stick or weighted steel tape

6.0 PROCEDURE

6.1 Oil/Water Interface Probe

6.1.1 Make sure the bottom five (5) feet of the probe and measuring tape have been decontaminated according to the field equipment decontamination SOP before entering each well.

6.1.2 Based on previous data, if any, ensure that non-product wells are measured prior to product wells to reduce the possibility of cross-contamination.

6.1.3 Remove the well cap or plug and clean the top of the well with a clean rag. Place the cap or plug on clean plastic on the ground to protect it from potential contamination.

6.1.4 Slowly lower the thoroughly decontaminated probe to the product surface. A distinct tone or beep will indicate the presence and level of product. The depth to product (DTP) from the measuring point will be recorded in the field notebook and on appropriate field forms. Continue lowering the probe until the tone or beep indicates the presence of water. The oil/water interface is best measured by lowering the probe about six inches into the water and then raising it to the interface. The depth to water (DTW) from the measuring point will be recorded in the field notebook and on appropriate field forms. The product thickness is the difference between the DTW and DTP.

6.1.5 Replace locking and/or protective caps on the well.

6.1.6 Thoroughly clean the probe and the portion of the tape which entered the product according to the field equipment decontamination SOP.

6.2 Clear Acrylic Bailer

6.2.1 Make sure all equipment is cleaned of gross contamination before entering and exiting the site or moving to different areas of product accumulation.

6.2.2 Remove the well cap or plug and clean the top of the well with a clean rag. Place the cap or plug on clean plastic on the ground to protect it from potential contamination.

6.2.3 Slowly lower a clear, decontaminated bottom-filling acrylic bailer into the well until the bottom of the bailer contacts the fluid surface.

6.2.4 Using a reference point on the bailer line, slowly lower the bailer into the fluid a distance less than the bailer length so that at its deepest point the top of the bailer remains above the air/fluid contact.

6.2.5 Slowly raise the bailer out of the well.

6.2.6 The thickness of the floating free product will be approximated by placing a tape measure along side the bailer. The data will be documented in the field notebook and on appropriate field forms.

6.2.7 Dispose of the product in an appropriate manner as specified in the work plan. This may include draining the product back into the well or tank, or containerization if the measurement is in conjunction with bailing for removal purposes.

6.2.8 Replace locking and/or protective caps on the well.

6.2.9 Thoroughly clean the bailer as described in Section 6.2.1. Discard the cotton cord in an appropriate manner. Wrap decontaminated bailer in a suitable material (e.g., clean plastic bag, aluminum foil).

6.2.10 If the free product is extensive or thicker than the height of the bailer, then an electronic interface probe should be used to measure product thickness.

6.3 Oil/Water Paste - (Generally not applicable for monitoring wells)

6.3.1 Make sure all equipment is decontaminated and cleaned before use according to the field equipment decontamination SOP.

6.3.2 Secure access to the tank or drum to be measured only after the contents are known and properly addressed in the HASP. Attempt to estimate the depth and thickness of product and the depth to water so the entire stick or weighted steel tape does not have to be coated with oil and water paste.

6.3.3 Coat one side of the stick or steel tape with oil paste and the other with water paste. Since these are typically different colors, confusion should not result. Depending upon information needs, lower the tape to just below the water interface or to the bottom of the tank or drum.

6.3.4 If only DTP and DTW data is required, then the top of the tape is held at an even-foot increment at the measuring point (MP). This is called the

"held" value, and is recorded as such. If the depth to the bottom of the tank is also required, then the held value can't be specifically selected at an even-foot increment.

6.3.5 The steel tape or graduated stick is removed and the "water cut" and "product cut" levels are recorded. The difference between the "held" value and the "product cut" value is the DTP. The difference between the "held" value and the "water cut" is the DTW. The difference between the "product cut" and the "water cut" is the product thickness. If the diameter of a horizontal tank is desired, then the difference between the "held" value (to the bottom of the tank) and the depth of the fill pipe is required.

6.3.6 All pertinent data will be recorded in the field notebook and on appropriate field forms.

6.3.7 Make sure all equipment is decontaminated before use in the next tank or drum according to the field equipment decontamination SOP. All disposable materials must be discarded in a manner consistent with site conditions.

END OF PROCEDURE

Date: January 9, 2011
Revision: May 12, 2015

## 1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish guidelines for the collection of soil samples for laboratory analysis. This SOP is applicable to soil samples collected from split-spoon, Geoprobe™ core samples, and Sonic core samplers during drilling, hand auger samples, grab samples from stockpiled soils, surface samples, test pit samples, etc.

## 2.0 CONSIDERATIONS

Soil samples may be collected in either a random or biased manner. Random samples can be based on a grid system or statistical methodology. Biased samples can be collected in areas of visible impact or suspected source areas. Soil samples can be collected at the surface, shallow subsurface, or at depth. When samples are collected at depth, the water content should be noted, since generally "soil sampling" is restricted to the unsaturated zone. Equipment selection will be determined by the depth of the sample to be collected. A thorough description of the sampling locations and proposed methods of sample collection should be included in the work plan.

Commonly, surface sampling refers to the collection of samples at a 0 to 6 inch depth interval. Certain regulatory agencies may define the depth interval of a surface sample differently, and this must be defined in the work plan. Collection of surface soil samples is most efficiently accomplished with the use of a stainless steel trowel or scoop. For samples at greater depths, a Geoprobe™ or other direct push sampling method, or a decontaminated bucket auger or power auger may be needed to advance the hole to the point of sample collection. If augering to depth, once the sampling depth is reached a clean bucket auger should be used to collect the sample. To collect samples at depths of greater than approximately six feet, the use of a drill rig (direct push, split spoon, etc) will usually be necessary. In some situations, such as an excavation or trench, sample locations are accessed with the use of a backhoe.

## 3.0 EQUIPMENT AND MATERIALS

a. Safety first. Obtain the appropriate Job Safety Analysis (JSA) and personal protection equipment (PPE), as specified in the site Health and Safety Plan (HASP).

b. A work plan which outlines soil sampling requirements.

c. Field notebook, field form(s), maps, chain-of-custody forms, and custody seals.

d. Decontamination supplies (including: non-phosphate laboratory grade detergent, buckets, brushes, potable water, distilled water, plastic sheeting, etc.).

e. Sampling device (split-spoon sampler, stainless steel hand auger, stainless steel trowel, etc.).

f. Stainless steel spoons or spatulas.

g. Disposable Nitrile sampling gloves and cut-proof gloves.

h. Laboratory-supplied sample containers with labels.

i. Cooler with blue or wet ice.

j. Plastic sheeting.

k. Black pen and indelible marker.

l. Zip-lock bags and packing material.

m. Tape measure.

n. Paper towels or clean rags.

o. Masking and packing tape.

p. Overnight (express) mail forms or schedule courier pickup.

## 4.0 DECONTAMINATION

All reusable sampling equipment will be thoroughly cleaned according to the decontamination SOP (ROUX SOP 9.1). Where possible, thoroughly pre-cleaned and wrapped sampling equipment should be used and dedicated to individual sampling locations. Disposable items such as sampling gloves and plastic sheeting will be changed after each use and discarded in an appropriate manner.

## 5.0 PROCEDURE

5.1 Prior to collecting soil samples, ensure that all sampling equipment has been thoroughly cleaned according to the ROUX SOP 9.1 decontamination procedures. If samples are to be collected at depth, then the boring must be advanced with thoroughly cleaned equipment to the desired sampling horizon and a different thoroughly cleaned sampler must be used to collect the sample.

5.2 Using disposable gloves and a pre-cleaned, stainless steel spatula or spoon, extract the soil sample from the sampler, measure the recovery, and separate the wash from the true sample. Where allowed by regulatory agency(ies), disposable plastic spoons may be used. The gloves should not come in contact with the media being sampled and should be changed any time during sample collection when their cleanliness is compromised

When sampling shallow soils, if a thick, matted root zone, gravel, concrete, etc. is present at or near the surface, it should be removed before the sample is collected. The depth measurement for the sample begins at the top of the soil horizon, immediately following any removed materials.

When using direct push sampling methods, it is important to maintain the proper orientation of the sample when the sampling liners are removed from the sample tubes define precisely the depth at which an aliquot was collected. This is particularly important when multiple sample depths are collected from the same push.

When utilizing a split spoon sampling method, always discard the top several inches of material in the spoon before removing any portion for sampling. This material normally consists of borehole wall material that has sloughed off of the boregole wall after removal of the drill string prior to inserting the split spoon.

When utilizing a backhoe to collect soil samples from a trench or excavation, measures should be taken to ensure that the bucket is decontaminated and that no paint, grease, and rust is present prior to sample collection.

5.3 Place the sample in a laboratory-supplied, pre-cleaned sample container. Cut-proof gloves should be worn at all times when handling glassware. This should be done as quickly as possible and this is especially important when sampling for volatile organic compounds (VOCs). Samples to be analyzed for VOCs must be collected prior to other constituents.

If samples are to be analyzed for VOCs, they should be collected in a manner that minimizes disturbance of the sample. ***Samples for VOC analysis must not be homogenized.***

5.4 The sample container will be labeled with appropriate information such as, client name, site location, sample identification (location, depth, etc.), date and time of collection, and sampler's initials.

5.5 Using the remaining portion of soil from the sampler, log the sample in detail and record physical characteristics (color, odor, moisture, texture, density, consistency, organic content, layering, grain size, etc.). Refer to Soil Classification and logging SOP.

5.6 If soil samples are to be composited in the field, then equal portions from selected locations will be placed on a clean plastic sheet or in a Zip-lock bag and homogenized. make sure that each composite location (aliquot) consist of equal volumes,( i.e., same number of equal spoonfuls). Alternately, several samples may be submitted to the laboratory for compositing by weight. The method used is dependent upon regulatory requirements. Specific compositing procedures shall be approved by the appropriate regulatory agency and described in the work

plan. Samples to be analyzed for VOCs will not be composited unless required by a regulatory agency.

5.7 After the sample has been collected, labeled, and logged in detail, it is placed in a zip-lock bag and stored in a cooler with ice, at 4°C. Store the sample cooler in a secure location.

5.8 A chain-of-custody form is completed for all samples collected. One copy is retained and two are sent with the samples in a Zip-lock bag to the laboratory. A signed and dated custody seal is placed on the cooler prior to shipment.

5.9 Samples collected from Monday to Friday are typically to be delivered to the laboratory within 24 hours of collection. If Saturday delivery is unavailable, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if any analytes require a shorter delivery time.

5.10 The field notebook and appropriate forms should include, but not be limited to, the following: client name, site location, sample location, sample depth, sample identification, sample date and time collected, sampler's name, method of sample collection, number and type of containers, geologic description of material, description of decontamination procedures, etc. A site map should be prepared with exact measurements to each sample location in case follow-up sampling is necessary.

5.11 All reusable sampling equipment must be thoroughly cleaned in accordance with the ROUX SOP 9.1 decontamination procedures. Following the final decontamination (after all samples are collected), the sampling equipment is wrapped with plastic. Discard any gloves, plastic, etc. in an appropriate manner that is consistent with site conditions.

END OF PROCEDURE

# FOR SCREENING SOIL SAMPLES FOR VOLATILE ORGANIC VAPORS USING A PORTABLE PHOTOIONIZATION DETECTOR

Date: January 10, 2011
Revision: May 12, 2015

## 1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for screening soil samples for volatile organic vapors using a portable photoionization detector (PID). This SOP is applicable to soil samples collected from split-spoon, Geoprobe™ macro-core, Sonic cores and Shelby tube samplers during drilling, hand auger samples, and grab samples from stockpiled soils.

## 2.0 CONSIDERATIONS

The primary objective of photoionization screening of soil samples is to obtain a qualitative understanding of the distribution of volatile organic compounds (VOCs) in soil. The proper design of an organic vapor screening program requires an understanding of site hydrogeology, potential source areas, and potential constituents of concern. Sample locations and frequency must be fully defined in the work plan. The work plan should outline the type of lamp to be utilized in the PID based on the ionization potentials and response factors of the constituents of concern. The work plan must also clearly describe the heating or equilibration procedures to be employed if they differ from those described in this SOP. Regardless of the specific equilibration procedure employed, it is imperative that each sample be treated identically to allow the photoionization results from different locations to be compared. Observations such as water, clay, and organic content should be noted to facilitate interpretation of the data. Every effort should be made to collect a representative portion of soil from the sampling device.

## 3.0 EQUIPMENT AND MATERIALS

a. Safety first. Obtain the appropriate Job Safety Analysis (JSA) and personal protection equipment (PPE), as specified in the site Health and Safety Plan (HASP).

b. A work plan which outlines photoionization screening requirements.

c. Decontamination supplies (including: non-phosphate laboratory grade detergent, buckets, brushes, potable water, distilled water, plastic sheeting, etc.).

d. Field notebook, field form(s), maps, chain-of-custody forms.

e. Sampling device (split-spoon sampler, stainless steel hand auger, stainless steel trowel, etc.).

f. Stainless steel spoons or spatulas.

g. Disposable plastic spoons.

h. Plastic sheeting.

i. Gallon size Zip-lock bags.

j. Photoionization detector (PID) with charging unit.

k. Calibration gases with regulator.

l. Indelible marker.

m. Masking tape.

n. Disposable Nitrile sampling gloves.

## 4.0 DECONTAMINATION

Where possible, thoroughly pre-cleaned and wrapped sampling equipment must be used and dedicated to individual sampling locations. Disposable items such as sampling gloves, aluminum foil, and sample jars will be changed after each use and discarded in an appropriate manner. If only photoionization results are to be obtained, then split-spoon samples and hand augers may be cleaned with a non-phosphate laboratory grade detergent and water wash and potable water rinse or steam cleaning, and a final distilled water rinse. However, if samples are to be collected concurrently for laboratory analytical results, then all reusable sampling equipment must be thoroughly decontaminated according to the ROUX SOP 9.1 for decontamination of field equipment.

## 5.0 CALIBRATION

5.1 The PID must be calibrated according to the manufacturer's specifications at a minimum frequency of once per day prior to collecting photoionization readings. In addition, periodic checks (e.g., every 2 hours or every ten samples) with the standard gas will be conducted to confirm that the calibration has not drifted.

5.2 The time, date, and calibration procedure must be clearly documented in the field notebook and the calibration log.

5.3 If at any time the photoionization results appear erratic or inconsistent with field observations, then the unit must be recalibrated. If calibration is difficult to achieve, then the unit's lamp should be checked for dirt or moisture and cleaned, as necessary. During humid or wet conditions, the unit should be calibrated on a more frequent basis as determined by field personnel.

## 6.0 PROCEDURE

6.1 Allow the temperature of the unit to equilibrate to its surrounding. This should take about five minutes.

6.2 Extract the soil sample from the sampler, quickly measure the recovery, and separate the wash from the true sample by using a dedicated, stainless steel spatula. Where allowed by regulatory agency(ies), disposable plastic spoons may be used.

6.2 Place the sample in a 1-Gallon Zip-lock bag (as quickly as possible to avoid loss of VOCs) filling the bag half full, if possible. Seal the bag and ensure an adequate seal has been created by pressing on the bag and observing if air discharges from the bag.

6.3 Label the bag with the boring/ID number, depth of sample, date of collection and sampler's initials. In addition, the field personnel will ensure the following: samples are taken at appropriate depths; unrepresentative portions of the sample are discarded properly; that the soil sampler (i.e., split spoon) is decontaminated properly between use; and the driller uses proper methods during sample collection and does not use oil or grease on tools entering the borehole.

6.4 Log the sample in detail and record physical characteristics (color, odor, moisture, texture, density, consistency, organic content, and layering). Refer to ROUX SOP 5.5 for soil classification and logging procedures.

6.5 Ensure that the PID has been calibrated and that the calibration information is documented in the field book. Pierce the Zip-lock bag with the probe from the PID and measure the relative concentration of VOCs in the headspace of the soil sample. The initial (peak) reading must be recorded.

6.6 Record the PID reading in the field notebook, on an appropriate field form, and on the base map, if appropriate. All readings should be recorded in parts per million (ppm).

6.7 Dispose of any soil/geologic material/cutting in a designated waste storage container (e.g. drum) consistent with site disposal requirements.

6.8 If only field screening results are to be obtained, then reusable sampling devices may be cleaned with a non-phosphate laboratory grade detergent and water wash and a potable water rinse. The sampler will then be rinsed with distilled water, assembled and placed on plastic sheeting for reuse. A more rigorous decontamination procedure is required when samples are also being collected for laboratory analysis. Refer to the SOP for collection of soil samples for laboratory analysis for additional information.

END OF PROCEDURE

Date: January 9, 2011
Revision: May 5, 2015

## 1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for decontamination of all field equipment potentially exposed to contamination during field investigation activities (i.e. drilling, soil and water sampling).

The objective of decontamination is to ensure that all field samplingequipment is decontaminated (free of potential contaminants): 1) prior to being brought onsite to avoid the introduction of potential contaminants to the site; 2) between drilling and sampling events/activities onsite to eliminate the potential for cross-contamination between boreholes and/or wells; and 3) prior to the removal of equipment from the site to prevent the transportation of potentially contaminated equipment offsite.

The decontamination line is setup so that the first station is used to clean the most contaminated item. It progresses to the last station where the least contaminated item is cleaned. A site is typically divided up into the following boundaries: Hot Zone or Exclusion Zone (EZ), the Contamination Reduction Zone (CRZ), and the Support or Safe Zone (SZ). The decontamination line should be setup in the Contamination Reduction Corridor (CRC).

In considering decontamination procedures, state and federal regulatory agency requirements must be considered because of potential variability between state and federal requirements. Decontamination procedures must be in compliance with state and/or federal protocols in order that regulatory agency(ies) scrutiny of the procedures and data collected do not result in non acceptance (invalidation) of the work undertaken and data collected.

The equipment and materials list for decontamination activities may include, but not necessarily be limited to, the following:

a. A work plan and health and safety plan which outlines decontamination procedures and requirements.

b. Field notebook and field form(s).

c. Decontamination solutions, including as necessary: non-phosphate, laboratory-grade detergent; distilled/deionized water; potable water; cleaning solvents if needed [e.g., hexane, acetone, nitric acid).

d. Long and short handled brushes,

e. Bottle brushes

f. Drop cloth/plastic sheeting

g. Paper towels

h. Plastic or galvanized tubs or buckets

i. Pressure washers or steam cleaners

j. Solvent sprayers

k. Trash / bilge pumps

l. Aluminum foil

m. 55-gallon drums.

## 2.0 PROCEDURE FOR DRILLING EQUIPMENT

The following is a minimum decontamination procedure for drilling equipment. Drilling equipment decontamination procedures will be documented on an appropriate field form or in the field notebook, especially any variation from the method itemized below:

2.1 Safety first. Obtain the appropriate Job Safety Analysis (JSA) and personal protection equipment (PPE), as specified in the site Health and Safety Plan (HASP). Prior to mobilization to a site, the expected types of contamination should be evaluated to determine if the field cleaning and decontamination activities will generate rinsates and other waste waters that might be considered RCRA hazardous waste or may require special handling.

2.2 The drill rig and all associated equipment should be properly decontaminated by the contractor before arriving at the site.

2.3 The augers, drilling casings, rods, samplers, tools, and any piece of equipment that can come in contact (directly or indirectly) with the soil, requires proper decontamination on-site prior to commencing drilling. The project work plan or HASP, and appropriate regulatory requirements, should be consulted to determine site-specific decontamination requirements.

2.4 The same decontamination procedures used prior to drilling will be followed between boreholes (at a fixed on-site location[s], if appropriate) and before leaving the site at the end of the investigation.

2.5 All on-site steam cleaning or (decontamination) activities will be monitored and documented by a member(s) of the staff of Roux Associates, Inc. and should be performed on a decontamination pad that meets the following specifications:

1. The pad should be constructed in an area known or believed to be free of surface contamination.

2. A temporary pad should be lined with a water impermeable material with no seams within the pad. This material should be either easily replaced disposable) or repairable.The pad should be regularly inspected to ensure there are no leaks.

3. Water should be removed from the decontamination pad frequently.

2.6 If drilling activities are conducted in the presence of thick, sticky oils (e.g., PCB oil) which coat drilling equipment, then special decontamination procedures may have to be utilized before steam cleaning (e.g., hexane scrub and wash).

2.7 Containment of decontamination fluids may be necessary (e.g., rinseate from steam cleaning) or will be required (e.g., hexane), and disposal must be in accordance with state and/or federalregulatory requirements.

## 3.0 PROCEDURE FOR SOIL-SAMPLING EQUIPMENT

The following is a minimum decontamination procedure for soil-sampling equipment (e.g., split spoons, stainless-steel spatulas). Soil-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

3.1 Safety first. Obtain JSA and PPE, as specified in the site HASP.

3.2 Wear disposable gloves while cleaning equipment to avoid cross-contamination and change gloves as needed.

3.3 Steam clean the sampler or rinse with potable water. If soil-sampling activities are conducted in the presence of thick, sticky oils (e.g., PCB oil) which coat sampling equipment, then special decontamination procedures may have to be utilized before steam cleaning and washing in detergent solution (e.g., hexane scrub and wash).

3.4 Prepare a non-phosphate, laboratory-grade detergent solution and distilled or potable water in a clean bucket.

3.5 Disassemble the sampler, as necessary and immerse all parts and other sampling equipment in the solution.

3.6 Scrub all equipment in the bucket with a brush to remove any adhering particles.

3.7 Rinse all equipment with copious amounts of potable water followed by distilled or deionized water.

3.8 Place clean equipment on a clean plastic sheet (e.g., polyethylene)

3.9 Reassemble the cleaned sampler, as necessary.

3.10 After equipment has been cleaned, all individuals involved in equipment handling should don clean gloves, or wrap the equipment with a suitable material (e.g., plastic bag, aluminum foil).

As part of the decontamination procedure for soil-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

## 4.0 PROCEDURE FOR WATER-SAMPLING EQUIPMENT

The following is a decontamination procedure for water-sampling equipment (e.g., bailers, pumps). Water-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

4.1 Safety first. Obtain the JSAs and PPE, as specified in the site HASP.

4.2 Decontamination procedures for bailers follow:

a. Wear disposable gloves while cleaning bailer to avoid cross-contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a bucket.

c. Disassemble sampling equipment. Discard all used sampling tubes and cords in an appropriate manner. Disconnect all power sources from electrical equipment (i.e. pumps). Scrub each piece of equipment with a brush and solution.

d. Rinse all sampling equipment with copious amounts of potable, distilled or deionized water, Reassemble equipment as per the manufacturer's instructions.

f. Air dry.

g. Wrap equipment with a suitable material (e.g., clean plastic bag, aluminum foil).

4.3 Decontamination procedures for pumps follow:

a. Wear disposable gloves while cleaning pump to avoid cross-contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a clean bucket, clean garbage can, or clean 55-gallon drum.

c. Flush the pump and discharge hose (if not disposable) with the detergent solution, and discard disposable tubing and/or cord in an appropriate manner.

d. Flush the pump and discharge hose (if not disposable) with potable water.

e. Place the pump on clear plastic sheeting.

f. Wipe any pump-related equipment (e.g., electrical lines, cables, discharge hose) that entered the well with a clean cloth and detergent solution, and rinse or wipe with a clean cloth and potable water.

g. Air dry.

h. Wrap equipment with a suitable material (e.g., clean plastic bag).

As part of the decontamination procedure for water-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

END OF PROCEDURE

## Attachment 2

# Chain of Custody Form

# Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

| Client Information | Sampler: | Lab PM: | Carrier Tracking No(s): | COC No: |
|---|---|---|---|---|
| Client Contact: | Phone: | E-Mail: | | Page: |

| Company: | Analysis Requested | Job #: |
|---|---|---|
| Address: | Due Date Requested: | |
| City: | TAT Requested (days): | |
| State, Zip: | | |
| Phone: | PO #: | |
| Email: | WO #: | |
| Project Name: | Project #: | |
| Site: | SSOW#: | |

**Preservation Codes:**

| | |
|---|---|
| A - HCL | M - Hexane |
| B - NaOH | N - None |
| C - Zn Acetate | O - AsNaO2 |
| D - Nitric Acid | P - Na2O4S |
| E - NaHSO4 | Q - Na2SO3 |
| F - MeOH | R - Na2S2SO3 |
| G - Amchlor | S - H2SO4 |
| H - Ascorbic Acid | T - TSP Dodecahydrate |
| I - Ice | U - Acetone |
| J - DI Water | V - MCAA |
| K - EDTA | W - ph 4-5 |
| L - EDA | Z - other (specify) |

**Other:**

| Sample Identification | Sample Date | Sample Time | Sample Type (C=Comp, G=grab) | Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air) | Field Filtered Sample (Yes or No) | Perform MS/MSD (Yes or No) | | | | | | | | | | | | Total Number of containers | Special Instructions/Note: |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Preservation Code: | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |

***Possible Hazard Identification***

☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*

***Sample Disposal ( A fee may be assessed if samples are retained longer than 1 month)***

☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For _____ Months*

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

| Empty Kit Relinquished by: | Date: | Time: | Method of Shipment: |
|---|---|---|---|

| Relinquished by: | Date/Time: | Company | Received by: | Date/Time: | Company |
|---|---|---|---|---|---|
| Relinquished by: | Date/Time: | Company | Received by: | Date/Time: | Company |
| Relinquished by: | Date/Time: | Company | Received by: | Date/Time: | Company |

| Custody Seals Intact: Δ Yes Δ No | Custody Seal No.: | Cooler Temperature(s) °C and Other Remarks: |
|---|---|---|

# Low Stress (Low Flow) Purging and Sampling Procedures for the Collection of Groundwater Samples From Monitoring Wells

# U.S. ENVIRONMENTAL PROTECTION AGENCY
# REGION I

# LOW STRESS (low flow) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUNDWATER SAMPLES FROM MONITORING WELLS

Quality Assurance Unit
U.S. Environmental Protection Agency – Region 1
11 Technology Drive
North Chelmsford, MA 01863

The controlled version of this document is the electronic version viewed on-line only. If this is a printed copy of the document, it is an uncontrolled version and may or may not be the version currently in use.

This document contains direction developed solely to provide guidance to U.S. Environmental Protection Agency (EPA) personnel. EPA retains the discretion to adopt approaches that differ from these procedures on a case-by-case basis. The procedures set forth do not create any rights, substantive or procedural, enforceable at law by party to litigation with EPA or the United States.

Prepared by: Charles Porfert 1/19/10
(Charles Porfert, Quality Assurance Unit) Date

Approved by: Gerard Sotolongo 1-19-10
(Gerard Sotolongo, Quality Assurance Unit) Date

## Revision Page

| Date | Rev # | Summary of changes | Sections |
|---|---|---|---|
| 7/30/96 | 2 | Finalized | |
| 01/19/10 | 3 | Updated | All sections |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

TABLE OF CONTENTS

| | Page |
|---|---|
| USE OF TERMS | 4 |
| SCOPE & APPLICATION | 5 |
| BACKGROUND FOR IMPLEMENTATION | 6 |
| HEALTH & SAFETY | 7 |
| CAUTIONS | 7 |
| PERSONNEL QUALIFICATIONS | 9 |
| EQUIPMENT AND SUPPLIES | 9 |
| EQUIPMENT/INSTRUMENT CALIBRATION | 13 |
| PRELIMINARY SITE ACTIVITIES | 13 |
| PURGING AND SAMPLING PROCEDURE | 14 |
| DECONTAMINATION | 19 |
| FIELD QUALITY CONTROL | 21 |
| FIELD LOGBOOK | 21 |
| DATA REPORT | 22 |
| REFERENCES | 22 |
| APPENDIX A PERISTALTIC PUMPS | 24 |
| APPENDIX B SUMMARY OF SAMPLING INSTRUCTIONS | 25 |
| LOW-FLOW SETUP DIAGRAM | 29 |
| APPENDIX C EXAMPLE WELL PURGING FORM | 30 |

## USE OF TERMS

Equipment blank: The equipment blank shall include the pump and the pump's tubing. If tubing is dedicated to the well, the equipment blank needs only to include the pump in subsequent sampling rounds. If the pump and tubing are dedicated to the well, the equipment blank is collected prior to its placement in the well. If the pump and tubing will be used to sample multiple wells, the equipment blank is normally collected after sampling from contaminated wells and not after background wells.

Field duplicates: Field duplicates are collected to determine precision of the sampling procedure. For this procedure, collect duplicate for each analyte group in consecutive order (VOC original, VOC duplicate, SVOC original, SVOC duplicate, etc.).

Indicator field parameters: This SOP uses field measurements of turbidity, dissolved oxygen, specific conductance, temperature, pH, and oxidation/reduction potential (ORP) as indicators of when purging operations are sufficient and sample collection may begin.

Matrix Spike/Matrix Spike Duplicates: Used by the laboratory in its quality assurance program. Consult the laboratory for the sample volume to be collected.

Poteniometric Surface: The level to which water rises in a tightly cased well constructed in a confined aquifer. In an unconfined aquifer, the potentiometric surface is the water table.

QAPP: Quality Assurance Project Plan

SAP: Sampling and Analysis Plan

SOP: Standard operating procedure

Stabilization: A condition that is achieved when all indicator field parameter measurements are sufficiently stable (as described in the "Monitoring Indicator Field Parameters" section) to allow sample collection to begin.

Temperature blank: A temperature blank is added to each sample cooler. The blank is measured upon receipt at the laboratory to assess whether the samples were properly cooled during transit.

Trip blank (VOCs): Trip blank is a sample of analyte-free water taken to the sampling site and returned to the laboratory. The trip blanks (one pair) are added to each sample cooler that contains VOC samples.

## SCOPE & APPLICATION

The goal of this groundwater sampling procedure is to collect water samples that reflect the total mobile organic and inorganic loads (dissolved and colloidal sized fractions) transported through the subsurface under ambient flow conditions, with minimal physical and chemical alterations from sampling operations. This standard operating procedure (SOP) for collecting groundwater samples will help ensure that the project's data quality objectives (DQOs) are met under certain low-flow conditions.

The SOP emphasizes the need to minimize hydraulic stress at the well-aquifer interface by maintaining low water-level drawdowns, and by using low pumping rates during purging and sampling operations. Indicator field parameters (e.g., dissolved oxygen, pH, etc.) are monitored during purging in order to determine when sample collection may begin. Samples properly collected using this SOP are suitable for analysis of groundwater contaminants (volatile and semi-volatile organic analytes, dissolved gases, pesticides, PCBs, metals and other inorganics), or naturally occurring analytes. This SOP is based on Puls, and Barcelona (1996).

This procedure is designed for monitoring wells with an inside diameter (1.5-inches or greater) that can accommodate a positive lift pump with a screen length or open interval ten feet or less and with a water level above the top of the screen or open interval (Hereafter, the "screen or open interval" will be referred to only as "screen interval"). This SOP is not applicable to other well-sampling conditions.

While the use of dedicated sampling equipment is not mandatory, dedicated pumps and tubing can reduce sampling costs significantly by streamlining sampling activities and thereby reducing the overall field costs.

The goal of this procedure is to emphasize the need for consistency in deploying and operating equipment while purging and sampling monitoring wells during each sampling event. This will help to minimize sampling variability.

This procedure describes a general framework for groundwater sampling. Other site specific information (hydrogeological context, conceptual site model (CSM), DQOs, etc.) coupled with systematic planning must be added to the procedure in order to develop an appropriate site specific SAP/QAPP. In addition, the site specific SAP/QAPP must identify the specific equipment that will be used to collect the groundwater samples.

This procedure does not address the collection of water or free product samples from wells containing free phase LNAPLs and/or DNAPLs (light or dense non-aqueous phase

liquids). For this type of situation, the reader may wish to check: Cohen, and Mercer (1993) or other pertinent documents.

This SOP is to be used when collecting groundwater samples from monitoring wells at all Superfund, Federal Facility and RCRA sites in Region 1 under the conditions described herein. Request for modification of this SOP, in order to better address specific situations at individual wells, must include adequate technical justification for proposed changes. All changes and modifications must be approved and included in a revised SAP/QAPP before implementation in field.

## BACKGROUND FOR IMPLEMENTATION

It is expected that the monitoring well screen has been properly located (both laterally and vertically) to intercept existing contaminant plume(s) or along flow paths of potential contaminant migration. Problems with inappropriate monitoring well placement or faulty/improper well installation cannot be overcome by even the best water sampling procedures. This SOP presumes that the analytes of interest are moving (or will potentially move) primarily through the more permeable zones intercepted by the screen interval.

Proper well construction, development, and operation and maintenance cannot be overemphasized. The use of installation techniques that are appropriate to the hydrogeologic setting of the site often prevent "problem well" situations from occurring. During well development, or redevelopment, tests should be conducted to determine the hydraulic characteristics of the monitoring well. The data can then be used to set the purging/sampling rate, and provide a baseline for evaluating changes in well performance and the potential need for well rehabilitation. Note: if this installation data or well history (construction and sampling) is not available or discoverable, for all wells to be sampled, efforts to build a sampling history should commence with the next sampling event.

The pump intake should be located within the screen interval and at a depth that will remain under water at all times. It is recommended that the intake depth and pumping rate remain the same for all sampling events. The mid-point or the lowest historical midpoint of the saturated screen length is often used as the location of the pump intake. For new wells, or for wells without pump intake depth information, the site's SAP/QAPP must provide clear reasons and instructions on how the pump intake depth(s) will be selected, and reason(s) for the depth(s) selected. If the depths to top and bottom of the well screen are not known, the SAP/QAPP will need to describe how the sampling depth will be determined and how the data can be used.

Stabilization of indicator field parameters is used to indicate that conditions are suitable for sampling to begin. Achievement of turbidity levels of less than 5 NTU, and stable drawdowns of less than 0.3 feet, while desirable, are not mandatory. Sample collection

may still take place provided the indicator field parameter criteria in this procedure are met. If after 2 hours of purging indicator field parameters have not stabilized, one of three optional courses of action may be taken: a) continue purging until stabilization is achieved, b) discontinue purging, do not collect any samples, and record in log book that stabilization could not be achieved (documentation must describe attempts to achieve stabilization), c) discontinue purging, collect samples and provide full explanation of attempts to achieve stabilization (note: there is a risk that the analytical data obtained, especially metals and strongly hydrophobic organic analytes, may reflect a sampling bias and therefore, the data may not meet the data quality objectives of the sampling event).

It is recommended that low-flow sampling be conducted when the air temperature is above 32°F (0°C). If the procedure is used below 32°F, special precautions will need to be taken to prevent the groundwater from freezing in the equipment. Because sampling during freezing temperatures may adversely impact the data quality objectives, the need for water sample collection during months when these conditions are likely to occur should be evaluated during site planning and special sampling measures may need to be developed. Ice formation in the flow-through-cell will cause the monitoring probes to act erratically. A transparent flow-through-cell needs to be used to observe if ice is forming in the cell. If ice starts to form on the other pieces of the sampling equipment, additional problems may occur.

## HEALTH & SAFETY

When working on-site, comply with all applicable OSHA requirements and the site's health/safety procedures. All proper personal protection clothing and equipment are to be worn. Some samples may contain biological and chemical hazards. These samples should be handled with suitable protection to skin, eyes, etc.

## CAUTIONS

The following cautions need to be considered when planning to collect groundwater samples when the below conditions occur.

If the groundwater degasses during purging of the monitoring well, dissolved gases and VOCs will be lost. When this happens, the groundwater data for dissolved gases (e.g., methane, ethene, ethane, dissolved oxygen, etc.) and VOCs will need to be qualified. Some conditions that can promote degassing are the use of a vacuum pump (e.g., peristaltic pumps), changes in aperture along the sampling tubing, and squeezing/pinching the pump's tubing which results in a pressure change.

When collecting the samples for dissolved gases and VOCs analyses, avoid aerating the groundwater in the pump's tubing. This can cause loss of the dissolved gases and VOCs in

the groundwater. Having the pump's tubing completely filled prior to sampling will avoid this problem when using a centrifugal pump or peristaltic pump.

Direct sun light and hot ambient air temperatures may cause the groundwater in the tubing and flow-through-cell to heat up. This may cause the groundwater to degas which will result in loss of VOCs and dissolved gases. When sampling under these conditions, the sampler will need to shade the equipment from the sunlight (e.g., umbrella, tent, etc.). If possible, sampling on hot days, or during the hottest time of the day, should be avoided. The tubing exiting the monitoring well should be kept as short as possible to avoid the sun light or ambient air from heating up the groundwater.

Thermal currents in the monitoring well may cause vertical mixing of water in the well bore. When the air temperature is colder than the groundwater temperature, it can cool the top of the water column. Colder water which is denser than warm water sinks to the bottom of the well and the warmer water at the bottom of the well rises, setting up a convention cell. "During low-flow sampling, the pumped water may be a mixture of convecting water from within the well casing and aquifer water moving inward through the screen. This mixing of water during low-flow sampling can substantially increase equilibration times, can cause false stabilization of indicator parameters, can give false indication of redox state, and can provide biological data that are not representative of the aquifer conditions" (Vroblesky 2007).

Failure to calibrate or perform proper maintenance on the sampling equipment and measurement instruments (e.g., dissolved oxygen meter, etc.) can result in faulty data being collected.

Interferences may result from using contaminated equipment, cleaning materials, sample containers, or uncontrolled ambient/surrounding air conditions (e.g., truck/vehicle exhaust nearby).

Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment and/or proper planning to avoid ambient air interferences. Note that the use of dedicated sampling equipment can also significantly reduce the time needed to complete each sampling event, will promote consistency in the sampling, and may reduce sampling bias by having the pump's intake at a constant depth.

Clean and decontaminate all sampling equipment prior to use. All sampling equipment needs to be routinely checked to be free from contaminants and equipment blanks collected to ensure that the equipment is free of contaminants. Check the previous equipment blank data for the site (if they exist) to determine if the previous cleaning procedure removed the contaminants. If contaminants were detected and they are a concern, then a more vigorous cleaning procedure will be needed.

## PERSONNEL QUALIFICATIONS

All field samplers working at sites containing hazardous waste must meet the requirements of the OSHA regulations. OSHA regulations may require the sampler to take the 40 hour OSHA health and safety training course and a refresher course prior to engaging in any field activities, depending upon the site and field conditions.

The field samplers must be trained prior to the use of the sampling equipment, field instruments, and procedures. Training is to be conducted by an experienced sampler before initiating any sampling procedure.

The entire sampling team needs to read, and be familiar with, the site Health and Safety Plan, all relevant SOPs, and SAP/QAPP (and the most recent amendments) before going onsite for the sampling event. It is recommended that the field sampling leader attest to the understanding of these site documents and that it is recorded.

## EQUIPMENT AND SUPPLIES

### A. Informational materials for sampling event

A copy of the current Health and Safety Plan, SAP/QAPP, monitoring well construction data, location map(s), field data from last sampling event, manuals for sampling, and the monitoring instruments' operation, maintenance, and calibration manuals should be brought to the site.

### B. Well keys.

### C. Extraction device

Adjustable rate, submersible pumps (e.g., centrifugal, bladder, etc.) which are constructed of stainless steel or Teflon are preferred. Note: if extraction devices constructed of other materials are to be used, adequate information must be provided to show that the substituted materials do not leach contaminants nor cause interferences to the analytical procedures to be used. Acceptance of these materials must be obtained before the sampling event.

If bladder pumps are selected for the collection of VOCs and dissolved gases, the pump setting should be set so that one pulse will deliver a water volume that is sufficient to fill a 40 mL VOC vial. This is not mandatory, but is considered a "best practice". For the proper operation, the bladder pump will need a minimum amount of water above the pump; consult the manufacturer for the recommended submergence. The pump's recommended submergence value should be determined during the planning stage, since it may influence well construction and placement of dedicated pumps where water-level fluctuations are significant.

Adjustable rate, peristaltic pumps (suction) are to be used with caution when collecting samples for VOCs and dissolved gases (e.g., methane, carbon dioxide, etc.) analyses. Additional information on the use of peristaltic pumps can be found in Appendix A. If peristaltic pumps are used, the inside diameter of the rotor head tubing needs to match the inside diameter of the tubing installed in the monitoring well.

Inertial pumping devices (motor driven or manual) are not recommended. These devices frequently cause greater disturbance during purging and sampling, and are less easily controlled than submersible pumps (potentially increasing turbidity and sampling variability, etc.). This can lead to sampling results that are adversely affected by purging and sampling operations, and a higher degree of data variability.

**D. Tubing**

Teflon or Teflon-lined polyethylene tubing are preferred when sampling is to include VOCs, SVOCs, pesticides, PCBs and inorganics. Note: if tubing constructed of other materials is to be used, adequate information must be provided to show that the substituted materials do not leach contaminants nor cause interferences to the analytical procedures to be used. Acceptance of these materials must be obtained before the sampling event.

PVC, polypropylene or polyethylene tubing may be used when collecting samples for metal and other inorganics analyses.

The use of 1/4 inch or 3/8 inch (inside diameter) tubing is recommended. This will help ensure that the tubing remains liquid filled when operating at very low pumping rates when using centrifugal and peristaltic pumps.

Silastic tubing should be used for the section around the rotor head of a peristaltic pump. It should be less than a foot in length. The inside diameter of the tubing used at the pump rotor head must be the same as the inside diameter of tubing placed in the well. A tubing connector is used to connect the pump rotor head tubing to the well tubing. Alternatively, the two pieces of tubing can be connected to each other by placing the one end of the tubing inside the end of the other tubing. The tubing must not be reused.

**E. The water level measuring device**

Electronic "tape", pressure transducer, water level sounder/level indicator, etc. should be capable of measuring to 0.01 foot accuracy. Recording pressure transducers, mounted above the pump, are especially helpful in tracking water levels during pumping operations, but their use must include check measurements with a water level "tape" at the start and end of each sampling event.

**F. Flow measurement supplies**

Graduated cylinder (size according to flow rate) and stopwatch usually will suffice.

Large graduated bucket used to record total water purged from the well.

**G. Interface probe**

To be used to check on the presence of free phase liquids (LNAPL, or DNAPL) before purging begins (as needed).

**H. Power source (generator, nitrogen tank, battery, etc.)**

When a gasoline generator is used, locate it downwind and at least 30 feet from the well so that the exhaust fumes do not contaminate samples.

**I. Indicator field parameter monitoring instruments**

Use of a multi-parameter instrument capable of measuring pH, oxidation/reduction potential (ORP), dissolved oxygen (DO), specific conductance, temperature, and coupled with a flow-through-cell is required when measuring all indicator field parameters, except turbidity. Turbidity is collected using a separate instrument. Record equipment/instrument identification (manufacturer, and model number).

Transparent, small volume flow-through-cells (e.g., 250 mLs or less) are preferred. This allows observation of air bubbles and sediment buildup in the cell, which can interfere with the operation of the monitoring instrument probes, to be easily detected. A small volume cell facilitates rapid turnover of water in the cell between measurements of the indicator field parameters.

It is recommended to use a flow-through-cell and monitoring probes from the same manufacturer and model to avoid incompatibility between the probes and flow-through-cell.

Turbidity samples are collected before the flow-through-cell. A "T" connector coupled with a valve is connected between the pump's tubing and flow-through-cell. When a turbidity measurement is required, the valve is opened to allow the groundwater to flow into a container. The valve is closed and the container sample is then placed in the turbidimeter.

Standards are necessary to perform field calibration of instruments. A minimum of two standards are needed to bracket the instrument measurement range for all parameters except ORP which use a Zobell solution as a standard. For dissolved oxygen, a wet sponge used for the 100% saturation and a zero dissolved oxygen solution are used for the calibration.

Barometer (used in the calibration of the Dissolved Oxygen probe) and the conversion formula to convert the barometric pressure into the units of measure used by the Dissolved Oxygen meter are needed.

**J. Decontamination supplies**

Includes (for example) non-phosphate detergent, distilled/deionized water, isopropyl alcohol, etc.

**K. Record keeping supplies**

Logbook(s), well purging forms, chain-of-custody forms, field instrument calibration forms, etc.

**L. Sample bottles**

**M. Sample preservation supplies (as required by the analytical methods)**

**N. Sample tags or labels**

**O. PID or FID instrument**

If appropriate, to detect VOCs for health and safety purposes, and provide qualitative field evaluations.

**P. Miscellaneous Equipment**

Equipment to keep the sampling apparatus shaded in the summer (e.g., umbrella) and from freezing in the winter. If the pump's tubing is allowed to heat up in the warm weather, the cold groundwater may degas as it is warmed in the tubing.

## EQUIPMENT/INSTRUMENT CALIBRATION

Prior to the sampling event, perform maintenance checks on the equipment and instruments according to the manufacturer's manual and/or applicable SOP. This will ensure that the equipment/instruments are working properly before they are used in the field.

Prior to sampling, the monitoring instruments must be calibrated and the calibration documented. The instruments are calibrated using U.S Environmental Protection Agency Region 1 *Calibration of Field Instruments (temperature, pH, dissolved oxygen, conductivity/specific conductance, oxidation/reduction [ORP], and turbidity),* January 19, 2010, or latest version or from one of the methods listed in 40CFR136, 40CFR141 and SW-846.

The instruments shall be calibrated at the beginning of each day. If the field measurement falls outside the calibration range, the instrument must be re-calibrated so that all measurements fall within the calibration range. At the end of each day, a calibration check is performed to verify that instruments remained in calibration throughout the day. This check is performed while the instrument is in measurement mode, not calibration mode. If the field instruments are being used to monitor the natural attenuation parameters, then a calibration check at mid-day is highly recommended to ensure that the instruments did not drift out of calibration. Note: during the day if the instrument reads zero or a negative number for dissolved oxygen, pH, specific conductance, or turbidity (negative value only), this indicates that the instrument drifted out of calibration or the instrument is malfunctioning. If this situation occurs the data from this instrument will need to be qualified or rejected.

## PRELIMINARY SITE ACTIVITIES (as applicable)

Check the well for security (damage, evidence of tampering, missing lock, etc.) and record pertinent observations (include photograph as warranted).

If needed lay out sheet of clean polyethylene for monitoring and sampling equipment, unless equipment is elevated above the ground (e.g., on a table, etc.).

Remove well cap and if appropriate measure VOCs at the rim of the well with a PID or FID instrument and record reading in field logbook or on the well purge form.

If the well casing does not have an established reference point (usually a V-cut or indelible mark in the well casing), make one. Describe its location and record the date of the mark in the logbook (consider a photographic record as well). All water level measurements must be recorded relative to this reference point (and the altitude of this point should be determined using techniques that are appropriate to site's DQOs.

If water-table or potentiometric surface map(s) are to be constructed for the sampling event, perform synoptic water level measurement round (in the shortest possible time) before any purging and sampling activities begin. If possible, measure water level depth (to 0.01 ft.) and total well depth (to 0.1 ft.) the day before sampling begins, in order to allow for re-settlement of any particulates in the water column. This is especially important for those wells that have not been recently sampled because sediment buildup in the well may require the well to be redeveloped. If measurement of total well depth is not made the day before, it should be measured after sampling of the well is complete. All measurements must be taken from the established referenced point. Care should be taken to minimize water column disturbance.

Check newly constructed wells for the presence of LNAPLs or DNAPLs before the initial sampling round. If none are encountered, subsequent check measurements with an interface probe may not be necessary unless analytical data or field analysis signal a worsening situation. This SOP cannot be used in the presence of LNAPLs or DNAPLs. If NAPLs are present, the project team must decide upon an alternate sampling method. All project modifications must be approved and documented prior to implementation.

If available check intake depth and drawdown information from previous sampling event(s) for each well. Duplicate, to the extent practicable, the intake depth and extraction rate (use final pump dial setting information) from previous event(s). If changes are made in the intake depth or extraction rate(s) used during previous sampling event(s), for either portable or dedicated extraction devices, record new values, and explain reasons for the changes in the field logbook.

## PURGING AND SAMPLING PROCEDURE

Purging and sampling wells in order of increasing chemical concentrations (known or anticipated) are preferred.

The use of dedicated pumps is recommended to minimize artificial mobilization and entrainment of particulates each time the well is sampled. Note that the use of dedicated sampling equipment can also significantly reduce the time needed to complete each

sampling event, will promote consistency in the sampling, and may reduce sampling bias by having the pump's intake at a constant depth.

**A. Initial Water Level**

Measure the water level in the well before installing the pump if a non-dedicated pump is being used. The initial water level is recorded on the purge form or in the field logbook.

**B. Install Pump**

Lower pump, safety cable, tubing and electrical lines slowly (to minimize disturbance) into the well to the appropriate depth (may not be the mid-point of the screen/open interval). The Sampling and Analysis Plan/Quality Assurance Project Plan should specify the sampling depth (used previously), or provide criteria for selection of intake depth for each new well. If possible keep the pump intake at least two feet above the bottom of the well, to minimize mobilization of particulates present in the bottom of the well.

Pump tubing lengths, above the top of well casing should be kept as short as possible to minimize heating the groundwater in the tubing by exposure to sun light and ambient air temperatures. Heating may cause the groundwater to degas, which is unacceptable for the collection of samples for VOC and dissolved gases analyses.

**C. Measure Water Level**

Before starting pump, measure water level. Install recording pressure transducer, if used to track drawdowns, to initialize starting condition.

**D. Purge Well**

From the time the pump starts purging and until the time the samples are collected, the purged water is discharged into a graduated bucket to determine the total volume of groundwater purged. This information is recorded on the purge form or in the field logbook.

Start the pump at low speed and slowly increase the speed until discharge occurs. Check water level. Check equipment for water leaks and if present fix or replace the affected equipment. Try to match pumping rate used during previous sampling event(s). Otherwise, adjust pump speed until there is little or no water level drawdown. If the minimal drawdown that can be achieved exceeds 0.3 feet, but remains stable, continue purging.

Monitor and record the water level and pumping rate every five minutes (or as appropriate) during purging. Record any pumping rate adjustments (both time and flow rate). Pumping rates should, as needed, be reduced to the minimum capabilities of the pump to ensure stabilization of the water level. Adjustments are best made in the first fifteen minutes of pumping in order to help minimize purging time. During pump start-up, drawdown may exceed the 0.3 feet target and then "recover" somewhat as pump flow adjustments are made. Purge volume calculations should utilize stabilized drawdown value, not the initial drawdown. If the initial water level is above the top of the screen do not allow the water level to fall into the well screen. The final purge volume must be greater than the stabilized drawdown volume plus the pump's tubing volume. If the drawdown has exceeded 0.3 feet and stabilizes, calculate the volume of water between the initial water level and the stabilized water level. Add the volume of the water which occupies the pump's tubing to this calculation. This combined volume of water needs to be purged from the well after the water level has stabilized before samples are collected.

Avoid the use of constriction devices on the tubing to decrease the flow rate because the constrictor will cause a pressure difference in the water column. This will cause the groundwater to degas and result in a loss of VOCs and dissolved gasses in the groundwater samples.

Note: the flow rate used to achieve a stable pumping level should remain constant while monitoring the indicator parameters for stabilization and while collecting the samples.

Wells with low recharge rates may require the use of special pumps capable of attaining very low pumping rates (e.g., bladder, peristaltic), and/or the use of dedicated equipment. For new monitoring wells, or wells where the following situation has not occurred before, if the recovery rate to the well is less than 50 mL/min., or the well is being essentially dewatered during purging, the well should be sampled as soon as the water level has recovered sufficiently to collect the volume needed for all anticipated samples. The project manager or field team leader will need to make the decision when samples should be collected, how the sample is to be collected, and the reasons recorded on the purge form or in the field logbook. A water level measurement needs to be performed and recorded before samples are collected. If the project manager decides to collect the samples using the pump, it is best during this recovery period that the pump intake tubing not be removed, since this will aggravate any turbidity problems. Samples in this specific situation may be collected without stabilization of indicator field parameters. Note that field conditions and efforts to overcome problematic situations must be recorded in order to support field decisions to deviate from normal procedures described in this SOP. If this type of problematic situation persists in a well, then water sample collection should be changed to a passive or no-purge method, if consistent with the site's DQOs, or have a new well installed.

**E. Monitor Indicator Field Parameters**

After the water level has stabilized, connect the "T" connector with a valve and the flow-through-cell to monitor the indicator field parameters. If excessive turbidity is anticipated or encountered with the pump startup, the well may be purged for a while without connecting up the flow-through-cell, in order to minimize particulate buildup in the cell (This is a judgment call made by the sampler). Water level drawdown measurements should be made as usual. If possible, the pump may be installed the day before purging to allow particulates that were disturbed during pump insertion to settle.

During well purging, monitor indicator field parameters (turbidity, temperature, specific conductance, pH, ORP, DO) at a frequency of five minute intervals or greater. The pump's flow rate must be able to "turn over" at least one flow-through-cell volume between measurements (for a 250 mL flow-through-cell with a flow rate of 50 mLs/min., the monitoring frequency would be every five minutes; for a 500 mL flow-through-cell it would be every ten minutes). If the cell volume cannot be replaced in the five minute interval, then the time between measurements must be increased accordingly. Note: during the early phase of purging emphasis should be put on minimizing and stabilizing pumping stress, and recording those adjustments followed by stabilization of indicator parameters. Purging is considered complete and sampling may begin when all the above indicator field parameters have stabilized. Stabilization is considered to be achieved when three consecutive readings are within the following limits:

**Turbidity** (10% for values greater than 5 NTU; if three Turbidity values are less than 5 NTU, consider the values as stabilized),
**Dissolved Oxygen** (10% for values greater than 0.5 mg/L, if three Dissolved Oxygen values are less than 0.5 mg/L, consider the values as stabilized),
**Specific Conductance** (3%),
**Temperature** (3%),
**pH** (± 0.1 unit),
**Oxidation/Reduction Potential** (±10 millivolts).

All measurements, except turbidity, must be obtained using a flow-through-cell. Samples for turbidity measurements are obtained before water enters the flow-through-cell. Transparent flow-through-cells are preferred, because they allow field personnel to watch for particulate build-up within the cell. This build-up may affect indicator field parameter values measured within the cell. If the cell needs to be cleaned during purging operations, continue pumping and disconnect cell for cleaning, then reconnect after cleaning and continue monitoring activities. Record start and stop times and give a brief description of cleaning activities.

The flow-through-cell must be designed in a way that prevents gas bubble entrapment in the cell. Placing the flow-through-cell at a 45 degree angle with the port facing upward can help remove bubbles from the flow-through-cell (see Appendix B Low-Flow Setup Diagram). All during the measurement process, the flow-through-cell must remain free of any gas bubbles. Otherwise, the monitoring probes may act erratically. When the pump is turned off or cycling on/off (when using a bladder pump), water in the cell must not drain out. Monitoring probes must remain submerged in water at all times.

**F. Collect Water Samples**

When samples are collected for laboratory analyses, the pump's tubing is disconnected from the "T" connector with a valve and the flow-through-cell. The samples are collected directly from the pump's tubing. Samples must not be collected from the flow-through-cell or from the "T" connector with a valve.

VOC samples are normally collected first and directly into pre-preserved sample containers. However, this may not be the case for all sampling locations; the SAP/QAPP should list the order in which the samples are to be collected based on the project's objective(s). Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

If the pump's flow rate is too high to collect the VOC/dissolved gases samples, collect the other samples first. Lower the pump's flow rate to a reasonable rate and collect the VOC/dissolved gases samples and record the new flow rate.

During purging and sampling, the centrifugal/peristaltic pump tubing must remain filled with water to avoid aeration of the groundwater. It is recommended that 1/4 inch or 3/8 inch (inside diameter) tubing be used to help insure that the sample tubing remains water filled. If the pump tubing is not completely filled to the sampling point, use the following procedure to collect samples: collect non-VOC/dissolved gases samples first, then increase flow rate slightly until the water completely fills the tubing, collect the VOC/dissolved gases samples, and record new drawdown depth and flow rate.

For bladder pumps that will be used to collect VOC or dissolved gas samples, it is recommended that the pump be set to deliver long pulses of water so that one pulse will fill a 40 mL VOC vial.

Use pre-preserved sample containers or add preservative, as required by analytical methods, to the samples immediately after they are collected. Check the analytical methods (e.g. EPA SW-846, 40 CFR 136, water supply, etc.) for additional information on preservation.

If determination of filtered metal concentrations is a sampling objective, collect filtered water samples using the same low flow procedures. The use of an in-line filter (transparent housing preferred) is required, and the filter size (0.45 $\mu$m is commonly used) should be based on the sampling objective. Pre-rinse the filter with groundwater prior to sample collection. Make sure the filter is free of air bubbles before samples are collected. Preserve the filtered water sample immediately. Note: filtered water samples are not an acceptable substitute for unfiltered samples when the monitoring objective is to obtain chemical concentrations of total mobile contaminants in groundwater for human health or ecological risk calculations.

Label each sample as collected. Samples requiring cooling will be placed into a cooler with ice or refrigerant for delivery to the laboratory. Metal samples after acidification to a pH less than 2 do not need to be cooled.

**G. Post Sampling Activities**

If a recording pressure transducer is used to track drawdown, re-measure water level with tape.

After collection of samples, the pump tubing may be dedicated to the well for re-sampling (by hanging the tubing inside the well), decontaminated, or properly discarded.

Before securing the well, measure and record the well depth (to 0.1 ft.), if not measured the day before purging began. Note: measurement of total well depth annually is usually sufficient after the initial low stress sampling event. However, a greater frequency may be needed if the well has a "silting" problem or if confirmation of well identity is needed.

Secure the well.

**DECONTAMINATION**

Decontaminate sampling equipment prior to use in the first well and then following sampling of each well. Pumps should not be removed between purging and sampling operations. The pump, tubing, support cable and electrical wires which were in contact with the well should be decontaminated by one of the procedures listed below.

The use of dedicated pumps and tubing will reduce the amount of time spent on decontamination of the equipment. If dedicated pumps and tubing are used, only the initial sampling event will require decontamination of the pump and tubing.

Note if the previous equipment blank data showed that contaminant(s) were present after using the below procedure or the one described in the SAP/QAPP, a more vigorous procedure may be needed.

Procedure 1

Decontaminating solutions can be pumped from either buckets or short PVC casing sections through the pump and tubing. The pump may be disassembled and flushed with the decontaminating solutions. It is recommended that detergent and alcohol be used sparingly in the decontamination process and water flushing steps be extended to ensure that any sediment trapped in the pump is removed. The pump exterior and electrical wires must be rinsed with the decontaminating solutions, as well. The procedure is as follows:

Flush the equipment/pump with potable water.

Flush with non-phosphate detergent solution. If the solution is recycled, the solution must be changed periodically.

Flush with potable or distilled/deionized water to remove all of the detergent solution. If the water is recycled, the water must be changed periodically.

Optional - flush with isopropyl alcohol (pesticide grade; must be free of ketones {e.g., acetone}) or with methanol. This step may be required if the well is highly contaminated or if the equipment blank data from the previous sampling event show that the level of contaminants is significant.

Flush with distilled/deionized water. This step must remove all traces of alcohol (if used) from the equipment. The final water rinse must not be recycled.

Procedure 2

Steam clean the outside of the submersible pump.

Pump hot potable water from the steam cleaner through the inside of the pump. This can be accomplished by placing the pump inside a three or four inch diameter PVC pipe with end cap. Hot water from the steam cleaner jet will be directed inside the PVC pipe and the pump exterior will be cleaned. The hot water from the steam cleaner will then be pumped from the PVC pipe through the pump and collected into another container. Note: additives or solutions should not be added to the steam cleaner.

Pump non-phosphate detergent solution through the inside of the pump. If the solution is recycled, the solution must be changed periodically.

Pump potable water through the inside of the pump to remove all of the detergent solution. If the solution is recycled, the solution must be changed periodically.

Pump distilled/deionized water through the pump. The final water rinse must not be recycled.

## FIELD QUALITY CONTROL

Quality control samples are required to verify that the sample collection and handling process has not compromised the quality of the groundwater samples. All field quality control samples must be prepared the same as regular investigation samples with regard to sample volume, containers, and preservation. Quality control samples include field duplicates, equipment blanks, matrix spike/matrix spike duplicates, trip blanks (VOCs), and temperature blanks.

## FIELD LOGBOOK

A field log shall be kept to document all groundwater field monitoring activities (see Appendix C, example table), and record the following for each well:

Site name, municipality, state.

Well identifier, latitude-longitude or state grid coordinates.

Measuring point description (e.g., north side of PVC pipe).

Well depth, and measurement technique.

Well screen length.

Pump depth.

Static water level depth, date, time and measurement technique.

Presence and thickness of immiscible liquid (NAPL) layers and detection method.

Pumping rate, drawdown, indicator parameters values, calculated or measured total volume pumped, and clock time of each set of measurements.

Type of tubing used and its length.

Type of pump used.

Clock time of start and end of purging and sampling activity.

Types of sample bottles used and sample identification numbers.

Preservatives used.

Parameters requested for analyses.

Field observations during sampling event.

Name of sample collector(s).

Weather conditions, including approximate ambient air temperature.

QA/QC data for field instruments.

Any problems encountered should be highlighted.

Description of all sampling/monitoring equipment used, including trade names, model number, instrument identification number, diameters, material composition, etc.

## DATA REPORT

Data reports are to include laboratory analytical results, QA/QC information, field indicator parameters measured during purging, field instrument calibration information, and whatever other field logbook information is needed to allow for a full evaluation of data usability.

Note: the use of trade, product, or firm names in this sampling procedure is for descriptive purposes only and does not constitute endorsement by the U.S. EPA.

## REFERENCES

Cohen, R.M. and J.W. Mercer, 1993, *DNAPL Site Evaluation*; C.K. Smoley (CRC Press), Boca Raton, Florida.

Robert W. Puls and Michael J. Barcelona, *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, April 1996 (EPA/540/S-95/504).

U.S. Environmental Protection Agency, 1992, *RCRA Ground-Water Monitoring: Draft Technical Guidance*; Washington, DC (EPA/530-R-93-001).

U.S. Environmental Protection Agency, 1987, *A Compendium of Superfund Field Operations Methods*; Washington, DC (EPA/540/P-87/001).

U.S Environmental Protection Agency, Region 1, *Calibration of Field Instruments (temperature, pH, dissolved oxygen, conductivity/specific conductance, oxidation/reduction [ORP], and turbidity),* January 19, 2010 or latest version.

U.S Environmental Protection Agency, EPA SW-846.

U.S Environmental Protection Agency, 40 CFR 136.

U.S Environmental Protection Agency, 40 CFR 141.

Vroblesky, Don A., Clifton C. Casey, and Mark A. Lowery, Summer 2007, Influence of Dissolved Oxygen Convection on Well Sampling, *Ground Water Monitoring & Remediation* 27, no. 3: 49-58.

# APPENDIX A
# PERISTALTIC PUMPS

Before selecting a peristaltic pump to collect groundwater samples for VOCs and/or dissolved gases (e.g., methane, carbon dioxide, etc.) consideration should be given to the following:

- The decision of whether or not to use a peristaltic pump is dependent on the intended use of the data.
- If the additional sampling error that may be introduced by this device is NOT of concern for the VOC/dissolved gases data's intended use, then this device may be acceptable.
- If minor differences in the groundwater concentrations could effect the decision, such as to continue or terminate groundwater cleanup or whether the cleanup goals have been reached, then this device should NOT be used for VOC/dissolved gases sampling. In these cases, centrifugal or bladder pumps are a better choice for more accurate results.

EPA and USGS have documented their concerns with the use of the peristaltic pumps to collect water sample in the below documents.

- "Suction Pumps are not recommended because they may cause degassing, pH modification, and loss of volatile compounds" *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001, December 1987.
- "The agency does not recommend the use of peristaltic pumps to sample ground water particularly for volatile organic analytes" *RCRA Ground-Water Monitoring Draft Technical Guidance*, EPA Office of Solid Waste, November 1992.
- "The peristaltic pump is limited to shallow applications and can cause degassing resulting in alteration of pH, alkalinity, and volatiles loss", *Low-flow (Minimal drawdown) Ground-Water Sampling Procedures*, by Robert Puls & Michael Barcelona, April 1996, EPA/540/S-95/504.
- "Suction-lift pumps, such as peristaltic pumps, can operate at a very low pumping rate; however, using negative pressure to lift the sample can result in the loss of volatile analytes", USGS Book 9 Techniques of Water-Resources Investigation, Chapter A4. (Version 2.0, 9/2006).

# APPENDIX B

## SUMMARY OF SAMPLING INSTRUCTIONS

These instructions are for using an adjustable rate, submersible pump or a peristaltic pump with the pump's intake placed at the midpoint of a 10 foot or less well screen or an open interval. The water level in the monitoring well is above the top of the well screen or open interval, the ambient temperature is above 32°F, and the equipment is not dedicated. Field instruments are already calibrated. The equipment is setup according to the diagram at the end of these instructions.

1. Review well installation information. Record well depth, length of screen or open interval, and depth to top of the well screen. Determine the pump's intake depth (e.g., mid-point of screen/open interval).

2. On the day of sampling, check security of the well casing, perform any safety checks needed for the site, lay out a sheet of polyethylene around the well (if necessary), and setup the equipment. If necessary a canopy or an equivalent item can be setup to shade the pump's tubing and flow-through-cell from the sun light to prevent the sun light from heating the groundwater.

3. Check well casing for a reference mark. If missing, make a reference mark. Measure the water level (initial) to 0.01 ft. and record this information.

4. Install the pump's intake to the appropriate depth (e.g., midpoint) of the well screen or open interval. Do not turn-on the pump at this time.

5. Measure water level and record this information.

6. Turn-on the pump and discharge the groundwater into a graduated waste bucket. Slowly increase the flow rate until the water level starts to drop. Reduce the flow rate slightly so the water level stabilizes. Record the pump's settings. Calculate the flow rate using a graduated container and a stop watch. Record the flow rate. Do not let the water level drop below the top of the well screen.

If the groundwater is highly turbid or colored, continue to discharge the water into the bucket until the water clears (visual observation); this usually takes a few minutes. The turbid or colored water is usually from the well being disturbed during the pump installation. If the water does not clear, then you need to make a choice whether to continue purging the well (hoping that it will clear after a reasonable time) or continue to

the next step. Note, it is sometimes helpful to install the pump the day before the sampling event so that the disturbed materials in the well can settle out.

If the water level drops to the top of the well screen during the purging of the well, stop purging the well, and do the following:

> Wait for the well to recharge to a sufficient volume so samples can be collected. This may take awhile (pump maybe removed from well, if turbidity is not a problem). The project manager will need to make the decision when samples should be collected and the reasons recorded in the site's log book. A water level measurement needs to be performed and recorded before samples are collected. When samples are being collected, the water level must not drop below the top of the screen or open interval. Collect the samples from the pump's tubing. Always collect the VOCs and dissolved gases samples first. Normally, the samples requiring a small volume are collected before the large volume samples are collected just in case there is not sufficient water in the well to fill all the sample containers. All samples must be collected, preserved, and stored according to the analytical method. Remove the pump from the well and decontaminate the sampling equipment.

If the water level has dropped 0.3 feet or less from the initial water level (water level measure before the pump was installed); proceed to Step 7. If the water level has dropped more than 0.3 feet, calculate the volume of water between the initial water level and the stabilized water level. Add the volume of the water which occupies the pump's tubing to this calculation. This combined volume of water needs to be purged from the well after the water level has stabilized before samples are be collected.

7. Attach the pump's tubing to the "T" connector with a valve (or a three-way stop cock). The pump's tubing from the well casing to the "T" connector must be as short as possible to prevent the groundwater in the tubing from heating up from the sun light or from the ambient air. Attach a short piece of tubing to the other end of the end of the "T" connector to serve as a sampling port for the turbidity samples. Attach the remaining end of the "T" connector to a short piece of tubing and connect the tubing to the flow-through-cell bottom port. To the top port, attach a small piece of tubing to direct the water into a calibrated waste bucket. Fill the cell with the groundwater and remove all gas bubbles from the cell. Position the flow-through-cell in such a way that if gas bubbles enter the cell they can easily exit the cell. If the ports are on the same side of the cell and the cell is cylindrical shape, the cell can be placed at a 45-degree angle with the ports facing upwards; this position should keep any gas bubbles entering the cell away from the monitoring probes and allow the gas bubbles to exit the cell easily (see Low-Flow Setup Diagram). Note,

make sure there are no gas bubbles caught in the probes' protective guard; you may need to shake the cell to remove these bubbles.

8. Turn-on the monitoring probes and turbidity meter.

9. Record the temperature, pH, dissolved oxygen, specific conductance, and oxidation/reduction potential measurements. Open the valve on the "T" connector to collect a sample for the turbidity measurement, close the valve, do the measurement, and record this measurement. Calculate the pump's flow rate from the water exiting the flow-through-cell using a graduated container and a stop watch, and record the measurement. Measure and record the water level. Check flow-through-cell for gas bubbles and sediment; if present, remove them.

10. Repeat Step 9 every 5 minutes or as appropriate until monitoring parameters stabilized. Note at least one flow-through-cell volume must be exchanged between readings. If not, the time interval between readings will need to be increased. Stabilization is achieved when three consecutive measurements are within the following limits:

**Turbidity** (10% for values greater than 5 NTUs; if three Turbidity values are less than 5 NTUs, consider the values as stabilized),
**Dissolved Oxygen** (10% for values greater than 0.5 mg/L, if three Dissolved Oxygen values are less than 0.5 mg/L, consider the values as stabilized),
**Specific Conductance** (3%),
**Temperature** (3%),
**pH** (± 0.1 unit),
**Oxidation/Reduction Potential** (±10 millivolts).

If these stabilization requirements do not stabilize in a reasonable time, the probes may have been coated from the materials in the groundwater, from a buildup of sediment in the flow-through-cell, or a gas bubble is lodged in the probe. The cell and the probes will need to be cleaned. Turn-off the probes (not the pump), disconnect the cell from the "T" connector and continue to purge the well. Disassemble the cell, remove the sediment, and clean the probes according to the manufacturer's instructions. Reassemble the cell and connect the cell to the "T" connector. Remove all gas bubbles from the cell, turn-on the probes, and continue the measurements. Record that the time the cell was cleaned.

11. When it is time to collect the groundwater samples, turn-off the monitoring probes, and disconnect the pump's tubing from the "T" connector. If you are using a centrifugal or peristaltic pump check the pump's tubing to determine if the tubing is completely filled with water (no air space).

All samples must be collected and preserved according to the analytical method. VOCs and dissolved gases samples are normally collected first and directly into pre-preserved sample containers. However, this may not be the case for all sampling locations; the SAP/QAPP should list the order in which the samples are to be collected based on the project's objective(s). Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

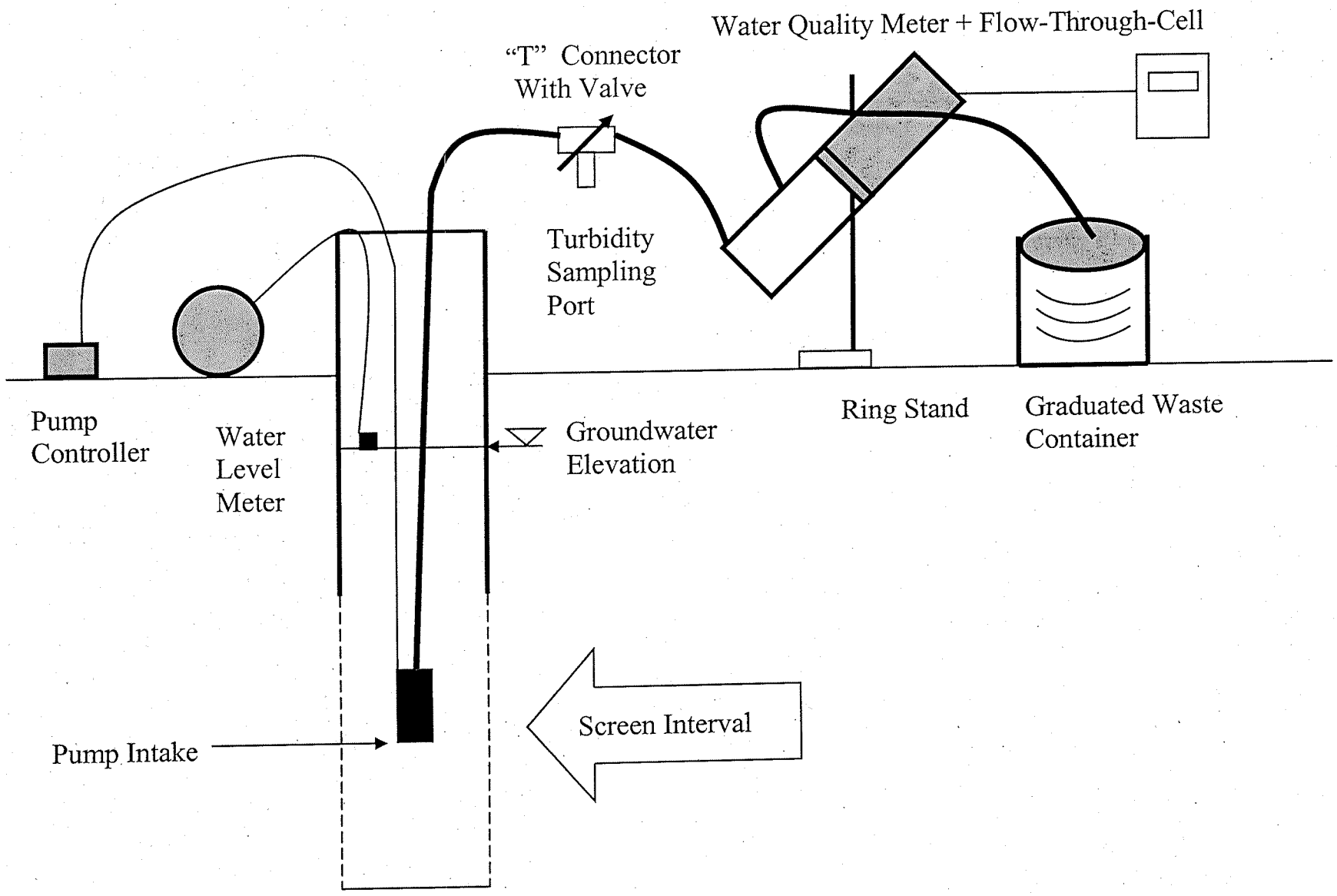
If the pump's tubing is not completely filled with water and the samples are being collected for VOCs and/or dissolved gases analyses using a centrifugal or peristaltic pump, do the following:

> All samples must be collected and preserved according to the analytical method. The VOCs and the dissolved gases (e.g., methane, ethane, ethene, and carbon dioxide) samples are collected last. When it becomes time to collect these samples increase the pump's flow rate until the tubing is completely filled. Collect the samples and record the new flow rate.

12. Store the samples according to the analytical method.

13. Record the total purged volume (graduated waste bucket). Remove the pump from the well and decontaminate the sampling equipment.

# Low-Flow Setup Diagram



APPENDIX C
EXAMPLE (Minimum Requirements)
WELL PURGING-FIELD WATER QUALITY MEASUREMENTS FORM

Location (Site/Facility Name)_____
Well Number_____ Date_____
Field Personnel_____
Sampling Organization_____
Identify MP_____

Depth to _____/_____ of screen
(below MP) top bottom
Pump Intake at (ft. below MP)_____
Purging Device; (pump type)_____
Total Volume Purged _____

| Clock Time 24 HR | Water Depth below MP ft | Pump Dial[1] | Purge Rate ml/min | Cum. Volume Purged liters | Temp. °C | Spec. Cond.[2] µS/cm | pH | ORP[3] mv | DO mg/L | Turb-idity NTU | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| Stabilization Criteria | | | | | 3% | 3% | ±0.1 | ± 10 mv | 10% | 10% | |

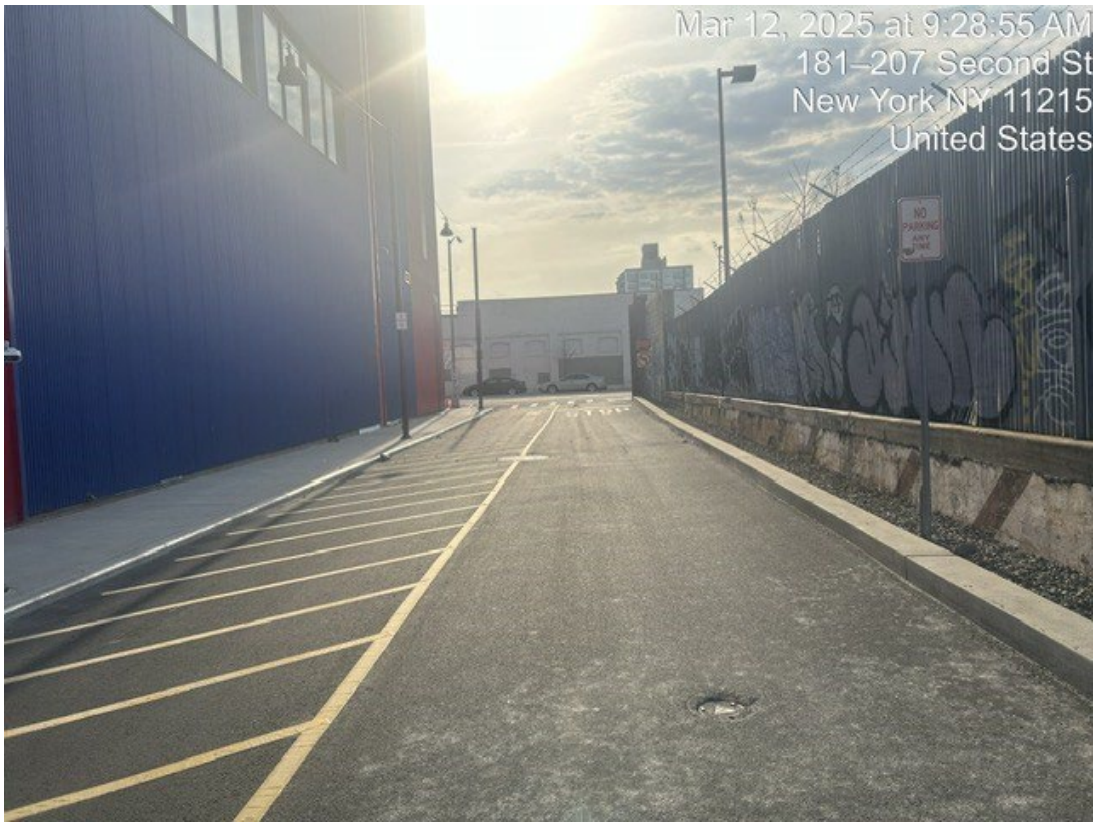
1. Pump dial setting (for example: hertz, cycles/min, etc).
2. µSiemens per cm(same as µmhos/cm)at 25 °C.
3. Oxidation reduction potential (ORP)

# APPENDIX D

Quarterly Groundwater Sampling Results Letters

# APPENDIX E

Site Inspection Checklist and Photo Log




**Photograph 1:** Facing southeast in the south site driveway. Final asphalt component of the Site composite cover system in place and in good condition.




**Photograph 2:** Facing southeast in the north site driveway. Final asphalt component of the Site composite cover system in place and in good condition.



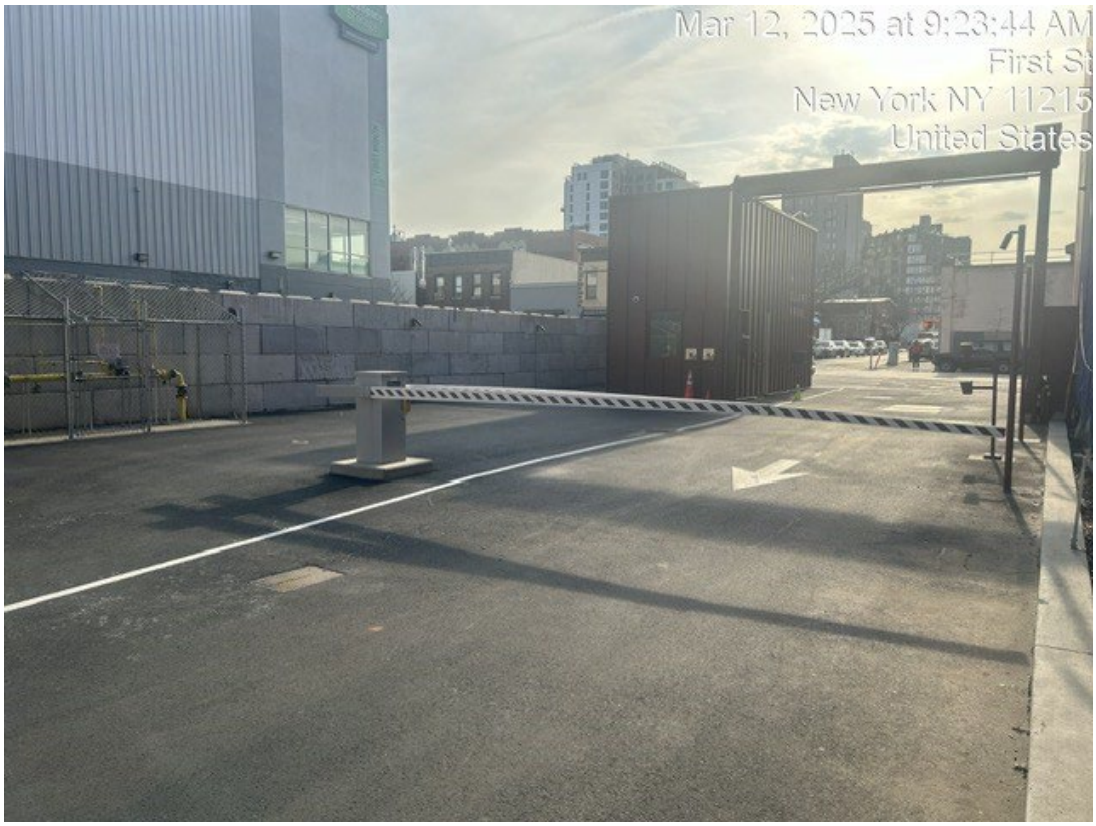

**Photograph 3:** Facing southwest in the forecourt area. Final asphalt component of the Site composite cover system in place and in good condition.



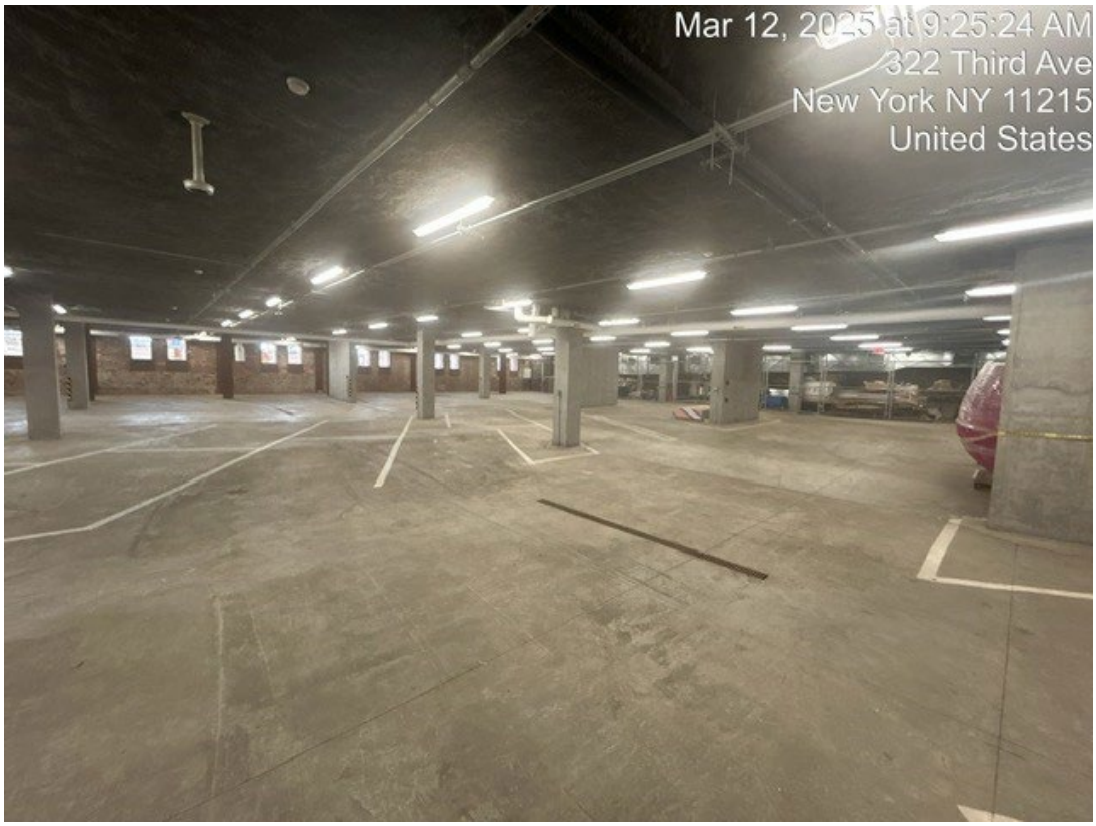

**Photograph 4:** Facing northeast. Landscaped slope, and drainage structure components of the Site composite cover system in place and in good condition.



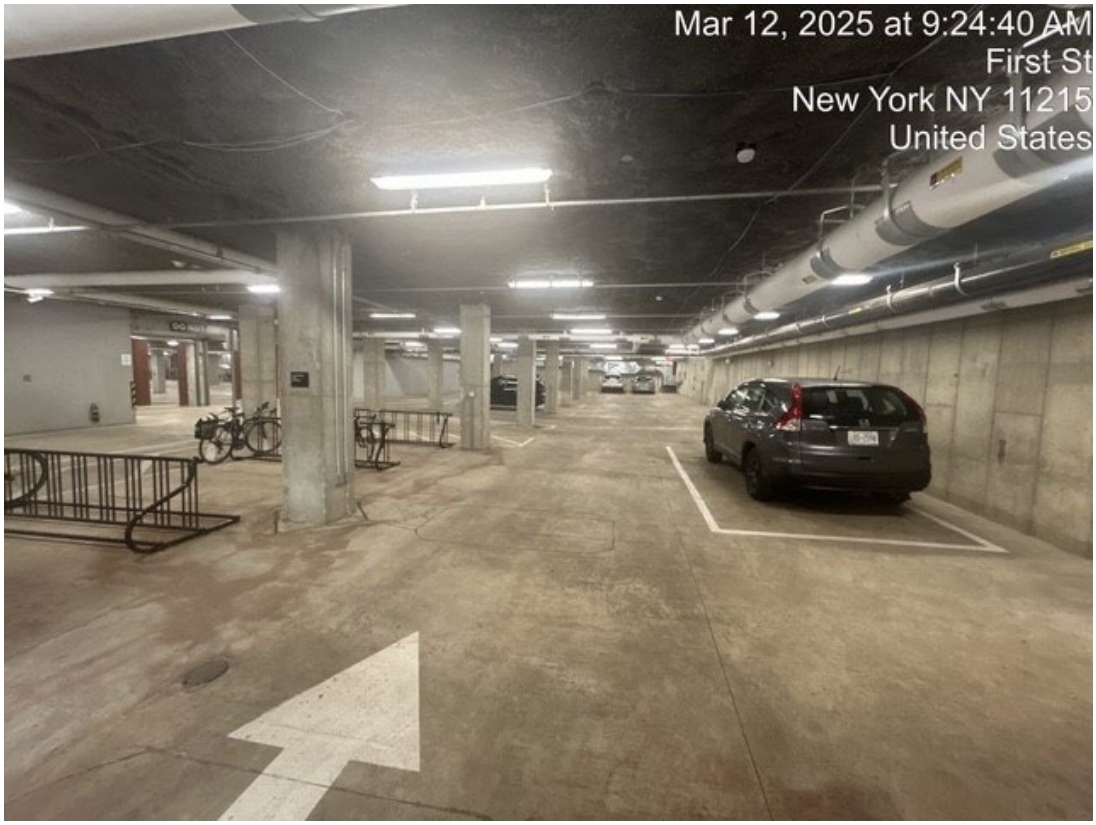

**Photograph 5:** Facing northwest in the northwest portion of the site. View of landscape bed, yard blocks, and stone cover system in place and in good condition.



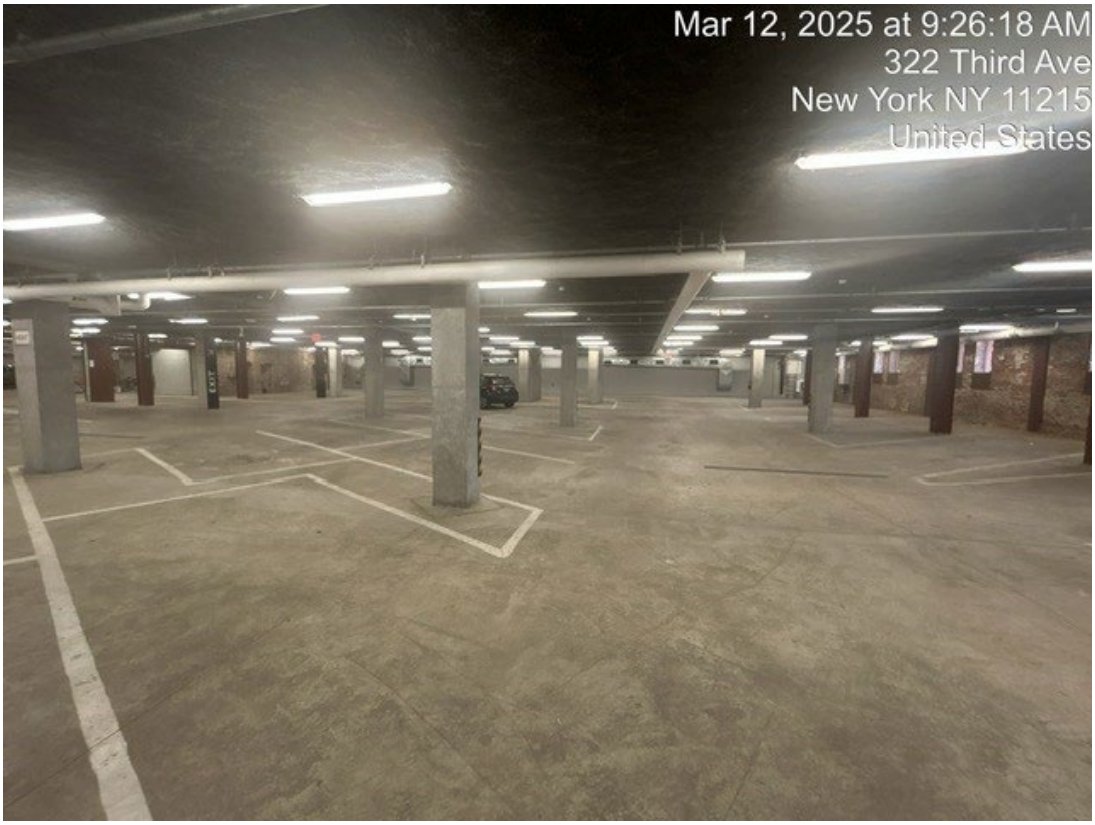

**Photograph 6:** Facing east in the northeast site driveway at the gatehouse building. Final asphalt component of the Site composite cover system in place and in good condition.




**Photograph 7:** View of the turbine hall cellar. TSCA-compliant cap component of the Site composite cover system in place and in good condition.




**Photograph 8:** View of the boiler house cellar. TSCA-compliant cap component of the Site composite cover system in place and in good condition.




**Photograph 9:** Facing east, view of the turbine hall cellar. Open window grilles located along the southern wall.




**Photograph 10:** Facing southwest, view of the turbine hall cellar. Cover system in place and in good condition.

**ROUX ENVIRONMENTAL ENGINEERING AND GEOLOGY, D.P.C.**

**SITE-WIDE MONITORING, INSPECTION AND MAINTENANCE FORM**

Client: **BRT Powerhouse, LLC**
Location: **153 2nd Street AKA 322 3rd Avenue, Brooklyn, New York 11215**
Inspector: **Michael Sarni**
Date: **3/12/2025**

**Site Observations:**

| Yes | No | |
|---|---|---|
| [ ] | [X] | Have any Site improvements been made since last inspection? |
| [ ] | [X] | Has there been any maintenance activity impacting engineering controls? |
| [X] | [ ] | Are monitoring wells intact? If no, refer to Page 2 for additional clarification. |
| | | -Include sketches or photos of observations |

**Inspection of RCA Cap:**

| Yes | No | |
|---|---|---|
| [ ] | [X] | Underlying demarcation barrier exposed? |
| [X] | [ ] | Are soil caps sloped to allow for drainage away from the peak? |
| | | -Include sketches or photos of observations |

**Inspection of Asphalt/Concrete Caps:**

| Yes | No | |
|---|---|---|
| [ ] | [X] | Significant cracks observed? |
| [ ] | [X] | Other damage observed? If yes, refer to Page 2 for additional clarification. |
| | | -Include sketches or photos of observations |

**Inspection of Building Covers:**

| Yes | No | |
|---|---|---|
| [X] | [ ] | Were all buildings inspected? |
| [ ] | [X] | Significant cracks observed? |
| [ ] | [X] | Other damage observed? If yes, refer to Page 2 for additional clarification. |
| [ ] | [X] | Any new slab penetrations observed? If yes, refer to Page 2 for additional clarification. |
| | | -Include sketched or photos of observations |

**Inspection of LNAPL Recovery System : N/A**

| Yes | No | |
|---|---|---|
| [ ] | [ ] | Was the one (1) Recovery well intact? |
| [ ] | [ ] | Was the one (1) Spill Buster seeker operating properly? |
| [ ] | [ ] | Were there any signs of corrosion on the 55 gallon drum? |
| [ ] | [ ] | Were the fill alarm and spill alarms operating properly? |
| [ ] | [ ] | Was the secondary containment pallet intact? |
| [ ] | [ ] | Is the Spill Buster control panel intact? |

**ROUX ENVIRONMENTAL ENGINEERING AND GEOLOGY, D.P.C.**
**SITE-WIDE MONITORING, INSPECTION AND MAINTENANCE FORM**

Client: **Gemini Arts Initiative, Inc.**
Location: **153 2nd Street AKA 322 3rd Avenue, Brooklyn, New York 11215**
Inspector: **Michael Sarni**
Date: **3/12/2025**

**Site Observations**

See Page 1 for additional observations.

- All required monitoring wells are intact and in good condition.
- Final Site-wide asphalt paving and landscaping completed in May 2022.
- Underlying demarcation layer not visible through the Site.
- All required monitoring wells are intact and in good condition.

**Additional Comments or Clarification Where Corrective Actions May Be Required:**

- No corrective actions required at this time.