GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

FINAL Remedial Investigation Work Plan

Former Dry Cleaners
495 Howard Avenue
Brooklyn, New York

Submitted to:
New York State Department of Environmental Conservation
Region 2
1 Hunters Point Plaza
47-40 21st street
Long Island City, NY 11101

Submitted By:
GEI Consultants, Inc., P. C.
110 Walt Whitman Road, Suite 204
Huntington Station, New York 11746
631.760.9300

May 2013
Project 130230

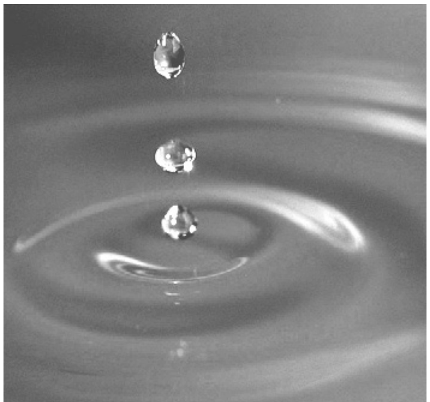


Table of Contents

Certification 1

1. Background and Site Description 1
- 1.1 Introduction 1
- 1.2 Objective of the RIWP 1
- 1.3 Background 1
- 1.4 Description of Local Hydrogeological Conditions 1
- 1.5 Previous Report Findings 2
- 1.6 Project Organizational Structure and Responsibility 5

2. Scope of Work 7

3. Quality Assurance / Quality Control (QA/QC) Protocols 14

4. Health and Safety Protocols 15

5. Data Evaluation and Remedial Investigation Report 16

6. Development of Remedial Alternatives (Feasibility Study) 18

7. Citizen Participation Activities 23
- 7.1 Description of Citizen Participation Activities 23

8. Schedule 25

Appendices

A Site Figures
B Key GEI Personnel Resumes
C Field Sampling Plan
D Quality Assurance Project Plan
E Community Air Monitoring Plan
F Potential Remediation Techniques
G Health and Safety Plan

H:\TECH\project\Omni New York\DCA-1 Brownfiled Program Brownsville Brooklyn Site\RIWP\Final - after Jane's Comments\FINAL RIWP text- 495 Howard 5-6.docx

Certification

I, Nicholas J. Recchia certify that I am currently a Qualified Environmental Professional as defined in 6 NYCRR Part 375 and that this Report Investigation Work Plan (RIWP) 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).

Nicholas J. Recchia

Signature

5/3/13

Date

1. Background and Site Description

1.1 Introduction

GEI Consultants, Inc. (GEI) has prepared this Remedial Investigation Work Plan (RIWP) for the Site located at 495 Howard Avenue (Block 1446, Lot 1) in Brooklyn, New York (the Site). Information regarding the Site conditions was obtained from the *Phase I Environmental Site Assessment ESA-11233* dated August 2011 and prepared by EEA, Inc. (EEA) and the *Phase II Environmental Subsurface Investigation Report* dated December 2011 and prepared by EEA.

Site figures are located in **Appendix A**.

1.2 Objective of the RIWP

The objective of this RIWP is to obtain valid data to evaluate and define the nature, extent, and degree of chlorinated volatile organic compound (CVOC) impacts previously identified onsite and resulting from the past operations at the property. The data generated during the field investigation will be used to determine what risks, if any, the onsite CVOC impacts present to public health and to the environment. Additionally, the RIWP has been designed to provide data needed to perform a remedial alternatives analysis for the Site.

1.3 Background

Based upon historical Sanborn atlases and historic reverse address directories of the Phase I ESA, a dry cleaning operation was identified in a former building on the Site in the 1960s. Dry cleaning establishments are types of businesses that typically store and use toxic or hazardous materials and generate toxic or hazardous wastes (i.e., dry cleaning solvents and wastes, spot cleaners, and contaminated dry cleaning machine components such as machine filter cartridges).

1.4 Description of Local Hydrogeological Conditions

Site Soil/Stratigraphy

The Site soil stratigraphy consists of historical fill from approximately grade to 7 feet below grade (ft bg), indigenous glacial till consisting of dense sand, silt, gravel, and cobbles from approximately 7 to 54 ft bg, and medium to fine grained sand from approximately 54 to 60 ft bg. The regional groundwater aquifer is likely within the medium to fine grained sand formation.

Aquifer Characteristics

What appears to be perched groundwater was encountered at approximately 13 ft bg in all three soil test boring locations during the Phase II investigation. The soil below this depth was moist to wet but not saturated. The regional groundwater elevation was encountered at a depth of 55 feet and was found in a permeable sand formation.

Groundwater Flow Direction

Regional groundwater flow direction is likely to the southeast.

1.5 Previous Report Findings

Prior to the preparation of the RIWP, several investigations were conducted onsite and on a contiguous property . These investigations included an onsite soil vapor investigation and an offsitevapor encroachment screening investigation and a limited Phase II subsurface investigation. Sample location maps from these investigations are included as **Appendix A**.

Onsite Soil Vapor Quality

A soil vapor investigation was performed onsite. Results of analytical laboratory sampling indicated concentrations of the dry cleaning chemical compound tetrachloroethene (PCE) in soil vapor test probes at significant levels in three sample locations; SV-1 (1,221.3 micrograms per cubic meter [$\mu g/m^3$]), SV-2 (4,206.7 $\mu g/m^3$), and SV-4 (278.19 $\mu g/m^3$). Trichloroethene (TCE) concentrations were also detected at SV-2 (69.9 $\mu g/m^3$). These locations are consistent with where the historical dry cleaning operation was performed and indicates that the former dry cleaning operations appear to have resulted in a release of dry cleaning chemicals into the subsurface. The extent of subsurface impacts is unknown and additional investigatory sampling was recommended to delineate the potential contamination concern.

Vapor Encroachment Screening:

In order to determine if operations associated with the former dry cleaning occupant have impacted offsite contiguous buildings sub-slab and ambient air quality, EEA had performed a vapor encroachment screening investigation in several offsite contiguous buildings, located adjacent to the Site.

There are three separate residential building structures located adjacent and contiguous to the Site, as listed below:

1. Sterling Place Building
2. Howard Avenue Building
3. Park Place Building

In each of the building structures, two sub-slab soil vapor samples were collected in accessible common locations such as hallways and corridors within the building. In accordance with New York State Department of Health (NYSDOH) guidelines, one background outdoor air sample and one indoor air sample were collected at each building location. All canisters were submitted to a NYSDOH Environmental Laboratory Accreditation Program (ELAP)-certified laboratory and analyzed for volatile organic compounds (VOCs) by United States Environmental Protection Agency (USEPA) Method TO-15. Soil vapor and ambient air sampling results were compared to the NYSDOH matrix guidelines, which are used as tools in making decisions when soil vapor/gas is entering buildings. These matrices are found in the "Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York" document and focus on soil vapor or ambient air containing any of the following four compounds: Carbon Tetrachloride, TCE, PCE, and 1,1,1 Trichloroethene.

TCE and PCE were detected in both sub-slab soil vapor samples (SV-9 and SV-10) collected from the Sterling Place building at low concentrations and were not detected within the indoor air sample collected in this building. According to the NYSDOH Decision Matrix Nos. 1 and 2, no further actions are needed to address human exposures.

PCE was detected in one sub-slab soil vapor sample (SV-8) collected from the Howard Avenue building at a low concentration and was not detected within the indoor air sample collected in this building. According to the NYSDOH Decision Matrix No. 2, no further actions are needed to address human exposures.

Results from the Park Place building did not detect Carbon Tetrachloride, TCE, PCE, or 1,1,1 Tricholoroethene above method level detection methods. Therefore no further actions are needed to address human exposures.

Phase II Subsurface Investigation

The following results are from the *Phase II Environmental Subsurface Investigation Report* dated December 2011 by EEA. Sampling during this investigation included both soil and groundwater samples.

Soil Analytical Results

Analytical laboratory results indicated that PCE was detected above laboratory method detection limits in the deep soil samples collected from B-2. Soil samples collected from B-1 and B-3 did not indicate any detectable concentrations of PCE.

The PCE concentrations in soil from deep soil boring B-2 were as follows:

Table A: Soil Analytical Results

Boring Location	Sample Depth (ft)	PCE Concentration (µg/kg)
B-2	20	7
B-2	30	36
B-2	40	63
B-2	50	640
B-2	60	<5.2

Notes

µg/kg = micrograms per liter

B-2 is located where historical dry cleaning operations were performed and indicates that the former dry cleaning operations appear to have resulted in a release of dry cleaning chemicals into the subsurface. The concentration of PCE increases with depth until the soil formation changes from glacial till to a more permeable sand layer at a depth of approximately 55 ft bg.

The soil sample collected from 60 feet consisted of saturated permeable sand and is likely within the regional groundwater aquifer. PCE was not detected at this depth in the formation.

Groundwater Analytical Results

Groundwater quality laboratory results collected from two locations B-1 (GW-1) and B-3 (GW-3) show concentrations of PCE above the New York State Department of Environmental Conservation (NYSDEC) groundwater quality standards.

Additionally, PCE was detected in onsite groundwater above the *New York State Ambient Water Quality Standards (AWQS) and Guidance Values for Class GA Groundwater* as summarized below.

Table B: Groundwater Analytical Results

Sample Location	AWQS	PCE Concentration (µg/kg)
GW-1	5 µg/L	24
GW-3		36

Notes

New York State Ambient Water Quality Standards (AWQS) and Guidance Values for Class GA Groundwater

1.6 Project Organizational Structure and Responsibility

GEI will work with NYSDEC to conduct the RIWP. Approval of this RIWP by the NYSDEC will be obtained prior to Site preparation.

The drilling subcontractor will be responsible for all drilling activities to include, but not be limited to, compliance with all applicable Occupational Safety and Health Administration (OSHA) regulations, personnel health and safety, installation of soil borings and monitoring wells associated with the RIWP, and any other specified tasks outlined in this RIWP.

GEI will be responsible for project management, subcontractor oversight, RIWP compliance, determination of corrective measures when needed, monitoring for health and safety, perimeter-air monitoring activities, collection of analytical samples, and maintenance of Site sampling and meteorological logs. GEI will also serve as the Site Health and Safety Officer.

The following are the key personnel or agencies involved with RIWP activities at the Site:

NYSDEC:	Mr. Nigel Crawford
Drilling Subcontractor:	Not selected at this time.
GEI:	Mr. Nick Recchia Project Manager 110 Walt Whitman Road, Suite 204 Huntington Station, NY 11746 (516) 395-8763

Ms. Jaimie Wargo
Quality Assurance Officer
455 Winding Brook Dr
Glastonbury, CT 06033
(860) 368-5300

Remedial
Party Contact: Gary Rodney
DCA 1, L.P. c/o Omni New York LLC
885 Second Avenue, Floor 31
New York, New York 10017

Resumes of key GEI personnel are included in **Appendix B**.

2. Scope of Work

All field work will be performed in accordance with the Field Sampling Program (FSP) methods included in **Appendix C**. Analytical sampling will be performed in accordance with the Quality Assurance Project Plan (QAPP) included in **Appendix D**. A Community Air Monitoring Plan (CAMP) will be implemented during field activities and is included in **Appendix E**.

The RIWP scope of work includes the following general tasks:

- Mobilization and Site Access
- Site Preparation
- Odor and Fugitive Dust Control
- Soil Boring Installations and Laboratory Analytical Sampling
- Groundwater Monitoring Well Installations
- Well Development
- Material Handling
- Site Restoration
- Survey
- Monitoring Well Sampling
- Reporting

Execution of the RIWP

Site work will commence at 0700 Monday through Friday with no heavy truck traffic until 0800. All work must be completed and the work area closed for the evening at 1700 unless otherwise authorized by the property owner. During working hours, the drilling subcontractor will make every effort to minimize potential community impacts. These include, but are not limited to, noise and traffic concerns associated with the execution of the RIWP. Site work will not be conducted on weekends or holidays without prior approval by the property owner.

Mobilization and Site Access

The selected drilling subcontractor will submit a Site-specific Health and Safety Plan (HASP) meeting the minimum requirements of GEI's HASP, which is included in **Appendix F**. All work will be performed in accordance with all OSHA, state, and industry safety standards. All onsite personnel performing intrusive activities that have the potential to come in contact with impacted materials will have the requisite 1910.120 OSHA Hazardous Waste

Operations and Emergency Response (HAZWOPER) Training as well as Site-specific training prior to intrusive activities. All personnel performing work associated with this RIWP will be required to have both general and Site-specific training. The general training includes all applicable OSHA and state required training, such as 40-hour HAZWOPER and the 8-hour Refresher Training. Supervisory personnel will also have Supervisory training. All personnel will be in a medical surveillance program. Also, Site-specific training will be given to all personnel performing fieldwork at the Site on a daily basis. This Site-specific training will include a review of potential Site hazards, required PPE, and Site warning and evacuation procedures.

The drilling subcontractor will apply for and obtain all necessary Federal, State, and local permits associated with the Remedial Action Plan (RAP)/IRM scope of work. These permits may include, but are not limited to, traffic routing, road opening, construction/zoning, etc. Conditions of these permits will be complied with during the construction.

The property owner will provide access to the Site. This access will include for all RIWP activities.

The drilling subcontractor will be responsible for contacting the New York City – Long Island One Call Center to request that all utilities on the Site be located and marked. The Contractor is responsible for resolving all potential conflicts. Underground utility protection will be the responsibility of the selected Contractor. When all utilities have been verified/ confirmed/protected, then intrusive activities may be initiated.

The selected drilling subcontractor will mobilize all necessary labor, equipment, supplies and materials to complete the RIWP. Lay down areas for equipment, supplies and materials, the appropriate exclusion zone(s) and support area(s) will be identified to conduct the planned activities safely and effectively. All equipment will be inspected prior to utilization for the RIWP and checked periodically for performance and corrective repair. All equipment will be clean prior to arrival on the job site.

Site Preparation

The Site will be prepared for the RIWP. Site preparation activities necessary to provide support for the work include the establishment of work zones, support facilities, decontamination facilities, and installation of temporary security measures around the work area. The work area will change daily based on the locations of the recovery wells. This will reduce the need for erosion control, security, overnight safety measures, and minimize disruption to normal community operations.

All work will be conducted to minimize impacts to existing utilities.

Odor and Fugitive Dust Control

The drilling subcontractor will provide materials to act as odor suppressant should odor suppression be required. This may include tarps and/or chemical foam, (e.g., Rusmar^{TM} foam). The drilling subcontractor will keep sufficient odor suppressant materials onsite to suppress heavy odors. The material will be stored near the excavation and will be easily mobile.

In accordance with NYSDEC and NYSDOH requirements, a CAMP will be implemented at the Site during drilling activities. The objective of the CAMP is to provide a measure of protection for the downwind community (i.e., offsite receptors, including residences and businesses and onsite workers not involved with Site RIWP activities) from potential airborne contaminant releases as a direct result of intrusive RIWP activities. Air monitoring stations will be placed up-wind and downwind of each intrusive work area (i.e., boring locations for well installations). Volatile organic compounds (VOCs) and respirable particulates (PM-10) will be monitored at the up-wind and downwind stations on a continuous basis. In addition, to the fixed stations, VOCs and particulates will be monitored in the work zone using hand held equipment. VOCs and particulates will also be monitored around the perimeter of the work zone on a regular basis (hourly) by the GEI air monitoring personnel.

Soil Boring Installations

A total of five soil borings (B-1R, B-2R, B-3R, B-4 and B-5) will be advanced to approximately 100 feet below ground surface (bgs). Borings B-1R, B-2R and B-3R will be advanced onsite adjacent to previously completed borings B-1, B-2, and B-3, respectively. Borings B-4 and B-5 will be advanced offsite, in areas adjacent to the Site (see **Figure 2**). The borings will be advanced utilizing sonic drilling technology, or equivalent. Soil samples will be collected continuously from each of the borings in accordance with the FSP to the total boring depth. Each sample will be inspected for impacts (e.g., staining and odor) and screened for the presence of VOCs using an organic vapor monitor (OVM) equipped with a photoionization detector (PID). Soil borings will be terminated if a perceived confining layer is observed below the groundwater table to prevent potential downward migration of groundwater impacts.

Analytical samples will be collected in 2-foot intervals approximately every 10-feet (e.g. 5 to 7-feet bgs, 15 to 17-feet bgs, 25 to 27-feet bgs, etc.), beginning at five feet bgs and continuing to the completion depth of the boring. Additionally, analytical samples will be collected at the soil/groundwater interface and at the terminus of the soil boring. If impacts are identified, one additional analytical sample will also be collected from the most impacted zone (if located outside of those previously planned for sampling) in each boring based on visual and olfactory findings and PID screening results. Soil samples will be properly transported to a NYSDOH ELAP-certified laboratory under chain-of-custody (COC) procedures and analyzed for target compound list (TCL) VOCs by EPA Method 8260B and for Total Analyte List (TAL) metals by EPA Method 6010B and 7471B. Soil samples collected in the shallow historic fill layer, which extends approximately from ground surface to approximately seven to nine feet bgs, will be additionally analyzed for TCL SVOCs by EPA Method 8270C, pesticides by EPA Method 8081, herbicides by EPA Method 8151 and for polychlorinated biphenyls (PCBs) by EPA method 8082. Quality Assurance/Quality Control (QA/QC) samples will be collected according to the Quality Assurance Project Plan (QAPP) included in **Appendix D**. The data will be provided in a Category B data deliverable.

Soil Vapor (SV) Monitoring Point Installations

A total of two soil gas (screening) samples (SVO-1 and SVO-2) will be collected from the proposed soil vapor locations on **Figure 2**. All samples will be collected in accordance with the Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York (NYSDOH October 2006). Conditions in the field may require adjustment to the sampling locations. The depth to groundwater is undetermined and may not be encountered during this investigation. If groundwater is encountered, the soil vapor probe will be installed at least one foot above the smear zone. The soil vapor probes will be installed to a depth coinciding with the foundation of the nearest building. If there is no basement in the adjacent building, the soil vapor probes will be installed to a depth of six feet below grade.

The soil vapor points will be installed using 1-inch diameter steel drill rods advanced using direct push drilling methods. The soil vapor probe will consist of a prefabricated 2-3 inch perforated steel vapor probe tip attached to 3/8-inch diameter low-density polyethylene (LDPE) plastic riser tubing. Once driven to depth, the rods are removed leaving only the tip and the tubing. The vapor probe borehole will be backfilled with #2 morie well grade gravel. A surface seal will be placed using an impermeable clay seal installed within the last six inches of the probe-hole annulus from surface grade level. The vapor well will be purged using a hand pump or equivalent device after installation.

Soil Vapor (SV) Monitoring Point Sampling

Samples will be collected in 6-liter Summa canisters which have been certified clean by the laboratory and analyzed by using USEPA Method TO-15. Flow rate of both purging and sampling will not exceed 0.2 L/min. Sampling will occur for the duration of 2 hours. A sample log sheet will be maintained summarizing sample identification, date and time of sample collection, sampling depth, identity of samplers, sampling methods and devices, soil vapor purge volumes, volume of the soil vapor extracted, vacuum of canisters before and after the samples are collected, apparent moisture content of the sampling zone, and chain of custody protocols.

As part of the vapor intrusion evaluation, a tracer gas will be used in accordance with NYSDOH protocols to serve as a quality assurance/quality control (QA/QC) device to verify the integrity of the soil vapor probe seal. Helium will be used as the tracer gas and a box will serve to keep it in contact with the probe during testing. A portable monitoring device will be used to analyze a sample of soil vapor for the tracer prior to sampling. If the tracer sample results show a significant presence of the tracer, the probe seals will be adjusted to prevent infiltration. As the conclusion of the sampling round, tracer monitoring will be performed a second time to confirm the integrity of the probe seals.

Groundwater Monitoring Well Installations

Three monitoring wells will be installed at each completed borehole at total depths of approximately 30, 60, and 100 ft bg for a total of 15 wells (MW-1S, MW-1I, MW-1D, MW-2S, MW-2I, MW-2D, MW-3S, MW-3I, MW-3D, MW-4S, MW-4I, MW-4D, MW-5S, MW-5I and MW-5D).

Actual installation depths will be determined in the field based on field screening results and soil stratigraphy observations. Each monitoring well will be constructed with 10 feet of 2-inch diameter schedule (SCH) 40 polyvinyl chloride (PVC) 0.010-inch slotted well screen threaded to 2-inch diameter SCH 40 PVC riser to surface. The wells will be completed with a Morie #2 sand pack to 2 feet above top-of-screen, 2 feet of wetted bentonite pellets, and tremie-grout to surface. Monitoring wells will be finished with an expanding well cap and accessed through an 8-inch bolted manhole. Drill cuttings and development water will be properly stored onsite until proper transportation and disposal.

All monitoring well and soil boring locations will be surveyed by a professional surveying firm.

Monitoring Well Development

Monitoring wells may be developed using a high flow pump and will be monitored for drawdown and recovery. Well development fluids will be pumped into 55-gallon drums, a large volume tank, or mobile tanker truck. All groundwater generated during development activities will be disposed offsite at an appropriate facility.

Material Handling

RIWP-derived wastes produced during soil boring and monitoring well installations, including soil cuttings, groundwater, decontamination waters, and removed groundwater will be collected and stored within 55-gallon United States Department of Transportation/United Nations (USDOT/UN) drums. The transporter and transport vehicle must be approved in accordance with 6 NYCRR, Chapter IV, Part 364. The location of the waste storage area will be determined during the preliminary Site visit to be completed prior to the start of RIWP activities. All investigation derived waste containing chlorinated solvents must be treated as listed (F) hazardous waste.

Site Restoration

The drilling subcontractor will restore all areas disturbed by the RIWP activities to pre-existing conditions based on the applicable access agreements. Restoration actions shall include, but may not be limited to:

- Removal of all temporary facilities, including decontamination areas, and unused materials
- Restoring any grass or landscaping disturbed during the RIWP
- Replacing any removed or damaged structures or appurtenances
- Replacement or repair of all asphalt and concrete surfaces removed or damaged during the RIWP

Survey

Following completion of the RIWP activities, a New York State Licensed Land Surveyor will survey all recovery wells and monitoring wells. The elevation of each new monitoring well will be determined to ±0.01 foot. All locations and elevations will be tied to the New York State Plane Coordinate System.

Monitoring Well Sampling

Groundwater samples will be collected from each monitoring well following installation and proper well development utilizing low-flow sampling techniques. Field parameter readings will be monitored during sampling including pH, oxidation reduction potential (ORP), specific conductance and dissolved oxygen (DO). Each monitoring well will be sampled for TCL VOCs by EPA Method 8260B, TCL SVOCs by EPA Method 8270, pesticides by EPA Method 8081, herbicides by EPA Method 8151, PCBs by EPA method 8082, chemical oxygen demand (COD), biological oxygen demand (BOD), NO_3, NO_2, SO_4, H_2, CH_4, Fe^{2+}, total organic carbon (TOC), ammonia by EPA Method 350.1, and TAL Metals by EPA Method 6010B and 7471B. In addition, a groundwater biochemical assay will be conducted to test for the presence of *dehalococcoides* and *dehalococcoides ethenogenes* to evaluate the potential of biodegradation of dissolved PCE impacts. QA/QC samples will be collected according to the QAPP included in **Appendix D**. Groundwater samples will be properly transported to a NYSDOH ELAP-certified laboratory under COC procedures.

Reporting

Reporting is discussed in Section 5.

3. Quality Assurance / Quality Control (QA/QC) Protocols

QA/QC protocols are included in **Appendix D**.

4. Health and Safety Protocols

Health and safety protocols are detailed in the HASP, which is included in **Appendix G**.

5. Data Evaluation and Remedial Investigation Report

The soil and groundwater sample results will be compared to 6 New York Codes, Rules, and Regulations (NYCRR) Part 375 Restricted-Residential Use Soil Cleanup Objectives (SCOs) and the New York State Ambient Water Quality Standards and Guidance Values for Class GA Groundwater, respectively. Additionally, the field and laboratory data will be used to perform a remedial alternative analysis to be included as part of the draft Remedial Action Work Plan (RAWP – see section 6). A summary of potential remediation techniques is included in **Appendix F**.

Data Evaluation

The purpose of the data evaluation is to determine the extent of onsite soil and groundwater impacts and to assure that data obtained during the implementation of the RIWP are adequate in quantity and quality, and applicable to project objectives. In order to make this determination, the data will be reviewed for the quality of data coverage, compatibility of data collection methods, and completeness, with respect to meeting project objectives.

To facilitate the interpretation of data generated during the remedial investigation activities, the data will be tabulated in data summary tables. Figures showing sampling locations with the corresponding analytical results will be prepared to enhance the overall understanding of Site conditions in regard to the magnitude, location, and flow and transport of contamination.

Geologic/Hydrogeologic and Water Quality Characteristics

Geologic and hydrogeologic characterization will incorporate the results of subsurface evaluation and sampling activities, groundwater sampling and monitoring activities, as well as general hydrogeologic and hydraulic features of the Site. The characterization will set forth conclusions regarding the direction, gradients, and potential fluctuations or anomalies of groundwater in the immediate vicinity of the Site (shallow groundwater).

Additional Field Investigations

Additional field investigations may be required upon completion of the remedial investigation scope of work. Conditions that would warrant additional investigation include data gaps, further delineation of groundwater or soil contamination, or additional data necessary to evaluate or determine the effectiveness of a potential remedial alternative technology.

If additional investigation is required, a supplemental work plan will be prepared and submitted to the NYSDEC for review and approval.

Remedial Investigation Report

The results, along with supporting documentation, will be provided to the NYSDEC in the form of a Remedial Investigation Report (RIR). Laboratory data will be provided as a Category B deliverable and a third-party data usability summary report (DUSR) will be prepared. All data generated as part of the RI must be submitted to NYSDEC in the appropriate Electronic Data Deliverable (EDD) format. The RIR will contain a description of the source, as well as characterizations of the geologic, hydrogeologic, soil and water quality.

Interim Remedial Measures

Upon review of the data and prior to the selection of the remedial alternative, an interim remedial measure (IRM) may be proposed to address unacceptable or imminent risks. Preliminary results from the remedial investigation (RI) will be used to evaluate the necessity for an immediate response associated with a particular medium, route of exposure, or potential sensitive receptor. The IRM will be selected with the understanding that the measure should be compatible with the overall project objectives and long-term remedial action goals.

If an IRM is deemed necessary, a work plan will be submitted to the NYSDEC, which describes the proposed measure, justification for its selection, and a schedule for the activities associated with its implementation. Depending on specific circumstances and conditions at the Site following complete implementation of IRMs, the activities associated with the IRMs may be determined to constitute complete remediation.

6. Remedial Action Work Plan

Remedial alternatives will be evaluated based on the information generated during the implementation of this RIWP, which will be summarized and presented in the RIR. Potential remedial alternatives will be compiled from appropriate available technologies. The possible alternatives will include active remediation, but may also include alternatives for groundwater monitoring, or no further action. The alternatives will be presented in the Remedial Action Work Plan (RAWP), which will be presented to the NYSDEC as a draft for comment and approval. Possible alternatives are included in **Appendix F**.

Remedial Alternatives Scoping

The remedial alternatives will be evaluated using reference documents including, but not limited to, USEPA Guidance on Feasibility Studies Under Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), National Oil and Hazardous Substances Pollution Contingency Plan, Remedial Action Costing Procedures Manual; Interim Guidance on Superfund Selection of Remedy, and any relevant technology guidance and evaluation documents that may be appropriate. As additional guidance documents become available, or are updated, they will be incorporated into the remedial alternative evaluation process.

Objectives of the Remedial Alternatives Evaluation

The overall objective of the remedial alternatives evaluation process is to select a remedial action. The selected remedial action will exhibit the following characteristics:

- Protection of public health and the environment;
- Attains federal and state public health and environmental requirements identified for the Site;
- Utilizes permanent solutions and alternative treatment technologies to most practical extent within proven technological feasibility and availability;
- Utilizes treatment to permanently reduce the toxicity, mobility, volume, or extent of contamination; and
- Minimizes costs.

The remedial alternatives considered will have the aforementioned characteristics. The remedial action selected will have the best combination of these characteristics as determined by the NYSDEC, GEI, the owner of the property, and other interested parties.

Remedial Alternative Sources

Based on the findings of the remedial investigation (as presented in the RIR), a list of applicable technologies will be developed for this Site. Sources utilized during the screening of initial technologies will include, but not be limited to, the following:

- Remedial Action at Waste Disposal Sites Handbook (Revised), USEPA, October 1985;
- Handbook for Evaluating Remedial Action Technology Plans, USEPA, September 1984;
- Review of In-Place Treatment Technologies for Contaminated Surface Soils: Volume I Technical Evaluation, USEPA, September 1984;
- Technologies Applicable to Hazardous Waste, USEPA, May 1985; and
- Handbook for Stabilization/Solidification of Hazardous Wastes, USEPA, June 1986.

Remedial Alternative Options

Remedial alternative technologies will be screened on the basis of effectiveness, technical feasibility, practicality, demonstrated performance, and availability of equipment. The remedial alternative technologies will be evaluated on each technology's ability to reduce the mobility, toxicity or volume of contaminants. A containment option involving little or no treatment and a no-action alternative will also be developed.

Source Control

To the extent that it is both feasible and appropriate, treatment alternatives for source control remedial actions will be developed. Alternatives that contain treatment technologies, which permanently reduce the toxicity, mobility, or volume of contamination, will be highlighted.

Migration Control

To the extent that it is both feasible and appropriate, treatment alternatives that address the management of migration will be developed. For groundwater remediation, remedial alternatives that provide varying degrees of treatment, in terms of restoration levels and rates of cleanup, will be evaluated.

Containment

An alternative that involves containment of waste, but provides protection of public health and the environment, will be developed. Although containment provides little or no treatment, it reduces the exposure potential by reducing the mobility of the waste.

Waste Removal

An alternative, which involves the offsite transportation and disposal of waste, will be developed. Under Superfund Amendments and Reauthorization Act (SARA), the offsite transportation and disposal of waste without treatment should be the least favored alternative remedial action if practical treatment technologies are available.

No-Action

A no-action alternative will also be developed.

Preliminary Screening of Alternatives

The remedial action alternatives will be screened to narrow the number of alternatives for a more detailed feasibility analysis. The screening will eliminate remedial alternatives that are not technically feasible, practical, or cost-effective, while retaining a range of treatment options. Reasons for elimination of technologies are as follows:

- Alternatives which are not technically reliable, do not effectively and adequately protect human health and the environment, or do not attain specified action levels;
- Alternatives that are not technically feasible or available, or require significant regulatory or administrative effort during implementation or operation; and
- Alternatives that are significantly more costly than other alternatives, but fail to achieve greater reliability, effectiveness, or environmental/health benefits.
- The FS report will document the selection process and rationale for elimination of remedial alternatives.

Treatability Studies

Additional investigation may be required to evaluate remedial alternatives selected for the Site. Field investigations may require bench scale or pilot scale testing to determine feasibility of various treatment technologies being considered for the Site. Computer modeling may be used to enhance field studies, or in limited cases will be applied when field studies are not feasible. The treatability studies would only be performed for those technologies, which require testing of Site-specific materials to document effectiveness or feasibility. Examples of technologies that may require field studies are: vapor extraction, biological treatment, thermal or chemical oxidation, and solidification.

Work plans will be prepared, if required, for each of the treatability studies. The exact technologies to be tested, the extent of testing, and the types of testing, will be determined by the technologies to be tested. The tests will be designed to determine the following information:

- Recovery, removal, or destruction efficiency for contaminants;
- Effluent or residual materials contamination levels;
- Major equipment and utility requirements; and
- Capital and operating costs.

Analysis of Alternatives

The relevant information regarding each selected remedial alternative will be analyzed to facilitate selection of the Site remedial action. The specific requirements that will be addressed for each remedial alternative include protectiveness of human health and the environment; attainment of guidance and regulatory values; reduction of mobility, toxicity and volume of hazardous contaminants, implementability, and cost effectiveness.

The analysis of each alternative includes a detailed description of the alternative. The description contains a projected length of system operation; bench or pilot scale test results or supporting data from a literature review; and projected short-term and long-term impacts, effectiveness and performance.

Comparison of Alternatives

Upon completion of the detailed analysis of each alternative, the alternatives will be compared to each other using the information collected and factors described above. The effectiveness of the alternatives, which achieve the same relative degree of protection of human health and the environment, will be compared on the basis of cost. The alternatives which achieve the same relative degree of protection of human health and the environment will be favored over those alternatives which attain the same effectiveness at a higher cost.

Remedial Action Work Plan

Upon completion of the remedial alternatives evaluation, the results and findings, including the selected remedial alternative, will be incorporated into the Draft RAWP. The Draft RAWP will then be submitted to NYSDEC for comment and approval.

The RAWP will be prepared in accordance with the RIWP and in a manner consistent with CERCLA, the National Contingency Plan (NCP) and other pertinent guidance documents. The RAWP will then be finalized and certified by a New York State licensed professional engineer that the remedial alternatives evaluation was conducted in accordance with the RIWP.

NYSDEC will review the RAWP and issued a Preliminary Decision Document (PDD). The PDD will be subject to a 45-day public comment period, after which the Decision Document will be issued by NYSDEC. Once the Decision Document is received, the RAWP will be finalized.

7. Citizen Participation Activities

GEI will provide personnel and materials to assist the NYSDEC in providing the community with information relating to the ongoing studies at the Site. The Consultant will:

- Establish a Community Information Repository at the local library, or other community center;
- Participate in public meetings that the NYSDEC deems necessary to apprize the community of the current or proposed activities;
- Identify public and elected officials who may have a need to be informed; and
- Identify the affected or interested public.
- Dissemination of the approved fact sheets to the Site Contact List.

A description of the plan is presented below.

7.1 Description of Citizen Participation Activities

This section describes the specific citizen participation activities that are to be carried out during the implementation of the RIWP.

<u>Citizen Participation Plan</u>

The Citizen Participation Plan (CPP) will be deposited in the designated document repository. In addition to the CPP, previously prepared documents, such as the Phase I report, Phase II report, Consent Order, and HASP will be deposited in the repository.

<u>RIWP</u>

The Final RIWP will be placed on file in the document repository as well.

<u>Remedial Investigation Report</u>

The Draft RIR will be placed in the information repositories and the public will be so notified of this with the fact sheet.

<u>Interim Remedial Measures (IRM)</u>

If an IRM is to be implemented, the public will be involved as part of the RI/FS Citizen Participation Process.

Remedial Action Work Plan

Upon completion and submittal of the Draft RAWP, which details the proposed remedial action plan, NYSDEC will issue a Preliminary Decision Document (PDD). The PDD will be placed in the document repository. An NYSDEC fact sheet will be distributed to the media on the Contact List to announce the availability of the PDD for public review and comment. A fact sheet and notice of public meeting will be distributed by a mailing. Public comments will be solicited to aid in the preparation of the Final RAWP. The public meeting will be conducted. Following the public comment period, a NYSDEC will issue a Decision Document, at which time the RAWP will be finalized. The Final FS Report will be placed in the document repository.

8. Schedule

The project schedule for implementation of the RIWP activities is presented below. The schedule may be affected by regulatory review time periods, contractor response timeframes, timeframes necessary to negotiate access agreements with property owners, community issues, permit review and approval timeframes, or other unknown factors. In addition, if the scope of the proposed RIWP changes as a result of negotiating access or regulatory review, then revisions to the work plan, and plans and specifications or change orders with the drilling subcontractor and/or GEI may be required and the schedule presented herein, may be impacted. Every effort, however, will be made to keep the project on the anticipated schedule.

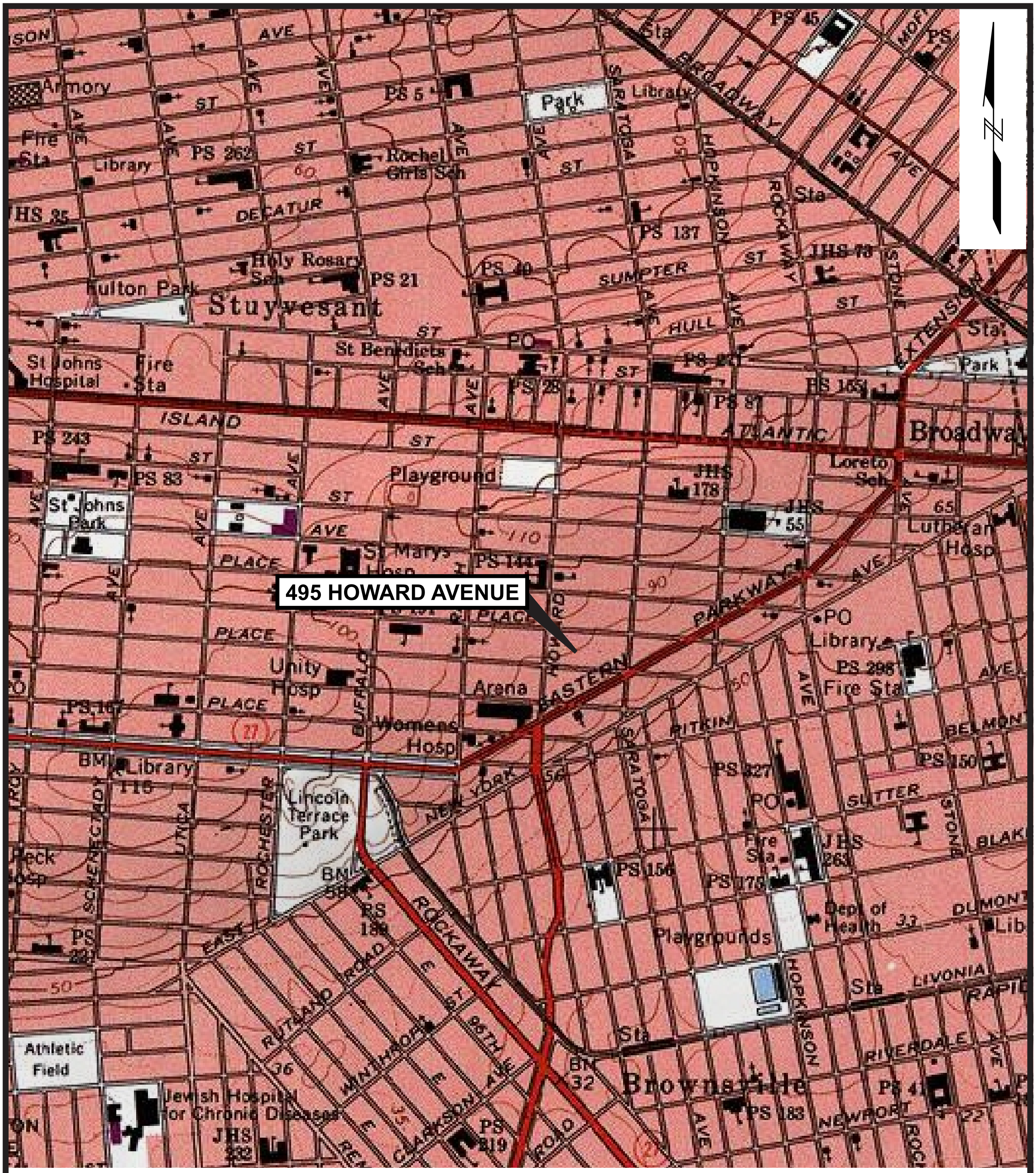
MILESTONE	**Time Frame (weeks)**	
	Individual	**Cumulative**
GEI Submits Final RIWP to NYSDEC	0	0
NYSDEC Approves Final RIWP	4	4
Drilling Subcontractor Mobilizes for Soil Boring and Well Installation	2	6
RIWP Activities Completed	2	8
GEI Submits Remedial Investigation Report (RIR)	8	16
GEI Submits Remedial Action Work Plan (RAWP)	4	20

REMEDIAL INVESTIGATION WORK PLAN (RIWP)
FORMER DRY CLEANERS
495 HOWARD AVENUE
BROOKLYN, NEW YORK
MAY 2013

Appendix A

Site Figures

GEI Consultants



0 1000 2000

SCALE, FEET

SOURCE:
Map created with TOPO! ® ©2001 National Geographic
(www.nationalgeographic.com/topo)

REMEDIAL INVESTIGATION WORK PLAN
495 HOWARD AVENUE
BROOKLYN, NEW YORK

OMNI GROUP LLC.
NEW YORK, NEW YORK

GEI Consultants

Project 130230-*-1000

SITE LOCATION MAP

April 2013

Figure 1

I:\Project\Omni Group\RIWP\others\New York-Site Loc.cdr

LEGEND:

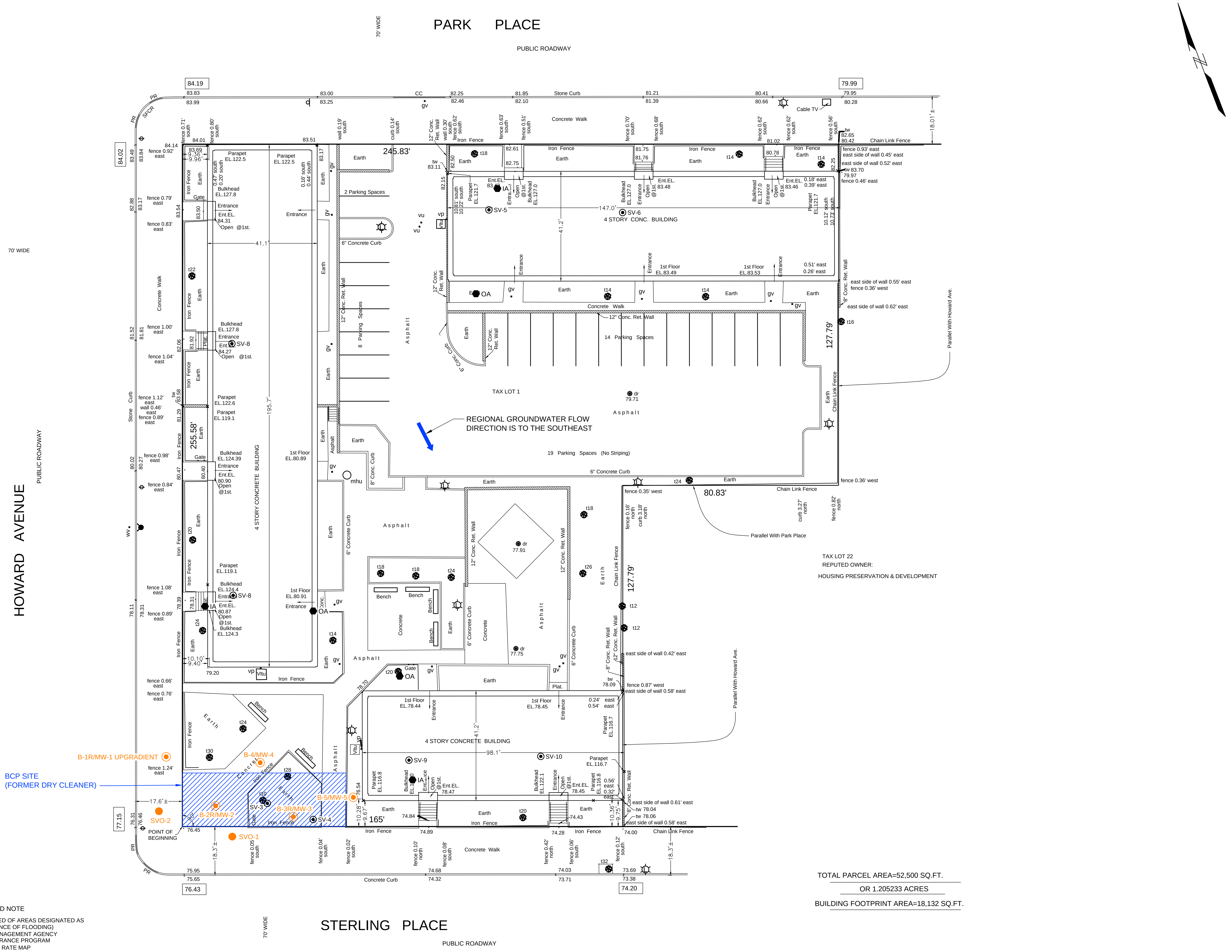
ASPH	ASPHALT	PR	PEDESTRIAN
BK	BRICK	RET	RETAINING
BSMT	BASEMENT	RIM	RIM ELEVATION SEWER MANHOLE
CC	CURB CUT	SFCR	STEEL FACED CURB ROUND
CCR	CONCRETE CURB ROUND	STY	STORY
CD	CELLAR DOOR	TB	TOP OF BANK ELEVATION
CLF	CHAIN LINK FENCE		TRAFFIC LIGHT
CO	CATCH BASIN CLEAN OUT	TEL	TELEPHONE
CONC	CONCRETE	TP	TREE PIT
CRF	CHAIN ROPE FENCE		TRAFFIC SIGN
CWA	CELLAR WINDOW AREA	TW	ELEVATION AT TOP OF WALL
DR	DRAIN	UP	UTILITY POLE
EL	ELEVATION	VU	VALVE UNKNOWN
FAB	FIRE ALARM BOX	VLTU	VAULT UNKNOWN
FC	FILL CAP	VP	VENT PIPE
FL. EL.	FLOOR ELEVATION	WV	WATER VALVE
GP	GUARD POLE	12"G	GAS MAIN WITH SIZE
GV	GAS VALVE	12"S	SEWER MAIN WITH SIZE
IF	IRON FENCE	12"W	WATER MAIN WITH SIZE
INL	CATCH BASIN INLET ELEVATION	▬	CATCH BASIN
INV	SEWER INVERT ELEVATION	☐ Ⓔ	ELECTRIC MANHOLE/VAULT
L	LIGHT POLE	Ⓕ	FIRE MANHOLE
MB	MAIL BOX	Ⓖ	GAS MANHOLE
MHU	UNKNOWN MANHOLE	Ⓢ	SEWER MANHOLE
OF	OIL FILL	Ⓣ	TELEPHONE MANHOLE
OHW	OVERHEAD WIRES	Ⓦ	WATER MANHOLE
P	POLE	☐	TRAFFIC VAULT
PAVT	PAVEMENT	●	HYDRANT
PM	PARKING METER	✿	TREE WITH SIZE
PMU	POLE, MULTIPLE USAGE		
◉ SV-1	EXISTING SOIL VAPOR	17.0	ESTABLISH/LEGAN GRADE
⬢ OA	EXISTING OUTSIDE AIR	➡	GROUNDWATER FLOW DIRECTION
⬢ IA	EXISTING INSIDE AIR		
○ B-1	EXISTING SOIL BORING		
◉ B-2/MW-2	PROPOSED SOIL BORING/ MONITORING WELL	▨	BCP SITE (FORMER DRY CLEANER) BOUNDARY
● SVO-1	PROPOSED SOIL VAPOR		

NOTES:

1. ELEVATIONS AND ESTABLISHED GRADES SHOWN HEREON REFER TO THE BOROUGH OF BROOKLYN HIGHWAY DEPARTMENT DATUM WHICH IS 2.56 FEET ABOVE MEAN SEA LEVEL DATUM.
2. ESTABLISHED GRADES SHOWN HEREON REFER TO TOP OF CURB.
3. BELOW GRADE ENCROACHMENTS AND VAULTS IF ANY NOT LOCATED.
4. THERE ARE 43 PARKING SPACES AND 0 HANDICAP SPACES ON THE PREMISES.
5. THE PREMISES IS SERVED BY GAS, WATER, ELECTRICITY, TELEPHONE AND SANITARY SEWER LINES INSTALLED IN STREET.
6. NO EVIDENCE OF THE SITE BEING USED AS SOLID WASTE DUMP.
7. THE PREMISES HAS ACCESS TO PARK PLACE, HOWARD AVENUE, STERLING PLACE.

SOURCE:

1. PLAN BASED ON MAP PREPARED BY MONTROSE SURVEYING CO., LLP, DATED 08/04/11 TITLED "ALTA-ACSM LAND TITLE SURVEY.



TOTAL PARCEL AREA=52,500 SQ.FT.

OR 1.205233 ACRES

BUILDING FOOTPRINT AREA=18,132 SQ.FT.

FLOOD HAZARD NOTE

THE PARCEL SURVEYED IS COMPRISED OF AREAS DESIGNATED AS
ZONE X (LESS THAN 0.2% CHANCE OF FLOODING)
FEDERAL EMERGENCY MANAGEMENT AGENCY
NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP
COMMUNITY PANEL NUMBER 360497 0216 F
EFFECTIVE DATE SEPTEMBER 5, 2007

BROOKLYN HIGHWAY DATUM 2.56
BROOKLYN SEWER DATUM 1.72 0.84'
MEAN SEA LEVEL 0.00

0 20 40
SCALE, FEET

REMEDIAL INVESTIGATION WORK PLAN
495 HOWARD AVE
BRONX, NEW YORK

OMNI GROUP
NEW YORK, NEW YORK

PROJECT 130230-*-1000

GEI Consultants
455 WINDING BROOK DRIVE
SUITE 201
GLASTONBURY, CONNECTICUT 06033

EXPLORATION LOCATION MAP

April 2013

Figure 2

I:\Project\Omni Group\RIWP\Howard Ave - RIWP_2013-04.dwg

REMEDIAL INVESTIGATION WORK PLAN (RIWP)
FORMER DRY CLEANERS
495 HOWARD AVENUE
BROOKLYN, NEW YORK
MAY 2013

Appendix B

Key GEI Personnel Resumes

NICHOLAS J. RECCHIA, P.G.

SENIOR HYDROGEOLOGIST

Mr. Recchia's responsibilities include the development, management, and supervision of hazardous waste site investigations and remedial corrective actions for commercial/industrial and government properties. These responsibilities include; environmental management and supervision of field testing and remediation operations, specializing in groundwater and surface water monitoring programs, in connection with the investigation and remedial cleanup of contamination at commercial/industrial facilities, evaluation of surface and groundwater impacts for planned developments, preparing spill control runoff plans at sites throughout the northeast and mapping regional groundwater surface water flow and chemistry data, designing and conducting quantitative aquifer tests and analyses, and geologic and geophysical evaluations of regional drinking water aquifers. Mr. Recchia has unique experience working with hazardous material impacts as related to ecological wetland issues and design.

Graduating with a dual BS degree in geology and water resources in 1983 from the State University of New York at Oneonta, and completing a MS degree in hydrogeology at Adelphi University, Mr. Recchia is a licensed/certified professional geologist and is an active member of the Association of Groundwater Scientists and Engineers (NGWA), the Association of Engineering Geologists, the Long Island Association of Professional Geologists and the New York Academy of Sciences.

RELEVANT PROJECT EXPERIENCE

Mr. Recchia is a hydrogeologist for hazardous waste testing studies. He has performed Phase II investigations at over 1800 sites. He has also completed remedial cleanup actions at over 300 sites. His past experience includes the preparation of work plans, Quality Assurance and Protection Plans, Health and Safety Plans, and environmental assessments for remedial investigations and feasibility studies at various State and Federal Superfund sites. He was also responsible for reviewing monitoring data and technical information to determine the magnitude of environmental impacts posed by hazardous waste sites. Mr. Recchia is currently involved in the implementation of corrective actions for soil, groundwater and surface water restoration at various hazardous waste sites in the New York metropolitan region.

Mr. Recchia's project list includes extensive hazardous materials remediation at a former petroleum bulk storage terminal along the East River (CITCO) that will be developed into a large New York City skyline residential complex. In addition, on Long Island, Mr. Recchia is supervising the cleanup of mercury and silver contaminated soils and

PROFESSIONAL REGISTRATION OR LICENSE

Subsurface, New Jersey No. 0013038
Professional Geologist, Indiana No. IN1120

NYS Department of Environmental Conservation, Erosion and Sediment Control SWT#15T-102511-55
2011 National Ground Water Association, Certified in Well Drilling
1993

EXPERIENCE IN THE INDUSTRY

29 years

EXPERIENCE WITH GEI

24 years

EDUCATION

M.S., Earth Science - Hydrogeology, Adelphi University
B.S., Duel Major Geology & Water Resources, SUNY Oneonta

closure of the wastewater and sanitary treatment at a former hospital for a Brownfields Redevelopment Project

Recent projects within NYC include NYC E-designated properties (Environmental Impaired Properties), New York State and New York City Office of Environmental Remediation (OER) Brownfield Cleanup Program (BCP) and the City Environmental Quality Review (CEQR) process. He has extensive experience working with various NYC agencies including Economic Development Corporation (EDC), Department of Housing and Preservation (HDP), Department of Sanitation (DOS), the NYC Department of Parks and Recreation, and the Police and Fire Departments. Mr. Recchia works closely with our ecologists and wetland scientists.

Connecticut River Fish Hatchery: Relevant experience working on a design for a new water source for the hatchery included calculating viable water quantity flow rates to supply sterile water separate from the river flow.

PROFESSIONAL ASSOCIATIONS

Association of Groundwater Scientists and Engineers (AGWSE)
Association of Engineering Geologists AEG)
Association for the Environmental Health of Soils (AEHS)
Long Island Association of Professional Geologists (LIAPG)
New Partners for Community Revitalization (NPCR)
U.S. Green Building Council Long Island Chapter (USGBC-LI)

Matthew J. O’Neil, P.E., Project Manager

Education
B.S., Environmental Engineering, United States Military Academy, 1996

Registration
Professional Engineer: Connecticut, Rhode Island, New York

Background

Mr. O’Neil is an environmental engineer and project manager with eleven years of environmental consulting experience. In addition, he has ten years of leadership and organizational experience as an officer in the U.S. Army and Army National Guard. His specialties include performing feasibility studies, remedial cost estimates, remedial engineering and construction oversight. He also has extensive experience performing Phase I, II, and III investigations; and conducting air-monitoring tasks for a variety of purposes.

Mr. O’Neil served as a senior environmental engineer prior to his employment with GEI. He was responsible for remedial design, remediation, and environmental compliance at over 30 sites in Connecticut, New York, and Rhode Island. Additionally, Mr. O’Neil served as a client account manager and was responsible for evaluating companies’ level of compliance with existing regulations, identifying non-compliant issues, and contracting new services.

Experience

Remedial Action Project Manager, Glen Cove, New York, National Grid, 2009-2010. Project manager and design engineer for a remedial action at an active electric substation. Project will include the excavation of MGP-impacted materials from areas adjacent to the substation and beneath active 69kV overhead utilities to approximately 17 feet below grade and implementation of a natural attenuation groundwater monitoring program.

Remedial Action Project Manager, Saratoga Springs, New York, National Grid, 2008-2009. Project manager and design engineer for a remedial action at an active fire station. Project included the excavation of MGP-impacted materials from within a former holder foundation. The remediation was completed successfully without disrupting operations of the active fire station.

Remedial Action Project Manager, Brentwood, New York, National Grid, 2008-2009. Project manager and design engineer for a remedial action in a residential neighborhood. Project included the closure of a section of a local road to remove approximately 3,500 tons of suspected purifier material from below the road and portions of six adjacent private properties. The remediation was successfully completed with excavations extending to within 15 feet of the houses without relocating the residents.

Site Characterization and Interim Remedial Measure Project Manger, Hastings on Hudson Former Manufactured Gas Plant, Hastings-on-Hudson, New York, Consolidated Edison Company of New York, 2008-2010. Project manger for the site characterization located primarily in the backyards of two properties (mixed-use and multistory-residential). Project included installation of a stabilized ramp to allow equipment access to the site via a 20% slope at the property boundary. An IRM is currently planned to remove perched groundwater from a former gas holder foundation located under the existing buildings.

Remedial Action Project Manager, East 173rd Street Works Former Manufactured Gas Plant, Bronx, New York, Consolidated Edison Company of New York, 2006-2009. Project manager and design engineer for a remedial action at a public park. Project included excavation and removal of soils to a site specific clean-up criteria, segregation and re-use of materials meeting the site specific criteria blow a demarcation barrier, an installation of a clean soil cover to accommodate park renovations. Project included extensive coordination between Consolidated Edison and the New York City and State agencies. Managed day to day contract and budget issues. The remediation was successfully completed in 2007 and is currently in the post-remedial monitoring phase.

Groundwater Treatment System Design and Operation, Bay Shore/Brightwaters Former Manufactured Gas Plant, BayShore, National Grid, 2006-2010. Design Engineer for an oxygen injection system as part of an IRM to mitigate surface water discharge from a 3,400 foot groundwater plume. System reduced groundwater BTEX and PAH concentrations from several thousand parts per billion to non-detect in six months. Project Manager for the design and installation of seven additional systems in the residential areas of the plume aimed at hastening the biodegradation of the plume. Project included soil vapor intrusion investigations at over 60 residential homes along the plume to evaluate the potential for soil vapor intrusion and a hydrologic study to evaluate the potential for plume deflection from the treatment.

In-Situ Chemical Oxidation Groundwater Treatment System Design and Operation, Bay Shore/Brightwaters Former Manufactured Gas Plant, Bay Shore, National Grid, 2006-2010. Project engineer and co-author for the design of an ozone injection groundwater treatment system to support a funnel and gate barrier style system. Managed installation and start-up phase of the system. During the first three months of operation, the system has reduced groundwater concentrations of all but four analytes to below the New York State Ambient Groundwater Quality Standards.

Remedial Alternative Analysis, Purdy Street Station Former Manufactured Gas Plant, Bronx, New York, Consolidated Edison Company of New York, 2006-2009. Project manager and lead author for a remedial alternatives analysis and remedial action work plan to remove impacts from below a private school's athletic fields. Coordinated with the property owner to incorporate potential site renovations into the remedial alternatives analysis. Completed multiple iterations of the remedial alternatives analysis as the property owner's future plans for the property changed.

Remedial Action Plan, Halesite Former Manufactured Gas Plant, Huntington New York, KeySpan Energy Corporation, 2006. Project engineer and lead author for a Remedial Action Plan of a former MGP site located under the footprint of an active electric substation in Huntington, New York. Developed project specific remedial action objective and likely remedial action alternatives capable of meeting those objectives. Conducted a detailed analysis of alternatives based on protection of human health and the environment, compliance with site specific standards, criteria, and guidance; long- and short-term effectiveness; reduction in toxicity, mobility, or volume of contaminants; implementability, and costs.

Remedial Investigation, Gowanus Canal, Brooklyn, New York, KeySpan Energy Corporation, 2006. Co-project coordinator for a Remedial Investigation of the Gowanus Canal located in Brooklyn, New York. Developed the site specific field sampling plan and assisted in the development and implementation of the RI work plan, including collection and analysis of sediment vibra-cores samples, surface sediment grab samples, and surface water samples. Developed subcontractor scope of work for hydraulic testing and bathometry surveys of the canal.

Remedial Action Selection Report, Purdy Street Station Former Manufactured Gas Plant, Bronx, New York, Consolidated Edison Company of New York, 2006. Project engineer and lead author for a Remedial Action Selection Report of a former MGP site located below an active private elementary school property in Bronx, New York. Developed the project specific remedial action objective and likely remedial action alternatives capable of meeting those objectives. Conducted a detailed analysis of the alternatives based on protection of human health and the environment, compliance with site specific standards, criteria, and guidance; long- and short-term effectiveness; reduction in toxicity, mobility, or volume of contaminants; implementability, and costs.

Remedial Investigation, Citizens Gas Works Former Manufactured Gas Plant, Brooklyn, New York, KeySpan Energy Corporation, 2003, 2005. Field operations manager for a Remedial Investigation at a former MGP site located in Brooklyn, New York. Revised and implemented RI work plan, including soil boring and monitoring well installation, soil and groundwater sampling, work-zone and perimeter air-monitoring, and hydraulic testing of on-site aquifers.

Remedial Investigation, Rockaway Park Former Manufactured Gas Plant, Rockaway Park, New York, KeySpan Energy Corporation, 2003. Field operations manager and lead author for a Remedial Investigation at a former MGP site located in Rockaway Park, New York. Implemented RI work plan, including soil boring and monitoring well installation, soil and groundwater sampling, work-zone and perimeter air-monitoring, and hydraulic testing of on-site aquifers. Completed site data analysis, including cross-section and contaminant distribution.

Focused Feasibility Study, Saranac Street Former Manufactured Gas Plant, Plattsburgh, New York, New York State Electric & Gas Corporation, 2003. Engineer and lead author for a Focused Feasibility Study of a former MGP site located in Plattsburgh, New York. Determined the remedial action objectives and potential remedial action alternatives to accomplish those objectives. Conducted an initial screening of all alternatives focusing on the effectiveness, implementability, and cost. Conducted a detailed analysis of likely alternatives for implementation based on compliance with the site standards, criteria, and guidance values for cleanup; the overall protection of human health and the environment; cost; short and long term effectiveness, impacts, and performance; and the reduction of toxicity, mobility, and volume of impacted materials.

Remedial Investigation Reports, Clove & Maple Former Manufactured Gas Plant and 93B Maple Avenue Former MGP, Haverstraw, New York, Orange & Rockland Utilities, 2002. Lead author for two remedial investigation reports at two former MGP sites located in Haverstraw, New York. Completed site data analysis, developed cross-section, and determined contaminant distribution in support of a conceptual site model.

Interim Remedial Measure, 93B Maple Avenue Former Manufactured Gas Plant, Haverstraw, New York, Orange & Rockland Utilities, 2002. Provided engineering support and lead author for an Interim Remedial Measure work plan to remove a former holder structure and impacted material from a site in a residential neighborhood. Developed the contractor bid specifications and engineering cost estimate for the IRM. IRM included installation of an excavation support and a temporary structure, dewatering, air handling, and community air monitoring.

Remedial Measure, South Glastonbury, Connecticut, J.T. Slocomb Corporation, 2004. Provided engineering support and lead author for a remedial measure work plan to remove a former oil storage tank/coal bin and impacted material from an active industrial site adjacent to a river and set in a residential neighborhood. Developed the contractor bid specifications and engineering cost estimate for the Remedial Measure.

Former Manufactured Gas Plant Work Zone Air-Monitoring, Hartford, Connecticut, Charter Oak Utility Constructors, Inc, 2001-2002. Health and Safety Officer for the installation of a utility corridor at a former MGP site located in Hartford, Connecticut. Conducted work zone air-monitoring and advised client of methods to minimize potential contaminant exposures to employees.

Former Manufactured Gas Plant Engineering Support, Various Sites, New Hampshire and New York, 2001-2006. Conducted various engineering support tasks for MGP sites located in New Hampshire and New York. Tasks include: conceptual remedial design, engineering cost estimates, development of contractor bid specifications, development of work scopes, and peer review of draft reports for regulatory submission. Sites include: Essex Mills Former MGP Site, Newmarket, NH, United Technologies, Inc., 2002; Keene Former MGP Site, Keene, NH, Northeast Utilities Service Company/Public Service Company of New

Hampshire, 2002; Glen Cove Former MGP Site, Glen Cove, NY, KeySpan Energy Corporation, 2003; Hempstead Former MGP Site, Hempstead, NY, KeySpan Energy Corporation, 2003.

Industrial Groundwater Monitoring, New Haven, Connecticut, Sargent Manufacturing, 2002. Managed and implemented a groundwater monitoring program for Connecticut Department of Environmental Protection compliance and Licensed Environmental Professional sign off. Program duties included quarterly monitoring, bi-annual sampling, and report preparation.

Connecticut Department of Transportation Projects, Various Sites, Connecticut, 2002. Completed site inspections, CTDEP and local records review for CTDEP Environmental Conditions Assessment Forms for several sites in Connecticut.

Various Phase I and Phase II ESAs, East Hartford, New Haven, and Jewett City, Connecticut, 2002. Completed Phase I ESAs for various sites in Connecticut. Completed site inspections, environmental record reviews, and subsurface investigations including test boring, monitoring well installation, and sampling. Prepared Phase I ESA reports, including recommended courses of action, and Phase II ESA reports, including data analysis and recommendations for remediation.

Military

First Lieutenant, Military Police; Operation Iraqi Freedom, Company Executive Officer/Platoon Leader, Baghdad, Iraq. Managed and supervised the planning, preparation and execution of logistical support, morale, welfare, and combat readiness of 180 soldiers and equipment valued in excess of $20 million. Conducted combat operations in support of Operation Iraqi Freedom in and around Baghdad to include convoy operations, high value target security (U.S. Embassy, Baghdad and U.N. Headquarters, Baghdad), training of Iraqi Police, and coordination of the mobile security of Interim Iraqi Government Officials to include Prime Minister Iyad Allawai and President Gazi Al Yawar.

First Lieutenant, Field Artillery; Firing Battery Platoon Leader/Operations Officer/Company Fire Support Officer/ Battalion Fire Direction Officer. Managed and supervised the long range planning, preparation and execution of training, logistical support, morale, welfare, and combat readiness of 90 soldiers and equipment valued in excess of $14.5 million. Rated top Logistic Section (out of five) by the Battalion Command Inspection Team. Transitioned Logistic Section to a new computer system with a 30% increase in productivity. Trained a previously untrained section to achieve the highest certification score (out of six) in the battalion. Developed, tested, and proved a new tactic for laser-guided munitions to improve effectiveness. Chosen twice ahead of peers and superiors to serve in a position slotted for an officer two grades above his.

Publications

- O'Neil, Matthew, Jeffery Parillo, William Ryan, at al, 2008. Evaluation of the Hydrologic Effects of Oxygen Injection for Biostimulation in an Upper Glacial Aquifer on Long Island. 2008 National Ground Water Association Conference on Eastern Regional Ground Water Issues Proceedings, Ronkonkoma, New York, June 23 - 24, 2008.

Professional Affiliations

- Member, Society of American Military Engineers

Jaimie Wargo, Senior Technician –Data manager

Education

Manchester Community College, Manchester, CT. 1995-1996
General Studies.

Background

Ms. Wargo joined GEI in May 2007. She is part of an in-house service team managing analytical data flowing through the Atlantic Region for QC and regulatory comparison.

Prior to joining GEI, Ms. Wargo worked as a Technician for a software company for 5 ½ years which provided software to food distributors to maintain databases for inventory, customers, vendor, accounts receivable, accounts payable and purchasing data. Her responsibilities included assisting clients with questions and troubleshooting programming bugs which also required connecting remotely to clients' network. She also conducted training sessions in-house and traveled to clients businesses.

Experience

As part of the Data Management team Ms. Wargo works with various laboratories that provide electronic data in multiple formats for output as one standardized format. This includes database setup and tracking, verifying samples, troubleshooting data errors, database input and comprehensive use of EarthSoft EQuIS, MS Access, and other software programs. Ms. Wargo uses established database software and maintains customized databases and procedures based on project needs which include generating chemical data tables with regulatory comparison and screening.

Data Management projects include:

- Bayshore Former MGP Site - Quarterly Groundwater Monitoring and Community Response Program, Long Island, New York, KeySpan Energy, ongoing
- Sag Harbor Quarterly Groundwater Monitoring, Long Island, New York, KeySpan Energy, ongoing
- National Grid, Halesite Quarterly Groundwater Monitoring, Long Island, New York, KeySpan Energy, ongoing
- Glen Cove Quarterly Groundwater Monitoring, Long Island, New York, KeySpan Energy, ongoing
- Long Island Site Characterizations, New York, KeySpan Energy. 2007-2008
- Flemington Former MGP Site, Flemington, New Jersey, National Grid, 2007 -present
- Carillon Cleaners Environmental Site Assessment, Huntington, New York, Gabrielle Flickinger, 2007
- Whitehall Former MGP Site, Whitehall, New York, NIMO, 2007
- Feather River Borrow Area Testing, Yuba County, California, TRLIA, 2007-2008
- East 173rd Street / Starlight Park Remedial Construction Oversight, Long Island, New York, ConEd, 2007-2009
- Stewardship Permit, Waterbury, Connecticut , MacDermid, Inc. 2008 – present
- Saratoga Springs Former MGP Site – Remedial Investigation, Remediation and Oversite and Pre-Design investigation, Saratoga Springs, New York, National Grid, ongoing
- Confidential Site – Data analysis, electronic submittals, table generation, National Grid, New York, 2010 to present
- Sanford Gasification Plant Site – Air monitoring; reporting, data completeness reviews Sanford, Florida, 2009 – 2011
- Sea Isle City- Data analysis, table generation, JCP&L, 2007-current

- Greenpoint– Data analysis, table generation, reporting, National Grid, New York, 2008 – current
- Williamsburg –Data analysis, table generation, reporting, National Grid, Brooklyn New York, 2009-current
- Alagasco – Data analysis, table generation, reporting, Huntsville Alabama, 2010-current
- Washington – Data analysis, table generation, reporting, Washington New Jersey, 2008-current

Related Experience

New England Computer Services, Madison, CT., Technical Support – Software. Supported over 150 clients via phone fax and email for Windows and DOS based software. Tested and reported potential bugs, flaws and enhancements in our software. Installed, supported and provided off-site and in-house training for software programs including laptop, accounts payable, general ledger, back-up, fax, and a web based version.

Computer Skills:

- EarthSoft EQuIS Chemistry
- Microsoft Word
- Microsoft Excel
- Microsoft Access
- Microsoft PowerPoint
- Adobe Acrobat
- Outlook
- PC Anywhere, Terminal Services, VPN
- Internet and 'Dot' a dos based command prompt

Elissa M. McDonagh

Data Validator

Ms. McDonagh is a data validator with 18 years of experience at GEI performing data validation for state and federal programs in several states in the northeastern Unites States, Alabama and Florida. She also supports the Atlantic Region with laboratory related issues for project setup.

EDUCATION

B.A., Chemistry, College of the Holy Cross

EXPERIENCE IN THE INDUSTRY

31 years

EXPERIENCE WITH GEI

20 years

PROJECT EXPERIENCE

Data Validator, GEI Consultants, Inc. Performing data validation in accordance with EPA Region I, Region II and IV, EPA National Functional Guidelines, and New Jersey DEP Guidelines. Responsible for in-house review of laboratory data.

Self-Employed Contractor, Organic Data Validator Subcontractor. Performed data validation in accordance with the United States Environmental Protection Agency (EPA) Region I and Region II, EPA National Functional Guidelines, and New Jersey Department of Environmental Protection (DEP) guidelines for environmental consulting firms.

Jacobs Engineering Group Inc., Organic Data Validator. Performed data validation in accordance with Jacobs' modified Region I guidelines.

Organic Data Validator, GEI Consultants, Inc. Performed data validation in accordance with EPA Region I and Region II, EPA National Functional Guidelines, and New Jersey DEP guidelines.

GC/MS Supervisor, Data Review National Environmental Testing Cambridge Division. Responsible for supervising the volatile and semivolatile GC/MS laboratories in all areas that affect the production and presentation of data and reports. Reviewed laboratory data for accuracy, completeness and compliance with protocol to ensure a high level of data quality. Prepared data for report generation. Provided guidance to the laboratory analysts, as well as training new personnel in the acquisition and presentation of laboratory data. Ensured that projects were completed and reported in a timely manner, with the appropriate reporting deliverables.

Love Canal Habitability Pilot Study. Work included semivolatile SIM analysis. Worked as primary analyst during the pilot and pre-validation studies.

GC/MS Volatiles Department Supervisor, National Environmental Testing. Responsible for supervising the daily operation of the volatile GC/MS laboratory. Supervised laboratory analysts and implemented work plan to ensure productivity and efficiency, including the actual scheduling of analyses. Monitored work in progress and completed work to ensure the timely and compliant completion of projects. Troubleshot problems with specific samples, programs or instruments. Verified department performance on an ongoing basis by review of analytical data, standards preparation logs and instrumentation logs. Trained new analysts. Ensured the optimal operation of laboratory equipment.

Associate Scientist, GCA Technology Division. Semivolatile and volatile GC/MS operator using EPA Methods 624 and 625. Responsible for preparing CLP data packages in a manner appropriate for defense in court. Sample preparation using EPA Methods 608 and 625.

Laboratory Data Consultants, Inc. Statement of Qualifications and Resumes

LABORATORY DATA CONSULTANTS, INC.
7750 El Camino Real, Suite 2L, Carlsbad, CA 92009 Bus: 760/634-0437 Fax: 760/634-0439

STATEMENT OF QUALIFICATIONS

PRESENTED BY:

Laboratory Data Consultants, Inc. (LDC)
7750 El Camino Real, Suite 2L
Carlsbad, CA 92009

LABORATORY DATA CONSULTANTS, INC.
7750 El Camino Real, Suite 2L, Carlsbad, CA 92009 Bus: 760/634-0437 Fax: 760/634-0439

March 1, 2013

LABORATORY DATA CONSULTANTS, INC.

7750 El Camino Real, Suite 2L, Carlsbad, CA 92009 Bus: 760/634-0437 Fax: 760/634-0439

Table of Contents

Contents

Introduction 4

Company Strengths 5

Capabilities and Services 6

Project Experience 10

Project Experience Table 11

Client/Professional References 14

Data Validation Review Process 15

Staff and Capabilities 17

Key Staff and Capabilities Summary 18

LDC Organizational Chart (as of 2/28/13) ....**Error! Bookmark not defined.**

Resumes of Key Personnel 22

Example Validation Worksheets 49

Introduction

Laboratory Data Consultants, Inc. (LDC) is a quality assurance and environmental chemistry company focused in data validation, data quality assessment, database implementation, and data usability. Our primary services include data validation, electronic transfer of data, oversight of Quality Assurance/Quality Control (QA/QC) programs, laboratory audits, technical support for litigation, and database management. Our services include:

- Data validation
- Database development and management
- Laboratory audits/Electronic tape audits
- Litigation support
- QA/QC training
- Automated data review software
- Automated audit software
- Software development

Our corporate office in Carlsbad, California is co-directed by Mr. Scott Denzer, Principal Scientist (Software Engineering/Database Support Services) and Ms. Linda Rauto, Principal Chemist (Data Validation/Data Quality/EDD Services) who have over 45 years of combined experience in the environmental laboratory industry. Our Northern California office is managed by Mr. Jeff McLeod, senior chemist in Sacramento, California. Our national sales office is directed by Mr. Tim Fitzpatrick in Denver, Colorado.

Laboratory Data Consultants, Inc. (LDC) is an experienced commercial, Navy, AFCEE, and Army Corps of Engineers Quality Assurance (QA) subcontractor. LDC's experience as a data validation, data management, quality assurance/quality control (QA/QC), litigation support, and software development subcontractor includes projects under the following contracts:

- Santa Susana Field Lab (Montgomery Watson)
- Tronox (Northgate Environmental)
- Stringfellow QA/QC Program (Dept of Toxic Substances, California)
- Aerojet QA/QC Program (Aerojet)
- Automated Software Program (Florida DEP)
- Caltrans QA/QC Software Program (Caltrans)
- Navy CLEAN EFA West (Tetra Tech EMI)
- Navy CLEAN Pacific Division (Earth Tech)
- Navy CLEAN Southwest Division (Bechtel National)
- Navy RAC Southwest Division (IT/OHM Remediation)
- Army Corps of Engineers, Fort Ord (Harding Lawson)
- Army Corps of Engineers, Travis AFB (CH2M Hill)
- Army Corps of Engineers, Fort Irwin (ACOE, Sacramento District 8A)
- Army Corps of Engineers, ADR.NET

- Army Corps of Engineers, FUDSCHEM
- AFCEE/Army Corps, George AFB (Montgomery Watson)
- AFCEE, McClellan AFB (Jacobs Engineering Group)
- AFCEE, Various bases, Mentor Protegee Program (Montgomery Watson)
- AFCEE, Pease AFB (Bechtel National, Inc.)
- State of Washington (WA), Department of Ecology (DOE)
- State of Oklahoma (OK), Department of Environmental Quality (DEQ)
- State of Louisiana (LA), Department of Health and Hospitals (DHH)
- State of Florida (FL), Department of Environmental Quality (DEQ)
- Environmental Services Assistance Team (ESAT) (ICF International)
- Environmental Protection Agency (EPA) Region I (Roy F. Weston)

LDC has successfully performed over 500 data validation projects worth over 10 million dollars for prime contractors servicing the United States Army Corps of Engineers (USACE), Air Force (AFCEE), Navy, CERCLA and industrial activities.

Company Strengths

Laboratory Data Consultants, Inc. (LDC) can provide your company with professional services with an impeccable track record for timeliness, quality, technical expertise, and the ability to mitigate complex issues. Our clients will confirm our current and past performance under DOD, DOE, EPA/Superfund and commercial programs. We have experience and a proven track record demonstrated by the following:

- Data validation experience as a subcontractor for more than 80 Army Corps sites, over 100 AFCEE sites, several EPA sites, and under 6 Navy CLEAN and RAC contracts. This experience includes thorough understanding of the EPA, NAVFAC, AFCEE, and Army Corps validation guidelines. LDC's data validation work has totaled over 15 million dollars in the past five years.

- Developed software applications for the Army Corps of Engineers, Caltrans, and the Navy to automate and streamline the quality of the data review process.

- Developed software applications for lab and field assessors to automate and streamline the auditing process.

- Developed a Web-enabled database management system (FUDSCHEM) for the USACE.

- Supported Web-enabled databases and secured project management collaboration portals over the Internet for large environmental projects.

- Hosted a Web-enabled database for EPA Superfund sites for the Stetson Watermaster program.

- Provided litigation support on several high profile environmental contamination projects including data fraud, MtBE, perchlorate, and NDMA.

- Thorough secondary QA review program and the staffing capacity (40 full time staff) to handle large projects of significant magnitude and importance.

- Successful completion of two DOE and four DOD audits to approve LDC's internal data validation procedures, QA program and documentation systems.

- LDC is a small, minority business and is a Small Business Administration self-certified small business. We have a small business certification by the state of California Department of General Services.

Capabilities and Services

Analytical and field data on environmentally impacted sites are used for many purposes including: compliance with regulatory requirements, determination of the presence, concentration, and movement of hazardous substances in the environment, potential effects upon a community, and for the disposal, treatment, or other remedial actions of hazardous materials. In some cases, the data may be used in litigation in defense of a PRP action or final site closure. Therefore data must be of known quality. LDC provides the following services:

Third Party Data Validation

LDC provides third party data validation services under a strict internal and external Quality Assurance program which will assure the data end user of known and documented quality. With our data validation experience on high profile projects over the past twenty years, LDC has developed well-documented procedures which support all facets of the data review process. This includes critical steps such as:

- Receipt and handling of data packages
- Project tracking
- Peer review for all data validation activities
- Internal training programs
- Internal and external audits
- Electronic data transfer and verification processes

Data Management/Software Programming

LDC provides database management and operations support to prime contractors and government entities. Additionally, LDC software programmers can customize programs to generate company specific reports and outputs. Our professionals will improve your productivity by producing high quality information systems for your applications. Our services include:

- Provide current hardware and software support
- Customize programs and reports

- Develop user friendly front end screens
- Train staff
- Provide Web hosted LDC Project Management System (LPMS)
- Provide LDC Web based Environmental Data Management System (EDMSi) database on .NET platform

Other software applications developed by LDC include the following:

- Army Corps Automated Data Review (ADR/ADR.NET) software
- Army Corps Environmental Data Management System (EDMS) software
- Army Corps EDMSi (Web version)
- Army Corps FUDSChem
- Army Corps FUDSForum
- Army Corps MRSPP
- Army Corps PM
- EDMS/NEDD NIRIS software
- Florida DEP ADaPT software
- Florida DEP EDMS software
- Florida STORET software
- ELB/ELBIS
- Caltrans Automated Data Validation (ADV) software
- Seattle ADV
- LDC Automated Lab Audit software (AAS)
- LDC Automated Field Audit Software (FAS)

Electronic Data Deliverables

As a supplement to hard copy data validation reports, LDC has the ability to deliver electronic data deliverables (EDD) in a variety of formats. The scope of this effort is based on client requirements although generally includes the transfer of data validation qualifiers from hard copy validation reports to an existing data base. The EDD format is based on project specific requirements and may assume a variety of established database structures (i.e. SEDD, NEDD, ERPIMS, ADaPT, ADR, ITEMS, IRDMIS, and ERIS). In addition, LDC has the ability to customize the format of electronic data deliverables to suit specific client demands.

Litigation Consulting

LDC has provided litigation support to attorneys as technical experts in several cases. Our experience includes projects relating to:

- Laboratory fraud
- Inaccurate reporting of analytical data
- False claims
- Leaking underground storage tank liability

- Tracing plume contamination
- PCB characterization

LDC's performance as an expert witness or technical support provider has simplified environmental chemistry data evaluation and laboratory performance assessment for attorneys so they can more effectively address complex environmental issues. Several references can be provided upon request.

Automated Electronic Data Review (ADR)

LDC’s ADR.NET software enables users to review method accuracy and precision data including field QC and calibration contained in electronic data deliverables (EDDs) and qualify that data according to project-specific criteria as defined in your Quality Assurance Project Plan (eQAPP). The qualified data can be exported to your database with the qualifier field appended. ADR also has a large variety of reports that summarize data quality outliers, detail the reason for the qualifier(s) and list all samples affected by the qualification. ADR makes an excellent front-end data checker for all environmental databases, allowing for 100% review of data prior to uploading to the database.

ADR.NET was designed to provide unparalleled access and review of environmental analytical data. The system was designed and produced by developers who have broad exposure to data validation, data management and the environmental chemistry industry.

ADR.NET Ease of Use

- Designed to provide user-friendly graphical interface utilizing MS Windows® features.
- Easy Installation
- Web-enabled user friendly search and data filtering capabilities
- Accepts ADR and SEDD 5.0/5.2 format electronic data deliverables (EDDs)

ADR.NET Data Review Features

- Fully automated data review
- Fully automated data verification and data logic evaluations
- Automated routines to evaluate compliance with data deliverable specifications.

ADR.NET Additional Features

- OLE functionality allows data to be linked to other applications
- System security with multiple levels of permissions
- Single or multi-user environment
- Integration with SEDD data deliverables

ADR.NET does not require specialized computer skills for operation. It was designed for ease of use with minimal user interface. The tool's powerful logic capabilities provide consistent, yet transparent, data validation conforming to EPA Inorganic and Organic Functional Guidelines.

Laboratory and Electronic Data Tape Audits

LDC has provided on-site laboratory audits for DOD and industrial clients to assure production of quality data from contract analytical laboratories. LDC also has experience and expertise in electronic tape audits generally required for litigation cases.

Laboratory QA/QC audits have been performed under DTSC, Shell Oil, Hewlett Packard (HP), NFESC, Army Corps, and other major programs.

Project Experience

Laboratory Data Consultants, Inc. (LDC) has performed quality assurance services for contaminated sites overseen by the DOE and DOD, and EPA Superfund projects overseen by the EPA, Army Corps, Navy, and Air Force projects.

LDC is continually evaluating and monitoring its capacity to meet client needs. It is company policy to not accept a project unless the service can be completed on-time with our expected quality of performance. This policy has proved very successful in meeting past project deadlines. Our client references can confirm our performance of on-time delivery.

LDC has validated over 1,000,000 analyses for tests such as volatile organics (CLP 0LM01.8, CLP 0LM03.2, EPA Method 8260B, TO-15), semivolatile organics (CLP OLM01.8, CLP 0LM03.2, EPA Method 8270C), organochlorine pesticides/PCBs (CLP 0LM01.8, CLP 0LM03.0, EPA Method 8080/8081/8082), chlorinated herbicides (EPA Method 8150/8151), purgeable halocarbons and aromatics (EPA Method 8010/8020/8021), trace metals (CLP ILM02.1, CLP ILM03.0, CLP ILM04.0, EPA Method 6010/7000), total petroleum hydrocarbons (EPA Method 8015/CDOHS LUFT), explosives, radiochemical constituents, perchlorate, NDMA, and general minerals.

Because of the versatile capabilities of our staff, personnel can also support multiple areas which are high in backlog. Our training program documents personnel approvals for all data review activities. All of our staff actively participate in the LDC training program.

Additionally, several of the projects listed below included the submittal of electronic data deliverables (EDDs) with data qualifiers. LDC has the ability to work with various formats utilizing its ACCESS, ADR.NET, and ADAPT customized programs. LDC's data management and software development staff have supported several clients in managing databases and developing software programs with user friendly interfaces. LDC has provided web based hosted and network based solutions for clients using the EQuIS database platform along other custom platforms.

Laboratory Data Consultants, Inc. (LDC) has met contractual turnaround time and quality requirements on over 99% of the projects completed. The following data validation, software development, and quality assurance projects are representative of our technical capabilities and demonstrate our capacity.

Project Experience Table

Name and Address, Contact Person, Telephone	Work Description and Location	Requested Deliverables	Number of samples/ Matrix	Value ($)	Start/Stop
AECOM 1001 Bishop Street, Suite 1600 Honolulu, HI 96813 Attn: Terri Choy	AECOM Elmendorf AFB, and various Hawaii and Guam Sites Third party data review and validation of analytical data for air and water samples.	Level III and IV data review reports and validation data quality assessment report (DQAR)	Air, Water, Soil	$40,000	8/09-10/11
Aerojet P.O. Box 13222 Sacramento, CA 95813-6000 Attn: Mr. Steve Costello	Environmental chemistry and QA/QC support under an IDIQ contract. Professional services included data review, QAPP generation and review, regulatory responses, laboratory and field audits.	Various audit findings and data validation reports for EPA and other agencies	>1,000 Soil and Water	$800,000	1/01-present
Bureau of Land Management Alaska State Office 222 W. 7th Avenue, #13 Anchorage, AK 99513-7599 Attn: Mr. Matthew Varner	Alaska BLM Kuskokwim Fish Tissue study LDC provided EPA level IV equivalent data validation for over 1,000 fish tissue samples.	EPA Level IV data validation reports	>1,000 Tissue	$40,000	3/11
California DTSC Site Mitigation Stringfellow Branch 8810 Cal Center Drive Sacramento, CA 95812 Attn: Ms. Sue Fears	Lab QA/QC technical support and data validation for the Stringfellow Superfund site. All project data is processed using DTSC's ADaPT software with included customized site tools. Qualified electronic data deliverables (EDDs) are uploaded to the client's EQuIS database.	QA/QC reports and documents, Electronic data upload to client database via EQuIS	>5,000 Soil and Water	$1.4M	5/03-present
CDM Federal Programs Corporation 555 17th Street, Suite 1100 Denver, CO 80202 Attn: Cherie Zakowski	Santa Susana Field Laboratory LDC performed EPA Level III and IV equivalent data validation for a full suite of analyses on more than 5,000 soil and water samples	EPA Level III and IV data validation reports.	>5,000 Soil and Water	$500,000	6/11-present
ERRG 2210 S. Azusa Ave. West Covina, CA 91792 (626) 810-7157 ATTN: Mr. Thom Lambertson	ERRG BKK Landfill LDC performs laboratory data validation and provides quality assurance chemistry consulting services in support of ERRG's activities at BKK Landfill. This includes manual and automated data review of analytical monitoring data using DTSC ADaPT software and upload of qualified EDDs to the client database in EQuIS.	QA/QC reports and documents, Electronic data upload to client database via EQuIS	Soil and Water	$65,000	9/10-present
HydroGeologic, Inc. 11107 Sunset Hills Road, Suite 400 Reston, VA 20190 Attn: Ms. Laura McNamara	HGL Kirtland AFB Level III data validation of semivolatiles, metals and explosives data.	Level III data validation reports	>500 Soil	$62,000	8/11-12/11
ICF 9300 Lee Highway Fairfax, Virginia 22031-1207 Attn: Mr. Jerry Vail	EPA Region IX ESAT technical support for data validation and document review, population of electronic data deliverables (EDDs) with data validation qualifiers	Data validation and QA reports, EDDs populated with data validation qualifiers	>10,000 samples	$1.0M	4/01-present

Name and Address, Contact Person, Telephone	Work Description and Location	Requested Deliverables	Number of samples/ Matrix	Value ($)	Start/Stop
Integral Consulting 319 SW Washington Street, Suite 1150 Portland, OR 97204 Attn: Ms. Abbie Spielman	Integral Consulting Georgetown Steam Plant Project Level III and IV equivalent data validation of soil and water samples from an industrial site.	Data validation and QA reports, EDDs populated with data validation qualifiers	>100 soil and water samples	$40,000	6/10-present
MWH Americas, Inc. PO Box 6610 Broomfield, CO 80021 Attn: Ms. Linda Goad	MWH Hamilton Army Airfield Level III and IV equivalent data validation of PAHs, lead and TPH analyses of soil samples	EPA Level III and IV data validation reports.	>200 soil samples	$73,000	5/04-present
San Jose State University Research Foundation (SJSURF), Russell Fairey, Program Director Marine Pollution Studies Lab Moss Landing Marine Laboratories 7544 Sandholdt Rd. Moss Landing, CA 95039	LDC provided general information management system quality assurance assistance to the State Water Resources Control Board's Office of Information Management and Analysis (OIMA) staff in the performance of a statewide California Integrated Water Quality System (CIWQS) data entry verification audit. This work supported efforts to set a baseline for current data entry accuracy by staff, assess the effectiveness of recent data entry accuracy improvement activities, and potentially indicate where additional improvements are necessary.	Audit plan, Individual office audit reports (13 in total), and a final statewide summary audit report	13 CIWQS audits of Regional and State Water Quality Control Board offices	$143,500	8/10-9/11
The Shaw Group, Inc. PO BOX 98519 Baton Rouge, LA 70884 Attn: Mr. Eric Schmidt	Fort Ord ADR and manual EPA Level III and IV equivalent data validation of various methods.	ADR and manual EPA Level III and IV data validation reports.	>500 Water and Soil	$56,000	2/01-present
The Shaw Group, Inc. PO BOX 98519 Baton Rouge, LA 70884 Attn: Ms. Yvonne Yang	Vandenburg AFB EPA Level III and IV equivalent data validation of water and soil samples for full suite of analyses.	EPA Level III and IV data validation reports.	>1,000 Water and Soil	$120,000	3/09-present
Main San Gabriel Basin Watermaster 725 North Azusa Avenue Azusa, CA 91702 Attn: Steve Johnson	Stetson Watermaster LDC provided ADR and EPA Level IV equivalent data validation and database hosting and support services.	ADR and EPA Level IV validation reports and updated database.	>1,000	$1.6M	4/06-present
Tetra Tech, Inc. Debra Soper, Program Manager 3140 Peacekeeper Way McClellan, CA 95652	LDC Sacramento performed manual data validation on monthly sampling data sets from the Monterey Peninsula Airport (MPA) Formerly Used Defense Sites (FUDS) Groundwater Monitoring and Treatment System project, providing a quarterly CDQAR report.	CDQAR (quarterly) and Enhanced ERPIMS EDDs with data qualifiers added.	>500 Groundwater	$72,000	4/03-3/10
Tetra Tech, Inc. Debra Soper, Program Manager 3140 Peacekeeper Way McClellan, CA 95652	LDC Sacramento teamed with Tetra Tech in writing a project-specific UFP QAPP; provided QAPP reviews and responses to USACE comments; performed manual and/or electronic data validation using ADR (as required) on data sets from various Formerly Used Defense Sites (FUDS) Groundwater and/or Investigation projects.	QAPP writing or QAPP review and responses to comments, QCSR or CDQAR report, reviewed SEDD stage2A files and/or an EDMS database (as required).	>200 Soil and Groundwater	$55,000	3/06-12/09
Northgate Environmental Management Henderson, NV 89009 Attn: Ms. Susan Crowley	Tronox Northgate SEDD Stage 2A and 4 automated data review and validation.	Data validation and summary reports.	>5,000	$508,000	5/09-5/11

Name and Address, Contact Person, Telephone	Work Description and Location	Requested Deliverables	Number of samples/ Matrix	Value ($)	Start/Stop
Tetra Tech EC, Inc. 1230 Columbia Street, Suite 750 San Diego, CA 92101 Attn: Sabina Sudoko	TTEC Alameda Pt. ADR and EPA Level IV equivalent data validation of water samples from NAS Alameda.	ADR and EPA Level IV data validation reports.	>1,000 Water	$130,000	10/01-9/11
URS Corporation Debbie Casagrande, Project Manager 2870 Gateway Oaks Drive, Suite 300 Sacramento, CA 95833	URS Modesto Superfund project LDC Sacramento performed manual and electronic data validation (using ADR.net) on monthly sampling data sets, providing a quarterly QCSR report, as well as reviewed ADR and SEDD stage2A files. Data review was 10% Level 4. Data were reviewed against ADR.net criteria, USEPA Region 9 Standard Operating Procedures (SOPs), and National Functional Guidelines.	1. QC Summary Report (quarterly) 2. ADR electronic deliverables 3. SEDD stage 2A electronic deliverables	500 groundwater and 220 air samples	$41,000	3/10-present
URS Corporation P.O. Box 203970 Austin, TX 78720 Attn: Mr. Peter Fairbanks	URS Pease AFB EPA Tier 1, 2 and 3 data validation of volatiles, semivolatiles, metals and wet chemistry analyses.	EPA Tier 1, 2 and 3 data validation reports.	>1,000 Soil and Water	$1.2M	2/06-present

Client/Professional References

Company	Contact
US Army Corps of Engineers, Sacramento	Pam Wehrmann
US Army Corps of Engineers, New Mexico	Brian Jordan
AECOM (formerly Earth Tech)	Chris Barr
Montgomery Watson	Ruth Siegmund
AECOM (formerly Bechtel National)	Toni Kuzmack
USEPA	Anand Mudambi
Tetra Tech EC	Lisa Bienkowski
Sealaska	Mary Schneider
Florida DEP	Tom Frick
SFWMD	Delia Ivanoff
AECOM (formerly BMT)	John D’Ath
Earth Tech	Scott Lewis
SWFWMD	Mark Rials
California DTSC	Sue Fears
Aerojet	Steve Costello
ESAT/ICF International	Jerry Vail
Sacramento Regional County Sanitation District	Vyomini Pandya

Data Validation Review Process

The data validation review process will follow the requirements stated in the project's Quality Assurance Project Plan (QAPP). If data validation procedures and criteria are not clearly stated in the QAPP, Laboratory Data Consultants, Inc. will follow internal validation procedures developed using Environmental Protection Agency (EPA), Air Force Center for Environmental Excellence (AFCEE), Army Corps, and Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control program guidelines, as applicable. The complete process includes the following steps:

1) Sample Log-in

All samples submitted for data validation are entered into the LDC Log-in system. The system generates various spreadsheets for sample tracking, listings of laboratory and client identifications, sampling dates, analysis requested, matrix, and project due date. These tracking documents are distributed to all data validation, QA and project management staff.

2) Pre-screening

The pre-screening is performed concurrently with the sample log-in process. This task verifies sample chain-of-custody, data package completeness, and concurrence with the authorized delivery order.

3) Data Validation

The data validation review process will follow the requirements stated in the project's QAPP or SOW. Laboratory Data Consultants, Inc. will also follow internal LDC validation procedures which were previously developed, as applicable. The data validation procedures will reference the most recent versions of the following two guidance documents along with any other applicable documents:

- "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review"
- "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review"

The data package review will be handled in a stepwise fashion. All samples for one analysis will be batched together and evaluated against each individual validation criterion. The validator will document each finding on a Validation Findings form. Along with the finding, the reviewer will document the date of the occurrence, the lab reference identification, the validation criteria, the associated samples, and the qualification of the data. For EPA Level 4 review, several recalculations are required. Results are recalculated back to the raw data and verified to within 10% of the reported value. A Validation Checklist is enclosed for review (See Appendix 2). This checklist is used as an inventory sheet to assure all samples were reviewed for all criteria. The findings documented on the Validation Findings forms will be transcribed into the final summary report.

All initial validation performed by Laboratory Data Consultants, Inc. has a secondary review by senior staff as needed.

4) First Report Review

The first review of the typed data validation report verifies that all findings and data qualification has been accurately transferred from the data validation worksheets. All sample identifications, methods, formatting, and general text are reviewed.

5) Senior Report Review

The senior review of the typed data validation report verifies that all findings, data qualification, and professional judgments previously integrated into the reports reflect the overall quality of the data. Any additional comments required to enhance the usability of the report will be inserted at this time.

6) QA Report Review

A QA check of selected data validation reports within an individual delivery order will be reviewed by the QA department. A formal nonconformance report will be generated for any identified deficiencies. The deficiency will be addressed with the appropriate staff and corrected prior to submittal to senior management for final review and signature.

7) Senior Management Review

The program/technical manager will perform a general review of the final reports. He will sign the report cover letter and submit the report to the sample custodian for shipment to the client.

8) Electronic Data Deliverables (EDD)

If EDD is required for a project, this task will be initiated at step 1 with the receipt of disks from the client. After verification of the disk formats and fields, the disks will be prepared for importing of data qualifiers. The importing of qualifiers typically occurs after step 5. If changes are necessary due to steps 6 or 7, the EDD will be modified.

Staff and Capabilities

Laboratory Data Consultants, Inc. (LDC) personnel have experience and formal training in the area of data validation, electronic data deliverables, laboratory QA/QC, and data management. As documented in the resumes and past experience of our data review staff, most of the LDC personnel have performed activities in several analytical disciplines. These include, but are not limited to, GC/MS volatiles, GC/MS semivolatiles, GC pesticides, ICP metals, ICP/MS metals, GFAA metals, GC petroleum hydrocarbons, GC/MS dioxins, explosives, radiochemistry, and wet chemistry. This versatility allows our organization to adapt to workload shifts and allows for an excellent secondary review system.

Our software engineering and data management staff have successfully worked with clients on developing cost effective database programs, processes, and software applications. Additionally, LDC's automated data review and automated audit software programs have been implemented at a national level.

LDC has assembled a highly-qualified team of environmental, technical and administrative professionals to serve our clients. See Table 1, Key Staff and Capabilities Summary, for a detailed listing of the names, education and experience of key staff at LDC, Inc.

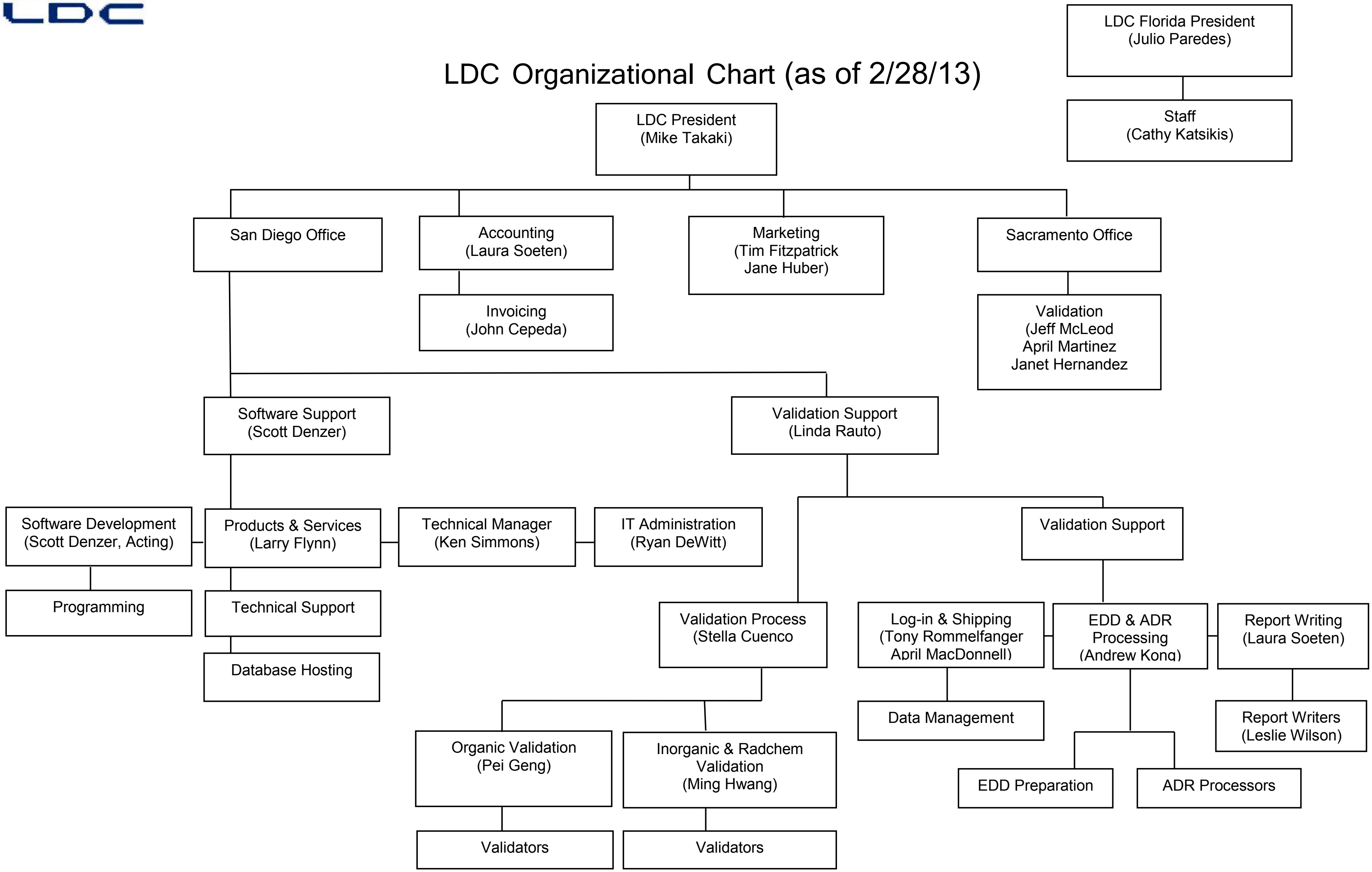
Table 1: Key Staff and Capabilities Summary

	Education		Number of Years of Experience							
Name	**Chemistry or related science**	**Other**	**Company Name/Years**	**Company Name/Years**	**Company Name/Years**	**This Company**	**Validation Experience (total years)**	**As an Analyst**	**Brief Description of Validation Expertise**	**Primary and Secondary Task Responsibilities**
Scott Denzer	B.S		SAIC/5 years	Analytical Technologies/ 4 years	Guam EPA/ 3 years	19	17	12	Pesticides, PCBs, Herbicides, TPH, Butlytins	Principal Chemist/ Technical Director
Erlinda T. Rauto	B.S.		PWCSA County Complex/ 3 years	AECOS/ 3 years	Appropriate Technologies/ 2 years	12	14	8	Pesticides, PCBs, Herbicides, TPH, Butlytins	Senior Chemist/ Operations Manager
Richard M. Amano	B.S.		West Coast Technical Service/ 3 years	Brown & Caldwell/ 3 years	Analytical Technologies/5 years	21	17	11	GC/MS VOCs, SVOCs, Pesticides, PCBs, Herbicides, TPH, Butlytins	Principal Chemist
Stella Cuenco	B.S.				Analytical Technologies/ Ceimic Corporation/ 5 years	16	16	5	GC/MS VOCs, SVOCs, Dioxins/Furans PCB Congeners, Pesticides, TPH	Senior Chemist
Pei Geng	M.S.			Pace Analytical/ 6 years	Ceimic Corporation/ 1 year	15	15	7	GC/MS VOCs, SVOCs, Dioxins/Furans PCB Congeners, Pesticides, TPH	Senior Chemist
Ming Hwang	Ph.D			Analytical Technologies/ 3 years	Laucks/ 5 years	7	7	8	Metals, Wet Chemistry	Senior Chemist
Andrew Kong	B.S.			Air Toxics, LTD./ 2 years	Kiff Analytical/ 1 year	5	5	3	ADR/SEDD	Project Manager

	Education		Number of Years of Experience							
Name	Chemistry or related science	Other	Company Name/Years	Company Name/Years	Company Name/Years	This Company	Validation Experience (total years)	As an Analyst	Brief Description of Validation Expertise	Primary and Secondary Task Responsibilities
Mark Gregg	B.S.				Pacific Analytical/ 9 years	9	9	9	GC/MS VOCs, SVOCs, Metals, Wet chemistry	Chemist
Felomina Tanguilig	B.S.		Engineering Science/2 years	Superior Analytical Lab/5 years	Transglobal Environmental/4 years	8	8	7	GC/MS VOCs, SVOCS, Pesticides, PCBs, TPH, Herbicides	Chemist
Josephine Go	B.S.		Sentro Tek Corp/ 1 year	Advanced Technology Labs/ 1 year	CRL Environmental Corp/ 1 year	6	6	4	Pesticides, PCBs, TPH, Herbicides	Chemist
Laura Soeten	B.A.			Pacific Analytical/ 3 years	QA Labs/ 1 year	17	3	NA	GC/MS VOCs, SVOCs	Group Lead Technical Writer Executive Administrator
Tony Rommelfanger			Smith Emery Co/ 2 years	Analytical Technologies/ 1 year	Terra Tech Labs/ 1 year	17	NA	NA	NA	Data Control Manager
Larry Flynn	B.S.			SAIC/ 3 years	Analytical Technologies/Ceimic Corporation/ 10 years	10	6	8	GC/MS VOCs, SVOCs, Metals	Software Development Manager
Dung Ngo					Analytical Technologies/ 3 years	12	12	3	Pesticides, PCBs, Herbicides, TPH	Senior Analyst/ADR Operator
Ken Simmons		B.S.	CSK Auto, Inc./ 1 year	Qiva, Inc/ 1 year	Xenon Software/ 3 years	5	NA	NA	NA	Software Programmer
Jeff McLeod			Analytical Technologies, Incorporated	Ecochem, Incorporated	Severn Trent Laboratories (STL)	5	8	6	GC/MS VOCs and SVOCs, GC VOCs, TPH, Pesticides/PCBs	Senior Chemist/ Sacramento Office Manager

	Education		Number of Years of Experience							
Name	**Chemistry or related science**	**Other**	**Company Name/Years**	**Company Name/Years**	**Company Name/Years**	**This Company**	**Validation Experience (total years)**	**As an Analyst**	**Brief Description of Validation Expertise**	**Primary and Secondary Task Responsibilities**
April Martinez	B.S.		New Mexico State University /1 year	Department of Chemistry, UC Davis / 2 years	Environmental Micro Analysis Laboratories / 4 years	7	7	4	GC/MS VOCs and SVOCs, Pesticides/PCBs, TPH, Metals, Wet chemistry	Senior Chemist/ Project Manager
Ryan Dewitt		B.A.	Inetcame, Inc. 2 years	PRAJA, Inc./ 3 years	Tyco, Video Systems Division/ 2 years	5	NA	NA	NA	Network Administrator/
Tim Fitzpatrick	B.S.		Transglobal Environmental/ 6 years	AMEC/Ogden/ 3 years	Cardinal Health/ 1 year	5	NA	10	NA	Senior Scientist/ National Sales Manager
Jane Huber	B.S.						NA		NA	National Sales Assistant

LDC Organizational Chart (as of 2/28/13)



Appendix 1

Resumes of Key Personnel

RESUME
SCOTT M. DENZER

EDUCATION

B.S. Meteorology (emphasis in Atmospheric Chemistry)
University of Wisconsin, Madison, 1983

CERTIFICATIONS

Laboratory Drinking Water Certification Officer: Organic Chemistry, Inorganic Chemistry and Microbiology, USEPA, 1998

40 Hour OSHA Hazwoper Certification and Annual 8 Hour Refresher Sessions

PROFESSIONAL HISTORY

Laboratory Data Consultants, Inc.
Technical Director/Principal Chemist, 2000 to present
QA Director/Principal Chemist, 1995 to 1997
Senior Chemist, 1992 to 1994

Guam Environmental Protection Agency
Laboratory Quality Assurance Officer/Chemist, 1997 to 2000

Analytical Technologies, Inc.
GC Supervisor, 1990 to 1992
GC Pesticide Senior Chemist/Group Leader, 1988 to 1990

Science Applications International Corporation
GC Chemist, 1983 to 1988

University of Wisconsin, Madison – Department of Meteorology
Atmospheric Chemistry Laboratory Assistant, 1982 to 1983

REPRESENTATIVE EXPERIENCE

Mr. Denzer has over 22 years combined experience in environmental sampling, analyses, data validation, quality assurance, laboratory auditing, and software design, implementation and training. Mr. Denzer's experience includes sampling, analysis and data validation in support of Federal and

State programs, including the Clean Water Act, the Clean Air Act, CERCLA, RCRA, and NIOSH. He has experience performing sampling and analysis for physical, microbiological, and organic and inorganic chemical parameters in drinking water, groundwater, wastewater, and marine water as well as air, soil, sand, sediment, tissue, and wipe samples. Mr. Denzer has performed data verification, review and data validation for numerous Department of Defense and commercial project and is familiar with program-specific requirements as well as the Uniform Federal Policy for Quality Assurance Project Plans, the EPA Data Quality Objective Process, and requirements of the Safe Drinking Water Act, the National Laboratory Accreditation Program, and quality control requirements of various analytical methods. Mr. Denzer has performed field audits as well as laboratory auditing for the Safe Drinking Water Program, the Navy, and the Government of Hong Kong. He has also installed, customized, implemented laboratory information management systems (LIMS) at the Navy PWC San Diego, Navy PWC Guam and Guam EPA. Mr. Denzer provided training for all laboratory staff at each facility and continues to provide technical support and customization. Mr. Denzer is currently working closely with the USEPA and US Army Corps of Engineers on development of the Staged Electronic Data Deliverable (SEDD) data transmission format and its integration with data review software applications. Mr. Denzer has provided technical support throughout various programs within the Guam Environmental Protection Agency with data quality assessment, data interpretation, document review and preparation of Agency’s Quality Assurance Program Plans and Quality Management Plans. Prior to his experience at LDC and the Guam Environmental Protection Agency, Mr. Denzer held laboratory positions including GC Pesticides supervisor, GC chemist, and section leader.

Specifically, Mr. Denzer has over 10 years quality assurance and validation experience on DOD and commercial projects.

- As Technical Director and Principal Chemist with Laboratory Data Consultants, Inc., Mr. Denzer currently oversees special data validation and software development projects and provides technical support to contractors by performing laboratory audits and technical review of Quality Assurance documents under various programs. In addition, he provides technical training and support to a variety of government agencies and contractors with the successfully implement automated environmental data processing systems such as the Automated Data Review (ADR) and Environmental Database Management System (EDMS) software programs. Mr. Denzer is currently performing SEDD and ADR software training at each of the EPA Regional offices for use in the Emergency Response Program. He is experienced in manual and automated data review for major DoD and litigation projects and has provided on-site data management activities for laboratory improper practice investigations. Mr. Denzer has performed on-site data management activities over the course of several months for a contractor providing the US Air Force with large volumes of data in the Air Force ERPIMS transmission format. Mr. Denzer has a thorough knowledge and understanding of methods referenced in EPA CLP, SW-846, EPA 500 and 600, EPA TO Series and Standard Methods documents. Mr. Denzer provided an independent evaluation of a Laboratory Information Management System (LIMS) under contract for a major laboratory.

In addition, he has installed, customized and implemented LIMS at the Navy PWC San Diego, the Navy PWC Guam and Guam Environmental Protection Agency. Mr. Denzer maintained constant communication with information technology (IT) staff, laboratory management and laboratory staff to ensure successful implementation of the system. This involved a thorough understanding of management requirements, regulatory program requirements, analytical requirements, IT constraints and efficiency needs.

Mr. Denzer has over 13 years experience in an environmental laboratory supervising or performing environmental analyses.

- While at the Guam EPA, Mr. Denzer served as the Agency Quality Assurance Officer as well as the Laboratory Certification Program Manager and lead auditor of Guam EPA's Laboratory Certification Team. In addition, he performed analyses for microbiological and chemical (organic and inorganic) parameters in drinking water using Safe Drinking Water Act analytical methodology, ensured adherence to quality control requirements of method and Act, performed analyses for microbiological and chemical parameters in marine and fresh water using methodology approved under the Clean Water Act, ensured adherence to quality control requirements of EPA methods, and performed analyses for microbiological and/or chemical parameters in soil, sand, sediment and air as requested by Guam EPA program administrators. Mr. Denzer provided technical support throughout the Agency with data quality assessment, data interpretation, document review and preparation of Agency Quality Assurance Program Plans and Quality Management Plans. He ensured Guam EPA's laboratory certification program was adequately defined and implemented in accordance with federal Safe Drinking Water Act standards and Guam Safe Drinking Water Act Standards, and ensured laboratories certified by Guam EPA were maintaining proficiency testing frequency and performance requirements. Mr. Denzer also served as Co-Chairperson of Guam’s 1999 Earth Week program and was a regular participant in Guam EPA’s community education outreach programs. He also served as Agency spokesperson to the media (television, radio and newspaper) on several environmental issues.

- While at Analytical Technologies, Inc., Mr. Denzer performed analyses and provided technical support within the laboratory as supervisor for the pesticide section. He was responsible for ensuring the timely and accurate analysis of PCB's, herbicides, triazine pesticides, organochlorine and organophosphorus pesticides in environmental samples. Analysis was accomplished using packed or capillary gas chromatography with electron capture, flame photometric or nitrogen/phosphorus detection. Mr. Denzer was familiar with the preparation, analysis and data reduction phases of frequently utilized analytical protocols including the EPA's SW 846 and CLP protocols. To enhance QA/QC program at ATI, Mr. Denzer implemented and monitored Total Quality Management (TQM) processes.

- At Science Applications International Corporation, Mr. Denzer performed trace organic analysis of a wide variety of sample matrices using liquid and gas chromatography methods with electron capture, flame ionization, photoionization, thermal conductivity, Hall electrolytic conductivity, ultra violet, and fluorescence detectors.

OPERATING SYSTEMS, COMPUTER LANGUAGES

Windows XP, NT, 2000

XML, MS Access, Dbase IV, Fortran

TECHNICAL PRESENTATIONS

"Performing Automated Data Review (ADR) and Data Quality Assessment on Staged Electronic Data Deliverable (SEDD) Files"
Pittsburgh Conference, Orlando, FL, February 2005 (Invited Speaker)

“Using SEDD Deliverables and Automated Data Assessment Software to Meet Project Specific Electronic Data Management Goals”
National Environmental Monitoring Conference, Washington, DC, July 2004 (Invited Speaker)

“SEDD Perspective: Data Review and Data Use”
DoD Environmental Monitoring and Data Quality Workshop, Reno, NV, May 2004“Automated Review and Management of Analytical Data Using ADAPT and EDMS”
California Department of Toxic Substances Control, Berkeley, CA, April 2004
"Electronic Review of SEDD Files"
Pittsburgh Conference, Chicago, IL, March 2004 (Invited Speaker)

“Performing Automated Data Review and Data Quality Assessment on SEDD Files”
National Environmental Monitoring Conference, Washington, DC, July 2003 (Invited Speaker)
DoE Environmental Management Consolidated Audit Program (EMCAP), Las Vegas, NV, Sept. 2003

“An Effective Automated Data Review Interface with SEDD”
Pittsburgh Conference, Orlando, FL, March 2003 (Invited Speaker)
“An Effective Automated Data Review Interface with the Superfund Electronic Data Deliverable (SEDD)”
Waste Testing and Quality Assurance Conference, Washington, DC, July 2002 (Invited Speaker)

LECTURING AND TEACHING

“SEDD, ADR and Scribe Implementation Training”, USEPA Region 8 OEM, Denver, CO, March 2005

“SEDD, ADR and Scribe Implementation Training”, USEPA Region 10 OEM, Seattle, WA

"EPA Quality Systems Training”
Aerojet GenCorp, Sacramento, CA 2004

"Instrumental Analysis of Hazardous Materials", Guest Lecturer
University of California, San Diego, CA 1992 - 1993

PUBLICATIONS

"Mathematical Description of the Shape of Plane Hexagonal Snow Crystals", P. Wang and S. Denzer, Journal of the Atmospheric Sciences, April 1983.

MEMBERSHIPS AND AFFILIATIONS

American Chemical Society
Association of Air and Waste Management
American Meteorological Society

RESUME
ERLINDA T. RAUTO

EDUCATION

B.S. Chemical Engineering 1967
Feati University - Manila, Philippines

PROFESSIONAL HISTORY

Laboratory Data Consultants, Inc.
Senior Chemist/Validation Group Manager
1993 to present

Appropriate Technologies, Inc.
Chemist II
1992 to 1993

AECOS Inc.
Laboratory Supervisor
1989 to 1992

PWCSA #4 County Complex
Laboratory Analyst
1986 to 1989

Kalama Specialty Chemical
Chemist
1980 to 1982

REPRESENTATIVE EXPERIENCE

Ms. Rauto has over 25 years combined environmental laboratory, QA/QC, and data validation experience. Her experience includes performance of data validation in the GC, trace metals, and wet chemistry areas for major Federal projects. Her laboratory experience includes hands-on CLP and EPA ICP/GFAA analysis, pesticide/PCBs and wet chemistry analysis.

Specifically, Ms. Rauto has over 19 years organic data validation and assessment experience using USEPA (including Region III) functional guidelines and other applicable documents.

- As a senior chemist with Laboratory Data Consultants, Inc., Ms. Rauto specializes in the data validation and compliance screening of gas chromatography organic analyses. This validation includes EPA CLP, SW-846, and EPA Water and Wastewater methods. Over the past 16 years, Ms. Rauto has performed USEPA Level 3 and Level 4 (including NFESC Level C and D) validation for projects including Boeing SSFL, Southwest Division CLEAN 1 (Jacobs Engineering/IT Corporation/CH2M Hill), Southwest Division CLEAN 2 (Bechtel National), Pacific Northwest Division CLEAN (URS Greiner), Southern Division CLEAN (ABB Environmental), Atlantic Division CLEAN (EA Engineering), Southwest Division RAC (OHM Remediation), Pacific Division CLEAN (Earth Tech), DOE Atomic City (Jacobs Engineering Group), Army Corps of Engineers, Travis AFB (CH2M Hill), Army Corps of Engineers, Camp Navajo (Tetra Tech), AFCEE Mather AFB (Montgomery Watson), AFCEE Pease AFB (Bechtel Environmental), AFCEE England AFB (Law Environmental), Army Corps of Engineers, Hawthorne Army Depot (Tetra Tech), Army Corps of Engineers, Fort Ord (Harding Lawson), Nevada Test Site (IT Corp), and AFCEE Beale AFB (Law/Crandall, Inc.).

Ms. Rauto has organic laboratory experience with over 7 years experience in an environmental laboratory supervising or performing the analyses of organic parameters.

- As a chemist II at Appropriate Technologies, Inc., a hazardous waste disposal facility, Ms. Rauto was responsible for the operation of the gas chromatographs. Organochlorine pesticides and PCBs analysis was the primary method performed. In addition, Ms. Rauto performed ICP analyses for trace metals, as well as, supported engineers in developing waste treatment processes.

- As the laboratory supervisor at AECOS Inc., Ms. Rauto supervised and directed operation of gas chromatography, atomic absorption, and wet chemistry instrumentation. She interfaced with state and federal agencies to maintain certification and developed a written QA/QC plan for the laboratory.

- As chemist at Kalama Specialty Chemical, Ms. Rauto performed gas chromatography analysis on raw materials and finished products. She worked on the research and development of new chemicals.

Additionally, Ms. Rauto has 2 years inorganic/conventional analytical experience.

- While employed at the Prince William County laboratory, Ms. Rauto was involved in the analysis of water and wastewater for metals and wet chemistry parameters. This included BOD, COD, nitrate, nitrite, sulfate, chloride, fluoride, TDS, conductivity, pH, cyanide, and phenols analyses. She maintained the QA/QC program to assure compliance with EPA guidelines.

AFFILIATIONS

American Society for Quality Control

RESUME
RICHARD M. AMANO

EDUCATION

B.S. Biochemistry
University of California, Los Angeles, 1979

A.A. Chemistry
El Camino College, 1977

PROFESSIONAL HISTORY

Laboratory Data Consultants, Inc.
President/Principal Chemist, Principal Chemist
1991 to present

Analytical Technologies, Inc
Laboratory Director
1986 to 1991

Brown & Caldwell
Laboratory Supervisor
1983 to 1986

West Coast Technical Service
Senior Chemist
1980 to 1983

University of California, Los Angeles
Laboratory Technician
1979 to 1980

REPRESENTATIVE EXPERIENCE

Mr. Amano has over 29 years of combined environmental laboratory, QA/QC, laboratory auditing, data management, and data validation experience. Prior to founding LDC in 1991, he directed to two major laboratories, Analytical Technologies, Inc. (San Diego) and Brown and Caldwell. His experience includes oversight and direction of major QA/QC and data validation efforts for confidential petroleum spill projects, Boeing sites, Superfund sites, DOE sites, Navy RI/FS projects, Army Corps of Engineers investigations, and AFCEE projects. He also has overseen several laboratory audits for major analytical testing programs.

Specifically, Mr. Amano has over 20 years experience with the validation of organic, inorganic, and radiochemical analyses using USEPA CLP (including Region III) functional guidelines and other applicable guidance documents.

- As principal chemist with Laboratory Data Consultants, Inc., Mr. Amano provides management and technical support to the data validation and data quality group. He provides technical support in the organic, inorganic, and radiochemical areas. Acting as project manager for several major QA/QC and data validation programs, he provides a final review of all data validation and assessment reports. Mr. Amano specializes in the evaluation, validation, and interpretation of environmental testing data. Additional responsibilities include laboratory QA/QC and NELAC audits, implementation and support of QA/QC programs and data management support for engineering firms, environmental lab training, consultation on LIMS data base designs for environmental laboratories, and expert witness litigation support. Mr. Amano has managed and directed several major data validation and QA/QC projects for Army Corps, Navy, Air Force, and commercial contracts. Industrial projects include major petroleum oil spill related data validation and assessment of hydrocarbon analyses. The DOD projects include Southwest Division CLEAN 1 (Jacobs Engineering/IT Corporation/CH2M Hill), Southwest Division CLEAN 2 (Bechtel National), Pacific Northwest Division CLEAN (URS Greiner), Southern Division CLEAN (ABB Environmental), Atlantic Division CLEAN (EA Engineering), Southwest Division RAC (OHM Remediation), Pacific Division CLEAN (Earth Tech), AFCEE Mather AFB (Montgomery Watson), AFCEE Pease AFB (Bechtel Environmental), AFCEE England AFB (Law Environmental), Army Corps Travis AFB (CH2M Hill), Army Corps Hawthorne Army Depot (Tetra Tech), Nevada Test Site (IT Corp), and Army Corps Fort Ord (Harding Lawson). He has a thorough knowledge and understanding of EPA CLP, SW-846, EPA 500, EPA 900, and EPA 600 series methods. He additionally has supported attorneys as an expert witness and has taught data integrity and lab ethics courses for several organizations.

Mr. Amano has over 10 years environmental laboratory experience in commercial laboratories supervising or performing the analyses of organic, inorganic, and radiochemical parameters.

- As laboratory director and technical director of Analytical Technologies, Inc, a full service environmental analytical chemistry facility, Mr. Amano was responsible for all facets of operations. These responsibilities include direct technical input for GC, GC/MS, and inorganic operations, personnel selection, assisting in method development, and selection of non-routine analysis. In addition, Mr. Amano was responsible for supervision of the 80 scientists employed at ATI's San Diego laboratory with all group supervisors, quality assurance and safety coordinators reporting directly to him. Mr. Amano has managed numerous analytical testing programs including the North Island Navy Confirmation Study, Miramar Air Force Base Confirmation Study, and investigations at several of the EPA Superfund sites. His environmental expertise focuses on the chemical testing related to hazardous waste investigations, site remediation, and groundwater monitoring programs.

- While at Brown & Caldwell, Mr. Amano's responsibilities encompassed supervision of daily operations of the laboratory, personnel staffing, technical advisor for operation of the gas chromatograph/mass spectrometer (GC/MS) section, maintenance of QA/QC programs, and coordination between engineers, clients, and laboratory analysts. Additionally, he supervised the daily operation of all radiochemistry activities which included alpha, beta, and radium analyses.

- At West Coast Technical Service, Mr. Amano was responsible for daily operation and quality control of the GC/MS group. Mr. Amano was highly involved with the USEPA hazardous waste contracts. Some special projects included dioxin selected ion monitoring analysis, EPA method 624 and 625 validation studies, and low level drinking water evaluations.

TECHNICAL PRESENTATIONS

"Understanding the Workings of an Environmental Laboratory"
Southern California Department of Health Services, 1984
Hargis & Associates, Inc, La Jolla, CA, 1987
Hargis & Associates, Inc, Tucson, AZ, 1987
Westec Services, San Diego, CA, 1987
Applied Hydrogeologic, Inc, San Diego, CA 1989

"Data Validation, QA/QC, and Environmental Analysis"
Van, Waters, and Rogers, Seattle, WA, 1990
ERC Environmental, Honolulu, HI, 1991
Harding Lawson Associates, Honolulu, HI, 1991
Pacific Division Naval Engineering Group, Honolulu, HI, 1991
OHM, Irvine, CA, 1996
Southwest Division Naval Engineering Group, San Diego, CA, 1996
Navy Public Works Center, San Diego, CA 1996

"GC versus GC/MS"
J.H. Kleinfelder & Associates, Artesia, CA 1986
Hargis & Associates, Inc, La Jolla, CA 1987

"Analytical Methods and QA/QC Procedures for Environmental Analysis"
County of San Diego Department of Health Services, San Diego, CA 1989
Regional Water Quality Control Board, San Diego, CA 1990

ERC Environmental, San Diego, CA 1990
Mittlehauser Corporation, Laguna Hills, CA 1991

"Hydrocarbon Testing Related to Underground Storage Tanks (UST)"
San Diego County DOHS, San Diego, CA, 1986
J.H. Kleinfelder & Associates, Artesia, CA 1986
Woodward Clyde Consultants, San Diego, CA 1987
Engineering Enterprises, Long Beach, CA 1987

"Quality Control/Quality Assurance in Laboratories"
Assoc of Hazardous Materials Professionals, Anaheim, CA 1986
R.L. Stollar & Associates, Santa Ana, CA 1989

"The Influence of Sample Matrix on Environmental Analysis"
Assoc of Hazardous Materials Professionals, San Diego, CA 1990

"Comparison of Air Sampling Media"
Assoc of Hazardous Materials Professionals, Anaheim, CA 1991
"Building a Second Generation LIMS for Commercial Laboratory Operations"
Pittsburgh Conference, New York, NY, 1990 (Invited Speaker)

"Employment Outlook in Environmental Laboratories"
Southern California American Chemical Society, 1985

"Opportunities in the Environmental Lab in the 1990's"
American Chemical Society, 1990

"Data Validation of Radiochemical Analyses"
Hargis + Associates, La Jolla, CA 1991

"Detection Limits - MDL, PQL, RDL, LOD ?"
Analytical Technologies, Inc., 1991

"Poor QA/QC or Laboratory Fraud: Have labs crossed the fine line?"
Environmental Professionals Organization, Newport Beach, CA 1996

"Electronic Data Deliverables and Automated Data Review/Validation"
Army Corps of Engineers, Sacramento District, Sacramento, CA 1996

"Navy Environmental Data Transfer Standards"
Kleinfelder, San Diego, CA 1997

"Laboratory QA/QC Update for DOD Programs"
ACTLabs, Long Beach, CA 1997

LECTURING AND TEACHING

"Instrumental Analysis of Hazardous Materials"
University of California, San Diego 1988 - 1995

"Field Monitoring & Laboratory Analysis of Hazardous Materials"
University of California, San Diego 1995 - present

California State Fullerton, Guest Lecturer, 1985 & 1990

San Diego State University, Hydrology Department, Guest Lecturer, 1988

"EPA Level 4 Data Validation" Workshop
Applied Geotechnology, Inc., Bellevue, WA, 1993

"Environmental Analyses in the 90's"
National University, Guest Lecturer, 1993

"Data Quality Objectives for Federal Environmental Programs"
University of California, San Diego 1993

"Data Integrity and Data Management for Federal Environmental Programs"
University of California, San Diego 1994

"Laboratory QA/QC and Electronic Data Requirements for DOD Programs"
University of California, San Diego 1995

"Application and Utilization of Department of Defense (DOD) Guidance Documents"
University of California, San Diego 1996

"Laboratory Quality Assurance for Department of Defense Programs"
University of California, San Diego 1997

PUBLICATIONS

"Managing an Environmental Chemistry Laboratory for Profit",
John H. Taylor, Jr and Richard M. Amano,
Journal of Chromatographic Science, 1987

MEMBERSHIPS AND AFFILIATIONS

American Chemical Society
Association of Hazardous Materials Professionals, (Steering Committee 1988-1994)
Water Pollution Control Federation
Association of California Testing Laboratories, (Board Member 1989-1991)
County of San Diego, Site Assessment and Mitigation Technical Forum (Steering Committee 1990-2000)
American Society of Mass Spectroscopists
American Society Quality Control

RESUME
STELLA S. CUENCO

EDUCATION

B.S. Chemistry, 1991
University of the Philippines (UP)

PROFESSIONAL HISTORY

Laboratory Data Consultants, Inc.
Senior Chemist
1996 to present

Ceimic Corporation
GC/MS Chemist
1996

Analytical Technologies, Inc.
GC/MS VOA Group Leader
1992 to 1996

Analytical Technologies, Inc.
GC/MS Chemist
1991 to 1992

Natural Products Research, UP
Research Assistant
1990 to 1991

REPRESENTATIVE EXPERIENCE

Ms. Cuenco has over 22 years combined environmental laboratory and data validation experience. Her experience includes performance of data validation in the GC and GC/MS areas for major Federal projects. She has performed large validation projects under Boeing, Navy Southwest, Northwest and Pacific Division, EPA Region IX ESAT, USACE and AFCEE programs. Her laboratory experience includes hands-on CLP and EPA analysis of GC and GC/MS volatile organic compounds.

Specifically, Ms. Cuenco has over 16 years organic data validation experience using USEPA (including Region III) functional guidelines and other applicable documents.

- As chemist with Laboratory Data Consultants, Inc., Ms. Cuenco specializes in the data validation and contract compliance screening of gas chromatography-mass spectrometry analyses as well as gas chromatography analyses. She has a thorough knowledge and understanding of gas chromatography and gas chromatography-mass spectrometry (GCMS) and high resolution GCMS methods referenced in EPA CLP, SW-846, EPA 500, 600, and 1600 series documents. She has worked on organic data from such sites as ERM/BRC/Henderson, CDM/Santa Susana Field Laboratory, and AECOM/Lower Passaic River, MWH/Boeing, Navy Southwest and Pacific Divisions and EPA Region IX ESAT, EPA Region II, EPA Region III, EPA Region X, USACE and AFCEE projects.

Ms. Cuenco has over 5 years experience in an environmental laboratory performing the analysis of organic parameters.

- As GC/MS chemist at Ceimic Corporation, a full service environmental analytical chemistry facility, Ms. Cuenco performed GC and GC/MS volatile analyses. She was responsible for the final reporting of analytical data for this section.

- As GC/MS VOA Group Leader at Analytical Technologies Inc., a full service environmental analytical chemistry facility, Ms. Cuenco was responsible for all GC/MS functions which included overseeing daily operations, training staff, final reporting of analytical data, and compliance with method requirements.

- As research assistant at Natural Products Research, UP, Ms. Cuenco researched chemical literature for plants with known medicinal properties as well as performed microbiological and pharmacological tests on plant extracts.

RESUME
PEI GENG

EDUCATION

M.S. Organic Chemistry, 1989
Sam Houston State University

B.S. Environmental Chemistry, 1983
Nankai University

PROFESSIONAL HISTORY

Laboratory Data Consultants, Inc.
Senior Chemist
1997 to present

Ceimic Corporation
GC/MS and GC Chemist
1996 to 1997

PACE Analytical Service Inc.
GC/MS and GC Chemist
1990 to 1996

REPRESENTATIVE EXPERIENCE

Ms. Geng has over 22 years combined environmental laboratory and data validation experience. Her experience includes performance of data validation in the GC and GC/MS areas for major Federal projects. She has performed large validation projects under Boeing, Navy Southwest, Northwest and Pacific Division, EPA Region IX ESAT, USACE and AFCEE programs. Her laboratory experience includes hands-on CLP and EPA analysis of GC and GC/MS volatile organic compounds.

Specifically, Ms. Geng has over 15 years organic data validation experience using USEPA CLP (including Region III) functional guidelines and other applicable documents.

- As senior chemist with Laboratory Data Consultants, Inc., Ms. Geng specializes in the data validation and contract compliance screening of gas chromatography-mass spectrometry analyses as well as gas chromatography analyses. She has a thorough knowledge and understanding of gas chromatography and gas chromatography-mass spectrometry (GCMS) and high resolution GCMS methods referenced in EPA CLP, SW-846, EPA 500, 600, and

1600 series documents. She has worked on organic data from such sites as ERM/BRC/Henderson, CDM/Santa Susana Field Laboratory, and AECOM/Lower Passaic River, MWH/Boeing, Navy Southwest and Pacific Divisions and EPA Region IX ESAT, EPA Region II, EPA Region III, EPA Region X, USACE and AFCEE projects.

Ms. Geng has over 7 years experience in an environmental laboratory performing the analysis of organic parameters.

- As both a GC and GC/MS chemist at Ceimic Corporation, a full service environmental analytical chemistry facility, Ms. Geng performed GC and GC/MS volatile and semivolatile analyses.

- As both a GC and GC/MS chemist at PACE Analytical Service Inc., a full service environmental analytical chemistry facility, Ms. Geng performed GC and GC/MS volatile and semivolatile analyses as well as overseeing the final reporting of analytical data, and compliance with method requirements.

RESUME
MING-HWA HWANG

EDUCATION

Ph.D. Chemistry, 1990
Boston College

BS Chemistry, 1979
National Tsing-Hua University

PROFESSIONAL HISTORY

Laboratory Data Consultants, Inc.
Senior Chemist
2000 to present

Analytical Technologies, Inc.
Metals/HPLC Supervisor
1995 to 2000

Analytical Technologies, Inc.
Inorganics Supervisor
1992 to 1995

Monitor Environmental Lab
1992 to 1992
Senior Inorganic Chemist

REPRESENTATIVE EXPERIENCE

Ms. Hwang has over 20 years combined environmental laboratory, QA/QC and data validation experience. Her experience includes performance of data validation in the trace metals, radiological and wet chemistry areas for major Federal and commercial projects. Her laboratory experience includes hands-on CLP and SW-846 ICP/GFAA analysis, direction of trace metals and inorganic chemistry groups, and overall technical review of CLP data deliverables. She is certified as a "Radiometric Data Validation Specialists" through course work and testing by the Radiochemistry Society.

Specifically, Ms. Hwang has over 12 years inorganic data validation experience using USEPA (including Region III) functional guidelines and other applicable documents.

- As senior chemist with Laboratory Data Consultants, Inc., Ms. Hwang specializes in the data validation and contract compliance screening of gas chromatography-mass spectrometry analyses as well as gas chromatography analyses. She has a thorough knowledge and understanding of gas chromatography and gas chromatography-mass spectrometry (GCMS) and high resolution GCMS methods referenced in EPA CLP, SW-846, EPA 500, 600 and 1600 series documents. She has performed large data validation under Boeing, Navy Southwest and Pacific Divisions and EPA Region IX ESAT, USACE and AFCEE projects.

Mr. Hwang has over 9 years of environmental laboratory experience in a laboratory supervising or performing the analyses of inorganic parameters.

- As metals and HPLC supervisor at Analytical Technologies, Inc., a full service environmental analytical chemistry facility, Ms. Hwang was responsible for managing all aspects of HPLC and trace metal projects such as ensuring complete and correct initiation of analyses, performing analyses, communication with clients regarding project status, QA/QC review, data interpretation, and review of final reports. As inorganic supervisor at Analytical Technologies, Inc., Ms. Hwang managed the inorganic chemistry section which performed techniques such as atomic absorption, inductively coupled argon plasma spectrometry, infrared spectroscopy, and ion chromatography. These analyses were performed from methods referenced in EPA CLP, SW-846, and Standard Methods documents.

- While employed at Monitor Environmental Lab, Ms. Hwang was involved in the analyses of trace metals and classical wet chemistry along with the final interpretation and QA/QC of the final reports.

RESUME
ANDREW KONG

EDUCATION

B.S. Environmental Toxicology, 2006
University of California at Davis

PROFESSIONAL HISTORY

Laboratory Data Consultants, Inc.
Senior Chemist
February 2007 to present

Air Toxics, LTD
GC/MS Analyst
October 2006 to February 2007

Kiff Analytical, LLC
GC/MS VOA Group Leader
November 2004 to October 2006

REPRESENTATIVE EXPERIENCE

Mr. Kong has just over 8 years combined environmental laboratory, data validation, and automated data review experience. His experience includes performance of automated data validation for major Federal projects and data validation for commercial and school district projects. His laboratory experience includes preparation analysis of samples for SW-846 GC and GC/MS organic methods, instrument maintenance, and data evaluation

Specifically, Mr. Kong has over 5 years of inorganic and organic data validation experience using USEPA functional guidelines, Navy procedures, AFCEE QAPP, and other applicable documents

- As chemist with Laboratory Data Consultants, Inc., Mr. Kong specializes in the data validation and contract compliance screening using LDC's Automated Data Review (ADR) software. He has a knowledge and understanding methods referenced in EPA CLP, SW-846, EPA 500 and 600 series documents. He has performed large data validation projects under the Navy Southwest Division RAC and CLEAN contracts.

Mr. Kong has over 3 years experience in an environmental laboratory performing the analysis of organic parameters.

- As organics analyst at Air Toxics LTD., an air testing environmental facility, Mr. Kong performed GC/MS TO-15 analyses. He was responsible for the instrument calibration, verifying sample analyses, approving data, and instrument maintenance for this section.

- As laboratory technician at Kiff Analytical, an environmental analytical chemistry facility, Mr. Kong was responsible for the calibration of GC and GC/MS instruments, training of technicians, reviewing data on Chemstation, and sample preparation.

RESUME
LAURA SOETEN

EDUCATION

B.S. Biology, 1991
University of California at San Diego

PROFESSIONAL HISTORY

Laboratory Data Consultants, Inc.
Technical Writing Group Lead, Contracts Executive Administrator
October 1995 to present

QA Labs
Organics Lab Technician, EDD Specialist, QA/QC
November 1994 to October 1995

Pacific Analytical, Inc.
Organics Lab Supervisor, Sample Receipt Controller
December 1991 to November 1994

REPRESENTATIVE EXPERIENCE

Ms. Soeten has over 22 years combined environmental laboratory and report preparation experience. Her experience includes performance of data validation in the GC and GC/MS, report preparation for organic and inorganic analyses for major Federal projects. She has prepared reports in LDC format and specific client formats for large validation projects under Boeing, Navy Southwest, Northwest and Pacific Division, EPA Region IX ESAT, USACE and AFCEE programs. Her laboratory experience includes hands-on standard preparation and various sample extraction methods for SVOC, Pest, PCB, Herbicides, and Dioxins following CLP and EPA methods.

Specifically, Ms. Soeten has over 17 years of report preparation for inorganic and organic data experience using USEPA functional guidelines, Navy procedures, AFCEE QAPP, project specific QAPP/SAP, and other applicable documents

Ms. Soeten has over 3 years experience in an environmental laboratory performing the preparation of samples for analysis of organic parameters.

- As organics laboratory technician at QA Labs, an environmental analytical chemistry facility, Ms. Soeten performed GC and GC/MS sample extraction methods following EPA methodology for sample extraction in preparation for analysis. Ms. Soeten also worked in the EDD department and QA/QC department finalizing data packages for various clients.

- As laboratory technician at Pacific Analytical, an environmental analytical chemistry facility, Ms. Soeten was responsible for the preparation of various standards including surrogate solutions and internal standards, for sample extraction for analysis by of GC and GC/MS instruments, training of technicians, sample receipt and storage, supply purchasing, and organizing the extractions lab to maintain on time performance of sample analyses.

RESUME
JEFFREY N. McLEOD

PROFESSIONAL HISTORY

Laboratory Data Consultants, Inc. (LDC)
Operations Manager / Principal Chemist
2011 to present

Laboratory Data Consultants, Inc. (LDC)
Senior Chemist
2007 to 2011

Severn Trent Laboratories (STL)
Scientist / Consultant
2002-2007

Ecochem, Incorporated
Project Manager / Chemist
1999-2002

Analytical Technologies, Incorporated
GC/MS Chemist
1994-1995

ETC Northwest
GC/MS Chemist
1989-1994

REPRESENTATIVE EXPERIENCE

Mr. McLeod has nearly 20 years of environmental industry and laboratory experience. His operations management experience includes the daily management of consulting activities for LDC's Sacramento office, as well as oversight and development of project management and support staff.

- In addition to oversight of all LDC Sacramento office projects, Mr. McLeod currently manages the automated data validation, data management, technical support and consulting services for a large site mitigation project associated with the California Department of Toxic Substances Control (DTSC).

- As Project Manager for Ecochem, Incorporated, Mr. McLeod managed the accounts of several clients focusing on private sector and USACE programs. He assisted in the recommendation of appropriate methods as well as data validation, report writing, data interpretation and laboratory selection. Mr. McLeod has a thorough knowledge of EPA methodologies as well as analytical laboratory protocols and procedures.

In the environmental laboratory field, Mr. McLeod's duties included final review of all Organic analyses including volatiles, semi-volatiles, pesticides and PCBs, and total petroleum hydrocarbons as well as internal laboratory consulting on laboratory practices and procedures. Mr. McLeod has served on key laboratory committees to prepare analytical data for potential litigation hearings. He has also served as a project manager on several complex projects, aiding clients with data interpretation and QAPP adherence.

- As Scientist / Consultant for Severn Trent Laboratories, Mr. McLeod was responsible for final review of all organic analyses performed at the laboratory. He assisted in the resolution of departmental analytical issues and offered suggestions to improve and streamline data analysis and report production. Mr. McLeod assisted on key litigation work for the laboratory to insure all data met strict EPA requirements and all internal processes were met.

- As Project Manager for Severn Trent Laboratories, Mr. McLeod managed the accounts of several key clients focusing on municipal and USACE programs. He assisted in the recommendation of appropriate methods and data interpretation as well as managed the daily projects within the laboratory. He was also responsible for final report writing and final data review. Mr. McLeod has over 7 years of experience in analysis of soils, drinking water, groundwater, wastewater, tissue and sludge by standard EPA SW 846 and CLP methods for a variety of organic analyses.

- As a GC/MS Chemist for Analytical Technologies, Inc. and ETC Northwest, Mr. McLeod performed analyses using CLP and standard USEPA methods for semi-volatile and volatile analyses. He also trained other analysts in analysis techniques, data reduction and review for the above methods.

EDUCATION

Physics and Mathematics Emphasis
Western Washington University (1981-1985)

Appendix 2

Example Validation Worksheets

LDC #:_______________
SDG #:_______________
Laboratory:____________

VALIDATION COMPLETENESS WORKSHEET

___EPA Level III __EPA Level IV

Date:_________
Page:___of____
Reviewer:_________
2nd Reviewer:_________

METHOD: GC/MS VOA (EPA 8260B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times		Sampling dates:
II.	GC/MS Instrument performance check		
III.	Initial calibration		
IV.	Continuing calibration		
V.	Blanks		
VI.	Surrogate spikes		
VII.	Matrix spike/Matrix spike duplicates		
VIII.	Laboratory control samples		
IX.	Regional Quality Assurance and Quality Control		
X.	Internal standards		
XI.	Target compound identification		
XII.	Compound quantitation/CRQLs		
XIII.	Tentitatively identified compounds (TICs)		
XIV.	System performance		
XV.	Overall assessment of data		
XVI.	Field duplicates		
XVII.	Field blanks		

Note: A = Acceptable ND = No compounds detected D = Duplicate
N = Not provided/applicable R = Rinsate TB = Trip blank
SW = See worksheet FB = Field blank EB = Equipment blank

Validated Samples:

1		11		21	
2		12		22	
3		13		23	
4		14		24	
5		15		25	
6		16		26	
7		17		27	
8		18		28	
9		19		29	
10		20		30	

REMEDIAL INVESTIGATION WORK PLAN (RIWP)
FORMER DRY CLEANERS
495 HOWARD AVENUE
BROOKLYN, NEW YORK
MAY 2013

Appendix C

Field Sampling Plan

Table of Contents

Section 1 – Introduction

Section 2 – Project Planning Activities (PP)

PP-001 General Guidance on Project Planning Activities
PP-002 General Guidance on Private Utility Markout
PP-003 General Guidance on Maintaining Markouts

Section 3 – Field Documentation (FD)

FD-001 Field Notebook
FD-002 Field Observation Report
FD-003 Sample Handling and Chain of Custody
FD-004 Photo Documentation
FD-005 Surveying and Mapping Specifications

Section 4 – Drilling Methods (DM)

DM-001 General Guidance on Determination of Appropriate Drilling Methods
DM-002 Sonic Drilling
DM-003 Monitoring Well Construction and Installation
DM-004 Monitoring Well Telescoping
DM-005 Monitoring Well Development
DM-006 General Guidance on Monitoring Well Abandonment

Section 5 – Sample Collection and Field Screening (SC)

SC-001 General Guidance on Sample Collection
SC-002 Sample Handling
SC-003 Investigation Derived Waste
SC-004 Head Space VOC Screening

Section 6 – Solid Matrix Sampling (SM)

SM-001 Soil Sampling Techniques Including Split-Spoon
SM-002 VOC Soil Collection and Preservation Method
SM-003 Soil Classification

Section 7 – Groundwater (GW)

GW-001 Water Level Measurement
GW-002 Non-Aqueous Phase Liquid (NAPL) Measurement
GW-003 Low Flow (Low Stress) Groundwater Sampling
GW-004 pH and Temperature Measurement
GW-005 Turbidity Measurement
GW-006 Specific Conductance Measurement
GW-007 Dissolved Oxygen Measurement

Acronyms and Abbreviations

AOC	Area of Concern
ASTM	American Society for Testing and Materials
BOD	Biological Oxygen Demand
BTEX	Benzene, Toluene, Ethyl Benzene, Xylenes
CAMP	Community Air Monitoring Plan
CD	Corrected Depth
COC	Chain of Custody
DNAPL	Dense Non-Aqueous Phase Liquid
DO	Dissolved Oxygen
DOT	Department of Transpsortation
EM	Electro-Magnetic
EPA	Environmental Protection Agency
FID	Flame Ionization Detector
FSP	Field Sampling Plan
GC/MS	Gas Chromatograph/Mass Spectrometer
GIS	Geographic Information Systems
GPR	Ground Penetrating Radar
GPS	Global Positioning System
HASP	Health and Safety Plan
HSAs	Hollow-Stem Augers
ID	Inner Diameter
IDW	Investigation Derived Waste

IHC	In-House Consultants
JHS	Jar Head Space
LNAPL	Light Non-Aqueous Phase Liquid
MC	Macrocore®
MTBE	Methyl Tert-Butyl Ether
NAPL	Non-aqueous Phase Liquids
NAVD	North American Vertical Datum
NYSDEC	New York State Department of Environmental Conservation
OD	Outer Diameter
ORP	Oxidation-Reduction Potential
OSHA	Occupational Safety and Health Administration
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PID	Photoionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
PVC	Polyvinyl Chloride
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation Recovery Act
SC	Specific Conductance
SMP	Site Management Plan
SOP	Standard Operating Procedure

SPLP	Synthetic Precipitate Leaching Procedure
SPT	Standard Penetration Test
SVOC	Semi-Volatile Organic Compounds
TCLP	Toxicity Characteristic Leaching Procedure
USEPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
VOC	Volatile Organic Compounds

Measurements

bgs	Below Ground Surface
ft	Feet or Foot
g	Grams
lpm	Liters per minute
mg/L	Milligram per liter
ml	Milliliter
mL/min	Milliliters per minute
MSL	Mean Sea Level
mV	Millivolt
ng	Nanogram
NTUs	Nephelometric Turbity Units
ppm	Parts per million
µg/Kg	Microgram per kilogram

Section 1

INTRODUCTION

1. Introduction

This document serves as a Field Sampling Plan (FSP) for various types of environmental sampling activities that may be utilized during implementation of Site Characterizations, Remedial Investigations, Interim Remedial Measures, Feasibility Studies, Remedial Designs, and/or Remedial Actions. The primary intent of this document is to promote accuracy and consistency for field and office support operations.

This FSP encompasses a broad range of activities to improve the planning, implementation, and documentation of field and pertinent office operations. All methodologies presented in this document may not be applicable to site-specific situations. In the event of differences between the FSP and any site-specific work plan, including a work plan or a quality assurance project plan, the provisions of the site-specific plan will prevail.

This document is organized according to the chronological sequence of typical work flow proceeding from project setup to field activities and then to data collection.

The document contains two types of guidance:

General Guidance Procedures – Documents intended to be informative and not prescriptive. The documents are designed to provide necessary background information to adequately understand associated field processes.

Standard Operating Procedures (SOPs) – Documents intended to provide the necessary procedures and notes to successfully implement the operation.

This FSP incorporates requirements including but not limited to New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation (DER)-10, Technical Guidance for Site Investigation and Remediation dated May 3, 2010, any applicable local, state, or federal requirements, and client requirements. Each SOP is current as of the effective date indicated in the header and will be updated as necessary.

This document has been provided to all staff performing field tasks for the client.

2. FSP Layout Design

2.1 Header Information

i. Each SOP contains, within its designation, a two letter abbreviation of the general category in which it belongs (i.e. PP-001 means it is in Project Planning). The table of contents provides the definition for each abbreviation. The SOP name and number is provided in the header and footer of the document. As discussed in the previous section, GEI guidance documents are not given an SOP reference number.

ii. The revision number is provided in the header of each SOP.

iii. The effective date is provided in the header of each SOP. The effective date provides the date when the revisions to the SOP are in effect and provides information as to the last time the SOP was updated. Each SOP should contain the most up-to-date version and effective date.

2.2 Footer Information

i. Each footer contains the page number and total page numbers as well as a second reference to the SOP name.

2.3 Body of Text

i. Details of the SOP are provided sequentially.

ii. Notes are provided to understand precautions or common issues associated with the performance of the procedure.

iii. References provide sources for the creation of the SOP.

iv. Attachments provide reference to external documentation that could be reviewed in conjunction with the document.

v. Reference and inclusion of complete SOPs are included within this document. Each SOP should contain the most up-to-date version and revision date.

Section 2

PROJECT PLANNING ACTIVITIES (PP)

SUMMARY GUIDANCE

PP-001 General Guidance on Project Planning Activities

---

1. Objective

The purpose of this summary guidance section is to present a summary of the project planning activities that must be completed prior to the start of field activities. The following text outlines the steps which should be followed.

To begin, the task-specific work plan should be reviewed to identify the specifics of the task to be completed. This includes the type of work, sampling requirements, and schedule, among others. A site visit (if possible) should be made to verify that sample locations are accessible. Once the review of the work plan is completed, it can then be determined which steps need to be taken to start the project. A project planning checklist (see attached) should be completed and includes the items detailed below

2. Execution

- **Subcontractor Selection** – If the subcontractor is to be contracted through GEI, the subcontractor should be selected based on a combination of their qualifications and their proposed costs, if not identified in the Master Services Agreement. A minimum of two subcontractor cost proposals should be obtained for each task.
- **Subcontractor Agreement** – Once a subcontractor is selected, a subcontractor agreement between GEI and the subcontractor must be established. This agreement is task specific and should reference an approved proposal from the subcontractor.
- **Markouts** – If the project includes intrusive work, a utility markout request must be called in to Dig Net (811). Markouts must be called in at least 72 hours prior to the start of intrusive activities; however, five business days is recommended. If the work conducted is on private property, markouts by a private markout company should be obtained as public utility locating services will generally only identify line point-of-entry to a private property from a right-of-way. Markout verifications from Dig Net must be received at least one day prior to the start of field activities. Following the receipt of the markout verifications, a GEI utility clearance form must be completed, and the markouts must be visually verified. The markout verifications, verification spreadsheet and the GEI utility clearance forms must be compiled and remain onsite during the duration of intrusive activity. In addition, markouts must be checked every 10 days throughout the duration of intrusive work. For more information on markouts, please see SOPs PP-002 and PP-003.

- **Health and Safety** – A site-specific Health and Safety Plan (HASP) must be developed prior to any field work. The site-specific HASP must be reviewed by the staff involved in the project and signed prior to the start of work (by field staff). Subcontractors are required to provide their own HASPs (which are at a minimum, as strict as the GEI HASP), or must sign and comply with the GEI site-specific HASP. The subcontractor must also provide the proper certifications for the field crew, which should include, but is not limited to, OSHA certifications (8-hour and 40-hour HAZWOPER) and medical clearance documentation. In addition, tailgate safety meetings must be held daily, which discuss hazards related to the task being performed. For more information, please refer to the site-specific HASP. For the SOPs presented in this FSP, health and safety items must be adhered to during the conduct of all field activities.
- **Notifications** – prior to the scheduling of field activities, all team members should be identified. The appropriate project manager should be notified as soon as possible of the upcoming work and the proposed schedule. As a general rule, at least one week notice should be provided. The client will coordinate access to any private property where sampling is planned to be conducted.
- **Data Group Notification** – GEI's Data Group should be notified if laboratory analysis is to be performed. The Data Group should be made aware of the types of analysis being performed, the approximate number of samples to be collected, the validation requirements and turnaround times.
- **Lab Notification** – If laboratory analysis is needed, the selected laboratory should be notified as soon as possible to order the necessary sample bottles and supplies. They also should be informed of the anticipated amount of samples, type of analysis and required turnaround times.
- **Equipment** – Any specialized equipment or supplies, including Community Air Monitoring Program (CAMP) equipment, needed for the job should be ordered, to allow for sufficient lead time. CAMP equipment is required for any intrusive work. For more information on CAMP requirements, please see the site-specific HASP or Work Plan and SOPs AR-001 through AR-005.
- **Investigation Derived Waste (IDW) Management** – Consideration should be given to the management of IDW. Based on the work to be performed at the specific site, a determination needs to be made on how the IDW is to be handled. Possibilities include drums for soil and groundwater, frac tanks for groundwater or roll-offs for soil. Reducing the amount of IDW generated through selection of the appropriate sampling and investigation methods, as well as cost and efficiency of disposal, should always be considered.

- **Background Information** – Prior to field activities, pertinent background information should be discussed with the field staff and GEI task and project managers. Such information may include: historical perspective, property owner/community member interests, potential litigation matters, access and logistical issues, safety concerns, requirements and concerns, among others.
- **Kick-off Meeting** – A kick-off meeting should be conducted prior to the start of field activities. At a minimum, the meeting should be attended by the project manager and field staff. This meeting should review the tasks to be completed, equipment needed, laboratory analysis, and a review of any necessary background information (including potential sensitivities associated with the site or work area of the site). Other items that should be discussed include the process of and the need to keep the client informed of the work progress (including any relevant observations) and the steps to be taken if a member of the field crew is approached/questioned by a regulator or a member of the public or media.

SUMMARY GUIDANCE

PP-002 General Guidance on Private Utility Markout

---

1. Overview

Prior to installing any wells, performing excavations or penetrating the subsurface for any investigation; all service lines, including water, electrical power, natural gas, sewers, cable and product distribution piping, and others, must be mapped out on the ground surface. This requirement is independent of the need for borehole clearing to 5 feet. Both exercises together minimize the safety risk as well as the time and cost penalty associated with severing an underground line.

This guidance describes and recommends technologies that should be (and normally are) employed from the companies performing the mapping, which are private utility locators. Public utility locating services will identify line point-of-entry from a right-of-way, but in many cases are unwilling to mark locations within the footprint of a site. Even if the public companies provide onsite service, it is good insurance to have a private company verify buried utility locations because of the potential consequences of hitting an unknown buried utility.

Because subsurface lines may be metal, plastic, clay, or concrete, multiple technologies are generally needed for their identification. For most applications the following technologies are fit-for-purpose.

<u>Electro-Magnetic (EM) Device:</u> This technology uses an electro-magnetic field in the subsurface to accurately locate metallic lines or non-metallic lines incorporating a metallic trace wire along their surface. The field is created either by direct contact to the pipe or trace wire, or by an induced current via radio waves.

<u>Sewer Sonde:</u> For non-metallic lines where internal access is possible (such as cleanout ports in a sewer), a beacon or 'sonde' that emits a signal to a surface receiver as it is snaked through the pipe provides the same accuracy as the EM detector. If the internal condition of the pipe is desired, a camera can be deployed instead of only a sonde.

<u>Ground Penetrating Radar</u> (GPR): This technology involves radar waves reflecting to a surface receiver which provides a visual real-time map of the subsurface by which anomalies (such as pipes or tanks) may be detected. It has limitations in clay or wet soils and requires a skilled operator for interpretation. For high risk utilities (e.g. PVC natural gas lines without trace

wire) where line-of-sight projection from site entry point to a kiosk or other building is uncertain, GPR should be considered.

For most sites, utility markouts using the above technologies can be conducted in about two hours, assuming work covers a limited area where subsurface activities will be conducted. Consideration should be given to mapping an entire site if as-built drawings are suspect and work is planned over an extended period of time.

SUMMARY GUIDANCE

PP-003 General Guidance on Maintaining Markouts

---

1. Overview

Maintain the marks set down by utility operators/ locators at your site. Several steps should be taken to ensure site markouts are maintained/refreshed throughout the project.

Walk-through the site to become familiar with the markings and the locations of buried utilities. Pay special attention to any changes in direction that the underground facilities take. Consider photographing the markouts.

If the excavation will cause the removal or disturbance of markings, establish offset marks in order to maintain a reference point for those underground facilities.

Make sure that everyone involved in your excavation is aware of any offsets that have been established, any marks that have been compromised, or any other information regarding facility locations.

Don’t put spoil piles over markings.

If the markouts are located over grassy areas or if snow is expected, flags or stakes should be employed to avoid having the markouts washed away by rain or covered by snow.

Avoid driving machinery over stakes and flags. Paved areas should be swept periodically so that painted marks remain visible.

If marks have faded or have been compromised to the point where proper and safe excavation is no longer possible, call the public or private utility markout service and make a request for a new markout ticket. If the markings at your site are refreshed, make sure that you use the uniform color code.

Attachment A

Project Planning Checklist

SITE: ____

PROJECT MANAGER: ____

Activity	Completed (Yes, No or NA)	Date Completed	Comments
Subcontractor Identified (if needed)			
Subcontractor agreement			
Markouts			
HASP			
Subcontractor certs obtained			
National Grid Notifications			
Data Group Notified			
Laboratory notified			
Equipment Ordered			
IDW Management			
Background info reviewed			
Kick-off meeting or call			

Section 3

FIELD DOCUMENTATION (FD)

STANDARD OPERATING PROCEDURE

FD-001 Field Notebook

---

1. Objective

Proper documentation of all site activities is a crucial part of the field investigation process. Documentation, relative to sampling procedures, includes sample labels, sample seals, field logbooks, chain of custody (COC) records, sample analysis request forms, and laboratory sample logs. The field notebook serves as a record of significant field activities performed or observed during the project. The field notebook provides a factual basis for preparing field observation reports, if required, and reports to clients and regulatory agencies. Example field notes are provided in Appendix A.

2. Execution

- Use a separate all-weather bound notebook for each site/location/ project number, as appropriate.
- Write neatly using black or blue waterproof indelible pen (or note if field conditions [i.e., cold or wet weather] require use of pencil).
- Write the project name, project number, book number (i.e., 1 of 3), and date on the front cover. On the inside cover, identify the project name, project number, and "Return Book To:" the office address of the project manager.
- Number all of the pages of the field book starting with the first entry if notebook is not numbered already.
- Record activities as they occur.
- Neatly cross out mistakes using a single line and initial them. Erasures are not permitted. If an error is made on an accountable document assigned to one individual, that individual will make all corrections. The person who made the entry will correct any subsequent error discovered on an accountable document. All subsequent corrections will be initialed and dated.
- Sign or initial and date the bottom of the last daily page of an entry. Place a diagonal line through unused portions of a page.
- Record the following information upon each arrival at the site:
    1. Date/time/weather/project number.
    2. GEI personnel.
    3. Purpose of visit/daily objectives.
    4. Record conversations with:
        a. Contractors.
        b. Client.
        c. Visitors (include complete names, titles, and affiliations whenever possible).
        d. GEI office staff.

        e. Landowners (site or abutters).
    5. If possible, record telephone numbers of individual contacts for the site in the field notebook.
    6. Note time of arrival and departure of individuals visiting the site.

- Potential additional observations to record (as needed):
    1. Type and quantity of monitoring well construction materials used.
    2. Use of field data sheets or electronic logging equipment (e.g. boring logs, monitoring well sampling logs, etc.).
    3. Ambient air monitoring data.
    4. Locations and descriptions of sampling points.
    5. Sample media (soil, sediment, groundwater, etc.).
    6. Sample collection method.
    7. Sample identification number(s) and date and time of sample collection.
    8. Approximate volume of groundwater removed before sampling.
    9. Field observations.
    10. Any field observations made such as pH, temperature, turbidity, conductivity, water level, etc.
    11. References for all maps and photographs of the sampling site(s).
    12. Information pertaining to sample documentation: bottle lot numbers/dates, method of sample shipments, COC record numbers, and overnight shipping numbers.
    13. Surveying data (including sketches with north arrows).
    14. Changes in weather.
    15. Rationale for critical field decisions.
    16. Recommendations made to the client representative and GEI Project Manager.
    17. Include a site sketch or representative site photograph of conditions at the end of the day, if required.
    18. Time.
    19. Summarize work completed/work remaining.

3. Notes

- Only record facts.
- Record all observations regardless of relevancy.
- Identify conditions or events that could affect/impede your ability to observe conditions.
- Do not use spiral notebooks because pages can be easily removed.

4. References

New Jersey DEP Field Sampling Procedures Manual, August 2005.

Yerington Mine Site SOP-03 Standard Operating Procedure Field Notes and Documentation, Revision 0 Revision Date: June 6, 2006.

ASFE Model Daily Field Report (1991), ASFE, Inc.

5. Attachments

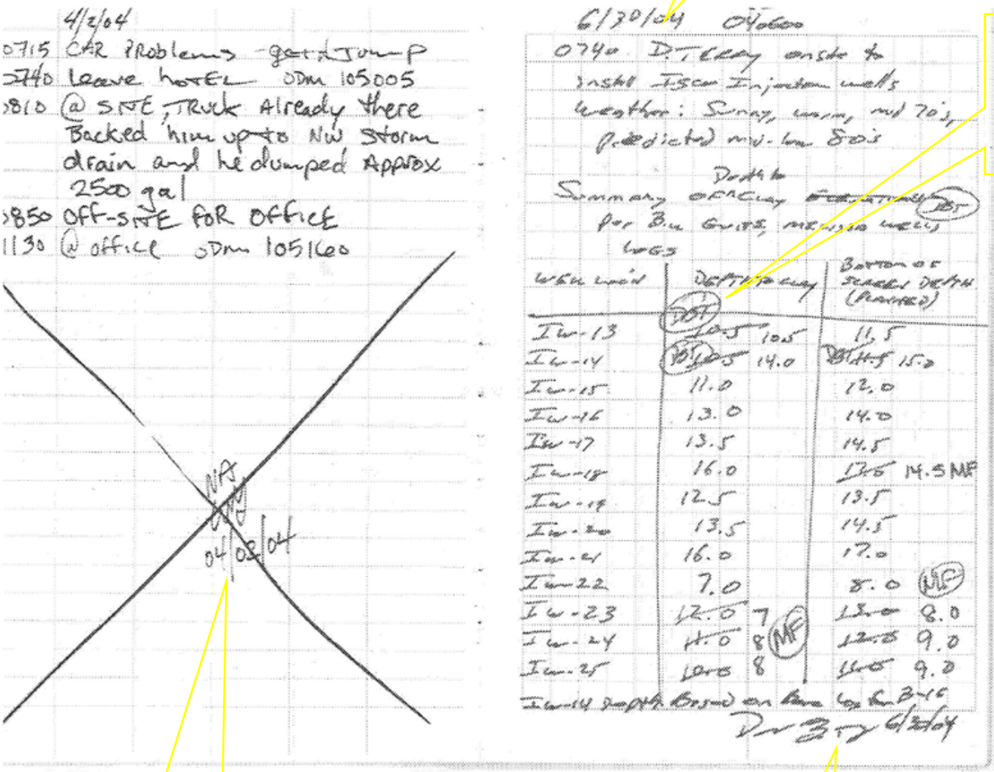
Attachment A – Example Field Notes

Attachment A

SOP FD-001

Attachment A – Example Field Notes

Start of each day includes:
- **Date**
- **Project Number**
- **People on site**
- **Purpose of Work**
- **Weather Conditions**



4/2/04
0715 CAR Problems - get Jump
0740 leave hotEL ODM 105005
0810 @ SITE, TRUCK Already there Backed him up to NW Storm drain and he dumped Approx 2500 gal
0850 Off-SITE FOR Office
1130 @ office ODM 105160

NAJ 04/02/04

6/30/04 04[illegible]
0740 D. Terry onsite to install ISCO Injection wells
weather: Sunny, warm, mid 70's, (predicted) mid-low 80's

Summary of Depth to Clay ~~[illegible]~~ DBT for [illegible] well logs

Well unit	Depth to clay	Bottom of screen depth (planned)
IW-13	DBT ~~10.5~~ 10.5	11.5
IW-14	DBT ~~10.5~~ 14.0	~~11.5~~ 15.0
IW-15	11.0	12.0
IW-16	13.0	14.0
IW-17	13.5	14.5
IW-18	16.0	~~17.5~~ 14.5 MF
IW-19	12.5	13.5
IW-20	13.5	14.5
IW-21	16.0	17.0
IW-22	7.0	8.0 MF
IW-23	~~12.0~~ 7 MF	~~13.0~~ 8.0
IW-24	~~11.0~~ 8	~~12.0~~ 9.0
IW-25	~~10.0~~ 8	~~11.0~~ 9.0

IW-14 depth based on Bore log for B-15

6/30/04

Errors are single line crossed out and initialed

Blank Space crossed out and initialed

Bottom of each page signed and dated

STANDARD OPERATING PROCEDURE

FD-002 Field Observation Report

---

1. Objective

A Daily Report may be required to accurately summarize the activities, observations, and decisions made during the day's field work. The daily field observation report may serve as a permanent record of the day's activity for the Project Manager (PM) and In-House Consultant (IHC).

2. Execution

- If required, at the close of the day's field work, a Daily Report must be prepared by the individual responsible for the field notebook. This report must be completed before leaving work for the day. Contents of the report should include, at a minimum, the following information.
    1. A record of person(s) present at the site, time of arrival, departure times (e.g., GEI, contractor(s), client, etc.).
    2. A record of the daily objective(s) and the activities performed (e.g., drilled five borings in the overburden).
    3. A summary of deviation(s) from the field plan or objectives.
    4. A summary of field decision(s) made, who made it/them, and the basis for such decision(s).
    5. A diagram, sketch, and/or map showing the location and extent of the work or other significant observation(s) made during the day.
    6. Any recommendations that may result from field observations and any actions that resulted from those recommendations.
    7. A summary listing and field sketch showing location(s) of field activity.
- Submit a draft report to the PM/IHC for review and editing related to the clarity and conciseness of the report. Complete any editorial changes, sign, date, and submit the report to PM/IHC for approval/signature. Field Observation Reports should be written neatly. They are not required to be typed unless specifically requested by the PM.

3. Notes

- Not all projects require daily field observation reports.
- The Field Observation Report should be based solely upon factual information, not opinions. Any speculation should be clearly noted in the report as such.

- The Field Observation Report should never be released to anyone other than the PM/IHC prior to review and signoff unless explicitly authorized by the PM/IHC.

4. References

New Jersey DEP Field Sampling Procedures Manual, August 2005.

Yerington Mine Site SOP-03 Standard Operating Procedure Field Notes and Documentation, Revision 0 Revision Date: June 6, 2006.

ASFE Model Daily Field Report (1991), ASFE, Inc.

5. Attachments

Attachment A – Example Daily Report Form

Attachment A

Attachment A: FIELD OBSERVATION REPORT

	Date:
Project :	**Report No.**
Client :	**Page:**
Contractor:	**GEI Proj. No.**

Time of Arrival: **Departure:** **Weather:**

Persons Contacted, Company	**GEI Representatives**

Purpose of Site Visit:

Observations

1.

By:	**Reviewed By:**

STANDARD OPERATING PROCEDURE

FD-003 Sample Handling and Chain of Custody

---

1. Objective

To properly collect, label, document, preserve, package, and transport environmental samples; provide a record of the custody of any environmental field sample from time of collection to delivery to the laboratory. The chain of custody (COC) can be used as a legal document to demonstrate that samples were not mishandled and that they were delivered to the laboratory within the timeframe necessary to start analysis. A sample is under custody if it is in:

a) GEI’s possession;
b) GEI’s sight after being in GEI's possession;
c) it was in GEI’s possession and then it was locked up to prevent tampering; or
d) a designated secure area. GEI facilities are designated secure areas.

2. Execution

- Review the work plan and Quality Assurance Project Plan (QAPP) prior to sampling to determine the following:
  i. The analysis required by the work plan and sample volumes required by the laboratory to perform those analysis. (Be explicit when requesting analysis on the COC (e.g. rather than “VOCs” [Volatile Organic Compounds], write “VOCs 8260”.)
  ii. The turnaround time required by the project.
  iii. If the data will be sent directly from the laboratory to the data validator or Data Group.
  iv. Holding time restrictions for sampling media and analytical methods.
- Label the jar or bottle
- Following sample collection, the sample container is labeled using a waterproof marker with the sample ID, the date and time (military time) of sample collection, project number, sample preservatives, and the sampler’s initials. Sample custody begins at this time.
- Record the above information in the field notebook.
- Individually wrap sample jars with packing material. Place samples in a chilled (4°C) cooler immediately after collection.
- Complete a COC for the samples as described below, and sign off on the COC each time a new person takes possession of the samples. A COC form must accompany each shipment/delivery of samples to the laboratory. GEI or laboratory COC forms may be used as long as the laboratory form contains the same required information as described below.

- An example COC is provided in Attachment A.
- Place a custody seal on the cooler if shipping.
- Transport samples to the laboratory as soon as possible. It is preferable the samples are sent from the field rather than brought back to the office for submission at a later date.

2.1. Chain of Custody (COC) Completion

- Record the project name and number, the sampler's name(s) and the site, town, and state where the samples were collected.
- For each sample, enter the sample identification number, date and time (military time) collected, whether the sample is a grab or composite sample and the number of sample containers. Record the type of analysis (including laboratory method; e.g. EPA-SW846 Method XX) requested and the preservative (if appropriate) in the vertical boxes.
- When samples are ready to be relinquished, complete the bottom of the form with date and time (military time) and signatures of relinquisher and receiver of samples as indicated. The sample collector is always the first signature while the analytical laboratory is the final signature. Theoretically, all individuals handling the samples between collection and laboratory should sign the form; however, if a common carrier (i.e., FedEx, UPS) is used for shipping, GEI must identify the carrier in the 'Received by' box on the COC. If the sampler hand delivers the samples to the laboratory, the received box must be signed by the laboratory.
- Include turnaround time and project contact on the COC.
- The forms are in triplicate (white, yellow, and pink copies). The pink copy should be retained by the sampling personnel and provided to the Data Group for proper filing. The white and yellow copies should accompany the samples to the laboratory.
- Prior to sample shipment, the COC must be placed inside the cooler (in a ziplock bag or other watertight package taped inside the lid of the cooler), and the cooler must be sealed with a signed COC seal.
- If a common carrier such as FedEx is used to transport the samples to the laboratory, include the carrier tracking number and identify the carrier in the "Received by" box on the COC.
- Any unused sampling containers/media that is sent back to the lab should be included on the COC. Return samples to the laboratory in a timely manner.
- Field duplicates should be anonymous to the laboratory, but must be recorded for use by the Data Group. To keep track of this information, link the field duplicate with the proper sample in the field copy of the COC and also the field book.

- Prior to samples being sent to the laboratory, the project or task manager will check the COCs for accuracy against the sample tracking summary, if appropriate, or the work plan.
- After the samples are sent to the laboratory, the field copy must be sent to the Data Group. You can send the field copy with duplicate information in the mail to the Data Group.

3. Notes

- The field notebook must document all GEI personnel who had custody of any samples prior to shipping the samples to the laboratory, the samples must be relinquished to the shipper and the COC signed and dated by the sampler and the shipper, even if both people are GEI personnel.
- Keep the number of people involved in collecting and handling samples and data to a minimum.
- Only allow people associated with the project to handle samples and data.
- Always document the transfer of samples and data from one person to another on chain of custody forms.
- Always accompany samples and data with their chain of custody forms.
- Give sample identification at all times that is legible and written with permanent ink.
- When sending samples via a common carrier, use one COC per package.
- Do not send samples from more than one site with separate COCs in a single package.

4. References

New Jersey Department of Environmental Protection, Field Sampling Procedures Manual, August 2005.

Connecticut Department of Environmental Protection, Guidance for Collecting and Preserving Soil and Sediment Samples for Laboratory

Determination of Volatile Organic Compounds, Version 2.0 February 28, 2006.

5. Attachments

Attachment A – Example Chain of Custody

Attachment A

Chain of Custody Record

STL-4124 (0901)

STL Connecticut
128 Long Hill Cross Road
Shelton, CT 06484
Tel: 203-929-8140

Example
COC

SEVERN TRENT **STL**
Severn Trent Laboratories, Inc.

Client: GEI	Project Manager: Dave Terry	Date: 12-31-07	Chain of Custody Number: 00452
Address: 455 Winding Brook Dr	Telephone Number (Area Code)/Fax Number: 860 368 5300 / 860 368 5307	Lab Number	Page 1 of 1
City: Glastonbury · State: CT · Zip Code: 06033	Site Contact: M. Felter · Lab Contact: Paul Hobart		
Project Name and Location (State): Carroll Gardens NY	Carrier/Waybill Number: FedEx 9383 7603 0879		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH		Analysis (Attach list if more space is needed): VOC 8260B	SVOC 8270C	TO-15 + NAPHTHALENE	Special Instructions/ Conditions of Receipt
CGSB-01 (0-2)	12-31-07	1130				X		X							X	X		
CGSB-02 (3-4)	12-31-07	1250				X		X							X	X		
CGSB-02 (3-4) MS	12-31-07	1250				X		X							X	X		
CGSB-02 (3-4) MSD	12-31-07	1250				X		X							X	X		
CGSB-XX (5-6)	12-31-07	0800				X		X							X	X		
CGTB-123107	12-31-07	1400					TB				X				X			
CGGW-01	12-31-07	1430		X				X			X				X	X		
CGSG-01	12-31-07	0700-1500	X														X	CANISTER# 2613 REGULATOR# 779

NEW JERSEY: "CLP data package deliverables"

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal
☐ Return To Client ☒ Disposal By Lab ☐ Archive For ______ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☒ Other See Contract

QC Requirements (Specify) NYS Cat B ASP deliverable Send EDD to datagroup@geiconsultants.com send to Lorie Mackinnon

1. Relinquished By: Melissa J Felter	Date: 12-31-07	Time: 1600	1. Received By: FedEx	Date: 12-31-07	Time
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments
USED FLOW CONTROLLER FOR AIR SAMPLE INCLUDED

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

STANDARD OPERATING PROCEDURE

FD-004 Photo Documentation

---

1. Objective

To properly document and retain photographic records. Keeping a record of photographs taken is crucial to their validity as a representation of an existing situation.

2. Execution

- Photographs of a site, individual samples, or other observations should be taken using a digital camera.
- All photographic records should be recorded in the Field Notebook (SOP FD 001) and the following information should be recorded in the field notebook:
    i. Number of photograph in sequence.
    ii. Compass direction describing the direction the photograph was taken (e.g. looking southeast).
    iii. Brief description of what the photograph is intended to show.
- The field notebook should also note who took the photographs, and the date and time each photograph was taken.
- The photographs should be electronically backed up on a computer or other data storage device.
- Photographs should be placed on a photograph record template and the relevant information describing the photograph should be inserted into the caption section for each photograph.

3. References

New Jersey Department of Environmental Protection, Field Sampling Procedures Manual, August 2005.

4. Attachments

Attachment A – Example of Photo Documentation Template

Attachment A

Attachment A – Example of Photographic Record
GEI Consultants, Inc.

Project: Project Name

Location: Project Location

Photographer: K. Barber
Date: 10/25/07
Photo No.: 1
Direction: N

Comments:
Entrance of site with tree mulching operations.

Photographer: K.Barber
Date: 10/25/07
Photo No.: 2
Direction: W

Comments:
On-site building built in 1936.

STANDARD OPERATING PROCEDURE

FD-005 Surveying and Mapping Specifications

---

1. Objective

The objective of this Standard Operating Procedure (SOP) is to present the minimum requirements for establishing horizontal and vertical surveying control for field programs. Accurately surveyed locations are a key element in the evaluation of all field data, and are necessary for the preparation of geologic profiles and the interpretation of horizontal and vertical groundwater flow directions, and the locations of facilities. The accuracy of measurements and established elevations is particularly important when groundwater gradients are low, as errors may easily lead to misinterpretation of the direction of groundwater flow. The survey is usually performed after the field activities have been completed. Activities and land features requiring accurate horizontal and vertical control include:

- borings;
- test pits and trenches;
- monitoring wells and piezometers;
- geophysical surveys;
- surface water and drainage features;
- buildings and structures; and
- underground utilities and storage tanks as marked on the surface.

2. Execution

Mapping shall be based on field measurements and calculated to sufficient accuracy to be in conformance with A-2 standards, regardless of the intended end product of such work.

Standard site plans, as a minimum, shall provide the following elements:

- Location of all surface features, including, but not limited to: buildings, structures, fences, aboveground utilities, drainage equipment, underground features as marked on the surface, limits of pavement, landscaped or graded areas, and a general description of surface material and vegetation. All monitoring wells, soil borings, test pits, and other samples points shall be located.
- Location of all enclosed or abutting water bodies. Flow direction of rivers, streams, or surface drainage shall be noted with arrows.
- Location of boundaries by reference to other plans, when available, and to lines of occupation, where apparent. If this information does not exist, the surveyor shall make reference to Assessor's map and lot numbers.

- Disclaimers of certification to boundary and title should be prominently displayed.
- Location of surface features on abutting properties to a distance of 100 feet beyond property boundaries of study area are desired where practical, but in any case, to a minimum of 20 feet. Names of abutting property owners, as listed by the Town Assessor, shall be included.
- Include a location map of sufficient scale and detail to locate the site from a statewide reference.
- Provide a verbal and graphical scale of distance. All maps shall include a north arrow with reference to direction (magnetic, true, or grid). Unless a site-specific grid system is required, NAD83 (2007) should be identified as the horizontal datum.
- All maps shall be accompanied by copies of all field notes and sketches used in their preparation. The surveyor shall provide a coordinate and elevation list for all control and location points.
- Topography, when requested, shall conform to Class T-2 standards (90 percent of contours true to within 1/2 contour interval). The vertical datum should be identified on the plan. Monitoring well elevations shall be established at the ground surface and at the top of casing or riser.
- Requirements for location by state plane coordinates will include reference to geodetic monuments or global positioning system (GPS) base stations used.
- Plan should comply with GEI’s Section 3 “File Specifications for Subcontractors” provided below.

Requests for boundary survey entail the following additional requirements.

- Examination of record descriptions of the property and adjoining parcels, of record surveys and plans, and of record easements appurtenant to the property. Record search will extend long enough to determine the original intended boundary locations. Certification as to ownership should be provided by the client’s legal counsel.
- Location and description of all boundary monumentation found.
- Location of record easements and visible evidence of entry.
- Location and description of apparent encroachments by structures, occupation, and improvements on the property.
- Location and description of any conflict between deed description and actual occupation.
- Distance and bearing of property lines are to be shown to the nearest hundredth foot (0.01') and arc second (0°00'01"). Area should be shown in decimal acres and/or square feet.

- Plans should include certification as to conformation to state standards for boundary and topographic survey. No other certifications should be provided, except as specifically negotiated with the client.

2.1. Survey Requirements for Exploration Programs

The project manager shall go over the survey program with the survey chief to be sure that all requirements are understood and that the survey crew is alerted to potential site hazards.

The following criteria should be met for <u>all</u> survey programs.

- The survey is to be performed by or under the direction of a registered professional land surveyor.
- The survey shall be accurately performed to a precision of 0.01 foot for vertical control and 0.1 foot for horizontal control.
- Horizontal control is to be related to either a state plane coordinate system or the Universal Transverse Mercator (UTM) coordinate system. North American Vertical Datum (NAVD) 1988 should be used as the vertical datum unless a site-specific datum is required.
- Elevation precision to be obtained at monitoring wells and piezometers shall be:
    i. Top lip of protective casing without cover (0.01 foot); this point should only be used for vertical control and not for water-level measurements.
    ii. Top of monitoring well riser pipe (0.01 foot); a permanent reference point should be marked on the top of the riser to be used as the measuring point for all water-level measurements.
- Establish a permanent site benchmark on the most stable nearby feature and note its location on survey maps.
- The surveyor should submit a report of the survey, including a copy of all original field notes. Survey information needs to be reviewed carefully with respect to horizontal and vertical determinations. Survey errors may often be caught by using relative distances between wells or noting apparent anomalies in water levels or flow directions.

2.1.1. Previous Use of a Datum Other Than Mean Sea Level

Many times a parcel of land contains a previously established vertical benchmark on site to which elevations have been referenced. Such an arbitrary local datum may not provide any specific information about its relationship to Mean Seal Level (MSL), or a standard vertical datum. An arbitrary datum, when used, should be identified as a local or arbitrary datum. In other cases, when a standard city-wide local datum is used, the vertical relationship to the standard datum should be provided.

Otherwise, surveys at all sites subject to agency review shall be referenced to NAVD88.

2.1.2. Weather Conditions

Inclement conditions increase the chance for errors in identification, measurement, and recordings. Surveyors need to take extra time to assure proper identification of all monitoring wells surveyed, to guarantee ice- and snow-free surface elevation shots, and to carefully record survey data despite adverse conditions. Obtaining stable tripod set-ups may be more difficult under these conditions. Sightings should use shorter distances than under more favorable conditions. Warm, sunny days generate heat waves that may present problems for optical instruments.

2.1.3. Work at Hazardous Waste Sites

Surveyors need to be made aware of hazardous site conditions and potential exposures. Surveyors should have been enrolled in a health monitoring program for any sites which require personal protection above Level D. Note that anticipated risks to surveyors would be expected to be less than for those engaged in collecting samples or in subsurface explorations. However, potential exposure to hazardous materials should be pointed out and appropriate protective equipment worn and used. Surveyors shall also be made aware of other site activities and procedures for evacuation in case of emergency.

3. File Specifications For Subcontractors

3.1. General File Standards

- The method of naming files shall incorporate the name of the site and/or the GEI project number and the content. For example, SITE NAME-001110-Site Layout.
- All files provided to GEI will be electronically transmitted or recorded on CD, DVD, or other permanent recording medium. All referenced files and other supporting files such as special line types, color tables, images, etc., shall be included.
- All files are to be provided in .DWG or .DXF format and shall be compatible with AutoCAD Release 2007.
- It will be standard procedure to have purged all unused entities from a CAD file prior to delivery.
- Each file will be clearly labeled as follows:
    i. Project No.:
    ii. Project Name:
    iii. Drawing Title:
    iv. File Size:
    v. Date:

    vi. Revised Date:

- Files which contain non-standard ACAD fonts, line types or custom menus are not acceptable.

3.2. General Drafting Standards

- All entity line types, colors, etc. are to be defined "BYLAYER."
- It shall be standard to use "object snap" for the creation or insertion of all entities (as compared to "eyeballing").
- All symbols will be originally drawn on layer "0." This will allow the symbol to acquire the color and line type properties it is inserted on. All symbols used to define sample locations are to contain attributes describing the sample identifier and any elevation data required by contract.
- All line entities are to be continuous polylines (PLINES).
- All text shall be rotated such that it is readable from the bottom of the sheet and from the right of the sheet. It will be standard to use the AutoCAD style "STANDARD" and Arial font whenever possible. All text shall be of a size such that it is legible when plotted at the file's intended scale.
- North up or to the right.

3.3. General Layering Standards

- The following are some of the acceptable layer names. Others may be added as needed. Descriptions of new layers are to be provided to GEI.
    - i. PROPERTY (property lines)
    - ii. TRAVERSE
    - iii. BASELINE
    - iv. BUILDING (buildings, other on-site/off-site structures)
    - v. STREET
    - vi. ELEC (all electrical lines, manholes, power poles, transformers)
    - vii. WATER (all water lines, manholes, hand holes, gates, valves)
    - viii. SAN (all sanitary sewer lines, manholes, catch basins, if combined sanitary/storm sewer)
    - ix. STM (all storm sewer lines, manholes, roof drains, catch basins)
    - x. CONTOUR (all contour lines & labels)
    - xi. TEL (telephone)
    - xii. GAS (all gas lines, valves, etc.)
    - xiii. TEXT
    - xiv. TANKRIVER
    - xv. STREAM
    - xvi. SEDIMENT (sediment sample location)
    - xvii. SURFACE SOIL (surface soil sample location)
    - xviii. MW (monitoring well location)

xix. BORING (soil boring location)
xx. SURFACE WATER (surface water sample location)
xxi. PAD, SLAB, STRUCTURE, FND (foundations or miscellaneous structures)
xxii. EASEMENT
xxiii. SAMPLING LAYERS (begin with “E” existing or “P” proposed)

3.4. Additional Data Required

- All files shall be accompanied by a “check plot” of each file. The “check plot” shall be checked for accuracy and corrected as necessary.
- Whenever surveyed files are supplied to GEI, they shall be considered incomplete until GEI is provided with copies of all field notes and sketches, data printouts, and a point reference file (if applicablel).

Section 4

DRILLING METHODS (DM)

SUMMARY GUIDANCE

DM-001 General Guidance on Determination of Appropriate Drilling Methods

---

1. Objective

There are multiple drilling methods which can be employed based on the type of stratum (e.g. overburden or bedrock) and the end use of borehole. End uses include geotechnical investigation, subsurface soil sampling, and monitoring well installation or a combination thereof.

The following text describes different methods of drilling with considerations for their use to collect groundwater and/or subsurface soil samples. Profiles of subsurface conditions encountered and well installation details must be recorded on logs. Procedures for field documentation are provided in Section 3 – Field Documentation.

2. Hollow-Stem Augers (HSAs)

Borings can be installed in unconsolidated formations using hollow-stem augers (HSAs). The augers are advanced by rotation and the drill cuttings are brought to the surface by travelling up the outside of the auger flights in a screw-like manner. HSAs have the advantage of allowing the well to be installed inside the hollow stem of the auger, which prevents the borehole from collapsing. Upon reaching the planned well depth, the casing and screen are placed inside the HSAs and the flights are individually removed while the annular space around the well is filled with the filter pack and grout, as appropriate. Conversely, solid-stem augers must be completely removed from the borehole before well installation, which can lead to collapse of the borehole. For this reason, solid stem augers are seldom used for installation of monitor wells.

HSAs come in a variety of sizes and allow collection of soil samples utilizing split spoons or Shelby tubes. Samples are collected ahead of the augers for determining soil/sediment type, stratigraphy, depth to the water table, and for collecting soil samples for chemical analysis. During this process, the standard penetration test (SPT, American Society for Testing and Materials [ASTM] Method D 1586) can also be performed. The HSA method also has an advantage over mud-rotary drilling techniques in that drilling mud is not used that can contaminate the soil samples and potentially reduce the yield of the wells.

A disadvantage of the method is that HSAs cannot be used to drill into competent bedrock or through large boulders. Also, "heaving or running sands" can be forced up inside the augers as a result of strong vertical groundwater gradients, which can hamper efforts to collect soil samples or complete well installation. Furthermore, the maximum depth achievable using HSAs, which is generally shallower than other methods, is dependent not only on the ability of the rig (e.g., horsepower, rig-torque, weight of augers, etc.), but also the lithology of the material drilled.

3. Rotary Drilling

Rotary drilling methods include both direct rotary and reverse-circulation rotary. Direct rotary is more commonly used in environmental investigations, whereas reverse-circulation rotary is used in drilling large-diameter water supply wells. In direct rotary drilling the borehole is advanced by rotating the drill pipe (rods) and bit to produce a cutting action. The cuttings are removed from the borehole by continuous circulation of a drilling fluid. The fluid or "mud" is pumped down the inside of the drill pipe and is circulated back to the surface on the outside of the pipe. The fluid removes the drill cuttings from the borehole and cools and lubricates the bit. Mud used during direct rotary consists of additives (e.g., bentonite), water, or air.

Reverse-circulation rotary drilling is similar to direct rotary except the drill rigs are larger and the flow of the drilling fluid is reversed. The drilling fluid moves upward inside the drill pipes and circulates back to the borehole via settling pits. The drilling fluid returns to the borehole via gravity and moves downward in the annular space between the drill pipe and borehole wall. Drilling fluids for reverse-circulation rotary are generally water and any suspended particles picked up from the surrounding formations.

Mud-rotary methods can be used to drill in both unconsolidated and consolidated (bedrock) formations. In addition, drilling mud stabilizes the borehole and limits the potential for borehole collapse. Disadvantages of using the mud-rotary method include the difficulty in determining the depth to the water table, the potential for drilling mud to impact soil samples and dragging of contamination into deeper zones since the drill cuttings are re-circulated in the borehole. Wells installed using this method typically take longer to develop than wells installed using the HSA or air-rotary methods due to the invasion of mud filtrate into the formation.

In air-rotary drilling, compressed air is directed down the inside of the drill pipe to a percussion “hammer” that breaks up soil and shatters rock. As in mud-rotary drilling, air removes the cuttings and lubricates the bit. However, since air has no viscosity, it cannot be used to stabilize a borehole therefore, casing must be advanced in unconsolidated formations to keep the borehole open. This is why air rotary methods are best suited for drilling in bedrock formations. The percussion-type air-rotary "hammer" bit provides the best penetration rate when drilling bedrock consisting of crystalline rock. However, when drilling above the water table, an air-rotary bit can grind the soil and bedrock to a fine powder which is blown out of the hole with air and which has the potential to be inhaled. Therefore, drilling above the water table using air-rotary methods requires the addition of potable water to the borehole for dust control. In addition, the air compressor should be of the oil-less variety, or have a filter to prevent any oil from entering the borehole.

A disadvantage of using rotary methods while drilling in unconsolidated formations is the requirement of pulling the drill pipe out of the hole each time a split-spoon soil sample is collected (and the SPT is performed). This adds up to considerable amounts of time when deep wells are being installed or when continuous split-spoon sampling is being performed. As stated above, split-spoons used to collect soil samples can become contaminated when they are advanced down a mud-filled borehole.

A special type of rotary drilling is bedrock coring, wherein a special core bit and barrel are used to retrieve relatively undisturbed core samples of the bedrock. Coring allows better characterization of bedrock lithology and other features including orientation of fractures and bedding planes, which can control contaminant migration. Core barrels can either be unoriented or oriented. An oriented core is scribed with respect to magnetic north. Although more expensive than collecting an unoriented core, this method gives the true orientation of the features encountered in the core.

Drilling fluids are generally air (air-rotary) or bentonite and/or water (mud-rotary). Water added to a borehole must be of potable quality. The source of the potable water used during the installation (and development) of monitor wells should be documented (e.g., in the Remedial Investigation Report).

Bentonite is high swelling clay with sodium montmorillonite as its primary clay mineral. Bentonite is added to water to increase the viscosity of the drilling fluid so that drill cuttings can be removed from the borehole more effectively. At the same time, the viscosity must be low enough to allow cuttings and coarse-grained particles to settle out once they are circulated out of the hole. Bentonite also adds weight to the drilling fluid, which helps to maintain borehole stability.

4. Sonic Drilling

The method involves driving a core barrel using vibration, rotation, and a downward force to collect soil samples. A sonic drill rig looks and operates very much like a conventional top-drive rotary or auger rig. The main difference is that a sonic drill rig has a specially designed, hydraulically powered drill head or oscillator, which generates adjustable high-frequency vibrational forces. The oscillator uses two eccentric, counter-rotating balance weights or rollers that are timed to direct 100 percent of the vibrational energy at 0 and 180 degrees. There is an air spring system in the drill head that insulates or separates the vibration from the drill rig itself. The sonic head is attached directly to the drill pipe or outer casing, sending the high-frequency vibrations down through the drill pipe to the bit.

A core barrel is advanced using vibration, rotation, and downward force to collect continuous soil cores up to 20 feet in length. The bit at the end of the core barrel contains carbide teeth allowing the core barrel to be advanced through most overburden, soft bedrock, and minor obstructions such as bricks and boulders. Once the core barrel has been advanced, a secondary or "over-ride" casing is advanced down to the same depth as the inner core barrel. The over-ride casing keeps the borehole from collapsing while the inner core barrel is removed. Once the core barrel is removed, the soil core is pushed out of the core barrel through the use of vibration and either air or water pressure. Soil core diameters are dependent on the size of core barrel used and range from 3 to 12 inches. The use of multiple over-ride casings of increasing diameter allows the borehole to be telescoped down through multiple confining units. The setup used in sonic drilling makes this drilling method amendable to collecting soil cores and installing wells in angled boreholes. With only the bottom of the inner and outer core barrel exposed to the aquifer at any given time, determining the location of the water table can be difficult.

While this drilling method has the capability of drilling through and providing samples of coarse gravels, boulders, and tight clays, these situations will result in slow drilling or advancement of the core barrel. The result is a hotter core barrel and a longer contact time between the core barrel and the encased soil core. The aforementioned conditions will increase the probability that the sonic method will raise the temperature of the soil core and facilitate volatile organic compound (VOC) and semi-volatile organic compound (SVOC) loss.

The ability to quickly install deep borings and wells, while generating a large-diameter continuous soil core, makes this drilling technique invaluable when continuous soil sampling is needed to assess deep or complex geological situations. However, sonic drilling's high cost, relative to other drilling methods, may be prohibitive for small projects or shallow boreholes. The higher cost of the drilling method should be weighed against the cost savings incurred due to its faster drilling rate and high quality of the soil core produced.

5. GeoProbe®-Direct Push

The method involves hydraulically pushing a sampling device attached to a string of hollow rods into the subsurface for the purpose of collecting soil and/or groundwater samples (e.g., Geoprobe®). The method can be used to collect discrete soil samples or groundwater samples, as well as install small-diameter groundwater monitoring wells.

Advantages of the direct-push method include the relatively quick collection of groundwater samples and, when used along with a mobile laboratory, collection of data in “real” time. The method allows for collection of multiple samples in a day with the potential for achieving contaminant delineation in one mobilization of the field equipment. The data can also be used to select locations of permanent monitor wells.

Disadvantages of using a mobile lab include the fact that the data quality achieved are often suitable only for screening purposes. Direct-push methods typically result in very turbid groundwater samples since an oversize borehole is not produced and a filter pack is not used. Turbid samples can produce higher metal concentrations in groundwater samples since metals are typically adsorbed onto soil particles. Use of direct-push methods can also cause cross-contamination since contamination from shallow zones may be driven down to deeper zones.

Another disadvantage of using direct-push technology for collecting groundwater samples is the potential to breech confining units. To prevent this, soil sampling using direct-push technology or conventional split-spoon sampling techniques should first be performed to identify the presence, depth and lateral extent of confining units. Pushing through confining units should be avoided if the presence of dense non-aqueous phase liquid (DNAPL) or very soluble compounds, such as methyl tert-butyl ether (MTBE), are suspected or the contaminant plume appears to be diving in the aquifer.

STANDARD OPERATING PROCEDURE

DM-002 Sonic Drilling

---

1. Objective

The objective of this standard operating procedure (SOP) is to standardize the drilling of overburden soil borings for environmental investigations. This SOP addresses the use of sonic drilling to drill the soil boring.

2. Execution

- If work is to be conducted on private property, verify that the client has been notified (see SOP PP-001) and that access has been granted.
- Ensure that markout procedures outlined in PP-001, PP-002, and PP-003 have been completed.
- Inspect the drilling rig to make sure it is clean and that the down-hole equipment has been steam-cleaned. Check that the steam-cleaner is working properly (i.e., that steam is being produced). Record all observations and measurements in the field notebook.
- Prior to the start of drilling, the borehole location should be hand-cleared to a minimum of 5 feet below ground surface (bgs).
- Collect soil cores in shorter runs. While some sonic rigs have the capability of collecting 20 feet of soil core at a time, the process of collecting the longer core results in the core being in contact with the core barrel for a longer period of time and consequently absorbing more heat from the core barrel itself.
- The core barrel should be cleaned with tap water following each use.
- The field geologist will classify and sample the soil located within the liner.
- Upon completion, the excess soil will be placed into a 55-gallon drum for disposal and the inner liner properly disposed.
- The core barrel will then be advanced, within the isolation casing on the same borehole, to collect the next soil core interval.
- Add water between the inner core barrel and the outer override casing. This water would reduce friction and adsorb heat between the inner core barrel and the outer over-ride casing.
- Maximize drilling advance rate. The faster the core barrel is advanced, the less likely the core barrel will heat up, and the less contact time the soil core has with the core barrel. Drilling with a 3-inch diameter core barrel and a 5-inch diameter override casing, instead of the standard 4-inch core barrel and 6-inch over-ride casing, may increase advance rates and reduce the potential for soil core heating.
- If a significant decrease in drilling advance rate is observed, stop drilling and remove what soil core has accumulated in the core barrel.

Resume drilling through the resistant material (gravel, boulder, hard clay, etc.). When the resistant material has been penetrated and the drilling advance rate increases, stop drilling and remove what material has accumulated in the core barrel.

- Wash down the core barrel with cool water to cool the core barrel and associated casing, and resume drilling.
- If a well is to be installed in the borehole, the sandpack and grout are placed as the core-barrel and over-ride casing(s) are selectively vibrated out of the ground. The vibratory action reportedly facilitates the settlement of the sandpack and grout. Upon completion, no casing is left in the ground other than the well casing and screen.

3. Notes

- Disturbance of the soil core is most likely to occur during removal of the soil core from the core barrel. The soil cores are usually vibrated out of the core barrel into plastic bags approximately 5 feet in length. As the plastic bags are a little larger than the soil core itself, fragmentation of the soil core may occur as the core is extruded into the bag or while the bagged core is being moved in an unsupported manner. Soil conditions that are prone to disturbance include wet or dry zones that contain little or no fines, and well graded sands that contain significant volumes of water.
- If integrity of the soil core is of concern, the following procedures should be implemented:
    i. Measures should be taken to ensure that the core, from the time it is extruded from the core barrel, is rigidly supported through the use of some type of cradle or carrying device.
    ii. The core should not be removed from its cradle until all sampling of the core has been completed. Acrylic liners are available for some core sizes and can be used to hold the core together upon removal from the core barrel.
    iii. If the soil is to be sampled for volatile organic compounds (VOCs), acrylic liners must be used.
    iv. Sampling of the soil core for VOCs or semi-volatile organic compounds (SVOCs) must be approved on a case by case basis. Proposals for VOC or SVOC soil core sampling must include provisions to minimize core fragmentation and heat generation, such as:
        1. Acetate liners in the core barrel so that the soil core does not have to be extruded out of the core barrel.
        2. Limit the length of soil core generated during a given downhole run.
        3. Implement practices to reduce the residency time of the soil core in the core barrel.

- For the analysis of SVOCs, the use of the acetate liners is not required.
- The large diameter of the core barrel enables ground water sampling equipment to be placed inside the core barrel so that discrete depth groundwater samples can be collected during borehole advancement.

4. References

Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers (October 1990), American Society for Testing and Materials [ASTM] D5092-90.

STANDARD OPERATING PROCEDURE

DM-003 Monitoring Well Construction and Installation

---

1. Objective

The objective of this standard operating procedure (SOP) is to standardize the installation of overburden monitoring wells for environmental investigations. This SOP assumes the monitoring wells will be constructed of flush-joint polyvinyl chloride (PVC) pipe; the screened section will have factory-slotted openings. Well dimensions (well diameter, screen length, and screen slot-diameters) will be specified in the Work Plan and recorded in field notes, along with rationale for any changes from the work plan.

2. Execution

- Attachment A provides a diagram of typical shallow, intermediate, and deep groundwater monitoring well construction detail.
- During the monitoring well installation, record all pertinent information on Attachment B, Well Construction Form.
- Using a weighted tape, measure and record the depth of the completed soil boring (within the augers), if applicable, before beginning the well installation.
- Measure the depth to groundwater in the borehole over a 10 to 15 minute period to ensure that the groundwater elevation has approximately stabilized. Compare the saturated soil depth estimated from the soil samples, if collected prior to well installation, to the measured water level in the borehole. If drilling water has been used during boring advancement, pump the water out of the borehole to the static water depth, based on examination of the soil samples, and monitor the recovery of groundwater until the level has stabilized.
- Choose the monitoring well screen and riser lengths so that the slotted section of the screen intersects the groundwater table, for shallow wells. If the borehole is deeper than the desired well depth, then fill the base of the borehole with sand.
- A minimum of a one-foot sump should extend to the bottom of the well if dense non-aqueous phase liquid (DNAPL) is suspected.
- Monitoring well screens should be constructed of either 2 or 4 inch inner diameter (ID) 0.01-inch or 0.02-inch slotted Schedule 40 PVC well screen.
- If DNAPL is suspected, the monitoring well should be constructed of either 2 or 4 inch ID 0.02-inch slotted Schedule 40 PVC well screen.
- Monitoring wells should be constructed of either 2 or 4 inch ID Schedule 40 threaded flush-jointed PVC. One-inch wells may be installed with prior approval of the client and the New York State Department of Environmental Conservation.

- Install and secure a bottom well cap. The bottom cap should be secured with either a threaded coupling and/or stainless steel screws. Do not use any kind glue to secure well sections together.
- Place at least 12 inches of clean uniformly graded medium quartz filter sand pack into the base of the borehole. Measure and record the depth of the boring. Temporarily cover the top of the riser pipe and lower the complete well plus riser into the borehole, with the base resting on the sand pack.
- Add adequate sand to surround the area around the slotted section. The filter sand should extend at least 2 feet above the top of the slotted section.
- Remove the drilling casing/augers from the borehole slowly, at a maximum of 2-foot intervals. As the drillers pour or use tamping rods to place the filter sand in the borehole, take frequent measurements of the depth-to-sand. Do not let the sand "bridge" in the annular space. Continue to observe the water level in the borehole.
- Place at least 1 foot of bentonite seal above the filter pack. If the seal is above the water table, use at least 5 gallons of potable water to hydrate the bentonite.
- If necessary, pump bentonite-cement grout using a tremie pipe into the bottom of the annular space to the ground surface. Grout should be mixed in approximately the following proportions: 7.5 gallons water to one 94-pound bag of cement to 2-4 pounds of pulverized bentonite. The grout must be mixed using the pump on the rig to ensure proper mixing. The protective casing should be set in the grout before it sets.
- The protective surface casing will be either a flush-mounted roadbox or a steel “stick up” pipe. The base of either type of casing should extend at least 1 foot into the grout below the ground surface (below the frost line) whenever possible.
- Cut the monitoring well riser flat and place a mark or "V"-notch or an arrow on the casing with an indelible marker at one point for surveying and groundwater measurements. Cut the well riser so that the top of the well is 3 to 6 inches below the top of the protective casing.
- Set bentonite-cement grout in the annular space between the protective casing and the borehole up to the ground surface. Slope the concrete radially away from the protective casing at the ground surface to promote surface water runoff. In areas of high traffic or areas of parking lots and/or roadways where plowing occurs, set the roadbox FLUSH with the ground surface to avoid damage to the well.
- If the well is installed in a high-traffic area with a guardpipe, additional protection such as steel pole bumpers around the guardpipe may be necessary.
- Place a locking, vented cap on the well pipe.

- All well locations should be photodocumented in accordance with SOP FD-004, *Photo Documentation*.
- Label the protective well casing with a paint pen and tape out the location to nearby landmarks so that the well may be located in the future. Make sure to enter this information in the field notebook. If possible, place a brightly colored stake or other identifier adjacent to the well.
- Develop the well (see SOP DM-009, *Monitoring Well Development*).
- Upon completion, all newly installed monitoring wells will be surveyed. This will include the well location, ground surface elevation and measuring point elevation.

3. Notes

- At all times, follow safety procedures as defined in the site-specific Health and Safety Plan.
- Site-specific conditions must be evaluated to determine appropriate materials.
- The water table will fluctuate seasonally and from year-to-year. Try and estimate the maximum high and low elevations of the water table from the current water table elevation and the season. Place the 10-foot screen so that at least 2 feet of the screen will extend above the top of the screen when water is at its highest. If very substantial fluctuations in the groundwater table are expected, a 15-foot screen is acceptable.
- Do not screen across different hydrostratigraphic units if possible (for example, outwash sands and till) unless specified in the Work Plan or approved by the Project Manager.
- If the formation is composed of a material that is uniformly coarser than the filter sand, the grain size of the filter sand must be increased. Consideration should also be given to changing the slot size on the well screen. Differences in average grain size should generally not be greater than a factor of two to four times.
- Do not use borehole/auger cuttings for backfill during monitoring well installation. If the cuttings are suspected to contain contamination which was identified during drilling, cuttings are to be containerized for later characterization and not used for filter pack materials.
- Do not screen across a confining layer (e.g., silt or clay). Backfill all confining layers with hydrated bentonite or grout.

4. References

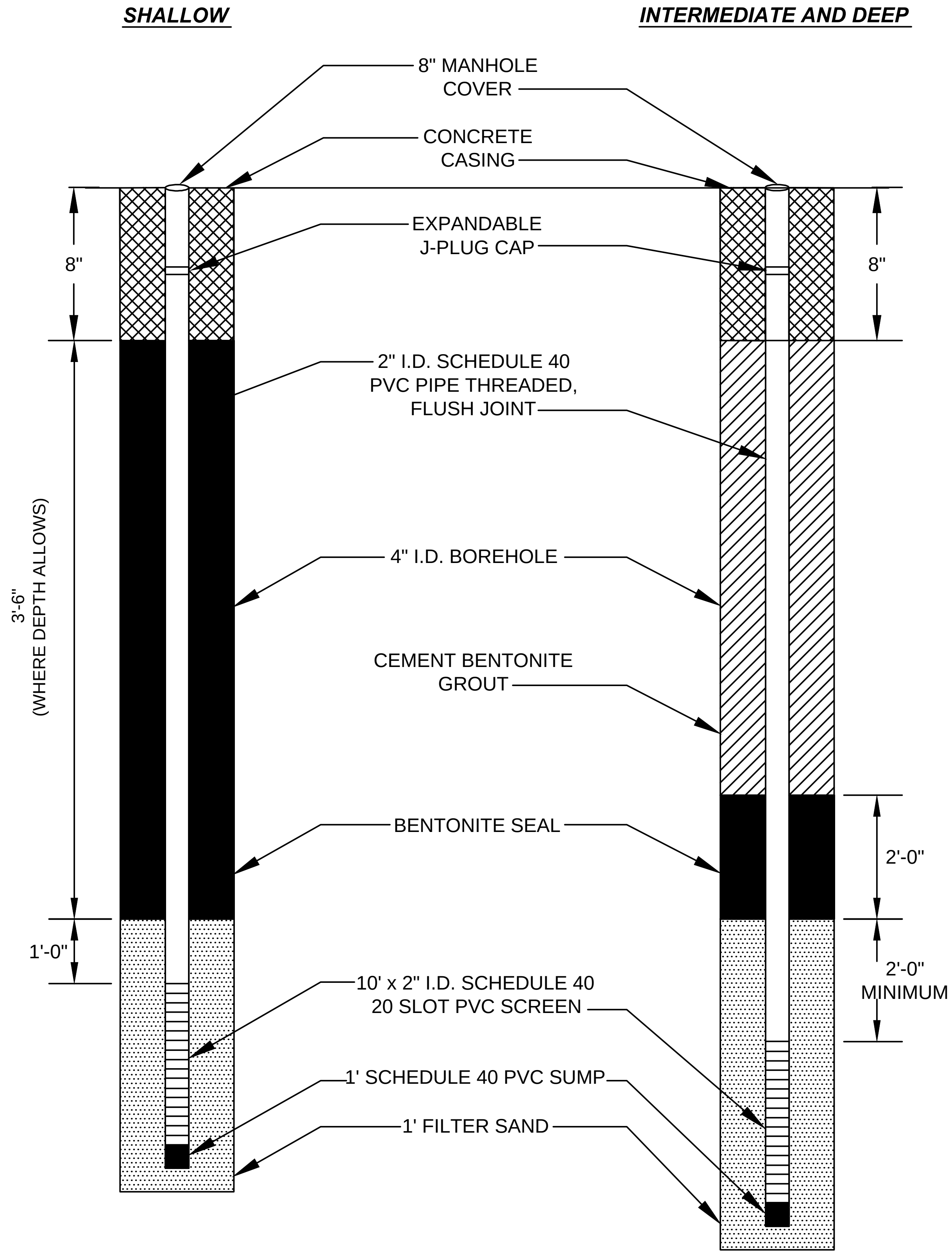
Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers (October 1990), American Society for Testing and Materials [ASTM] D5092-90.

Nielsen, D.M. (1993), "Correct Well Design Improves Monitoring," Environmental Protection, July, pp. 38-49.

5. Attachments

Attachment A – Typical Shallow, Intermediate, and Deep Groundwater Monitoring Well Construction Detail

Attachment B – Well Construction Form



NOT TO SCALE

GEI Consultants

TYPICAL SHALLOW, INTERMEDIATE AND DEEP GROUNDWATER MONITORING WELL CONSTRUCTION DETAIL

November 2010

WELL CONSTRUCTION FORM

ID No.

PG. 1 OF 1

Project

Location

Client

Contractor

Driller

Inspected by

Date Started

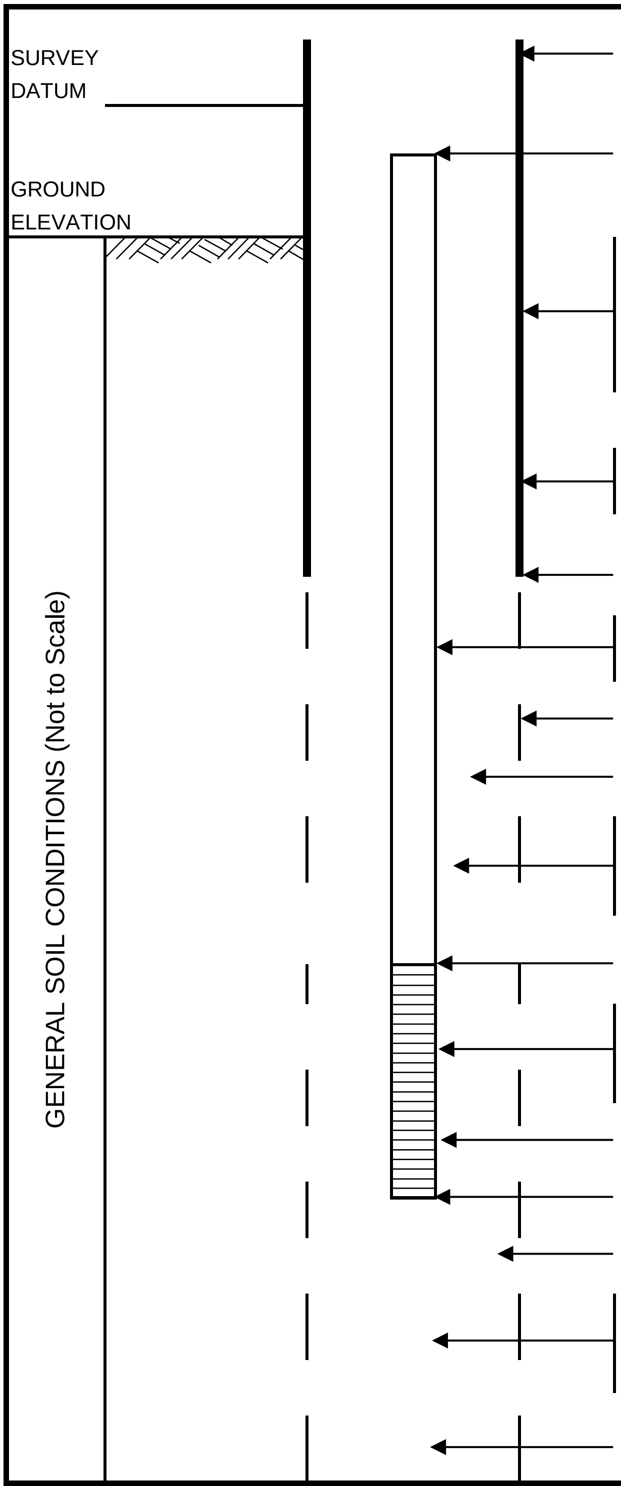
Checked by

Date Completed

Boring No.

Location

Project No.



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)

LENGTH OF RISER PIPE ABOVE GROUND SURFACE (FT)

THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)

TYPE OF SURFACE SEAL (indicate any additional seals)

ID OF SURFACE CASING (IN)

TYPE OF SURFACE CASING

DEPTH BOTTOM OF CASING (FT)

ID and OD OF RISER PIPE (IN)

TYPE OF RISER PIPE

DIAMETER OF BOREHOLE (IN)

TYPE OF BACKFILL AROUND RISER PIPE

DEPTH TOP OF SEAL, IF ANY (FT)

TYPE OF SEAL

DEPTH BOTTOM OF SEAL (FT)

DEPTH TOP OF PERVIOUS SECTION

TYPE OF PERVIOUS SECTION

DESCRIBE OPENINGS

ID and OD OF PERVIOUS SECTION (IN)

TYPE OF BACKFILL AROUND PERVIOUS SECTION

DEPTH BOTTOM OF PERVIOUS SECTION (FT)

DEPTH BOTTOM OF SAND COLUMN (FT)

ELEV./DEPTH TOP OF SEAL, IF ANY (FT)

TYPE OF SEAL

ELEV./DEPTH BOTTOM OF SEAL (FT)

TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY

NOTES:

GEI Consultants

STANDARD OPERATING PROCEDURE

DM-004 Monitoring Well Telescoping

---

1. Description

The method of monitoring well telescoping prevents the connection of two stratigraphic layers during monitoring well installation. Typically, these two stratigraphic layers are overburden and bedrock strata, or overburden deposits with a semiconfining layer.

2. Execution

- If work is to be conducted on private property, verify that the client has been notified (see SOP PP-001) and that access has been granted.
- Ensure that markout procedures outlined in PP-001, PP-002, and PP-003 have been completed.
  Prior to the start of drilling, the borehole location should be hand-cleared to a minimum of 5 feet below ground surface.
- Install large diameter casing (e.g., 6-inch outer diameter) to the top of the bedrock or semiconfining layer.
- Drill or core at least 10 feet into bedrock, or an appropriate thickness into the semiconfining layer, to confirm the presence of bedrock and adequately separate stratigraphic units (see precautions below).
- Freshly mixed grout is required. Depending on application, a mixture of Portland cement and bentonite meets most grouting requirements. For proper consistency, use no more than 6 gallons of water per 94-pound sack of cement. Add a few pounds of bentonite or hydrated lime per sack of cement for a better flow.
- Use a tremie pipe to deliver grout outside the casing. This method is not recommended for depths greater than 100 feet. You can use this method if the space between the casing and the borehole wall is large enough to contain a 1-inch tremie pipe. Use the following procedures to complete grouting using this method:
  i. Lower the tremie-pipe to the bottom of the borehole outside of the well casing. Make sure that the lower end of the casing is tightly seated at the bottom of the borehole.
  ii. Mix a sufficient quantity of grout and pump it through the tremie pipe or let it descend naturally. As the grout is placed, lift the tremie pipe slowly, but keep the lower end submerged in the grout.
  iii. Fill the casing with water as the grout is placed to balance the fluid pressure inside and outside the casing. Doing so prevents grout from leaking under the bottom of the casing.
  iv. Allow the grout to set for a minimum of 24 hours.

v. Drill through the existing casing into bedrock to complete monitoring well. Install additional casing, polyvinyl chloride (PVC), or open borehole into bedrock.

3. Notes

- These operating procedures include drilling the borehole used to case off the overburden a minimum of 10 feet into a semiconfining layer. However, if dense non-aqueous phase liquid (DNAPL) and/or dissolved contamination is suspected or likely to be present in the weathered bedrock, the 10-foot casing requirement will hide the DNAPL from detection. In this case, an overburden well (with casing and screen) should be installed in the weathered bedrock and an outer steel casing installed 10 feet into bedrock would not be required.

4. References

Environmental Protection Agency, Region 4, “Environmental Investigation Standard Operating Procedures and Quality Assurance Manual, Chapter 6 – Design and Installation of Monitoring Wells,” November 2001.

STANDARD OPERATING PROCEDURE

DM-005 Monitoring Well Development

---

1. Objective

To remove drilling fluids and fine soil particles that may be trapped in the monitoring well's sand pack and screen, and to set the sand pack so that it will function properly, and create good hydraulic communication between the well and the formation.

2. Execution

- Wait at least 48 hours following monitoring well installation before beginning development activities.
- Decontaminate all development equipment prior to use with, Alconox, and deionized-water rinses. See SOP QA-001, *Equipment Decontamination*.
- Calculate the volume of water in the monitoring well (one well volume).
- Record volume on Monitoring Well Development Record (Attachment A).
- Collect a sample of water from the monitoring well with a submersible pump, a bailer, or a water pump. Record the color and turbidity of the sample.
- Utilize one of the following methods for purging:
  - Surging;
  - Bailing;
  - Using a centrifugal pump and dedicated polyethylene tubing;
  - Positive displacement pumps and dedicated polyethylene tubing; and/or
  - Other methods recommended by the field geologist and approved by the client Project Manager.
- Purge groundwater until it runs clear (<50 nephelometric turbity units [NTUs]) or until pH, temperature and specific conductivity stabilize as judged suitable by the field geologist.
- Well development should not exceed two hours for a single well.
- Measure the purge rate (gallons per minute) and total volume purged.
- Monitor the groundwater level in the well during development to determine if the pumping rate is sufficient to create a drawdown in the well.
- Collect groundwater samples every few well volumes during the pumping and record the physical properties (color and turbidity).
- Stop pumping when the purge water is relatively clear. Place a surge block in the monitoring well (if the method of development doesn't include a down-hole pump which serves as a surge block). Slowly

move the surge block up and down in the well. Periodically remove the surge block and purge the groundwater until it is relatively clear again. Start at a slow pace and progress to a faster surging action through time.

- Monitor the turbidity and color of the water during this procedure. The well is considered fully developed when all of the following criteria have been met:
    i. The volume of fluid added during drilling has been removed.
    ii. The water removed from the well is relatively free of fine-grained particles.
    iii. Record the volume of water pumped from the well and the physical properties (color, turbidity) of the water.

3. Notes

- Always remove groundwater with fine particles from the well before surging. The fine particles may be forced into the well screen by the surging action.
- Pump contaminated groundwater into an approved container (properly labeled drum or portable tank for transfer into frac tank).
- Use a bailer to develop monitoring wells that are installed in soils that are composed of fine-grained silts and clays. Pumping and mechanical surging is not recommended because these more vigorous techniques can cause fine particles to clog the filter pack.
- Sampling of groundwater should not occur within one weekafter development.

4. Calculations

To calculate the volume of water in the well, the following equation is used:
Well Volume (V) = $Br^2 h$ (cf) **[Equation 1]**
where:

B = pi (3.14)
r = radius of monitoring well in feet (ft)
h = height of the water column in ft. [This may be determined by subtracting the depth to water from the total depth of the well as measured from the same reference point.]
cf = conversion factor in gallons per cubic foot (gal/ft^3) = 7.48 gal/ft^3. [In this equation, 7.48 gal/ft^3 is the necessary conversion factor.]

Monitor well diameters are typically 2-, 3-, 4-, or 6-inches. A number of standard conversion factors can be used to simplify the above equation using the diameter of the monitor well. The volume, in gallons per linear foot, for various standard monitor well diameters can be calculated as follows:
Where:

V (gal/ft) = Br^2 (cf) **[Equation 1]**

B = pi (3.14)
r = radius of monitoring well (ft)
cf = conversion factor (7.48 gal/ft^3)

For example, a 2 inch diameter well, the volume per linear foot can be calculated as follows:

V (gal/ft) = Br^2 (cf) **[Equation 2]**
= 3.14 $(1/12\ ft)^2$ 7.48 gal/ft^3
= 0.1631 gal/ft

NOTE: The diameter must be converted to the radius in feet as follows:

Well Diameter (inches) x 0.5 = Well Radius (ft) **[Equation 3]**

The volume in gallons/feet for the common size monitor wells are as follows:

Well diameter (inches)	Volume (gal/ft)
2	0.1631
3	0.3670
4	0.6524
6	1.4680

If you utilize the volumes for the common size wells above, Equation 1 is modified as follows:
Where:

Well volume = (h) (f) **[Equation 4]**

h = height of water column (ft)

f = the volume in gal/ft calculated from Equation 2

5. References

Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers (October 1990), American Society for Testing and Materials [ASTM] D5092-90.

Nielsen, D.M. (1993), "Correct Well Design Improves Monitoring," Environmental Protection, July, pp. 38-49.

"The Methods & Mechanics of Well Development, Part 2 of 5," National Drillers Buyers Guide, March 1993, p. 17.

Standard References for Monitoring Wells (April 1991), Commonwealth of Massachusetts Department of Environmental Protection, WSC-310-91.

U. S. EPA Environmental Response Team Standard Operating Procedure SOP: 2044 ," Monitor Well Development" REV: 0.1, 10/23/01.

6. Attachments

Attachment A - Monitoring Well Development Record

Monitoring Well Development Record

Project: ______________________ **Well ID:** __________________ **Date:** ____________________

Total Well Depth (from top of casing): ______________________

Depth to Water (from top of casing): ____________________

Well Diameter: ______________________

Pump Intake Depth: ____________________

Sampling Crew: ______________________

Purge Time: *Start:* ____________________ *Finish:* ____________________

Purging Method: ______________________

Sampling Method: ______________________

Sample Time: *Start:* ____________________ *Finish:* ____________________

Sample Analysis: ______________________

Purge Data

Sample Time	**Flow Rate** *(lpm/gpm)*	**Volume Purged** *(liters/gals.)*	**pH** *(std. Units)*	**Conductivity** *(mS/cm)*	**Turbidity** *(NTU)*	**Dissolved Oxygen** *(mg/l)*	**Temperature** *(Cel.)*	**Salinity** *(%)*	**ORP** *(mV)*	**Comments/Observations**
										Well Headspace PID =

Final Stabilization Data

Sample Time	**Flow Rate** *(lpm/gpm)*	**Volume Purged** *(liters/gals.)*	**pH** *(std. Units)*	**Conductivity** *(mS/cm)*	**Turbidity** *(NTU)*	**Dissolved Oxygen** *(mg/l)*	**Temperature** *(Cel.)*	**Salinity** *(%)*	**ORP** *(mV)*	**Comments/Observations**

GEI Consultants

SUMMARY GUIDANCE

DM-006 General Guidance on Monitoring Well Abandonment

---

1. Objective

To properly abandon a monitoring well, preventing direct connections from surface conditions to the well screen zone.

When a decision is made to abandon a monitoring well, the borehole should be sealed in such a manner that the well can not act as a conduit for migration of contaminants from the ground surface to the water table or between aquifers. Guidelines for well abandonment are provided below but do not supersede state or local regulations. Make sure all well abandonment procedures adhere to appropriate regulations.

To properly abandon a well, the preferred method is to completely remove the well casing and screen from the borehole, clean out the borehole, and backfill with a cement or bentonite grout, neat cement, or concrete. In order to comply with New York State well abandonment requirements, the New York State Department of Environmental Conservation (NYSDEC) should be notified (if applicable) of monitoring well abandonment. However, some state requirements are not explicit, so a technically sound well abandonment method should be designed based on the site geology, well casing materials, and general condition of the well(s). In New York, the NYSDEC policy document titled, CP-43: Groundwater Monitoring Well Decommissioning Policy, should be followed. The document includes a flow chart to be used in selecting the appropriate decommissioning methods based upon the geologic and hydrogeologic conditions at the well site, the presence or absence of contamination in the groundwater and the original well construction details.

Execution

In accordance with NYSDEC's policy document referenced above, the four primary well decommissioning methods are:

- Grouting in-place.
- Perforating the casing followed by grouting in-place.
- Grouting in-place followed by casing pulling.
- Overdrilling and grouting with or without a temporary casing.

The methods and rationale for each of these methods is detailed in NYSDEC's policy document.

1.1. Borehole Abandonment

All soil borings not finished as monitoring wells or piezometers will be abandoned by adding neat cement grout or cement/bentonite grout via tremie pipe from the bottom of the borehole up to the ground surface. If the boring was completed via the hollow stem auger method, the borehole will be grouted as the augers are withdrawn, in the case of a direct-push soil boring, the borehole will be redrilled and pressure-grouted from the bottom depth of the borehole up. The neat cement grout will be mixed in accordance with the manufacturer's recommendations. The bentonite/cement grout will be mixed in the following relative proportions: 30 gallons of water to three 94-pound bags of cement to 25 pounds granular bentonite.

2. References

New York State Department of Environmental Conservation, *"CP-43: Groundwater Monitoring Well Decommissioning Policy"*, November 2009.

Environmental Protection Agency, Region 4*, "Environmental Investigation Standard Operating Procedures and Quality Assurance Manual, Chapter 6 – Design and Installation of Monitoring Wells,"* November 2001.

3. Attachment

Attachment A – CP-43: Groundwater Monitoring Well Decommissioning Policy

CP-43:Groundwater Monitoring Well Decommissioning Policy

New York State Department of Environmental Conservation

DEC POLICY

Issuing Authority: Commissioner Alexander B. Grannis

Date Issued: November 3, 2009	**Latest Date Revised:**

I. Summary:

Groundwater monitoring wells provide essential access to the subsurface for scientific and engineering investigations (including monitoring wells installed for leak detection purposes). To a degree, every monitoring well is an environmental liability because of the potential to act as a conduit for pollution to reach the groundwater. To limit the environmental risk, a groundwater monitoring well must be properly decommissioned when its effective life has been reached. This document provides procedures to satisfactorily decommission groundwater monitoring wells in New York State. This policy also pertains to other temporary wells such as observation wells, test wells, de-watering wells and other small diameter, non-potable water wells. It does not pertain to water supply wells.

II. Policy:

Environmental monitoring wells should be decommissioned when:

1. they are no longer needed and re-use by another program is not an option; or
2. the well's integrity is suspect or compromised.

The method for decommissioning will be determined based upon well construction and environmental parameters. The method selected must be designed to protect groundwater and implemented according to current best engineering practices while following all applicable federal, state and local regulations. *Groundwater Monitoring Well Decommissioning Procedures* shall be maintained as an addendum to this policy.

This policy is applicable to all New York State Department of Environmental Conservation (DEC) programs that install, utilize and maintain monitoring wells for the study of groundwater, except monitoring wells for landfills regulated under 6 NYCRR Part 360 decommissioned in accordance with those regulations [*see* 6 NYCRR 360-2.11(a)(8)(vi)] and wells installed under the Oil, Gas and Solution Mining Law, Environmental Conservation Law Article 23. There is no specific time frame to dictate when to decommission a well; timing is dependent upon the use and condition of the well and shall be determined on an individual basis. Best professional judgment must be exercised when using the decommissioning procedures. Outside of DEC use, this policy is mandatory when incorporated into the specifications of a state contract, an Order on Consent or a permit. In all other situations, it shall serve as guidance.

III. Purpose and Background:

This document establishes a monitoring well decommissioning policy and provides technical guidance. Synonyms for well decommissioning include “plugging,” “capping” and “abandoning. For consistency, only the term “decommissioning” is used within this document.

Unprotected, neglected and improperly abandoned monitoring wells are a serious environmental liability. They can function as a pollution conduit for surface contaminants to reach the subsurface and pollute our groundwater. They also can cause unwanted mixing of groundwater, which degrades the overall water quality within an aquifer. Improperly constructed, poorly maintained or damaged monitoring wells can yield anomalous poor data that can compromise the findings of an environmental investigation or remediation project. Unneeded or compromised monitoring wells should be properly decommissioned in order to prevent harm to our groundwater.

Since 1980, the DEC has installed, directed or overseen the installation of thousands of monitoring wells throughout New York for various state and federal programs, such as Superfund, solid waste, Resource Conservation and Recovery Act (RCRA), spill response, petroleum bulk storage and chemical bulk storage. This guidance addresses the environmental liability associated with this aging network of wells.

Within its boring zone, a successfully decommissioned well prevents the following:

1. Migration of existing or future contaminants into an aquifer or between aquifers;
2. Migration of existing or future contaminants within the vadose zone;
3. Potential for vertical or horizontal migration of fluids in the well or adjacent to the well; and
4. Any change in the aquifer yield and hydrostatic head, unless due to natural conditions.

Monitoring well construction in New York varies considerably with factors such as age of the well, local geology and either the presence or absence of contamination. The predominant type of monitoring well in New York is the shallow, watertable monitoring well constructed of polyvinyl chloride plastic (PVC). The best method for decommissioning should be selected to suit the conditions and circumstances. Each decommissioning situation is to be evaluated separately using this guidance before a method is chosen and implemented.

IV. Responsibility:

The Division of Environmental Remediation (DER) is responsible for updating this policy and the *Groundwater Monitoring Well Decommissioning Procedures* (addendum) in consultation with the Division of Solid and Hazardous Materials (DSHM) and the Division of Water (DOW). Compliance with the guidance does not relieve any party of the obligation to properly decommission a monitoring well. Oversight responsibility will be carried out by the DEC Regional Engineer.

V. Procedure:

Groundwater Monitoring Well Decommissioning Procedures, the addendum to this policy, provides guidance on proper decommissioning of monitoring wells in New York State.

VI. Related References:

- Groundwater Monitoring Well Decommissioning Procedures, October 1986. Prepared by Malcolm Pirnie, Inc. for the New York State Department of Environmental Conservation, Division of Environmental Remediation.

- Standard Guide for the Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities, ASTM D 5299-99. American Society for Testing and Materials (ASTM). Philadelphia. 2005.

- 6 NYCRR Part 360 Solid Waste Management Facilities, New York State Department of Environmental Conservation, Division of Solid and Hazardous Materials.

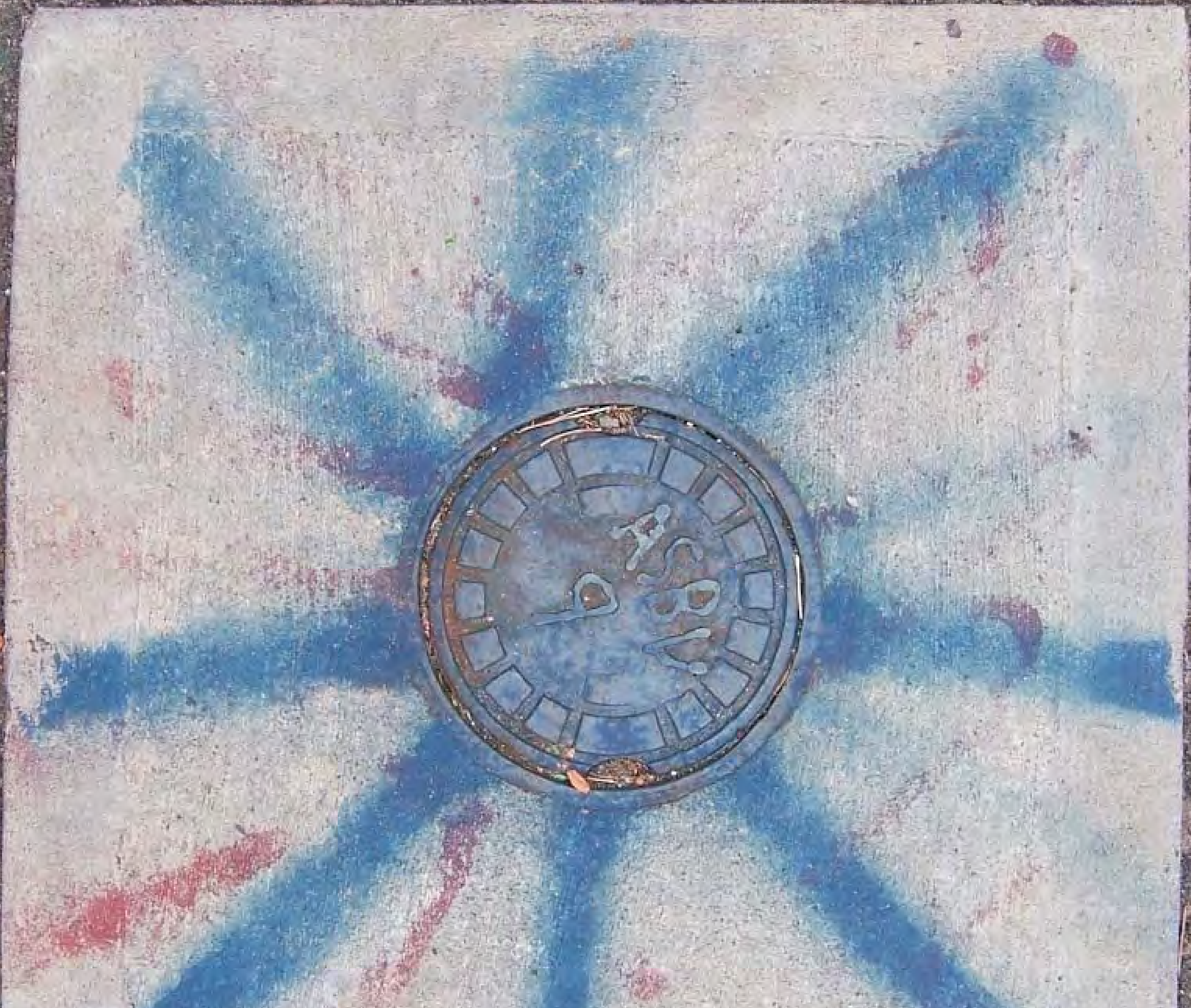
- Specifications for Abandoning Wells and Boreholes in Unconsolidated Materials, New York State Department of Environmental Conservation, Region 1 - Water Unit, undated.

- Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells, EPA 600/4-89/034, United States Environmental Protection Agency (EPA).

[Page Intentionally Left Blank]

Final - August 2009

GROUNDWATER MONITORING WELL DECOMMISSIONING PROCEDURES



New York State Department of Environmental Conservation
Division of Environmental Remediation

[Page Intentionally Left Blank]

TABLE OF CONTENTS

INTRODUCTION 3

1.0 PREPARATION 3

2.0 DECOMMISSIONING METHODS 4
    2.1 Grouting In-Place 5
    2.2 Casing Perforating/Grouting In-Place.. 6
    2.3 Casing Pulling... 6
    2.4 Over-Drilling... 7

3.0 SELECTION PROCESS AND IMPLEMENTATION 8
    3.1 Bedrock Wells... 8
    3.2 Uncontaminated Overburden Wells 9
    3.3 Contaminated Overburden Monitoring Wells/Piezometers.................. 9
    3.4 Telescoped Riser 10

4.0 LOCATING AND SETTING-UP ON THE WELL 10

5.0 REMOVING THE PROTECTIVE CASING 10

6.0 SELECTING, MIXING, AND PLACING GROUT 11
    6.1 Standard Grout Mixture... 11
    6.2 Special Mixture...12
    6.3 Grout Mixing Procedure... 12
    6.4 Grout Placement... 12

7.0 BACKFILLING AND SITE RESTORATION 13

8.0 DOCUMENTATION 13

9.0 FIELD OVERSIGHT 14

10.0 RELATED REFERENCES 14

FIGURES

FIGURE 1 - MONITORING WELL FIELD INSPECTION LOG

FIGURE 2 - DECOMMISSIONING PROCEDURE SELECTION

FIGURE 3 - WELL DECOMMISSIONING RECORD

APPENDICES

APPENDIX A - REPORTS

    APPENDIX A1 - INSPECTOR’S DAILY REPORT

    APPENDIX A2 - PROBLEM IDENTIFICATION REPORT

    APPENDIX A3 - CORRECTIVE MEASURES REPORT

INTRODUCTION

This document, *Groundwater Monitoring Well Decommissioning Procedures*, is the addendum to CP-43, Groundwater Monitoring Well Decommissioning Policy, which provides acceptable procedures to be used as guidance when decommissioning monitoring wells in New York State. Please note that this document does not address some site-specific special situations that may be encountered in the field. Compliance with the procedures set forth in this document does not relieve any party of the obligation to properly decommission a monitoring well.

Unprotected, neglected and improperly abandoned monitoring wells are a serious environmental liability. They can function as a pollution conduit for surface contaminants to reach the subsurface and pollute our groundwater. They also can cause unwanted mixing of groundwater, which degrades the overall water quality within an aquifer. Improperly constructed, poorly maintained or damaged monitoring wells can yield anomalous poor data that can compromise the findings of an environmental investigation or remediation project. Unneeded or compromised monitoring wells should be properly decommissioned in order to prevent harm to our groundwater.

Previous versions of this guidance have been issued since 1995. Originally developed as a specification for well decommissioning at Love Canal, the procedures were rewritten to make them applicable across the state. From an engineering standpoint, the guidance has changed very little. Most situations do not require a complex procedure.

If you have any questions, please contact Will Welling at (518) 402-9814.

Sincerely,

Gerald J. Rider, Jr., P.E.
Chief, Remedial Section D
Remedial Bureau E
Division of Environmental Remediation

1.0 PREPARATION

If an unneeded monitoring well remains in good usable condition, an alternative to decommissioning might be the reuse by another agency program. DEC encourages reuse in situations where a well will continue to be used and cared for responsibly.

When reuse is not an option, the first step in the well decommissioning process is to review all pertinent well construction information. One must know the well depth and construction details. GPS coordinates and permanent labeling (if available) will be useful in confirming the well to be decommissioned. An inspection must be performed prior to decommissioning in order to verify the construction and condition of each well. Specific details and subsurface conditions form the basis for decisions throughout the decommissioning process.

Well Details

1. Is the well a single stem riser (all one diameter)?
2. Is the well a simple overburden well (no penetration into bedrock)?
3. Does the well riser consist of telescoping diameters of pipe which decrease with depth?
4. Is the well seal compromised (leaking, inadequate or damaged)?
5. If the well is PVC, is it 25 feet or shallower and not grouted into rock?
6. Can the riser be pulled and is removal of the well desired?
7. Is the well a bedrock well?
8. If the monitoring well is a bedrock well, does it have an open hole?
9. Is there a well assembly (riser and screen) installed within the bedrock hole?

Subsurface Conditions

10. Is the soil contaminated?
11. Does the well penetrate a confining layer?
12. If the well penetrates a confining layer, might overdrilling or casing pulling cause contamination to travel up or down through a break in the confining layer?
13. Does the screened interval cross multiple water-bearing zones?

For additional collection and verification of information, the "Monitoring Well Field Inspection Log" (Figure 1) can be used during a field inspection. After the well has been located and the information gathered, one is ready to select the decommissioning procedure in accordance with Section 2.

Special conditions, such as access problems, well extensions through capped and covered non-Part 360 landfills and seasonal weather patterns affecting construction, should be assessed in the planning stage. Decommissioning work requiring the use of heavy vehicular equipment on landfill caps should be scheduled during dry weather (if possible) so as to minimize damage to the cover. If work must be performed during the spring, winter or inclement weather, special measures to reduce ruts should be employed to maintain the integrity of a completed landfill cover system. As an example, placement of plywood under vehicular equipment can eliminate deep ruts that would require repair.

2.0 DECOMMISSIONING METHODS

The primary rationale for well decommissioning is to remove any potential groundwater pathway. A secondary rationale, often important to the property owner or owner of the well, is to physically remove the well. Removed well materials may be recycled and will not interfere with future construction excavation. The previous versions of these decommissioning procedures have stressed that physical removal of the well by pulling is preferable to leaving casing in the ground. Due to the added effort, expense and risk involved with pulling, the decision of whether to pull or not should be a separate consideration aside from selecting the sealing procedure.

One should select a decommissioning procedure that takes into account the geologic and hydrogeologic conditions at the well site; the presence or absence of contamination in the groundwater; and original well construction details. The selection process for well decommissioning procedures is provided by the flow chart, Figure 2. Answers to the questions in the preceding section are the input for this flow chart. The four primary well decommissioning methods are:

1. Grouting in-place;
2. Perforating the casing followed by grouting in-place;
3. Grouting in-place followed by casing pulling;
4. Over-drilling and grouting with or without a temporary casing.

In a complex situation, one or more decommissioning procedures may be used for different intervals of the same well.

The remainder of Section 2 discusses the well decommissioning methods and the selection process. Refer to Figure 2 for a flow chart diagram of the complete procedure selection process. The DEC Project Manager has the discretion to deviate from the flow chart, (Figure 2), based on site conditions and professional judgment.

2.1 Grouting In-Place

Grouting in-place is the simplest and most frequently used well decommissioning method and grouting itself is the essential component of all the decommissioning methods. The grout seals the borehole and any portion of the monitoring well that may be left in the ground. Because dirt and foreign objects can fall into an open well, whenever possible a well should be sealed first with grout before attempting subsequent decommissioning steps.

For the purpose of these decommissioning procedures, the well seal is defined as the bentonite seal above the sand pack. Aside from obvious channeling by in-flowing surface water around the well, an indication of the well seal integrity may be obtained through review of the boring logs and/or a comparison of groundwater elevations if the well is part of a cluster. Any problems noted on the boring logs pertaining to the well seal, such as bridging of bentonite pellets or running sands, or disparities between field notes (if available) and the well log would indicate the potential for a poor (compromised) well seal.

If the well seal is not compromised and there is no confining layer present, a single-stem, 2-inch PVC, monitoring well can be satisfactorily decommissioned by grouting it in-place. If the seal is compromised, casing perforation may be called for as discussed in Section 2.2.

As discussed in Section 2.4 and its sub-sections, this method is specified for the bedrock portion of a well, and is used for decommissioning small diameter cased wells. Grouting in-place involves filling the casing with grout to a level of five feet below the land surface, cutting the well casing at the five-foot depth, and removing the top portion of the casing and associated well materials from the ground. The casing must be grouted according to the procedures in Section 6. In addition, the upper five feet of the borehole is filled to land surface and restored according to the procedures described in Section 7.

For open-hole bedrock wells, the procedure involves filling the opening with grout to the top of rock according to the procedures in Section 5. A thicker grout may be required to fill any bedrock voids. If excessive grout is being lost down-hole, consider grouting in stages to reduce the pressure caused by the height of the grout column.

The standard mix with the maximum amount of allowable water will be required to penetrate the well screen and sand pack when a well assembly has been installed within a bedrock hole. For an assembly such as this, the grout should be mixed thinly enough to penetrate the slots and sand pack. The grout mixes are discussed in Sections 6.1 and 6.2.

2.2 Casing Perforating/Grouting In-Place

Casing perforation followed by grouting in-place is the preferred method to use if there is poor documentation of the grouting of the well annulus, or the annulus was allowed to be back-filled with cuttings. The grout will squeeze through the perforations to seal any porous zones along the outside of the casing. The procedure involves puncturing, cutting or splitting the well casing and screen followed by grouting the well. A variety of commercial equipment is available for perforating casings and screens in wells with four-inch or larger inside diameters. Due to the diversity of applications, experienced contractors must recommend a specific technique based on site-specific conditions. A minimum of four rows of perforations several inches long around the circumference of the pipe and a minimum of five perforations per linear foot of casing or screen is recommended (American Society for Testing and Materials, Standard D 5299-99, 1999). After the perforating is complete, the borehole must be grouted according to the procedures in Section 6 and the upper five feet of borehole restored according to the procedures in Section 7.

2.3 Casing Pulling

Casing pulling should be used in cases where the materials of the well assembly are to be recycled, or the well assembly must be removed to clear the site for future excavation or re-development. Casing pulling is an acceptable method to use when no contamination is present; contamination is present but the well does not penetrate a confining layer; and when both contamination and a confining layer are present but the contamination cannot cross the confining layer. Additionally, the well construction materials and well depth must be such that pulling will not break the riser. When contamination is likely to cross the confining layer during pulling, a temporary casing can be used. See Section 2.4.

Casing pulling involves removing the well casing by lifting. Grout is to be added during pulling; the grout will fill the space once occupied by the material being withdrawn. An acceptable procedure to remove casing involves puncturing the bottom of the well or using a casing cutter to cut away the screen, grouting, using jacks to free casing from the hole, and lifting the casing out by using a drill rig, backhoe, crane, or other suitable equipment. Additional grout must be added to the casing as it is withdrawn. Grout mixing and placement procedures are provided in Section 6. In wells or well points in which the bottom cannot be punctured, the casing or screened interval will be perforated or cut away prior to being filled with grout. This procedure should be followed for wells installed in collapsible formations or for highly contaminated wells.

At sites in which well casings have been grouted into the top of bedrock, the casing pulling procedure should not be attempted unless the casing can be first cut or freed from the rock.

2.4 Over-Drilling

Over-drilling is the technique used to physically remove an entire monitoring well, its sand pack and the old grout column and fill. In situations where PVC screens and risers are expected to sever and removal of all well materials is required, over-drilling will be required. Over-drilling is called for when a riser can’t be pulled and it penetrates a confining layer. Compared to the other procedures, over-drilling is the least common method of well decommissioning.

A "temporary casing" may be necessary when extraordinary conditions are present, such as a high concentration of mobile contaminants in the overburden, depth to water is shallow, there is poor construction documentation or shoddy construction practices. The approach involves installing a large diameter steel casing around the outside of the well followed by drilling / pulling /grouting within this casing. The casing is withdrawn at the end of pulling, grouting and (perhaps) drilling. If the confining layer is less than 5 feet thick, the casing should be installed to the top of the confining layer. Otherwise, it is installed to a depth of 2 feet below the top of the confining layer. After the outer casing has been set, the well can be removed and grouted through pulling if possible or removed and grouted by drilling inside the casing.

Over-drilling is used where casing pulling is determined to be unfeasible, or where installation of a temporary casing is necessary to prevent cross-contamination, such as when a confining layer is present and contamination in the deeper aquifer could migrate to the upper aquifer as the well is pulled. The over-drilling method should:

- Follow the original well bore;
- Create a borehole of the same or greater diameter than the original boring; and
- Remove all of the well construction materials.

In over-drilling the difficulty lies in keeping the augers centered on the old well as the bit is lowered; it will tend to wander off. As a precaution, the well column should be filled with grout before over-drilling. Then without allowing the grout to dry, the driller proceeds with over-drilling the well. Grouting first guarantees that if the drill wanders off the old well and the effort is less than 100% successful, the remaining well portion will at least have been grouted. There are many methods for over-drilling. Please note that the following methods are not suitable for all types of casing, and the advice of an experienced driller should be sought.

- Conventional augering (i.e., a hollow stem auger fitted with a pilot bit). The pilot bit will grind the well construction materials, which will be brought to the well surface by the auger.
- A conventional cable tool rig to advance “temporary” casing having a larger diameter than the original boring. The cable tool kit is advanced within the casing to grind the well construction materials and soils, which are periodically removed with large diameter bailer. This method is not applicable to bedrock wells.

- An over-reaming tool with a pilot bit nearly the same size as the inside diameter of the casing and a reaming bit slightly larger than the original borehole diameter. This method can be used for wells with steel casings.

- A hollow-stem auger with outward facing carbide cutting teeth having a diameter two to four inches larger than the casing.

Prior to over-drilling, the bottom of the well should be perforated or cut away, and the casing filled with grout as with casing removal by pulling.

In all cases above, over-drilling should advance beyond the original bore depth by a distance of half a foot to ensure complete removal of the construction materials. Oversight attention should be focused on the drill cuttings, looking for fragments of well materials. Absence of these indicators is a sign that the drill has wandered off the well. If wandering is suspected, having previously filled the well with grout, the remaining portion which cannot be over-drilled can be considered grouted in-place. When the over-drilling is complete, grout should be tremied within the annular space between the augers and well casings. The grout level in the borehole should be maintained as the drilling equipment and well materials are sequentially removed. As with all the other methods, the upper five feet of borehole should be restored according to the procedures in Section 7.

3.0 SELECTION PROCESS AND IMPLEMENTATION

The decommissioning procedure selection flow chart, Figure 2, is to be used to select decommissioning methods. The selection process first identifies the basic monitoring well type. There are only two types of monitoring wells described in this guidance, overburden wells and bedrock wells. Bedrock wells typically have an overburden portion which in the selection process is to be treated as an overburden well. Techniques are specified for wells based upon their type and the other physical conditions present. Decommissioning techniques called for by the selection process have their practical limits; construction details dictate when a well stem can be pulled without breaking and when it cannot be pulled. The DEC project manager has the discretion to deviate from the flow chart, (Figure 2), based on site conditions, budgetary concerns and professional judgment. The remainder of this section will discuss types of monitoring wells in various settings along with recommended decommissioning techniques.

3.1 Bedrock Wells

Referring to Figure 2 and Section 2.1, if the well extends into bedrock, the rock hole portion of the well is to be grouted in-place to the top of the rock. The grout mix, however, may vary according to the conditions. A thicker grout may be required to fill voids and a thinner grout may be necessary to penetrate well screen and sand pack. Refer to the grout mixture specifications given in Section 6.1 and 6.2.

Prior to grouting, the depth of the well will be measured to determine if any silt or debris has plugged the well. If plugging has occurred, all reasonable attempts to clear it should be made before grouting. The borehole will then be tremie grouted according to Section 6.4 from the bottom of the well to the top of bedrock to ensure a continuous grout column.

After the rock hole is grouted, the overburden portion of the well is decommissioned using appropriate techniques described below. If the bedrock extends to the ground surface, grouting can extend to the ground surface or to slightly below so that the site can be restored as appropriate in accordance with Section 7.

3.2 Uncontaminated Overburden Wells

For overburden wells and the overburden portion of bedrock wells, the first factor in determining the decommissioning method is whether the overburden portion of the well exhibits contamination, as determined through historical groundwater and/or soil sampling results. If the overburden is uncontaminated, the next criteria considers whether the well penetrates a confining layer. In the case that the overburden portion of the well does not penetrate a confining layer, the casing can either be tremie-grouted and pulled or tremie grouted and left in place. As a general rule, PVC wells greater than 25-feet deep should not be pulled unless site-specific conditions or other factors indicate that the well can be pulled without breaking. If the well cannot be pulled, the well should be grouted in-place as accordance with Sections 2.1 and 2.2.

If a non-telescoped overburden well penetrates a confining layer, the casing should be removed by pulling (if possible) in accordance with Section 2.3. If the casing cannot be removed by pulling, the well should be grouted in-place or where complete removal is required, removed by over-drilling. Over-drilling will be based upon the site-specific conditions and requirements. If pulling is attempted and fails (i.e., a portion of the riser breaks) the remaining portion of the well should be removed by using the conventional augering procedure identified in Section 2.4. Note that if the riser is broken during pulling, it is highly unlikely that the driller will be able to target it to over-drill it. This is the reason why all wells should be grouted first. In all cases, after the well construction materials have been removed to the extent possible, the borehole will be grouted in accordance with Section 6 and the upper five feet will be restored in accordance with Section 7.

3.3 Contaminated Overburden Monitoring Wells/Piezometers

Contamination in the overburden plays a role in the selection process. Any contamination present in the overburden must not be allowed to spread as a result of the decommissioning construction. For wells and piezometers suspected or known to be contaminated with light non-aqueous phase liquid (LNAPL) and/or dense non-aqueous phase liquid (DNAPL), often referred to as "product," the decision to decommission the well should be reviewed. Such gross contamination is a special condition and requires design of the decommissioning procedure. If decommissioning is determined to be the proper course of action, measurement of the non-aqueous phase liquid volume will be determined and this liquid will be removed.

If an overburden well (or the overburden portion of a bedrock well) is contaminated with LNAPL, DNAPL and /or dissolved fractions as indicated by historical sampling results, one must evaluate the potential for contamination to cross an overburden confining layer (if one exists) during decommissioning. A rock or soil horizon of very low permeability is known as a confining layer. Contamination in the overburden lying above a confining layer is a significant condition to recognize. To prevent mobile contaminants from crossing a confining layer during pulling or over-drilling, a temporary casing should be installed to isolate the work zone. One should follow the procedure selection flow chart. Some contaminated conditions call for over-drilling or a specially designed procedure.

A well in contaminated overburden may be grouted in-place as long as the grout fully seals the well and boring zone. If a well in contaminated overburden was constructed allowing formation collapse as annular backfill or if the well has a compromised well seal, one must either physically remove the well or thoroughly perforate the riser and grout it in-place.

If physical removal of the well is required and the overburden contaminants are likely to be dragged upward or downward during decommissioning, a temporary casing should be used to seal off the construction work zone. Casing pulling and overdrilling can be safely accomplished within the temporary casing. Section 2.4 discusses the temporary casing technique.

3.4 Telescoped Riser

If the riser is telescoped in one or more outer casings, the decommissioning approach depends upon the integrity of the well seal. If there is no evidence that the well seal integrity is compromised, the riser should be grouted in-place in accordance with Sections 2.1 or 2.2 and the upper 5 feet of the well surface should be restored in accordance with Section 7. If indications are that the well seal is not competent, it will be necessary to design and implement a special procedure to perforate and grout or remove the well construction materials. The presence and configuration of the outer casing(s) will be specific in the individual wells and will be a key factor in the decommissioning approach. The special procedure must mitigate the potential for cross-contamination during removal of the well construction materials.

4.0 LOCATING AND SETTING-UP ON THE WELL

Prior to mobilizing to decommission a monitoring well, one should notify the property owner and/or other interested parties including the governing regulatory agency. It is advisable that when at the well location, one should review the proposed well decommissioning procedure. Verify well locations and identification by their identifying markers and GPS coordinates. Lastly, verify the depth of each well with respect to depth recorded on the well construction log.

5.0 REMOVING THE PROTECTIVE CASING

Most monitoring wells installed in non-traffic locations are finished with an elevated, protective casing (guard pipe) and a concrete rain pad. Wells at gasoline stations, usually being in high-traffic areas, are typically finished with a flush-mount, curb box and protective 8" dia steel inspection plate rather than a stick-up riser. The curb box is usually easily removed from around the flush-mount well before pulling or over-drilling. In the case of stick-up wells, the riser pipe may be bonded to the guard pipe and rain pad. When the protective casing and concrete pad of a stick-up monitoring well are "yanked out," a PVC riser will typically break off at the bottom of the guard pipe several feet below grade. Once this happens, it may become impossible to center a drill rig upon the well. The riser may become splintered and structurally unstable for pulling. Unless grouted first, the well may fill with dirt. Before pulling a casing or over-drilling a well, a method must be devised for removing these protective surface pieces without jeopardizing the remaining decommissioning effort.

Generally, unless the protective casing is loose and can be safely lifted off by hand, *one* *should fill the monitoring well with grout before removing the outer protective casing.* This will ensure that the well is properly sealed regardless of any problems later when removing the protective casing. Remove the protective casing or road box vault initially only if the stick-up or vault will interfere with subsequent down-hole work which must be done before grouting. This down-hole work may include puncturing, perforating or cutting the screen or riser. But as a general procedure don't remove the protective casing or road box until after initial grouting is complete.

The procedure for removing the protective casing of a well depends upon the decommissioning method specified for the monitoring well. The variety of protective casings available preclude developing a specific removal procedure but often one can simply break up the concrete seal surrounding the casing and jack or hoist the protective casing out of the ground. A check should be made during pulling to ensure that the inner well casing is not being hoisted with the protective casing. If this occurs, the well casing should be cut off after the base of the protective casing is lifted above the land surface. At well locations where the riser has been extended, the burial of a previous concrete pad may require the excavation of soil to the top of the concrete pad to remove the well.

Steel well casing should be removed approximately five feet below the land surface so as to be below the frost line and out of the way of any subsequent shallow digging. The upper five feet of casing and the protective casing can be removed in one operation if a casing cutter is used.

Waste handling and disposal must be consistent with the methods used for the other well materials unless an alternate disposal method can be employed (i.e., steam cleaning followed by disposal as non-hazardous waste).

6.0 SELECTING, MIXING, AND PLACING GROUT

This section gives recipes for the “standard grout mixture” and the thicker “special grout mixture.” Mixing and placing grout is also discussed in this section. The goal of well decommissioning is to eliminate the capability of water to travel up or down within the volume of the former well and its boring. Success depends upon the correct grout mixture and placement where it is needed. There are two types of grout mixes that may be used to seal monitoring wells: a standard mix and a special mix. Both mixes use Type 1 Portland cement and four percent bentonite by weight. However, the special mix uses a smaller volume of water and is used in situations where excessive loss of the standard grout mix is possible (e.g., highly-fractured bedrock or coarse gravels).

6.1 Standard Grout Mixture

For most boreholes, the following standard mixture will be used:

- One 94-pound bag Type I Portland cement;
- 3.9 pounds powdered bentonite; and
- 7.8 gallons potable water.

Slightly more water may be used in order to penetrate a sand pack when a well screen transects multiple flow zones. This mixture results in a grout with a bentonite content of four percent by weight and will be used in all cases except in boreholes where excessive use of grout is anticipated. In these cases a special thicker mixture will be used.

6.2 Special Mixture

In cases where excessive use of grout is anticipated, such as high permeability formations and highly fractured or cavernous bedrock formations, the following special mixture will be used:

- one 94-pound bag type I Portland cement;
- 3.9 pounds powdered bentonite;
- 1 pound calcium chloride; and
- 6.0-7.8 gallons potable water (depending on desired thickness).

The special mixture results in a grout with a bentonite content of four percent by dry weight. It is thicker than the standard mixture because it contains less water. This grout is expected to set faster than the Standard Grout Mixture due to the added calcium chloride. The least amount of water that can be added for the mixture to be readily pumpable is 6 gallons per 94-pound bag of cement.

6.3 Grout Mixing Procedure

To begin the grout-mixing procedure, calculate the volume of grout required to fill the borehole. If possible, the mixing basin should be large enough to hold all of the grout necessary for the borehole.

Mix grout until a smooth, homogeneous mixture is achieved. Grout can be mixed manually or with a mechanized mixer. Colloidal mixers should not be used as they tend to excessively decrease the thickness of the grout for the above recipes.

6.4 Grout Placement

This guidance requires that grout be placed in the well from the bottom to the top by means of a "tremie." A tremie is a pipe, a hose or a tube extending from the grout supply to the bottom of the well. The tremie delivers the grout all the way down through the water column without its being diluted and mixed with the water that may be present in the well. The tremie pipe or tube is withdrawn as (or after) the well is filled with grout.

Using the tremie, grout is placed in the borehole filling from the bottom to the top. Two-inch and larger wells should use tremie tubing of not less than 1-inch diameter. Smaller diameter wells will call for a smaller tremie pipe. Grout will then be pumped in until the grout appears at the land surface (when grouting open holes in bedrock, the grout level only needs to reach above the bedrock surface). Any groundwater displaced during grout placement, if known to be contaminated, will be contained for proper disposal.

At this time the rate of settling should be observed. If grouting the well in place, the well casing remains in the hole. But if the decommissioning method has involved down-hole tools such as hollow-stem augers or temporary casing for overdrilling, these will be removed from the hole. As each section is removed, grout will be added to keep the level between 0 and 5 feet below grade. If the grout level drops below the land surface to an excessive degree, an alternate grouting method must be used. One possibility is to grout in stages; i.e., the first batch of grout is allowed to partially cure before a second batch of grout is added.

As previously described in Section 5.0, the outer protective casing "stick-up" should be removed only after a well has been properly filled with grout. This will ensure that the well is properly sealed regardless of any breakage which may occur when removing the stick-up. It is important to reiterate that when either casing pulling or over-drilling are required, due to the uncertainty of successfully pulling a well or over-boring a well, we insist that the driller tremie grout the well first. Then without allowing the grout to dry, the driller proceeds with pulling the casing or over-drilling the well.

Upon completion of grouting, ensure that the final grout level is approximately five feet below land surface. A ferrous metal marker will be embedded in the top of the grout to indicate the location of the former monitoring well. Lastly, a fabric "utility" marking should be placed one foot above the grout so an excavator can see it clearly.

7.0 BACKFILLING AND SITE RESTORATION

The uppermost five feet of the borehole at the land surface should be filled with material physically similar to the natural soils. The surface of the borehole should be restored to the condition of the area surrounding the borehole. For example, concrete or asphalt will be patched with concrete or asphalt of the same type and thickness, grassed areas will be seeded, and topsoil will be used in other areas. All solid waste materials generated during the decommissioning process must be disposed of properly.

8.0 DOCUMENTATION

A form which may be used in the field to record the decommissioning construction is included as Figure 3. Additional documentation may be required by a DEC project manager and samples are included in Appendix A. Programs within the DEC that maintain geographic data on monitoring wells strive to keep that data up to date. Owners of these data sets must be notified when a well is decommissioned. Historical groundwater quality data is linked to monitoring well locations so when a well is decommissioned, existing GIS data must be updated to reflect that fact but the coordinate location in the GIS database should not be eliminated. A metal detector may not be able to detect a deeply buried marker so if this locator is important for future utility runs or foundations, a map should be submitted to the property owner and the town engineer showing the decommissioned well locations. Global Positioning System (GPS) coordinates should be indicated on this map. Lastly, whatever documentation is produced should be provided to the property owner, the DEC, and all other parties involved.

9.0 FIELD OVERSIGHT

Over-drilling requires careful observation to detect whether the drill has wandered off the well. Grout preparation and tremie work should be carefully observed. The successful implementation of a decommissioning work plan depends upon proper direction, observation and oversight. Methods to be employed must be clearly worked through and all parties must understand what they have to do before going into the field. Flexibility is allowed where necessary but the work effort must be thorough and effective to protect our groundwater.

10.0 RELATED REFERENCES

- *Groundwater Monitoring Well Decommissioning Procedures*, October 1986. Prepared by Malcolm Pirnie, Inc., for the New York State Department of Environmental Conservation, Division of Environmental Remediation.

- American Society for Testing and Materials, A.S.T.M. D 5299-99, Standard Guide for the Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities. A.S.T.M.. Philadelphia. 2005.

- New York State Department of Environmental Conservation, Division of Solid and Hazardous Materials, 6 NYCRR Part 360, Solid Waste Management Facilities.

- New York State Department of Environmental Conservation, Region I - Water Unit, Specifications for Abandoning Wells and Boreholes in Unconsolidated Materials, undated.

- United States Environmental Protection Agency, The Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells, EPA 600/4-89/034.

FIGURES

FIGURE 1 - MONITORING WELL FIELD INSPECTION LOG

FIGURE 2 - DECOMMISSIONING PROCEDURE SELECTION

FIGURE 3 - WELL DECOMMISSIONING RECORD

APPENDICES

APPENDIX A - REPORTS

- APPENDIX A1 - INSPECTOR'S DAILY REPORT
- APPENDIX A2 - PROBLEM IDENTIFICATION REPORT
- APPENDIX A3 - CORRECTIVE MEASURES REPORT

[Page Intentionally Left Blank]

FIGURE 1

MONITORING WELL FIELD INSPECTION LOG

FIGURE 1

SITE NAME:

SITE ID.: ______
INSPECTOR: ______
DATE/TIME: ______
WEll ID.: ______

MONITORING WELL FIELD INSPECTION LOG
NYSDEC WELL DECOMMISSIONING PROGRAM

	YES	NO
WELL VISIBLE? (If not, provide directions below)		
WELL I.D. VISIBLE?		
WELL LOCATION MATCH SITE MAP? (if not, sketch actual location on back)		

WELL I.D. AS IT APPEARS ON PROTECTIVE CASING OR WELL:

	YES	NO
SURFACE SEAL PRESENT?		
SURFACE SEAL COMPETENT? (If cracked, heaved etc., describe below)		
PROTECTIVE CASING IN GOOD CONDITION? (If damaged, describe below)		

HEADSPACE READING (ppm) AND INSTRUMENT USED ______
TYPE OF PROTECTIVE CASING AND HEIGHT OF STICKUP IN FEET (If applicable) ______
PROTECTIVE CASING MATERIAL TYPE: ______
MEASURE PROTECTIVE CASING INSIDE DIAMETER (Inches):

	YES	NO
LOCK PRESENT?		
LOCK FUNCTIONAL?		
DID YOU REPLACE THE LOCK?		
IS THERE EVIDENCE THAT THE WELL IS DOUBLE CASED? (If yes,describe below)		
WELL MEASURING POINT VISIBLE?		

MEASURE WELL DEPTH FROM MEASURING POINT (Feet): ______
MEASURE DEPTH TO WATER FROM MEASURING POINT (Feet): ______
MEASURE WELL DIAMETER (Inches): ______
WELL CASING MATERIAL: ______
PHYSICAL CONDITION OF VISIBLE WELL CASING: ______
ATTACH ID MARKER (if well ID is confirmed) and IDENTIFY MARKER TYPE ______
PROXIMITY TO UNDERGROUND OR OVERHEAD UTILITIES ______

DESCRIBE ACCESS TO WELL: (Include accessibility to truck mounted rig, natural obstructions, overhead power lines, proximity to permanent structures, etc.); ADD SKETCH OF LOCATION ON BACK, IF NECESSARY.

DESCRIBE WELL SETTING (For example, located in a field, in a playground, on pavement, in a garden, etc.) AND ASSESS THE TYPE OF RESTORATION REQUIRED.

IDENTIFY ANY NEARBY POTENTIAL SOURCES OF CONTAMINATION, IF PRESENT (e.g. Gas station, salt pile, etc.):

REMARKS:

FIGURE 2

DECOMMISSIONING PROCEDURE SELECTION

NYSDEC Monitoring Well Decommissioning Procedure Selection

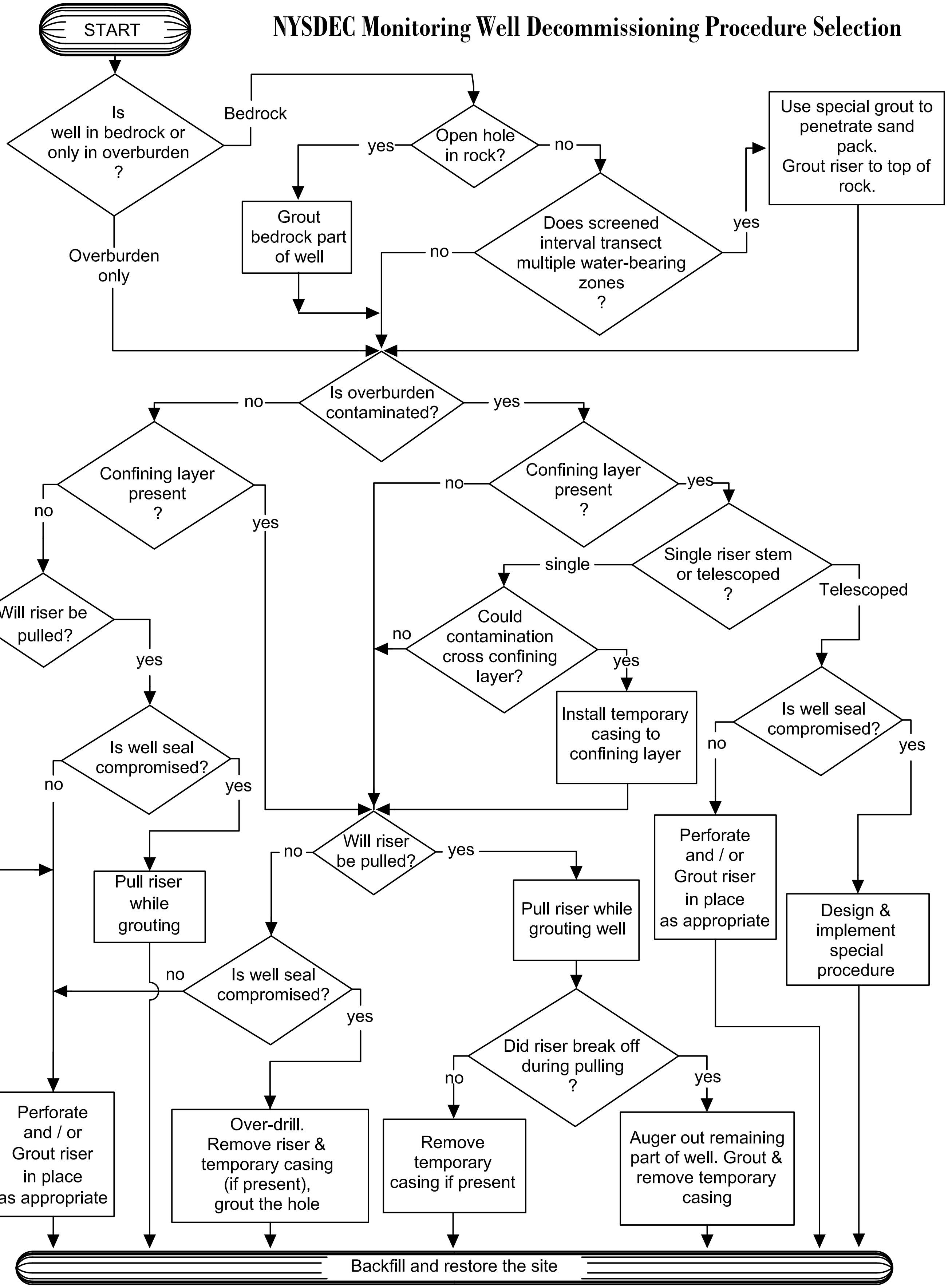


FIGURE 2

FIGURE 3

WELL DECOMMISSIONING RECORD

FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name:	Well I.D.:
Site Location:	Driller:
Drilling Co.:	Inspector:
	Date:

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	

CASING PULLING

Method employed	
Casing retrieved (feet)	
Casing type/dia. (in)	

CASING PERFORATING

Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	

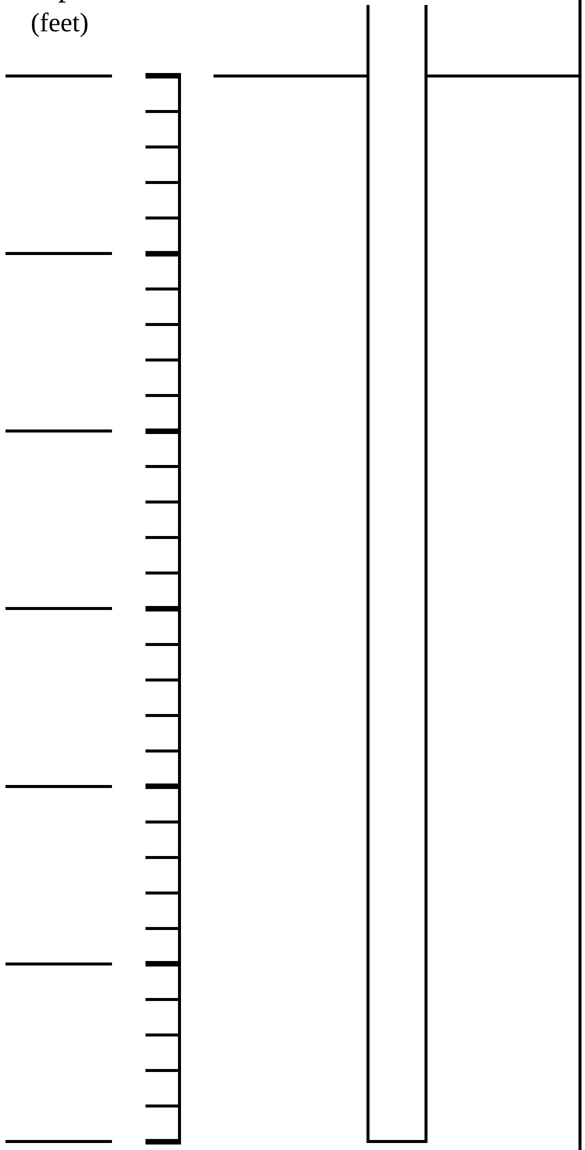
GROUTING

Interval grouted (FBLS)	
# of batches prepared	

For each batch record:

Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



COMMENTS:

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

APPENDIX A - REPORTS

APPENDIX A1 - INSPECTOR'S DAILY REPORT

APPENDIX A2 - PROBLEM IDENTIFICATION REPORT

APPENDIX A3 - CORRECTIVE MEASURES REPORT

[Page Intentionally Left Blank]

Appendix A1

Inspector's Daily Report

CONTRACTOR:
ADDRESS:

TELEPHONE:
LOCATION ____________________ FROM ____________ TO ____________
WEATHER ____________________ TEMP ________ A.M. ________ P.M. ________ DATE ____________

CONTRACTOR'S WORK FORCE AND EQUIPMENT

DESCRIPTION	*H*	*#*	*DESCRIPTION*	*H*	*#*	*DESCRIPTION*	*H*	*#*	*DESCRIPTION*	*H*	*#*
Field Engineer						Equipment			Front Loader Ton		
Superintendent			Ironworker			Generators			Bulldozer		
						Welding Equip.					
Laborer Foreman			Carpenter								
Laborer									Backhoe		
Operating Engineer			Concrete Finisher								
Carpenter						Paving Equip. & Roller					
						Air compressor					

SEE REVERSE SIDE FOR SKETCH YES ☐ NO ☐

WORK PERFORMED:

PAY ITEMS

CONTRACT		STA		DESCRIPTION	QUANTITY	REMARKS
Number	ITEM	FROM	TO			

TEST PERFORMED:
PICTURES TAKEN:

VISITORS:

QA PERSONNEL
SIGNATURE

REPORT NUMBER
SHEET ________ Of ________

[Page Intentionally Left Blank]

PROBLEM IDENTIFICATION REPORT

Date ____________________

Day	Su	M	T	W	Th	F	Sa

Project ____________________ Job Number__________

Contractor ______________________________

Subject ______________________________

Sky/Precip.	Clear	Partly Cloudy	Cloudy	Rainy	Snow
TEMP.	<32F	32-40F	40-70F	70-80F	80-90F
WIND	No	Light	Strong		
HUMIDITY	Dry	Mod.	Humid		

PROBLEM DESCRIPTION Reference Daily Report Number 1: ____________________

PROBLEM LOCATION - REFERENCE TEST RESULTS AND LOCATION (Note: Use sketches on back of form as appropriate):

PROBABLE CAUSES: ____________________

SUGGESTED CORRECTIVE MEASURES: ____________________

APPROVALS:

QA ENGINEER: ____________________

PROJECT MANAGER: ____________________

Distribution:

1. Project Manager
2. Field Office
3. File
4. Owner

QA Personnel
Signature: ____________________

MEETINGS HELD AND RESULTS

REMARKS

REFERENCES TO OTHER FORMS

SKETCHES

SAMPLE LOG

SAMPLE NUMBER

APPROXIMATE LOCATION OF STOCKPILE

NUMBER OF STOCKPILE

DATE OF COLLECTION

CLIMATIC CONDITIONS

FIELD OBSERVATION

SHEETS OF

Appendix A3

CORRECTIVE MEASURES REPORT

Date ______________________

Day

Su	M	T	W	Th	F	Sa

Project ______________________ **Job Number** __________

Contractor ______________________

Subject ______________________

Sky/Precip.	Clear	Partly Cloudy	Cloudy	Rainy	Snow
TEMP.	<32F	32-40F	40-70F	70-80F	80-90F
WIND	No	Light	Strong		
HUMIDITY	Dry	Mod.	Humid		

CORRECTIVE MEASURES TAKEN (Reference Problem Identification Report No.): ______________________

RETESTING LOCATION: ______________________

SUGGESTED METHOD OF MINIMIZING RE-OCCURRENCE: ______________________

SUGGESTED CORRECTIVE MEASURES: ______________________

APPROVALS:

QA ENGINEER: ______________________

PROJECT MANAGER: ______________________

Distribution:

1. Project Manager
2. Field Office
3. File
4. Owner

QA Personnel
Signature: ______________________

Section 5

SAMPLE COLLECTION AND FIELD SCREENING (SC)

SUMMARY GUIDANCE

SC-001 General Guidance on Sample Collection

---

1. Overview

The primary objective of all sampling activities is to characterize a site accurately so that its impact on human health and the environment can be properly evaluated. It is only through sampling and analysis that site hazards can be measured and the job of cleanup and restoration can be accomplished effectively with minimal risk. The sampling itself must be conducted so that every sample collected retains its original physical form and chemical composition. In this way, sample integrity is insured, quality assurance standards are maintained, and the sample can accurately represent the larger body of material under investigation. The extent to which valid inferences can be drawn from a sample depends on the degree to which the sampling effort conforms to the project's objectives. For example, one sample may produce adequate, technically valid data to address the project's objectives. Meeting the project's objectives requires thorough planning of sampling activities, and implementation of the most appropriate sampling and analytical procedures.

2. Sample Purposes

In relation to the media to be sampled, two basic types of samples can be considered:

2.1. Waste Characterization Sample

Hazardous or concentrated samples are those collected from drums, tanks, lagoons, pits, waste piles, soil, groundwater, soil vapor, fresh spills, or areas previously identified as contaminated, and require special handling procedures because of their potential toxicity or hazard. These samples can be further subdivided based on their degree of hazard; however, care should be taken when handling and shipping any wastes believed to be concentrated regardless of the degree.

2.2. Environmental sSample

Environmental samples are those collected from streams, ponds, lakes, wells, and are off-site samples that are not expected to be contaminated with hazardous materials. They usually do not require the special handling procedures typically used for concentrated wastes. However, in certain instances, environmental samples can contain elevated concentrations of pollutants and in such cases would have to be handled as hazardous samples.

The importance of making the distinction between environmental and hazardous samples is two-fold:

- Personnel safety requirements: Any sample thought to contain enough hazardous materials to pose a safety threat should be designated as hazardous and handled in a manner which ensures the safety of both field and laboratory personnel.
- Transportation requirements: Hazardous samples must be packaged, labeled, and shipped according to the International Air Transport Association (lATA) Dangerous Goods Regulations or the Department of Transportation (DOT) regulations and U.S. Environmental Protection Agency (EPA) guidelines.

3. Sample Collection Techniques

In general, two basic types of sample collection techniques are recognized, both of which can be used for either environmental or hazardous samples.

3.1. Grab Samples

A grab sample is defined as a discrete aliquot representative of a specific location at a given point in time. The sample is collected all at once at one particular point in the sample medium. The representativeness of such samples is defined by the nature of the materials being sampled. In general, as sources vary over time and distance, the representativeness of grab samples will decrease.

3.2. Composite Samples

Composites are non-discrete samples composed of more than one specific aliquot collected at various sampling locations and/or different points in time. Analysis of this type of sample produces an average value and can in certain instances be used as an alternative to analyzing a number of individual grab samples and calculating an average value. It should be noted, however, that compositing can mask problems by diluting isolated concentrations of some hazardous compounds below detection limits. Compositing of hazardous waste is often performed after compatibility tests have been completed to determine an average value over a number of different locations (group of drums). This procedure generates data that can be useful by providing an average concentration within a number of units, can serve to keep analytical costs down, and can provide information useful to transporters and waste disposal operations.

For sampling situations involving hazardous wastes, grab sampling techniques are generally preferred because grab sampling minimizes the amount of time sampling personnel must be in contact with the wastes, reduces risks associated with compositing unknowns, and eliminates chemical changes that might occur due to compositing.

3.3. Types of Sampling Strategies

The number of samples that should be collected and analyzed depends on the objective of the investigation. There are three basic sampling strategies: random, systematic, and judgmental sampling.

- Random sampling involves collection of samples in a nonsystematic fashion from the entire site or a specific portion of a site.
- Systematic sampling involves collection of samples based on a grid or a pattern which has been previously established.
- When judgmental sampling is performed, samples are collected only from the portions) of the site most likely to be contaminated.

Often, a combination of these strategies is the best approach depending on the type of the suspected/known contamination, the uniformity and size of the site, the level/type of information desired, etc.

4. Sample Hold Time, Container, and Preservation Methods

The following table provides general required Holding Time, Container, and Preservation Methods. Most of the information is specific to the EPA analytical method and should be pertinent to all sampling schemes. However, some analytical preservation and analytical methods are state specific. The QAPP should clearly identify preservation methods and hold times prior to sampling.

Samples should be submitted to the laboratory as soon as possible. It is preferable to send samples from the field via courier service rather than bringing to the office for later pickup.

Aqueous

Parameter	Holding Time	Container	Volume	Preservative
Acidity	14 days	P, G	100 ml	Cool, 4°C
Alkalinity	14 days	P, G	100 ml	Cool, 4°C
Biological Oxygen Demand (BOD)	48 hours	P, G	1000 ml	Cool, 4°C
Chemical Oxygen Demand (COD)	28 days	P, G	100 ml	Cool, 4°C, H_2SO_4 to pH<2
Chloride	28 days	P, G	100 ml	Cool, 4°C
Chromium, Hexavalent	24 hours	P, G	250 ml	Cool, 4°C
Cyanide				
Amenable	14 days[1]	P, G	500 ml	Cool, 4°C, NaOH to pH>12
Free	14 days[1]	P, G	500 ml	Cool, 4°C, NaOH to pH>12
Total	14 days[1]	P, G	500 ml	Cool, 4°C, NaOH to pH>12
Fluoride	28 days	P	100 ml	Cool, 4°C
Hardness, Total	6 months	P, G	100 ml	HNO_3 to pH<2
Metals (except Cr+6, Hg)	6 months	P	500 ml	Cool, 4°C, HNO_3 to pH<2
MBAS	48 hours	G	500 ml	Cool, 4°C
Mercury	28 days	P, G	500 ml	HNO_3 to pH<2
N, Ammonia	28 days	P, G	100 ml	H_2SO_4 to pH<2
N, T. Kjeldahl	28 days	P, G	500 ml	H_2SO_4 to pH<2
N, Nitrate	48 hrs/ 28 days preserved	P, G	100 ml	Cool, 4°C or add H_2SO_4 to pH<2
N, Nitrite	48 hours	P, G	100 ml	Cool, 4°C
Oil and Grease	28 days	G	1000 ml	Cool, 4°C, H_2SO_4 or HCl to pH<2
Petroleum Hydrocarbons	14 days	G	1000 ml	Cool, 4°C, H_2SO_4 to pH<2
pH	Analyze Immediately	P, G	50 ml	N/A
Phenols,Recoverable	28 days	G	500 ml	Cool, 4°C, H_2SO_4 to pH<2
Phosphorus, Ortho	48 hours	P, G	100 ml	Filter, Cool, 4°C
Phosphorus, Total	28 days	P, G	100 ml	Cool, 4°C, H_2SO_4 to pH<2
Radiological Tests				
Alpha, Beta & Radium	6 months	P, G	4 L	Cool, 4°C, HNO_3 to pH<2
Solids, Total	7 days	P, G	100 ml	Cool, 4°C

Aqueous (cont)

Parameter	Holding Time	Container	Volume	Preservative
Solids, Total Dissolved	7 days	P, G	100 ml	Cool, 4°C
Solids, Total Suspended	7 days	P, G	100 ml	Cool, 4°C
Solids, Volatile Suspended	7 days	P, G	100 ml	Cool, 4°C
Sulfate	28 days	P, G	100 ml	Cool, 4°C
Total Organic Carbon	28 days	P, G	100 ml	Cool, 4°C, H_2SO_4 to pH<2
Halogenated Volatiles	14 days	40 ml vials	2x40 ml	Cool, 4°C3
Purgeable Aromatics	14 days[4]	40 ml vials	2x40 ml	Cool, 4°C, HCl to pH<2
Phenols by GC/MS	7 days/40 days[5]	G	1 L	Cool, 4°C
Pesticides/PCBs	7 days/40 days[5]	G	1 L	Cool, 4°C
Polynuclear Aromatics	7 days/40 days[5]	G	1 L	Cool, 4°C
Acid/Base-Neutral Extractables	7 days/40 days[5]	G	1 L	Cool, 4°C

Solid

Parameter	Holding Time	Container	Volume	Preservative
Metals (except Hg)	6 months	P, G	100 g	Cool, 4°C
Mercury	28 days	P, G	100 g	Cool, 4°C
Halogenated Volatile Organics	14 days	G	10 g/10 ml methanol, 10 g/10 Ml DI water	Methanol and deionized water preserved in field[6]
Halogenated Volatile Organics	14 days	Encore Samplers	Three 5 gram samples	Must be frozen within 48 hours
Purgeable Aromatics	14 days	G	10 g/10 ml methanol, 10 g/10 Ml DI water	Methanol and deionized water preserved in field[6]
Phenols	14 days/40 days[5]	G	100 g	Cool, 4°C
Pesticides/PCBs	14 days/40 days[5]	G	100 g	Cool, 4°C
Polynuclear Aromatics	14 days/40 days[5]	G	100 g	Cool, 4°C
Acid/Base-Neutral Extractables	14 days/40 days[5]	G	100 g	Cool, 4°C

NOTES:
P = Plastic
G = Glass

Holding times in red indicate 48 hours or less holding times.

1. If residual chlorine is present, add 0.6 gm. ascorbic acid.

2. Maximum holding time is 24 hours when sulfide is present. Test with lead acetate paper prior to pH adjustment. Remove sulfide with addition of lead nitrate until a negative spot test is obtained. Filter and add NaOH to pH>12.

3. If samples contain residual chlorine, add 0.008% sodium thiosulfate at the time of sampling.

4. With pH adjustment; without, holding time is 7 days.

5. Seven days prior to extraction. Samples must be analyzed within 40 days after extraction.

6. Encore samplers may be used, but must be received in lab and extracted within 48 hours.

5. References

DER-10, Technical Guidance for Site Investigation and Remediation. New York State Department of Environmental Conservation. May 3, 2010.

Analytical Service Protocol, New York State Department of Environmental Conservation. July 2005.

New Jersey Department of Environmental Protection, Field Sampling Procedures Manual, August 2005.

Connecticut Department of Environmental Protection, Guidance for Collecting and Preserving Soil and Sediment Samples for Laboratory.

Determination of Volatile Organic Compounds, Version 2.0 February 28, 2006.

STANDARD OPERATING PROCEDURE

SC-002 Sample Handling

---

1. Objective

Sample handling involves the collection and shipping of environmental samples to a laboratory for chemical analysis. The overall objective of sample handling is to ensure that samples are properly:

- labeled and documented;
- preserved;
- packaged; and
- transported to laboratories.

2. Execution

- Prior to mobilizing to the field, select a shipper or arrange for a courier for sample delivery to the laboratory. If using a shipper (i.e., FedEx, or UPS) determine the time constraints for pickup requests, the location and hours of the nearest shipping office, and any size/weight restrictions.
- Label all laboratory glassware with waterproof ink prior to collecting the respective samples. The label should have an adhesive and be placed on the jar or bottle, not on the cap.
- Record the following information on the label and in the field notebook (see *Field Notebook* SOP FD-001): project number, sample identification (i.e., MW201 or SS-2), date, and time (military time) of collection, sampler's initials, and preservative, if present.
- If sample jars are not pre-preserved, add preservative as appropriate.
- At each sampling location, samples must be collected in order of volatility, most volatile first. Samples collected for volatile analysis must be placed in sample containers immediately upon retrieval of the sample.
- Aqueous samples for volatile analysis must be collected without air bubbles. Soil samples for volatile analysis should be compacted to eliminate as much headspace as possible. Other laboratory glassware should also be filled when possible. Care must be taken to avoid getting soils on the threads of sample jars, which can cause a faulty seal.
- If compositing of samples is performed in the field, specify basis for composite (i.e., volume, weight, spoon recovery, etc.) and record procedure for compositing sample in the field book.
- Once samples have been collected, place samples in a cooler with ice or a blue pack and start the chain of custody (COC) form (SOP FD-003, *Sample Handling and Chain of Custody*).

- For shipping, individually wrap each sample bottle with bubble packing or suitable packing material and place the wrapped bottles in the cooler with sufficient packing material between samples to avoid breakage.
- Place a layer of packing material above and below the sample bottles. Place blue ice packs or ice bags on top of the packing material. Fill the remaining space in the cooler with packing material to eliminate the possibility of vertical movement of samples.
- Place the completed and signed COC form in a plastic bag and place on top of the packing material in the cooler.
- Fill out the appropriate shipping or courier forms and attach to the top of the cooler. If necessary, place the proper shipping labels on the cooler. Have the courier sign the COC form (or write pickup by FedEx, UPS, etc., with date and time). Place a custody seal on the cooler.
- All samples should be submitted as soon as possible. It is preferable for samples to be mailed prior to returning to the office.
- A copy of the waybills must be kept by the field supervisor to track shipments if necessary.

3. Notes

- At all times, follow safety procedures as defined in the site-specific Work Plan and Health and Safety Plan.
- Field personnel must be aware of analyses which have short holding times and schedule sampling events and shipping accordingly. Shipment of samples for analyses with short holding times must be planned in advance. Refer to the project work plan, quality assurance project plan, or state/federal regulations for holding time and preservative information.
- In general, glassware for aqueous samples contains preservatives, (i.e., HNO3, HCl, etc). When collecting the sample, take care not to overfill the container, thus flushing the preservative out of the bottle.
- Never composite samples for volatile organic compounds (VOCs) in the field. Collect individual aliquots and direct the laboratory to perform compositing.
- Collection of aqueous samples should not be performed over the opening of a monitoring well. Preservatives from overfilling or a marker pen or other objects could fall into the well.
- If the recharge volume for a monitoring well is low, completely fill all volatile vials and then collect the minimum sample volume required for each remaining analysis.
- During subsurface soil sampling, if the recovery from the split-spoon sample is inadequate, if appropriate, resample the bottom of the borehole to obtain proper sample volume.

- Laboratories will homogenize and test the contents of the sample container, unless directed otherwise. Samples should not contain rocks, twigs, leaves, etc., unless these materials are of interest.

4. References

DER-10, Technical Guidance for Site Investigation and Remediation. New York State Department of Environmental Conservation. May 3, 2010.

Analytical Service Protocol, New York State Department of Environmental Conservation. July 2005.

New Jersey Department of Environmental Protection, Field Sampling Procedures Manual, August 2005.

Connecticut Department of Environmental Protection, Guidance for Collecting and Preserving Soil and Sediment Samples for Laboratory.

Determination of Volatile Organic Compounds, Version 2.0 February 28, 2006.

5. Attachments

Attachment A – General Guidelines for selecting equipment on the basis of construction material and target analyte(s)

Table 2. General Guidelines for selecting equipment on the basis of construction material and target analyte(s)

[✔, generally appropriate for use shown; Si, silica; Cr, chromium; Ni, nickel; Fe, iron; Mn, manganese; Mo, molybdenum; CFC, chlorofluorocarbon; B, boron]

Construction material for sampling equipment		**Target analyte(s)**	
Material	**Description**	**Inorganic**	**Organic**
Plastics[1]			
Fluorocarbon ploymers[2] (other varies available for differing applications)	Chemically inert for most analytes	✔ (potential source of fluoride)	✔ (Sorption of some organics)
Polypropylene	Relatively inert for inorganic analytes	✔ (not appropriate for Hg)	**Do not use**
Polypropylene (linear)	Relatively inert for inorganic analytes	✔ (not appropriate for Hg)	**Do not use**
Polyvinyl chloride (PVC)	Relatively inert for inorganic analytes	✔ (not appropriate for Hg)	**Do not use**
Silicone	Very porous. Relatively inert for most inorganic analytes	✔ (potential source of Si)	**Do not use**
Metals			
Stainless steel 316 (SS 316)	SS-316-metal having the greatest corrosion resistance. Comes in various grades. Used for submersible pump casing.	✔ (Potential source of Cr, Ni, Fe, and possible Mn and Mo) **Do not use** for surface water unless encasted in plastic.	✔ Do not use if corroded[3]
Stainless steel 304	Similar to SS-316, but less corrosion resistant	**Do not use**	✔ Do not use if corroded[3]
Other metals: brass, iron, copper, aluminum, galvanized and carbon steels	Refrigeration-grade copper or aluminum tubing are used routinely for collection of CFC samples	**Do not use**	✔ Routinely used for CFCs Do not use if corroded[3]
Glass			
Glass, borosilicate (laboratory grade)	Relatively inert. Potential sorption of analytes	✔ **Do not use** for trace element analyses. Potential source of B and Si	✔

[1] Plastic used in connection with inorganic trace-element sampling should be uncolored or white. Tubing used for trace metal sampling should be cleaned by soaking in 5-10 percent HCl solution for 8-24 hours, rinsing with reagent water (metals free) and allowed to air dry in mercury-free environment. After drying, the tubing is doubled-bagged in clear polyethylene bags, serialized with a unique number, and stored until used.

[2] Fluorocarbon polymers include materials such as Teflon™, Kynar™, and Tefzel™ that are relatively inert for sampling inorganic or organic analytes. Only fluoropolymer should be used for samples that will analyzed for mercury because mercury vapors can diffuse in or out of other materials, resulting in either contaminated or biased results.

[3] Corroded/weathered surfaces are active sorption sites for organic compounds.

STANDARD OPERATING PROCEDURE

SC-003 Investigation Derived Waste

---

1. Objective

The objective is to provide guidelines for the proper management of Investigation Derived Waste (IDW) resulting from site investigation activities. This Standard Operating Procedure (SOP) addresses IDW generated during field tasks typically performed for environmental site investigations. The intent of this SOP is to provide a set of guidelines for proper assessment and handling of these IDWs.

2. Execution

- Determine the suspected contamination type and impacted media anticipated based on previous investigations, current analytical data, and/or site history.
- Consider the following issues when selecting IDW management option(s):
  i. anticipated volume of IDW to be generated during on-site activities
  ii. potential contaminants and their concentrations
  iii. location of the nearest populations and the likelihood and/or degree of site access
  iv. potential exposures to workers
  v. potential for environmental impacts
  vi. community concerns
  vii. potential storage areas
  viii. regulatory constraints
  ix. potential on-site treatment options
- Select IDW Management Option(s) prior to the commencement of field activities that will generate waste materials.
- In addition to the issues considered above for the selection of IDW management strategies/disposal options, more specific considerations/guidelines include:

2.1. Test Pit Excavation

- Segregate contaminated soil from uncontaminated soil using visual and/or field screening methods.
- Use appropriate barrier (plastic sheeting) for temporary stockpiling of contaminated soil adjacent to test pit.
- Backfill test pits with uncontaminated soil.
- For situations where returning contaminated soil to the test pit is deemed protective by the project manager, backfill soil in the same order as the soil was excavated from the test pit.

- For contaminated soil pile, collect representative sample(s) for test pit(s) for waste disposal characterization
- Ensure that the pile is appropriately covered with polysheeting and secured until disposed offsite.

2.2. Boring/Monitoring Well Installation

- For auger borings, segregate contaminated soil (determined by visual and/or field screening methods) from uncontaminated soil during drilling. Segregate residual contaminated soil from split-spoon sampling.
- Auger cuttings or sediment generated by drive and wash may be spread around the ground surface at the boring location if deemed appropriate by the project manager. IDW may be placed in an appropriate area or container pending characterization and appropriate disposal. (A useful rule of thumb is to assume generation of one 55-gallon drum of cuttings for each 20 feet drilled with 7-¼-inch-inner diameter [ID] augers).
- Segregate contaminated drilling fluid from uncontaminated fluid for rotary wash borings.
- Drilling fluid management options include pouring the drilling fluid on the ground in the Area of Concern (AOC) or containerizing the fluid in drums or tanks.

2.3. Water Development/Sampling

- Contaminated groundwater removed from wells by pumping or bailing for the purpose of well development and sampling should be containerized at the project manager's discretion.

2.4. Decontamination Fluids

- Decontamination fluids should be containerized in drums or tanks.

2.5. Disposable Personal Protective Equipment (PPE)

- Disposable PPE must be managed like any other IDW. It should only be removed from the site with the project manager's approval, and may be disposed of as ordinary rubbish only if it has not come into contact with hazardous materials.

3. Notes

- The preferred IDW management option is to return the IDW to its source. However, this is not always an option.
- The IDW selected must be in accordance with state/federal regulations.

- The Client contracts directly with the transportation and disposal contractor for the disposal of IDW, should disposal be necessary.

4. References

Guide to Management of Investigation - Derived Wastes (April 1992), United States Environmental Protection Agency, Publication 9345.3-03FS.

Standard References for Monitoring Wells, Massachusetts Department of Environmental Protection, Publication No. WSC-310-91.

Connecticut Department of Environmental Protection Connecticut's RCRA "Contained-In" Policy, Updated June 2005

GEI CONSULTANTS, INC.
110 Walt Whitman Road, Suite 204
Huntington Station, New York

SOP No. SC-004
Revision No.0
Effective Date: November 2010

STANDARD OPERATING PROCEDURE

SC-004 Head Space VOC Screening

1. Objective

To obtain a site-specific indication of the volatile organic compounds (VOC) concentrations present in soil. This information can be used: 1) to segregate soil based on degree of contamination, 2) to identify samples for quantitative analysis of VOCs, or 3) as a qualitative method to evaluate the presence or absence of VOCs in soil.

2. Execution

- A photoionization detector (PID) or flame ionization detector (FID) instrument is used to measure VOCs in jar head space (JHS) screening. Select the appropriate instrument, lamp, and calibration gas for the site-specific contaminants. Calibrate the instrument in accordance with the manufacturer's instructions before JHS screening begins. Record the type of calibration gas, detector, and lamp in the field notebook.
- Note the highest VOC concentration that the instrument measures in air in the work area before performing JHS screening. Record this as the initial background concentration.
- Half-fill a clean, glass jar with the soil. Use a clean trowel or soil spatula. Quickly cover the open top with one or two sheets of clean, aluminum foil and screw on the cap to tightly seal the jar. Label the sample location and depth from which the sample was collected on the jar.
- Allow headspace development for at least 10 minutes at an ambient temperature of 50°F or greater. Vigorously shake the jar for 15 seconds at the beginning and end of the headspace development period. When ambient temperatures are below 50°F, place the jar in a heated van or building during the headspace development period.
- After headspace development, remove the screw cap to expose the foil seal. Quickly puncture the foil seal with the instrument's sampling probe and insert it to a point at about one-half of the headspace depth.
- Record the highest VOC concentration that the instrument displays as the JHS concentration. The highest concentration should occur between 2 and 5 seconds after probe insertion.

3. Notes

- The instruments may work poorly in the rain and in freezing temperatures. PIDs may not function in high-humidity conditions. Under such conditions, operate the instrument in a heated vehicle or building.

- Prevent water and soil particles from entering the tip of the instrument probe. Use a filter on the instrument’s probe.
- Measure background VOC conditions and perform JHS screening away from non-site-related VOC sources, such as vehicle and heavy equipment exhaust.
- The VOC concentration on the instrument’s display may vary when the air contains high VOC concentrations or high moisture.
- JHS screening is a guide that helps the screener to segregate soils into broadly defined categories. JHS screening results may differ by orders of magnitude from laboratory testing results.

4. References

Interim Remediation Waste Management Policy for Petroleum Contaminated Soils. (April 1994), Massachusetts Department of Environmental Protection, Policy #WSC-94-400.

Section 6

SOLID MATRIX SAMPLING (SM)

STANDARD OPERATING PROCEDURE

SM-001 Soil Sampling Techniques Including Split-Spoon

---

1. Objective

This Standard Operating Procedure (SOP) is used primarily to collect surface, shallow subsurface, and stockpile soil samples. Surface soils are generally classified as soils between the ground surface and 6 to 12 inches below ground surface (bgs). The shallow subsurface interval may be considered to extend from approximately 12 inches bgs to a site-specific depth at which sample collection using manual methods becomes impractical.

2. Execution

2.1. At-Depth Sampling

When sampling at depth, utilize the procedures outlined in the following SOPs for the drilling method used:

Hollow Stem Auger (split spoon): SOP DM-002
Sonic Drilling: SOP DM-003
Geoprobe or Direct Push (macrocore): SOP DM-005

2.2. Surface Soil Sampling

Collection of samples from near-surface soil can be accomplished with tools such as spades, shovels, trowels, and scoops. Surface material is removed to the required depth and a stainless steel or plastic scoop is then used to collect the sample. This method can be used in most soil types but is limited to sampling at or near the ground surface. Accurate, representative samples can be collected with this procedure depending on the care and precision demonstrated by the sample team member. A flat, pointed mason trowel to cut a block of the desired soil is helpful when undisturbed profiles are required.

- Carefully remove the top layer of soil or debris to the desired sample depth with a pre-cleaned spade.
- Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area which came in contact with the spade.
- If volatile organic analysis is to be performed, transfer the sample directly into an appropriate labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly.
- Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval.

- Either place the sample into appropriate labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval or location into the homogenization container and mix thoroughly.
- When compositing is complete, place the sample into appropriate labeled containers and secure the caps tightly.
- Label, preserve, and store the sample in accordance with SOP SC-002 *Sample Handling*.

2.3. Stockpile Sampling

- Collection of samples from stockpiles can be accomplished with tools such as spades, shovels, trowels, and scoops. Surface material from the stockpile is removed and a stainless steel or plastic scoop is then used to collect the sample.
- Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area which came in contact with the spade.
- If volatile organic analysis is to be performed, transfer the sample directly into an appropriate labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly.
- Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling stockpile.
- When collecting composite samples, place a sample from another sampling location into the homogenization container and mix thoroughly.
- When compositing is complete, place the sample into appropriate labeled containers and secure the caps tightly.
- Label, preserve, and store the sample in accordance with SOP SC-002 *Sample Handling*.

3. References

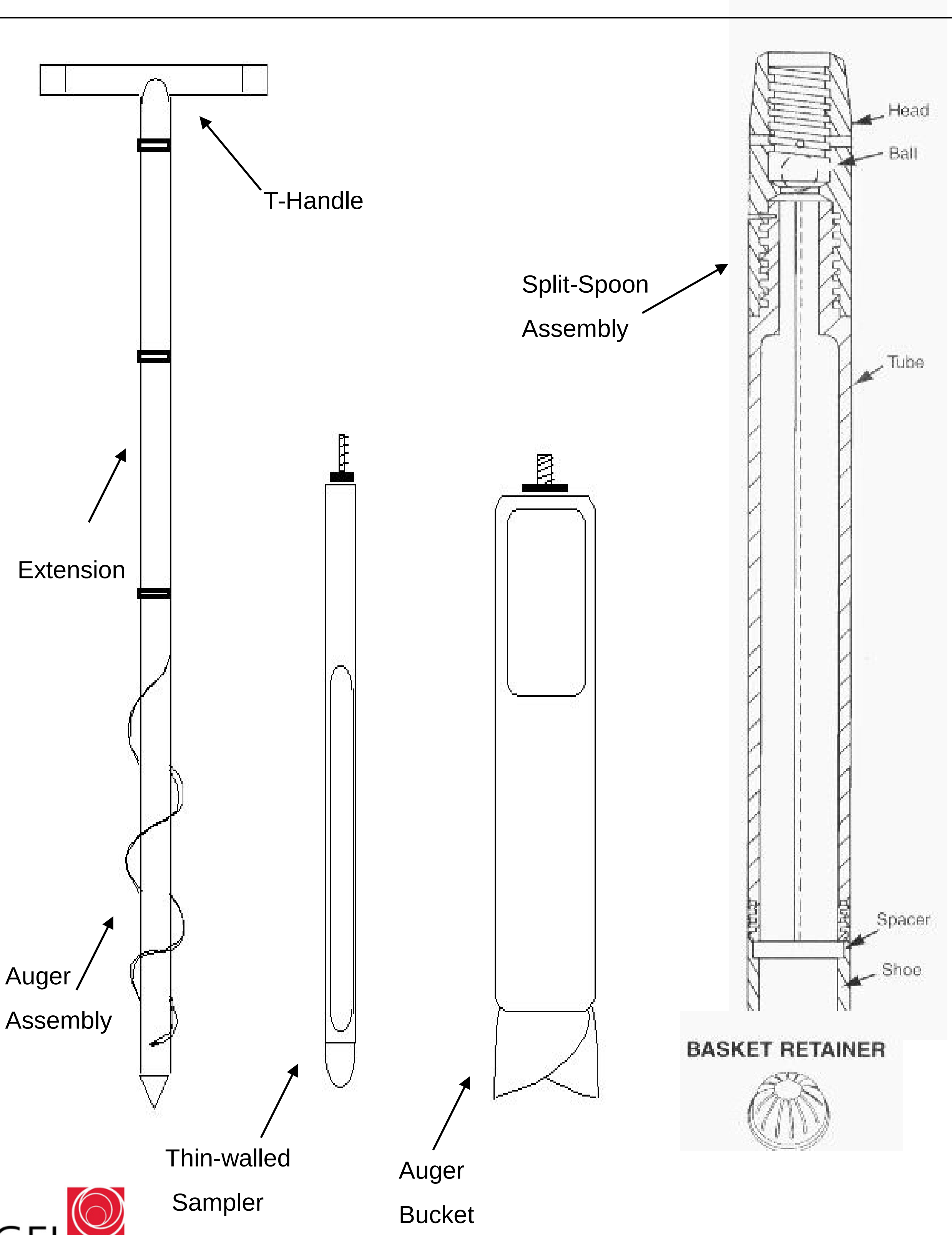
ASTM D1585-98, "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils". 1998.

United States Environmental Protection Agency, SOP 2012 “Soil Sampling”, Revision 0.0, February 18, 2000.

Attachment A

SM-001

Attachment A – Sampler Design Assembly



STANDARD OPERATING PROCEDURE

SM-002 VOC Soil Collection and Preservation Method (if necessary)

---

1. Objective

To establish a standard for preserving soil samples for analysis of Volatile Organic Compounds (VOCs).

2. Execution

The soil sample collection procedure for determination of VOCs is a two-step process.

- Step 1 – Collect an undisturbed soil sample from the subsurface, or expose the targeted area from where a sub-sample for lab analysis will be collected.
- Step 2 – Collect a representative sub-sample from the undisturbed sample or directly from the exposed surface.

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 are not homogenized. Preservatives may be required for some samples with certain variations of Method 5035. Consult the method or the principal analytical chemist to determine if preservatives are necessary.

When the soil sample is collected for VOC analysis, it must be placed within the laboratory container immediately. It must not be allowed to sit exposed for more than 5 minutes. In addition, the sample must not be exposed to extreme weather conditions (i.e., rain, extreme sunlight, wind, etc.).

Sub-samples are a portion of the undisturbed sample that will be sent to the lab for VOC analysis. Sub-samples must be obtained utilizing a small diameter core sampler. Some of the acceptable small diameter core samplers include: a 10 milliliter (ml) plastic disposable syringe, a Purge and Trap Soil Sampler, En Core Samplers, or an Easy Draw Syringe. The En Core Sampler is the only small diameter core sampler that can be used to collect the sample, store the sample, and transport the sample to the lab.

The procedure for the collection of sub-samples is as follows:

- Once the sampling interval has been selected, trim off the exposed surface of the matrix, with a decontaminated trowel or spatula, to expose a fresh surface. Then sample immediately.
- Push the En Core sampler into the matrix to collect a volume of material that will yield the required mass of sample (wet weight) as determined by the analytical method.

- Push the En Core sampler into the material at an angle as many times as is needed to obtain the required sample weight.
- Wipe the exterior of the sampler clean.
- Seal the En Core sampler as explained in the manufacturer’s instructions.
- Collect the required number of En Core samplers based on the chosen preservation and analytical methods, as discussed in the section on soil preservation methods below.
- Collect a separate sample for head space screening and moisture content determination.
- Make sure that the threads of the En Core sampler are free of particles (by cleaning with a paper towel).
- Mark the samplers with a permanent marker and not an adhesive label (due to weight considerations).
- Once the samples have been collected, sealed, and labeled, place the samples into an iced cooler. It is recommended to place each sample container in separate zip lock bag.

If collecting VOC soil samples during drilling, please refer to SM-001: *Soil Sampling Techniques Including Split-Spoon* for detailed information.

2.1. Preservation of Soil Samples

When collecting soil samples for determination of VOCs, three types of samples may be required:

- High concentration sample (Section 2.2 below).
- Low concentration sample (Section 2.3 below).
- Synthetic Precipitation Leaching Procedure/Toxicity Characteristic Leaching Procedure (SPLP/TCLP) sample (Section 2.4 below).

2.2. Two options for the collection of a suspected “high” concentration sample

- Collect one 10 gram sample in a pre-weighted vial containing 10 ml methanol.
- Use an “En Core” sampler.

2.2.1. Option 1 – Methanol Preservation Method

Supplies include: two pre-weighed vials (per sample) with 10 ml methanol, and a sampling device to collect a 10 gram sample.

Sampling Procedure:

- Label vials using permanent marker.
- Scrape away surface to be sampled to expose fresh soil.

- Collect the sample using the sampling device and extrude the sample into the preserved vial. Wipe the threads and cap clean and seal the vial.
- Store the sample in an iced cooler.
- Collect a separate sample for percent solids and head space sampling.

2.2.2. Option 2 – En Core Sampling Method

Supplies needed: One 5 or 10 ml En Core sampler.

Sampling Procedure:

- Label the En Core sampling container.
- Locate the sampling area, scrape a fresh face, collect the sample quickly, and clean and seal the sampler.
- Place sampler in a clean zip lock bag and place on ice.
- Collect separate samples in separate containers for percent solids and head space sampling.
- Samples must be frozen, or preserved, or analyzed within 48 hours (coordinated with the lab).

Option 2 (En Core Sampler) is preferred due to possible problems with minimum detection levels when using the methanol method.

2.3. Four different options for the collection of “low” concentration samples for VOC analysis

- Collect two vials each of 5 grams of sample into a pre-weighted 40 ml vial with 5 ml of water and a magnetic stirrer.
- Collect two vials each of 5 grams of sample into a pre-weighted 40 ml vial with a magnetic stirrer.
- Collect two 5 gram En-Core type samples.
- Collect two vials each of 5 grams of sample into a pre-weighted vial containing sodium bisulfate with a magnetic stirrer.

2.3.1. Option 1 – Collection in Volatile Organic Compound (VOC) vials containing water

Supplies required: an electronic field balance, two VOC 40 ml vials pre-weighted and containing 5 ml of water, a magnetic stirrer, and a sampling device.

Sampling procedure:

- Label vials using permanent marker.
- Select the area to be sampled.
- Test sample and weigh to verify the amount of sample needed.
- Scrape a clean surface to be sampled.

- Collect the sample using the sampling device and extrude the sample into one of the two vials containing water. Wipe the threads and cap clean and seal the vial.
- Repeat the last step for the second vial.
- Weigh the vials and record the weights.
- Store the sample in an iced cooler.
- Collect a separate sample for percent solids and head space sampling.

2.3.2. Option 2 – Collection in empty VOC vials

Supplies required: electronic field balance, two VOC 40 ml vials pre-weighted, a magnetic stirrer, and a sampling device.

Sampling Procedure:

- Label vials using permanent marker.
- Select the area to be sampled.
- Test sample and weigh to verify the amount of sample needed.
- Scrape a clean surface to be sampled.
- Collect the sample using the sampling device and extrude the sample into the vial. Wipe the threads and cap clean and seal the vial.
- Repeat the last step for the second vial.
- Weigh the vials and record the weights.
- Store the sample in an iced cooler.
- Collect a separate sample for percent solids and head space sampling.
- Samples must be frozen or analyzed within 48 hours.

2.3.3. Option 3 – Collection in VOC vials preserved with Sodium Bisulfate

Supplies required: electronic field balance, two VOC vials with 5 ml of sodium bisulfate, a magnetic stir bar, and a sampling device.

Sampling Procedure:

- Label vials using permanent marker.
- Select the area to be sampled.
- Test sample and weigh to verify the amount of sample needed.
- Scrape a clean surface to be sampled.
- Collect the sample using the sampling device and extrude a 5 gram sample into the vial containing the sodium bisulfate. Wipe treads and cap and seal the vial.
- Repeat the last two steps for the second vial.
- Weigh the vial and record the weight.
- Store the sample in an iced cooler.
- Collect a separate sample for percent solids and head space sampling.

2.3.4. Option 4 – Collection of the sample with an En Core Sampler

Supplies required: two 5 gram En Core samplers.

Sampling Procedure:

- Label samplers using permanent marker.
- Select the area to be sampled.
- Scrape a clean surface to be sampled.
- Collect the sample using one En Core devise, wipe the contact areas clean and seal, and place into a re-sealable zip lock bag.
- Repeat the last two steps with the second En Core device.
- Store the sample in an iced cooler.
- Collect a separate sample for percent solids and head space sampling.
- Samples must be frozen or analyzed within 48 hours.

2.4. Collection of samples being analyzed for VOCs by the TCLP or SPLP method

Supplies required: a 25 gram En Core Sampler.

Sampling Procedure

- Label sampler using permanent marker.
- Select the area to be sampled.
- Scrape a fresh surface to be sampled.
- Collect the sample using one En Core devise, wipe the contact areas clean and seal, and place into a re-sealable zip lock bag.
- Store the sample in an iced cooler.
- Samples must be frozen or analyzed within 48 hours.

To determine percent solids, approximately 20 grams of soil sample must be collected in a separate glass or plastic sampling container. The percent solids sample is **NOT** to be taken from the VOC samples.

3. Holding Times

- Field investigators should note that the holding time for an un-preserved VOC soil/sediment sample is 48 hours. Arrangements should be made to ship the soil/sediment VOC samples to the laboratory by overnight delivery the day they are collected so the laboratory may preserve and/or analyze the sample within 48 hours of collection.

STANDARD OPERATING PROCEDURE

SM-003 Soil Classification

---

1. Objective

To describe and classify soil samples collected in the field in a consistent and useful manner. GEI has adopted the (ASTM) Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) D2488..

2. Execution

- Describe soil samples according to the ASTM Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) D2488 (see Attachment A – Visual Manual Descriptions).
- Identify and record the soil in terms of the major and minor constituents (i.e., sand gravel, silt, clay), group symbol, group name, sample structure, plasticity and dilatancy for fine-grained soils, color, local or geologic name if known (e.g., glacial till), odor, presence of iron or other staining, and presence of organic matter, shells, debris, or other unusual characteristics of the same.
- If a soil split-spoon sample contains more than one soil type (for example, the upper portion is silty sand and the lower portion is clay) describe each type separately, and obtain separate jars of each type.
- Record sampler type, blow counts, soil description, etc., on the boring log.
- One modification to the ASTM standard: Use "widely graded" and "narrowly graded" instead of "well-graded" and "poorly graded."
- Based on the percent volume, the following descriptions should be used:
    1. “and” = 35-50%
    2. “some” = 20-35%
    3. “little” = 10-20%
    4. “trace” = 1-10%

3. Notes

- Some soil characteristics, such as plasticity and dilatancy, are difficult to identify in the field during extremely cold or wet weather. The field classification should be verified in the office after the samples have returned to room temperature if samples were collected during extreme weather conditions.

- The ASTM Standard Test Method for Classification Soils for Engineering Purposes, D2487 may be used in conjunction with the Visual-Manual Method to confirm the soil classification.

4. References

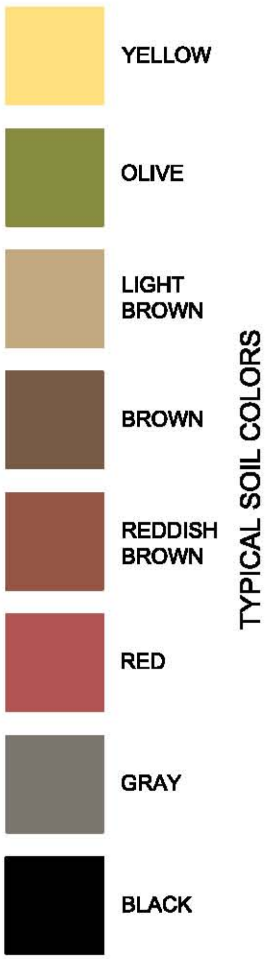
Annual Book of ASTM Standards (1993), Section 4, v. 4.08 Soil and Rock; Building Stones; Geosynthetics, D2488-90, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), American Society of Testing Materials (ASTM).

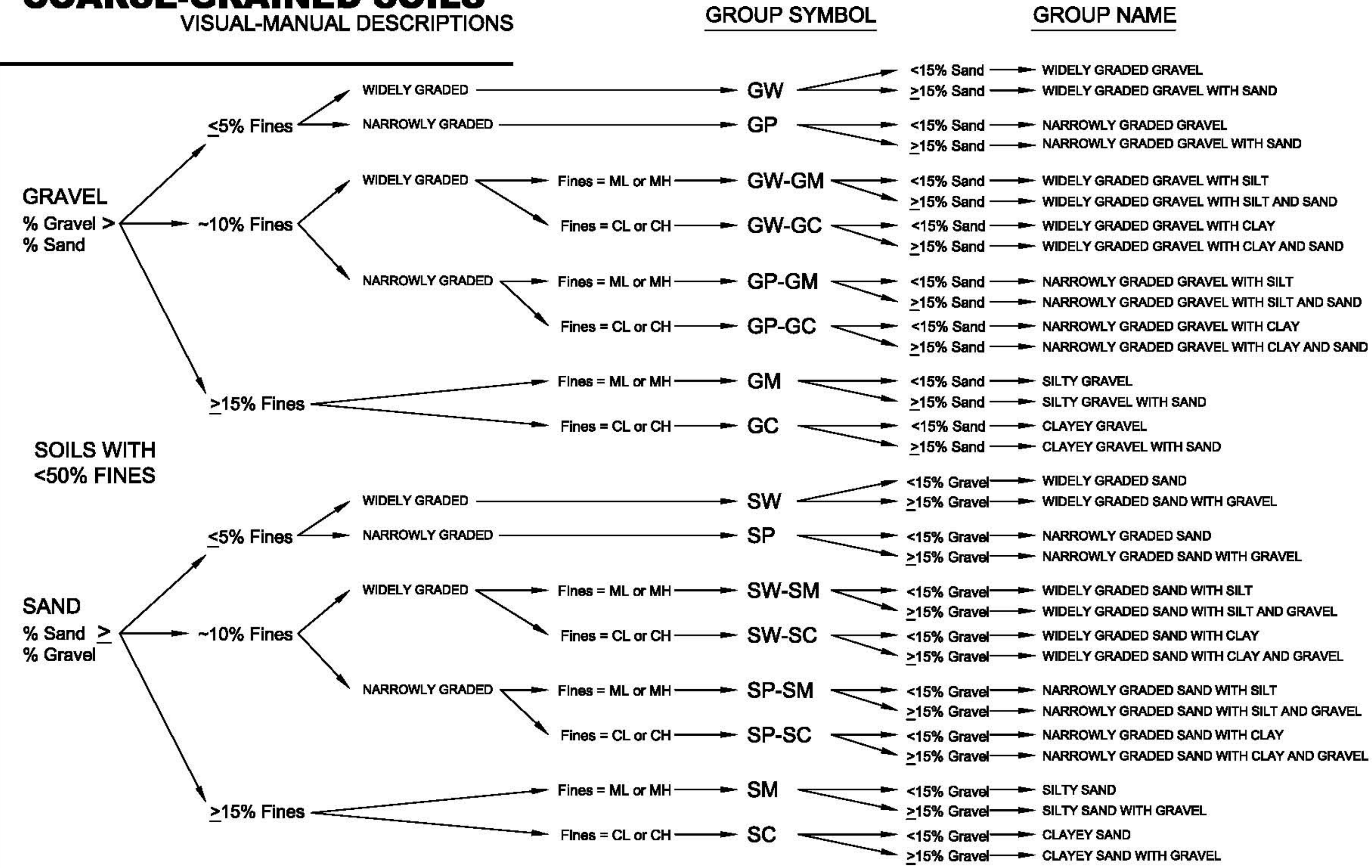
5. Attachments

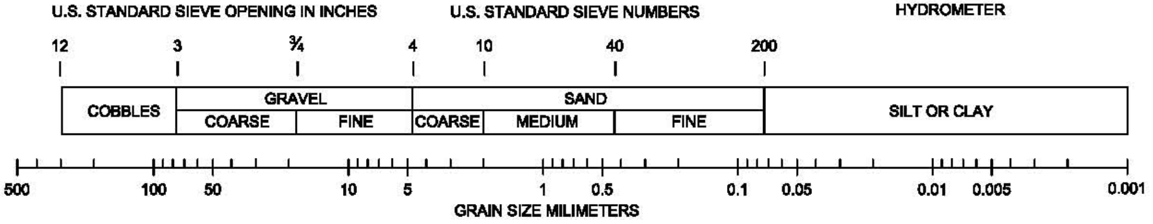
Attachment A – Visual Manual Descriptions with example boring log

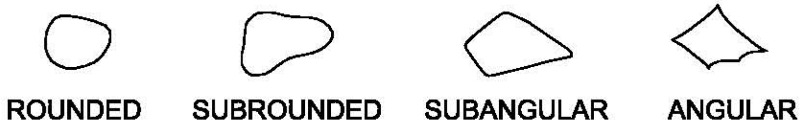
Attachment A

COARSE-GRAINED SOILS
VISUAL-MANUAL DESCRIPTIONS





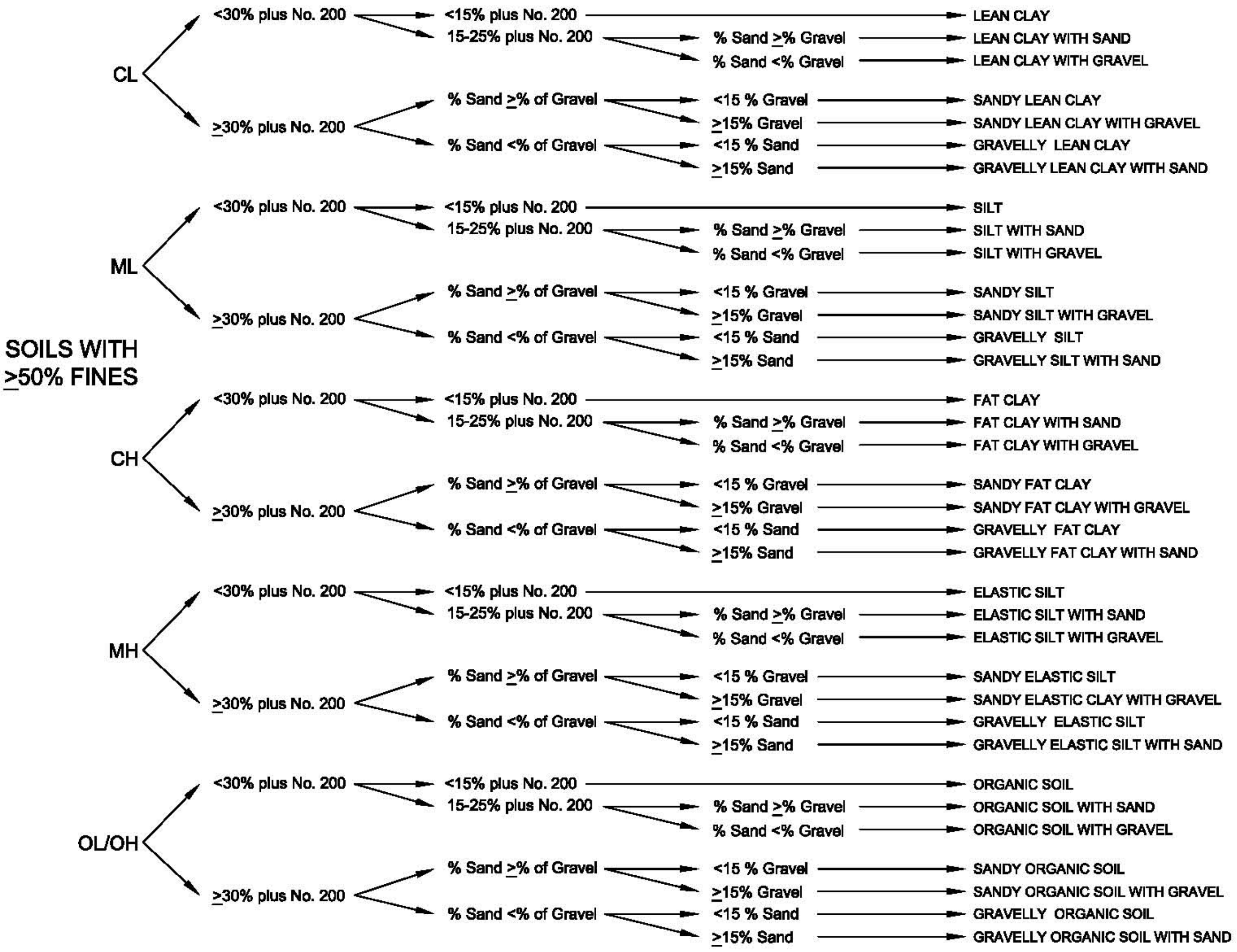




1. GROUP NAME and (SYMBOL)
2. Structure , if any. (stratified layer thicknesses, lenses, varves, gradational changes)
3. Describe sand, gravel and fines components, with percentages, in order of predominance. Include max gravel size. For test pits give percent cobbles and boulders, by volume, and include max size.
4. Color
5. Sheen, odor, roots, ash, brick, cementation, reaction with HCL, etc.
6. "Fill," local name or geologic name, if known

FINE-GRAINED SOILS

VISUAL-MANUAL DESCRIPTIONS



ID OF INORGANIC FINE SOILS FROM MANUAL TESTS

Symbol	Name	Dry Strength	Dilatancy	Toughness*
ML	Silt	None to low	Slow to rapid	Low or thread cannot be formed
CL	Lean Clay	Medium to high	None to slow	Medium
MH	Elastic Silt	Low to medium	None to slow	Low to medium
CH	Fat Clay	High to very high	None	High

1. GROUP NAME and (SYMBOL)
2. Describe fines, sand, and gravel components, in order of predominance. Include plasticity of fines. Include percentages of sand and gravel.
3. Color
4. Sheen, odor, roots, ash, brick, cementation, torvane and penetrometer results, etc.
5. "Fill," local name or geologic name, if known

PEAT

Peat refers to a sample composed primarily of vegetable matter in varying stages of decomposition. The description should begin: PEAT (PT) and need not include percentages of sand, gravel or fines.

CRITERIA FOR DESCRIBING PLASTICITY

Description	Criteria
Nonplastic ML	A 1/8-in. (3 -mm) thread cannot be rolled at any water content
Low Plasticity ML, MH	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit *
Medium Plasticity MH, CL	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit
High Plasticity CH	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit

* Toughness refers to the strength of the thread near plastic limit. The lump refers to a lump of soil drier than the plastic, similar to dry strength.

BORING LOCATION Maple Ave Sidewalk
GROUND ELEVATION (NGVD)
GROUNDWATER EL. DATE
DATE START/FINISH 2/14/07 - 2/15/07
DRILLED BY Geologic: M. Costigan
LOGGED BY T. Kahl/M. Yako TOTAL DEPTH (FT) 25

B101

PG. 1 OF 1

EL. FT.	DEPTH FT.	SAMPLE TYPE and NO.	SAMPLE BLOWS PER 6 IN.	SAMPLE PEN IN.	SAMPLE REC IN.	PID JAR HS / REMARKS	GRAPHIC LOG	SOIL AND ROCK DESCRIPTIONS
								4" pavement
	2.5	S1	13-9 17-14	24	0	0.5 ppm	FILL	S1: Redrove 0.5 to 3.5 ft. Recovery 11": WIDELY GRADED SAND (SW) ~85% sand, ~10% gravel to 1", <5% nonplastic fines, brown. Contains brick fragments and ash. Fill.
	5					hard drilling 3 to 4 ft, possible boulder		
		S2	7-7 11-13	24	8	2.0 ppm		S2: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM) ~65% mostly fine sand, ~25% gravel to 3/4 inch ~10% non-plastic fines, brown. Fill.
	7.5	S3	9-10 2-1	24	16	0.0 ppm		S3 (0-10"): Similar to S2.
	10						ORGANICS	S3 (10"-16"): ORGANIC SILT (OL) ~100% slightly plastic fines, dark gray, organic odor, contains white shell fragments.
	12.5	S4	WOH 1-2 1	24	15	0.0 ppm		
	15					hard drilling at 15.5 ft		S4: Similar to S3, bot 6".
	17.5	S5	20-35 50/3"	15	8	Top of rock ~19 ft. Roller bit to 20 ft.	TILL	S5: SILTY SAND WITH GRAVEL (SM) ~60% mostly fine sand, ~25% slightly plastic fines, ~15% gravel to 1/2 inch, olive. Glacial Till.
	20							
	22.5	C1	RQD 70%	60	54	lost ~10 gallons drill fluid from 23 to 25 ft	ROCK	C1: SCHIST, hard, slight weathering at joint surfaces, joints at ~30 degrees from horizontal and generally parallel to foliation, gray. Marlborough Formation.
	25							Bottom of Boring 25 ft Truck-mounted drill rig. 4-inch casing to 19 ft. Safety-hammer with rope and cathead for SPT. Backfilled with drill cuttings.
	27.5							
	30							

BLOWS PER 6 IN.–140 LB. HAMMER FALLING 30 IN. TO DRIVE A 2.0 IN. OD SPLIT SPOON SAMPLER
PEN–PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC–RECOVERY LENGTH OF SAMPLE
RQD–LENGTH OF SOUND CORES > 4 IN./ LENGTH CORED, %
S–SPLIT SPOON SAMPLE
U–UNDISTURBED SAMPLES, UF–FIXED PISTON UO–OSTERBERG
▽ GROUNDWATER

NOTES:
1: Groundwater at 10 ft depth at start of day 2/15/07.

PROJECT 07999-0
DATE

GEI Consultants

EXAMPLE SOIL DESCRIPTIONS

SANDY SILT (ML) ~60% slightly plastic fines, ~40% mostly fine sand, 1" thick layer of fine to medium sand with <20% fines, gray.

LEAN CLAY (CL) ~90% moderately plastic fines, ~10% fine sand, olive. Boston Blue Clay. Sv = 0.5, 0.5, 0.8 tsf, Qp = 1.0, 1.5, 1.6 tsf

Stratified CLAYEY SAND (SC) and WIDELY GRADED SAND (SW) SC layers 1 to 2 inches thick consist of fine sand with ~30% moderately plastic fines, gray. SW layers 1 to 4 inches thick consist of fine to coarse sand, ~10% gravel to 1/2 inch, <5% fines, brown. Hydraulic Fill.

EXAMPLE ROCK DESCRIPTIONS

(0-9"): GRANITE, hard, one piece, joint surface slightly weathered, pink.
(6-60"): PHYLLITE, joints ~ 45° generally parallel to foliation, 9" to 44" moderate to severe jointing and joint weathering. 44" to 60" single piece, green-gray.

ARGILLITE, medium hard, moderately weathered joints, gray. Cambridge Argillite.

GEOPROBE AND ROTOSONIC

When SPTs are not performed, note sample density (sands) or stiffness (clays) in description.

CRITERIA FOR DESCRIBING DILATANCY OF FINE-GRAINED SOILS

Description	Criteria
None	No visible change in the specimen
Slow	Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing.
Rapid	Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing.

SPT: Standard Penetration Test

30-inch drop with 140-lb hammer
1 3/4 to 2 1/4 turns around cathead
2-inch O.D. split spoon sampler

ENV'L TERMINOLOGY FOR SOIL DESCRIPTIONS

- **Ash** - Typically silt-size to medium sand-size.
- Do not use the term "cinders." This is not a technical term. Instead, use "ash," "burnt wood," "burnt material," or a similar term.
- **Coal-like material** - If it looks like coal but you aren't sure.
- **Clinker** - Vitrified (glass-like) or heat-fused material. Often burned impurities in coal. Often looks like pumice, but heavier.
- **Slag** - Similar to clinker, but normally refers to residue from metal ore processing.

- **Sheen** - Iridescent petroleum-like sheen. Not to be used for a "bacterial sheen," which can be distinguished by its tendency to break up on the water surface at angles. Petroleum sheen will be continuous and will not break up.
- **Stained** - Use with a color ("brown-stained") to indicate that the soil is stained a color other than its natural (unimpacted) color.
- **Coated** - Soil grains are coated with NAPL (oil, tar, etc.). There is not enough NAPL to saturate the pore spaces. ("Split spoon sampler coated with brown oil." "Soil grains coated with gray substance with slight gasoline-like odor.")
- **Saturated** - The entire sample pore space is saturated with NAPL. If you use this term, be sure it is not water saturating the pore spaces. Depending on viscosity, the NAPL may drain from a soil sample. ("Sample saturated with green, sticky substance.")
- **Blebs** - Discrete sphericals of NAPL in a soil matrix that was not visibly coated or saturated. ("Occasional blebs of reddish-brown tar.")
- **Oil** - Exhibits a petroleum odor, different from MGP odors.
- **Tar** - Exhibits an MGP odor (e.g. naphthalene-like odor).

- **Odors** - Use terms such as "naphthalene-like odor" or "petroleum-like odor." Use modifiers (strong, moderate, slight) to indicate odor intensity.

Section 7

GROUNDWATER (GW)

STANDARD OPERATING PROCEDURE

GW-001 Water Level Measurement

---

1. Objective

The purpose of this Standard Operating Procedure (SOP) is to set guidelines for the determination of the depth to water in an open borehole, cased borehole, monitoring well, or piezometer.

2. Execution

- Prior to mobilizing onto a site, notification requirements must be followed.
- Prior to collecting water level measurements, all wells should be opened to the atmosphere and allowed to equilibrate prior to collecting groundwater elevation measurements, if practical.
- All groundwater level measurements need to be performed in the shortest possible timeframe (no more than four hours, if practical).
- Groundwater levels are measured using a decontaminated electronic groundwater level indicator, which has a cable divided into incremental measurements of 0.01 feet and two conductors forming a probe. When groundwater is encountered, the circuit is completed and a light, meter, or audible buzzer is activated. The depth to groundwater is then measured from this point to the reference mark on the inner casing of the monitor well.
- All groundwater-level measurements should be made from the same marked reference point at the top of the inner well casing. A licensed surveyor must mark the reference point.
- If no discernable survey mark is observed on the inner casing, the groundwater-level measurement should be read from the highest point of the inner casing.
- If no survey mark is observed on the inner casing, it should be noted with the ground water-level data and the highest point of the casing must be marked for future reference.
- Measurements should be made three to four times to confirm the measurement. Each time a measurement is made, it should be determined to the nearest one-hundredth of a foot (0.01).
- Certain situations may necessitate that all water level measurements at a given site should be collected within a shorter than 24-hour period. These situations may include:
    1. The magnitude of the observed changes between wells appears too large.
    2. Changes in atmospheric pressure.
    3. Aquifers which are tidally influenced.

4. Aquifers affected by river stage, impoundments, and/or unlined ditches.
5. Aquifers stressed by intermittent pumping of production wells.
6. Aquifers being actively recharged due to precipitation events.
7. Occurrence of pumping.

- All well measurements should, if practical, be performed the same day, prior to the evacuation of any wells which may influence groundwater elevations in the area of the investigation.
- The following items should be recorded on field data sheets while collecting groundwater level measurements:
    1. Project name.
    2. Well identification.
    3. Date and time of measurements.
    4. If applicable, the time and cycle of the tide.
    5. Thickness of non-aqueous phase liquids (NAPL) product, if any. (See SOP GW-002, *NAPL Measurement*.)
    6. Note any miscellaneous information, such as recent damage, well box in need of repair, car parked over well, etc.

3. Notes

- Do not measure the total-well-depth with an electronic groundwater level indicator.
- Groundwater levels should be obtained from all wells in a network prior to sampling the first well.
- Local water body elevations may need to be measured. Check site-specific work plan for this requirement.
- Weak batteries in electronic groundwater-level indicators frequently produce weak or gradual auditory and/or visual responses, making it difficult to accurately determine when the probe of the unit has come in contact with ground water. As such, it is recommended that electronic groundwater-level indicators be tested before they are brought out into the field.
- Note that electronic groundwater-level indicators will not respond to distilled water, so distilled water should not be used to test these units.
- Wells that are not plumb may result in probe contact with the side of the well casing providing a false measurement. Once the probe has come in contact with groundwater in the well, water may be trapped by capillary action between the probe and the well casing. If this happens, the unit may continue to signal even after the probe has been raised above the ground water surface.

The deeper the well, the more likely this problem may occur. To correct this, the cable should be raised several feet above the water and shaken to remove water from the probe. A new groundwater-level measurement should then be collected. If the signals from the unit are not abrupt or reproducible, the probe may need to be reeled up to the surface and dried off before re-attempting another measurement.

- Accumulation of sediment, organic material, or floating debris on the probe may also result in gradual or non-reproducible readings. Wells that are constructed with metal inner casings may lead to difficulties in collecting reproducible groundwater-level measurements because the inner sides of the well casing are conductive.
- In some cases, a rubber grommet or metal centralizer may need to be placed on the probe so that the probe is not allowed to come in contact with the inner casing. Groundwater-level-measuring equipment should be properly decontaminated between wells and piezometers to avoid cross contamination.
- Once a well has been located and properly identified, the field measurements listed below should be noted in a field logbook. Be certain that the proper well is being measured. The misidentification of a sampling point in the field will result in erroneous data that may result in incorrectly constructed contour maps.

4. References

U. S. EPA Environmental Response Team Standard Operating Procedures SOP: 2043,"Water Level Measurement" REV: 0.0, 10/03/94.

U. S. EPA Environmental Response Team Standard Operating Procedures SOP: 2044," Monitor Well Development" REV: 0.1, 10/23/01.

5. Attachments

Attachment A – Monitoring Well Sampling Record

STANDARD OPERATING PROCEDURE

GW-002 Non-Aqueous Phase Liquid (NAPL) Measurement

---

1. Objective

To obtain accurate and repeatable measurement of the thickness of Non-Aqueous Phase Liquids (NAPL) contained in monitoring wells. These methods can be applied to light non-aqueous phase liquids (LNAPL) and dense non-aqueous phase liquids (DNAPL).

2. Execution

Three procedures for measuring NAPL are provided below using a clear bailer, Interface Probe, and graduated tape.

2.1. Clear Bailer (LNAPL Measurement)

- Determine depth to the surface level of the LNAPL layer utilizing an interface probe.
- Record depth.
- Lower a clear bailer into the well and slowly into the product, being careful not to submerge the bailer.
- Raise the bailer and measure product thickness.
- Once the product thickness is known, the depth to ground water may be determined (see calculation below).
- This method has inaccuracies because successful use of the bailer is dependent upon the expertise of the operator and assumes the check valve does not leak upon retrieval.

2.2. Interface Probes (LNAPL Measurement)

- Decontaminate Interface Probe prior to use.
- Check battery and replace if necessary.
- Check the unit is functioning correctly. Note: De-ionized water will not provide a correct reading.
- Measure the hydrocarbon/air interface first by going from air to the LNAPL surface to prevent dripping hydrocarbons from enhancing the thickness reading.
- Record the reading.
- Measure the hydrocarbon/water reading by lowering the Interface Probe past the LNAPL layer quickly minimizing the contact time of the probe within the hydrocarbon phase.
- DNAPL can also be measured by quickly lowering the Interface Probe past the LNAPL layer and to the bottom of the well noting any audio or visual indications of DNAPL.

- The optical sensor on interface probes may become damaged if solvents are used to clean product from the probes.
- The optical sensor may become smeared when used to measure product, rendering pinpoint accuracy to an estimate at best.
- Close attention to decontamination procedures will improve accuracy, operational life, and reduce the risk of cross contamination with other wells.

2.3. Graduated Tape (DNAPL Measurement)

- Outfit a measuring tape with a narrow cylindrical weight that is heavy enough to sink through a viscous DNAPL.
- Open the well box or unlock the protective casing
- Lower the tape slowly through the water column in the well. When the tape reaches the bottom, stop releasing tape and measure the total well depth. Any extra tape released after the bottom of well was encountered will give a false reading of the DNAPL thickness. Repeat this procedure, if necessary.
- While extracting the tape, use absorbent rags and/ or GOJO Wipes to clean the tape. When the DNAPL line of demarcation is encountered on the measuring tape, record the thickness of DNAPL in the well.
- Clean the DNAPL from the tape over the well so excess DNAPL flows back into the well. This can lessen or eliminate the need to clean DNAPL from in or around the well box.
- Clean up any DNAPL in or around the well box.
- Repeat these steps as necessary to clean the tape and clean up the area around the well box.
- Decontaminate tape in accordance with SOP QA-001.
- Dispose of waste in accordance with SOP SC-003.
- Secure the well box or close and lock the protective casing.

3. Notes

- When measuring DNAPL, care must be taken when encountering the well bottom so a false measurement is not recorded.
- When a LNAPL thickness is measured in a monitoring well, it will usually exhibit an apparent thickness rather than an actual thickness. This apparent thickness is caused when LNAPL from within and above the capillary fringe migrates into the monitoring well causing the ground water-level to become depressed below the surrounding capillary fringe area. As a result, LNAPL will continue to flow into the well until equilibrium is reached causing

an apparent LNAPL thickness, which is greater than the actual thickness**.**

- LNAPL thickness can be affected by fluctuations in the water table. In some cases, an LNAPL's thickness may decrease when the water table rises, while its thickness increases as the water table drops. In other cases, fluctuating water tables may cause sudden appearances and disappearances of LNAPL layers.
- Monitoring points with LNAPLs can pose a problem when measuring the level of ground water. Floating LNAPLs can depress the ground water-level in a monitoring well or piezometer and distort the measurement. Therefore, the Corrected Depth (CD) formula shown below should be applied to ground water-level measurements in monitoring points where LNAPLs are present:

CDTW = Static DTW – (PT x G)

CDTW = Corrected Depth to Ground water
DTW = Depth to Ground Water (Static)
PT = Measured Product Thickness
G = Specific Gravity (density of free product / density of water)

4. References

U. S. EPA Environmental Response Team Standard Operating Procedures SOP: 2043,"Water Level Measurement" REV: 0.0, 10/03/94.

STANDARD OPERATING PROCEDURE

GW-003 Low Flow (Low Stress) Groundwater Sampling

---

1. Objective

Provide a method to collect groundwater samples that accurately and precisely represent the aquifer conditions. Low-flow purging is limited to wells that, with sustained pumping, exhibit no continuous drawdown.

2. Background for Implementation

- 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 nephelometric turbity units (NTUs), and stable drawdowns of less than 0.3 feet are recommended.
- 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 (e.g., insulation) will need to be taken to prevent the groundwater from freezing in the equipment.
- Direct sunlight and hot ambient air temperatures may cause the groundwater in the tubing and flow-through-cell to heat up. When sampling under these conditions, the sampler will need to shade the equipment from the sunlight (e.g., umbrella, tent, pipe insulation, etc.).
- The tubing exiting the monitoring well should be kept as short as possible to avoid sunlight or ambient air from heating up the groundwater. Tubing lengths greater than 6 feet should be fitted with 0.5-inch diameter pipe insulation.

3. Execution

- Complete site-access notification requirements prior to mobilization.
- Wait at least one week following well development before sampling.
- Record all activities in the field notebook (see SOP FD-001, *Field Notebook*) and on Attachment A – Monitoring Well Sample Data Form. Use a separate form for each sampling location and event.
- Calibrate the photoionization detector (PID), pH, temperature, specific conductance (SC), turbidity, dissolved oxygen (DO), and oxidation-reduction potential (ORP) meters and record data on Attachment B – Portable Equipment Calibration Log.
- Check the well, the lock, and the locking cap for damage or evidence of tampering.
- Record observations.

- Remove well cap and, if appropriate, measure VOCs at the rim of the well with a PID or flame ionization detector (FID) instrument and record the reading in field notebook or well logs.
- Being careful to not disturb the water column, slowly and gently measure the depth to water with a water level probe and/or oil water interface probe. Do not measure depth to well bottom at this time (wait until sampling has been completed). Measure water level to the nearest 0.01 foot from the top of casing or the highest point (or "V" notch) on the polyvinyl chloride (PVC). If the top of casing cannot be used, note the reference location. Mark the datum point with an indelible marker and note reference location in field book.
- Check newly constructed wells for the presence of light non-aqueous phase liquid (LNAPL) or dense non-aqueous phase liquid (DNAPL) before the initial sampling event.
- If LNAPL is present, the tubing intake should be at the mid-point of the well screen. Initial purge water should not be sent through the field parameter meter flow cell but sent directly to the purge water container. After the initial column of purge water is poured, the field parameter meters may be placed inline and the collection of data may be started.
- If DNAPL is present, the tubing intake should be placed approximately 1 foot below the water table or to the approximate depth below the known drawdown depth (refer to previous sample logs).
  - Calculate the well volume (V_w [gallons]) using the measured depth to water ($Depth_{water}$ [feet]), total well depth ($Depth_{total}$ [feet]), and well diameter:
    - $V_w = n \times (Depth_{total} - Depth_{water})$

    - 1-inch well: n = 0.04
    - 2-inch well: n = 0.16
    - 4-inch well: n = 0.65
    - 6-inch well: n = 1.47

  - Purge at low flow rates checking for DNAPL migration. If no DNAPL migration is observed during the last 15 minutes of purging, begin collecting field data. If DNAPL migration occurs during the last 15 minutes of purging, abort sampling and document on sample log.
  - For wells without LNAPL and/or DNAPL, slowly and gently insert the pump intake tubing to the middle of the saturated screened interval, open borehole, or to the pre-determined sampling depth. The pump intake must be kept at least 2 feet above the bottom of

  the well to prevent disturbance or suspension of any sediment or DNAPL present in the bottom of the well. Record the depth of the pump intake.
  - Place decontaminated flow-cell inline with tubing and connect calibrated Horiba U-22 Multiparameter Water Quality Meter, or equivalent. Place flow-cell in shade or insulate.
  - Start the pump on the lowest setting and increase slowly until flow begins. Adjust the pumping rate so that drawdown in the well is minimal (0.3 feet or less, if achievable). Use a pumping rate between 100 to 1,000 milliliters per minute (mL/min). Measure rates with a graduated container.
- While purging, record water levels every five minutes, or as appropriate. A steady state flow rate will be maintained that results in a stabilized water level with a drawdown of 0.3 feet or less, if achievable.
- During purging, monitor and record, every five minutes, the water quality indicator parameters that include: pH, temperature, SC, turbidity, DO, and ORP.
- Purging is complete when, after three consecutive measurements, the water quality parameters have stabilized as follows:
  1. pH (+/- 0.1 standard units)
  2. temperature (3%)
  3. SC (3%)
  4. turbidity (10% for values greater than 5 NTU; if three turbidity values are less than 5 NTU, consider the values as stabilized)
  5. DO (10% for greater than 0.5 milligram per liter [mg/L] or 3 consecutive values less than 0.5 mg/L)
  6. ORP (+/- 20 millivolt [mV] or 10%, whichever is greater)
- Containerize purge water in tanks or 55 gallon steel drums.
- Collect the samples.
- Following purge, disconnect the flow-through cell and fill all containers from the discharge end of the tubing. Collect samples at a flow rate equal to the steady state purge rate.
- Fill sample containers directly from the sampling device in order of decreasing volatility (i.e., Volatile Organic Compounds [VOC] samples will be collected first; see SOP SC-002, *Sampling Handling*).
- Label each sample collected and store samples in a cooler (SC-002, *Sampling Handling*).
- Secure the well cap and manhole cover and restore well area to pre-sampling conditions.

4. Notes

- Prior to the field activities, obtain available information on well construction for use in field investigation (i.e., screen and riser material, well diameter and depth, screened interval, optimum sampling depth, etc.).
- If using dedicated equipment, to the extent achievable install equipment into well at least 24 hours before sample collection to minimize disturbance of the water column and/or suspension of sediments or NAPL on bottom.
- To minimize the potential of cross-contamination between wells, dedicated, in-place pumps (and tubing) can be used.
- If the water quality indicator parameters do not stabilize after 2 hours, then either continue purging or, contact the Project Manager.
- All sample containers are to be filled with minimal turbulence by allowing the groundwater to flow from the tubing gently down the inside of the container.
- Be aware of any preservatives in the sample bottles and handle with care, in accordance with the Health and Safety Plan.

5. References

Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samles From Monitoring Wells (January 19, 2010), USEPA Region-1, EQASOP-GW 001.

Standard Reference for Monitoring Wells (April 19, 1991), Massachusetts DEP, DEP Publication No. WSC-310-91.

Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures (1996), R.W. Puls and M.J. Barcelona, U.S. Environmental Protection Agency, EPA/540/S-95/504.

Reproducible Well-Purging Procedures and VOC Stabilization Criteria for Ground Water Sampling (1994), M.J. Barcelona, H. A. Wehram, and M.D. Varljen, Ground Water, Vol. 32, No. 1, 12-22.

Low-Flow Purging and Sampling of Ground Water Monitoring Wells with Dedicated Systems (1995), R.W. Puls, and C.J. Paul, Groundwater Monitoring and Review, Summer 1995 116-123.

Ground Water Sampling Procedure Low Stress (Low Flow) Purging and Sampling, (1998), Ground-Water Sampling SOP, Final, U.S. Environmental Protection Agency, Region II, March 16, 1998.

RCRA Ground-Water Monitoring: Draft Technical Guidance, (1993), U.S. Environmental Protection Agency, EPA/530-R-93-001.

To Filter, or Not to Filter, That is the Question, (1997), Special Topics Subcommittee Letter Report EPA-SAF-EEC-LTR-97-011, April 29, 1997, Meeting, U.S. Environmental Protection Agency, Science Advisory Board Environmental Engineering Committee, September 5, 1997.

Should Filtered or Unfiltered Groundwater and Surface Water Samples be Collected for the Risk Assessment?, (1995), MCP Q&A: Subparts I and J, Special #4, Bureau of Waste Site Cleanup, Massachusetts Department of Environmental Protection (DEP), February, 1995.

6. Attachments

Attachment A – Monitoring Well Sample Data Form
Attachment B – Portable Equipment Calibration Log

Monitoring Well Sample Data Form

Project: ______________________ **Well ID:** ______________________ **Date:** ______________________

Total Well Depth (from top of casing): ______________________

Depth to Water (from top of casing): ______________________

Well Diameter: ______________________

Pump Intake Depth: ______________________

Sampling Crew: ______________________

Purge Time: *Start:* ______________________ *Finish:* ______________________

Purging Method: ______________________

Sampling Method: Low Flow

Sample Time: *Start:* ______________________ *Finish:* ______________________

Sample Analysis: ______________________

Purge Data

Sample Time	**Flow Rate** *(lpm/gpm)*	**Volume Purged** *(liters/gals.)*	**pH** *(std. Units)*	**Conductivity** *(mS/cm)*	**Turbidity** *(NTU)*	**Dissolved Oxygen** *(mg/l)*	**Temperature** *(Cel.)*	**Salinity** *(%)*	**ORP** *(mV)*	**Comments/Observations**
										Well Headspace PID =

Final Stabilization Data

Sample Time	**Flow Rate** *(lpm/gpm)*	**Volume Purged** *(liters/gals.)*	**pH** *(std. Units)*	**Conductivity** *(mS/cm)*	**Turbidity** *(NTU)*	**Dissolved Oxygen** *(mg/l)*	**Temperature** *(Cel.)*	**Salinity** *(%)*	**ORP** *(mV)*	**Comments/Observations**

GEI Consultants

Portable Equipment Calibration Log

Date: ____________________

Equipment Information

Equipment Type: ____________________

Manufacturer and Model: ____________________

Identification Number: ____________________

Calibration Information

Time	Parameter	Initial Reading	Calibration Value	Lot No.	Expiration	Final Reading

Notes:

Record information for all calibrated parameters.

If performing zero and span calibration, use a separate line for each.

Comments/Observations

GEI CONSULTANTS, INC.
110 Walt Whitman Rd, Suite 204
Huntington Station, New York

STANDARD OPERATING PROCEDURE

GW-004 pH and Temperature Measurement

---

1. Objective

The objective of this Standard Operating Procedure (SOP) is to provide standard methods for determining the pH and temperature of liquids using a combination pH/temperature meter.

2. Execution

- Calibrate the meter according to the equipment manufacturer’s instructions at the beginning of each day of use. Calibration for pH shall be performed using at least two buffer solutions from various ranges. Solutions chosen should be similar in pH to the expected level of the samples or liquids tested (pH 7 and four buffer solutions are preferred in most cases for ground or surface water measurements). Record data on Attachment A – Portable Equipment Calibration Log.
- Calibration is checked every two hours or every five monitoring locations, whichever occurs first, and at the end of the day by measuring the two calibration solutions used. The reading and times are recorded. If the readings are outside +/– 0.2 pH units, the meter must be recalibrated.
- Immediately prior to testing a sample, decontaminate testing beaker or container and probe assembly with one rinse of sample solution. Do not use methanol to rinse the probe. Methanol rinses could damage the probe.
- Gently shake the probe and beaker to remove excess solution. Visually inspect the bottom of the probe to ensure that liquid or sediment is not trapped between outer casing and probe.
- Pour the sample into the testing container and insert both temperature and pH probe. Stir sample for 30 seconds using both probes. Let the probes equilibrate in the sample solution for another 30 seconds. Measure and record the temperature. A reading has stabilized if pH units have not changed +/– 0.1 pH units during a five second period.
- Record pH to the nearest 0.1 unit and temperature to the nearest whole number.

3. Notes

- At all times, follow safety procedures as defined in the site-specific Health and Safety Plan.

- Coatings and particulates may affect the response of the probe; more thorough cleaning with distilled water and gently wiping the probe surface may be required to clean the surface of the probe.
- Temperature affects both the response of the instrument to pH and the actual pH of the sample. The Automatic Temperature Compensation (ATC) function compensates for the variation in the response of the meter only. Therefore, the pH must always be reported with temperature.
- The probe is a fragile thin glass bulb surrounded on three sides by a plastic casing. Care must be taken in handling the probe to avoid breakage.
- Buffer solutions should not be used past their expiration date.

4. References

Standard Methods for the Examination of Water and Wastewater, 18th Edition, Method 4500-H. American Public Health Association (1992).

5. Attachment

Attachment A – Portable Equipment Calibration Log

GEI CONSULTANTS, INC.
110 Walt Whitman Rd, Suite 204
Huntington Station, New York

SOP No. GW-005
Revision No.0
Effective Date: November 2010

STANDARD OPERATING PROCEDURE

GW-005 Turbidity Measurement

---

1. Description

A nephelometer/turbidimeter is used in comparing the turbidity of liquids by viewing light through them and determining how much light is eliminated. Turbidity readings are required to be read using a portable (e.g. Horiba or Hach) instrument outside the flow-through cell.

2. Execution

- Turn the meter "ON".
- Calibrate the meter according the manufacture's specifications and record data on Attachment A – Portable Equipment Calibration Log.
- Rinse the sample cell three times with organic free or de-ionized water.
- Fill the cell to the fill line with organic free or de-ionized water and then cap the cell.
- Use a non-abrasive lint-free paper or cloth (preferably lens paper) to wipe off excess water and streaks.
- Open the cover and insert the cell (arrow to the front) into the unit and close the cover.
- Press "READ" and wait for the 'light bulb' icon to go off. Record the reading.
- Using the Gelex standards, repeat steps above. Record all measurements (note anomalies).
- Collect a representative sample or use a portion of the sample that is collected for pH, temperature, or conductivity analysis, and pour off enough to fill the cell to the fill line (about 15 milliliters [ml]) and replace the cap on the cell.
- Wipe off excess water and any streaks with a soft, lint-free cloth (lens paper).
- Press "I/O" and the instrument will turn on. Place the meter on a flat, sturdy surface. Do not hold the instrument while making measurements.
- Insert the sample cell in the instrument so the diamond or orientation mark aligns with the raised orientation mark in the front of the cell compartment. Close the lid.
- Select manual or automatic range selection by pressing the range key.

- Select signal averaging mode by pressing the “Signal Average” key. Use signal average mode if the sample causes a noisy signal (display changes constantly).
- Press Read. The display will show “---- NTU” and then the turbidity in nephelometric turbidity units (NTUs). Record the result after the lamp symbol turns off.
- Rinse the cell with de-ionized water.
- Perform an operational check.
- Periodically check the turbidity meter during the day by using the Gelex secondary standards provided.
- Perform a post calibration at the end of the day and record all measurements.

3. Notes

- Turbidity measurements are reported in NTUs. It is important to note that if the turbidity measurements are for National Pollutant Discharge Elimination System (NPDES) reporting purposes, all values above 40 NTU must be diluted with turbidity free water and calculated by multiplying by a dilution factor.

4. References

Standard Methods for the Examination of Water and Wastewater, 18th Edition, Method 4500-H. American Public Health Association (1992).

GEI CONSULTANTS, INC.
110 Walt Whitman Rd, Suite 204
Huntington Station, New York

STANDARD OPERATING PROCEDURE

GW-006 Specific Conductance Measurement

---

1. Objective

The objective of this Standard Operating Procedure (SOP) is to provide standard methods for determining the conductivity of waters using a field conductivity meter.

2. Execution

- Calibrate the meter according to equipment manufacturer's instructions at the beginning of each day of use and record data on Attachment A – Portable Equipment Calibration Log. Calibration shall be performed using a standard KCl solution of 0.20 mS/cm (200 uS/cm, S=mho).
- Calibration is checked at the beginning of the day immediately prior to sampling, after five sampling locations or two hours (whichever occurs first), and at the end of the day. If the readings are outside +/- 0.02 mS/cm, the meter must be recalibrated. Initial calibration should be conducted under the same conditions (i.e., temperature, and location) of field testing.
- Immediately prior to testing a sample, decontaminate testing beaker or container and probe assembly with one distilled water rinse, and one sample solution rinse.
- Gently shake the probe and beaker to remove excess solution.
- Pour sample into the testing container and insert probe. Stir sample with the probe for approximately 10 seconds. Let the probe equilibrate in the sample solution for another five seconds. Measure conductivity and record in the field notebook.
- Record conductivity to the nearest whole number.

3. Notes

- At all times, follow safety procedures as defined in the site-specific Health and Safety Plan.
- Coatings and particulates may affect the probe's response; more thorough cleaning using a weak alconox solution and double distilled water rinse and gently wiping the probe surface may be required to clean the surface of the probe.
- If contaminated, (e.g., stained, conductance >750 mhos/cm), rinse probe with clean water immediately after measuring sample to minimize fouling of probe.
- Calibration solutions should not be used past their expiration date and must be discarded after three months of use.

4. References

Standard Methods for the Examination of Water and Wastewater, 18th Edition, Method 4500-H. American Public Health Association (1992).

5. Attachment

Attachment A – Portable Equipment Calibration Log

STANDARD OPERATING PROCEDURE

GW-007 Dissolved Oxygen Measurement

---

1. Objective

To accurately quantify dissolved oxygen (DO) in water.

2. Execution

Typically, the Horiba U-22 Multiparameter Water Quality Meter is used to measure groundwater DO during low-flow purging activities.

Horiba U-22 Multiparameter Water Quality Meter

1) Calibrate meter in accordance with manufactures specifications.
2) Calibrate the meter according to equipment manufacturer's instructions at the beginning of each day of use and record data on Attachment A – Portable Equipment Calibration Log.
3) In accordance with SOP GW-003, connect decontaminated meter inline with purge/sample tubing utilizing decontaminated flow-cell.
4) Record DO readings during monitoring well purging in accordance with SOP GW-003

3. Notes

- Collecting measurements from samples in containers will alter the gaseous content of the sample.
- Freshwater can hold more oxygen than saltwater. The dissolved salt forces dissolved gas out of water thereby lowering the solubility of water. A known relationship between salinity and dissolved oxygen concentration allows for a correction for salinity.

4. References

Standard Methods for the Examination of Water and Wastewater, 18th Edition, Method 4500-H. American Public Health Association (1992).

5. Attachment

Attachment A – Portable Equipment Calibration Log

Portable Equipment Calibration Log

Date:

Equipment Information

Equipment Type:
Manufacturer and Model:
Identification Number:

Calibration Information

Time	Parameter	Initial Reading	Calibration Value	Lot No.	Expiration	Final Reading

Notes:
Record information for all calibrated parameters.
If performing zero and span calibration, use a separate line for each.

Comments/Observations

Portable Equipment Calibration Log

Date:

Equipment Information

Equipment Type:

Manufacturer and Model:

Identification Number:

Calibration Information

Time	Parameter	Initial Reading	Calibration Value	Lot No.	Expiration	Final Reading

Notes:

Record information for all calibrated parameters.

If performing zero and span calibration, use a separate line for each.

Comments/Observations

REMEDIAL INVESTIGATION WORK PLAN (RIWP)
FORMER DRY CLEANERS
495 HOWARD AVENUE
BROOKLYN, NEW YORK
MAY 2013

Appendix D

Quality Assurance Project Plan

Geotechnical
Environmental and
Water Resources
Engineering

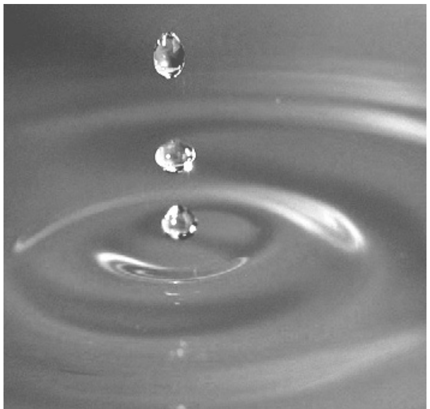
Quality Assurance Project Plan

Property Described as:
Former Dry Cleaners
495 Howard Avenue
Brooklyn, New York

Prepared For:
DCA 1, L.P.
c/o Omni New York LLC
885 Second Avenue, Floor 31
New York, New York 10017

Prepared By:
GEI Consultants, Inc.
110 Walt Whitman Road, Suite 204
Huntington Station, New York 11746
631.760.9300

May 2013
130230



Quality Assurance Project Plan

Former Dry Cleaners
495 Howard Avenue
Brooklyn, New York

Submitted by:
GEI Consultants, Inc.
110 Walt Whitman Road, Suite 204
Huntington Station, NY 11746
631-760-9300

May 2013

Table of Contents

Abbreviations and Acronyms iv

Quality Assurance Glossary vi

1. Purpose 1

2. Project Goals and Objectives 2

3. Project Organization and Responsibility 3

4. Quality Assurance Objectives 6
- 4.1 Required Quantification Limit 7
- 4.2 Accuracy 7
- 4.3 Precision 8
- 4.4 Completeness 8
- 4.5 Representativeness 9
- 4.6 Comparability 9

5. Sampling Plan 11
- 5.1 Sample Type, Location, and Frequency 11
  - 5.1.1 Subsurface Soil Samples 11
  - 5.1.2 Groundwater samples 11
  - 5.1.3 Field QC Sample Collection 11
- 5.2 Sample Preservation and Containerization 12
- 5.3 Equipment Decontamination 13

6. Documentation and COC 14
- 6.1 Sample Collection Documentation 14
  - 6.1.1 Field Notes 14
  - 6.1.2 COC Records 14
  - 6.1.3 Sample Labeling 15
  - 6.1.4 Sample Handling 15
- 6.2 Sample Custody 15
  - 6.2.1 Field Custody Procedures 16
  - 6.2.2 Laboratory Custody Procedures 17

7. Calibration Procedure 18
- 7.1 Field Instruments 18
- 7.2 Laboratory Instruments 18

8. Sample Preparation and Analytical Procedures 19

9. Data Reduction, Validation, and Reporting 20
- 9.1 Field Data Evaluation 20
- 9.2 Analytical Data Validation 20

10. Internal Quality Control 21

11. Performance and System Audits 22

12. Preventative Maintenance 23

13. Specific Procedures to Assess Data Quality Indicators 24
- 13.1 Detection Limits 24
  - 13.1.1 Method Detection Limit 24
  - 13.1.2 Reporting Limit 24
- 13.2 Precision 25
- 13.3 Accuracy 26
- 13.4 Completeness 26
- 13.5 Representativeness 27
- 13.6 Comparability 27

14. Corrective Action 28
- 14.1 Immediate Corrective Action 28

Table of Contents (cont.)

Tables

Table 1 – Soil and Sediment Field Sampling Matrix
Table 2 – Groundwater Field Sampling Matrix
Table 3 – Analytical Methods/Quality Assurance Summary Table
Table 4 – Chemical Parameters, Reporting Limits and Data Quality Objectives for Soil Samples
Table 5 – Chemical Parameters, Reporting Limits and Data Quality Objectives for Groundwater Samples
Table 6 – Quality Control Limits Precision and Accuracy for Soil and Sediment Samples
Table 7 – Quality Control Limits Precision and Accuracy for Groundwater Samples

Appendices

A H2M Labs Inc. Laboratory Quality Manual (electronic only)

H:\TECH\project\EEA Consultants Inc\Brownsville Brooklyn Site\QAPP\QAPP 3-23-12.docx

Abbreviations and Acronyms

ASP	Analytical Service Protocol
BOD	Biological Oxygen Demand
CAS	Chemical Abstracts Service
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CHMM	Certified Hazardous Materials Manager
CMS	Chip Measurement System
CLP	Contract Laboratory Protocol
COC	Chain Of Custody
COD	Chemical Oxygen Demand
DQO	Data Quality Objective
DO	Dissolved Oxygen
DUSR	Data Usability Summary Report
ELAP	Environmental Laboratory Approval Program
EPA	United States Environmental Protection Agency
FSP	Field Sampling Plan
GC/MS	Gas Chromatography/Mass Spectroscopy
GEI	GEI Consultants, Inc.
H2M	H2M Labs, Inc.
LCS	Labortory Control Sample
LEL	Lower Explosive Limit
LEP	Licenced Environmental Professional (Connecticut)
MDL	Method Detection Limit
MPH	Master of Public Health
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NTU	Nephelometric Turbidity Unit
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
ORP	Oxidation Reductioin Potential
PAH	Polycyclic Aromatic Hydrocarbon
PCE	Perchloroethylene (also know as tetrachloroethene)
PID	Photoionization Detector
PM	Project Manager
PQL	Practical Quantification Limit
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation Recovery Act
RIWP	Remedial Investigation Work Plan
RL	Reporting Limit
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SD	Standard Deviation

SOP	Standard Operating Procedures
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
TCL+30	Target Compound List Plus 30
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Identified Compounds
TOC	Total Organic Carbon
USDOT	United States Department of Transporation
VOC	Volatile Organic Compound

Quality Assurance Glossary

“Alteration” means altering a sample collected for analysis in any way other than by adding a preservative, such as nitric acid to lower pH. Examples of alteration include, but are not limited to: filtering, settling and decanting, centrifuging and decanting, and acid extracting.

“Analytical Services Protocol” or “ASP” means the NYSDEC’s compendium of approved EPA and NYSDEC laboratory methods for sample preparation and analysis and data handling procedures.

“Correlation Sample” means a sample taken, when using a field-testing technology, to be analyzed by an ELAP-certified laboratory to determine the correlation between the laboratory and field analytical results.

“Confirmatory Sample” means a sample taken after remedial action is expected to be complete to verify that the cleanup requirements have been met. This term has the same meaning as “post remediation sample.”

“Contract laboratory program” or “CLP” means a program of chemical analytical services developed by the United States Environmental Protection Agency (EPA) to support CERCLA.

“Data Usability Summary Report, (DUSR)” is a document that provides a thorough evaluation of the analytical data to determine whether or not the data, as presented, meets the site/project specific criteria for data quality and use.

“Effective solubility” means the theoretical aqueous solubility of an organic constituent in groundwater that is in chemical equilibrium with a separate phase mixed product (product containing several organic chemicals). The effective solubility of a particular organic chemical can be estimated by multiplying its mole fraction in the product mixture by its pure phase solubility.

“Environmental Laboratory Accreditation Program” or “ELAP” means a program conducted by the New York State Department of Health (NYSDOH), which certifies environmental laboratories through onsite inspections and evaluation of principles of credentials and proficiency testing.

“Filtration” means the filtering of a groundwater or surface water sample, collected for metals analysis, at the time of collection and prior to preservation. Filtering includes, but is not limited to, the use of any membrane, fabric, paper or other filter medium, irrespective of pore size, to remove particulates from suspension.

“**Final delineation sample**” means a sample taken as an endpoint sample, used to make a decision regarding the extent of contamination at a site, which is to be analyzed by an ELAP-certified laboratory.

“Intermediate Sample” means a sample taken during the investigation process that will be followed by another sampling event to confirm that remediation was successful or to confirm that the extent of contamination has been defined to below a level of concern.

“Method detection limit” or “MDL” means the minimum concentration of a substance that can be measured and reported with a 99 percent confidence that the analyte concentration is greater than zero and is determined from the analysis of a sample in a given matrix containing the analyte.

“Minimum reporting limit” means the lowest concentration at which an analyte can be detected and which can be reported with a reasonable degree of accuracy. It is the lowest concentration that can be measured, a lab-specific number, developed from minimum detection limits, and is also referred to as the practical quantitation limit (PQL).

“Nephelometric Turbidity Unit” or "NTU" is the unit by which turbidity in a sample is measured.

“Non-targeted compound” means a compound detected in a sample using a specific analytical method that is not a targeted compound, a surrogate compound, a system monitoring compound or an internal standard compound.

“Practical quantitation level” or “PQL” means the lowest quantitation level of a given analyte that can be reliably achieved among laboratories within the specified limits of precision and accuracy of a given analytical method during routine laboratory operating conditions.

"Preservation" means preventing the degradation of a sample due to precipitation, biological action, or other physical/chemical processes between the time of sample collection and analysis. The most common examples involve refrigeration at 4 degrees Celsius and lowering sample pH by the addition of acid to keep dissolved metals in solution or to reduce the biodegradation of dissolved organic analytes.

"PAH" means polycyclic aromatic hydrocarbon as defined by USEPA Method 8270.

"Quality assurance" or "QA" means the total integrated program for assuring the reliability of monitoring and measurement data, which includes a system for integrating the quality planning, quality assessment and quality improvement efforts to meet data end-use requirements.

"Quality assurance project plan" or "QAPP" means a document, which presents in specific terms the policies, organization, objectives, functional activities, and specific quality assurance/quality control activities designed to achieve the data quality goals or objectives of a specific project or operation.

"Quality control" or "QC" means the routine application of procedures for attaining prescribed standards of performance in the monitoring and measurement process.

"Semivolatile organic compound" or "SVOC" means compounds amenable to analysis by extraction of the sample with an organic solvent. For the purposes of this section, semivolatiles are those target compound list compounds identified in the statement of work in the current version of the EPA Contract Laboratory Program.

"Target analyte list" or "TAL" means the list of inorganic compounds/elements designated for analysis as contained in the version of the EPA Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration in effect as of the date on which the laboratory is performing the analysis. For the purpose of this chapter, a Target Analyte List scan means the analysis of a sample for Target Analyte List compounds/ elements.

"Targeted compound" means a hazardous substance, hazardous waste, or pollutant for which a specific analytical method is designed to detect that potential contaminant both qualitatively and quantitatively.

"Target compound list plus 30" or "TCL+30" means the list of organic compounds designated for analysis (TCL) as contained in the version of the EPA "Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration" in effect as of the date on which the laboratory is performing the analysis, and up to 30 non-targeted organic compounds (plus 30) as detected by gas chromatography/mass spectroscopy (GC/MS) analysis. For the purposes of this chapter, a Target Compound List+30 scan means the analysis of a sample for Target Compound List compounds and up to 10 non-targeted volatile organic compounds and up to 20 non-targeted semivolatile organic compounds using GC/MS analytical methods. Non-targeted compound criteria should be pursuant to the version of the EPA “Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration” in effect as of the date on which the laboratory is performing the analysis.

"Tentatively identified compound or TIC" means a chemical compound that is not on the target compound list but is detected in a sample analyzed by a GC/MS analytical method. TICs are only possible with methods using mass spectrometry as the detection technique. The compound is tentatively identified using a mass spectral instrumental electronic library search and the concentration of the compound estimated.

“Unknown compound” means a non-targeted compound which cannot be tentatively identified. Based on the analytical method used, the estimated concentration of the unknown compound may or may not be determined.

“Volatile organic compounds” or “VOC” means organic compounds amenable to analysis by the purge and trap technique. For the purposes of this chapter, analysis of volatile organics means the analysis of a sample for either those priority pollutants listed as amenable for analysis using EPA method 624 or those target compounds identified as volatiles in the version of the EPA “Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration” in effect as of the date on which the laboratory is performing the analysis.

“**Waste oil”** means used and/or reprocessed engine lubricating oil and/or any other used oil, including but not limited to: fuel oil, engine oil, gear oil, cutting oil, transmission fluid, oil storage tank residue, animal oil and vegetable oil, which has not subsequently been refined.

“Well development” means the application of energy to a newly installed well to establish a good hydraulic connection between the well and the surrounding formation. During development, fine-grained formation material that may have infiltrated the sand pack and/or well during installation is removed, allowing water from the formation to enter the well without becoming turbid and unrepresentative of groundwater in the formation.

1. Purpose

GEI Consultants, Inc. (GEI) has prepared this Quality Assurance Project Plan (QAPP) to address analytical sampling at the former dry cleaners site located at 495 Howard Avenue, Brooklyn, New York (the site). The QAPP is a companion document and attachment to the *Remedial Investigation Work Plan (RIWP).* The QAPP presents the project scope and goals, organization, objectives, sample handling procedures and Quality Assurance Quality Control (QA/QC) procedures associated with the site.

Furthermore, this QAPP identifies project responsibilities, prescribes guidance and specifications to make certain that:

- Samples are identified and controlled through sample tracking systems and chain-of-custody (COC) protocols.
- Field and laboratory analytical results are valid and usable by adherence to established protocols and procedures.
- All aspects of the investigation, from field to laboratory are documented to provide data that are technically sound and legally defensible.

The requirements of this QAPP apply to all contractor activities as appropriate for their respective tasks.

This QAPP was prepared based upon guidance provided by the United States Environmental Protection Agency (USEPA) and New York State Department of Environmental Conservation (NYSDEC) including:

- *DER-10, Technical Guidance for Site Investigation and Remediation.* New York State Department of Environmental Conservation. *May 3, 2010.*
- *Analytical Service Protocol,* New York State Department of Environmental Conservation. *July 2005.*
- *US EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations (EPA QA/R-5, March 2001).*
- *Guidance for Quality Assurance Project Plans (EPA QA/G-5, December 2002).*

2. Project Goals and Objectives

An RIWP has been developed to develop a remedial analysis for onsite tetrachloroethene (PCE) impacts. The RIWP program will include:

- Soil borings
- Monitoring well installations
- Soil field screening
- Soil analytical sampling
- Groundwater analytical sampling

3. Project Organization and Responsibility

GEI is responsible for the implementation of the scope of work associated with the RIWP, including the supervision of contractors, field activities, and the evaluation and interpretation of data. GEI will perform the sampling activities and coordinate submittal of samples to testing laboratories. The project organization and key personnel for GEI are listed below:

In-House Consultant: Dennis Unites, P.G., Licensed Environmental Professional (LEP)
Program Manager: Errol Kitt
Project Manager: Nick Recchia
Field Team Leader: Brandon Nathe/Chris Anastasiou
Quality Assurance Officer: Brian Skelly
GEI Corporate Health & Safety Officer: Robin B. DeHate, Master of Public Health (MPH), PhD(c), Certified Hazardous Materials Manager (CHMM)
Data Manager: Brian Skelly

The primary responsibilities of each of these personnel are described in the following table.

Key Project Personnel and Responsibilities

Position	GEI Personnel	Areas of Responsibilities
In-House Consultant	Dennis Unites	▪ Provide strategic guidance of project activities ▪ Client contact regarding strategic issues ▪ Review of project deliverables
Program Manager	Errol Kitt	▪ Overall program oversight ▪ Project management ▪ Project schedule ▪ Client contact regarding project related issues ▪ Personnel and resource management ▪ Review of project submittals ▪ Budgeting
Project Manager	Nick Recchia	▪ Client contact regarding project related issues ▪ Coordination of contractors ▪ Technical development and implementation of RIWP and related documents ▪ Personnel and resource management ▪ Preparation and review of project submittals ▪ Budgeting
Field Team Leader	Brandon Nathe	▪ Client contact regarding project related issues on day to day basis as part of field operations ▪ Coordination of contractors ▪ Implementation of RIWP and Field Sampling ▪ Plan personnel and resource management ▪ Preparation of project submittals

Key Project Personnel and Responsibilities		
Position	**GEI Personnel**	**Areas of Responsibilities**
Quality Assurance Officer	Brian Skelly	▪ QA/QC for sampling and laboratory performance
Data Manager	Brian Skelly	▪ Manage raw data from the laboratory ▪ Maintain copies of COCs in the project file

H2M Labs Inc. (H2M), located in Melville, New York, has been selected to perform the following standard analytical chemistry parameters for subsurface soil and groundwater samples including:

- Volatile Organic Compounds (VOCs) according to EPA Method 8260B
- Target Analyte List (TAL) Metals according to EPA Method 6010B/7470A/7471B
- Chemical Oxygen Demand (COD) according to EPA Method 410.4
- Biological Oxygen Demand (BOD) according to SM 5210B
- Nitrate (NO_3) according to EPA Method 353
- Nitrite (NO_2) according to EPA Method 353
- Sulfate (SO_4) according to EPA Method 375.2
- Hydrogen (H_2)
- Methane (CH_4)
- Ferrous Iron (Fe 2+) according to ASTM Method D3872-86
- Total Organic Carbon (TOC) according to SM 5310 (aqueous) and Lloyd Kahn test method (solids)
- Ammonia according to EPA Method 350.1
- Nitrogen according to EPA Method 351.2

Shallow subsurface soil samples collected within the historical fill layer and all groundwater samples will also be analyzed for the following standard analytical chemistry parameters:

- Target Compound List Semi-volatile Organic Compounds (SVOCs) according to EPA Method 8270C
- Polychlorinated Biphenyls (PCBs) according to EPA Method 8082
- Pesticides according to EPA Method 8081
- Herbicides according to EPA Method 8151

H2M’s relevant certifications are summarized in the following table.

H2M’s Certifications		
Location	Responsible Agency	Certification
New York	New York State Department of Health	Environmental Laboratory Approval Program (ELAP) for potable water/non-potable water,

		solid and hazardous waste Contract Laboratory Protocol (CLP)
	New York State Department of Conservation	July 2005 Analytical Service Protocol (ASP)
United States	United States Environmental Protection Agency	CLP-Lab: 10478 [VOCs/ SVOCs/Inorganics/Pesticides/PCBs/Herbicides]

Table 1 provides a summary of soil analyses, **Table 2** provides a summary of groundwater analyses. **Table 3** provides a summary of quality assurance samples, holding times and analysis for each media.

4. Quality Assurance Objectives

This section establishes the QA objectives for measurements that are critical to the project. The QA objectives are developed for relevant data quality indicators. These indicators include the method detection limit (MDL), reporting limit (RL), precision, accuracy, completeness, representativeness, and comparability. The data quality objectives (DQOs) are based on project requirements and ensure: (1) that the data generated during the project are of known quality and (2) that the quality is acceptable to achieve the project's technical objectives.

Quantitation Limits are laboratory-specific and reflect those values achievable by the laboratory performing the analyses. However, in order to ensure that the analytical methodologies are capable of achieving the DQOs, measurement performance criteria have been set for the analytical measurements in terms of accuracy, precision, and completeness. The analytical methods to be used at this site will provide a level of data quality and can be used to evaluate potential impacts to soil, groundwater, and soil vapor from the former MGP operations, compared to New York State Standards, Criteria and Guidance values, and for purposes of risk assessment.

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting which will provide results that are scientifically valid, and the levels of which are sufficient to meet DQOs. Specific procedures for sampling, chain of custody, laboratory instruments calibration, laboratory analysis, reporting of data, internal quality control, and corrective action are described in other sections of the QAPP.

The data quality indicators are presented in subsections 4.1 through 4.6. Procedures to assess the data quality indicators are given below in Section 13.

Table 4 and **Table 5** provide the RLs, MDLs and the DQO's for soil and groundwater samples, respectively. The DQO's for soil samples for this project include minimum RLs specified within the 2005 NYSDEC ASP as well as unrestricted use criteria listed in 6 NYCRR Part 375. The DQO's for groundwater samples for this project include minimum RLs specified within the 2005 NYSDEC ASP as well as GA groundwater criteria listed in the Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations.

Tables 6 and **Table 7** provide the precision and accuracy DQO's for soil and water samples, respectively.

4.1 Required Quantification Limit

The required quantification limit is the quantitative analytical level for individual analytes needed to make decisions relative to the objectives of the project. Quantitative limits may be expressed as the MDL or some quantitative level defined in terms relative to the program. It should be noted that there is some ambiguity in the definitions and use of terms that define quantification limits. The MDL presented herein is a well-defined and accepted entity, although attainable only under ideal laboratory conditions.

Method Detection Limit: The MDL is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. MDL is determined from analysis of a sample in a given matrix type containing the analyte.

Practical Quantitation Limit: The practical quantitation limit (PQL) [also referred to as the reporting limit (RL)] is the concentration in the sample that corresponds to the lowest concentration standard of the calibration curve.

Tables 4 and **Table 5** provide the reporting limits and the DQO's for soil and groundwater samples, respectively.

4.2 Accuracy

Accuracy is the closeness of agreement between an observed value and an accepted reference value. The difference between the observed value and the reference value includes components of both systematic error (bias) and random error.

Accuracy in the field is assessed through the adherence to all field instrument calibration procedures, sample handling, preservation, and holding time requirements, and through the collection of equipment blanks prior to the collection of samples for each type of equipment being used (e.g., sample liners, drilling shoe, or stainless–steel sampling implements).

The laboratory will assess the overall accuracy of their instruments and analytical methods (independent of sample or matrix effects) through the measurement of "standards," materials of accepted reference value. Accuracy will vary from analysis to analysis because of individual sample and matrix effects. In an individual analysis, accuracy will be measured in terms of blank results, the percent recovery (%R) of surrogate compounds in organic analyses, or %R of spiked compounds in matrix spikes (MSs), matrix spike duplicates

(MSDs) and/or laboratory control samples (LCSs). This gives an indication of expected recovery for analytes tending to behave chemically like the spiked or surrogate compounds.

4.3 Precision

Precision is the agreement among a set of replicate measurements without consideration of the "true" or accurate value: i.e., variability between measurements of the same material for the same analyte. In environmental sampling, precision is the result of field sampling and analytical factors. Precision in the laboratory is easier to measure and control than precision in the field. Replicate laboratory analyses of the same sample provide information on analytical precision; replicate field samples provide data on overall measurement precision. The difference between the overall measurement precision and the analytical precision is attributed to sampling precision. Precision is measured in a variety of ways including statistically, such as calculating variance or standard deviation. The difference between the overall measurement precision and the analytical precision is attributed to sampling precision.

Precision in the field is assessed through the collection and measurement of field duplicates. Field duplicates will be collected at a frequency of one per twenty investigative samples per matrix per analytical parameter, with the exception of the waste characterization parameters. Precision will be measured through the calculation of relative percent differences (RPDs) as described below in subsection 13.2. The resulting information will be used to assess sampling and analytical variability. Duplicate samples are described below in subsection 5.1.3. **Table 3** summarizes the number of duplicates per media sampled.

Precision in the laboratory is assessed through the calculation of RPD for duplicate samples. For organic analyses, laboratory precision will be assessed through the analysis of MS/MSD samples and field duplicates. For the inorganic analyses, laboratory precision will be assessed through the analysis of matrix duplicate pairs and field duplicate pairs. MS/MSD samples or matrix duplicate pairs will be performed at a frequency of one per twenty primary samples per matrix. Duplicate samples are described below in subsection 5.1.3. **Table 4** summarizes the number of duplicates per media sampled.

4.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. "Normal conditions" are defined as the conditions expected if the sampling plan was implemented as planned. The objective for completeness is a sufficient amount of valid data to achieve a predetermined statistical level of confidence. Critical samples must be identified and plans must be formulated to secure requisite valid data for these samples.

Field completeness is a measure of the amount of 1) valid measurements obtained from all the measurements taken in the project and 2) valid samples collected. The field completeness objective is greater than 90 percent.

Laboratory completeness is a measure of the amount of valid measurements obtained from all valid samples submitted to the laboratory. The laboratory completeness objective is greater than 95 percent.

To ensure that these percentages are met, materials for crucial parameters will be retained if re-sampling is required and strict adherence to holding times will be required.

4.5 Representativeness

Representativeness is a qualitative parameter that expresses the degree to which data accurately and precisely represents either a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary. To ensure representativeness, the sampling locations have been selected to provide coverage over a wide area and to highlight potential trends in the data.

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that any future work plans and the current operations, maintenance, and monitoring (OM&M) plan are followed and that proper sampling, sample handling, and sample preservation techniques are used.

Representativeness in the laboratory is ensured by using the proper analytical procedures, appropriate methods, and meeting sample-holding times.

4.6 Comparability

Comparability is a qualitative parameter that expresses the confidence with which one data set can be compared to another. Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the RIWP is followed and that proper sampling techniques are used. Maximization of comparability with previous data sets is expected because the sampling design and field protocols are consistent with those previously used.

Comparability is dependent on the use of recognized USEPA or equivalent analytical methods and the reporting of data in standardized units. To facilitate data comparison, the data-reporting format as presented below will be used:

- Conventions (units reported as): for solids (weight/unit weight [i.e., mg/kg]); for liquids (weight/unit volume [i.e., µg/L]); for air (weight/unit volume [i.e., µg/m3]).
- Use common chemical name with corresponding chemical abstracts service (CAS) code.
- Report all data for soils on a dry-weight basis.

5. Sampling Plan

Environmental sampling will include subsurface soil, soil vapor, sediment, groundwater, and waste characterization sampling. Direct push drilling (Geoprobe®) will be the preferred method for obtaining subsurface soil samples. Groundwater samples will be collected utilizing low-flow sampling methods, peristaltic pumps, bailers, whale pumps, or bladder pumps. Performing grab or composite sampling by appropriate hand-held sampling equipment will be the preferred method for waste characterization sampling. Analytical samples and analysis methods will be described in future work plans. Sampling methods and procedures are presented in **Appendix A** of the RIWP.

5.1 Sample Type, Location, and Frequency

5.1.1 Subsurface Soil Samples

If subsurface soil samples are required, field conditions at the time of sampling will determine the appropriate method. Possible methods include Geoprobe®, hollow-stem auger, or other appropriate drilling methods. The depth, location and number of soil borings will be specified in a job specific Work Plan. Soil samples will be collected and submitted for laboratory analysis in general accordance with the RIWP and field sampling plan (FSP). A summary of typical subsurface soil sample naming analysis are located on **Table 1**.

5.1.2 Groundwater samples

Groundwater samples will be collected and submitted for laboratory analysis in general accordance with the RIWP. Water quality parameters including temperature, pH, turbidity, salinity, dissolved oxygen (DO), oxidation reduction potential (ORP), and specific conductance, will be collected prior to laboratory analysis. A summary of groundwater samples and analysis as depicted on **Table 2**.

5.1.3 Field QC Sample Collection

Field QC samples are used to monitor the reproducibility and representativeness of field sampling activities. The field QC samples are handled, transported and analyzed in the same manner as the associated field samples. Field QC samples will include equipment blanks, trip blanks, field duplicates and MS/MSDs. The quantity, field QC sample type and analysis is detailed on **Table 3**.

Equipment Blank Samples are used to monitor the adequacy of decontamination procedures and possible sources of contamination such as potential laboratory methodologies.

Equipment blanks will consist of laboratory-supplied, distilled or de-ionized water and will be used to check for potential contamination of the equipment which may cause sample contamination. Equipment blanks will be collected by routing the distilled water through a decontaminated piece of sampling equipment or disposable sampling equipment into laboratory supplied bottles. Non-dedicated field equipment will be decontaminated as specified below in subsection 5.3. Equipment blanks will be submitted to the laboratory at a frequency of one per 20 samples per matrix per type of equipment being used per parameter. Equipment blanks will not be completed for waste characterization sampling activities.

Trip Blank Samples will consist of analyte free water and will be prepared by the laboratory. Trip blanks are used to assess the potential for VOC contamination of samples due to contaminant migration during sample shipment and storage. Trip blanks will be transported to the project location unopened, stored with the site characterization samples, and kept closed until analyzed by the laboratory. Trip blanks will be submitted to the laboratory at a frequency of one per cooler which contains samples submitted for VOC analysis.

Field Duplicate Samples, also referred to as blind duplicate samples, are two samples that are submitted from the same interval using the same sample procedures. Field duplicates will be used to assess the sampling and analytical reproducibility. Both samples are collected utilizing the same methods and are submitted for the same laboratory analysis however different sample identification numbers are used. Field duplicates will be submitted at a frequency of one per 20 samples for all matrices and all parameters. Field duplicates will not be completed for waste characterization sampling activities.

MS/MSD Samples are two additional aliquots of the same sample submitted for the same parameters as the original sample. However, the additional aliquots are spiked with the compounds of concern. Matrix spikes provide information about the effect of the sample matrix on the measurement methodology. MS/MSDs will be submitted at a frequency of one per 20 investigative samples per matrix for organic and inorganic parameters. MS/MSDs will not be completed for waste characterization sampling activities.

Refer to **Table 4** for a summary of QC sample preservation and container requirements.

5.2 Sample Preservation and Containerization

The analytical laboratory will supply the sample containers for the chemical samples. These containers will be cleaned by the manufacturer to meet or exceed all analyte specifications established in the latest USEPA’s Specifications and Guidance for Contaminant-Free Sample Containers. Certificates of analysis are provided with each bottle lot and maintained on file to document conformance to USEPA specifications. The containers will be pre-preserved, where appropriate. Sample preservation and containerization details are outlined in **Table 4**.

5.3 Equipment Decontamination

All non-dedicated sampling equipment shall be cleaned between each use in the following manner:

- Wash/scrub with a biodegradable degreaser ("Simple Green") if there is oily residue on equipment surface.
- Tap water rinse.
- Wash and scrub with Alconox (or non-phosphate soap) and water mixture.
- Tap water rinse.
- All equipment used to collect samples for VOCs analysis will then receive a methanol rinse followed by a de-ionized water rinse.
- All equipment used to collect samples for metals analysis will then receive a 10% nitric acid solution rinse followed by a de-ionized water rinse.
- Equipment will be wrapped in polyethylene plastic or aluminum foil for storage or transportation from the designated decontamination area to the sampling location, where appropriate.

The drilling equipment will be decontaminated by steam cleaning or equivalent.

Decontamination fluids will be containerized into United States Department of Transportation (USDOT)/UN-approved 55-gallon drums or containment vessels and will be characterized and disposed of by an approved disposal facility.

6. Documentation and COC

6.1 Sample Collection Documentation

6.1.1 Field Notes

Field notes documenting field activities will be maintained in a field notebook in general accordance with the FSP. Field logbooks will provide the means of recording the chronology of data collection activities performed during the investigation. The logbook will be a bound notebook with water-resistant pages. Logbook entries will be dated, legible, and contain accurate and inclusive documentation of the activity. No erasures or obliterations of field notes will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark, which is signed and dated by the sampler. The correction shall be written adjacent to the error.

Field logbooks will be reviewed at regular intervals by the field team leader, site manager, and project manager for completeness and representativeness. When necessary, logbooks will be supported by daily activity reports.

6.1.2 COC Records

Sample custody is discussed in detail below in subsection 6.2. COC records are initiated by the samplers in the field. The field portion of the custody documentation should include:

- The project name
- Signature(s) of sampler (s) responsible for sample custody
- Sample ID number
- Date and time of collection
- Whether the sample is grab or composite
- Names of individuals involved in sampling
- Air bill or other shipping number (if applicable)

On a regular basis (daily or on such a basis that all holding times will be met), samples will be transferred to the custody of the respective laboratories, via third-party commercial carriers or via laboratory courier service. Sample packaging and shipping procedures, and field COC procedures are described below in subsection 6.2.1 of this Plan. Sample receipt and log-in procedures at the laboratory are described below in subsection 6.2.2 of this Plan.

6.1.3 Sample Labeling

Each sample will be labeled with a pre-printed adhesive label using indelible ink. The label should include the date and time of collection, sampler's initials, tests to be performed, preservative (if applicable), and a unique identification. The following identification scheme will be used:

PRIMARY SAMPLES TYPES	QA/QC SAMPLE TYPES
SOIL SAMPLES Boring -ID (SAMPLE DEPTH-FEET) SB-01 (10-15) **GROUNDWATER SAMPLES** Monitoring Well-ID MW-01S	**FIELD BLANKS** SAMPLE-ID – [DATE] SS-FB-033110 **MATRIX SPIKE/DUP** SAMPLE [ID] [DEPTH] [EITHER MS OR MSD] SS-01 (10-15) MS/MSD **TRIP BLANKS** SAMPLE- ID [DATE] TB-033110 **BLIND DUPLICATES** SAMPLE -ID[XX][DATE] SS-XX-033110

This sample label contains the authoritative information for the sample. Inconsistencies with other documents will be settled in favor of the vial or container label unless otherwise corrected in writing from the field personnel collecting samples or the Data Manager and/or the Project QA Officer.

6.1.4 Sample Handling

Samples will be handled in general accordance with Appendix A.

6.2 Sample Custody

The COC provides a record of the custody of any environmental field sample from the time of collection to the delivery to the laboratory. Custody is one of several factors that are necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files.

A sample is considered to be under a person's custody if:

- The item is in the actual possession of a person
- The item is in the view of the person after being in actual possession of the person

- The item was in the actual physical possession of the person but is locked up to prevent tampering
- The item is in a designated and identified secure area

6.2.1 Field Custody Procedures

Samples will be collected following the sampling procedures indicated in the FSP. A summary of samples and collection methods are provided above in Section 5 of this QAPP. Documentation of sample collection is described above in subsection 6.1. Sample COC and packaging procedures are summarized below. These procedures will ensure that the samples will arrive at the laboratory with the COC intact.

- The field sampler is personally responsible for the care and custody of the samples until they are transferred or dispatched properly. Field procedures have been designed such that as few people as possible will handle the samples.
- All bottles will be identified by the use of sample labels with sample numbers, sampling locations, date/time of collection, and type of analysis. The sample numbering system is presented above in subsection 6.1.3.
- Sample labels will be completed for each sample using waterproof ink unless prohibited by weather conditions.
- Samples will be accompanied by a completed COC form. The sample numbers and locations will be listed on the COC form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents the transfer of custody of samples from the sampler to another person, to a mobile laboratory, and to the laboratory facility.
- All shipments will be accompanied by the COC record identifying the contents. The original record will accompany the shipment, and copies will be retained by the sampler and provided to the data manager and placed in the project files.
- Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in and secured to the inside top of each sample box or cooler. Shipping containers will be secured with strapping tape and custody seals for shipment to the laboratory. The custody seals will be attached to the cooler and covered with clear plastic tape after being signed by field personnel.
- If the samples are sent by common carrier, the air bill will be used. Air bills will be retained as part of the permanent documentation. Commercial carriers are not required to sign off on the custody forms since the custody forms will be sealed inside the sample cooler and the custody seals will remain intact.
- Samples remain in the custody of the sampler until transfer of custody is completed. This consists of delivery of samples to the laboratory sample custodian, and signature

of the laboratory sample custodian on COC document as receiving the samples and signature of sampler as relinquishing samples.

6.2.2 Laboratory Custody Procedures

After accepting custody of the shipping containers, the laboratory will document the receipt of the shipping containers by signing the COC record. The laboratory will:

- Examine the shipping containers to verify that the custody tape is intact
- Examine all sample containers for damage
- Determine if the temperature required for the requested testing program has been maintained during shipment and document the temperature on the COC records
- Compare samples received against those listed on the COC
- Verify that sample holding times have not been exceeded
- Examine all shipping records for accuracy and completeness
- Determine sample pH (if applicable) and record on COC forms
- Sign and date the COC immediately (if shipment is accepted) and attach the air bill
- Note any problems associated with the coolers and/or samples on the cooler receipt form and notify the laboratory project manager, who will be responsible for contacting the GEI data manager
- Attach laboratory sample container labels with unique laboratory identification and test
- Place the samples in the proper laboratory storage.

Following receipt, samples will be logged in according to the following procedure:

- The samples will be entered into the laboratory tracking system. At a minimum, the following information will be entered: project name or identification, unique sample numbers (both client and internal laboratory), type of sample, required tests, date and time of laboratory receipt of samples, and field ID provided by field personnel.
- The completed COC, air bills, and any additional documentation will be placed in the project file.

7. Calibration Procedure

7.1 Field Instruments

Field instruments will be calibrated according to the manufacturer's specifications. Air monitoring instruments will be calibrated to a known reference gas standard and ambient air outside the work zone. Calibration will be completed daily. If concentrations of VOCs are encountered above the reference gas standard, the soil screening photoionization detector (PIDs) may be calibrated or re-checked against the reference gas standard. Water quality meters will be calibrated with known reference solutions. All calibration procedures performed will be documented in the field logbook and will include the date/time of calibration, name of person performing the calibration, reference standard used, and the readings. The following equipment may be used during sampling activities.

Subsurface Soil Sampling Activities:

- RAE Systems MultiRAE Plus equipped with VOC (10.6 eV lamp), lower explosive limit (LEL), percent oxygen, hydrogen sulfide and hydrogen cyanide or equivalent.
- RAE Systems MiniRAE 2000 (PID) with 10.6 eV lamp or equivalent.
- Drager Chip Measurement System (CMS) and compound specific chips (including benzene, hydrogen sulfide, hydrogen cyanide, etc.) or equivalent.
- MIE pDR 1200 with cyclone and pump [particulate monitor] or equivalent.
- MSA LC Pump or SKC 224-PCXR4 [air pump for dust monitoring] or equivalent.
- BIOS Dry Cal DC Lite Primary Flow Meter Model ML [air pump calibration] or equivalent.

Groundwater Sampling Activities

- Horiba U22 or equivalent.

7.2 Laboratory Instruments

Calibration procedures for a specific laboratory instrument will consist of initial calibrations, initial calibration verifications, and/or continuing calibration verification. Detailed descriptions of the calibration procedures for a specific laboratory instrument are included in the laboratory's quality assurance plan, which describe the calibration procedures, their frequency, acceptance criteria, and the conditions that will require recalibration.

The laboratory quality plan for H2M is located in **Appendix A**.

8. Sample Preparation and Analytical Procedures

Analytical samples will be collected in general accordance with the FSP and as specified in the RIWP. **Table 1** and **Table 2** provide sample collection matrices for soil and groundwater.

9. Data Reduction, Validation, and Reporting

Appropriate QC measures will be used to ensure the generation of reliable data from sampling and analysis activities. Proper collection and organization of accurate information followed by clear and concise reporting of the data is a primary goal in this project. Complete data packages suitable for data validation to support the generation of a Data Usability Summary Report (DUSR) according to NYSDEC requirements will be provided by the project data validator Ms. Elissa M. McDonagh. Data Management will be performed under the direction of Jaimie Wargo Senior Technician – Data Management.

9.1 Field Data Evaluation

Measurements and sample collection information will be transcribed directly into the field logbook or onto standardized forms. If errors are made, results will be legibly crossed out, initialed and dated by the person recording the data, and corrected in a space adjacent to the original (erroneous) entry. Reviews of the field records by the field team leader, site manager, and project manager will ensure that:

- Logbooks and standardized forms have been filled out completely and that the information recorded accurately reflects the activities that were performed.
- Records are legible and in accordance with good record keeping procedures, i.e., entries are signed and dated, data are not obliterated, changes are initialed, dated, and explained.
- Sample collection, handling, preservation, and storage procedures were conducted in accordance with the protocols described in the FSP and Work Plan, and that any deviations were documented and approved by the appropriate personnel.

9.2 Analytical Data Validation

Laboratory deliverables will consist of an original hard copy data package that is in general accordance with NYSDEC ASP Category B data deliverable requirements when validation is requested.

10. Internal Quality Control

Laboratory and field quality internal control checks will be used to ensure the data quality objectives. At a minimum, this will include:

- Matrix spike and/or matrix spike duplicate samples
- Matrix duplicate analyses
- Laboratory control spike samples
- Instrument calibrations
- Instrument tunes for VOC 8260B analyses
- Method and/or instrument blanks
- Surrogate spikes for organic analyses
- Internal standard spikes for VOC 8260B analyses
- Detection limit determination and confirmation by analysis of low-level calibration standard

Field quality control samples will include:

- Equipment blanks as outlined in **Table 3**
- Field duplicate samples as outlined in **Table 3**
- Trip blanks as outlined in **Table 3**
- MS/MSDs as outlined in **Table 3**

11. Performance and System Audits

Audits are an independent means of: 1) evaluating the operation or capability of a measurement system, and 2) documenting the use of QC procedures designed to generate data of known and acceptable quality.

Field audits may be completed to assess sample collection protocols, determine the integrity of COC procedures, and evaluate sample documentation and data handling procedures. Field audits may be scheduled by the QA officer, Project Manager (PM), site manager or in-house consultant, at their discretion. Written records of audits and any recommendations for corrective action will be submitted to the PM.

The QA officer is the interface between management and project activities in matters of project quality. The QA officer will review the implementation of the QAPP. Reviews will be conducted at the completion of field activities and will include the results of any audits and an evaluation of the data quality.

12. Preventative Maintenance

Preventative maintenance will be performed on field equipment in accordance with the manufacturer’s recommendations. Preventative maintenance to rented field equipment will be provided by equipment vendor, U.S Environmental Rental Corporation, Pine Environmental Services, or other selected vendors.

Laboratory equipment calibration and maintenance procedures are specified in H2M’s laboratory quality manual located in **Appendix A**.

13. Specific Procedures to Assess Data Quality Indicators

QC analyses conducted as a part of the testing program will provide a quantitative quality assessment of the data generated and their adherence to the data quality indicators. The data quality indicators ensure that the quality assurance objectives for the project are met.

13.1 Detection Limits

13.1.1 Method Detection Limit

The MDL is defined as follows for all measurements:

MDL = (t[n-1,1-a=0.99]) x (s)

where: s = standard deviation of the replicate analysis,
t(n-1, 1-a=0.99) = student’s t-value for a one-sided, 99 percent confidence level and a standard deviation estimate with n-1 degrees of freedom

The MDLs calculated by the laboratory are determined under ideal conditions. MDLs for environmental samples are dependent on the sample aliquot, the matrix, the concentration of analyte, and interference present in the matrix, the percent of moisture, dilution factor, etc. The MDL for each sample analysis will be adjusted accordingly.

13.1.2 *Reporting Limit*

The RL is the concentration of an analyte in the sample that corresponds to the lowest concentration standard of the calibration curve. As with the MDLs, the RLs are dependent on the sample aliquot, the final sample volume, the percent of moisture, dilution factor, etc.

The RL is determined as follows:

$$RL = \frac{Lowest\ conc.\ std\ (ng)}{Volume\ injected\ (uL)}\ x\ \frac{Sample\ aliquot\ (mL\ or\ g)}{Final\ volume\ (mL)}\ x\ DF\ x\ \frac{100}{(100 - \%M)}$$

where: DF = dilution factor, including all dilutions or lost samples not accounted for in a sample aliquot/final volume ratio
%M = percent moisture for solid samples.

13.2 Precision

Variability will be expressed in terms of the RPD when only two data points exist. The RPD is calculated as:

$$RPD = \frac{(Larger\ Value - Smaller\ Value)}{[(Larger\ Value + Smaller\ Value)/2]}\ x\ 100\%$$

For data sets greater than two points, the percent relative standard deviation (percent RSD) is used as the precision measurement. It is defined by the equation:

$$Percent\ RSD = \frac{Standard\ Deviation}{Mean}\ x\ 100\%$$

Standard deviation (SD) is calculated as follows:

$$SD = \sqrt{\sum_{i=1}^{n} \frac{(y_i - y)^2}{n - 1}}$$

where: SD = standard deviation
yi = measured value of the ith replicate
y = mean of replicate measurements
n = number of replicates

For measurements such as pH, where the absolute variation is more appropriate, precision is usually reported as the absolute range (D) of duplicate measurements:

$$D = \left| \text{first measurement - second measurement} \right|$$

or as the absolute standard deviation previously given. RPD, %RSD, and D are independent of the error of the analyses and reflect only the degree to which the measurements agree with each other, not the degree to which they agree with the true value for the parameter measured.

13.3 Accuracy

Accuracy is related to the bias in a measurement system. Accuracy describes the degree of agreement of a measurement with a true value. Accuracy will be expressed as percent recovery for each matrix spike analyte by using the following equation:

$$\%\ Recovery = \frac{Css - Cus}{Csa}\ X\ 100\%$$

where: Css = measured concentration in spiked sample
Cus = measured concentration in unspiked sample
Csa = known concentration added to the sample

Accuracy for a measurement such as pH is expressed as bias in the analysis of a standard reference sample according to the equation:

$$\text{Bias} = pH_m - pH_t$$

where: pH_m = measured pH
pH_t = the true pH of the standard reference sample

13.4 Completeness

Data completeness is a measure of the amount of usable data resulting from a measurement effort. For this program, completeness will be defined as the percentage of valid data obtained compared to the total number of measurements necessary to achieve our required statistical level of confidence for each test. The confidence level is based on the total number of samples.

Data completeness is calculated as:

$$Completeness = \frac{Number\ of\ valid\ data\ points}{Number\ of\ data\ points\ necessary\ for\ confidence\ level}\ x\ 100\%$$

The completeness goal is to generate a sufficient amount of valid data. It is anticipated that 95 percent of the data will be complete. Data validation criteria discussed in Section 9 of this QAPP will be used to determine data completeness. Any data deficiencies and their effect on project goals will be evaluated in the DUSR.

13.5 Representativeness

Representativeness is a qualitative statement that expresses the extent to which the sample accurately and precisely represents the characteristics of interest of the study. Representativeness is primarily concerned with the proper design of the sampling program and is best ensured by proper selection of sampling locations and the taking of a sufficient number of samples. It is addressed by describing the sampling techniques, the matrices sampled, and the rationale for the selection of sampling locations, which are discussed in the FSP and job specific Work Plan.

13.6 Comparability

Comparability is a qualitative parameter expressing the confidence that one set of data can be compared to another. Comparability is possible only when standardized sampling and analytical procedures are used.

14. Corrective Action

If unacceptable conditions are identified as a result of audits or are observed during field sampling and analysis, the PM, Field Team Leader, and QA officer will document the condition and initiate corrective procedures. The specific condition or problem will be identified, its cause will be determined, and appropriate action will be implemented.

The entire sampling program will be under the direction of the PM and QA officer. The emphasis in this program is on preventing problems by identifying potential errors, discrepancies, and gaps in the data collection, laboratory analysis, and interpretation process. Any problems identified will be promptly resolved. Likewise, follow-up corrective action is always an option in the event that preventative corrective actions are not effective.

The acceptance limits for the sampling and analyses to be conducted in this program will be those stated in the method or defined by other means in the Work Plan and FSP. Corrective actions are likely to be immediate in nature and most often will be implemented by the contracted laboratory analyst or the PM. The corrective action will usually involve recalculation, reanalysis, or repeating a sample run.

14.1 Immediate Corrective Action

Corrective action in the field may be needed when the sample requirements are changed (i.e., more/less samples, sampling locations other than those specified in the Work Plan), or when sampling procedures and/or field analytical procedures require modification, etc. due to unexpected conditions. The field team may identify the need for corrective action. The Field Team Leader, Site Manager, and PM will approve the corrective action and notify the QA officer. The PM and QA officer will approve the corrective measure. The Field Team Leader and Site Manager will ensure that the corrective measure is implemented by the field team.

Corrective actions will be implemented and documented in the field record book. Documentation will include:

- A description of the circumstances that initiated the corrective action
- The action taken in response

- The final resolution
- Any necessary approvals

Corrective action in the laboratory will be completed in accordance with the quality assurance procedures located in **Appendix A**. Any corrective actions completed by the laboratory will be documented in both the laboratory's corrective action files, and the narrative data report sent from the laboratory to the PM. If the corrective action does not rectify the situation, the laboratory will contact the PM, who will determine the action to be taken and inform the appropriate personnel.

If potential problems are not solved as an immediate corrective action, the contractor will apply formalized long-term corrective action if necessary.

Tables

Table 1
Soil and Sediment Field Sampling Matrix
495 Howard Avenue
Brooklyn, New York

Typical Sample I.D.	**<u>TYPICAL SOIL & SEDIMENT BORING SAMPLE SELECTION RATIONALE:</u>** **1. Shallow soil/sediment within historic fill layer (above ~9 ft bgs).** **2. Subsurface soil/sediment within heaviest observed impacts below 5 feet (if present).** **3. Subsurface soil/sediment below deepest observed visual impacts.** **4. Refer to job specific Work Plan for specific sampling details.** **<u>IF NO IMPACTS ARE OBSERVED IN BORING:</u>** **1. 30, 60, and 90 ft bgs.**								Analysis					
	Sample Number													
	Number Samples Proposed	Number Samples Collected	Date Collected	Within Historic Fill Layer	Heaviest Impacted Zone below 5 feet (if Present)	Water Table Interface	Subsurface soil/sediment below deepest observed visual impacts	Completion depth of boring	TCL VOCs (EPA Method 8260B)	TAL Metals (EPA Method 6010B/7470A)	TCL SVOCs (EPA Method 8270)	Pesticides (EPA Method 8081)	Herbicides (EPA Method 8151)	PCBs (EPA Method 8082)
Subsurface Soil														
B-XX	TBD								X	X	X*	X*	X*	X*

Notes:
VOCs - Volatile Organic Compounds
SVOCs - Semivolatile Organic Compounds
PCBs - Polychlorinated Biphenyls
TCL - Target Compound List
TAL - Target Analyte List
TBD - To Be Determined
EPA - Environmental Protection Agency
bgs - Below Ground Surface
1) Samples will be collected in accordance with the job specific Work Plan and the Field Sampling Plan
2) Samples will be analyzed in accordance with the job specific Work Plan and the Field Sampling Plan
*: Analyzed only in shallow wamples within historic fill layer

Table 2
Groundwater Field Sampling Matrix
495 Howard Avenue
Brooklyn, New York

Sample I.D.	Sample Location	**SAMPLE SELECTION RATIONALE:** 1. Groundwater Sample locations and depth intervals will be specified within a job specific Work Plan				Water Quality Measurements							Analysis														
		Sample Number			Sample Zone																						
		Number Samples Proposed	Number Samples Collected	Date Collected	Water Table	pH	Specific Conductance	Temperature	Oxidation Reduction Potential (ORP)	Turbidity	Salinity	Dissolved Oxygen	TCL VOCs (EPA Method 8260B)	TCL SVOCs (EPA Method 8270)	Pesticides (EPA Method 8081)	Herbicides (EPA Method 8151)	PCBs (EPA Method 8082)	chemical oxygen demand (COD)	biological oxygen demand (BOD)	Nitrate/Nitrite (EPA Method 353.3)	SO4	TAL Metals (EPA Method 6010B/7470A)	H2	CH4	Fe2+	total organic carbon (TOC)	dehalococcoides and dehalococcoides ethenogenes
Monitoring Well Sample Locations																											
MW-XX	TBD					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Notes:
VOCs - Volatile Organic Compounds
SVOCs - Semi-volatile Organic Compounds
PCBs - Polychlorinated Biphenyls
TCL - Target Compound List
TAL - Target Analyte List
TBD - To Be Determined
EPA - Environmental Protection Agency
1) Samples will be collected in accordance with the job-specific Work Plan and the Field Sampling Plan
2) Samples will be analyzed in accordance with the job-specific Work Plan and the Field Sampling Plan

Table 3
Analytical Methods/Quality Assurance Summary Table
495 Howard Avenue
Brooklyn, New York

Media	Number of Primary Samples	QA/QC Samples				Total Number of Samples	Analytical Parameters	Method	Preservative	Holding Time	Container
		TB	FB[1]	DUP	MS/MSD						
Shallow Subsurface Soil*	TBD	1/Cooler	1/20	1/20	1/20	TBD	TCL VOCs	8260B	Cool to 4°C	10 days	3-40 mL vials (2 with stir bars) + 2 - 1 oz jars
	TBD	1/Cooler	1/20	1/20	1/20	TBD	TAL Metals	6010B/7471B	Cool to 4°C	28 days to analysis for mercury; 6 months to analysis for other metals	Wide mouth 8-oz. clear glass jar
	TBD	1/Cooler	1/20	1/20	1/20	TBD	TCL SVOCs	8270C	Cool to 4°C	10 days	2-oz jar
	TBD	1/Cooler	1/20	1/20	1/20	TBD	Pesticides	8081	Cool to 4°C	10 days	2-oz jar
	TBD	1/Cooler	1/20	1/20	1/20	TBD	Herbicides	8151	Cool to 4°C	10 days	4-oz jar
	TBD	1/Cooler	1/20	1/20	1/20	TBD	PCBs	8082	Cool to 4°C	10 days	2-oz jar
Subsurface Soil	TBD	1/Cooler	1/20	1/20	1/20	TBD	TCL VOCs	8260B	Cool to 4°C	5 days unpreserved, 12 days preserved	3-40 mL vials (2 with stir bars) + 2 - 1 oz jars
	TBD	1/Cooler	1/20	1/20	1/20	TBD	TAL Metals	6010B/7471B	Cool to 4°C	28 days to analysis for mercury; 6 months to analysis for other metals	Wide mouth 8-oz. clear glass jar
Ground Water	TBD	1/Cooler	1/20	1/20	1/20	TBD	TCL VOCs	8260B	pH<2 with HCl, Cool to 4°C	10 days	(2) 40 mL VOA vials w/HCL
	TBD	1/Cooler	1/20	1/20	1/20	TBD	TCL SVOCs	8270C	Cool to 4°C	5 days	(2) Liter amber glass
	TBD	1/Cooler	1/20	1/20	1/20	TBD	Pesticides	8081	Cool to 4°C	5 days	(2) Liter amber glass
	TBD	1/Cooler	1/20	1/20	1/20	TBD	Herbicides	8151	Cool to 4°C	5 days	(2) Liter amber glass
	TBD	1/Cooler	1/20	1/20	1/20	TBD	PCBs	8082	Cool to 4°C	5 days	(2) Liter amber glass
	TBD	1/Cooler	1/20	1/20	1/20	TBD	Sulfate	375.2	Cool to 4°C	26 days	(1) 250 mL Polyethylene container / (1) 1000 mL Polyethylene container w/NaOH + Zn Acetate
	TBD	1/Cooler	1/20	1/20	1/20	TBD	Nitrogen	351.2	Cool to 4°C	26 days	(1) 250 mL amber glass w/H2SO4
	TBD	1/Cooler	1/20	1/20	1/20	TBD	Nitrate/Nitrite	353.3	Cool to 4°C	24 hours	(1) 250 mL Polyethylene container
	TBD	1/Cooler	1/20	1/20	1/20	TBD	Ammonia	350.1	Cool to 4°C	26 days	(1) 250 mL amber glass w/H2SO4
	TBD	1/Cooler	1/20	1/20	1/20	TBD	TAL Metals	6010B7470A	pH<2 with HNO3 Cool to 4°C	28 days to analysis for mercury; 6 months to analysis for other metals	(1) 500 mL Polyethylene container w/HNO3

*: Shallow samples located within fill layer - estimated to be to a maximum depth of nine feet.

[1]: Soil field blanks will include bottles listed in groundwater section of the table.

Waste Characterization disposal sample analysis will meet the requirements of the selected disposal facility.
VOCs - volatile organic compounds
PAH - polycyclic aromatic hydrocarbons
°C- Degrees Celsius
L - Liter
oz. - ounce
mL - Milliliter

Table 4
Chemical Parameters, Reporting Limits and Data Quality Objectives for Soil Samples
495 Howard Avenue
Brooklyn, New York

CAS Number	Analyte	DQO's		H2M Labs [2]	
		ASP 2005	Residential Use [1]		
		CRQL	SCO	RL	MDL
TCL Volatile Organic Compounds (µg/Kg) via Method 8260 B					
71-55-6	1,1,1-Trichloroethane	10	100,000	5	0.389
79-34-5	1,1,2,2-Tetrachloroethane	10	35,000	5	0.591
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	NE	100,000	5	3.9
79-00-5	1,1,2-Trichloroethane	10	NE	5	0.699
75-34-3	1,1-Dichloroethane	10	19,000	5	0.426
75-35-4	1,1-Dichloroethene	10	100,000	5	0.355
87-61-6	1,2,3-Trichlorobenzene	10	NE	5	1.55
120-82-1	1,2,4-Trichlorobenzene	10	NE	5	1.29
96-12-8	1,2-Dibromo-3-chloropropane	100	NE	5	2.06
106-93-4	1,2-Dibromoethane (EDB)	10	NE	5	0.729
95-50-1	1,2-Dichlorobenzene	10	100,000	5	1.2
107-06-2	1,2-Dichloroethane	10	2,300	5	0.845
78-87-5	1,2-Dichloropropane	10	NE	5	1.86
541-73-1	1,3-Dichlorobenzene	10	17,000	5	1.32
106-46-7	1,4-Dichlorobenzene	10	9,800	5	1.22
123-91-1	1,4-Dioxane	NE	9,800	125	22.2
78-93-3	2-Butanone (MEK)	10	100,000	10	1.05
591-78-6	Methyl Butyl Ketone (2-Hexanone)	10	NE	10	0.212
108-10-1	4-Methyl-2-pentanone (MIBK)	10	NE	10	0.617
67-64-1	Acetone	10	100,000	10	1.42
71-43-2	Benzene	10	2,900	5	0.591
74-97-5	Bromochloromethane	10	NE	5	0.743
75-27-4	Bromodichloromethane	10	NE	5	0.412
75-25-2	Bromoform	10	NE	5	0.807
74-83-9	Bromomethane	10	NE	5	0.571
75-15-0	Carbon disulfide	10	100,000	5	0.584
56-23-5	Carbon tetrachloride	10	1,400	5	0.407
108-90-7	Chlorobenzene	10	100,000	5	0.797
75-00-3	Chloroethane	10	NE	5	0.56
67-66-3	Chloroform	10	10,000	5	0.662
74-87-3	Chloromethane	10	NE	5	0.74
156-59-2	cis-1,2-Dichloroethene	10	59,000	5	0.4
10061-01-5	cis-1,3-Dichloropropene	10	NE	5	0.363
110-82-7	Cyclohexane	NE	NE	5	4.45
124-48-1	Dibromochloromethane	10	NE	5	0.831
75-71-8	Dichlorodifluoromethane (FREON 12)	10	NE	5	1.17
100-41-4	Ethylbenzene	10	30,000	5	1.01
98-82-8	Isopropylbenzene	10	NE	5	0.734
79-20-9	Methyl Acetate	NE	NE	5	1.13
1634-04-4	Methyl tert-butyl ether (MTBE)	NE	62,000	5	0.577
108-87-2	Methylcyclohexane	NE	NE	5	1.27
75-09-2	Methylene chloride	10	51,000	5	0.649
100-42-5	Styrene	10	NE	5	0.6
127-18-4	Tetrachloroethene	10	5,500	5	1.92
108-88-3	Toluene	10	100,000	5	0.379
156-60-5	trans-1,2-Dichloroethene	10	100,000	5	0.507
10061-02-6	trans-1,3-Dichloropropene	10	NE	5	0.501
79-01-6	Trichloroethene	10	10,000	5	0.589
75-69-4	Trichlorofluoromethane (FREON 11)	10	NE	5	0.334
75-01-4	Vinyl chloride	10	210	5	0.706
1330-20-7	Total Xylene	10	100,000	5	0.732

Table 4
Chemical Parameters, Reporting Limits and Data Quality Objectives for Soil Samples
495 Howard Avenue
Brooklyn, New York

CAS Number	Analyte	DQO's		H2M Labs [2]	
		ASP 2005	Residential Use [1]		
		CRQL	SCO	RL	MDL
TCL Semivolatile Organic Compounds (µg/Kg) via Method 8270					
92-52-4	1,1´-Biphenyl	NE	NE	170	48.6
95-94-3	1,2,4,5-Tetrachlorobenzene	330	NE	170	41.8
52438-91-2	2,2-oxybis[1-Chloropropane]	330	NE	170	41
95-95-4	2,4,5-Trichlorophenol	330	NE	330	60
88-06-2	2,4,6-Trichlorophenol	330	NE	170	52.1
120-83-2	2,4-Dichlorophenol	330	2,000	170	36.7
105-67-9	2,4-Dimethylphenol	330	NE	170	43.2
51-28-5	2,4-Dinitrophenol	800	NE	330	57.6
121-14-2	2,4-Dinitrotoluene	330	NE	170	41.2
606-20-2	2,6-Dinitrotoluene	330	1,030	170	43.2
91-58-7	2-Chloronaphthalene	330	NE	170	42.7
95-57-8	2-Chlorophenol	330	400,000	170	33.7
91-57-6	2-Methylnaphthalene	330	NE	170	42.1
95-48-7	2-Methylphenol (o-Cresol)	330	100,000	170	37.3
88-74-4	2-Nitroaniline	800	NE	330	38.9
88-75-5	2-Nitrophenol	330	NE	170	55.3
91-94-1	3,3-Dichlorobenzidine	660	NE	170	35.5
99-09-2	3-Nitroaniline	800	NE	330	35.1
534-52-1	4,6-Dinitro-2-methylphenol	800	NE	330	53
101-55-3	4-Bromophenyl phenyl ether	330	NE	170	49.5
59-50-7	4-Chloro-3-methylphenol	330	NE	170	46.2
106-47-8	4-Chloroaniline	330	200,000	170	36.8
7005-72-3	4-Chlorophenyl phenyl ether	330	NE	170	45.5
106-44-5	4-Methylphenol (p-Cresol)	330	100,000	170	78.8
100-01-6	4-Nitroaniline	800	NE	330	42.8
100-02-7	4-Nitrophenol	800	NE	330	42.6
83-32-9	Acenaphthene	330	100,000	170	40.2
208-96-8	Acenaphthylene	330	100,000	170	38.8
98-86-2	Acetophenone	330	NE	170	57.7
120-12-7	Anthracene	330	100,000	170	41.8
108-95-2	Atrazine	NE	NE	170	47.8
100-52-7	Benzaldehyde	NE	NE	170	107
56-55-3	Benz[a]anthracene	330	1,000	170	40.8
50-32-8	Benzo[a]pyrene	330	1,000	170	40.5
205-99-2	Benzo[b]fluoranthene	330	1,000	170	34.2
191-24-2	Benzo[g,h,i]perylene	330	100,000	170	34.6
207-08-9	Benzo[k]fluoranthene	330	1,000	170	59.5
111-91-1	Bis(2-chloroethoxy)methane	330	NE	170	44.8
111-44-4	Bis(2-chloroethyl)ether	330	NE	170	38.7
117-81-7	Bis(2-ethylhexyl)phthalate	330	50,000	170	46.9
85-68-7	Butyl benzyl phthalate	330	100,000	170	48.9
105-6--2	Caprolactam	NE	NE	170	41.7
86-74-8	Carbazole	330	NE	170	42.6
218-01-9	Chrysene	330	1,000	170	49.3
84-74-2	Di-n-butyl phthalate	330	100,000	170	38.5
117-84-0	Di-n-octyl phthalate	330	100,000	170	45.6
53-70-3	Dibenz[a,h]anthracene	330	330	170	37.9
132-64-9	Dibenzofuran	330	14,000	170	41.7
84-66-2	Diethyl phthalate	330	100,000	170	38.2
131-11-3	Dimethyl phthalate	330	NE	170	41.5
206-44-0	Fluoranthene	330	100,000	170	29.7
86-73-7	Fluorene	330	100,000	170	41.6
118-74-1	Hexachlorobenzene	330	410	170	41.2
87-68-3	Hexachlorobutadiene	330	NE	170	42.2
77-47-4	Hexachlorocyclopentadiene	330	NE	170	43.3
67-72-1	Hexachloroethane	330	NE	170	41.9
193-39-5	Indeno[1,2,3-cd]pyrene	330	500	170	36.6
78-59-1	Isophorone	330	100,000	170	45.8
621-64-7	N-Nitrosodi-n-propylamine	330	NE	170	29.6
86-30-6	N-Nitrosodiphenylamine	330	NE	170	86.1
91-20-3	Naphthalene	330	100,000	170	41.6
98-95-3	Nitrobenzene	330	3,700	170	32.7
87-86-5	Pentachlorophenol	800	2,400	330	64.6
85-01-8	Phenanthrene	330	100,000	170	42.4
108-95-2	Phenol	330	100,000	170	23.3
129-00-0	Pyrene	330	100,000	170	51.5

Table 4
Chemical Parameters, Reporting Limits and Data Quality Objectives for Soil Samples
495 Howard Avenue
Brooklyn, New York

CAS Number	Analyte	DQO's		H2M Labs [2]	
		ASP 2005	Residential Use [1]		
		CRQL	SCO	RL	MDL
Inorganic Analytes (mg/Kg) via Methods 6010 & 7471					
7429-90-5	Aluminum	NE	NE	200	24
7440-36-0	Antimony	60	NE	60	4
7440-38-2	Arsenic	10	16	10	4
7440-39-3	Barium	200	350	200	16
7440-41-7	Beryllium	5	14	5	0.2
7440-43-9	Cadmium	5	2.5	**5**	0.0
7440-70-2	Calcium	NE	NE	5000	27
7440-47-3	Chromium (sum of Cr III and Cr IV)	10	NE	10	8
7440-48-4	Cobalt	50	30	**50**	1
7440-50-8	Copper	25	270	25	3
7439-89-6	Iron	NE	2,000	100	29
7439-92-1	Lead	5	400	3	24
7439-95-4	Magnesium	NE	NE	5000	34
7439-96-5	Manganese	NE	2,000	15	1
7439-97-6	Mercury	0.2	0.8	0.1	0.2
7440-02-0	Nickel	40	140	40	1
7440-09-7	Potassium	NE	NE	5000	176
7782-49-2	Selenium	5	36	5	4
7440-22-4	Silver	10	36	10	0
7440-23-5	Sodium	NE	NE	5000	338
7440-28-0	Thallium	10	NE	10	17
7440-62-2	Vanadium	50	100	50	1
7440-66-6	Zinc	20	2,200	20	2
Pesticides (µg/Kg) via Method 8081					
72-54-8	4,4'-DDD	16	1,800	3.3	0.153
72-55-9	4,4'-DDE	16	1,700	3.3	0.234
50-29-3	4,4'-DDT	16	2,600	3.3	0.237
309-00-2	Aldrin	8	19	1.7	0.408
319-84-6	alpha-BHC	8	97	1.7	0.176
5103-71-9	alpha-Chlordane	NE	910	1.7	0.197
319-85-7	beta-BHC	8	72	1.7	0.918
319-86-8	delta-BHC	8	100,000	1.7	0.176
60-57-1	Dieldrin	16	39	3.3	0.168
959-98-8	Endosulfan I	16	4,800	1.7	0.168
33213-65-9	Endosulfan II	16	4,800	3.3	0.189
1031-07-8	Endosulfan sulfate	16	4,800	3.3	0.226
72-20-8	Endrin	16	2,200	3.3	0.176
7421-93-4	Endrin aldehyde	32	NE	3.3	0.134
53494-70-5	Endrin ketone	NE	NE	3.3	0.386
58-89-9	gamma-BHC (Lindane)	8	280	1.7	0.187
5103-74-2	gamma-Chlordane	NE	540	1.7	0.347
76-44-8	Heptachlor	8	420	1.7	0.201
1024-57-3	Heptachlor epoxide	8	77	1.7	0.108
72-43-5	Methoxychlor	8	100,000	17	0.388
8001-35-2	Toxaphene	160	NE	170	21.2

Table 4
Chemical Parameters, Reporting Limits and Data Quality Objectives for Soil Samples
495 Howard Avenue
Brooklyn, New York

CAS Number	Analyte	DQO's		H2M Labs [2]	
		ASP 2005	Residential Use [1]		
		CRQL	SCO	RL	MDL
PCBs (µg/Kg) via Method 8082					
12674-11-2	Aroclor 1016	80	NE	33	4.65
11104-28-2	Aroclor 1221	80	NE	67	
11141-16-5	Aroclor 1232	80	NE	33	
53469-21-9	Aroclor 1242	80	NE	33	
12672-29-6	Aroclor 1248	80	NE	33	
11097-69-1	Aroclor 1254	160	NE	33	
11096-82-5	Aroclor 1260	160	NE	33	15.61
Herbicides (µg/Kg) via Method 8151					
93-76-5	2,4,5-T	320	100,000	5	0.148
93-72-1	2,4,5-TP (Silvex)	320	58	5	0.146
94-75-7	2,4-D	800	NE	10	0.269
1918-00-9	Dicamba	NE	NE	3	1.05

Notes:
mg/kg - milligrams per kilogram
µg/Kg - micrograms per kilogram
RL - Reporting Limits
MDL - Method Detection Limit
DQO - Data Quality Objectives
1 - DQOs are based on 6 NYCRR Part 375 -6.8(b) Residential Use Soil Clean-up Objectives
2 - RLs and MDLs are based on H2M Labs Inc's Reporting Limits and Method Detection limits as of October 2010.
NE - Not Established

Table 5
Chemical Parameters, Reporting Limits and Data Quality Objectives for Groundwater Samples
495 Howard Avenue
Brooklyn, New York

CAS Number	Analyte Name	DQO's		H2M Labs [2]	
		ASP 2005	NY AWQS GA [1]		
		CRQL	H(WS)	RL	MDL
Volatile Organic Compounds Method 8260 B (µg/L)					
71-55-6	1,1,1-Trichloroethane	1	5	5	0.06
79-34-5	1,1,2,2-Tetrachloroethane	1	5	5	0.12
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	NE	5	5	0.78
79-00-5	1,1,2-Trichloroethane	1	1	**5**	0.104
75-34-3	1,1-Dichloroethane	1	5	5	0.07
75-35-4	1,1-Dichloroethene	1	0.07	**5**	0.155
87-61-6	1,2,3-Trichlorobenzene	1	5	5	0.252
120-82-1	1,2,4-Trichlorobenzene	1	5	5	0.296
96-12-8	1,2-Dibromo-3-chloropropane	1	0.04	**5**	0.178
106-93-4	1,2-Dibromoethane (EDB)	1	0.0006	**5**	0.085
95-50-1	1,2-Dichlorobenzene	1	3	**5**	0.114
107-06-2	1,2-Dichloroethane	1	NE	5	0.087
78-87-5	1,2-Dichloropropane	1	1	**5**	0.095
541-73-1	1,3-Dichlorobenzene	1	3	**5**	0.129
106-46-7	1,4-Dichlorobenzene	1	3	**5**	0.113
123-91-1	1,4-Dioxane	NE	NE	125	28.259
78-93-3	2-Butanone (MEK)	5	50*	10	0.77
591-78-6	Methyl Butyl Ketone (2-Hexanone)	5	50*	10	0.439
108-10-1	4-Methyl-2-pentanone (MIBK)	5	NE	10	0.164
67-64-1	Acetone	5	50*	10	0.356
71-43-2	Benzene	1	1	**5**	0.074
74-97-5	Bromochloromethane	1	5	5	0.074
75-27-4	Bromodichloromethane	1	50*	5	0.063
75-25-2	Bromoform	1	50*	5	0.486
74-83-9	Bromomethane	1	5	5	0.216
75-15-0	Carbon disulfide	1	60*	5	0.543
56-23-5	Carbon tetrachloride	1	5	5	0.467
108-90-7	Chlorobenzene	1	5	5	0.034
75-00-3	Chloroethane	1	5	5	0.196
67-66-3	Chloroform	1	7	5	0.111
74-87-3	Chloromethane	1	5	5	0.181
156-59-2	cis-1,2-Dichloroethene	1	5	5	0.149
10061-01-5	cis-1,3-Dichloropropene	1	0.4	**5**	0.105
110-82-7	Cyclohexane	NE	NE	5	0.087
124-48-1	Dibromochloromethane	1	50*	5	0.174
75-71-8	Dichlorodifluoromethane (FREON 12)	1	5	5	0.102
100-41-4	Ethylbenzene	1	5	5	0.132
98-82-8	Isopropylbenzene	1	5	5	0.108
79-20-9	Methyl Acetate	NE	NE	5	0.753
1634-04-4	Methyl tert-butyl ether (MTBE)	NE	10*	5	0.031
108-87-2	Methylcyclohexane	NE	NE	5	1.27
75-09-2	Methylene chloride	2	5	5	0.169
100-42-5	Styrene	1	5	5	0.118
127-18-4	Tetrachloroethene	1	5	5	0.384
108-88-3	Toluene	1	5	5	0.077
156-60-5	trans-1,2-Dichloroethene	1	5	5	0.075
10061-02-6	trans-1,3-Dichloropropene	1	0.4	**5**	0.144
79-01-6	Trichloroethene	1	5	5	0.08
75-69-4	Trichlorofluoromethane (FREON 11)	1	5	5	0.141
75-01-4	Vinyl chloride	1	2	**5**	0.119
1330-20-7	Total Xylene	1	5	5	0.065

Table 5
Chemical Parameters, Reporting Limits and Data Quality Objectives for Groundwater Samples
495 Howard Avenue
Brooklyn, New York

CAS Number	Analyte Name	DQO's		H2M Labs [2]	
		ASP 2005	NY AWQS GA [1]		
		CRQL	H(WS)	RL	MDL
Semivolatile Organic Compounds (µg/L) via Method 8270					
92-52-4	1,1´-Biphenyl	NE	5	5	0.318
95-94-3	1,2,4,5-Tetrachlorobenzene	10	5	5	0.637
52438-91-2	2,2´-oxybis(1-chloropropane)	10	NE	5	0.595
95-95-4	2,4,5-Trichlorophenol	10	NE	10	1.044
88-06-2	2,4,6-Trichlorophenol	10	NE	5	0.692
120-83-2	2,4-Dichlorophenol	10	5	5	0.784
105-67-9	2,4-Dimethylphenol	10	50*	5	0.476
51-28-5	2,4-Dinitrophenol	25	10*	10	0.866
121-14-2	2,4-Dinitrotoluene	10	5	5	0.473
606-20-2	2,6-Dinitrotoluene	10	5	5	0.701
91-58-7	2-Chloronaphthalene	10	10**	5	0.677
95-57-8	2-Chlorophenol	10	NE	5	0.82
91-57-6	2-Methylnaphthalene	10	NE	5	0.616
95-48-7	2-Methylphenol (o-Cresol)	10	1**	**5**	0.262
88-74-4	2-Nitroaniline	25	5	10	0.699
88-75-5	2-Nitrophenol	10	NE	5	1.867
91-94-1	3,3-Dichlorobenzidine	20	5	5	0.815
99-09-2	3-Nitroaniline	25	5	10	0.486
534-52-1	4,6-Dinitro-2-methylphenol	25	NE	10	2.313
101-55-3	4-Bromophenyl phenyl ether	10	NE	5	0.692
59-50-7	4-Chloro-3-methylphenol	10	NE	5	0.601
106-47-8	4-Chloroaniline	10	5	5	0.49
7005-72-3	4-Chlorophenyl phenyl ether	10	NE	5	0.594
106-44-5	4-Methylphenol (p-Cresol)	10	1**	**5**	0.253
100-01-6	4-Nitroaniline	25	5	10	0.517
100-02-7	4-Nitrophenol	25	NE	10	0.925
83-32-9	Acenaphthene	10	20**	5	0.523
208-96-8	Acenaphthylene	10	NE	5	0.604
98-86-2	Acetophenone	10	NE	5	0.711
120-12-7	Anthracene	10	50*	5	0.591
108-95-2	Atrazine	NE	7.5	5	0.341
100-52-7	Benzaldehyde	NE	NE	5	0.507
56-55-3	Benz[a]anthracene	10	0.002*	**5**	0.63
50-32-8	Benzo[a]pyrene	10	ND	5	0.511
205-99-2	Benzo[b]fluoranthene	10	0.002*	**5**	0.587
191-24-2	Benzo[g,h,i]perylene	10	NE	5	0.45
207-08-9	Benzo[k]fluoranthene	10	0.002*	**5**	0.419
111-91-1	Bis(2-chloroethoxy)methane	10	5	5	0.465
111-44-4	Bis(2-chloroethyl)ether	10	1	5	0.56
117-81-7	Bis(2-ethylhexyl)phthalate	10	5	5	1.024
85-68-7	Butyl benzyl phthalate	10	50*	5	0.447
105-6--2	Caprolactam	NE	NE	5	0.128
86-74-8	Carbazole	10	NE	5	0.321
218-01-9	Chrysene	10	0.002*	**5**	0.657
84-74-2	Di-n-butyl phthalate	10	50	5	0.515
117-84-0	Di-n-octyl phthalate	10	50*	5	0.416
53-70-3	Dibenz[a,h]anthracene	10	NE	5	0.477
132-64-9	Dibenzofuran	10	NE	5	0.584
84-66-2	Diethyl phthalate	10	50*	5	0.555
131-11-3	Dimethyl phthalate	10	50*	5	0.564
206-44-0	Fluoranthene	10	50*	5	0.463
86-73-7	Fluorene	10	50*	5	0.532
118-74-1	Hexachlorobenzene	10	0.04	5	0.602
87-68-3	Hexachlorobutadiene	10	0.5	5	0.559
77-47-4	Hexachlorocyclopentadiene	10	5	5	0.392
67-72-1	Hexachloroethane	10	5	5	0.498
193-39-5	Indeno[1,2,3-cd]pyrene	10	0.002*	**5**	0.363
78-59-1	Isophorone	10	50*	5	0.55
621-64-7	N-Nitrosodi-n-propylamine	10	NE	5	0.626
86-30-6	N-Nitrosodiphenylamine	10	50*	5	0.438
91-20-3	Naphthalene	10	10**	5	0.526
98-95-3	Nitrobenzene	10	0.4	**5**	0.481
87-86-5	Pentachlorophenol	25	1**	**10**	1.304
85-01-8	Phenanthrene	10	50*	5	0.673
108-95-2	Phenol	10	1**	**5**	0.336
129-00-0	Pyrene	10	50*	5	0.624

Table 5
Chemical Parameters, Reporting Limits and Data Quality Objectives for Groundwater Samples
495 Howard Avenue
Brooklyn, New York

CAS Number	Analyte Name	DQO's		H2M Labs [2]	
		ASP 2005	NY AWQS GA [1]		
		CRQL	H(WS)	RL	MDL
Inorganic Analytes (mg/L) via Methods 6010 & 7470					
7429-90-5	Aluminum	NE	NE	200	10
7440-36-0	Antimony	60	3	**60**	3
7440-38-2	Arsenic	10	25	10	3
7440-39-3	Barium	200	1000	200	200
7440-41-7	Beryllium	5	3*	**5**	0.3
7440-43-9	Cadmium	5	5	5	0
7440-70-2	Calcium	NE	NE	5000	15
7440-47-3	Chromium (sum of Cr III and Cr IV)	10	50	10	1
7440-48-4	Cobalt	50	NE	50	1
7440-50-8	Copper	25	200	25	1
7439-89-6	Iron	NE	300	100	8
7439-92-1	Lead	5	25	3	1
7439-95-4	Magnesium	NE	35000*	5000	35
7439-96-5	Manganese	NE	300	15	0
7439-97-6	Mercury	0.2	0.7	0.1	0.3
7440-02-0	Nickel	40	100	40	1
7440-09-7	Potassium	NE	NE	5000	238
7782-49-2	Selenium	5	10	5	4
7440-22-4	Silver	10	50	**10**	1
7440-23-5	Sodium	NE	20000	5000	48
7440-28-0	Thallium	10	0.5*	**10**	4
7440-62-2	Vanadium	50	NE	50	1.4
7440-66-6	Zinc	20	2000*	20	1
Pesticides (µg/L) via Method 8081					
72-54-8	4,4´-DDD	0.1	0.3	0.1	0.012
72-55-9	4,4´-DDE	0.1	0.2	0.1	0.01
50-29-3	4,4´-DDT	0.1	0.2	0.1	0.011
309-00-2	Aldrin	0.05	ND	0.05	0.007
319-84-6	alpha-BHC	0.05	NE	0.05	0.009
5103-71-9	alpha-Chlordane	NE	NE	0.05	0.01
319-85-7	beta-BHC	0.05	NE	0.05	0.018
319-86-8	delta-BHC	0.05	NE	0.05	0.009
60-57-1	Dieldrin	0.1	NE	0.1	0.011
959-98-8	Endosulfan I	0.1	NE	0.05	0.01
33213-65-9	Endosulfan II	0.1	NE	0.1	0.01
1031-07-8	Endosulfan sulfate	0.1	NE	0.1	0.011
72-20-8	Endrin	0.1	ND	0.1	0.011
7421-93-4	Endrin Aldehyde	0.2	5	0.1	0.015
53494-70-5	Endrin Ketone	NE	5	0.1	0.012
58-89-9	gamma-BHC (Lindane)	0.05	NE	0.05	0.009
5103-74-2	gamma-Chlordane	NE	NE	0.05	0.012
76-44-8	Heptachlor	0.05	0.04	**0.05**	0.009
1024-57-3	Heptachlor epoxide	0.05	0.03	**0.05**	0.01
72-43-5	Methoxychlor	0.5	35	0.5	0.013
8001-35-2	Toxaphene	1	0.06	**5**	0.199

Table 5
Chemical Parameters, Reporting Limits and Data Quality Objectives for Groundwater Samples
495 Howard Avenue
Brooklyn, New York

CAS Number	Analyte Name	DQO's		H2M Labs [2]	
		ASP 2005	NY AWQS GA [1]		
		CRQL	H(WS)	RL	MDL
PCBs (ug/L) via Method 8082					
12674-11-2	Aroclor 1016	0.5	NE	1	0.046
11104-28-2	Aroclor 1221	0.5	NE	2	
11141-16-5	Aroclor 1232	0.5	NE	1	
53469-21-9	Aroclor 1242	0.5	NE	1	
12672-29-6	Aroclor 1248	0.5	NE	1	
11097-69-1	Aroclor 1254	1.0	NE	1	
11096-82-5	Aroclor 1260	1.0	NE	1	0.033
Herbicide (µg/L) via Method 8151					
93-76-5	2,4,5-T	2.0	35	0.25	0.0618
93-72-1	2,4,5-TP (Silvex)	2.0	0.26	0.25	0.0523
94-75-7	2,4-D	10	50	0.5	0.123
1918-00-9	Dicamba	NE	0.44	0.15	0.0012
88-85-7	Dinoseb	1.0	1	0.2	0.008
Wet Chemistry (µg/L)					
NA	Biological Oxygen Demand	NE	NE	2,000	1,640
NA	Chemical Oxygen Demand	NE	NE	10,000	7,200
14797-55-8	Nitrate	100	10,000	100	3
14797-65-0	Nitrite	100	1,000	100	1
14808-79-8	Sulfate	5,000	250,000	5,000	409
18496-25-8	Sulfide	NE	50*	**2,000**	470
7440-44-0	Total Organic Carbon	NE	NE	100	210
74-82-8	Methane	NE	NE	100	0.248

* = Guidance Value

Notes:

mg/L - milligrams per Liter

µg/L - micrograms per Liter

RL - Reporting Limit

MDL - Method Detection Limit

DQO - Data Quality Objectives

1 - DQOs are based on TOGS Ambient Water Quality Standards and Guidance Values and Groundwater

** NY AWQS are for the GA water class deginated as type Health (Water Source) [H(WS)]. If the H(WS) designation was not available, the Aesthetic [E] type is used shown.

2 - RLs and MDLs are based on H2M Labs Inc's Reporting Limits and Method Detection limits as of January 2012.

Bolding - RL does not meet the DQO

Table 6
Quality Control Limits Percision and Accuracy for Soil and Sediment Samples
494 Howard Avenue
Brooklyn, New York

Soil/Sediment QC Limits

Analytical	Analytical Method	MS/MSD Compound	MS/MSD % Recovery			LCS % Recovery		Surrogate	Surrogate % Recovery	
			Low	High	RPD	Low	High		Low	High
VOCs	8260B	1,1-Dichloroethene	59	172	22	59	172	1,2-Dichloroethane-d4	33	145
		Benzene	66	142	21	66	142	4-Bromofluorobenzene	60	148
		Chlorobenzene	60	133	21	60	133	Toluene-d8	60	132
		Toluene	59	139	21	59	139			
		Trichloroethene	62	137	24	62	137			
SVOCs	8270	2,4-Dinitrotoluene	28	116	47	24	96	1,2-Dichlorobenzene-d4	20	130
		2-Chlorophenol	25	102	50	27	123	2,4,6-Tribromophenol	19	122
		4-Chloro-3-methylphenol	26	103	33	23	97	2-Chlorophenol-d4	20	130
		4-Nitrophenol	11	114	50	10	80	2-Fluorobiphenyl	30	115
		Acenaphthene	31	137	19	46	118	2-Fluorophenol	25	121
		N-Nitroso-di-n-propylamine	41	126	38	41	116	4-Terphenyl-d14	18	137
		Pentachlorophenol	17	109	47	9	103	Nitrobenzene-d5	23	120
		Phenol	26	90	35	12	110	Phenol-d5	24	113
		Pyrene	35	142	36	26	127			
Pesticides	8081	4,4´-DDT	23	134	27	23	134	Decachlorobiphenyl	30	150
		Aldrin	34	132	43	34	132	Tetrachloro-m-xylene	30	150
		Dieldrin	31	134	38	31	134			
		Endrin	42	139	45	42	139			
		gamma-BHC (Lindane)	35	135	31	35	135			
		Heptachlor	40	131	20	40	131			
PCBs	8082	Aroclor 1016	50	136	40	50	136	Decachlorobiphenyl	30	150
		Aroclor 1260	45	154	40	45	154	Tetrachloro-m-xylene	30	150
Herbicides	8151	2,4,5-T	16	136	40	16	136	DCAA	29	136
		2,4,5-TP (Silvex)	12	146	40	12	146			
		2,4-D	25	157	40	25	157			
		Dicamba	16	136	40	16	136			
Metals	6010B	Metals excluding Hg	75(a)	125	20(b)	Varies	Varies	NA		
	7471B	Mercury	75(a)	125	20(b)	NA	NA	NA		

Notes:
(a) Matrix spike only
(b) Laboratory duplicate RPD
NA - Not Applicable
VOCs - volatile organic compounds
SVOCs - semivolatile organic compounds
RPD - Relative Percent Difference

Table 7
Quality Control Limits Percision and Accuracy for Groundwater Samples
495 Howard Avenue
Brooklyn, New York

Aqueous QC Limits										
			MS/MSD % Recovery			**LCS % Recovery**			**Surrogate % Recovery**	
Analytical	**Analytical Method**	**MS/MSD Compound**	Low	High	RPD	Low	High	**Surrogate**	Low	High
VOCs	8260B	1,1-Dichloroethene	61	145	14	61	145	1,2-Dichloroethane-d4	76	114
		Benzene	76	127	11	76	127	4-Bromofluorobenzene	86	115
		Chlorobenzene	75	130	13	75	130	Toluene-d8	88	110
		Toluene	76	125	13	76	125			
		Trichloroethene	71	120	14	71	120			
SVOCs	8270	2,4-Dinitrotoluene	24	96	38	24	96	1,2-Dichlorobenzene-d4	16	110
		2-Chlorophenol	27	123	40	27	123	2,4,6-Tribromophenol	10	123
		4-Chloro-3-methylphenol	23	97	42	23	97	2-Chlorophenol-d4	33	110
		4-Nitrophenol	10	80	50	10	80	2-Fluorobiphenyl	43	116
		Acenaphthene	46	118	31	46	118	2-Fluorophenol	21	110
		N-Nitroso-di-n-propylamine	41	116	38	41	116	4-Terphenyl-d14	33	141
		Pentachlorophenol	9	103	50	9	103	Nitrobenzene-d5	35	114
		Phenol	12	110	42	12	110	Phenol-d5	10	110
		Pyrene	26	127	31	26	127			
Pesticides	8081	4,4´-DDT	38	127	27	23	134	Decachlorobiphenyl	30	150
		Aldrin	40	120	22	34	132	Tetrachloro-m-xylene	30	150
		Dieldrin	52	126	18	31	134			
		Endrin	56	121	21	42	139			
		gamma-BHC (Lindane)	56	123	15	35	135			
		Heptachlor	40	131	20	40	131			
PCBs	8082	Aroclor 1016	53	116	40	42	134	Decachlorobiphenyl	30	150
		Aroclor 1260	46	126	40	34	146	Tetrachloro-m-xylene	30	150
Herbicides	8151	2,4,5-T	40	115	29	40	121	DCAA	36	121
		2,4,5-TP (Silvex)	48	113	23	64	128			
		2,4-D	39	111	34	53	115			
		Dicamba	60	140	40	10	159			
Metals	6010B	Metals excluding Hg	75(a)	125	20(b)	80	120	NA		
	7470A	Mercury	75(a)	125	20(b)	NA	NA	NA		
Wet Chemistry	353.2	Nitrite	75(a)	125	20(b)	80	120	NA		
	353.2	Nitrate	75(a)	125	20(b)	90	110	NA		
	SW9034	Sulfide	75(a)	125	20(b)	80	120	NA		
	375.2	Sulfate	75(a)	125	20(b)	80	120	NA		
	SM4500-P E	Total Phosphorus	75(a)	125	20(b)	80	120	NA		
	351.2	Total Kjeldahl Nitrogen	75(a)	125	20(b)	80	120	NA		
	SM4500-NH3 H	Ammonia	75(a)	125	20(b)	80	120	NA		
	SM4500-NC	Total Nitrogen	NA	NA	NA	NA	NA	NA		
	SM5210B	Biological Oxygen Demand	NA	NA	NA	84.5	115.5	NA		
	410.4	Chemical Oxygen Demand	75(a)	125	20(b)	80	120	NA		
	SM5310B	Total Organic Carbon	75(a)	125	20(b)	80	120	NA		
		Hydrogen	75(a)	125	20(b)	80	120	NA		
	ASTM Method D3872-86	Ferrous Iron	75(a)	125	20(b)	80	120	NA		
	RSK-175	Methane (dissolved gases)	41	156	40	41	156	Propene	40	176

Notes
(a) Matrix spike only
(b) Laboratory duplicate RPD
NA - Not Applicable
VOCs - volatile organic compounds
SVOCs - semivolatile organic compounds

Appendix A

H2M Labs Inc. Laboratory Quality Manual (electronic only)

H2M LABS, INC.

QUALITY ASSURANCE QUALITY CONTROL MANUAL

H2M Labs
575 Broad Hollow Road
Melville, New York 11747

(631) 694-3040

This document has been read and approved by:

John Molloy — Date: 9/26/11
Laboratory Director
President and CEO

Joann Slavin

Joann M. Slavin — Date: 9/26/11
Senior Vice President
Laboratory Manager

Nicole R. Crespi

Nicole R. Crespi — Date: 9/23/11
Quality Assurance Manager

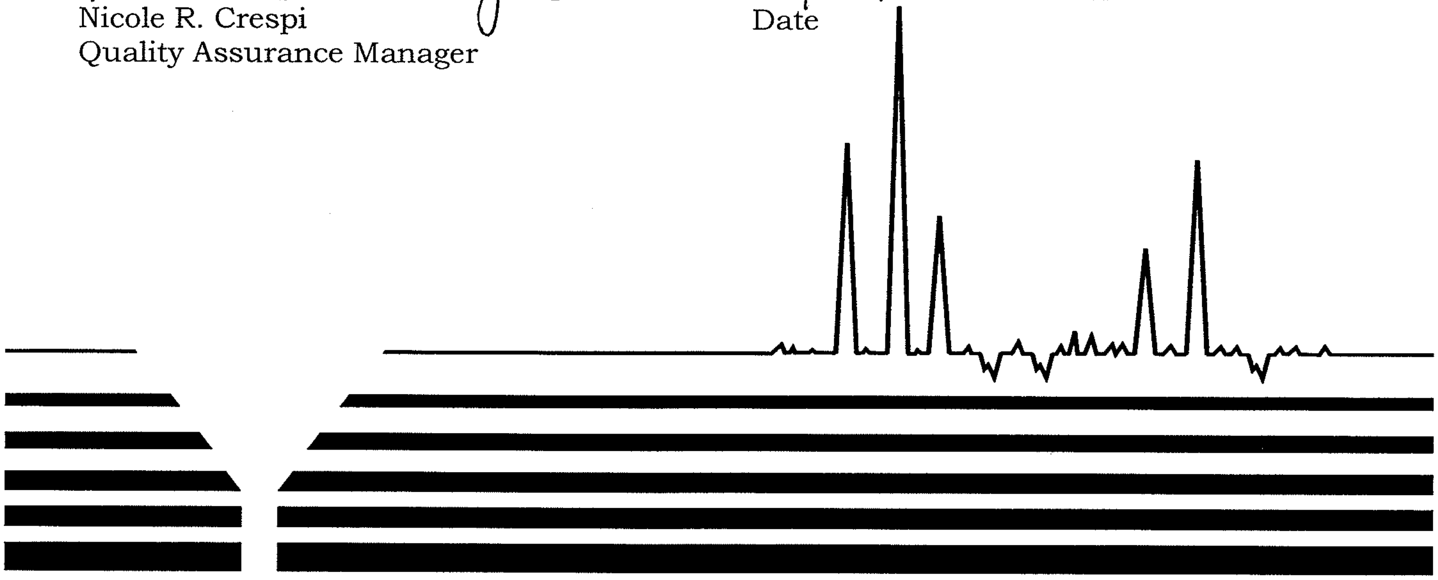


Table of Contents

Section	Page Number
Approval Signatures	1
Revision History	5
1.0 Quality Policy Statement	6
2.0 Organization and Management Structure	6
3.0 Management Structure Relationships/Responsibility Designations	7
Table 1.0 Management Structure	7
4.0 Record Retention	8
Table 2.0 Temporary Storage	8
Table 3.0 Archival Storage	9
5.0 Document Control	9
6.0 Job Descriptions and Communication Process	12
7.0 Lab Approval Signatures	15
8.0 Data Reduction Procedure	16
9.0 Data Reporting and Authorization Procedures	16
10.0 Authorized Personnel to Review Data Packages	17
11.0 Traceability of Measurements	17
Table 4.0 Verification of Measurement and Testing Equipment	18
Table 5.0 Working Thermometers	21
Table 6.0 Reagent Grade (Laboratory Pure) Water	21
12.0 Accredited Test Methods	21
13.0 Contract Review	21
14.0 Review of New Work	22
15.0 Conflict of Interest	24
16.0 Confidentiality	24
17.0 Subcontracting	24
18.0 Calibration and/or Verification Test Procedures	25
Table 7.0 Calibration and Verification	25
19.0 Procedures for Handling Submitted Samples	26
20.0 Sample Preservation, Containers, and Holding Times	30
Table 8.0 Potable Water Bottle and Preservation Requirements	31
Table 9.0 Non-potable Water Bottle and Preservation Requirements	35
Table 10.0 Solid/Hazardous Waste Bottle and Preservation Requirements	39
21.0 Laboratory Water Supply	40
22.0 Major Equipment and Reference Measurement Standards	41
23.0 Facilities	42
24.0 Security	43
25.0 Purchasing	43
26.0 Waste Generation, Storage and Disposal	44
27.0 Standard Reference Materials	45
28.0 Internal Quality Control	46

Section	Page Number
Table 11.0: Spiking Requirements	47
Table 12.0 Summary of Essential QC for Chemical Analysis	48
Table 13.0 Summary of Essential QC for Microbiological Analysis	49
Table 14.0 Purgeable Organics QC Summary	51
Table 15.0 CLP Semi-volatile Organics QC Summary	52
Table 16.0 CLP Pesticides/PCBs QC Summary	53
Table 17.0 Organophosphorus Pesticide QC Summary	53
Table 18.0 Herbicide QC Summary	54
Table 19.0 CLP-M TAL Metals QC Summary	55
Table 20.0 Wet Chemistry QC Summary	56
29.0 Departures from Documented Policies and Procedures	57
30.0 Instrument Corrective Action	57
31.0 Systems/Internal Audits/Data Integrity	58
32.0 Performance/External Audits	59
33.0 Corrective and Preventative Action	60
34.0 Quality System Report to Management	61
35.0 Procedure for Dealing with Complaints	62
36.0 Training	62
37.0 New Employee Orientation	63
38.0 Employee Job Responsibilities	64
39.0 Seminars and Continuing Education	65
40.0 Ethics Policy Agreement	65
41.0 Policy on Stress Reduction and Quality of Work	66
42.0 Standard Operating Procedures	67
43.0 References	68

H2M LABS, INC.

This document has been read and approved for continued acceptance by:

Signature Title Date

Signature Title Date

Signature Title Date

Signature Title Date

Signature Title Date

Signature Title Date

Signature Title Date

Signature Title Date

Signature Title Date

Signature Title Date

Signature Title Date

Revision History

Revision Number	Revision Date	Revisions made
09	02/19/09	Add signature page, effective date. Combine document into one revision. Streamline information into tables. Added continued acceptance provision. Added the appendix. Removed floor plan, instrument listing, vendor listing, approved methods, resumes, org chart to the Appendix.
10	6/14/09	Moved approval signatures to cover page. Added NYELAP to section 1.1.2. Add logbooks to table 3.0. Define temporary and archival storage. Change table 6.0 name to Bacti Reagent Grade (laboratory pure) Water. Added more details to Data Integrity procedures.
11	7/8/11	Updated Personnel. Added reference to document ADMIN001 *Plan for Going Out of Business or Transfer of Ownership* and reference to document ADMIN002 for Computers and Programs. Hardcopy of lab reports not retained, only electronic. Retain PW lead and copper records for 12 years. Master list of documents using an excel spreadsheet. Data packages burned to CD semi-annually. Ursual Middel approved lab report signatory. James Bidas approved for pesticide package review. Refrigerators 0-6.0°C. Freezers recommended -5 to -15 °C. ICV meet CCV criteria. LOD must be lower than LOQ. Updated bottle and preservation tables. Added details to housekeeping measures. Consumable storage in area of use. Control of waste room by special process supervisor or designee. QC limits generally not updated if confirmed to maintain consistency. Added policy on stress reduction and quality of work. T.O.C. updated to reflect changes. Updated Appendix.
12	8/2/11	Table 3- 12 years retention for all. 20.1.7-20.1.8 chlorine checks for DW organics. 20.1.9 and Table8&9 -Bacteria acceptance 1-inch headspace and procedure for over filled samples. 20.1.14 and Table 9 -NW unpreserved metals – wait 24 hrs after preservation for analysis. pH 3 for 531.1 in Table 8, also added RSK to Tables 8&9. Added reference #38.

1.0 Quality Policy Statement

H2M Laboratories, Inc. has established systems, policies, programs, and procedures in order to assure the quality of the test results of the laboratory. Laboratory personnel are committed to exceptional professional practices and to the quality of its environmental testing in servicing its clients.

1.1 Quality System Policies and Objectives

1.1.1 The overall quality system objectives are documented in the quality policy statement and are issued under authority of John Molloy, President and CEO.

1.1.2 The laboratories standard of service are intended to meet or exceed the requirements of the NY ELAP, National Environmental Laboratory Accreditation Program (NELAC), the USEPA Contract Laboratory Program as well as the requirements found in ISO 17025.

1.1.3 The QAM is supported by a larger collection of Standard Operating Procedures (SOPs) and documents for all programs in the laboratory.

1.1.4 All laboratory personnel concerned with environmental testing activities within the laboratory will familiarize themselves with the laboratories system policies and objectives.

1.1.5 The QA Manager will maintain evidence on file that demonstrates that each employee has read, understood, and is using the latest version of the laboratory's in-house quality documentation, which relates to his/her job responsibilities.

1.1.6 Opportunities for improvement of operations and processes are identified by managers on a continual basis from ongoing feedback on operations and through management reviews.

1.1.7 Inputs for improvement opportunities may be obtained from the following sources:

- 1.1.7.1 Customer satisfaction surveys
- 1.1.7.2 Employees
- 1.1.7.3 Internal and external audits of the management system
- 1.1.7.4 Records of service nonconformities

1.1.8 Opportunities for improvement from daily feedback are evaluated by the Technical or Quality Manager(s) and are implemented through the preventative and correction action procedures.

1.1.9 Opportunities for improvement from analysis of longer-term data and trends are evaluated and implemented through the management review process.

2.0 Organization and Management Structure

2.1 Organization Chart (See the Appendix, Section 1.0)

3.0 Management Structure Relationships/Responsibility Designations

Table 1.0 Management Structure

Laboratory Director	John J. Molloy, P.E. is responsible for all technical and quality operations in the laboratory
Laboratory Manager	Joann M. Slavin oversees day-to-day operations of the analyses. She is responsible for arranging and overseeing all support services including instrument service contracts, subcontracting agreements and physical maintenance of the lab. The laboratory manager is responsible for and directs the operations and activities of the laboratory, including the receipt, analysis and delivery of all work performed by the laboratory. Through departmental supervisors, she coordinates schedules and manages all work in the organic, inorganic and bacteriology sections of the laboratory.
QA Manager	Nicole R. Crespi is responsible for the quality system and its implementation. She serves as the focal point for QA/QC and is responsible for the oversight and/or review of quality control data. The QA Manager functions independently from laboratory operations for which she has quality assurance oversight. In her role she is able to evaluate data objectively and perform assessments without outside (e.g., managerial) influence. The QA Manager has documented training and/or experience in QA/QC procedures and is knowledgeable in the quality system as defined under NELAC. She has a general knowledge of the analytical test methods for which data review is performed and arranges for or conducts internal audits annually. In addition, the QA Manager will notify laboratory management of deficiencies in the quality system and monitor corrective action.
Production Manager	Stuart M. Murrell supervises the production capability of all departments. He prioritizes testing and is responsible for completeness and correctness of reports.
Technical Manager	Ursula R. Middel provides technical guidance and data review of sample packages for completeness and compliance. She is also responsible for initial and ongoing training of staff.
GC/MS Supervisor	Glenn K. Bocchicchio supervises the operation of the GC/MS laboratory. He reviews analyses and implementation and oversight of QC data.
GC Supervisor	James Bidas supervises the operations of the GC laboratory. He reviews GC analyses and implementation and oversight of QC data.
Special Process Supervisor	James Bidas supervises sample preparation procedures for organic analyses, and RCRA characteristic-procedures. He is responsible for the oversight and QC of the processes.
Inorganic Supervisor	Christopher Otterberg supervises the wet chemistry and bacteriology laboratories. He reviews analyses and the implementation and oversight of QC data.
Metals Supervisor	Christopher Otterberg oversees the metals laboratory including digestion and analyses. He also reviews analyses and the implementation and oversight of QC data.

Package Production Coordinator	Jennifer Aracri is responsible for data package coordination and verification of correctness and completeness of data.
Receiving Supervisor	Linda Siciliano-Dunn coordinates bottle preparation and sample receipt, serves as sample custodian, and ensures proper execution of chain-of-custody procedures.
Analysts	All analysts are responsible for complying with all QA/QC requirements that pertain to their job function. In both the organic and inorganic departments, H2M scientists perform analyses under direct management of the supervisors. The responsibility of the scientists is to perform analyses according to the established and documented procedures, calibrate and maintain equipment and adhere to all quality control requirements.
LIMS Administrator/ Technical Manager	Jonathon Walsh is Senior Computer Programmer and LIMs Administrator. He is an MS Access/VBA programmer responsible for customizing and the implementation of the Omega LIMs. As technical manager, he rebuilds, overhauls, modifies and interfaces laboratory equipment and assists in technical methodology issues.

4.0 Record Retention

4.1 All records are retained as required by regulatory requirements and client contractual agreements. The system shall produce unequivocal, accurate records that document all laboratory activities.

4.2 Instrument raw data is backed up daily to the network.

4.3 The Laboratory Information Management System (LIMs) is maintained in a fireproof room. In addition, a copy of the operating system is stored off-site.

4.4 Electronic files are backed up daily to the network. (Refer to document ADMIN002 for computers and programs.)

4.5 In the case of transfer of ownership or if the lab goes out of business, all records are to be transferred to the new owner or retained by the current Lab Director for the required time period. H2M has a more detailed documented plan for going out of business or transfer of ownership. Refer to document ADMIN001, *Plan for Going Out of Business or Transfer of Ownership*.

Table 2.0: Temporary Storage (held on-site)

Record	Retention	Hardcopy	Location	Organization
Current Lab Reports	10 year	No	LIMs and Network	Lab Number
Current Data Packages	3-6 months	Yes	QC Department	Alphabetized by month
Standard Operating Procedures	Current Version	Electronic Copy	LIMs and Network	Directories and Sub-directories
Completed Logbooks	1-2 years	Yes	In the lab	Numbered
Accreditation Support Data	3 years	Yes	QA Office	Study number and date
Data Integrity Issues	5 years	Yes	QA Office	Date

Employee File/ Training Records	Current Employees	Yes	QA Office	Alphabetized

Table 3.0: Archival Storage (held off-site)

Record	Retention	Hardcopy	Location	Electronic	Location
Accreditation Support Data	5 years	Yes	QA office	Yes	Computer Directories
Raw Data/ Test Report Data/Lab Reports	12 years	Yes	Off-site storage	Yes	Tape storage/ CDs
Data Integrity Issues	5 years	No	Off-site storage	Yes	Tape storage/ CDs
Method Evaluations	5 years	Yes	QA Office	NO	N/A
Water Quality Tests	12 years	Yes	Off-site Storage	Yes	Tape storage/ CDs
Drinking Water Program	10 years 12 years for lead and copper	Yes	Off-site Storage	Yes	Tape storage/ CDs
Potable and Non-Potable Water Microbiology	5 years	Yes	Off-site Storage	Yes	Tape storage/ CDs
Employee File/ Training Records	10 years	Only original SDGs folder Case files	Off-site storage	NO	NA
CLP Reports	5 years	No	N/A	Yes	Tape Storage/ CDs stored onsite
SOPs	5 years	Signature Page only	QA Office	Yes	Server Network
Completed Logbooks	12 years	Yes	Off-site storage	Yes	Tape

5.0 Document Control

5.1 All records, documents and manuals generated by the laboratory will be maintained and controlled through a document control system. The purpose of the document control system is to ensure that only the most recent versions are available to the appropriate personnel, that revisions are timely, and that the document receives the required approvals. This system allows for retrieval of information such as lab reports, raw data as well as control of manuals, documents and Standard Operating Procedures produced.

5.2 The Quality Assurance Manager or designee is responsible for the document control system and maintains a master list of the location of all documents and their current revision by using an access database and excel spreadsheet.

5.3 Document Approval

5.3.1 The Laboratory Manager and the Quality Assurance Manager approve all newly released documents and revised documents.

5.3.2 The Laboratory Director, Quality Assurance Manager, and the Laboratory Manager approve the QAM.

5.3.3 Controlled documents will have an approval signature page and a revision change record.

5.3.4 The central repository for controlled documents is the H2M Server.

5.4 Revision Control

5.4.1 All documents will contain the following control information:

5.4.1.1 Document Title
5.4.1.2 Revision Date
5.4.1.3 Revision Number
5.4.1.4 Effective Date (date of approval signature)

5.5 Obsolete Documents

5.5.1 The Quality Assurance Manager will maintain one electronic copy of an obsolete standard operating procedure in an archive folder on the server/network.

5.5.2 The original hardcopy signature page from the obsolete standard operating procedure is stored in the QA Office.

5.6 Document Archive

5.6.1 All hardcopy records are legible.

5.6.2 Completed laboratory logbooks are individually numbered.

5.6.3 Final archival is completed by the following:

5.6.3.1 Records are boxed.

5.6.3.2 Each box is labeled with a consecutive number that is generated by an electronic notebook.

5.6.4 The electronic notebook (archival storage) serves as the index for archived items.

5.6.5 Items removed from archive are done using an access log that records the following:

- Date removed
- Requested by
- Box Number
- Item number and description
- Authorized by
- Date returned

5.6.6 All archived data is stored to an off site document storage facility at Central Avenue in Farmingdale, NY.

5.6.7 The storage facility is locked, is free of vermin and is environmentally stable in regard to temperature and humidity and is kept safe from loss.

5.7 Data Package Archive

- 5.7.1 Data packages are scanned to a file (adobe PDF format) and saved to the local and network drives.
- 5.7.2 Original chain-of-custody, narratives, and title and chronicle pages are removed and filed in the case file in the QC department.
- 5.7.3 The PDF files are burned to a CD on a semi-annual basis.
- 5.7.4 After 3 to 6 months, the paper copy is destroyed.

5.8 Changes to Documents

- 5.8.1 Changes to documents will be reviewed and approved by the same function that performed the original review.
- 5.8.2 Where practicable, the altered or new text shall be identified in the document or the appropriate attachments.
- 5.8.3 Changes to any document will be made so as not to obscure or delete the previous data entry.
- 5.8.4 All changes will be crossed out and the correct entry made alongside.
- 5.8.5 Mistakes are not erased, made illegible, or deleted.
- 5.8.6 All alterations to records are signed or initialed by the person making the correction.
- 5.8.7 The H2M error codes will be applied to the correction to explain the change.
- 5.8.8 Hand amendments of standard operating procedures are only permitted by those personnel authorized to do so.
- 5.8.9 Hand amendments of standard operating procedures, pending the re-issue of the documents, will be clearly marked, initialed and dated.
- 5.8.10 The QA Manager, prior to implementation as a new or modified procedure, will approve all hand amendments.

5.9 Laboratory Logbooks

- 5.9.1 Templates of some logbooks are maintained in the QC department and new books are generated and issued through this department.
- 5.9.2 In some cases, an electronic run log is generated using the instrument software, printed out, comments written were necessary. Final storage is in a binder.
- 5.9.3 Logbooks are bound and the pages in all logbooks are numbered sequentially to maintain the integrity of the document.
- 5.9.4 The books are given a book number and are signed out by the QC department, which maintains a master record of all logbooks.
- 5.9.5 Upon completion, the logbook binder is labeled with the test, start and completion date, and run number and are then logged back into the electronic notebook for archiving.
- 5.9.6 Analysts are required to sign initials and date next to all analyses performed.
- 5.9.7 For GC and GC/MS, the instrument program is to be listed as well as sample ID, amount of sample injected and reason, if any, for re-analysis (under remarks).
- 5.9.8 For wet chemistry tests, all raw data used in calculations is to be recorded in the logbook.
- 5.9.9 For sample preparation, all weights and/or exact volume of sample extracted are to be listed as well as type of cleanup performed and date extracted.

5.10 Document Distribution

- 5.10.1 Only the most recent versions of SOPs and the QAM are available on the document central repository.

5.10.2 The central repository to be used by employees for all current versions of laboratory documents is the server/network.

5.10.3 The Document Control Officer in the QC Department maintains instrument and logbooks and data packages.

5.10.4 A signed statement is on file that demonstrates that each employee has read, understood, and is using the latest version of the laboratory's QAM documentation, which relates to his/her job responsibilities.

5.10.5 Each analyst must certify by signature that they have read, understand and agreed to perform the most recent version of the test method, the approved method or standard operating procedure as defined by this document control system.

6.0 Job Descriptions and Communication Processes

6.1 H2M management ensures that appropriate communication processes are established within the laboratory.

6.2 The current job descriptions for all personnel who manage, perform, or verify work affecting the quality of the environmental tests is listed below.

6.3 Complete resumes are found in the Appendix, Section 2.0.

6.4 The laboratory maintains records of the relevant educational and professional qualifications, training, skills and experience required of all technical personnel, including contracted personnel.

<u>Laboratory Director</u>
<u>Job Description</u>
The Laboratory Director is responsible for all technical and quality operations in the laboratory
<u>Educational Requirements</u>
Chemical Analyses
A bachelor's degree in the chemical, environmental, biological sciences, physical sciences or engineering and at least two years of experience in environmental analysis is required.
Microbiological Analyses
For microbiology, a minimum of an associated degree and four college semester credits is required for analysis of total coliform, fecal coliform and standard plate count unless grandfathered in the position.

<u>Laboratory Manager</u>
<u>Job Description</u>
The laboratory manager is responsible for and directs the operations and activities of the laboratory, including the receipt, analysis and delivery of all work performed by the laboratory. Through departmental supervisors, he schedules and manages all work in the organic, inorganic and bacteriology labs.
<u>Educational Requirements</u>
Minimum requirements are a bachelors degree in chemistry or biology or a related science and a degree in Business Administration, five years supervisory experience, good written and verbal communication skills, and strong laboratory background.

<u>Quality Assurance Manager</u>
<u>Job Description</u>

The Laboratory Quality Assurance Manager is responsible for developing, implementing and monitoring the required systems and controls to assure company compliance with established regulatory and industry standards.

The QA manager implements the QA/QC program, reviews analytical reports and oversees chain-of custody policies. The QA manager also performs data validation of packages for correctness and completeness; is liaison to regulatory agencies for issues of proficiency testing and certification.

Educational Requirements

The QA manager will have at least a degree in chemistry, bacteriology, biology or related science, preferably a graduate degree, excellent organizational and communication skills, experience in quality assurance procedures and a minimum of five years of relevant experience.

Technical Manager

Job Description

Is responsible for CLP data review for completeness and correctness, technical guidance, and development of new methods and special projects. The technical manager also assists section supervisors with training and staff development.

Educational Requirements

Minimum requirements include undergraduate degree in chemistry or related science, five years of analytical experience, and good communication skills.

Laboratory Scientist

Job Description

Performs chemical tests on a variety of environmental samples often using sophisticated instrumentation under supervision. Maintain and monitor QA/QC requirements associated with test. Maintain instrumentation in optimum operational condition and analyze and report data for work assigned.

Educational Requirements

Minimum requirements are a bachelor’s degree in appropriate scientific disciplined. With experience and/or education employees can advance from Scientist I to II, III, IV & V. this rating of levels is documented in the Human Resource Dept.

Laboratory Technician

Job Description

Performs routine laboratory testing or sample preparation under the direct supervision of a section supervisor. Technicians perform routine analytical tasks according to standard operating procedures. They operate and maintain lab instruments and maintain required quality control for each test.

Educational Requirements

Minimum requirements for technician I are a high school diploma with an associates degree preferred in a technical course of study. Employees can advance to technician II, III, IV or V with experience. This rating of levels is documented in the Human Resource Dept.

Data Package/QC Coordinators

Job Description

Maintain and monitor the QA/QC and project elements of CLP projects. Input methods data into CLP reporting packages and produce custom spreadsheets and diskettes. Coordinators, review external and internal chain of custody for accuracy and completeness. Assist the lab manager in prioritizing projects, prepare and mail completed data packages, prepare and distribute workbooks and communicate with clients regarding the status of or problems associated with their projects.

Educational Requirements

Minimum requirements are an associate's degree with one year of experience or a high school diploma and three years experience strong word processing and data entry skills essential as well as strong organizational and good communication skills.

Laboratory Section Supervisors

Job Description

The supervisors of the operational sections of the laboratory: GC, GC/MS, metals, wet chemistry, sample preparation, QA/QC and receiving, direct the daily activities of the section and supervise the staff in their section. They are responsible for directing and distributing daily work, employee training, maintaining and monitoring quality control programs, maintenance of instrumentation and operating supplies. They also implement new tests and protocols, review and approve data completed by section personnel and analyze and report samples.

Educational Requirements

Minimum requirements are a bachelor's degree in chemistry or related science or an associate degree and at least four years of related laboratory experience.

Educational Requirements for performing CLP (Contract Laboratory Protocol) analysis:

GC/MS Laboratory Supervisor

A bachelor's degree in chemistry or the physical sciences and three years of relevant laboratory experience, including one year in a supervisory capacity is required.

GC/MS Operator

A GC/MS Operator shall be a person with at least a bachelor's degree in chemistry or the physical sciences, and one year of experience in operating and maintaining a GC/MS data system. Three years of operating and maintaining a GC/MS data system may be substituted for the educational requirements

Mass Spectral Interpretation Specialist

Mass Spectral Interpretation Specialist_shall be a person with at least a bachelor's degree in chemistry or the physical sciences, who has successfully completed a specialized training course in mass spectral interpretation and has at least two years experience in mass spectral interpretation.

Pesticide Residue Analyst

Pesticide Residue Analyst shall be a person with at least a bachelor's degree in chemistry or the physical sciences, and two years of experience in operating and maintaining a gas chromatograph and interpreting gas chromatograms.

Organic Sample Preparation Supervisor

Organic Sample Preparation Supervisor shall be a person with at least a bachelor's degree in chemistry or the physical sciences and at least three years of organic laboratory experience, including at least one year in a supervisory capacity.

Extraction/Concentration Expert

Extraction/Concentration Expert shall be a person with at least a high school diploma, including one course in chemistry and one year of experience in an analytical chemistry laboratory.

Inductively Coupled Plasma (ICP) Spectroscopist

Inductively Coupled Plasma (ICP) Spectroscopist shall be a person with at least a bachelor's degree in chemistry or the physical sciences, who has successfully completed specialized training courses in ICP spectroscopy and has two years of applied experience in ICP analysis of environmental samples.

ICP Operator

ICP Operator shall be a person with at least a bachelor's degree in chemistry or the physical sciences, and one year of experience in the operation and maintenance of ICP instrumentation, or, in lieu of the educational requirement, four years of experience in the operation and maintenance of ICP instrumentation.

Atomic Absorption (AA) Operator

Atomic Absorption (AA) Operator shall be a person with at least a bachelor's degree in chemistry or the physical sciences, and a minimum of one year experience in operating and maintaining AA instrumentation for frame, graphite, furnace and cold vapor techniques, or, in lieu of the educational requirement, three years of experience in operating and maintaining AA instrumentation.

Inorganic Sample Preparation Specialist

Inorganic Sample Preparation Specialist shall be a person with at least a high school diploma, successful completion of a college level course in general chemistry or it equivalent, and six months experience in analytical chemistry.

Classical Chemistry Analyst

Classical Chemistry Analyst shall be a person with at least a bachelor's degree in chemistry or the physical science, and six months experience in classical chemistry laboratory procedures or in lieu of the education requirement, two and one half years of experience performing classical chemistry analysis.

7.0 **Lab Approved Signatures**

7.1 The Quality Assurance Manual is approved by the Laboratory Director, the Laboratory Manager, and the Quality Assurance Manager.

7.2 Lab reports generated by H2M Labs, Inc. must be approved prior to release to client except if data is stamped "Preliminary Results".

7.3 The approved signatories are:

- 7.3.1 Lab Director, John J. Molloy P.E.
- 7.3.2 Lab Manager, Joann M. Slavin
- 7.3.3 QA Manager, Nicole R. Crespi.
- 7.3.4 Technical Manager , Ursula Middel,

7.4 Case narratives, which are part of a data package, list any non-compliances pertaining to the package and require a signature that certifies that the analyses were performed in accordance with the said requirements.

7.4.1 The individual that reviewed the data package signs the narrative.

7.5 Data package reporters sign a form indicating that the data was reported truthfully.

7.5.1 This form is generated for each fraction and is included at the end of each data package fraction.

7.6 In the case where the person requiring a signature for the narrative or chain of custody is not present it is permitted to either sign the persons name followed by your initials or sign your name followed by "for" and the individual's name.

8.0 Data Reduction Procedure

8.1 Laboratory validation of the data begins with the processing of data and continues through data review and reporting of analytical results.

8.2 Data processing can be performed by the analyst who obtained the data or by another analyst.

8.3 Data review starts with an analyst independent of the data acquisition and processing, reviewing (validating) the data to determine if the data processing was performed correctly. The review continues through verifying that the reported analytical results correspond to the data acquired and processed.

8.4 In general, data will be processed by an analyst in one of the following manners:

8.4.1 manual computation of results directly on the data sheet or on calculation pages that are attached to the data sheet

8.4.2 input of raw data for computer processing

8.4.3 direct acquisition and processing of raw data by computer

8.5 If data is manually processed by an analyst, all steps in the computation shall be provided including:

8.5.1 equations used

8.5.2 the source of input parameters such as response factors (RF), dilution factors, calibration constants

8.5.3 if calculations are not performed directly on the data sheet, calculations shall be attached to the data sheets.

8.6 Analysts enter data into the LIMS where the data is computer processed to apply final calculations if necessary.

8.7 The samples analyzed shall be evident on the raw data and the input is signed and dated by the analyst.

8.8 If data is directly acquired from instrumentation and imported into the LIMS, the analyst shall verify that the following are correct:

8.8.1 sample numbers

8.8.2 calibration constants and RF

8.8.3 output parameters such as units and numerical values used for reporting limits .

9.0 Data Reporting and Authorization Procedures

9.1 Completed data packages are generated in the departments.

9.2 Data reported to the clients in Massachusetts will be reported with the addition of a parameter list indicating the certified parameter list in that state.

9.3 Either the department supervisor, Technical Manager, Laboratory Manager or QA

Manager, reviews all data packages.

9.4 Any deviations or non-compliances are documented in the “case narrative” written by the reviewer.

9.5 Any omissions or errors are listed and the data package is rejected and returned to the department for correction.

9.6 After corrections have been made, the reviewer verifies the corrections, the case narrative is revised as necessary, and the case narrative is signed by the reviewer.

10.0 Personnel Authorized to Review Data Packages

Metals and Metals Inorganic:	Metals Supervisor	Christopher Otterberg
	Wet Chem Supervisor	Christopher Otterberg
	Vice President	Vincent Stancampiano
	QA Manager	Nicole R. Crespi
	Technical Manager	Ursula Middel
	Laboratory Manager	Joann Slavin
Pesticides:	Technical Manager	Ursula Middel
	QA Manager	Nicole R. Crespi
	Laboratory Manager	Joann Slavin
	Scientist IV	Elizabeth Gustin
	GC and Special Process Supervisor	James Bidas
GC/MS:	GC/MS Supervisor	Glen Bochicchio
	Technical Manger	Ursula Middel
	QA Manager	Nicole R. Crespi
	Laboratory Manager	Joann Slavin

11.0 **Traceability of Measurements**

11.1 Measurement Traceability is defined as ensuring that all equipment used for environmental tests, including equipment for subsidiary measurements (e. g. for environmental conditions) having a significant effect on the accuracy or validity of the result of the environmental test or sampling shall be calibrated before being put into service and on a continuing basis.

11.2 Table 4 lists the program and verification of the measuring and testing equipment.

11.3 All measurement and support equipment are maintained in proper working order in accordance with the manufacturer instructions.

11.4 H2M utilizes an outside calibration service to perform its annual calibration of equipment and instruments.

11.5 Records of maintenance activities are kept.

11.6 During annual calibration of equipment, (depending on the severity of the issue) item(s) that are found to be out of tolerance will undergo the following corrective actions (by sectional supervisor and management):

11.6.1 The data will be evaluated for anomalies and out of performance specifications from the last acceptable calibration.
11.6.2 Any analyses that could potentially be impacted will be reviewed to determine possible effects on reported results.
11.6.3 If reported results are affected, data must be recalled, re-reported and qualified.

Table 4: Verification of Measurement and Testing Equipment

Equipment	Requirement	Frequency	QC Limits
Analytical Balances	Calibrated by Integrated Service Solutions	Annually	NA
Analytical Balances	Check the working range with NIST traceable class S (NIST F) weights. The range should reflect the routine use of the balance and should bracket the target weight and should test the balance at mid-point.	Daily or before each use	±1% of expected value
Top-loading Balances	Calibration by Integrated Service Solutions	Annually	NA
Top-loading Balances	Calibration check in-house (micro and soils) using 150g weight	Daily or before each use	Must detect 0.1g at 150g load
pH meter	Calibration with standard buffers of pH 4.0 and 10.0. Slope verified with standard buffer of pH 7.0	Daily or before each use	Slope verification must be ±0.1 pH units to proceed
Conductivity Meter	Calibration	Day of use	±20% of the

Equipment	Requirement	Frequency	QC Limits
	check with 0.01, 0.001, and 0.005M KCL solution		expected value
Conductivity Meter	Cell constant determination using a 0.01M KCl solution	Annually or as needed	±1% of the manufacturer's specifications
Dissolved Oxygen Meter	Calibration of Meter and probe against winkler method	Day of use	
Spectrophotometers	Verify wavelength settings using NIST traceable color standards or their equivalent	Annually	See manufacturers specifications
NIST Thermometers	Checked at ice-point and correction factor adjusted	Annually	NA
Liquid in Glass Working Thermometers	Correction factor determined verses the NIST.	Annually	NA
Digital Thermometers	Must read to 3 significant figures. Calibration verses NIST	Quarterly	NA
Turbidimeters	Initial Calibration with formazin or AMCO-AEPA-1	Annually	Results within manufacturers specifications
Turbidimeters	Checked with a Polymer sphere standard in the range(s) of interest.	Daily or each use	Must fall within the standard control limits.
Refrigerators	Temperature checks	Daily	0-6.0°C
Freezers	Temperature checks	Daily	<0°C (Recommended -5 to -15 °C)
BOD Incubators	Temperature checks	Daily	20°C ±1 °C

Equipment	Requirement	Frequency	QC Limits
Bacteriological Incubators	Temperature Checks monitored on each shelf	Daily	35°C ±0.5 °C
Ovens	Temperature check	Beginning and end of cycle and/or daily if left on always	Must maintain the target temperature of interest during use
Autoclaves	Temperature Check	Beginning and end of cycle	Must maintain sterilization temperatures during the sterilization cycle. Cycle must be completed within 45 minutes when a 10-12 minute sterilization period is used.
Autoclaves	Autoclave mechanical timing device check verses a NIST digital timer.	Quarterly	Within 120 seconds
Autoclaves	Demonstration of sterilization	Biological indicators weekly OR continuous monitoring	Indicators must show sterility or continuous monitoring must indicate correct temperature
Bacteriological Water Baths	Temperature check	Daily	Must maintain a temperature of 44.5 °C ±0.2 °C
Volumetric Dispensing Devices	Calibrated at all levels of use	Quarterly	Calculate %accuracy and %error
Syringes	Certified calibrated from the vendor	NA	Store certificates

Table 5.0: Working Thermometers

Equipment	Requirement	QA Limits
Freezer	Dedicated and calibrated. Immersed in liquid.	Graduations no greater than 1°C.
BOD Incubator	Dedicated and calibrated. Immersed in liquid.	Graduations no greater than 0.2 °C
Ovens	Dedicated and calibrated. Immersed in sand.	Graduations no greater than 1.0 °C
Refrigerators	Dedicated and calibrated. Immersed in liquid.	Graduations no greater than 1.0 °C
Bacteriological Air Bath Incubators	Dedicated and calibrated located on each shelf in the incubator.	Graduations no greater than 0.1 °C
Bacteriological Water Bath Incubators	Dedicated and calibrated located on each shelf in the incubator.	Graduations no greater than 0.1 °C

Table 6.0: Reagent Grade (Laboratory pure) Water

Parameter	Frequency	Acceptance Criteria
Conductivity (at 25°C)	Daily or when maintenance is performed	<2 micromhos/cm at 25°C
Free residual chlorine	Monthly or when maintenance is performed	<0.1 mg/L
Standard plate count	Monthly or when maintenance is performed	<500 colonies/mL
Suitability test	Yearly or when maintenance is performed	Ratio between 0.8 to 3.0
Heavy metals	Yearly or when maintenance is performed	< 50 ug/L for each metal collectively <100 ug/L

12.0 Accredited Test Methods

12.1 See the Appendix, Section 3.0

13.0 Contract Review

13.1 Records of request, tender and contract review, including significant changes, are maintained. Records of pertinent discussions with customers relating to the customer's requirements or work during the period of execution of the contract are also maintained.

13.2 Routine Work

13.2.1 For review of routine work and other simple tasks, the date and identification of the person on the chain-of-custody who is responsible for accepting the samples is considered adequate.

13.3 Written Contract Work

13.3.1 Prior to acceptance of new written contract work, the Project Manager thoroughly reviews the requirements of the written contract to ensure that the laboratory has the appropriate facility and resources to successfully complete the project. Criteria considered includes, but it not limited to:

13.3.1.1 Methodology
13.3.1.2 Detection Limits
13.3.1.3 Personnel requirements
13.3.1.4 Turn-around-time

13.3.2 At this time, guidance from the various departments and/or QC and Administration are provided. If a project specific quality plan is provided, it is reviewed in the above manner.

13.3.3 After initial review by the Project Manager and subsequent review by departmental personnel, the contract is then reviewed for legal considerations. Any questions or issues may be discussed with and Officer of the Company for approval.

13.4 Questions, modifications, or changes to the contract are then discussed and resolved prior to agreeing to the terms of the contract. An amendment to the contract may be included if needed.

13.5 The mutually agreed upon contract is then signed by an authorized representative of the firm.

14.0 Review of New Work

14.1 To maintain current methodologies and implement new regulations new test methods and procedures are occasionally added to the scope of testing in the laboratory.

14.2 There are varying degrees to the addition of new work. These include:

14.2.1 The addition of an analyte to an existing method.
14.2.2 Complete start-up of an established method.
14.2.3 Analyte requested with no established method.

14.3 Addition of an Analyte to an Existing Method

14.3.1 The analytical method is reviewed to determine if its use is appropriate for the new analyte. The standard is purchased from a commercial vendor and prepared. If the analyte is available from more than one source, a second source may be purchased to verify the calibration standard. The standard is analyzed to determine its elution time in the scan.

14.3.2 A calibration curve is produced to determine linearity. If preparatory steps are required, four replicates of the standard are carried through all phases of the method. The initial start-up procedure is documented.

14.3.3 A MDL or IDL is performed and the detection limit is determined.

14.3.4 An in-house SOP is written and used by the analysts. Demonstration of capability is maintained on file.

14.3.5 If necessary, the appropriate state accreditation is sought for the additional analyte following approved state certification processes.

14.4 Complete Start-Up of an Established Method

14.4.1 The method is obtained and reviewed by the Technical Manager or Supervisor to determine if new instrumentation or reagents/standards are required by the method.

14.4.2 If the required instrumentation is currently available in the laboratory, the reagents, standards and other supplies are gathered/purchased.

14.4.3 If more than one analyte is quantified in the method, the analytes may be initially analyzed individually to determine elution time.

14.4.4 If the analyte is available from more than one source, a second source may be purchased to verify the calibration standard.

14.4.5 A calibration curve is produced to determine linearity. If preparatory steps are required, four replicates of the standard are carried through all phases of the method and compared to the established QC of the method. The initial start-up procedure is documented.

14.4.6 A MDL or IDL is performed and the detection limit is determined.

14.4.7 An in-house SOP is written and used by the analysts. Demonstration of capability is maintained on file.

14.4.8 The samples and standards and associated QC samples are carried through the procedure and the QC is compared to the method QC acceptance criteria.

14.4.9 If necessary, the appropriate state accreditation is sought for the additional analyte following approved state certification processes.

14.5 Analyte Requested with No Established Method

14.5.1 The analyte to be analyzed is researched and reviewed by the Technical Manager to determine the compound classification.

14.5.2 After the compound classification is complete, it is determined if it can be analyzed by an existing method. If not, it is determined if perhaps a modification to an existing method would allow successful determination of the compound.

14.5.3 Different approaches to testing the analyte may be tried, comparing the efficiency of the various approaches. The method that allows for acceptable precision and accuracy is used.

14.5.4 If more than one analyte is quantified in the method, the analytes may be initially analyzed individually to determine elution time.

14.5.5 If the required analytes are available from more than one source, a second source may be purchased to verify the calibration standard. A calibration curve is produced to determine linearity.

14.5.6 If preparatory steps are required, four replicates of the standard are carried through all phases of the method and compared to the established QC of the method. The initial start-up procedure is documented.

14.5.7 A MDL or IDL is performed and the detection limit is determined.

14.5.8 An in-house SOP is written and used by the analysts. Demonstration of capability is maintained on file.

14.5.9 The samples and standards and associated QC samples are carried through the procedure and the QC is compared to the method QC acceptance criteria.

14.5.10 If necessary, the appropriate state accreditation is sought for the additional analyte following approved state certification processes.

15.0 Conflict of Interest

15.1 The H2M company policy regarding conflict of interest is found in section 2.7 of the company Personnel Manual. This includes the receipt of gifts and ownership in other businesses. Policies are in place regarding “Moonlighting”.

15.2 The Personnel Manual also includes ways in which to deal with employee issues and conflict resolution.

15.3 The Human Resources Department is available to all employees for guidance regarding personal issues.

15.4 The Personnel Manual can be accessed via the company intranet.

16.0 Confidentiality

16.1 It is H2M’s policy to protect the confidential information and proprietary rights of our customers including the electronic storage and transmission of results.

16.2 All employees sign an Employee Confidentiality Agreement. The signed agreement is retained by the Human Resource Department.

16.3 The confidentiality of client results is ensured by enforcement of the following:

16.3.1 All results are held in the strictest confidence.

16.3.2 Sample results are not released to others without pre-authorized permission by the client or a written release request allowing transmittal of the data to an outside source.

16.3.3 Some clients require data to be kept strictly confidential with limited access by laboratory personnel.

16.3.4 If required, all sample information generated, as well as raw data, is kept in a locked area in the QC Department and access is limited to the Laboratory Manger, Quality Assurance Manager, and document control officer.

16.4 Notification of the requirement for strict confidentiality (limited personnel access) must be received with the samples.

17.0 Subcontracting

17.1 Occasionally, it is necessary to subcontract samples to other approved laboratories if H2M does not perform an analysis, instruments are down, or there is a current overload of work making meeting holding times questionable.

17.2 No samples are subcontracted to an outside laboratory without prior permission of the client.

17.3 Prior to shipping of subcontract samples, the specific client requirements are reviewed with the laboratory including:

17.3.1 Specific method requirements

17.3.2 Reporting and detection limits

17.3.3 QC requirements

17.3.4 Submission of a project QAPjP SOP, if required.

17.4 Once the requirements are reviewed with the subcontract laboratory, a copy of their state certification is reviewed and maintained on file.

17.5 All subcontract results are generated on the subcontract laboratories report forms and submitted to H2M.

17.6 Results may be transcribed onto H2Ms lab report with the qualifier that an outside laboratory performed the results. The H2M laboratory report shows the test subcontracted out and have the notation “see attached”.

17.7 Copies of the subcontract process are maintained in individual client files. The information need only be filled out once for an ongoing project.

17.8 Project Management maintains a file with the current laboratory certifications from the laboratories used for subcontracting. These certifications will be updated annually.

17.9 It is the responsibility of the person providing the quote or setting up the project to notify the client that their samples will be subcontracted.

18.0 Calibration and/or Verification Test Procedures

18.1 Calibration and/or verification procedures are designed to insure that the data will be of known quality and the results are appropriate for a given regulation or decision.

18.2 Raw data is retained to reconstruct the calibration used to calculate the sample result.

Table 7.0: Calibration and Verification

QC Requirement	Frequency	QC Limits	Correction
Instrument Calibration	Per the requirements of the method	Linear Regression: Correlation coefficient (r^2) >0.995 unless demonstrated that a lower r^2 can produce acceptable data. Average Response Factor: as per method requirements Calibration Factor: as per method requirements	Analysis cannot proceed unless an acceptable calibration is produced unless covered under the exceptionally permitted departures from procedure. All departures are reviewed by section supervisors. Data may be reported if determined acceptable by supervisor and will be documented in the run log.
Calibration Documentation	Each time instrument is calibrated	Labeled with the method used, instrument, date of analysis, analyte concentrations and response factor or calibration factor.	
Second source Standard	Immediately following initial calibration	Unless specified otherwise in the analytical method, the measured value of the analyte must meet the criteria of the continuing calibration	

QC Requirement	Frequency	QC Limits	Correction
		verification.	
Mid-point Standard	Daily or as required by analytical method		
Instrument Blank	Daily or as required by the method		
Lowest Concentration Level Reported (LOQ)	Each Initial Calibration	The lowest calibration standard is the lowest concentration level reported.	Results reported below this standard are considered estimated and the data are flagged with a qualifier and/or discussed in the case narrative.
Highest Level Concentration	Each Initial Calibration	The highest calibration standard is the highest concentration reported without dilution	Results reported above this standard (unless from a diluted run) are considered estimated and the data flagged with a qualifier and/or discussed in the case narrative.
Method Detection Limit (LOD)	Annually	Determined for all analytes where spiking solutions are available. The LOD must be lower than the LOQ.	Results reported down to MDL are qualified as estimated (J).

19.0 Procedures for Handling Submitted Samples

Personnel are in the laboratory: Monday to Friday 7am to 11pm
Saturday and Sunday: 9am to 3pm
If deliveries must be made later than 6pm on weekdays, or anytime on weekends, the laboratory must be contacted in advance so that arrangements can be made with our staff to ensure proper receipt of samples.

19.1 External Chain of Custody

19.1.1 Sample tracking is accomplished through the use of chains of custody.

19.1.2 A sample is considered to be in custody if it is:

- In an individual's actual possession;
- In view, after being in physical possession;
- Locked so that no one can tamper with it, after having been in physical custody;
- In a secured area, restricted to authorized personnel only.

19.1.3 All samples are handled under conditions, which avoid contamination, deterioration or damage to samples, and which secure their use for litigation purposes.

19.1.4 The chain of custody (COC) procedure begins with either sample collection or bottle preparation depending on client's needs.

19.1.5 Every sample shall be assigned a unique identification number that is entered on the COC.

19.1.5.1 All bottles are identified with the lab ID number and a suffix of A, B, C, D, etc. when samples are fractionated.

19.1.5.2 The total number of bottles received is entered.

19.1.5.3 If the sample is not fractionated, the bottles are all listed as A

19.1.5.4 In this case, the total quantity of bottles is differentiated by the number of bottles as indicated by the designation "1 of 3, 2 of 3, etc." on the bottles.

19.1.6 The COC includes:

- container type
- preservative type
- number of containers for each sample location (including MS/MSD, trip blank and field blank)
- any distinctive notification
- signature of sampler
- receiver's signature
- date/time of relinquishment.

19.1.7 Upon receipt of the samples by an H2M representative, the first "relinquished by/received by" blocks shall be completed on the COC.

19.1.8 The date and time of receipt in the lab is entered on the external COC form.

19.1.9 The shipment is checked for integrity, completeness and the samples are examined for damage.

19.1.9.1 All sample bottles are checked to verify that they are sealed properly, that they have no breakage, air bubbles (volatiles), and proper labeling.

19.1.9.2 Any shortages and damage is noted on the external COC.

19.1.9.3 If any problems occur, the project manager will be notified.

19.1.9.3.1 If the samples aren't in jeopardy of holding time exceedences, they are assigned cold storage before proceeding with sample accession until laboratory-receiving personnel receive instructions.

19.1.9.3.2 If the samples need to be analyzed immediately, the samples will be giving a laboratory number.

19.1.9.3.3 If the samples analyzed need to be re-collected, the laboratory number will be deleted and a new work order with a new number will be generated for the re-collected samples.

19.1.9.4 A sample receipt checklist is prepared in the sample-receiving department to account for any breakage or discrepancy in sample documentation, as compared to the sample shipment

19.1.10 The temperature of the cooler is checked for samples that require storage at <= 6°C.

19.1.10.1 A temperature blank is sent out with the coolers.

19.1.10.2 A 100ml plastic bottle filled with water and labeled Temperature Blank is placed in the cooler during cooler set up.

- 19.1.10.3 This bottle is read with the IR gun upon receipt in the lab and logged on the COC form.
- 19.1.10.4 Local samples may not be in transit long enough to be chilled, however there must be evidence that the preservation process has begun, such as receipt on ice.
- 19.1.10.5 If no temperature blank is present, a clear plastic or glass bottle may be used for the temperature blank.
- 19.1.10.6 Amber bottles are not to be used to check the temperature nor are vials or bottles wrapped in bubble pack.

19.1.11 A cooler checklist form is completed for samples received after normal business hours or on weekends.

- 19.1.11.1 The cooler temperature is checked as is the custody seal.
- 19.1.11.2 The COC is signed and placed back in the cooler and stored in the lab walk-in refrigerator.

19.1.12 Samples that have not been properly stored during transport to the lab will either be rejected and a resample collected or it will be noted on the non-conformance report and on the final lab report.

19.1.13 A copy of the external COC is returned to the project manager.

19.1.14 The sample custodian places the original in the H2M Labs client file.

19.1.15 The H2M project manager will notify the client of non-conformances.

19.2 DC-1 Form Completion

19.2.1 If applicable to the samples received, the USEPA sample login form (Form DC-1) is completed. This form is used to document the receipt and inspection of the samples and coolers.

19.2.2 One original of the DC-1 form is required per cooler.

19.2.3 If the samples in a single cooler must be assigned to more than one Sample Delivery Group (SDG), the original DC-1 accompanies the deliverables for the SDG of the lowest Arabic number and a copy accompanies the other SDG's.

19.2.4 The copies must be stamped "COPY" and the location of the original noted on the copy.

19.2.5 The following information will be required to complete the DC-1 form:

- 19.2.5.1 Lab Name
- 19.2.5.2 Log-in data
- 19.2.5.3 Print and signature of lab personnel who received samples
- 19.2.5.4 Case number
- 19.2.5.5 SDG number
- 19.2.5.6 SAS number
- 19.2.5.7 Condition of shipping coolers
- 19.2.5.8 Sign and date air bill
- 19.2.5.9 Record the presence/absence of custody seals and their condition in item 1 of the form
- 19.2.5.10 Add pH of cyanide and metals samples as verified upon receipt in the laboratory. Cyanide must be greater than 12.
- 19.2.5.11 Record the air bill or sticker number in item 6
- 19.2.5.12 Record condition of bottles and presence or absence of sample tags in items 7 and 8 on the form
- 19.2.5.13 Review shipping documents and compare information on all documents and complete item 9
- 19.2.5.14 If there are no problems, sign, date and indicate time on the

DC-1 form.

- 19.2.5.15 Record the sample tag I.D. numbers and assigned lab numbers.
- 19.2.5.16 Cross reference H2M numbers with the SMO.
- 19.2.5.17 Project coordinator will document communication in the CLP communication logbook
- 19.2.5.18 Record the fraction and area stored in the sample transfer space and sign and date.

19.3 Internal Chain-of-Custody

- 19.3.1 The sample custodian assigns laboratory identification numbers to the samples and then transfers the samples to department custodians.
- 19.3.2 An internal COC form is completed with the project number, date of receipt and listing of samples by number and H2M laboratory identification numbers.
- 19.3.3 The sample custodian and department custodian sign for transfer with date and time indicated.
- 19.3.4 The department custodian places samples in secured areas for storage.
- 19.3.5 The department custodian relinquishes samples to the technicians for sample preparation and/or analysis.
- 19.3.6 The analysts sign for the samples and extracts/digestates each time the samples exchange hands.
- 19.3.7 Upon completion of analysis, any remaining original sample matrix containers are returned to the appropriate sample custodian.

19.4 Internal Verification of COC Procedures

- 19.4.1 The sample custodian gives a copy of the external and internal COCs to the project manager as well as any information received with the sample to the document control section of the QA Department.
- 19.4.2 All paperwork is reviewed and checked for any transcription errors.
- 19.4.3 If there are any transcription errors, the sample custodian and any affected departments are contacted.
- 19.4.4 Verification that corrections were made properly is the responsibility of the laboratory’s document control section or QA Department.
- 19.4.5 The samples are automatically entered into a CLP status spreadsheet and the sample delivery group folder is prepared including all pertinent information.
- 19.4.6 The folder is labeled with the SDG number and filed.

19.5 Initial Sample Storage

- 19.5.1 All samples are stored in an area free from secondary contamination.
- 19.5.2 CLP Volatile
  - 19.5.2.1 Samples are stored in the GC/MS section in a locked refrigerator at 4°C (±2°C) and are protected from light from receipt until analysis.
- 19.5.3 CLP BNA, Pesticide/PCB
  - 19.5.3.1 Samples are stored in the Special Process section in a locked refrigerator or the walk-in refrigerator at 4°C (±2°C) and are protected from light upon receipt until extraction and analysis.
  - 19.5.3.2 After analysis, extracts and unused samples are protected from light and stored at 4°C (±2°C).
  - 19.5.3.3 The extracts are stored in the locked refrigerator between the GC/MS and Special Process sections.

19.5.4 CLP Metals
    19.5.4.1 Water samples are stored in a locked refrigerator in the Metals section.
    19.5.4.2 Soil samples are stored in a locked refrigerator in the metals section and maintained at 4°C (±2°C).
19.5.5 CLP Cyanide
    19.5.5.1 Samples are stored in a locked refrigerator at 4°C (±2°C) in the Wet Chemistry storage area.

19.6 Final Sample Storage
19.6.1 The time that samples are held after completion of analysis is dependent on the client’s requirements.
19.6.2 Some samples are stored for 6 months.
19.6.3 Most samples are stored for 60days after report generation.
19.6.4 If extended storage is required, the samples are boxed and moved to the off-site storage facility.

20.0 Sample Preservation, Containers, and Holding Times

A summary of preservation, container and holding times is found in Tables 8.0-10.0

20.1 Sample Preservation

20.1.1 The addition of preservative is verified upon receipt and documented.
20.1.2 The pH of all preserved samples (except volatile samples and oil and grease which are verified in the departments) are verified in the receiving department by the use of pH paper.
20.1.3 A small aliquot of sample is poured over the pH paper.
20.1.4 Do not dip the paper into the sample.
20.1.5 Note the pH in the LIMS in the pH field on the chain of custody.
20.1.6 Volatile aqueous samples are checked for proper preservative by the use of pH paper after sample analysis.
20.1.7 Chlorine residual checks are performed for samples submitted for organic drinking water analyses using chlorine test strips.
20.1.8 Chlorine residual checks will take place in the departments, except for the methods that also need pH preservative verification; these will be checked in the receiving department (i.e., 525.2, 531.1, 549, 508.1).
20.1.9 Bacteria samples must be received with 1-inch headspace to allow for proper mixing.
    20.1.9.1 If a sample bottle is filled too full to allow for proper mixing, do not pour off and discard a portion of the sample. Rather, pour the entire sample into a larger sterile container, mix properly, and proceed with the analysis.
20.1.10 Tables 8.0-10.0 contain proper sample preservations.
20.1.11 For USEPA samples, note the pH on the DC-1 form.
20.1.12 Bottles without preservative will be noted on the COC and if allowable, preservative will be added at the laboratory.
20.1.13 Notify the project manager if preservations have been added at the laboratory.
20.1.14 If non-potable water samples submitted for metals analyses are received unpreserved, preservative may be added at the lab, however, acid must be added at least 24 hours before analysis to dissolve any metals that adsorb to the container walls.
    20.1.14.1 The receiving department must note the time of

preservation in the LIMS and on the sample bottle so the metals department is aware of the 24-hour time period.

20.1.14.2 Clients must be notified immediately if rush turn around time is requested (i.e., 24 TAT).

20.1.15 If sample preservations do not comply with the requirements in Table 8.0-10.0, notify the project manager immediately.

20.1.16 The client will be notified as soon as possible.

20.2 Sample Containers

20.2.1 Sample containers are usually provided by H2M, except where otherwise specified by the client.

20.2.2 Several different sampling containers may be used for one project.

20.2.3 Materials must be selected that would not result in interference with the analysis.

20.2.4 Each sample container will have a durable waterproof label, which contains all the information necessary to identify the sample.

20.2.5 New clients are given a summary of which bottle to use for what test to ensure that the correct bottle is used for the test requested.

20.2.6 The amount of information on the label may vary depending on the source and other factors, but, in general may include:

- Number of bottles per analysis
- Collector’s name
- Sample location
- Date and time of collection
- Depth of sample
- Atmospheric conditions

20.2.7 The bottles used are verified as non-contaminated by monthly checking of bottles. This is done by filling the bottle with distilled water and analyzing the water for the parameters that would normally be analyzed from that bottle.

20.2.8 This record is kept on file in the QC Department.

20.2.9 Any positive readings for any analytes are flagged and the supervisor and QA Manager are notified.

20.2.10 No bottles from the affected lot are used until the source of contamination is determined and remedied.

20.3 Holding Time Status

20.3.1 On a daily basis, holding times are monitored as a check on the different departments and the supervisors notify staff if holding times are drawing near (at least two days in advance).

20.3.2 The Package Production Supervisor meets with the Section Supervisors on a weekly basis to update the status of the project.

20.3.3 A status report is available to all laboratory employees in the LIMs.

20.3.4 To ensure that the status report is kept current, all analysts are required to update sample status on a daily basis.

20.3.5 After completion of a project, the Package Production section coordinates collation of the data package and reviews that all required forms are included and that the package is mailed within the required time frame.

Table 8.0 Potable Water Bottle and Preservation Requirements

Analyte	Bottle	Preservation	Holding Time
The information contained in this item comes from the Code of Federal Regulations (40 CFR 141). Note 1: Maximum holding time includes the time elapsed from collection of the sample to placement in the incubator. Note 2: Consumer collected samples may be left unpreserved for up to 14 days. Note 3: E. coli samples enumerated for reporting to EPA under the LT2 rule may be tested when the 8 hour hold time is exceeded and within 30 hours from the time of collection to set-up only when preservation is documented intact. All data generated outside of the 8 hour hold time must be qualified as such in the report to the client. No samples older than 30 hours shall be tested. Note 4: ELAP offers Nitrate or Nitrite only for accreditation. ELAP does not offer combined Nitrate-Nitrite. The preservation and holding time requirements for combined Nitrate-Nitrite is Cool to 4°C, H_2SO_4 to pH<2, and 28 days. Note 5: For bacteriological tests, when the sample is collected, leave ample air space in the bottle (at least 2.5 cm or 1 in) to facilitate mixing by shaking.			
Bacteriological Tests: Note 5 Fully processed Drinking Water (40 CFR 141.21(f)(3)):			
Coliform (Total) and E. coli presence/absence	Sterile P,G	0.008% $Na_2S_2O_3$	30 hours NOTE 1
Standard Plate Count	Sterile P,G	0.008% $Na_2S_2O_3$	8 hours NOTE 1
Coliphage	P	Cool to 4oC, 0.5mL 10% $Na_2S_2O_3$ per L of sample	48 hours
Surface Water (40 CFR 141.74(a)(1)):			
Coliform (Total) and E. coli enumeration	P,G	Cool to 4oC	8 hours NOTE 1, 3
Standard Plate Count	P,G	Cool to 4oC	8 hours NOTE 1
Coliphage	P	Cool to 4oC	48 hours
Inorganic Tests			
Alkalinity	P,G	Separate bottle completely filled to the exclusion of air, cool, 4oC	14 days
Metals (Sb, As, Ba, Be, Cd, Ca, Cr, Cu, Pb, Ni, Se, Ag, Na, Tl)	P,G	HNO_3 to pH<2	6 months NOTE 2
Bromate	P,G	50 mg/L EDA	28 days

Analyte	Bottle	Preservation	Holding Time
Chloride	P,G	None	28 days
Chlorite	P,G	50 mg/L EDA, Cool to 4oC	14 days
Color	P,G	Cool, 4oC	48 hours
Conductivity	P,G	Cool, 4oC	28 days
Cyanide	P,G	Cool, 4oC NaOH to pH<12 1.2 g/L ascorbic acid	14 days
Fluoride	P,G	None	28 days
Mercury	G	HNO3 to pH<2	28 days
Mercury	P	HNO3 to pH<2	28 days
Nitrate By Ion Chromatography	P,G	Cool, 4oC	48 hours NOTE 4
Nitrate Chlorinated Supplies	P,G	Cool, 4oC	14 days NOTE 4
Nitrate Non-chlorinated Supplies	P,G	H2SO4 to pH<2	48 hours NOTE 4
Nitrite	P,G	Cool, 4oC	48 hours
Phosphorus (as Orthophosphate)	P,G	Cool, 4oC	48 hours
Silica	P	Cool, 4oC	28 days
Sulfate	P,G	Cool, 4oC	28 days
Total Filterable Residue	P,G	Cool, 4oC	7 days
UV254 Absorbance	P,G	Cool, 4oC	48 hours
Organic Tests			
Trihalomethanes Bromodichloromethane Bromoform Chlorodibromomethane Chloroform	Glass with Teflon-lined Septum	0.008%Na2S2O3	14 days
Volatile Halocarbon and Volatile Aromatics: Methy-tert-butyl ether	Glass with Teflon-lined Septum	Ascorbic Acid (25 mg/40 ml) added to empty sample bottle then add 1:1 HCl to pH<2. Cool 4oC	14 days
Microextractables: Method 504.1	Glass with Teflon-lined Septum	Cool, 4oC3 mg Na2S2O3 per 40 ml vial	28 days
Method 505	40-ml glass vial with cap liner	3 mg Na2S2O3 Cool, 4oC	7 days

Analyte	Bottle	Preservation	Holding Time
Method 506	1-L (or qt.) amber glass with TFE lined cap	60 mg Na2S2O3 Cool, 4oC	14 days until extraction, then 14 days after extraction
Method 507	1-L Borosilicate glass, graduated, with TFE lined cap	80 mg Na2S2O3 Cool, 4oC Protect from light	14 days until extraction, then 14 days after extraction
Method 508	1-L Borosilicate glass, graduated, with TFE lined cap	80 mg Na2S2O3 Cool, 4oC Protect from light	7 days until extraction, then 14 days after extraction
Method 508A PCB's, Total as decachlorobiphenyl	1-L glass, with TFE lined cap	Cool, 4oC	14 days until extraction, then 30 days after extraction
Method 508.1	1-L glass with TFE lined cap	50 mg Na2S2O3 then 1:1 HCl to pH<2 Cool, 4oC	14 days until extraction then 30 days after extraction
Method 515.1: 515.2, 515.3 Chlorinated Acids	1-L Borosilicate glass, graduated, with TFE lined cap	80 mg Na2S2O3 Cool, 4oC Protect from light	14 days until extraction, then 14 days after extraction
Method 525.2	Refrigerated glass sample containers, sampling must be free of plastic tubing, gaskets, etc. that may leach analytes into water	Cool, 4 C Remove Cl residual; adjust pH<2 with6 N HCl	Extract within14 days. Analyze within 30 days of sample extraction
Method 531.1 Methylcarbamate pesticides	60-ml vial with PTFE silicone faced septa	1.8 ml acetic acid Buffer to pH </=3, 4.8 mg Na2S2O3 Ship 4oC Store at-4oC.	28 days
Glyphosate	60-ml vial PTFE faced Silicone	6 mg Na2S2O3 Cool 4oC; Protect from light	14 days

Analyte	Bottle	Preservation	Holding Time
Endothall	40-ml amber glass vial with TFE lined cap	Cool 4oC; Protect from light	7 days
Diquat	1-L amber plastic or silanized glass with screw cap	100 mg $Na_2S_2O_3$ H_2SO_4 to pH=2, Cool to 4oC, Protect from light	7 days until extraction, then 21 days after extraction
Benzo(a)pyrene	1-L (or qt.) amber glass with TFE lined cap	100 mg $Na_2S_2O_3$ 1:1 HCl to pH<2; Cool to 4oC; Protect from light	7 days until extraction then 30 (40 for Method 550.1) days after extraction
Method 551.1	60 ml glass vials Teflon lined Septum	Sodium Sulfite or Ammonium Chloride (for microextractables), pH 4.5-5.0 with phosphate buffer Cool, 4C	14 days until extraction, then 14 days after extraction
Method 552.1	Amber glass with TFE liner	Add NH_4Cl to a concentration of 100mg/L in sample; Cool 4oC	Extract within 28 days of collection. Analyze extract within 48 hours if stored at 4oC or less.
Method 552.2	Amber glass with TFE liner	Add NH_4Cl to a concentration of 100mg/L in sample; Cool 4oC	Extract within 28 days of collection. Analyze extract within 7 days if stored dark at 4oC or less or 14 days if 10oC or less.
Method 555	glass TFE lined	Acidify to pH2 with 1:1 HCl; Dechlorinate with 5mg $NaSO_3$ per 100mL sample; Cool 4oC Protect from light	Analyze after extraction, within 14 days of collection

Analyte	Bottle	Preservation	Holding Time
Dissolved Gases Method RSK-175	40 mL Glass with Teflon lined Septum	HCL to pH<2. Cool to <=6°C	14 days

Table 9.0 Non-potable Water Bottle and Preservation Requirements

Analyte	Bottle	Preservation	Holding Time
♦ Note that where “Cool to <=6°C” is stated, samples are not to be frozen. Rounding down to 6°C may not be used to meet the <=6°C requirement. The preservation temperature does not apply to samples that are analyzed immediately (less than 15 minutes). ♦ For bacteriological tests, when the sample is collected, leave ample air space in the bottle (at least 2.5 cm or 1 in) to facilitate mixing by shaking. ♦ For metals tests, an aqueous sample may be collected and shipped without acid preservation. However, acid must be added at least 24 hours before analysis to dissolve any metals that adsorb to the container walls.			
Bacteriological Tests			
Coliform, Total, Fecal, and E. coli, and Enterococcus	P,G	Cool to <=6°C	8 hours*
Coliform, Total, Fecal, and E. coli and Enterococcus in chlorinated samples	P,G	Cool to <=6°C 0.008% $Na_2S_2O_3$	8 hours*
Standard Plate Counts	P,G	Cool to <=6°C, 0.008% $Na_2S_2O_3$	8 hours*
*Maximum holding time includes the time elapsed from collection of the sample to placement into the incubator.			
Inorganic Tests ** ELAP offers Nitrate or Nitrite only for accreditation. ELAP does not offer combined Nitrate-Nitrite. The preservation and holding time requirements for combined Nitrate-Nitrite is cool to ≤ 6°C, H_2SO_4 to pH<2, and 28 days (40 CFR 136, Table II).			
Acidity	P, FP,G Separate bottle completely filled to the exclusion of air	Cool to <=6°C	14 days
Alkalinity	P, FP,G Separate bottle completely filled to the exclusion of air	Cool to <=6°C	14 days

Analyte	Bottle	Preservation	Holding Time
Metals (Al, Sb, As, Ba, Be, B, Cd, Ca, Cr, Co, Cu, Au, Fe, Pb, Mn, Mg, Mo, Ni, Pd, Pt, Ag, Tl, Sn, Ti, V)	P, FP,G	Cool to <=6°C, H2SO4 to pH<2	28 days
Biochemical oxygen demand	P, FP,G	Cool to <=6°C	48 hours
Bromide	P, FP,G	None	28 days
Biochemical oxygen demand, carbonaceous	P, FP,G	Cool to <=6°C	48 hours
Chemical oxygen demand	P, FP,G	Cool to <=6°C, H2SO4 to pH<2	28 days
Chloride	P, FP,G	None	28 days
Chlorine Residual	P, G	None	Analyze within 15 minutes
Chromium VI	P, FP,G	Cool to <=6°C	24 hours
Chromium VI	P, FP,G	Cool to <=6°C, Plus pH9.3-9.7 with (NH4)2SO4	28 Days
Color	P, FP,G	Cool to <=6°C	48 hours
Cyanide, total and amendable to chlorination	P, FP,G	Cool to <=6°C, NaOH to pH>12, 0.6g No Sulfide	48 Hrs
Cyanide, total and amendable to chlorination	P, FP,G	Cool to <=6°C, NaOH to pH>12, 0.6g No Sulfide: Plus mitigate for interferences	14 Days
Fluoride	P	None	28 days
Hardness	P, FP,G	HNO3 or H2SO4 to pH<2	6 months
Hydrogen ion (pH)	P, FP,G	None	Analyze within 15 Minutes
Kjeldahl and organic nitrogen	P, FP,G	Cool to <=6°C, H2SO4 to pH<2	28 days
Mercury	P, FP,G	HNO3 to pH<2	28 days
Nitrate	P, FP,G	Cool to <=6°C	48 hours
Nitrate-nitrite	P, FP,G	Cool to <=6°C, H2SO4 to pH<2	28 days
Nitrite	P, FP,G	Cool to <=6°C	48 hours
Oil and Grease	G	Cool to <=6°C, HCl or H2SO4 to pH<2	28 days

Analyte	Bottle	Preservation	Holding Time
Organic carbon	P, FP,G	Cool to <=6°C, HCl or H3PO4, or H2SO4 to pH<2	28 days
Orthophosphate	P, FP,G	Filter within 15 minutes, Cool to <=6°C	48 hours
Phenols	G	Cool to <=6°C H2SO4 to pH<2	28 days
Phosphorus, total	P, FP,G	Cool to <=6°C, H2SO4 to pH<2	28 days
Residue, Total	P, FP,G	Cool to <=6°C	7 days
Residue, Filterable	P, FP,G	Cool to <=6°C	7 days
Residue, Non-filterable	P, FP,G	Cool to <=6°C	7 days
Residue, Settleable	P, FP,G	Cool to <=6°C	7 days
Silica	P, Quartz	Cool to <=6°C	28 days
Specific Conductance	P, FP,G	Cool to <=6°C	28 days
Sulfate	P, FP,G	Cool to <=6°C	28 days
Sulfide	P, FP,G	Cool to <=6°C, add zinc acetate plus sodium hydroxide to pH>9	7 days
Surfactants	P, FP,G	Cool to <=6°C	48 hours
Temperature	P, FP,G	None	Analyze within 15 Minutes
Turbidity	P, FP,G	Cool to <=6°C	48 hours
Organic Tests			
Purgeable Halocarbons plus Benzyl Chloride and Epichlorohydrin	G, Teflon- lined septum	Cool to <=6°C, Ascorbic Acid (25 mg/40 ml) for residual chlorine	14 days (7 days if not preserved)
Purgeable Aromatics	G, Teflon-lined septum	Cool to <=6°C, 0.008%Na2S2O3 for residual chlorine Preserve as above and HCl to pH<2	14 days (7days if not preserved)
Acrolein and Acrylonitrile	G, Teflon-lined septum	Cool to <=6°C, 0.008%Na2S2O3 for residual chlorine Preserve as above and pH to 4-5	14 days for acrylonitrile, 3 days for acrolein 14 days

Analyte	Bottle	Preservation	Holding Time
Phenols	G, Teflon- lined cap	Cool to <=6°C, 0.008% Na2S2O3 for residual chlorine	7 days until extraction 40 days after extraction
Benzidines	G, Teflon- lined cap	Cool to <=6°C, 0.008% Na2S2O3 for residual chlorine	7 days until extraction 7 days after extraction if stored under inert gas
Phthalate Esters	G, Teflon- lined cap	Cool to <=6°C	7 days until extraction 40 days after extraction
Nitrosamines	G, Teflon- lined cap	Cool to <=6°C, store in dark, 0.008% Na2S2O3 for residual chlorine. For diphenylnitrosamine add 0.008% Na2S203 and adjust pH 7-10 with NaOH within 24 hours of sampling	7 days until extraction 40 days after extraction
Nitroaromatics and Isophorone	G, Teflon lined cap	Cool to <=6°C, 0.008% Na2S2O3 for residual chlorine, store in dark	7 days until extraction 40 days after extraction
PCBs	G, Teflon-lined cap	Cool to <=6°C	1 year until extraction 1 year after extraction
Pesticides	G, Teflon-lined cap	Cool to <=6°C Cool to <=6°C, pH 5-9, 0.008% Na2S2O3 for residual chlorine if aldrin is to be determined	72 hours 7 days until extraction 40 days after extraction

Analyte	Bottle	Preservation	Holding Time
Polynuclear Aromatic Hydrocarbons	G, Teflon-lined cap	Cool to <=6°C, 0.08%$Na_2S_2O_3$ for residual chlorine only, store in dark	7 days until extraction 40 days after extraction
Haloethers	G, Teflon-lined cap	Cool to <=6°C, 0.008%$Na_2S_2O_3$ for residual chlorine only	7 days until extraction 40 days after extraction
Chlorinated Hydrocarbons	G-Teflon-lined cap	Cool to <=6oC	7 days until extraction 40 days after extraction
Dissolved Gases Method RSK-175	40 mL Glass with Teflon lined Septum	HCL to pH<2. Cool to <=6°C	14 days
***When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed to safeguard sample integrity. When the analytes fall within two or more chemical categories, the sample may be preserved by cooling to ≤ 6°C, reducing residual chlorine with 0.008% $Na_2S_2O_3$, storing in the dark, and adjusting the pH to 6-9; samples preserved in this manner may be held for 7 days before extraction and for 40 days after extraction. Exceptions to this procedure are noted in footnotes to 40 CFR 136 Table II and the approved methods.			

Table 10.0 Solid/Hazardous Waste Bottle and Preservation Requirements

Analyte	Bottle	Preservation	Holding Time
Note: Due to the variety of possible sample types, only generalizations can be made. Most solid samples are best preserved by refrigeration to 4 • C. Analysis should begin as soon as possible. If SW846 does not list a holding time, then the holding time must not exceed the holding time listed for water samples. A complete record should be maintained on each sample to provide a history of sample handling from collection to analysis.			
HCr+6	P	≤6 °C	30 days to digestion, 7 days from extraction to analysis
Mercury	P	≤6 °C	28 days
Metals	P	None	6 months
HEM, Grease & Oil	P	≤6 °C	28 days
Cyanide	P	≤6 °C	14 days
pH	P	None	Analyze immediately
Total Organic Carbon	P	≤6 °C	28 days

Analyte	Bottle	Preservation	Holding Time
Volatile Organics	P	≤6 °C	14 days
Semi-volatile Organics Pesticides Herbicides	125-mL wide-mouth glass with PTFE-lined lid	≤6 °C	Samples extracted within 14 days and extracts analyzed within 40 days following extraction
PCBs	250-mL wide-mouth glass container with PTFE-lined lid.	Cool to ≤6 °C.	Samples extracted within 14 days and extracts analyzed within 40 days following extraction

21.0 Laboratory Water Supply

21.1 The water used for reagents and blanks (trip, field, method, holding) and general laboratory procedures is derived from two sources: ultra pure still (Nanopure water filtration system) and the Millipore Alpha Q.

21.2 Nanopure Water Filtration System
- 21.2.1 Used for all organic work and all blanks sent to clients (field, trip).
- 21.2.2 GC and GC/MS sections use this water as the source for the method blanks for extractions and volatile organics.
- 21.2.3 The water is verified on a daily basis by the analysis of a method blank and determined to be free of organic contaminates. The resistivity is checked on a daily basis and logged into a logbook.
- 21.2.4 The conductivity is checked on a monthly basis and the values recorded in a notebook.
- 21.2.5 The cartridges are replaced when the resistivity is no longer within the allowable range (0.5 to 2.0 megohms-cm).
- 21.2.6 No volatile organics greater than the reporting limit can be detected in this water.

21.3 Millipore Alpha Q Filtration System
- 21.3.1 Used for all inorganic work.
- 21.3.2 The conductivity is checked daily and must be within the limits of 0.5 to 2.0 megohms/m.
- 21.3.3 This result will be recorded daily in a logbook.

21.4 Field and Trip Blank Sample Preparation
- 21.4.1 Laboratory distilled water, certified as pure, is used for all field and trip blanks.

- 21.4.2 This water is verified as pure by analysis prior to filling the trip and field blank bottles by analysis for volatiles, semi-volatiles and pesticide/PCBs.
- 21.4.3 All organic analytes must be detected at less than the reporting limit.
- 21.4.4 A record of this analysis is kept on file in the QC department.
- 21.4.5 Preservations are added to the sample containers prior to shipment.

22.0 Major Equipment and Reference Measurement Standards

22.1 Preventative Maintenance Procedures

- 22.1.1 The preventative maintenance procedures are designed to generate consistent production of a quality product. The proper calibration and verification of equipment is critical.
- 22.1.2 Preventative maintenance is important in preventing probable down time and instrument problems by instituting a proactive program to ensure that the routine maintenance procedures are performed to prevent failure of the equipment during use.
- 22.1.3 The calibration and maintenance on all the instruments are documented in the calibration log books and the individual instrument maintenance logbooks.
- 22.1.4 See the Appendix Section 5 for general preventative maintenance.

22.2 Responsibility for Maintenance

- 22.2.1 The responsibility for the preventative maintenance lies with the analyst and the supervisor of the department.
- 22.2.2 All staff are trained to perform routine daily maintenance on instrumentation.

22.3 Service Contracts

- 22.3.1 All major laboratory instrumentation is covered under service contracts from either the instrument manufacturer or an outside service organization (Compco Analytical).
- 22.3.2 The service agreements include preplanned service during the course of the contract to minimize downtime. Examples include:
  - 22.3.2.1 Source Cleaning, changing pump oil, cleaning the source and other routine maintenance.
- 22.3.3 Trained staff observes all external source maintenance
- 22.3.4 Once maintenance is requested, the time frame for arrival to the site is anywhere from 48 hours to 4 days depending on the specific agreement.

22.4 Equipment Redundancy

- 22.4.1 All major equipment has a back-up instrument that can be used in a situation where an instrument failure occurs.
- 22.4.2 All GC, GC/MS, ICP instrumentation have more than one instrument available at all times.
- 22.4.3 Spare parts for small consumables and columns are kept on site.
- 22.4.4 In the event that an instrument fails and no redundant instrument is available, the client is notified and arrangements are made to subcontract the impacted samples.
- 22.4.5 Equipment that fails is taken out of service, clearly marked, and appropriately stored (if applicable) until it has been repaired and shown by calibration test to perform correctly.

22.5 Reference Standards

22.5.1 Reference standards are obtained or calibrated by a body that can provide traceability (National Institute of Standards and Technology(NIST)).

22.5.2 Reference standards of measurement held by the laboratory are used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

23.0 Facilities

23.1 H2M Laboratories, Inc. is located at:

575 Broad Hollow Road (Route 110)
Melville, New York 11747
Exit 49 South of the Long Island Expressway (495)

23.2 The laboratory comprises approximately 10,400 square feet in size (see Floor Plan, Appendix, Section 3.0)

23.3 The laboratory is subdivided into six sections:

23.3.1 Shipping/Receiving
23.3.2 Inorganic Chemistry (Wet Chemistry)
23.3.3 Inorganic Chemistry (Metals)
23.3.4 Organic Chemistry (GC)
23.3.5 Organic Chemistry (GC/MS)
23.3.6 Special Process Laboratory

23.4 The laboratory is staffed by approximately 50 technically qualified scientists, technicians, and support staff whose educational backgrounds vary depending on specific job functions.

23.5 The laboratories air supply is designed to minimize cross-contamination in various lab areas (e.g. sample preparation and volatile organic analysis). The air supply is monitored via computer and records of temperature fluctuations and humidity are available.

23.5.1 Negative pressure exists between the special process (extractions) room and the rest of the laboratory to eliminate contamination of extraction solvents in the volatile organic testing areas.

23.6 Bench tops and floors are made of impervious, smooth easily cleaned materials.

23.7 There is at least two linear meters workspace per analyst while working.

23.8 Specific work areas are defined and access is controlled. Only authorized personnel and escorted signed-in visitors may enter the work area. This limits the access of unauthorized personnel from entering work areas with potentially hazardous chemicals.

23.9 Good housekeeping measures are employed to avoid the possibility of contamination as well as to maintain safety. Good Housekeeping is critical to a safe, efficient, clean and pleasant work environment.

23.9.1 Reducing unwanted clutter helps to avoid accidents and potential for fires.

23.9.2 Maintaining standards of housekeeping conveys a sense of professionalism to those who work in and visit the laboratory.

23.9.3 An outside service provides daily cleaning of the garbage, recyclables, cleaning of the floors and cleaning of the bathrooms and cafeteria.

23.9.4 A lab maintenance person is responsible for maintenance of the lighting, water spillsand all around building issues.

23.9.5 Adequate lighting and ventilation is important for a safe work environment. Safe storage of chemicals and compressed gas cylinders must be in place to prevent accidents.

23.9.6 The use of personal protective wear such as safety glasses, gloves and lab coats are to be worn in the lab areas only, not outside the lab to prevent cross contamination.

23.9.7 Emergency equipment must be in view and easily accessible: this includes but is not limited to: telephones, eye wash stations, first aid kits, fire extinguishers, fire alarms, and spill kits.

23.9.8 Keeping the floor and bench tops free of clutter also helps in keeping the lab area safe and presentable.

24.0 Security

24.1 The entire building is equipped with a security system monitored by a private alarm company.

24.2 The laboratory area is divided into separate zones.

24.3 The access doors to these areas are wired with sensors so that the zones can be operated individually.

24.4 Each employee is assigned a FOB, which allows access to the building during a preset time schedule.

24.4.1 The FOBs are codes with the analyst information and are given to each analyst.

24.4.2 The number of FOBs and responsible persons is controlled.

24.4.3 FOBs are signed for by each analyst and handed in to Human Resources if employment ends.

24.5 Access to the building is monitored both internally and by an outside security company.

24.6 The lab is equipped with a hand scanner that limits entry to the building to employees that have been scanned in for approved entry.

24.7 All other entries are made by made by either the receptionist or receiving personnel electronically opening the door.

25.0 Purchasing

25.1 Non-capital purchases in the laboratory are centralized.

25.2 The decision of the vendor used to purchase products from is dependent on several factors which may include:

25.2.1 The quality of the product must be of an adequate quality to ensure confidence in the results.

25.2.2 The cost must be fair.

25.3 If no independent assurance of the quality is available, the lab must document that the product was inspected, calibrated or otherwise verified before use.

25.4 “Standing orders” are arranged as often as possible to ensure a constant supply of disposable materials while not requiring storage on site.

25.5 Records of all suppliers are maintained.

25.6 A listing of vendors may be found in the Appendix, Section 4.0.

25.7 Packing slips are checked against package content labels and matched with the purchase order if accepted.

25.8 Once accepted, the packing slip is dated and initialed as evidence of compliance.

25.9 Certificates of analysis (COA) are maintained on file after the COA is checked to ensure the received item meets the minimum specifications.

25.10 Where no independent assurance of quality of procured goods or services is available from the supplier, the laboratory ensures that purchased goods and services comply with specified requirements.

25.11 Consumables are stored in the area of use.

26.0 Waste Generation, Storage and Disposal

26.1 Waste Storage Facility

26.1.1 The waste storage room was designed and constructed according to Article XII of the Suffolk County Sanitary Code.

26.1.2 The room includes secondary containment for 15-55 gallon drums, explosion proof lighting/HVAC systems, and a fire suppression system.

26.1.3 The storage room is located adjacent to the laboratory's eastern lobby.

26.1.4 The waste room is restricted to certain personnel and is controlled by the Special Process Supervisor or designee.

26.1.5 Entrance to the waste room is obtained by submitting to the Special Process Supervisor, or designee a list of types and quantities of wastes to be transferred.

26.1.6 The list is reviewed and maintained by the Special Process Supervisor, or designee, to document the types and quantities of wastes transferred.

26.1.7 On a weekly basis, an inspection of the storage facility is conducted and documented.

26.2 Samples that are not hazardous or contaminated are disposed of through conventional means.

Under no circumstances are any hazardous wastes discharged into any sink or drain

26.3 Bulk and Small Quantity Hazardous Wastes

26.3.1 These wastes are initially accumulated in the section of the laboratory where they are generated.

26.3.2 Bulk wastes are initially stored in containers ranging from 1 liter to 5 gallons in size.

26.3.3 After accumulation of a maximum of 5 gallons in size, the waste is transferred to a designated 55-gallon drum in the hazardous waste storage facility by the department supervisor or authorized hazardous waste handler.

26.4 Hazardous Waste Storage

26.4.1 Major Waste is segregated into 55 gallon drums as follows:

- 26.4.1.1 Waste acids
- 26.4.1.2 Waste methylene chloride/chloroform
- 26.4.1.3 Waste ether
- 26.4.1.4 Waste granulated activated carbon

26.5 Small Quantity Waste Storage

26.5.1 Small quantity waste consists primarily of contaminated samples, prepared samples, and expired or off-spec analytical standards.

26.6 Hazardous Waste Removal

26.6.1 All hazardous waste is removed for final disposal by a fully licensed transporter and treatment, storage and storage facility (TSD).

26.6.2 During transfer of wastes from the storage room by the disposal contractor, spill control equipment is on-site to respond to potential spills.

26.6.3 All final waste is processed through physical treatment and/or incineration.

27.0 Standard Reference Materials

27.1 Solvents, Reagents, and Absorbent Check Analysis

27.1.1 All solvents, absorbent materials, and reagents are routinely demonstrated to be free from contamination under the conditions of the analysis by analyzing a reagent blank.

27.1.2 All solvents, absorbent materials and reagents are stored so as to ensure their integrity by preventing against deterioration, contamination, and loss of identity.

27.1.3 Traceability of solvents and reagents is documented by monitoring and recording:

27.1.3.1 Lot numbers

27.1.3.2 Date opened

27.1.3.3 Expiration date

27.1.4

27.2 Reference Material Use

27.2.1 Stock Standards

27.2.1.1 All stock standards purchased, if available, are traceable to NIST (National Institute of Standards and Technology).

27.2.1.2 All stocks come with documentation from the vendor attesting to the integrity of the standard solution.

27.2.2 Volatile Organic Standards

27.2.2.1 Generally, volatile standards are replaced every month or sooner if necessary.

27.2.2.2 Gas standard solutions are replaced on a weekly basis.

27.2.3 Semi-volatile and GC/ECD

27.2.3.1 Standards are generally replaced every 6 months or sooner if necessary.

27.2.4 Metals

27.2.4.1 Stock standards are generally used up to the date of expiration.

27.2.4.2 Working standards for metals analysis are prepared on a daily basis.

27.2.5 Wet Chemistry

27.2.5.1 Stock standards are generally used up to the date of expiration.

27.2.5.2 Working standards are prepared at a frequency prescribed by the analytical method.

27.3 Proficiency Samples

27.3.1 H2M Laboratories participates in the NYSDOH proficiency sample program.

27.3.2 In addition, other state regulatory agencies as well as outside vendors such as ERA or Absolute Standards provide scheduled proficiency samples for various parameters.

27.3.3 The NYSDOH proficiency samples are performed twice a year per matrix.

27.3.4 The samples are incorporated into the analytical system in the same manner as normal environmental samples and results reported.

27.3.4.1 NYSDOH evaluates the data and scores are assigned to each analyte as satisfactory or unsatisfactory.
27.3.4.2 No response is required for satisfactory results.
27.3.4.3 In the case of an unsatisfactory result, a review of the test and its accompanying QC is performed and the cause of the unsatisfactory result is investigated.
27.3.4.4 A report listing the cause and the corrective action is generated.

27.4 Double Blind Samples
27.4.1 A double blind sample is one that replicates a real environmental sample in composition and appearance.
27.4.2 Laboratory sample bottles are used to prepare whole-volume PT samples by an outside standard vendor company and usually submitted as a fictitious engineering firm.
27.4.3 The full range of services provided to the customer is checked including turn around time, correctness, and customer service.
27.4.4 A report is generated documenting the accuracy of the results submitted.

28.0 Internal Quality Control

28.1 The data acquired from QC procedures are used to estimate the quality of the data to determine the need for corrective action, and to interpret results following corrective actions that were implemented.
28.2 Details of each method stipulated QC is stated in the method standard operating procedure (SOP).
28.3 When no method limits exist, QC limits are generated in-house.
28.4 If less than 20 data points are available, interim QC limits are used, i.e., 70-130% for accuracy and ±20% relative percent difference for precision.
28.5 For spiking data when 20 data points become available, limits are calculated based on the mean recovery ±3 standard deviations.
28.5.1 Results that are slightly *above* the LCS QC limit are not counted toward the allowable number of analytes outside the QC limits.
28.5.2 This situation must still be noted in the case narrative.
28.6 For duplicate data when 20 points become available, limits are calculated based on the mean of the historical difference.
28.7 Quality control measures are assessed and evaluated on an on-going basis to monitor trend analysis through control charts.
28.8 Long standing established limits are generally not updated as long as they are confirmed in order to maintain consistent Q. C.
28.9 Marginal Exceedences (ME)
28.9.1 For methods that contain a large number of analytes in the LCS, it is statistically unlikely that all analytes will be in control.
28.9.2 Upper and Lower marginal exceedence (ME) limits may be established to determine if corrective action is needed (3 standard deviation units around the mean).
28.9.3 An ME is defined as being beyond the LCS control limit but within the marginal exceedence limit.
28.9.4 The ME is calculated as being between 3 and 4 standard deviation units around the mean.
28.9.5 Marginal exceedences must be random. If the same analyte is

consistently outside the LCS control limits, the cause must be investigated.

Table 11.0: Spiking Requirements

Number of Analytes in Method	Minimum Number of Analytes to be Spiked	Number of analytes to fall outside the marginal exceedence (ME)
<10	10	0
11 to 30	80%	1
31 to 50	Spike at least 16 parameters.	2
51 to 70		3
71 to 90		4
>90		5

28.10 Failure to Meet QC Requirements/Customer Requirements

28.10.1 If the non-conformance requires a resampling or re-extraction, the analyst completes a form and distributes it to the QA Manager and the QC Department.

28.10.2 If there is a specific project manager, they also would receive a copy.

28.10.3 The QA department then reviews the non-compliance and takes action by either contacting the client to inform them and asking for feedback or initiating an investigation by a technical nature to determine the root cause of the problem.

28.10.4 If data must be reported even though all QC requirements were not met, the affected sample results must be qualified in the case narrative (if applicable) or by qualifying the data on the report form.

28.11 Positive Results

28.11.1 All drinking water samples, with positive results without a historical background associated with it are re-prepped and re-analyzed for confirmation prior to reporting the result to the client.

28.11.2 A resample may be collected to confirm results especially for SOCs.

Table 12.0: Summary of Essential QC for Chemical Analysis

REFERENCE	TYPE OF CONTROL	FREQUENCY	CRITERIA
Negative control	Method blank	1 per batch/matrix type/sample extraction or prep method	Must be less than1/10 of regulatory level or 1/10 any positive result except for normal laboratory

REFERENCE	TYPE OF CONTROL	FREQUENCY	CRITERIA
			contaminants which are addressed in SOPs and methods.
Positive control	Matrix spikes	1 per 20 samples/matrix type/prep method	Advisory only
Positive control	Lab fortified blank	1 per batch/prep procedure	Method dependent
Positive control	Laboratory control Sample	1 per batch/prep procedure	Method dependent
Precision	Matrix spike/matrix spike duplicate or duplicates	1per20/ matrix /prep procedure	Advisory
Method evaluation	Demonstration of capability	Initial verification per analyst	Method dependent
Method evaluation	Calibration	Initially with daily verification	Method dependent
Method evaluation	Proficiency results	NELAC freq	NELAC spec
Sensitivity	Method detection limit	Yearly	Method dependent
Data reduction	Documentation	Not specified	Protocol dependent
Quality of standards and reagents	Reagent quality checks	Reagent grade	Per label
Quality of standards and reagents	Water quality checks	Bottle checks monthly	Less than reporting limit
Selectivity	Absolute retention time	Method	Instrument

REFERENCE	TYPE OF CONTROL	FREQUENCY	CRITERIA
	and relative retention time	dependent	dependent
Constant and consistent test conditions	Instrument stability	None specified	Method dependent
Constant and consistent test conditions	Glassware cleaning	Method dependent	Protocol dependent

Table 13.0 Summary of Essential QC for Microbiological Analysis

REQUIREMENTS	TYPE OF CONTROL	FREQUENCY	CRITERIA
Negative control	Sterility checks and Blanks	Method specified	Method specified
Negative control	Un-inoculated control	Method specified	None specified
Positive control	Positive	Monthly	None specified
Precision	Duplicates	5% of suspected positives	None specified
Precision	Proficiency tests	NELAC	None specified
Method Evaluation	Proficiency tests	NELAC	To be specified
Method Evaluation	Method validation	Method dependent	None specified
Test Performance	Media appropriateness	Check prior to use	None specified
Data Reduction	Analyst counting	Verify ability to count monthly	None specified
Quality of Standards, Reagents and Media	Shelf life for reagents and media	Manufacturer specified	Manufacturer specified
Quality of	Water quality	Free from	Method

REQUIREMENTS	TYPE OF CONTROL	FREQUENCY	CRITERIA
Standards, Reagents and Media		bacterial and inhibitory substances	specified
Selectivity	Traceability/selectivity	Reference cultures	Not specified
Selectivity	Confirmation/verification	Method specified	Method specified
Quality of Standards, Reagents and Media	Detergent inhibition	Check detergent lot(initially verify)	Not specified
Constant and Consistent Test Conditions	Contaminant monitoring	Trend analysis	Not specified
Constant and Consistent Test Conditions	Autoclave performance	Within temperature tolerances	Method specified
Constant and Consistent Test Conditions	Performance of volumetric equipment	Manufacturer specified	Manufacturer specified
Constant and Consistent Test Conditions	Measurement instruments	Manufacturer specified	Manufacturer specified

Table 14.0 Purgeable Organics QC Summary

	Tune Performance	System Evaluation	Calibration Check	Instrument Blank	Matrix Spike Sample/ Matrix Spike Duplicate	Matrix Spike Blank	System Monitoring Compound Recoveries	Internal STD Area and RT
Measure Taken	BFB Injection	Initial calibration standards 5 levels	Continuing calibration standard run	Analyze Nanopure water	Run sample spiked with select standard mix	Run reagent water spiked with select standard mix	Add system monitoring compounds	Compare I.S. area and RT of 12 hour Std to samples
Frequency	Every 12 hours	Good until cont. calibration not met or change in system	Every 12 hours	Every 12 hours	One per 20 samples or SDG or matrix or 7 days sampling	One per 20 samples or SDG or matrix or 7 days sampling	All standards, blanks, samples, MS/MSD, MSB	every sample
Acceptance Criteria	Ion abundance must meet ASP criteria in Table 7.2F	Maximum %RSD and minimum RRF in Table 7.2G	Maximum %D and minimum RRF in Table 7.2G	Common solvents <5 x CRQL Others <CRQL	See lab established limits	See lab established limits	See lab established limits	RT: ± 30 seconds from Std, I.S. area -50% to +100% from Std
Corrective Action	Tune with FC 43 or PFTBA	1.New standard 2.Leak check 3.Column 4.Trap	Recalibrate Using the 5 levels	1.Check spikes for contamination 2.Bake instrument 3.Re-analyze samples assoc.	Not required	1.Re-analyze MSB/MS/MSD 2.Check solution 3.Check system	1.Check for calc errors 2.Check inst. 3.Re-analyze	1.Inspect MS system 2.Re-analyze samples

Table 15.0 CLP Semi-Volatile Organics QC Summary

	Tune Performance	System Evalua-tion	Calibration Check	Instru-ment Blank	Matrix Spike Sample/ Matrix Spike Duplicate	Matrix Spike Blank	System Monitoring Compound Recoveries	Internal STD Area and RT
Measure Taken	DFTPP Injection	Five calibration standard runs	Continuing calibration standard run	Analyze Nanopure filtered water	Run sample spiked with select standard in duplicate	Run reagent water with spiked select standard	Spike system monitoring compounds into samples, blank standards, MS, MSD, MSB	Monitor I.S. area and RT of samples and compare samples
Frequency	Every 12 hours	Good until cont. calibration not met or change in system	Every 12 hours	Per Extraction batch	One per 20 samples or SDG or matrix or 7 days collection	One per 20 samples or SDG or matrix or 7 days collection	All standards, blanks, samples, MS standards, MSD, MSB	Every 12 hours
Accept-ance Criteria	Ion abundance must meet ASP criteria in Table 7.3F	Maximum %RSD and minimum RRF in Table 7.3G	Maximum %D and minimum RRF in Table 7.3G	Common phthalate esters <5 x CRQL all others <CRQL	See lab established limits	See lab established limits	See lab established limits	RT: 30 seconds from Std, I.S. area: within –50% to +100%
Corrective Action	Tune with FC 43 or PFTBA	1.New standard 2.Leak check 3.Column 4.Trap	1.Recalibrate 2.Re-do initial calibration	1.Alleviate phthalate source 2.Re-extract SDG	Advisory	1.Check spiking 2.Re-analyze 3.MS/MSD	1.Check solution 2.Check system 3.Re-analyze	1.Check solutions 2.Check system 3.Re-analyze

Table 16.0 CLP Pesticide/PCBs QC Summary

	Initial and Continuing Calibration Column Resolution	**Initial Calibration Linearity**	**Initial and Continuous Calibration Breakdown**	**Matrix Spike Blank**	**Method Blank**
Measure Taken	Initial and continuing calibration and PEM and resolution check std (RESC)	Determine linearity by analyzing min 3 levels of Std for mixture standard single level for multi-component	Initial and continuing calibration and PEM analyzed and endrin and DDT breakdown calculated in the PEM	Reagent water spiked with select list of analytes and surrogates extracted	Reagent water Spiked with surrogate
Frequency	Initially or when continuing calibration not met or major change to system	Initially or when continuing calibration not met or major change to system	Initially or when continuing calibration not met or major change to system	Each SDG or 7 days or matrix or 20 samples	Each batch of Samples Extracted
Accept-ance Criteria	PEM: all peaks must be 90% resolved on columns Ind. A&B: midpoint conc. Resolution must be ≥90% %D: ≤ 25% of true value, %RSD ≤ 20%, %RSD surrog. ≤ 30% except <25% •- and •-BHC Resc. 60% resolution Two may be out but must be ≤ 30%		Breakdown of DDT and endrin in the PEM ≤ 20%, combined breakdown ≤ 30%	See Lab established limits	Less than CRQL
Corrective Action	1. Change the parameter (e.g. temp. prog or flow) 2. Re-analyze	Re-calibrate	1. Clip column 2. Clean injection port area	1. Check solution 2. Check instrument response 3. Re extract and reanalyze	1. Determine cause of contamination 2. Re-extract and re-analyses

Table 17.0 Organphosphorus Pesticide QC Summary

	INITIAL CALIBRATION LINEARITY	**CONTINUING CALIBRATION**	**SURROGATE STANDARD RECOVERY**	**MS/MSD**	**LAB FORTIFIED BLANK**	**METHOD BLANK**
Measure Taken	Six calibration standard runs	Analyze continuing Calibration Standard	Run sample spiked With select standard In duplicate	Run sample spiked W/ select standard In duplicate	Run reagent Water spiked W/ select standard	Analyze Nanopore water
Frequency	Good until calibration not Met or change in system	Initially and after Every 10 samples	All standards, blanks, Samples, MS/MSD, LFB	One per 20 samples Or SDG, or Matrix Or 7 days collection	One per 20 samples Or SDG, or matrix Or 7 days collection	One per Extraction batch
Acceptance Criteria	%RSD < 20%	%D < 15% on quantitation column	Achieve recoveries	See lab established limits	See lab established limits	< CRQL
Corrective Action	1.Linear regression used 2.Or second order function 3.Or quadratic curve	1.reinject 2.new solution 3.instrument corrective action 4.analyze new initial calibration	1.Check solution 2.Check system 3.Re-analyze	Advisory	Check solution Check system Re-analyze MSB/ MS/MSD	Identify source Of contamination Re-analyze

Table 18.0 Herbicide QC Summary

	INITIAL CALIBRAT LINEARITY	CONTINUING CALIBRATION	SURROGATE STANDARD RECOVERY	MS/MSD	LAB FORTIFIED BLANK	METHOD BLANK
Measure Taken	Six calibration standard runs	Analyze continuing Calibration Standard	Run sample spiked With select standard In duplicate	Run sample spiked W/ select standard In duplicate	Run reagent Water spiked W/ select standard	Analyze Nanopore water
Frequency	Good until calibration not Met or change in system	Initially and after Every 10 samples	All standards, blanks, Samples, MS/MSD, LFB	One per 20 samples Or SDG, or Matrix Or 7 days collection	One per 20 samples Or SDG, or matrix Or 7 days collection	One per Extraction batch
Acceptance Criteria	%RSD < 20%	%D < 15% on quantitation column	Achieve recoveries	Lab established limits	Lab established limits	< CRQL
Corrective Action	1.Linear regression function used 2.Or second order function 3.Or quadratic curve	1.Reinject 2.new solution 3.instrument corrective action 4.analyze new initial calibration	1.Check solution 2.Check system 3.Re-analyze	Advisory	1.Check solution 2.Check system 3.Re-analyze MSB/ MS/MSD	1.Identify source of contamination 2.Re-analyze

Table 19.0 CLP-M TAL Metals QC Summary

	Verification Of Linearity at CRQL	System Evaluation Calibration	Calibration Check ICV and CCV	Instrument Blank	Spiked Sample	Duplicate	Preparation Blank	ICP Interference Check Sample	Laboratory Control Sample (.CS)	ICP Serial Dilution
Measure Taken		Analyze a blank standard independence for calibration levels	Analyze standard independent from calibration	Analyze ICB and CCBs	Sample spiked with analytes	Analyze a sample twice	A prep blank carried through prep and analysis	Analyze ICS, ICS A and ICS B	Carry through prep. & analyze aqueous and solid LCS	Analyze a 5 fold dilution of sample that is 50x IDL
Frequency	After the ICV in each analysis	Each 24 hours of use	10% or every 2 hrs during analysis whichever is more frequent	10% or every 2 hrs during analysis whichever is more frequent	One per matrix and conc. or SDG whichever is more frequent	One per matrix and conc. or SDG which-ever is more frequent	One per SDG or with each batch of samples digested whichever is more frequent	At beginning and end of analysis run of minimum of 2x per 8-hr.whichever is more frequent	One LCS per batch digested per matrix or per SDG whichever is more frequent except Hg and Cn	If analyte conc. is at minimum of factor of 50 above IDL on each group of samples of a similar matrix or for each SDG
Acceptance Criteria	Advisory	± 5% of true value except at CRDL	See Table 7.5B	Absolute value must be less than or equal to the CRDL	Spike recov. Should be between 75-125% except if sample conc. 4x > spike conc.	> 5x CRQL RPD 20%, < 5x CRQL or one above and one below RPD ± CRQL	The absolute value must be less than or equal to CRQL	ICS AB must be within ± 20% of true value	80–120% except Ag & Sb, soil/sed's limits provided 10/LCS	Dilution must be within 10% of the original determination
Corrective Action	None	Re-calculate	1.Stop analysis 2.Correct problem 3.Re-calibrate 4.Re-analyze	1.Stop analysis 2.Correct problem 3.Re-calculate 4.Re-analyze	Flag with "N" and for non-furnace & Hg elements also perform a post-spike	Flag with "*"	If above CRDL, the lowest conc. in the smpls must be 10x blank conc. or re-digested and re-analyzed	1.Stop analysis 2.Correct problem 3.Re-calibrate 4.Re-analyze	1.Terminate 2.Correct 3.Re-digest/ re-analyze	Flag with "E"

Table 20.0 Wet Chemistry QC Summary

Parameter	Method	ICV/ CCV/ Freq	ICV/ CCV Limits	Matrix Spike Freq	Matrix Spike Limits *	ICB/ CCB Freq	ICB/ CCB Limits	DUP Freq	RPD Limits
Alkalinity	SM2320B	1 per 10	± 20%	1 per 20	± 25%	1 per 10	± CRQL	1 per 20	± 20
BOD	SM5210B	1 per 20	± 20%	NA	NA%	1 per20	± CRQL	1 per 20	± 20%
Bromide	SM15p.S44	1 per 10	± 20%	1 per 20	± 25%	1 per 10	± CRQL	1 per 20	± 20% or CRDL
Chloride	SM4500 ClE	1 per 10	± 20%	1 per 20	± 25%	1 per 10	± CRQL	1 per 20	± 20% or CRQL
Nitrate	353.2	1 per 10	± 20%	1 per 20	± 25%	1 per 10	± CRQL	1 per 20	± 20% or CRQL
Sulfate	SM4500 SO4E	1 per 5	± 20%	1 per 20	± 25%	1 per 10	± CRQL	1 per 20	± 20% or CRQL
TDS	SM2540C	1 per 10	±20%	1 per 20	±25%	1 per 10	± CRQL	1 per 20	± 20% or CRQL
TSS	SM2540D	1 at start of run	±20%	NA	NA	1 per 10	± CRQL	1 per 20	± 20% or CRQL
Color	SM2120B	1 per 10	± 20%	NA	NA	1 per 20	± CRQL	1 per 20	± 20% or CRQL
Turbidity	180.1	1 per 10	± 10%	NA	NA	1 per 10	± CRQL	1 per 20	± 20%
Hex. Chrom	SM3500 CRD	1 per 10	± 20%	1 per 20	± 25%	1 per 10	± CRQL	1 per 20	± 20%
TPH	1664A	1 per 10	± 20%	1 per 20	± 25%	1 per 10	± CRQL	1 per 20	± 20%
TOC	SM5310B	1 per 10	± 20%	1 per 20	± 25%	1 per 10	± CRQL	1 per 20	± 20%
TOC	Kahn	1 per 10	± 20%	1 per 20	± 25%	1 per 10	± CRQL	Quad 1 per 20	± 3 SD
Total Phenols	420.1	1 per 10	± 10%	1 per 20	± 25%	1 per 10	± CRQL	1 per 20	± 20% or CRQL
Ammonia	350.1	1 per 10	± 20%	1 per 20	± 25%	1 per 10	± CRQL	1 per 20	± 20% or CRQL
COD	410.4	1 per 10	± 20%	1 per 20	± 25%	1 per 10	± CRQL	1 per 20	± 20% or CRQL
TKN	351.2	1 per 10	± 20%	1 per 20	± 25%	1 per 10	± CRQL	1 per 20	± 20% or CRQL
Hardness	SM2340C	1 per 10	± 10%	1 per 20	± 25%	1 per 10	± CRQL	1 per 20	± 20% or CRQL
Oil & Grease	1664A	1 per 20	± 20 &	1 per 20	± 25%	1 per 20	+ CRQL	1 per 20	± 20% or CRQL
Sulfide	SM4500 SE	1 per 10	± 20%	1 per 20	± 25%	1 per 10	± CRQL	1 per 20	± 20% or CRQL

* = If outside limits, repeat matrix spike analysis once.

29.0 **Departures from Documented Policies and Procedures**

29.1 All policies and procedures in place in the laboratory must be adhered.

29.2 Departures from documented policies and procedures may be permitted if approved by the QA Manager, Laboratory Manager, or Technical Manager.

29.3 This departure must be fully documented and include the reason for departure and signed and dated by either the Technical Manager, Laboratory Manager, or the QA Manager.

29.4 No departures are permitted unless this procedure is followed.

30.0 Instrument Corrective Action

30.1 Specific corrective action protocols for handling out-of-control QC are stated in each SOP.

30.2 Instrument Corrective Action

- 30.2.1 The analyst is responsible for reviewing the initial calibration, blank and QC check criteria for adherence to the method requirements prior to initiating sample analysis.
- 30.2.2 On going QC is checked by the analyst either in real time or the following morning for an overnight run.
- 30.2.3 The analyst is responsible for reviewing the data in comparison with the QC of the method.
- 30.2.4 Analysis proceeds if all QC is met and analysis is halted if the QC requirements are not met.
- 30.2.5 Corrective actions are taken to correct instrument non-compliances that may include:
  - 30.2.5.1 Checking calculation
  - 30.2.5.2 Verification of standard
  - 30.2.5.3 Recalibrating instrument
  - 30.2.5.4 Baking out the instrument, etc.
- 30.2.6 If the corrective action doesn't correct the instrument non-compliance, the department supervisor is notified and is involved in the decision making process of corrective action.
- 30.2.7 If due to holding time constraints, analysis must proceed, another instrument will be used if available.
- 30.2.8 If another instrument is not available, the QC Manager, Technical Manager and Laboratory Manager are notified and if the QC requirement does not affect the sample results, the sample analysis may be approved and the discrepancy noted on the report or in the case narrative.
- 30.2.9 The QA Manager, Laboratory Manager or Technical Manager may override the QC requirement.
- 30.2.10 This is documented in the run log by the initials, date and a short statement of the non-compliance and that it was approved.
- 30.2.11 Either the QA Manager, Laboratory Manager or Technical Manager grants approval with the documentation in the run log only.
- 30.2.12 General procedures are followed to determine when departures from quality controlled have occurred.

30.3 Due to sampling schedule and time frame of analysis, it is not always possible to repeat the analysis if the quality control measures are not acceptable.

30.4 If a quality control measure is found to be out-of-control and the data is to be reported, all samples associated with the failed quality control measure are reported with the data qualified.

30.4.1 This may occur by the addition of the qualifier to the result:

30.4.1.1 B – analyte detected in method blank

30.4.1.2 E – concentration level over calibration

30.4.1.3 J – estimated result

30.4.2 It may also be documenting the discrepancy in the case narrative (if it is a full data package) or by indicating the non-conformance in the remarks section in the lab report.

30.4.3 A non-conformance report is completed documenting the out-of-control QC event and stating corrective measures to prevent re-occurrence.

31.0 Systems/Internal Audits/Data

31.1 The laboratory has a program of audits to ensure the effective operation of the quality system. Several different types of audit procedures are used in the laboratory. These include the following:

31.1.1 Non-conformance Summary Reports

31.1.1.1 This form is used intra as well as interdepartmental to note any deficiencies, systematic or human errors for specific samples.

31.1.1.2 This form is prepared by the analyst and distributed to the Technical Manager.

31.1.1.3 The Technical Manager meets with the supervisors and analysts or the entire department, if necessary, to discuss and resolve the non-conformance issues.

31.1.1.4 The QA Manager is consulted if procedural changes need to be implemented.

31.1.2 LIMs Holding Time Worksheet

31.1.2.1 The ACCESS-based LIMs has the capability to monitor samples and required analyses by holding time.

31.1.2.2 A daily printout lists the sample and the date by which it must be prepared/analyzed.

31.1.2.3 This is reviewed on a daily basis by the Production Manager and Laboratory supervisors to ensure that holding times are met.

31.1.3 Data Package Review

31.1.3.1 All data packages are reviewed by the Technical Manager, QA Manager, or departmental supervisors.

31.1.4 Internal Audit of Chain-of- Custody (COC)

31.1.4.1 The QA Manager or designated representative conducts random audits of the internal COC records.

31.1.4.2 A sample is tracked throughout the internal custody of the department to ensure consistency.

31.1.4.3 Since all COC documentation is submitted in the data packages, the COC is also reviewed at that time.

31.1.5 Internal Audit of QC Measures and Records

31.1.5.1 The QA Manager or designated representative conducts random inspections of the various laboratory departments.

31.1.5.2 This may be formal (use of checklist) or informal.

31.1.5.3 These inspections include logbook review, QC records, standard preparation logs and instrument maintenance records.

31.1.5.4 This may include retesting of samples, intralaboraory comparison of results and interlaboratory comparisons.

31.1.6 Data Package Audit

31.1.6.1 On a weekly basis, an update of the status of deliverable requirements is prepared in the QA Department and given to all managers and supervisors to monitor the progress of the data packages.

31.1.6.2 Corrective measures are taken if the department or reporting of the various components of the package is not on schedule.

31.1.7 Methods Audit

31.1.7.1 Analyst reviews of the in-house SOPs are occasionally performed to ensure compliance with the method.

31.1.7.2 The analyst will review the most recent version of the SOP and make edits if necessary to comply with the method. A new revision may be required.

31.1.8 Quality System Audit

31.1.8.1 An annual quality systems audit of technical activities is performed. These audits are designed to verify that activities are conducted in accordance with the requirements of the laboratory quality system.

31.1.8.2 The QA Manager or a staff member of the QC department trained in the area to be audited performs the annual internal audit.

31.1.8.3 The Technical Manager if so authorized by the QA Manager may also perform the audit.

31.1.8.4 In cases where the audit identifies circumstances in which the correctness or validity of test results is questioned, the laboratory must take corrective action immediately and notify all clients whose work may have been affected.

32.0 Performance/External Audits

32.1 Several procedures are in place for monitoring the performance of the product produced by the laboratory.

32.1.1 External Data Validation

32.1.1.1 A minimum of 20% of the data packages produced by the laboratory undergo data validation by an outside service.

32.1.1.2 A report is generated listing the comments by noted by the validator.

32.1.1.3 The QA Manager responds to the comments noted by the validator, and if necessary, corrective action measures are introduced in the appropriate department.

32.1.2 Internal Data Validation

32.1.2.1 The review of the data covers:

32.1.2.1.1 appropriateness of equations used

32.1.2.1.2 correctness of numerical input

32.1.2.1.3 numerical correctness of all calculations

(accomplished by re-performing numerical computations)

32.1.2.2 The review process must be thorough enough to verify the results.

32.1.2.3 If the reviewer disagrees with any part of the computations, the reviewer marks through the number with a single line and places the revised number above it.

32.1.2.4 All large corrections are returned to the analyst for modification.

32.1.2.5 The originator of the data shall review any changes made by the reviewer.

32.1.2.6 If the originator agrees with the change, no action is necessary.

32.1.2.7 If the originator disagrees, then both the originator and reviewer must resolve the difference so that they agree with the result presented.

32.1.2.8

32.1.3 Inter-Laboratory Comparison Testing Programs

32.1.3.1 Testing in regards to blind samples or comparison of data inter-laboratory is performed periodically.

32.1.4 State/Federal Laboratory Audits

32.1.4.1 The laboratory is certified in several states.

32.1.4.2 The laboratory is audited for all methods in use on an ongoing basis.

32.1.5 Consultant/Customer Laboratory Audits

32.1.5.1 Clients may choose to audit the laboratory at any stage during project development and analysis.

32.1.6 Proficiency Sample Program

32.1.6.1 The laboratory participates the NYSDOH Proficiency Program as well as outside PT provider programs.

32.1.7 Double Blind Samples

32.1.7.1 An outside supplier may be utilized to evaluate the capability of the laboratory through the use of double blind samples.

33.0 Corrective and Preventative Action

33.1 A proactive approach is taken in regards to the initiation of preventative actions where the process includes the identification of opportunities for improvement rather than a reaction to the problem.

33.2 Improvements and potential sources of non-conformances, either technical or concerning the quality system, shall be identified on an ongoing basis.

33.3 If preventative action is required, corrective action plans will be put into place and monitored.

33.4 Some examples of preventative action are:

33.4.1 The use of holding time worksheets
33.4.2 Analyst monitoring of method QC requirements
33.4.3 Instrument maintenance
33.4.4 Column Replacement
33.4.5 Preparation of new solutions as needed
33.4.6 Checking calculations
33.4.7 Performing re-analysis

- 33.4.8 Schedule changes
- 33.4.9 Data Validation
- 33.4.10 Internal Audits
- 33.4.11 Non-conformance reports
- 33.4.12 Double Blind Samples

33.5 Corrective Action is implemented to document the reasons behind and remediation for an isolated event or a pattern of events that could potentially raise concerns about data integrity should they not be properly recorded.

33.6 The first step in corrective action is to identify the root causes.

33.6.1 Potential root causes that are evaluated are problems with:

- 33.6.1.1 Customer requirements
- 33.6.1.2 Samples
- 33.6.1.3 Sample specifications
- 33.6.1.4 Methods and procedures
- 33.6.1.5 Personnel skills and training
- 33.6.1.6 Consumable materials
- 33.6.1.7 Equipment
- 33.6.1.8 Calibration

33.7 Where corrective action is needed, the laboratory shall identify potential corrective actions.

33.8 Corrective actions are designed to select and implement the action(s) most likely to eliminate the problem and to prevent recurrence.

33.9 Corrective actions shall be to a degree appropriate to the magnitude and the risk of the problem.

33.10 The QA Manager shall document and implement any required changes resulting from corrective action investigations.

33.11 The QA Manager shall monitor the results to ensure that the corrective actions taken have been effective.

33.12 Where the identification of nonconformances or departures casts doubts on the laboratory's compliance with its own policies and procedures, or on its compliance with regulations, the laboratory shall ensure that the appropriate areas of activity are audited as soon as possible.

34.0 Quality System Report to Management

34.1 On an annual basis the laboratory’s executive management performs a review of the laboratories quality system and environmental testing activities to ensure their continuing suitability and effectiveness, and to introduce necessary changes or improvements.

34.2 The review shall take account of:

- 34.2.1 the suitability of policies and procedures
- 34.2.2 reports from managerial and supervisory personnel
- 34.2.3 the outcome of recent internal audits
- 34.2.4 corrective and preventive actions
- 34.2.5 assessments by external bodies
- 34.2.6 the results of interlaboratory comparisons or proficiency tests
- 34.2.7 changes in the volume and type of the work
- 34.2.8 client feedback
- 34.2.9 complaints
- 34.2.10 other relevant factors, such as quality control activities, resources and staff training

34.3 Findings from management reviews and the actions that arise from them shall be recorded.

34.4 All actions will be addressed within 90 days of their identification.

35.0 Procedure for Dealing with Complaints

35.1 Records of all complaints received from clients or other parties are maintained as well as the investigations and potential corrective actions that arise from the compliant.

35.2 Customer Service/Timeliness of Reports/Invoice Issues

35.2.1 Complaints that deal with responsiveness to the client are handled by laboratory staff.

35.2.2 If a client complains that they have not received resolution to a complaint, the call may be forwarded to the Project Manager, QA Manager or Laboratory Manager for resolution.

35.2.3 These issues are documented via email or phone log.

35.3 Quality of Product

35.3.1 All complaints received regarding the quality of the data produced are handled by the QC department.

35.3.2 The date and the name of the person receiving the complaint, source of complaint, resolution and any written material associated with the complaint are documented and kept on file in the project management department.

35.3.3 The form is completed by the individual who received the complaint and forwarded to the QA Manager for investigation.

35.3.4 The complaint is investigated by the QA officer or designee and a technical review of the suspected test is undertaken.

35.3.5 The results of the investigation are documented on a customer complaint form.

35.3.6 This information is to be used by all laboratory personnel that have contact with clients.

35.3.7 These forms need to be filled out each time there is a customer complaint (for example- late results, client left message and was not called back, etc).

35.3.8 These files are located in S:\LABSHARE\NELACLOGS\

36.0 **Training**

36.1 Employee training is an ongoing process and also includes extensive, supervised cross training.

36.2 For new employees, it begins with a company orientation, followed by laboratory safety orientation in which employees are familiarized with laboratory hazards, safety policies, and the use of material safety data sheets and laboratory emergency evacuation procedures.

36.3 Specific training continues in the employee's laboratory section.

36.4 The employee is extensively trained in the use of instrumentation, equipment, techniques and theory of the tasks in his/her specific job description.

36.5 New employees receive supervised training upon reporting for duty.

36.5.1 The training period varies depending upon the work required of these individuals.

36.5.2 Training of new employees includes a review of laboratory techniques, safety requirements and intensive on-the-job training.

36.5.3 After a four-month review period, the new employee's progress will be reviewed.
36.5.4 Initial Demonstrations of Capability are performed for each method that the new employee will be performing.
36.5.5 As employees remain in the assigned departments, they are continuously trained in different methods to provide cross training.
36.5.6 The technical manager or QA manager maintains records of staff training in the various departments in order to assure coverage and sufficient backup of trained personnel.

37.0 New Employee Orientation

37.1 The Human Resource Manager presents company policy, benefits and other aspects of the personnel manual to the new employee.
37.2 Each employee receives a personnel manual also under the direction of the Human Resources Manager.
37.3 The Human Resources Manager informs the employee that there is an open door policy and the employee should be free to discuss any problems or difficulties with them.
37.4 The technical manager/safety officer then gives the employee a laboratory orientation.
37.4.1 H2M Safety procedures may be referenced in the Chemical Hygiene Plan Rev. 2 May 2009 and the New Employee Handbook.
37.5 The section supervisor shows the new employee the facilities and introduces him/her to laboratory personnel.
37.6 General aspects of establishing a successful working relationship as well as group dynamics are discussed.
37.7 The importance of honesty, integrity, dependability, and providing correct data is stressed.
37.8 If the employee is assigned to a technical, receiving or sampling section of the laboratory, he/she will be scheduled for a pre-employment physical at that time.
37.9 It is company policy that all employees who routinely work with samples, chemicals or reagents have a comprehensive employment physical and annual physicals thereafter.
37.10 Because of the inherent dangers involved in working in a laboratory, safety measures are discussed in detail, as it is the responsibility of each technician to employ safe laboratory practices.
37.11 He/she should bring any unsafe conditions to the attention of his/her supervisor, safety officer or laboratory manager.
37.12 The laboratory safety policy is read and discussed with the new employee.
37.13 Additional material on lab safety is given to the employee for later reading.
37.14 The required use of protective clothing is discussed and each employee is given goggles and sized for laboratory coats.
37.15 The employee is shown how to use and understand the information from product warning labels and material safety data sheets.
37.16 The material safety data sheets exist for every chemical used in the laboratory and readily available to all employees.
37.17 Handout material regarding safety measures provides additional information.
37.18 Also explained in the orientation is the emergency fire evacuation plan, location of fire extinguishers, emergency showers and eye wash stations.

37.19 The employee learns the location of North Shore University Hospital in Plainview where accidents are treated when necessary.

37.20 The alarm and security system is demonstrated and the employee is given the appropriate security code for his/her section.

38.0 Employee Job Responsibilities

38.1 The employee is given the appropriate SOP to read and to sign that he/she has read, understands and complies with its requirements.

38.2 The analyst is also given the QA Manual to read and to sign.

38.3 The analyst is assigned to an experienced analyst for specific job training.

38.4 It is the supervisor’s responsibility to follow the training schedule.

38.5 Training includes theoretical explanation as well as hands-on demonstrations.

38.6 Emphasized are the proper techniques for handling and storing flammable liquids, use of hoods and laboratory glassware, safety procedures, QC and record keeping, and use of the laboratory information management system.

38.7 After an interim time of working together with an experienced analyst, the newly trained employee demonstrates his capability for a specific test.

38.8 This is documented formally by the demonstration of capability summary form and signed off by management.

38.8.1 The QA Manager maintains all raw data associated with the “DOC” on file.

38.8.2 The demonstration of capabilities must be made prior to analyzing samples.

38.8.3 Standards or blind samples of which the analyst does not know the true value concentrations are prepared.

38.8.4 The analytes are diluted into a clean volume of sample and given to the analyst to test.

38.8.5 The concentration level used is approximately 1 to 4 times the expected limit of quantitation.

38.8.6 Four aliquots are prepared and tested. The mean recovery and the standard deviation are calculated for each parameter of interest.

38.8.7 This information is compared against the method QC criteria or if not available, against in-house control limits.

38.8.8 If the parameters meet the required limits analysis may proceed.

38.8.9 If not, performance is deemed unacceptable for that parameter and corrective measures are taken to determine the problem.

38.8.10 Analysis is not permitted until acceptable performance has been demonstrated.

38.8.11 A certification statement is completed and the statement and raw data are placed in the employee files.

38.8.12 The newly trained analyst is permitted to perform sample analysis independently, still under close supervision of the instructor.

38.8.13 A DOC is performed prior to using a test method, any time that there is a change in instrument type, personnel and test method.

38.9 The QA Manager monitors progression of training of individuals in the various tasks.

38.9.1 Tables for the departments are maintained, reflecting the tests that can be performed by each analyst.

38.9.2 These tables are periodically updated in the computer system to provide a reference for management about capabilities of each employee to perform testing and training requirements.

38.9.3 The analyst's capabilities are verified annually by various means such as proficiency testing, Lab fortified blank analysis, blind duplicate testing or another DOC.

39.0 Seminars and Continuing Education

39.1.1 Seminars are scheduled on a yearly basis.

39.1.2 These seminars may cover special interest subjects such as quality control, sample tracking, new methods, updates to regulations, waste disposal, etc.

39.1.3 Managers and/or department heads specially qualified in a particular subject may conduct these seminars.

39.1.4 For instance, supervisors of the analytical departments are called upon to inform analysts in the sample preparation departments about analytical aspects in their department.

39.1.5 This increases the awareness for certain requirements during the preparation of the samples.

39.1.6 These seminars therefore not only serve to increase knowledge but also provide a means to develop understanding and communication between departments.

39.1.7 To keep employees current on new techniques, employees are also encouraged to attend outside seminars and conferences on subjects and techniques beneficial to their job requirements, and specialized training offered by the instrument manufacturers.

39.1.8 Internal group training by outside vendors also is provided for equipment and software enhancements. This may also be used to disseminate training information such as troubleshooting of instruments or new columns available.

39.1.9 Tuition reimbursement is also offered to employees who take relevant courses, and dues reimbursement is provided for professional society memberships.

40.0 Ethics Policy Agreement

40.1 It is the policy of H2M Labs that all employees at all times shall conduct themselves and the business of H2M Labs in an honest and ethical manner.

40.2 Management and personnel are to be free from any undue internal and external commercial, financial and other pressures that may adversely affect the quality of their work.

40.3 Compliance with this policy will be strictly enforced.

40.4 Ethics training is a required part of new employee orientation and is provided on an annual basis for all laboratory staff. Initial training during orientation includes the overall organizational mission and its relationship to the absolute need for honesty and full disclosure in all analytical reporting and record-keeping. The initial orientation is followed-up by senior laboratory management with the specifics of the laboratory's data integrity plan.

40.5 Following initial ethics training and on-going annual training, trainees shall sign a written ethics agreement. The agreement states that the signers will not engage in any unethical practices with respect to data integrity nor will they tolerate improper behavior in others if it is observed or suspected. The signed agreement is retained in the employee files.

40.6 Unethical behavior or fraud is, among other things, falsification of data or records, (such as sampling or sample handling records), laboratory worksheets or logbooks, instrument settings or data, sample results or laboratory analysis reports and date and time of analysis.

40.7 Violators of this policy are subject to immediate dismissal.

40.8 Unacceptable behavior includes such misconduct as:

- 40.8.1 lack of adherence to company and method requirements (including procedures for instrument calibration
- 40.8.2 quality control
- 40.8.3 standard and reagent preparation
- 40.8.4 sample handling
- 40.8.5 sample preparation and analysis

40.9 The following is a list of some unacceptable and fraudulent activities. This list is not intended to be all-inclusive:

- 40.9.1 Making up data or other sampling and analysis information.
- 40.9.2 Misrepresentation of QC samples and spikes as being extracted or digested when they were not.
- 40.9.3 Falsification of the clock setting or improper recording of dates and times on any document.
- 40.9.4 Improper peak integration.
- 40.9.5 Improper GC/MS tuning.
- 40.9.6 Improper calibration/QC analysis.
- 40.9.7 File substitution.
- 40.9.8 Deletion of non-compliant data.
- 40.9.9 Improper alteration of analytical conditions.
- 40.9.10 Unwarranted manipulation of computer software.
- 40.9.11 Failure to notify management of sample or data errors.

40.10 Information regarding ethics concerns, questions or reports of suspected unethical behavior could be directed to Nicole R. Crespi, Quality Assurance Manager or to Liz Davis, Human Resource Manager.

40.11 Data integrity is monitored. Reports and the data used to support them are randomly selected by the Quality Assurance Officer (QAO) for auditing.

40.12 All data integrity documents, plans, SOPs, personal records and records of investigations shall be maintained for a period of ten years.

41.0 Policy on Stress Reduction and Quality of Work

41.1 Open communication is encouraged for all employees of the laboratory. The Human Resources Department, the QA Manager and the Laboratory Manager have an open door policy for discussion of issues and concerns.

41.2 Procedures are in place to allow the staff to be free of undue pressures and stress.

- 41.2.1 These include a means of technical communication to allow for the notification of noncompliant data and the corrective action needed. All analysts are empowered with a stop work authority to allow for maintenance and to notify upper management of the need for corrective action and additional support in correcting an issue.
- 41.2.2 The department supervisor, QA Manger, and the Technical Managers are all empowered to assist the analyst with technical issues to resolve problems.
- 41.2.3 A nonconformance form is filled out to allow for notification of noncompliant data and the corrective action.

41.2.4 The case narrative and comment field on lab reports allows for communication to the clients of nonconformances as well.

41.3 An additional means of reducing the stress of the work place has been implemented.

41.3.1 This includes wellness programs to allow for a change of focus from work only to the health and well being of the person. Seminars, group fitness activities such as yoga and healthy lifestyle discussions are part of the program. Several of the seminars that have been held during the work day are as follows:

41.3.1.1 Emotional freedom: Techniques for Immediate Relief of Stress, Anxiety and Cravings, Sleepless in Long Island, Life's Simple 7: Tips for Healthier Living, Beating the Sugar Blues, Wellness from Within-The Mind Body Connection, Symptoms of heart Disease and Strokes.

41.3.1.2 The lab has implemented "fruit Wednesday" where fresh fruit is served all day to allow for a break from the routine.

41.3.1.3 These personal focuses have allowed a break from the work only mentality.

42.0 Standard Operation Procedures

42.1 Electronic copies of SOP's are available to all employees.

42.2 The SOP lists the title, revision number the effective date and signatures of the approving authority.

42.3 Each method SOP contains the following information or references where the information may be found.

42.4 The information listed in the SOP may not be in the following order:

42.4.1 Identification of test method
42.4.2 Applicable matrix or matrices
42.4.3 Detection limit
42.4.4 Scope and application to be analyzed
42.4.5 Summary of the test method
42.4.6 Definitions
42.4.7 Interference's
42.4.8 Safety
42.4.9 Equipment and supplies
42.4.10 Reagents and standards
42.4.11 Sample collection, preservation, and storage
42.4.12 Quality control
42.4.13 Calibration and standardization
42.4.14 Calculations
42.4.15 Method performance
42.4.16 Pollution prevention
42.4.17 Data assessment and acceptance criteria
42.4.18 Corrective action for out of control data
42.4.19 Contingencies for handling out of control data
42.4.20 Waste management
42.4.21 References
42.4.22 Any tables, diagrams, flow charts and validation data

43.0 References

1. “New York State Department of Environmental Protection Analytical Services Protocol” October 1995, or most recent approved version.

2. “New York State Department of Environmental Protection Analytical Services Protocol” June 2000, or most recent approved version.

3. “New York State Department of Environmental Protection Analytical Services Protocol” July 2005, or most recent approved version.
4. “Methods for the Determination of Organic Compounds in Drinking Water”, EPA/600/4-88/039, USEPA Office of Research and Development, Washington D.C., December 1988, revised July 1991, or most recent approved version.

5. “Method for the Low Level Determination of Total Organic Carbons”, USEPA Environmental Monitoring and Support Laboratory, Cincinnati, Ohio, April 1978, or most recent approved version.

6. “The Determination of Total Organic Halide”, Interim Method 450.1, USEPA Environmental Monitoring and Support laboratory, Cincinnati, Ohio, November 1980, or most recent approved version.

7. “Methods for Chemical Analysis of Water and Wastes”, E600/4-79/020, USEPA Environmental Monitoring and Support Laboratory, Cincinnati, Ohio Revised 1983, or most recent approved version.

8. “Standard Methods for the Examination of Water and Wastewater”, 18th Edition, 1992, American Public Health Association (APHA), or most recent approved version.

9. “Analytical Handbook”, New York State Department of Health, Analytical Methods Toxicology Institute, Division of Laboratories and Research, Albany, New York, Revised January 1986, or most recent approved version.

10. “Methods for the Determination of Organic Compounds in Drinking Water”, Supplement I, EPA600/4-90/020, USEPA Office of Research and Development, Washington, D.C., December 1988, revised July 1991, or most recent approved version.

11. “Methods for the Determination of Organic Compounds in Drinking Water -Supplement II”, EPA/600/R-92/129, USEPA Office of Research and Development, Washington, D.C., December 1988, revised July 1991, or most recent approved version.

12. “Test Methods for Evaluating Solid Waste”, EPA/SW-846, USEPA, Water Characterization Branch, Update 3 Dec. 1996, or most recent approved version.

13. “Handbook for Analytical Quality control in Water and Wastewater Laboratories”. USEPA, Office of Research and Development, Cincinnati, Ohio 1979, or most recent approved

version.

14. "Methods for Organochlorine Pesticides and Chlorophenoxy Acid Herbicides in Drinking Water and Raw Source Water", EPA/600/4-81/053, USEPA, EMSL Cincinnati, Ohio July 1978, or most recent approved version.

15. "Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water":, USEPA, EMSL, USEPA Cincinnati, Ohio, Revised December 1988, or most recent approved version.

16. USEPA Contract Laboratory Protocol Statement of Work for Inorganic Analysis, SOW, ILMO 4.1, Revised 1999, or most recent approved version.

17. USEPA Contract Laboratory Protocol Statement of Work For Organic, OLMO 4.2 Revised May 1999, or most recent approved version.

18. "Compendium of Methods for the Determination of Air Pollutants in Indoor Air". USEPA Office of Research and Development, Washington, D.C., April 1990, or most recent approved version.

19. "Guidance for Performing Tests On Dredged Material to be Disposed of in Ocean Waters", US Army Corps of Engineers, December 1984, or most recent approved version.

20. "EPA Regulations On Test Procedures for the Analysis of Pollutants", USEPA 40 CFR 136, October 1984, revised August 1990, or most recent approved version.

21. "NIOSH Manual of Analytical Methods, Fourth Edition", U. S. Department of Health and Human Services, Cincinnati, Ohio, August 1994, or most recent approved version.

22. "Analytical Handbook", New York State Department of Health, Laboratory of Organic Analytical Chemistry, Albany, NY 1988, or most recent approved version.

23. "Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air", EPA/600/4-84/041, USEPA Environmental Monitoring System Laboratory, April 1984, Revised June 1998, or most recent approved version.

24. "Protocol for the Collection and Analysis of Volatile POHCs Using VOST", Environdyne Engineers, Inc., St. Louis, Missouri, March 1984, or most recent approved version.

25. "Validation of the VOST Protocol, Volume 2 – Field Validation Phase", NTIS, PEI Associates, Inc., Cincinnati, Ohio, January 1986, or most recent approved version.

26. "USEPA Contract Laboratory Program – Volatile Organics Analysis of Ambient Air', Revised VCAA 01.0, December 1991, or most recent approved version.

27. "USEPA Contract Laboratory Program – Metal Analysis of Ambient Air", Revised MAA 01.0, December 1991, or most recent approved version.

28. "USEPA Contract Laboratory Program – Semi-volatile Organics Analysis of Ambient Air", Revised SVAA 01.0, January 1992, or most recent approved version.

29. "Superfund Analytical Methods for Low Concentration Water for Organics Analysis", EPA/540/R-94/087, USEPA Office of Solid Waste and Emergency Response, Cincinnati, Ohio, December 1994, or most recent approved version.

30. "Methods for the Determination of Inorganic Substances in Environmental Samples", EPA/600/R-93/100, USEPA Office of Research and Development, Washington, D.C., August 1993, or most recent approved version.

31. "USEPA Contract Laboratory Program – Multimedia High – Concentration", 50W No. Rev 9/88 including Rev. 4/89, or most recent approved version.

32. "Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air', USEPA Office of Research and Development, Research Triangle Park N.C. EPA/600/4-89/018, June 1988, or most recent approved version.

33. "Environmental Laboratory Approval Program Certification Manual", New York State Department of Health, Wadsworth Center, 10/99 update, or most recent approved version.

34. "Methods and Guidance for Analysis of Water", USEPA Office of Water, Washington, D.C., EPA 827 C97001, April 1997, or most recent approved version.

35. "Determination of Metals in Environmental Samples", Supplement I, EPA 600/R-94/11, May 1994, or most recent approved version.

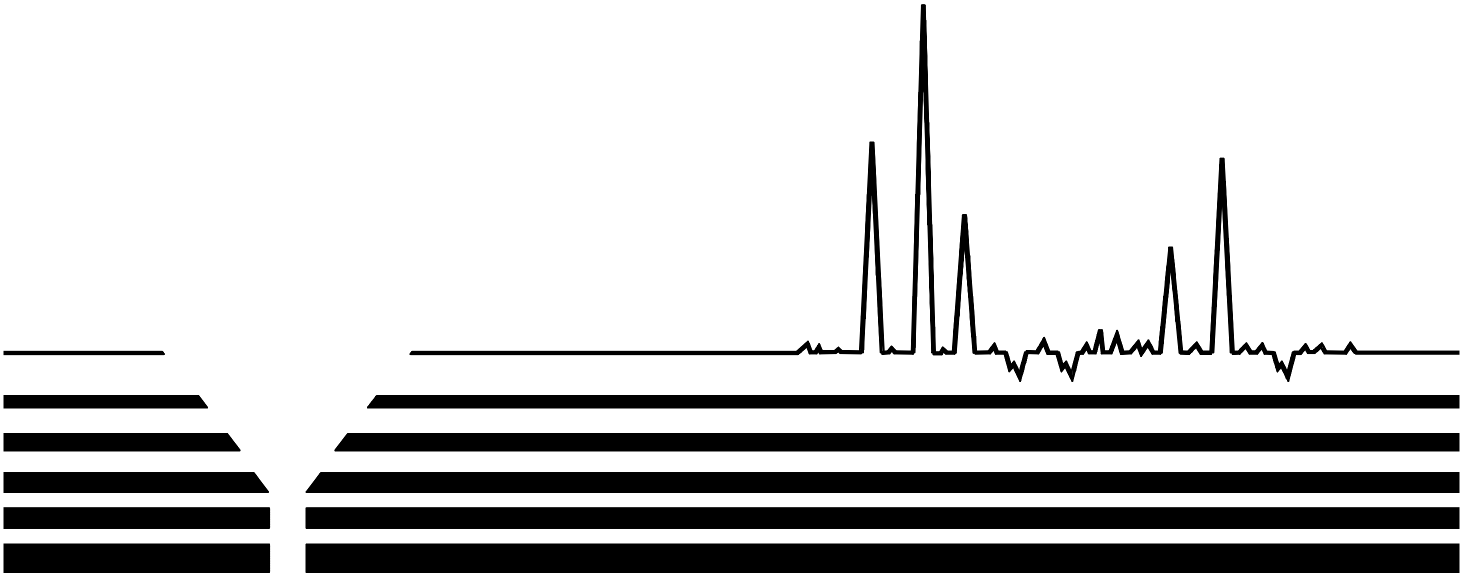
36. "Methods for the Determination of Organic Compounds in Drinking Water -Supplement III", EPA/600/R-95/131, USEPA Office of Research and Development, Washington, D.C., December 1988, revised August 1995, or most recent approved version.

37. "Standard Methods for the Examination of Water and Wastewater", 19th Edition, 1995, American Public Health Association (APHA), or most recent approved version.

38. "Manual for the Certification of Laboratories Analyzing Drinking Water, Criteria and Procedures Quality Assurance" USEPA Office of Water, Office of Ground Water and Drinking Water, Technical Support Center, Cincinnati, Ohio 45268, EPA 815-R-05-004, January 2005, Fifth Edition.

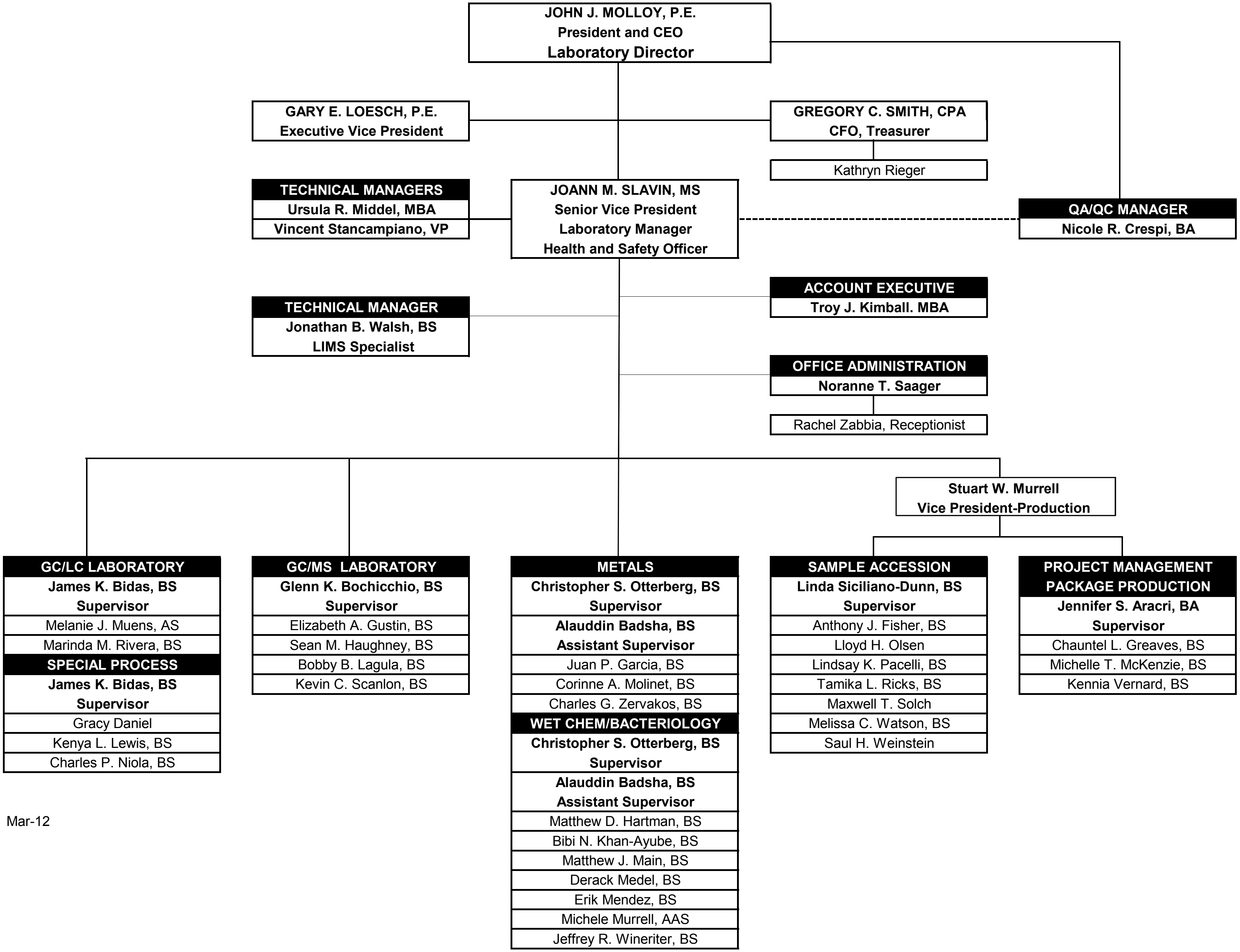
QUALITY ASSURANCE
QUALITY CONTROL MANUAL,
Appendix

H2M Labs
575 Broad Hollow Road
Melvile, New York 11747
(631) 694-3040



Section 1.0 Organizational Chart

LAB ORGANIZATION CHART



JOHN J. MOLLOY, P.E.
President and CEO
Laboratory Director

GARY E. LOESCH, P.E.
Executive Vice President

GREGORY C. SMITH, CPA
CFO, Treasurer
Kathryn Rieger

TECHNICAL MANAGERS
Ursula R. Middel, MBA
Vincent Stancampiano, VP

JOANN M. SLAVIN, MS
Senior Vice President
Laboratory Manager
Health and Safety Officer

QA/QC MANAGER
Nicole R. Crespi, BA

ACCOUNT EXECUTIVE
Troy J. Kimball. MBA

TECHNICAL MANAGER
Jonathan B. Walsh, BS
LIMS Specialist

OFFICE ADMINISTRATION
Noranne T. Saager
Rachel Zabbia, Receptionist

Stuart W. Murrell
Vice President-Production

GC/LC LABORATORY
James K. Bidas, BS
Supervisor
Melanie J. Muens, AS
Marinda M. Rivera, BS
SPECIAL PROCESS
James K. Bidas, BS
Supervisor
Gracy Daniel
Kenya L. Lewis, BS
Charles P. Niola, BS

GC/MS LABORATORY
Glenn K. Bochicchio, BS
Supervisor
Elizabeth A. Gustin, BS
Sean M. Haughney, BS
Bobby B. Lagula, BS
Kevin C. Scanlon, BS

METALS
Christopher S. Otterberg, BS
Supervisor
Alauddin Badsha, BS
Assistant Supervisor
Juan P. Garcia, BS
Corinne A. Molinet, BS
Charles G. Zervakos, BS
WET CHEM/BACTERIOLOGY
Christopher S. Otterberg, BS
Supervisor
Alauddin Badsha, BS
Assistant Supervisor
Matthew D. Hartman, BS
Bibi N. Khan-Ayube, BS
Matthew J. Main, BS
Derack Medel, BS
Erik Mendez, BS
Michele Murrell, AAS
Jeffrey R. Wineriter, BS

SAMPLE ACCESSION
Linda Siciliano-Dunn, BS
Supervisor
Anthony J. Fisher, BS
Lloyd H. Olsen
Lindsay K. Pacelli, BS
Tamika L. Ricks, BS
Maxwell T. Solch
Melissa C. Watson, BS
Saul H. Weinstein

PROJECT MANAGEMENT
PACKAGE PRODUCTION
Jennifer S. Aracri, BA
Supervisor
Chauntel L. Greaves, BS
Michelle T. McKenzie, BS
Kennia Vernard, BS

Mar-12

Section 2.0 Resumes

John J. Molloy, P.E.

President and CEO

Experience

H2M

Education

B.E., Chemical Engineering, Manhattan College

License/Certifications

Professional Engineer: NY

Environmental Laboratory Approval Program Director: NY, NJ, CT, MA, PA, DE

Dale Carnegie Leadership Training for Managers Course

Offices Held

American Council of Independent Laboratories: Chairman 2009**,** Secretary Board of Directors 2002-present, Environmental Section Board of Directors 2000 – 2001, Eastern Division Chairman 1996-1997, Secretary/Treasurer 2000–2001

NYS Association of Approved Environmental Laboratories: Director 1989 –1995, Chairman 1989 –1993

Town of Huntington Chamber of Commerce: Director 1989 –1995, Committee for Better Government Vice-Chairman 2000 – 2001, Director 1995 – 2001

Town of Hempstead: Business Council 1989-1992

Boy Scouts of America, Suffolk County Council: Director 1995 –2001

Memberships

American Water Works Association

Environmental Management Association

Long Island Water Conference

National Society of Professional Engineers

New York State Society of Professional Engineers

Water Environmental Federation

Mr. Molloy is President and Chief Executive Officer of the H2M group of firms that includes: Holzmacher, McLendon & Murrell, P.C.; H2M Labs, Inc.; H2M Associates, Inc.; and H2M Architects & Engineers, Inc. Mr. Molloy is responsible for all facets of corporate management including administration, finance; staffing and budgeting; planning and development; and marketing.

In his professional capacity with Holzmacher, McLendon & Murrell, P.C., Mr. Molloy directs engineering programs for a wide-array of the firm's clients. His experience includes all phases of project engineering and management including feasibility studies, pilot studies, planning studies, cost estimating, design services and construction management. Mr. Molloy has provided professional services to government and industrial clients covering most spheres of environmental engineering, air pollution control; water and wastewater; and, solid and hazardous waste management.

Since assuming direction of H2M Labs, Inc. in the late 1970's, Mr. Molloy has been the key principal responsible for its growth and development, overseeing all aspects of management including planning; budgeting; sales and marketing; and quality control and quality assurance.

Mr. Molloy began his professional career as a project engineer in the chemical process industry. He has also served as an air pollution control engineer for the City of New York where he was involved in the testing and evaluation of air emissions for industrial processes.

With H2M he has been responsible for the assessment of numerous industrial sites. The extent and severity of site contamination has been assessed both privately and with regulatory agency overview. He has worked on programs throughout the eastern region of the United States that have included soil borings and analysis, groundwater monitoring well installation, sampling and analysis, and remediation. The projects have varied in scope from Phase I and Phase II real estate liability assessments through formal remedial investigation and feasibility studies at hazardous waste sites.

Mr. Molloy has participated in and managed hundreds of projects relating to water quality protection, supply, treatment and system development; industrial wastewater treatment; hazardous and solid waste management; and, site evaluation and remediation.

He was the project manager for a major Long Island water project to remove volatile organic compounds by air stripping. This five million gallon per day system became operational in the spring of 1985 and was one of the first such treatment systems in the region.

Mr. Molloy has applied his treatment expertise to many additional applications for contaminated public supply wells and groundwater remediation projects, employing air strippers, as well as carbon adsorption units.

John J. Molloy, P.E.

He also serves in the capacity of H2M's project director for the following water supply clients. In all cases, water supply is obtained from a sole-source aquifer that has been impacted by contamination and where treatment has been implemented.

- Hicksville Water District -- Ongoing contract for professional engineering services covering water supply, treatment, storage and distribution for this community of 48,000.
- South Huntington Water District -- Ongoing contract for professional engineering services covering water supply, treatment, storage and distribution for this community of 55,000.

Mr. Molloy also serves in the capacity of H2M's Principal-in-Charge for a number of key programs and clients. He brings 30 years of professional experience in all areas of engineering, planning and the environmental sciences. His input and direction is essential in a wide variety of the firm's engagements and is applied in solving clients' issues and problems. ■

Articles/Papers

Hazardous Waste, Soil & Groundwater Contamination: The Law, Strategies and Technology Solutions for the 1990s. National Asbestos Council, Pittsburgh, Pennsylvania, April 1991.

Industrial Property Transactions: Protecting Yourself Against the Liabilities. Institute for International Research Environmental Compliance Conference, Chicago, Illinois, October 1990.

Industrial Property Transactions. New York Water Pollution Control Association, Inc., New York, New York, January 1990.

Air Stripping for Organics. American Water Works Association, Toronto, Canada, April 1985.

Joann M. Slavin

Senior Vice President, Laboratory Manager

Experience

H2M

Education

M.S., Toxicology, St. John's University

B.S., Toxicology, St. John's University

ACEC Leadership Training

Dale Carnegie Leadership training for Managers

Offices Held

NY Association of Approved Environmental Laboratories:
Secretary/Treasurer 1997, 1999, 2008-present
Immediate Past-Chair 2008-2010; Chair 2004-2008
Vice Chair 2000 – 2002
B. of Directors 1995 – present

Melville Rotary: Board of Directors 2006-present
Vice President 2007-2009
President 2009-present

ACIL, Environmental Science Section, Exec Board 2011

Memberships

American Chemical Society

American Chemical Society - Safety and Health Section

American Council for Independent Laboratories

American Laboratory Managers Association

New York Association of Approved Environmental Laboratories

Honors/Awards

Top 50 most Influential Women in Business,
Long Island Business News, 2008, 2010

Martin Luther King Leadership Award, 2010

Articles/Papers

Environmental Chemistry and Analysis of Regulated Compounds. Environmental Science & Technology Handbook, Government Institutes, Inc.

As Senior Vice President and Laboratory Manager, Ms. Slavin is responsible for and directs all laboratory operations and activities. She maintains all records for laboratory operations, including reports, billing and purchasing. She is responsible for all contract administration and serves as liaison between lab and client. She directs over 50 scientists and technicians, and manages the programs necessary to conduct the organic, inorganic bacteriological and sampling services of the laboratory. She also reviews and supervises the execution of methods, protocols and guidelines for sample collection and analysis based upon USEPA and state contract requirements and chain-of-custody procedures.

Ms. Slavin's responsibilities include the day to day management of laboratory procedures and reporting of results. Her duties include the monitoring of performance standard in QC and QA, monitoring the validity of the analysis performed in the laboratory and the data generated to assure reliable results and to provide technical guidance and educational direction to the laboratory staff.

She is currently the Secretary/Treasurer of the New York Association of Approved Environmental Laboratories (NYAAEL) and a member of the Environmental Science Section Executive Board of the American Council of Independent Laboratories.

As the Laboratory's safety officer, OSHA representative and trained toxicologist, Ms. Slavin supervises all aspects of occupational safety and health programs. She has designed safety protocols for the safe handling and disposal of hazardous materials. She has completed the following courses: OSHA 40 hour Hazardous Materials Training course and maintains the certification with yearly eight-hour refresher training; eight-hour hazard Material Transportation Training and Testing as per 49 CFR 172.704; and the ACEC Leadership Training Program.

Ms. Slavin attended a course on the interpretation of mass spectra at the Finnigan Institute. She reviews the identifications of non-targeted components in the GC/MS Laboratory. She also attended a course in Denver, Colorado on the compliance criteria for inorganic and organic USEPA CLP data packages. She also attended several USEPA-sponsored seminars/symposia discussing CLP and associated criteria and a training course in Total Quality Management

Prior experience at H2M includes QA Manager of the laboratory, GC/MS supervisor for volatile and semi-volatile organics; analysis of pesticides, PCBs, herbicides, volatiles and semi-volatile organics by GC and priority pollutant and HSL by GC/MS; semi-volatile, pesticides and herbicide sample preparation and clean-up procedures. ■

Ursula R. Middel

Scientist VI – Technical Manager

Experience

H2M

Own Radiological Lab

Columbia University

PE Gas Chromatographs

Education

M.B.A., Business Administration, Dowling College

Chemical Engineering, Ohm-Polytechnikum, Germany

Memberships

American Chemical Society, Environmental Division

American Chemical Society-Long Island, Environmental Committee

Delta Mu Delta

Honors/Awards

H2M Employee Excellence Award

Articles/Papers

Environmental Chemistry and Analysis of Regulated Compounds. Environmental Science & Technology Handbook, Government Institutes, Inc.

Ms. Middel is responsible for research for special projects, technical guidance and development, and implementation of new methodologies. This includes keeping instrumentation up to the latest developments. Under her guidance, H2M has excelled in performing many tasks for unusual types of analyses for the USEPA Special Analytical Services (SAS) projects. She is also responsible for staff training and updates to the laboratory Standard Operating Procedures manual to include new analyses and revisions.

Ms. Middel conducts a safety orientation seminar for all new employees, as well as in-service seminars on various sampling analytical topics. She is specifically involved with review of the operations of the special process lab for GC and GC/MS sample preparation.

Her responsibilities also include the review of in-house data packages completeness, accuracy and contract compliance for GC and GC/MS analyses. Ms. Middel has successfully completed numerous software training programs and has frequently attended USEPA sponsored seminars on analytical methods and quality assurance. She also gave technical presentations in environmental symposia (EAS, WTQA).

As former supervisor of the GC laboratory, she developed a comprehensive understanding of NYSDEC CLP protocols and deliverables. She has participated in a training session for organic data validation given by the NYSDEC. Apart from review of H2M's in-house CLP packages, she has also conducted data validation of data packages from other laboratories for government agencies and engineering firms for organic and radiological tests. Since no USEPA guidelines are available for radiological analyses, she has developed validation protocols for tritium and SIRA C13 testing. Ms. Middel has been instrumental in developing H2M's expertise in air analyses, in particular for low level analyses by sorbent tubes, summa canisters and VOST tubes well before air analyses were developed in other laboratories. H2M protocols were ahead of the methodologies published by the USEPA.

Prior to H2M, Ms. Middel was a sales engineer for gas chromatographs, QC supervisor in an aircraft factory where she also gained experience in GC installation, repair and application problems, and research in U/TH analysis for Columbia University. ■

Nicole R. Crespi

Quality Assurance Manager

Experience

H2M

Education

B.A., Biology, State University of New York at Oneonta

Ms. Crespi's responsibilities include the monitoring of performance standards in QC and QA. This includes the monitoring of the validity of the analysis performed in the laboratory and the data generated to assure reliable results to the client and to provide technical guidance, education and direction to the laboratory staff. Ms. Crespi is responsible for the NELAP certification as well as the coordination of performance evaluation studies and maintaining certifications in varying states. She is the liaison with governmental agencies.

Ms. Crespi is also responsible for the laboratory Standard Operating Procedures and QA Manual updates, and coordinates staff training and new method implementation. She is also responsible for the laboratory ethics training for new and existing employees.

Prior experience at H2M includes sample preparation and analysis by GC/MS, GC and HPLC. She is proficient in both routine and CLP analyses and reporting by USEPA methodologies and CLP reporting requirements.

Ms. Crespi has assisted in the development of the laboratory’s Laboratory Information Management System (LIMS), where she refined, developed and implemented organic and inorganic CLP reporting. In addition to training laboratory personnel in the use of the LIMS, her expertise also includes the maintenance and troubleshooting of the system. ■

Stuart W. Murrell

Vice President, Production Manager

Experience

H2M

Education

Course work in Business Management, State University of New York at Farmingdale

SQL*LIMS - Key Personnel, Training and Advanced Training

Mr. Murrell has 39 years of laboratory experience at H2M. His responsibilities encompass production oversight of all analytical departments. This includes prioritizing testing, ensuring all analyses are performed within holding times, and liaison with service departments. He assists in the planning and scheduling of analytical events, monitors laboratory productivity and acts as liaison with the computer department.

Mr. Murrell monitors production capacity levels in the various departments and monitors on-time performance. ■

Jonathan B. Walsh

Technical Manager, LIMS Specialist

Experience

H2M

NYTest

Education

B.S., Chemistry, Syracuse University

Course work in Engineering and Computer Science, Syracuse University

Microsoft Windows NT Server Administration Training

Crystal Reports Training

Honors/Awards

H2M Employee Excellence Award

Mr. Walsh is Senior Computer Programmer and LIMS administrator. He is an MS Access /VBA programmer responsible for customizing and the implementation of the Omega LIMS. He has significantly expanded the scope of H2M's LIMS system with new features and with enhancements to existing ones. These improvements have increased the efficiency and interoperability of our software / hardware systems.

Selected project experience:

- Interfaced all Lab hardware based data systems to the LIMS.
- Customized and modified the LIMS-based CLP reporting system to be compliant with the latest regulatory requirements.
- Maintained and enhanced a wide range of industry standard electronic data deliverable capability of the LIMS.
- Created an extensive range of custom, client-specific electronic data deliverables.
- Created extensive client-specific custom reporting/data monitoring reports and facilities.

Due to his extensive knowledge of chemistry, physics, electronics, mechanics and software, as well as his extensive ability to troubleshoot and optimize systems, Mr. Walsh rebuilds, overhauls, modifies and interfaces laboratory equipment.

His capabilities in the field of analytical chemistry encompass atomic absorption/emission, GC and GC/MS extractables/volatiles, and most forms of spectroscopy. As such, Mr. Walsh has designed, developed, built and patented a system and methodology to automatically spike sorbent tubes for air analysis. He conducted method validations of summa canister analysis for the USEPA with an in-house developed GC/MS canister sampling system. He has designed and constructed an automated eight-position VOST air tube analysis system capable of performing split samples analysis. He also constructed an ultra trace DC plasma atomic emission spectroscopic device.

Past experience includes air, potable water, groundwater, industrial wastewater analysis for metals, purgeable organics, semi-volatile organics, instrumentation calibration, setup, analysis, data reduction and reporting, following full QA/QC protocols. He attended a GC/MS training course designed by Hewlett Packard specifically for H2M. ■

Vincent Stancampiano

Vice President, Technical Advisor

Experience

H2M

Education

A.A.S., Air and Water Pollution Control, Sullivan County Community College

Sample Collection and Laboratory Training, USEPA

Air and Water Sample Collection and Testing Procedures, New York City Laboratories

Memberships

American Association for the Advancement of Science

Mr. Stancampiano is a technical advisor and client liaison for major accounts and has assisted clients in negotiations with regulatory agencies. His strong technical background and comprehensive understanding of the environmental field make Mr. Stancampiano a highly successful client ombudsman. He also consults with potential clients to define and discuss their analytical and regulatory compliance needs. Mr. Stancampiano's years of scientific experience, together with his extensive knowledge of the laboratory's capabilities, make him uniquely qualified to present H2M's services

As an experienced data validator, Mr. Stancampiano reviews the metals and inorganic parameter data packages for compliance with USEPA Contract Laboratory Protocol. He also has extensive experience conducting laboratory audits to ensure that laboratories meet regulatory or contract compliance.

He formerly served as H2M's Supervisor of Inorganic Chemistry where he supervised laboratory technicians in analyses of water, sewage and industrial/hazardous wastes, metals, flash point, ignitability, EP TOX (extraction procedure), corrosivity and toxicity tests; automated analyses for inorganic constituents via Technicon and total organic carbon analysis via Dohrmann Envirotech TOC analyzer. ■

Supervisors

James K. Bidas
Scientist V – GC/LC Laboratory, Special Process Laboratory

Mr. Bidas is experienced with all phases of GC and is responsible for the analysis and reporting of pesticides, PCBs by GC/ECD. Prior to H2M, Mr. Bidas has had over five years of environmental laboratory experience that included GC, GCMS, HPLC, IC, FAAS, UV/VIS and all organic extraction procedures. He has a strong knowledge of EPA methodologies and ASTM standards. He is skilled in the maintenance and repair of instruments and laboratory equipment.

Experience
H2M

Education
B.S., Chemistry, State University of New York at Stony Brook

Memberships
American Chemical Society

Glenn K. Bochicchio
Scientist VI – GC/MS Laboratory

As supervisor of the GC/MS laboratory, Mr. Bochicchio's responsibilities include scheduling of analyses and staff, quality control, maintenance of instrumentation, calibration and programming of the GC/MS system, interpretation of results, implementation of test protocols and the training and supervision of chemists in the GC/MS laboratory. Prior to supervisor, Mr. Bochicchio is responsible for the analysis of semi-volatile priority pollutants and TCL compounds by GC/MS, analysis and reporting of data, spectra interpretation, data system management and instrumental quality control. He attended a GC/MS in-house training course designed by Hewlett Packard to specifically meet the needs of the laboratory personnel. Mr. Bochicchio has performed wet chemical analysis for sulfate, cyanide, total alkalinity, and dissolved carbon dioxide. In the organic section, he prepared samples for analysis and has conducted instrumental analysis of pesticides, PCB's, and herbicides, including interpretation and reporting of data. Prior experience included wet and instrument analysis of plating solutions, wastewater and treatment operation, and hazardous waste management including collection, transportation, storage and manifestation.

Experience
H2M

Education
B.S., Biology, University of Hawaii

Technical Courses
Hewlett Packard Systems Manager
Hewlett Packard Mass Spectral Interpretation
Superincos Quantitation Procedures, Finnigan Mat
Target Compound Analysis - Autoquan, Finnigan Mat

Memberships
American Chemical Society

Honors/Awards
H2M Employee Excellence Award

Christopher Otterberg
Scientist VI – Metals Laboratory, Wet Chem/Bacteriology Laboratory

Mr. Otterberg is responsible for the coordinate and scheduling of the various tests in the wet chemistry, metals and bacteriology laboratory. He is responsible for the generation of as well as data package generation and reporting.

Experience
H2M

Environmental Testing Laboratories

Education
B.S., Microbiology, Kutztoun University

Linda Siciliano-Dunn
Lab Technician VI - Supervisor of Sample Handling, Shipping and Receiving

Ms. Siciliano-Dunn is acting supervisor to a team of five laboratory assistants and samplers and is the primary laboratory sample custodian. She oversees chain-of-custody procedures, preparation of sample kits, scheduling sampling and sample pick-up and logging samples into the laboratory LIMS system. She also acts as liaison with county health departments and water suppliers regarding changes in monitoring requirements and setting up sampling programs. Prior to this position, Ms. Siciliano-Dunn assisted the laboratory production manager in all phases of laboratory operations and production. Her responsibilities included the input and preliminary review of analytical results, generation of laboratory analytical reports and weekly production of invoices. She also assisted in the month end closing and generated monthly backlog reports. ■

Experience
H2M

NYTest

Education
B.S., Natural Resources, Cornell University

Total Quality Management Business Training Course

Gas Chromatography / Mass Spectrometry Laboratory

Experience
H2M

Education
B.S., Biology, University of Hawaii, 1982

Specialized Courses
Hewlett Packard Systems Manager and Mass Spectral Interpretation
Superincos Quantitation Procedures; and Target Compound Analysis - Autoquan, Finnigan Mat Inst.

Memberships
American Chemical Society

Awards
H2M Employee Excellence Award, 1990

Glenn K. Bochicchio, Scientist VI
Supervisor of GC/MS Laboratory

As supervisor of the GC/MS laboratory, Mr. Bochicchio's responsibilities include scheduling of analyses and staff, quality control, maintenance of instrumentation, calibration and programming of the GC/MS system, interpretation of results, implementation of test protocols and the training and supervision of chemists in the GC/MS laboratory. Prior to supervisor, Mr. Bochicchio was responsible for the analysis of semi-volatile priority pollutants and TCL compounds by GC/MS, analysis and reporting of data, spectra interpretation, data system management and instrumental quality control. He attended a GC/MS in-house training course designed by Hewlett Packard to specifically meet the needs of the laboratory personnel. Mr. Bochicchio has performed wet chemical analysis for sulfate, cyanide, total alkalinity, and dissolved carbon dioxide. In the organic section, he prepared samples and conducted instrumental analysis of pesticides, PCB's, and herbicides, including interpretation and reporting of data. Prior experience includes wet and instrument analysis of plating solutions, wastewater and treatment operation, and hazardous waste management.

Experience
H2M

Education
B.S., Environmental Science, Lynchburg College, 1993

Specialized Courses
Hewlett Packard Mass Spectral Interpretation

Elizabeth A. Gustin, Scientist IV

Ms. Gustin is responsible for the analysis and reporting of semi-volatile organics and TCL compounds according to USEPA methods and CLP reporting requirements. Ms. Gustin is also responsible for the analysis of volatile drinking water by Method 524.2 including instrument maintenance, calibration and data interpretation. She is crossed trained to also perform the analysis and reporting of pesticides, PCB’s, herbicides and organophosphates by gas chromatography, and CLP analysis using HP and PE dual ECD Gas Chromatographs.

Experience
H2M

Education
B.S. Chemistry, Adelphi University, 2006

Sean M. Haughney, Scientist I

Mr. Haughney is responsible for the analysis and reporting of semi-volatile organics and TCL compounds according to USEPA methods and CLP reporting requirements. He also has experience in the extraction of pesticides/PCBs, base neutrals and acid extractable compounds, solid phase extraction for potable water, pesticides and BNA extractable analytes.

Experience
H2M
Chemtech

Education
B.S., Chemistry, Far Eastern University, 1979

Bobby B. Lagula, Scientist IV

Mr. Lagula is responsible for the analysis and reporting of volatile organics and TCL compounds according to USEPA methods and CLP reporting requirements. His prior experience includes analysis of volatile and semi-volatile analysis by GC/MS. Previous experience includes analysis of volatile and semi-volatile compounds by GC/MS on the HP 5995, 5970 and 5971. He is experienced in the analysis of water, soil and air using NYSDEC CLP protocols for priority pollutants, target compound list compounds and RCRA compounds. He performs all steps in the analysis including instrument calibration, sample set up, real time QC and reporting.

Experience
H2M

Education
B.S., Chemistry, Hofstra University, 2008

Certifications
OSHA 40 hour HAZWOPER
Loss Prevention System
Lead Based paint Inspector
Asbestos Inspector

Kevin C. Scanlon, Scientist I

Mr. Scanlon has experience with the analysis of environmental samples and hazardous waste by GC/MS. He is proficient on Hewlett Packard instrumentation for purgeable compounds, and is quite familiar with both Federal Register and USEPA CLP methods. He routinely analyzes and reports CLP volatile organic compounds on HP instrumentation. Mr. Scanlon is also responsible for the analysis of air samples by Method TO-15 and has attended a training course given by Entech Instruments. His prior experience includes GC/MS analysis for volatile organic compounds in a mobile laboratory. ■

Gas Chromatography / Liquid Chromatography Laboratory

Experience
H2M

Education
B.S., Chemistry, State University of New York at Stony Brook

Memberships
American Chemical Society

James K. Bidas, Scientist V
Supervisor of GC/LC Laboratory

Mr. Bidas is experienced with all phases of GC and is responsible for the analysis and reporting of pesticides, PCBs by GC/ECD. Prior to H2M, Mr. Bidas has had over five years of environmental laboratory experience that included GC, GCMS, HPLC, IC, FAAS, UV/VIS and all organic extraction procedures. He has a strong knowledge of EPA methodologies and ASTM standards. He is skilled in the maintenance and repair of instruments and laboratory equipment.

Experience
H2M

Education
A.S., Laboratory Technology, Suffolk County Community College, 1997

Specialized Courses
Comprehensive HPLC Seminar, Restek

Memberships
American Chemical Society

Melanie J. Muens, Scientist II

Ms. Muens is responsible for the analysis and reporting of pesticides, PCBs, and herbicides by GC/ECD, carbamates and glyphosate are by HPLC. Prior to H2M, She has over five years laboratory experience that included organic extraction procedures, GC, HPLC, and wet chemistry analyses. Ms Muens is also proficient with HPLC, GC, UV and IR instrumentation and also the maintenance and repair of GC and LC instrumentation.

Experience
H2M

Education
B.S., Chemistry, Fordham University, 2003

Marinda M. Rivera, Scientist II

Ms. Rivera is responsible for the analysis and reporting of pesticides, PCBs, and herbicides by GC/ECD. Prior to H2M, She also has 2.5 years of environmental laboratory experience that included organic extractions, GC and GC/MS analyses. She is crossed trained to also perform the analysis and reporting of volatile organics by GC/MS. Ms Rivera is in the maintenance and repair of GC instrumentation. ■

Special Process Laboratory

Experience
H2M

Education
B.S., Chemistry, State University of New York at Stony Brook

Memberships
American Chemical Society

James K. Bidas, Scientist VI
Supervisor of Special Process Laboratory

Mr. Bidas is experienced with all phases of GC and is responsible for the analysis and reporting of pesticides, PCBs by GC/ECD. Prior to H2M, Mr. Bidas has had over five years of environmental laboratory experience that included GC, GCMS, HPLC, IC, FAAS, UV/VIS and all organic extraction procedures. He has a strong knowledge of EPA methodologies and ASTM standards. He is skilled in the maintenance and repair of instruments and laboratory equipment.

Experience
H2M

Education
B.S., Forensic Science, minor in Chemistry, C.W. Post – Long Island University, 2008

Charles P. Niola, Scientist I

Mr. Niola is responsible for the extraction of pesticides/PCBs base neutrals and acid extractable compounds, solid phase extraction for potable water, pesticides and BNA extractable analytes. He also does TCLP prep and ignitability.

Experience
H2M

Education
B.S., Forensic Chemistry, Buffalo State College, 2010

Kenya L. Lewis, Scientist I

Ms. Lewis is responsible for the extraction of pesticides/PCBs base neutrals and acid extractable compounds, solid phase extraction for potable water, pesticides and BNA extractable analytes.

Experience
H2M

Education
Course work towards B.A., St. John's College, India

Gracy Daniel, Technician IV

Ms. Daniel is responsible for sample preparation of environmental samples. She preps glassware, weighs samples and performs filtrations. Ms. Daniel does extraction for PCBs in soil, water, and solid phase extraction for potable water pesticides as well as base-neutral-acid-extractable analytes. Ms. Daniel performs cleanups on sample extracts using GPC instrumentation. ■

Metals Laboratory

Experience
H2M
Environmental Testing Laboratories

Education
B.S., Microbiology, Kutztoun University, 2002

Christopher Otterberg, Scientist VI
Supervisor of Metals Laboratory

Mr. Otterberg is responsible for the coordinate and scheduling of the various tests in the wet chemistry, metals and bacteriology laboratory. He is responsible for the generation of as well as data package generation and reporting. He oversees the analysis of trace metals by atomic absorption, and inductively coupled plasma spectrophotometer, as well as ICP/MS using USEPA methods. He is responsible for a variety of preparative analytical procedures on sample matrices requiring metals analysis, and performs acid digestions on waters, soils, and other solid sample types including lead solder scrapings, paint chips and surface wipes.

Experience
H2M

Education
B.S., Chemistry, State University of New York at Stony Brook, 1987

Awards
H2M Employee Excellence Award, 1991

Charles Zervakos, Scientist IV

Mr. Zervakos is responsible for the analyses of trace metals by inductively coupled plasma spectrophotometer using USEPA methods. Mr. Zervakos also possesses unique expertise in computer software and hardware.

Experience
H2M

Education
B.S., Public Health, State University of New York at Stony Brook, 2006

Corrinne A. Molinet, Scientist I

Ms. Molinet is responsible for the analyses of trace metals by inductively coupled plasma spectrophotometer, as well as ICP/MS. She is also trained in the acid digestions of waters and soils. Ms. Molinet is also responsible for the the data package generation and reporting.

Experience
H2M

Education
B.S., Health Science, State University of New York at Stony Brook, 2005

Alauddin Badsha, Scientist I

Mr. Badsha is responsible for the day to day scheduling of the metals lab. He is responsible for the analysis of trace metals by atomic absorption, inductively coupled plasma spectrophotometer, and ICP/MS using USEPA methods. He is also responsible for the data package generation and reporting. Mr. Badsha is also trained in performing acid digestion on waters, soils, and other solid sample types including lead solder scrapings, paint chips and surface wipe.

Experience
H2M

Education
B.S., Biology, Adelphi University, 2008

Juan P. Garcia, Scientist II

Mr. Garcia is responsible for performing a variety of preparative analytical procedures on sample matrices requiring metals analysis. He performs acid digestion on waters, soil, and other solid types including lead solder scrapings, paint chips, and surface wipes. Mr. Garcia is also responsible for the analysis of Hg by cold vapor atomic absorption using USEPA methods. ■

Wet Chemistry Laboratory

Experience
H2M
Environmental Testing Laboratories
Education
B.S., Microbiology, Kutztoun University, 2002

Christopher Otterberg, Scientist VI
Supervisor of Wet Chemistry / Bacteriology Laboratory

Mr. Otterberg is responsible for the coordination and scheduling of the various tests in the wet chemistry, metals, and bacteriology laboratory. He is responsible for data package generation and reporting. He oversees the analysis of trace metals by atomic absorption, and inductively coupled plasma spectrophotometer, as well as ICP/MS using USEPA methods. He is responsible for a variety of preparative analytical procedures on sample matrices requiring metals and wet chem analysis.

Experience
H2M
American Analytical Labs
Education
B.S., Biological Sciences, State University of New York at Old Westbury, 2001

Bibi N. Khan-Ayube, Scientist III

Ms. Khan-Ayube is responsible for several wet chem. Analysis, including NH3, TKN, Cl, NO2, NO3 by lachat, and Anions by IC on lachat. She is also responsible for the analysis of perchlorate by IC.

Experience
H2M
Education
B.S., Environmental Studies, State University of New York at Oneonta, 2006

Matthew D. Hartman, Scientist I

Mr. Hartman is responsible for cyanide analysis, which includes free cyanide and amenable cyanide. Other tests include Ortho Phosphate, Turbidity, Color, Odor, and MBAS.

Experience
H2M
Education
B.S., Biology, State University of New York at Binghamton, 2007

Matthew J. Main, Scientist I

Mr. Main is the laboratory microbiologist. He is responsible for total and fecal coliform analysis as well as E. Coli and enterococcus using EPA approved methodology. He is also responsible for the bacteriological speciation of sample.

Experience
H2M
Education
B.S., Biology, Texas A&M University, 2011

Derack Medel, Scientist I

Mr. Medel is responsible for Alk, Hardness, NH3, BOD, CBOD, COD, solids and many other various wet chemistry tests.

Experience
H2M
Education
B.S., Biology, State University of New York at Geneseo, 2007

Erik Mendez, Scientist I

Mr. Mendez is responsible for Ortho Phosphate, Turbidity, Color, Odor, MBAS, NO2, NO3, and various other tests. He is also responsible for the digestion of TKN and NH3, he is also trained in the analysis of these tests. Mr. Mendez is also cross trained in the bacteriology lab.

Experience
H2M
Education
B.S., Biology, Texas A&M University, 2011

Jeffrey R. Wineriter, Scientist I

Mr. Wineriter is responsible for cyanide analysis; this includes free cyanide and amenable cyanide. He is also crossed trained in Alk, Hardness, Conductivity, BOD/CBOD, and lachat which is used for NO2, NO3, Cl, and Anions by IC.

Experience
H2M
Education
A.A.S., Laboratory Technology, 1978

Michele Murrell, Technician III

Ms. Murrell is responsible for all solids analysis; this includes TSS, TS, TDS, and PMOIST. She is also crossed trained in many various tests, which she fills in when needed. Ms. Murrell also fills in and or helps out in the bacteriology lab, where she used to be the lead technician. ■

Jennifer S. Aracri

Senior Project Manager

Experience

H2M

Education

B.A., Biology, State University of New York at Stony Brook

As project manager, Ms. Aracri assists clients and potential clients with their regulatory and analytical testing needs through completion of the project. She provides assistance in the coordination and organization of analytical services for H2M's major engineering, consulting and industrial clients. She works with clients to assure the correct methodologies, quality control requirements and deliverables are requested at the inception of each project. Ms. Aracri also provides analytical cost quotations to current and potential clients.

Ms. Aracri provides project management for clients requiring drinking water sampling and analysis. She is the main contact for local water suppliers and consulting firms. Ms. Aracri is familiar with the protocols and guidelines set forth by USEPA and county health departments. She is also familiar with the requirements of the Disinfectant Byproduct Role as well as the upcoming sampling for the UCMR 2 program.

Prior to this, Ms. Aracri was the supervisor of the sample preparation department. She performed the extraction of environmental samples including semi-volatile GC and GC/MS extractions and concentration, including pesticide, herbicide and semi-volatile compounds, TCLP extractions, and sample cleanup including GPC and Florisil. She was also responsible for scheduling the extractions staff, monitoring work flow to meet tight holding times, maintaining sample prep equipment and instrumentation, and training staff in extraction procedures. ■

Package Production / Document Control

Experience

H2M

Noranne T. Saager

Project Coordinator

Ms. Saager is responsible for coordinating package production in order to meet client-specified turnaround times. Ms. Saager is responsible for the routing of data packages through appropriate channels for QA/QC review and package assembly. She is the liaison between the production manager and customer service in order to ensure the timely and correct delivery of client data packages and Electronic Diskette Deliverables. Ms. Saager also assists in the all aspects of contract-required data deliverables procedures in meeting client-specified turnaround times.

Experience

H2M

Education

B.S., Toxicology, St. John's University, 2008

Chauntel L. Greaves

Package Production

Ms. Greaves is responsible for all aspects of contract-required data deliverables, including organization, packaging, copying and delivery. Ms. Greaves prepares electronic diskette deliverables in various formats required by H2M clients. Ms. Greaves is highly proficient in the creation of Equis EDDs. Ms Greaves has an active role in logbook maintenance and electronic and hardcopy data archiving procedures. Ms. Greaves also assists in the day-to-day management of project coordination efforts, client communication and report submittal.

Experience

H2M

Proctor & Gamble

OSI Pharmaceuticals, Inc.

Ledoux & Company

Education

B.S.M., Management, University of Phoenix, 2004

A.A.S., Chemical Technology, New York City College of Technology, 1995

Michelle T. McKenzie

Package Production

Ms. Mckenzie is responsible for all aspects of contract-required data deliverables, including organization, packaging, copying and delivery. She is proficient in the creation of electronic data packages in PDF format that provide searchable text, book marking and hyperlinks. Ms. Mckenzie has an active role in logbook maintenance and electronic and hardcopy data archiving procedures. She assists clients and potential clients with their regulatory and analytical testing needs assuring correct methodologies, quality control requirements and deliverables meet the regulatory and project requirements.

Experience

H2M

Icon Central Laboratories, Site Service Specialist

Education

B.S., Biology (Major), Chemistry (Minor), Utica College of Syracuse University, 2010

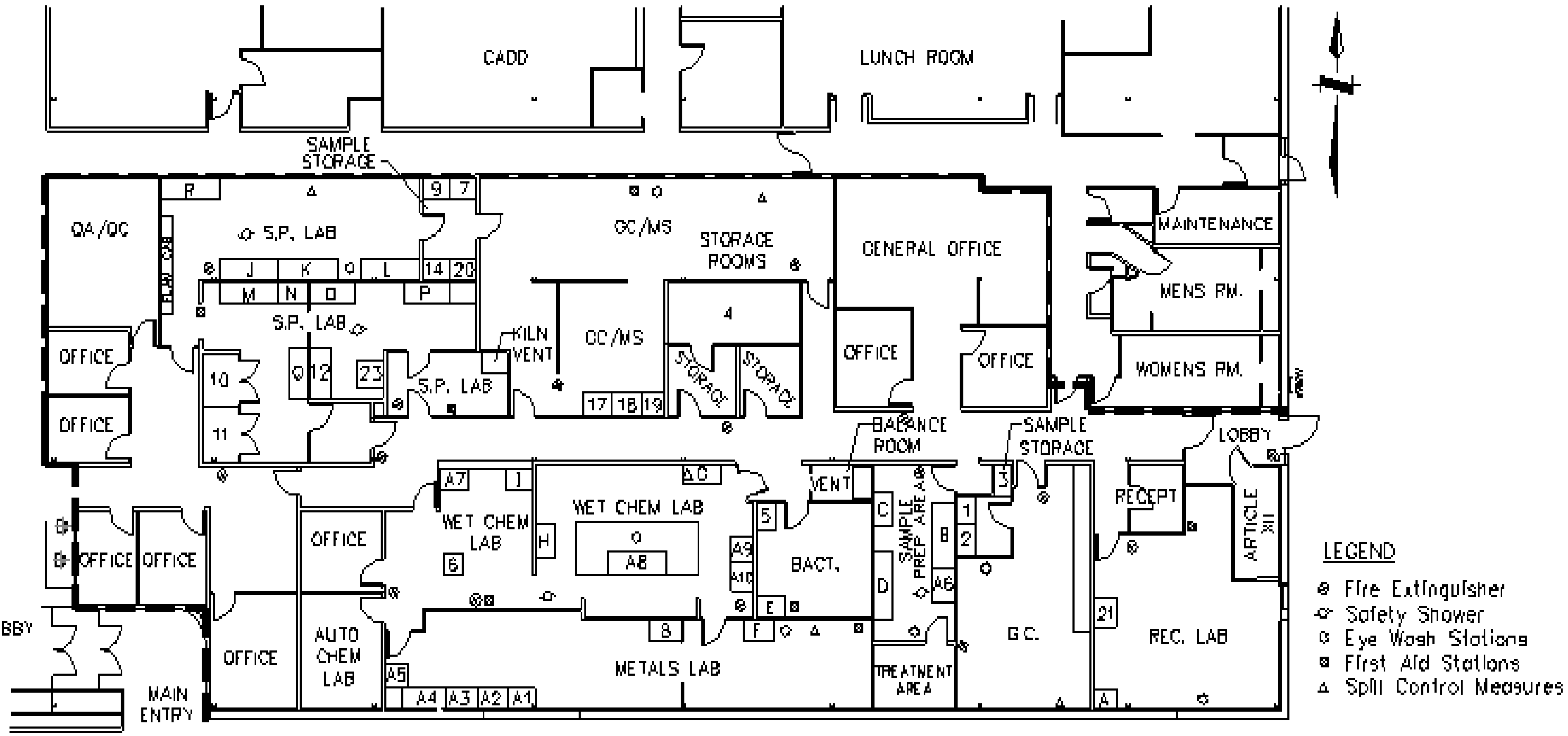
Kennia Vernard

Package Production

Ms. Vernard is responsible for all aspects of contract-required data deliverables, including organization, packaging, copying and delivery. She is proficient in the creation of electronic data packages in PDF format that provide searchable text, book marking and hyperlinks. Ms. Vernard assists clients and potential clients with their regulatory and analytical testing needs assuring correct methodologies, quality control requirements and deliverables meet the regulatory and project requirements. ■

Section 3.0 Floor Plan

LABORATORY FLOOR PLAN



REFRIGERATOR NUMBER
1 - Standards (GC)
2 - Potable H2O Samples VOA (GC)
3 - Not in Use
4 - Walk-in Refrigerator
5 - Bacteriology Lab Samples
6 - Wet Chem Routine
7 - Wet Chem
8 - Metals CLP
9 - BNA Extracts
10 - Routine BNA/Pest Samples
11 - CLP BNA/Pest Samples

REFRIGERATOR NUMBER
12 - Drinking H2O BNA/Pest Samples
13 - Not in Use
14 - Semi-volatile Extracts Non-Evidentiary
15 - Not in Use
16 - Not Currently in Use
17 - GC/MS Volatile Evidentiary
18 - VOA Standards Freezer
19 - GC/MS Volatile Non-Evidentiary
20 - Semi-VOA Standards Freezer
21 - Receiving
22 Not in Use
23 Semi-volatile Extracts

CABINET NUMBER (METALS)
A1 - Water (not digested)
A2 - Water (not digested)
A3 - Furnace Digestate
A4 - Evening Access
A5 - Flame Digestate
A6 - Evidentiary Sample Digestate
A7 - Flame Digestate
A8 - Flame Digestate
A9 - Furnace Digestate
A10 - Furnace Digestate

FUME HOODS
A - Receiving-3' hood
B - Inorganic Sample Prep-8' hood
C - Inorganic Sample Prep-4' hood
D - Inorganic Sample Prep-8' hood
E - None
F - Metals Lab-4' hood
G - Wet Chem Lab-5' hood
H - Wet Chem Lab-5' hood
I - Wet Chem Lab-4' hood

FUME HOODS (SPECIAL PROCESS)
J - 8' hood Concentrations
K - 8' hood
l - 8' hood Auto-extractions Standard Prep
M - 8' hood w/sink
N - 4' hood
O - 6' hood
P - 6' hood Herbicide Extractions
Q - 6' hood Soil Extractions
R 10’ hood Atuo Extractions

Note: Limited Access Laboratories (locked) are: GC, GC/MS, Metals, Bacteriology, Special Process

Revised 4/00

Section 4.0 Methodology Listing

Matrix	Analyte	Method	Technology
NW	Demand	Method	Technology
NW	Biochemical Oxygen Demand	SM 18-21 5210B (01)	TITR
NW	Carbonaceous BOD	SM 18-21 5210B (01)	TITR
NW	Chemical Oxygen Demand	EPA 410.4 Rev. 2.0	COLOR
NW	Residue	Method	Technology
NW	Settleable Solids	SM 18-21 2540 F (97)	GRAV
NW	Solids, Total Dissolved	SM 18-21 2540C (97)	GRAV
NW	Solids, Total Suspended	SM 18-21 2540D (97)	GRAV
NW	Solids, Total	SM 18-21 2540B (97)	GRAV
NW	Bacteriology	Method	Technology
NW	Coliform, Fecal	SM 18-21 9221E (99)	FB-QN
NW	Standard Plate Count	SM 18-21 9215B	PP-QN
NW	Coliform, Total	SM 18-21 9221B (99)	FB-QN
NW	Enterococci	ASTM D6503-99	FB-PAF-QL
NW	Enterococci	Enterolert	FB-PAF-QL
NW	Mineral	Method	Technology
NW	Acidity	SM 18-21 2310B.4a (97)	TITR
NW	Alkalinity	SM 18-21 2320B (97)	TITR
NW	Chloride	EPA 300.0 Rev. 2.1	IC-COND
NW	Chloride	SM 18-21 4500-Cl- E (97)	COLOR
NW	Chloride	EPA 9056A	IC-COND
NW	Fluoride, Total	EPA 300.0 Rev. 2.1	IC-COND
NW	Fluoride, Total	EPA 9056A	IC-COND
NW	Calcium Hardness	EPA 200.7 Rev. 4.4	ICP-AES
NW	Hardness, Total	SM 18-21 2340C (97)	TITR
NW	Hardness, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Sulfate (as SO4)	EPA 300.0 Rev. 2.1	IC-COND
NW	Sulfate (as SO4)	EPA 9056A	IC-COND
NW	Nutrient	Method	Technology
NW	Ammonia (as N)	SM 18 4500-NH3 H	AUTO
NW	Ammonia (as N)	EPA 350.1 Rev. 2.0	AUTO
NW	Ammonia (as N)	SM 18-21 4500-NH3 B (97)	PREP
NW	Kjeldahl Nitrogen, Total	EPA 351.2 Rev. 2.0	AUTO
NW	Nitrate (as N)	EPA 353.2 Rev. 2.0	AUTO
NW	Nitrate (as N)	EPA 300.0 Rev. 2.1	IC-COND
NW	Nitrate (as N)	EPA 9056A	IC-COND
NW	Nitrite (as N)	EPA 353.2 Rev. 2.0	AUTO
NW	Nitrite (as N)	EPA 300.0 Rev. 2.1	IC-COND
NW	Nitrite (as N)	EPA 9056A	IC-COND
NW	Orthophosphate (as P)	EPA 300.0 Rev. 2.1	IC-COND
NW	Orthophosphate (as P)	SM 18-21 4500-P E	COLOR
NW	Orthophosphate (as P)	EPA 9056A	IC-COND

Matrix	Analyte	Method	Technology
NW	Phosphorus, Total	SM 18-20 4500-P b.5	PREP
NW	Phosphorus, Total	SM 18-21 4500-P E	COLOR
NW	Wastewater Metals I	Method	Technology
NW	Barium, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Barium, Total	EPA 3010A	PREP
NW	Barium, Total	EPA 3005A	PREP
NW	Barium, Total	EPA 6010B	ICP-AES
NW	Barium, Total	EPA 6010C	ICP-AES
NW	Barium, Total	EPA 6020A	ICP-MS
NW	Barium, Total	EPA 6020	ICP-MS
NW	Barium, Total	EPA 200.8 Rev. 5.4	ICP-MS
NW	Cadmium, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Cadmium, Total	EPA 3010A	PREP
NW	Cadmium, Total	EPA 3005A	PREP
NW	Cadmium, Total	EPA 6010B	ICP-AES
NW	Cadmium, Total	EPA 6010C	ICP-AES
NW	Cadmium, Total	EPA 6020A	ICP-MS
NW	Cadmium, Total	EPA 6020	ICP-MS
NW	Cadmium, Total	EPA 200.8 Rev. 5.4	ICP-MS
NW	Calcium, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Calcium, Total	EPA 3010A	PREP
NW	Calcium, Total	EPA 3005A	PREP
NW	Calcium, Total	EPA 6010B	ICP-AES
NW	Calcium, Total	EPA 6010C	ICP-AES
NW	Chromium, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Chromium, Total	EPA 3010A	PREP
NW	Chromium, Total	EPA 3005A	PREP
NW	Chromium, Total	EPA 6010B	ICP-AES
NW	Chromium, Total	EPA 6010C	ICP-AES
NW	Chromium, Total	EPA 6020A	ICP-MS
NW	Chromium, Total	EPA 6020	ICP-MS
NW	Chromium, Total	EPA 200.8 Rev. 5.4	ICP-MS
NW	Copper, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Copper, Total	EPA 3010A	PREP
NW	Copper, Total	EPA 3005A	PREP
NW	Copper, Total	EPA 6010B	ICP-AES
NW	Copper, Total	EPA 6010C	ICP-AES
NW	Copper, Total	EPA 6020A	ICP-MS
NW	Copper, Total	EPA 6020	ICP-MS
NW	Copper, Total	EPA 200.8 Rev. 5.4	ICP-MS
NW	Iron, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Iron, Total	EPA 3010A	PREP

Matrix	Analyte	Method	Technology
NW	Iron, Total	EPA 3005A	PREP
NW	Iron, Total	EPA 6010B	ICP-AES
NW	Iron, Total	EPA 6010C	ICP-AES
NW	Lead, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Lead, Total	EPA 3010A	PREP
NW	Lead, Total	EPA 3005A	PREP
NW	Lead, Total	EPA 6010B	ICP-AES
NW	Lead, Total	EPA 6010C	ICP-AES
NW	Lead, Total	EPA 6020A	ICP-MS
NW	Lead, Total	EPA 6020	ICP-MS
NW	Lead, Total	EPA 200.8 Rev. 5.4	ICP-MS
NW	Magnesium, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Magnesium, Total	EPA 3010A	PREP
NW	Magnesium, Total	EPA 3005A	PREP
NW	Magnesium, Total	EPA 6010B	ICP-AES
NW	Magnesium, Total	EPA 6010C	ICP-AES
NW	Manganese, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Manganese, Total	EPA 3010A	PREP
NW	Manganese, Total	EPA 3005A	PREP
NW	Manganese, Total	EPA 6010B	ICP-AES
NW	Manganese, Total	EPA 6010C	ICP-AES
NW	Manganese, Total	EPA 6020A	ICP-MS
NW	Manganese, Total	EPA 6020	ICP-MS
NW	Manganese, Total	EPA 200.8 Rev. 5.4	ICP-MS
NW	Nickel, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Nickel, Total	EPA 3010A	PREP
NW	Nickel, Total	EPA 3005A	PREP
NW	Nickel, Total	EPA 6010B	ICP-AES
NW	Nickel, Total	EPA 6010C	ICP-AES
NW	Nickel, Total	EPA 6020A	ICP-MS
NW	Nickel, Total	EPA 6020	ICP-MS
NW	Nickel, Total	EPA 200.8 Rev. 5.4	ICP-MS
NW	Potassium, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Potassium, Total	EPA 3010A	PREP
NW	Potassium, Total	EPA 3005A	PREP
NW	Potassium, Total	EPA 6010B	ICP-AES
NW	Potassium, Total	EPA 6010C	ICP-AES
NW	Silver, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Silver, Total	EPA 3005A	PREP
NW	Silver, Total	EPA 6010B	ICP-AES
NW	Silver, Total	EPA 6010C	ICP-AES
NW	Silver, Total	EPA 6020A	ICP-MS

Matrix	Analyte	Method	Technology
NW	Silver, Total	EPA 6020	ICP-MS
NW	Silver, Total	EPA 200.8 Rev. 5.4	ICP-MS
NW	Sodium, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Sodium, Total	EPA 3010A	PREP
NW	Sodium, Total	EPA 3005A	PREP
NW	Sodium, Total	EPA 6010B	ICP-AES
NW	Sodium, Total	EPA 6010C	ICP-AES
NW	Strontium, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Strontium, Total	EPA 3010A	PREP
NW	Strontium, Total	EPA 3005A	PREP
NW	Strontium, Total	EPA 6010B	ICP-AES
NW	Strontium, Total	EPA 6010C	ICP-AES
NW	Strontium, Total	EPA 6020A	ICP-MS
NW	Strontium, Total	EPA 6020	ICP-MS
NW	Strontium, Total	EPA 200.8 Rev. 5.4	ICP-MS
NW	Wastewater Metals II	Method	Technology
NW	Aluminum, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Aluminum, Total	EPA 3010A	PREP
NW	Aluminum, Total	EPA 3005A	PREP
NW	Aluminum, Total	EPA 6010B	ICP-AES
NW	Aluminum, Total	EPA 6010C	ICP-AES
NW	Aluminum, Total	EPA 6020	ICP-MS
NW	Aluminum, Total	EPA 200.8 Rev. 5.4	ICP-MS
NW	Antimony, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Antimony, Total	EPA 3005A	PREP
NW	Antimony, Total	EPA 6010B	ICP-AES
NW	Antimony, Total	EPA 6010C	ICP-AES
NW	Antimony, Total	EPA 6020A	ICP-MS
NW	Antimony, Total	EPA 6020	ICP-MS
NW	Antimony, Total	EPA 200.8 Rev. 5.4	ICP-MS
NW	Arsenic, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Arsenic, Total	EPA 3010A	PREP
NW	Arsenic, Total	EPA 3005A	PREP
NW	Arsenic, Total	EPA 6010B	ICP-AES
NW	Arsenic, Total	EPA 6010C	ICP-AES
NW	Arsenic, Total	EPA 6020A	ICP-MS
NW	Arsenic, Total	EPA 6020	ICP-MS
NW	Arsenic, Total	EPA 200.8 Rev. 5.4	ICP-MS
NW	Beryllium, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Beryllium, Total	EPA 3010A	PREP
NW	Beryllium, Total	EPA 3005A	PREP
NW	Beryllium, Total	EPA 6010B	ICP-AES

Matrix	Analyte	Method	Technology
NW	Beryllium, Total	EPA 6010C	ICP-AES
NW	Beryllium, Total	EPA 6020A	ICP-MS
NW	Beryllium, Total	EPA 6020	ICP-MS
NW	Beryllium, Total	EPA 200.8 Rev. 5.4	ICP-MS
NW	Chromium VI	EPA 7196A	COLOR
NW	Chromium VI	SM 18-19 3500-Cr D	COLOR
NW	Mercury, Total	EPA 245.1 Rev. 3.0	CVAAS
NW	Mercury, Total	EPA 7470A	CVAAS
NW	Mercury, Total	EPA 6020A	ICP-MS
NW	Mercury, Total	EPA 6020	ICP-MS
NW	Mercury, Total	EPA 200.8 Rev. 5.4	ICP-MS
NW	Selenium, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Selenium, Total	EPA 3010A	PREP
NW	Selenium, Total	EPA 3005A	PREP
NW	Selenium, Total	EPA 6010B	ICP-AES
NW	Selenium, Total	EPA 6010C	ICP-AES
NW	Selenium, Total	EPA 6020A	ICP-MS
NW	Selenium, Total	EPA 6020	ICP-MS
NW	Selenium, Total	EPA 200.8 Rev. 5.4	ICP-MS
NW	Vanadium, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Vanadium, Total	EPA 3010A	PREP
NW	Vanadium, Total	EPA 3005A	PREP
NW	Vanadium, Total	EPA 6010B	ICP-AES
NW	Vanadium, Total	EPA 6010C	ICP-AES
NW	Vanadium, Total	EPA 6020A	ICP-MS
NW	Vanadium, Total	EPA 6020	ICP-MS
NW	Vanadium, Total	EPA 200.8 Rev. 5.4	ICP-MS
NW	Zinc, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Zinc, Total	EPA 3010A	PREP
NW	Zinc, Total	EPA 3005A	PREP
NW	Zinc, Total	EPA 6010B	ICP-AES
NW	Zinc, Total	EPA 6010C	ICP-AES
NW	Zinc, Total	EPA 6020	ICP-MS
NW	Zinc, Total	EPA 200.8 Rev. 5.4	ICP-MS
NW	Wastewater Metals III	Method	Technology
NW	Cobalt, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Cobalt, Total	EPA 3010A	PREP
NW	Cobalt, Total	EPA 3005A	PREP
NW	Cobalt, Total	EPA 6010B	ICP-AES
NW	Cobalt, Total	EPA 6010C	ICP-AES
NW	Cobalt, Total	EPA 6020A	ICP-MS
NW	Cobalt, Total	EPA 6020	ICP-MS

Matrix	Analyte	Method	Technology
NW	Cobalt, Total	EPA 200.8 Rev. 5.4	ICP-MS
NW	Molybdenum, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Molybdenum, Total	EPA 3005A	PREP
NW	Molybdenum, Total	EPA 6010B	ICP-AES
NW	Molybdenum, Total	EPA 6010C	ICP-AES
NW	Molybdenum, Total	EPA 6020A	ICP-MS
NW	Molybdenum, Total	EPA 6020	ICP-MS
NW	Molybdenum, Total	EPA 200.8 Rev. 5.4	ICP-MS
NW	Thallium, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Thallium, Total	EPA 3010A	PREP
NW	Thallium, Total	EPA 3005A	PREP
NW	Thallium, Total	EPA 6010B	ICP-AES
NW	Thallium, Total	EPA 6010C	ICP-AES
NW	Thallium, Total	EPA 6020A	ICP-MS
NW	Thallium, Total	EPA 6020	ICP-MS
NW	Thallium, Total	EPA 200.8 Rev. 5.4	ICP-MS
NW	Tin, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Tin, Total	EPA 6010B	ICP-AES
NW	Tin, Total	EPA 6010C	ICP-AES
NW	Titanium, Total	EPA 200.7 Rev. 4.4	ICP-AES
NW	Titanium, Total	EPA 6010B	ICP-AES
NW	Titanium, Total	EPA 6010C	ICP-AES
NW	Acrylates	Method	Technology
NW	Acrolein (Propenal)	EPA 5030B	PREP
NW	Acrolein (Propenal)	EPA 8260B	GC-MS
NW	Acrolein (Propenal)	EPA 624	GC-MS
NW	Acrylonitrile	EPA 5030B	PREP
NW	Acrylonitrile	EPA 8260B	GC-MS
NW	Acrylonitrile	EPA 624	GC-MS
NW	Ethyl methacrylate	EPA 8260B	GC-MS
NW	Methyl acrylonitrile	EPA 8260B	GC-MS
NW	Methyl methacrylate	EPA 8260B	GC-MS
NW	Benzidines	Method	Technology
NW	Benzidine	EPA 3510C	PREP
NW	Benzidine	EPA 3520C	PREP
NW	Benzidine	EPA 625	GC-MS
NW	Benzidine	EPA 8270C	GC-MS
NW	3,3'-Dichlorobenzidine	EPA 3510C	PREP
NW	3,3'-Dichlorobenzidine	EPA 3520C	PREP
NW	3,3'-Dichlorobenzidine	EPA 625	GC-MS
NW	3,3'-Dichlorobenzidine	EPA 8270C	GC-MS
NW	3,3'-Dichlorobenzidine	EPA 8270D	GC-MS

Matrix	Analyte	Method	Technology
NW	3,3'-Dimethylbenzidine	EPA 8270C	GC-MS
NW	Chlorinated Hydrocarbons	Method	Technology
NW	1-Chloronaphthalene	EPA 8270C	GC-MS
NW	2-Chloronaphthalene	EPA 3510C	PREP
NW	2-Chloronaphthalene	EPA 3520C	PREP
NW	2-Chloronaphthalene	EPA 8121	GC-ECD
NW	2-Chloronaphthalene	EPA 625	GC-MS
NW	2-Chloronaphthalene	EPA 612	GC-ECD
NW	2-Chloronaphthalene	EPA 8270C	GC-MS
NW	2-Chloronaphthalene	EPA 8270D	GC-MS
NW	Hexachlorobenzene	EPA 3510C	PREP
NW	Hexachlorobenzene	EPA 3520C	PREP
NW	Hexachlorobenzene	EPA 8121	GC-ECD
NW	Hexachlorobenzene	EPA 625	GC-MS
NW	Hexachlorobenzene	EPA 612	GC-ECD
NW	Hexachlorobenzene	EPA 8270C	GC-MS
NW	Hexachlorobenzene	EPA 8270D	GC-MS
NW	Hexachlorobutadiene	EPA 3510C	PREP
NW	Hexachlorobutadiene	EPA 3520C	PREP
NW	Hexachlorobutadiene	EPA 8121	GC-ECD
NW	Hexachlorobutadiene	EPA 625	GC-MS
NW	Hexachlorobutadiene	EPA 612	GC-ECD
NW	Hexachlorobutadiene	EPA 8270C	GC-MS
NW	Hexachlorobutadiene	EPA 8270D	GC-MS
NW	Hexachloroethane	EPA 3510C	PREP
NW	Hexachloroethane	EPA 3520C	PREP
NW	Hexachloroethane	EPA 8121	GC-ECD
NW	Hexachloroethane	EPA 625	GC-MS
NW	Hexachloroethane	EPA 612	GC-ECD
NW	Hexachloroethane	EPA 8270C	GC-MS
NW	Hexachloroethane	EPA 8270D	GC-MS
NW	Hexachlorocyclopentadiene	EPA 3510C	PREP
NW	Hexachlorocyclopentadiene	EPA 3520C	PREP
NW	Hexachlorocyclopentadiene	EPA 8121	GC-ECD
NW	Hexachlorocyclopentadiene	EPA 625	GC-MS
NW	Hexachlorocyclopentadiene	EPA 612	GC-ECD
NW	Hexachlorocyclopentadiene	EPA 8270C	GC-MS
NW	Hexachlorocyclopentadiene	EPA 8270D	GC-MS
NW	Hexachloropropene	EPA 8270C	GC-MS
NW	Pentachlorobenzene	EPA 8270C	GC-MS
NW	1,2,4-Trichlorobenzene	EPA 3510C	PREP
NW	1,2,4-Trichlorobenzene	EPA 3520C	PREP

Matrix	Analyte	Method	Technology
NW	1,2,4-Trichlorobenzene	EPA 8121	GC-ECD
NW	1,2,4-Trichlorobenzene	EPA 625	GC-MS
NW	1,2,4-Trichlorobenzene	EPA 612	GC-ECD
NW	1,2,4-Trichlorobenzene	EPA 8270C	GC-MS
NW	1,2,4-Trichlorobenzene	EPA 8270D	GC-MS
NW	1,2,3-Trichlorobenzene	EPA 8260C	GC-MS
NW	1,2,3-Trichlorobenzene	EPA 8260B	GC-MS
NW	1,2,3-Trichlorobenzene	EPA 8021B	GCELCD/PID
NW	1,2,4,5-Tetrachlorobenzene	EPA 8270C	GC-MS
NW	Haloethers	Method	Technology
NW	Bis(2-chloroethyl)ether	EPA 3510C	PREP
NW	Bis(2-chloroethyl)ether	EPA 3520C	PREP
NW	Bis(2-chloroethyl)ether	EPA 625	GC-MS
NW	Bis(2-chloroethyl)ether	EPA 8270C	GC-MS
NW	Bis(2-chloroethyl)ether	EPA 8270D	GC-MS
NW	Bis (2-chloroisopropyl) ether	EPA 3510C	PREP
NW	Bis (2-chloroisopropyl) ether	EPA 3520C	PREP
NW	Bis (2-chloroisopropyl) ether	EPA 625	GC-MS
NW	Bis (2-chloroisopropyl) ether	EPA 8270C	GC-MS
NW	Bis (2-chloroisopropyl) ether	EPA 8270D	GC-MS
NW	Bis(2-chloroethoxy)methane	EPA 3510C	PREP
NW	Bis(2-chloroethoxy)methane	EPA 3520C	PREP
NW	Bis(2-chloroethoxy)methane	EPA 625	GC-MS
NW	Bis(2-chloroethoxy)methane	EPA 8270C	GC-MS
NW	Bis(2-chloroethoxy)methane	EPA 8270D	GC-MS
NW	4-Chlorophenylphenyl ether	EPA 3510C	PREP
NW	4-Chlorophenylphenyl ether	EPA 3520C	PREP
NW	4-Chlorophenylphenyl ether	EPA 625	GC-MS
NW	4-Chlorophenylphenyl ether	EPA 8270C	GC-MS
NW	4-Chlorophenylphenyl ether	EPA 8270D	GC-MS
NW	4-Bromophenylphenyl ether	EPA 3510C	PREP
NW	4-Bromophenylphenyl ether	EPA 3520C	PREP
NW	4-Bromophenylphenyl ether	EPA 625	GC-MS
NW	4-Bromophenylphenyl ether	EPA 8270C	GC-MS
NW	4-Bromophenylphenyl ether	EPA 8270D	GC-MS
NW	Nitroaromatics and Isophorone	Method	Technology
NW	1,3-Dinitrobenzene	EPA 8270C	GC-MS
NW	1,3,5-Trinitrobenzene	EPA 8270C	GC-MS
NW	1,4-Naphthoquinone	EPA 8270C	GC-MS
NW	2,4-Dinitrotoluene	EPA 3510C	PREP
NW	2,4-Dinitrotoluene	EPA 3520C	PREP
NW	2,4-Dinitrotoluene	EPA 625	GC-MS

Matrix	Analyte	Method	Technology
NW	2,4-Dinitrotoluene	EPA 8270C	GC-MS
NW	2,4-Dinitrotoluene	EPA 8270D	GC-MS
NW	2,6-Dinitrotoluene	EPA 3510C	PREP
NW	2,6-Dinitrotoluene	EPA 3520C	PREP
NW	2,6-Dinitrotoluene	EPA 625	GC-MS
NW	2,6-Dinitrotoluene	EPA 8270C	GC-MS
NW	2,6-Dinitrotoluene	EPA 8270D	GC-MS
NW	Isophorone	EPA 3510C	PREP
NW	Isophorone	EPA 3520C	PREP
NW	Isophorone	EPA 625	GC-MS
NW	Isophorone	EPA 8270C	GC-MS
NW	Isophorone	EPA 8270D	GC-MS
NW	Nitrobenzene	EPA 3510C	PREP
NW	Nitrobenzene	EPA 3520C	PREP
NW	Nitrobenzene	EPA 625	GC-MS
NW	Nitrobenzene	EPA 8270C	GC-MS
NW	Nitrobenzene	EPA 8270D	GC-MS
NW	Nitrosoamines	Method	Technology
NW	N-Nitrosodiethylamine	EPA 8270C	GC-MS
NW	N-Nitrosodiethylamine	EPA 8270D	GC-MS
NW	N-Nitrosodimethylamine	EPA 3510C	PREP
NW	N-Nitrosodimethylamine	EPA 3520C	PREP
NW	N-Nitrosodimethylamine	EPA 625	GC-MS
NW	N-Nitrosodimethylamine	EPA 8270C	GC-MS
NW	N-Nitrosodimethylamine	EPA 8270D	GC-MS
NW	N-Nitrosodiphenylamine	EPA 3510C	PREP
NW	N-Nitrosodiphenylamine	EPA 3520C	PREP
NW	N-Nitrosodiphenylamine	EPA 625	GC-MS
NW	N-Nitrosodiphenylamine	EPA 8270C	GC-MS
NW	N-Nitrosodiphenylamine	EPA 8270D	GC-MS
NW	N-Nitrosodi-n-butylamine	EPA 8270C	GC-MS
NW	N-nitrosomethylethylamine	EPA 8270C	GC-MS
NW	N-nitrosomorpholine	EPA 8270C	GC-MS
NW	N-nitrosomorpholine	EPA 8270D	GC-MS
NW	N-Nitrosodi-n-propylamine	EPA 3510C	PREP
NW	N-Nitrosodi-n-propylamine	EPA 3520C	PREP
NW	N-Nitrosodi-n-propylamine	EPA 625	GC-MS
NW	N-Nitrosodi-n-propylamine	EPA 8270C	GC-MS
NW	N-Nitrosodi-n-propylamine	EPA 8270D	GC-MS
NW	N-nitrosopiperidine	EPA 8270C	GC-MS
NW	N-Nitrosopyrrolidine	EPA 8270C	GC-MS
NW	Phthalate Esters	Method	Technology

Matrix	Analyte	Method	Technology
NW	Benzyl butyl phthalate	EPA 3510C	PREP
NW	Benzyl butyl phthalate	EPA 3520C	PREP
NW	Benzyl butyl phthalate	EPA 625	GC-MS
NW	Benzyl butyl phthalate	EPA 8270C	GC-MS
NW	Benzyl butyl phthalate	EPA 8270D	GC-MS
NW	Bis(2-ethylhexyl) phthalate	EPA 3510C	PREP
NW	Bis(2-ethylhexyl) phthalate	EPA 3520C	PREP
NW	Bis(2-ethylhexyl) phthalate	EPA 625	GC-MS
NW	Bis(2-ethylhexyl) phthalate	EPA 8270C	GC-MS
NW	Bis(2-ethylhexyl) phthalate	EPA 8270D	GC-MS
NW	Diethyl phthalate	EPA 3510C	PREP
NW	Diethyl phthalate	EPA 3520C	PREP
NW	Diethyl phthalate	EPA 625	GC-MS
NW	Diethyl phthalate	EPA 8270C	GC-MS
NW	Diethyl phthalate	EPA 8270D	GC-MS
NW	Dimethyl phthalate	EPA 3510C	PREP
NW	Dimethyl phthalate	EPA 3520C	PREP
NW	Dimethyl phthalate	EPA 625	GC-MS
NW	Dimethyl phthalate	EPA 8270C	GC-MS
NW	Dimethyl phthalate	EPA 8270D	GC-MS
NW	Di-n-butyl phthalate	EPA 3510C	PREP
NW	Di-n-butyl phthalate	EPA 3520C	PREP
NW	Di-n-butyl phthalate	EPA 625	GC-MS
NW	Di-n-butyl phthalate	EPA 8270C	GC-MS
NW	Di-n-butyl phthalate	EPA 8270D	GC-MS
NW	Di-n-octyl phthalate	EPA 3510C	PREP
NW	Di-n-octyl phthalate	EPA 3520C	PREP
NW	Di-n-octyl phthalate	EPA 625	GC-MS
NW	Di-n-octyl phthalate	EPA 8270C	GC-MS
NW	Di-n-octyl phthalate	EPA 8270D	GC-MS
NW	Polychlorinated Biphenyls	Method	Technology
NW	PCB-1016	EPA 3510C	PREP
NW	PCB-1016	EPA 8082	GC-ECD
NW	PCB-1016	EPA 8082A	GC-ECD
NW	PCB-1016	EPA 608	GC-ECD
NW	PCB-1221	EPA 3510C	PREP
NW	PCB-1221	EPA 8082	GC-ECD
NW	PCB-1221	EPA 8082A	GC-ECD
NW	PCB-1221	EPA 608	GC-ECD
NW	PCB-1232	EPA 3510C	PREP
NW	PCB-1232	EPA 8082	GC-ECD
NW	PCB-1232	EPA 8082A	GC-ECD

Matrix	Analyte	Method	Technology
NW	PCB-1232	EPA 608	GC-ECD
NW	PCB-1242	EPA 3510C	PREP
NW	PCB-1242	EPA 8082	GC-ECD
NW	PCB-1242	EPA 8082A	GC-ECD
NW	PCB-1242	EPA 608	GC-ECD
NW	PCB-1248	EPA 3510C	PREP
NW	PCB-1248	EPA 8082	GC-ECD
NW	PCB-1248	EPA 8082A	GC-ECD
NW	PCB-1248	EPA 608	GC-ECD
NW	PCB-1254	EPA 3510C	PREP
NW	PCB-1254	EPA 8082	GC-ECD
NW	PCB-1254	EPA 8082A	GC-ECD
NW	PCB-1254	EPA 608	GC-ECD
NW	PCB-1260	EPA 3510C	PREP
NW	PCB-1260	EPA 8082	GC-ECD
NW	PCB-1260	EPA 8082A	GC-ECD
NW	PCB-1260	EPA 608	GC-ECD
NW	PCB-1262	EPA 8082	GC-ECD
NW	PCB-1262	EPA 8082A	GC-ECD
NW	PCB-1268	EPA 8082	GC-ECD
NW	PCB-1268	EPA 8082A	GC-ECD
NW	Polynuclear Aromatics	Method	Technology
NW	2-Acetylaminofluorene	EPA 8270C	GC-MS
NW	Acenaphthene	EPA 3510C	PREP
NW	Acenaphthene	EPA 3520C	PREP
NW	Acenaphthene	EPA 625	GC-MS
NW	Acenaphthene	EPA 8270C	GC-MS
NW	Acenaphthene	EPA 8270D	GC-MS
NW	Anthracene	EPA 3510C	PREP
NW	Anthracene	EPA 3520C	PREP
NW	Anthracene	EPA 625	GC-MS
NW	Anthracene	EPA 8270C	GC-MS
NW	Anthracene	EPA 8270D	GC-MS
NW	Acenaphthylene	EPA 3510C	PREP
NW	Acenaphthylene	EPA 3520C	PREP
NW	Acenaphthylene	EPA 625	GC-MS
NW	Acenaphthylene	EPA 8270C	GC-MS
NW	Acenaphthylene	EPA 8270D	GC-MS
NW	Benzo(a)anthracene	EPA 3510C	PREP
NW	Benzo(a)anthracene	EPA 3520C	PREP
NW	Benzo(a)anthracene	EPA 625	GC-MS
NW	Benzo(a)anthracene	EPA 8270C	GC-MS

Matrix	Analyte	Method	Technology
NW	Benzo(a)anthracene	EPA 8270D	GC-MS
NW	Benzo(a)pyrene	EPA 3510C	PREP
NW	Benzo(a)pyrene	EPA 3520C	PREP
NW	Benzo(a)pyrene	EPA 625	GC-MS
NW	Benzo(a)pyrene	EPA 8270C	GC-MS
NW	Benzo(a)pyrene	EPA 8270D	GC-MS
NW	Benzo(b)fluoranthene	EPA 3510C	PREP
NW	Benzo(b)fluoranthene	EPA 3520C	PREP
NW	Benzo(b)fluoranthene	EPA 625	GC-MS
NW	Benzo(b)fluoranthene	EPA 8270C	GC-MS
NW	Benzo(b)fluoranthene	EPA 8270D	GC-MS
NW	Benzo(ghi)perylene	EPA 3510C	PREP
NW	Benzo(ghi)perylene	EPA 3520C	PREP
NW	Benzo(ghi)perylene	EPA 625	GC-MS
NW	Benzo(ghi)perylene	EPA 8270C	GC-MS
NW	Benzo(ghi)perylene	EPA 8270D	GC-MS
NW	Benzo(k)fluoranthene	EPA 3510C	PREP
NW	Benzo(k)fluoranthene	EPA 3520C	PREP
NW	Benzo(k)fluoranthene	EPA 625	GC-MS
NW	Benzo(k)fluoranthene	EPA 8270C	GC-MS
NW	Benzo(k)fluoranthene	EPA 8270D	GC-MS
NW	Chrysene	EPA 3510C	PREP
NW	Chrysene	EPA 3520C	PREP
NW	Chrysene	EPA 625	GC-MS
NW	Chrysene	EPA 8270C	GC-MS
NW	Chrysene	EPA 8270D	GC-MS
NW	Dibenzo(a,h)anthracene	EPA 3510C	PREP
NW	Dibenzo(a,h)anthracene	EPA 3520C	PREP
NW	Dibenzo(a,h)anthracene	EPA 625	GC-MS
NW	Dibenzo(a,h)anthracene	EPA 8270C	GC-MS
NW	Dibenzo(a,h)anthracene	EPA 8270D	GC-MS
NW	7,12-Dimethylbenzyl (a) anthracene	EPA 8270C	GC-MS
NW	Fluoranthene	EPA 3510C	PREP
NW	Fluoranthene	EPA 3520C	PREP
NW	Fluoranthene	EPA 625	GC-MS
NW	Fluoranthene	EPA 8270C	GC-MS
NW	Fluoranthene	EPA 8270D	GC-MS
NW	Fluorene	EPA 3510C	PREP
NW	Fluorene	EPA 3520C	PREP
NW	Fluorene	EPA 625	GC-MS
NW	Fluorene	EPA 8270C	GC-MS
NW	Fluorene	EPA 8270D	GC-MS

Matrix	Analyte	Method	Technology
NW	Indeno(1,2,3-cd)pyrene	EPA 3510C	PREP
NW	Indeno(1,2,3-cd)pyrene	EPA 3520C	PREP
NW	Indeno(1,2,3-cd)pyrene	EPA 625	GC-MS
NW	Indeno(1,2,3-cd)pyrene	EPA 8270C	GC-MS
NW	Indeno(1,2,3-cd)pyrene	EPA 8270D	GC-MS
NW	Naphthalene	EPA 3510C	PREP
NW	Naphthalene	EPA 3520C	PREP
NW	Naphthalene	EPA 625	GC-MS
NW	Naphthalene	EPA 8270C	GC-MS
NW	Naphthalene	EPA 8270D	GC-MS
NW	3-Methylcholanthrene	EPA 8270C	GC-MS
NW	Phenanthrene	EPA 3510C	PREP
NW	Phenanthrene	EPA 3520C	PREP
NW	Phenanthrene	EPA 625	GC-MS
NW	Phenanthrene	EPA 8270C	GC-MS
NW	Phenanthrene	EPA 8270D	GC-MS
NW	Pyrene	EPA 3510C	PREP
NW	Pyrene	EPA 3520C	PREP
NW	Pyrene	EPA 625	GC-MS
NW	Pyrene	EPA 8270C	GC-MS
NW	Pyrene	EPA 8270D	GC-MS
NW	Low Level Polynuclear Aromatics	Method	Technology
NW	Acenaphthene	EPA 8270C SIM	GC-MS
NW	Acenaphthylene	EPA 8270C SIM	GC-MS
NW	Anthracene	EPA 8270C SIM	GC-MS
NW	Benzo(a)anthracene	EPA 8270C SIM	GC-MS
NW	Benzo(b)fluoranthene	EPA 8270C SIM	GC-MS
NW	Benzo(k)fluoroanthene	EPA 8270C SIM	GC-MS
NW	Benzo(g,h,i)perylene	EPA 8270C SIM	GC-MS
NW	Benzo(a)pyrene	EPA 8270C SIM	GC-MS
NW	Chrysene	EPA 8270C SIM	GC-MS
NW	Dibenzo(a,h)anthracene	EPA 8270C SIM	GC-MS
NW	Fluoranthene	EPA 8270C SIM	GC-MS
NW	Fluorene	EPA 8270C SIM	GC-MS
NW	Indeno(1,2,3-cd)pyrene	EPA 8270C SIM	GC-MS
NW	Naphthalene	EPA 8270C SIM	GC-MS
NW	Phenanthrene	EPA 8270C SIM	GC-MS
NW	Pyrene	EPA 8270C SIM	GC-MS
NW	Priority Pollutant Phenols	Method	Technology
NW	4-Chloro-3-methylphenol	EPA 3510C	PREP
NW	4-Chloro-3-methylphenol	EPA 3520C	PREP
NW	4-Chloro-3-methylphenol	EPA 625	GC-MS

Matrix	Analyte	Method	Technology
NW	4-Chloro-3-methylphenol	EPA 8270C	GC-MS
NW	4-Chloro-3-methylphenol	EPA 8270D	GC-MS
NW	2-Chlorophenol	EPA 3510C	PREP
NW	2-Chlorophenol	EPA 3520C	PREP
NW	2-Chlorophenol	EPA 625	GC-MS
NW	2-Chlorophenol	EPA 8270C	GC-MS
NW	2-Chlorophenol	EPA 8270D	GC-MS
NW	2,4-Dichlorophenol	EPA 3510C	PREP
NW	2,4-Dichlorophenol	EPA 3520C	PREP
NW	2,4-Dichlorophenol	EPA 625	GC-MS
NW	2,4-Dichlorophenol	EPA 8270C	GC-MS
NW	2,4-Dichlorophenol	EPA 8270D	GC-MS
NW	2,6-Dichlorophenol	EPA 8270C	GC-MS
NW	2,6-Dichlorophenol	EPA 8270D	GC-MS
NW	2,4-Dimethylphenol	EPA 3510C	PREP
NW	2,4-Dimethylphenol	EPA 3520C	PREP
NW	2,4-Dimethylphenol	EPA 625	GC-MS
NW	2,4-Dimethylphenol	EPA 8270C	GC-MS
NW	2,4-Dimethylphenol	EPA 8270D	GC-MS
NW	2,4-Dinitrophenol	EPA 3510C	PREP
NW	2,4-Dinitrophenol	EPA 3520C	PREP
NW	2,4-Dinitrophenol	EPA 625	GC-MS
NW	2,4-Dinitrophenol	EPA 8270C	GC-MS
NW	2,4-Dinitrophenol	EPA 8270D	GC-MS
NW	2-Methyl-4,6-dinitrophenol	EPA 3510C	PREP
NW	2-Methyl-4,6-dinitrophenol	EPA 3520C	PREP
NW	2-Methyl-4,6-dinitrophenol	EPA 625	GC-MS
NW	2-Methyl-4,6-dinitrophenol	EPA 8270C	GC-MS
NW	2-Methyl-4,6-dinitrophenol	EPA 8270D	GC-MS
NW	2-Nitrophenol	EPA 3520C	PREP
NW	2-Nitrophenol	EPA 625	GC-MS
NW	2-Nitrophenol	EPA 8270C	GC-MS
NW	2-Nitrophenol	EPA 8270D	GC-MS
NW	4-Nitrophenol	EPA 3520C	PREP
NW	4-Nitrophenol	EPA 625	GC-MS
NW	4-Nitrophenol	EPA 8270C	GC-MS
NW	4-Nitrophenol	EPA 8270D	GC-MS
NW	2-Methylphenol	EPA 3510C	PREP
NW	2-Methylphenol	EPA 3520C	PREP
NW	2-Methylphenol	EPA 8270C	GC-MS
NW	2-Methylphenol	EPA 8270D	GC-MS
NW	3-Methylphenol	EPA 8270C	GC-MS

Matrix	Analyte	Method	Technology
NW	3-Methylphenol	EPA 8270D	GC-MS
NW	4-Methylphenol	EPA 3510C	PREP
NW	4-Methylphenol	EPA 3520C	PREP
NW	4-Methylphenol	EPA 8270C	GC-MS
NW	4-Methylphenol	EPA 8270D	GC-MS
NW	Cresols, Total	EPA 625	GC-MS
NW	Cresols, Total	EPA 8270C	GC-MS
NW	Cresols, Total	EPA 8270D	GC-MS
NW	Pentachlorophenol	EPA 3510C	PREP
NW	Pentachlorophenol	EPA 3520C	PREP
NW	Pentachlorophenol	EPA 625	GC-MS
NW	Pentachlorophenol	EPA 8270C	GC-MS
NW	Pentachlorophenol	EPA 8270D	GC-MS
NW	Phenol	EPA 3510C	PREP
NW	Phenol	EPA 3520C	PREP
NW	Phenol	EPA 625	GC-MS
NW	Phenol	EPA 8270C	GC-MS
NW	Phenol	EPA 8270D	GC-MS
NW	2,3,4,6 Tetrachlorophenol	EPA 8270C	GC-MS
NW	2,3,4,6 Tetrachlorophenol	EPA 8270D	GC-MS
NW	2,4,5-Trichlorophenol	EPA 3520C	PREP
NW	2,4,5-Trichlorophenol	EPA 625	GC-MS
NW	2,4,5-Trichlorophenol	EPA 8270C	GC-MS
NW	2,4,5-Trichlorophenol	EPA 8270D	GC-MS
NW	2,4,6-Trichlorophenol	EPA 3510C	PREP
NW	2,4,6-Trichlorophenol	EPA 3520C	PREP
NW	2,4,6-Trichlorophenol	EPA 625	GC-MS
NW	2,4,6-Trichlorophenol	EPA 8270C	GC-MS
NW	2,4,6-Trichlorophenol	EPA 8270D	GC-MS
NW	Volatile Aromatics	Method	Technology
NW	1,2,4-Trichlorobenzene, Volatile	EPA 8260C	GC-MS
NW	1,2,4-Trichlorobenzene, Volatile	EPA 8260B	GC-MS
NW	1,2,4-Trichlorobenzene, Volatile	EPA 8021B	GCELCD/PID
NW	Benzene	EPA 5030B	PREP
NW	Benzene	EPA 8260C	GC-MS
NW	Benzene	EPA 8260B	GC-MS
NW	Benzene	EPA 8021B	GCELCD/PID
NW	Benzene	EPA 624	GC-MS
NW	Benzene	EPA 602	GC-PID
NW	Bromobenzene	EPA 8260C	GC-MS
NW	Bromobenzene	EPA 8260B	GC-MS
NW	Chlorobenzene	EPA 5030B	PREP

Matrix	Analyte	Method	Technology
NW	Chlorobenzene	EPA 8260C	GC-MS
NW	Chlorobenzene	EPA 8260B	GC-MS
NW	Chlorobenzene	EPA 8021B	GCELCD/PID
NW	Chlorobenzene	EPA 601	GC-ELCD
NW	Chlorobenzene	EPA 624	GC-MS
NW	Chlorobenzene	EPA 602	GC-PID
NW	1,2-Dichlorobenzene	EPA 5030B	PREP
NW	1,2-Dichlorobenzene	EPA 8260C	GC-MS
NW	1,2-Dichlorobenzene	EPA 8260B	GC-MS
NW	1,2-Dichlorobenzene	EPA 8021B	GCELCD/PID
NW	1,2-Dichlorobenzene	EPA 601	GC-ELCD
NW	1,2-Dichlorobenzene	EPA 624	GC-MS
NW	1,2-Dichlorobenzene	EPA 602	GC-PID
NW	1,3-Dichlorobenzene	EPA 5030B	PREP
NW	1,3-Dichlorobenzene	EPA 8260C	GC-MS
NW	1,3-Dichlorobenzene	EPA 8260B	GC-MS
NW	1,3-Dichlorobenzene	EPA 8021B	GCELCD/PID
NW	1,3-Dichlorobenzene	EPA 601	GC-ELCD
NW	1,3-Dichlorobenzene	EPA 624	GC-MS
NW	1,3-Dichlorobenzene	EPA 602	GC-PID
NW	1,4-Dichlorobenzene	EPA 5030B	PREP
NW	1,4-Dichlorobenzene	EPA 8260C	GC-MS
NW	1,4-Dichlorobenzene	EPA 8260B	GC-MS
NW	1,4-Dichlorobenzene	EPA 8021B	GCELCD/PID
NW	1,4-Dichlorobenzene	EPA 601	GC-ELCD
NW	1,4-Dichlorobenzene	EPA 624	GC-MS
NW	1,4-Dichlorobenzene	EPA 602	GC-PID
NW	1,2,4-Trimethylbenzene	EPA 8260B	GC-MS
NW	1,2,4-Trimethylbenzene	EPA 8021B	GCELCD/PID
NW	1,3,5-Trimethylbenzene	EPA 8260B	GC-MS
NW	1,3,5-Trimethylbenzene	EPA 8021B	GCELCD/PID
NW	2-Chlorotoluene	EPA 8260B	GC-MS
NW	2-Chlorotoluene	EPA 8021B	GCELCD/PID
NW	4-Chlorotoluene	EPA 8260B	GC-MS
NW	4-Chlorotoluene	EPA 8021B	GCELCD/PID
NW	Ethyl benzene	EPA 5030B	PREP
NW	Ethyl benzene	EPA 8260C	GC-MS
NW	Ethyl benzene	EPA 8260B	GC-MS
NW	Ethyl benzene	EPA 8021B	GCELCD/PID
NW	Ethyl benzene	EPA 624	GC-MS
NW	Ethyl benzene	EPA 602	GC-PID
NW	Isopropylbenzene	EPA 8260C	GC-MS

Matrix	Analyte	Method	Technology
NW	Isopropylbenzene	EPA 8260B	GC-MS
NW	Isopropylbenzene	EPA 8021B	GCELCD/PID
NW	Naphthalene, Volatile	EPA 8260B	GC-MS
NW	Naphthalene, Volatile	EPA 8021B	GCELCD/PID
NW	n-Butylbenzene	EPA 8260B	GC-MS
NW	n-Butylbenzene	EPA 8021B	GCELCD/PID
NW	n-Propylbenzene	EPA 8260B	GC-MS
NW	n-Propylbenzene	EPA 8021B	GCELCD/PID
NW	p-Isopropyltoluene (P-Cymene)	EPA 8260B	GC-MS
NW	p-Isopropyltoluene (P-Cymene)	EPA 8021B	GCELCD/PID
NW	Toluene	EPA 5030B	PREP
NW	Toluene	EPA 8260C	GC-MS
NW	Toluene	EPA 8260B	GC-MS
NW	Toluene	EPA 8021B	GCELCD/PID
NW	Toluene	EPA 624	GC-MS
NW	Toluene	EPA 602	GC-PID
NW	Total Xylenes	EPA 5030B	PREP
NW	Total Xylenes	EPA 8260C	GC-MS
NW	Total Xylenes	EPA 8260B	GC-MS
NW	Total Xylenes	EPA 8021B	GCELCD/PID
NW	Total Xylenes	EPA 624	GC-MS
NW	Total Xylenes	EPA 602	GC-PID
NW	sec-Butylbenzene	EPA 8260B	GC-MS
NW	sec-Butylbenzene	EPA 8021B	GCELCD/PID
NW	tert-Butylbenzene	EPA 8260B	GC-MS
NW	tert-Butylbenzene	EPA 8021B	GCELCD/PID
NW	Styrene	EPA 5030B	PREP
NW	Styrene	EPA 8260C	GC-MS
NW	Styrene	EPA 8260B	GC-MS
NW	Styrene	EPA 8021B	GCELCD/PID
NW	Styrene	EPA 624	GC-MS
NW	Volatile Halocarbons	Method	Technology
NW	Bromochloromethane	EPA 5030B	PREP
NW	Bromochloromethane	EPA 8260C	GC-MS
NW	Bromochloromethane	EPA 8260B	GC-MS
NW	Bromochloromethane	EPA 8021B	GCELCD/PID
NW	Bromodichloromethane	EPA 5030B	PREP
NW	Bromodichloromethane	EPA 8260C	GC-MS
NW	Bromodichloromethane	EPA 8260B	GC-MS
NW	Bromodichloromethane	EPA 8021B	GCELCD/PID
NW	Bromodichloromethane	EPA 601	GC-ELCD
NW	Bromodichloromethane	EPA 624	GC-MS

Matrix	Analyte	Method	Technology
NW	Bromoform	EPA 5030B	PREP
NW	Bromoform	EPA 8260C	GC-MS
NW	Bromoform	EPA 8260B	GC-MS
NW	Bromoform	EPA 8021B	GCELCD/PID
NW	Bromoform	EPA 601	GC-ELCD
NW	Bromoform	EPA 624	GC-MS
NW	Bromomethane	EPA 5030B	PREP
NW	Bromomethane	EPA 8260C	GC-MS
NW	Bromomethane	EPA 8260B	GC-MS
NW	Bromomethane	EPA 8021B	GCELCD/PID
NW	Bromomethane	EPA 601	GC-ELCD
NW	Bromomethane	EPA 624	GC-MS
NW	Carbon tetrachloride	EPA 5030B	PREP
NW	Carbon tetrachloride	EPA 8260C	GC-MS
NW	Carbon tetrachloride	EPA 8260B	GC-MS
NW	Carbon tetrachloride	EPA 8021B	GCELCD/PID
NW	Carbon tetrachloride	EPA 601	GC-ELCD
NW	Carbon tetrachloride	EPA 624	GC-MS
NW	Chloroethane	EPA 5030B	PREP
NW	Chloroethane	EPA 8260C	GC-MS
NW	Chloroethane	EPA 8260B	GC-MS
NW	Chloroethane	EPA 8021B	GCELCD/PID
NW	Chloroethane	EPA 601	GC-ELCD
NW	Chloroethane	EPA 624	GC-MS
NW	2-Chloro-1,3-butadiene (Chloroprene)	EPA 5030B	PREP
NW	2-Chloro-1,3-butadiene (Chloroprene)	EPA 8260B	GC-MS
NW	2-Chloroethylvinyl ether	EPA 5030B	PREP
NW	2-Chloroethylvinyl ether	EPA 8260B	GC-MS
NW	2-Chloroethylvinyl ether	EPA 8021B	GCELCD/PID
NW	2-Chloroethylvinyl ether	EPA 601	GC-ELCD
NW	2-Chloroethylvinyl ether	EPA 624	GC-MS
NW	Chloroform	EPA 5030B	PREP
NW	Chloroform	EPA 8260C	GC-MS
NW	Chloroform	EPA 8260B	GC-MS
NW	Chloroform	EPA 8021B	GCELCD/PID
NW	Chloroform	EPA 601	GC-ELCD
NW	Chloroform	EPA 624	GC-MS
NW	Chloromethane	EPA 5030B	PREP
NW	Chloromethane	EPA 8260C	GC-MS
NW	Chloromethane	EPA 8260B	GC-MS
NW	Chloromethane	EPA 8021B	GCELCD/PID
NW	Chloromethane	EPA 601	GC-ELCD

Matrix	Analyte	Method	Technology
NW	Chloromethane	EPA 624	GC-MS
NW	3-Chloropropene (Allyl chloride)	EPA 5030B	PREP
NW	3-Chloropropene (Allyl chloride)	EPA 8260B	GC-MS
NW	Dibromochloromethane	EPA 5030B	PREP
NW	Dibromochloromethane	EPA 8260C	GC-MS
NW	Dibromochloromethane	EPA 8260B	GC-MS
NW	Dibromochloromethane	EPA 8021B	GCELCD/PID
NW	Dibromochloromethane	EPA 601	GC-ELCD
NW	Dibromochloromethane	EPA 624	GC-MS
NW	Dibromomethane	EPA 5030B	PREP
NW	Dibromomethane	EPA 8260C	GC-MS
NW	Dibromomethane	EPA 8260B	GC-MS
NW	Dibromomethane	EPA 8021B	GCELCD/PID
NW	Dichlorodifluoromethane	EPA 5030B	PREP
NW	Dichlorodifluoromethane	EPA 8260C	GC-MS
NW	Dichlorodifluoromethane	EPA 8260B	GC-MS
NW	Dichlorodifluoromethane	EPA 8021B	GCELCD/PID
NW	Dichlorodifluoromethane	EPA 601	GC-ELCD
NW	Dichlorodifluoromethane	EPA 624	GC-MS
NW	trans-1,4-Dichloro-2-butene	EPA 5030B	PREP
NW	trans-1,4-Dichloro-2-butene	EPA 8260B	GC-MS
NW	1,1-Dichloroethane	EPA 5030B	PREP
NW	1,1-Dichloroethane	EPA 8260C	GC-MS
NW	1,1-Dichloroethane	EPA 8260B	GC-MS
NW	1,1-Dichloroethane	EPA 8021B	GCELCD/PID
NW	1,1-Dichloroethane	EPA 601	GC-ELCD
NW	1,1-Dichloroethane	EPA 624	GC-MS
NW	1,2-Dichloroethane	EPA 5030B	PREP
NW	1,2-Dichloroethane	EPA 8260C	GC-MS
NW	1,2-Dichloroethane	EPA 8260B	GC-MS
NW	1,2-Dichloroethane	EPA 8021B	GCELCD/PID
NW	1,2-Dichloroethane	EPA 601	GC-ELCD
NW	1,2-Dichloroethane	EPA 624	GC-MS
NW	1,1-Dichloroethene	EPA 5030B	PREP
NW	1,1-Dichloroethene	EPA 8260C	GC-MS
NW	1,1-Dichloroethene	EPA 8260B	GC-MS
NW	1,1-Dichloroethene	EPA 8021B	GCELCD/PID
NW	1,1-Dichloroethene	EPA 601	GC-ELCD
NW	1,1-Dichloroethene	EPA 624	GC-MS
NW	cis-1,2-Dichloroethene	EPA 5030B	PREP
NW	cis-1,2-Dichloroethene	EPA 8260C	GC-MS
NW	cis-1,2-Dichloroethene	EPA 8260B	GC-MS

Matrix	Analyte	Method	Technology
NW	cis-1,2-Dichloroethene	EPA 8021B	GCELCD/PID
NW	cis-1,2-Dichloroethene	EPA 624	GC-MS
NW	trans-1,2-Dichloroethene	EPA 5030B	PREP
NW	trans-1,2-Dichloroethene	EPA 8260C	GC-MS
NW	trans-1,2-Dichloroethene	EPA 8260B	GC-MS
NW	trans-1,2-Dichloroethene	EPA 8021B	GCELCD/PID
NW	trans-1,2-Dichloroethene	EPA 601	GC-ELCD
NW	trans-1,2-Dichloroethene	EPA 624	GC-MS
NW	1,1-Dichloropropene	EPA 5030B	PREP
NW	1,1-Dichloropropene	EPA 8260B	GC-MS
NW	1,1-Dichloropropene	EPA 8021B	GCELCD/PID
NW	1,2-Dichloropropane	EPA 5030B	PREP
NW	1,2-Dichloropropane	EPA 8260C	GC-MS
NW	1,2-Dichloropropane	EPA 8260B	GC-MS
NW	1,2-Dichloropropane	EPA 8021B	GCELCD/PID
NW	1,2-Dichloropropane	EPA 601	GC-ELCD
NW	1,2-Dichloropropane	EPA 624	GC-MS
NW	1,3-Dichloropropane	EPA 5030B	PREP
NW	1,3-Dichloropropane	EPA 8260B	GC-MS
NW	1,3-Dichloropropane	EPA 8021B	GCELCD/PID
NW	2,2-Dichloropropane	EPA 5030B	PREP
NW	2,2-Dichloropropane	EPA 8260B	GC-MS
NW	2,2-Dichloropropane	EPA 8021B	GCELCD/PID
NW	trans-1,3-Dichloropropene	EPA 5030B	PREP
NW	trans-1,3-Dichloropropene	EPA 8260C	GC-MS
NW	trans-1,3-Dichloropropene	EPA 8260B	GC-MS
NW	trans-1,3-Dichloropropene	EPA 8021B	GCELCD/PID
NW	trans-1,3-Dichloropropene	EPA 601	GC-ELCD
NW	trans-1,3-Dichloropropene	EPA 624	GC-MS
NW	cis-1,3-Dichloropropene	EPA 5030B	PREP
NW	cis-1,3-Dichloropropene	EPA 8260C	GC-MS
NW	cis-1,3-Dichloropropene	EPA 8260B	GC-MS
NW	cis-1,3-Dichloropropene	EPA 8021B	GCELCD/PID
NW	cis-1,3-Dichloropropene	EPA 601	GC-ELCD
NW	cis-1,3-Dichloropropene	EPA 624	GC-MS
NW	1,2-Dibromo-3-chloropropane	EPA 5030B	PREP
NW	1,2-Dibromo-3-chloropropane	EPA 8260C	GC-MS
NW	1,2-Dibromo-3-chloropropane	EPA 8260B	GC-MS
NW	1,2-Dibromo-3-chloropropane	EPA 8021B	GCELCD/PID
NW	1,2-Dibromo-3-chloropropane	EPA 8011	GC-ECD
NW	1,2-Dibromoethane	EPA 5030B	PREP
NW	1,2-Dibromoethane	EPA 8260C	GC-MS

Matrix	Analyte	Method	Technology
NW	1,2-Dibromoethane	EPA 8260B	GC-MS
NW	1,2-Dibromoethane	EPA 8021B	GCELCD/PID
NW	1,2-Dibromoethane	EPA 8011	GC-ECD
NW	Hexachlorobutadiene, Volatile	EPA 8260B	GC-MS
NW	Hexachlorobutadiene, Volatile	EPA 8021B	GCELCD/PID
NW	Methylene chloride	EPA 5030B	PREP
NW	Methylene chloride	EPA 8260C	GC-MS
NW	Methylene chloride	EPA 8260B	GC-MS
NW	Methylene chloride	EPA 8021B	GCELCD/PID
NW	Methylene chloride	EPA 601	GC-ELCD
NW	Methylene chloride	EPA 624	GC-MS
NW	Methyl iodide	EPA 8260B	GC-MS
NW	1,1,1,2-Tetrachloroethane	EPA 5030B	PREP
NW	1,1,1,2-Tetrachloroethane	EPA 8260B	GC-MS
NW	1,1,1,2-Tetrachloroethane	EPA 8021B	GCELCD/PID
NW	1,1,2,2-Tetrachloroethane	EPA 5030B	PREP
NW	1,1,2,2-Tetrachloroethane	EPA 8260C	GC-MS
NW	1,1,2,2-Tetrachloroethane	EPA 8260B	GC-MS
NW	1,1,2,2-Tetrachloroethane	EPA 8021B	GCELCD/PID
NW	1,1,2,2-Tetrachloroethane	EPA 601	GC-ELCD
NW	1,1,2,2-Tetrachloroethane	EPA 624	GC-MS
NW	Tetrachloroethene	EPA 5030B	PREP
NW	Tetrachloroethene	EPA 8260C	GC-MS
NW	Tetrachloroethene	EPA 8260B	GC-MS
NW	Tetrachloroethene	EPA 8021B	GCELCD/PID
NW	Tetrachloroethene	EPA 601	GC-ELCD
NW	Tetrachloroethene	EPA 624	GC-MS
NW	1,1,1-Trichloroethane	EPA 5030B	PREP
NW	1,1,1-Trichloroethane	EPA 8260C	GC-MS
NW	1,1,1-Trichloroethane	EPA 8260B	GC-MS
NW	1,1,1-Trichloroethane	EPA 8021B	GCELCD/PID
NW	1,1,1-Trichloroethane	EPA 601	GC-ELCD
NW	1,1,1-Trichloroethane	EPA 624	GC-MS
NW	1,1,2-Trichloroethane	EPA 5030B	PREP
NW	1,1,2-Trichloroethane	EPA 8260C	GC-MS
NW	1,1,2-Trichloroethane	EPA 8260B	GC-MS
NW	1,1,2-Trichloroethane	EPA 8021B	GCELCD/PID
NW	1,1,2-Trichloroethane	EPA 601	GC-ELCD
NW	1,1,2-Trichloroethane	EPA 624	GC-MS
NW	Trichloroethene	EPA 5030B	PREP
NW	Trichloroethene	EPA 8260C	GC-MS
NW	Trichloroethene	EPA 8260B	GC-MS

Matrix	Analyte	Method	Technology
NW	Trichloroethene	EPA 8021B	GCELCD/PID
NW	Trichloroethene	EPA 601	GC-ELCD
NW	Trichloroethene	EPA 624	GC-MS
NW	Trichlorofluoromethane	EPA 5030B	PREP
NW	Trichlorofluoromethane	EPA 8260C	GC-MS
NW	Trichlorofluoromethane	EPA 8260B	GC-MS
NW	Trichlorofluoromethane	EPA 8021B	GCELCD/PID
NW	Trichlorofluoromethane	EPA 601	GC-ELCD
NW	Trichlorofluoromethane	EPA 624	GC-MS
NW	1,2,3-Trichloropropane	EPA 5030B	PREP
NW	1,2,3-Trichloropropane	EPA 8260C	GC-MS
NW	1,2,3-Trichloropropane	EPA 8260B	GC-MS
NW	1,2,3-Trichloropropane	EPA 8021B	GCELCD/PID
NW	1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260C	GC-MS
NW	1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260B	GC-MS
NW	Vinyl chloride	EPA 5030B	PREP
NW	Vinyl chloride	EPA 8260C	GC-MS
NW	Vinyl chloride	EPA 8260B	GC-MS
NW	Vinyl chloride	EPA 8021B	GCELCD/PID
NW	Vinyl chloride	EPA 601	GC-ELCD
NW	Vinyl chloride	EPA 624	GC-MS
NW	Chlorinated Hydrocarbon Pesticides	Method	Technology
NW	Aldrin	EPA 8081A	GC-ECD
NW	Aldrin	EPA 8081B	GC-ECD
NW	Aldrin	EPA 3510C	PREP
NW	Aldrin	EPA 3520C	PREP
NW	Aldrin	EPA 608	GC-ECD
NW	alpha-BHC	EPA 8081A	GC-ECD
NW	alpha-BHC	EPA 8081B	GC-ECD
NW	alpha-BHC	EPA 3510C	PREP
NW	alpha-BHC	EPA 3520C	PREP
NW	alpha-BHC	EPA 608	GC-ECD
NW	beta-BHC	EPA 8081A	GC-ECD
NW	beta-BHC	EPA 8081B	GC-ECD
NW	beta-BHC	EPA 3510C	PREP
NW	beta-BHC	EPA 3520C	PREP
NW	beta-BHC	EPA 608	GC-ECD
NW	delta-BHC	EPA 8081A	GC-ECD
NW	delta-BHC	EPA 8081B	GC-ECD
NW	delta-BHC	EPA 3510C	PREP
NW	delta-BHC	EPA 3520C	PREP
NW	delta-BHC	EPA 608	GC-ECD

Matrix	Analyte	Method	Technology
NW	Lindane	EPA 8081A	GC-ECD
NW	Lindane	EPA 8081B	GC-ECD
NW	Lindane	EPA 3510C	PREP
NW	Lindane	EPA 3520C	PREP
NW	Lindane	EPA 608	GC-ECD
NW	alpha-Chlordane	EPA 8081A	GC-ECD
NW	alpha-Chlordane	EPA 8081B	GC-ECD
NW	alpha-Chlordane	EPA 3510C	PREP
NW	alpha-Chlordane	EPA 3520C	PREP
NW	gamma-Chlordane	EPA 8081A	GC-ECD
NW	gamma-Chlordane	EPA 8081B	GC-ECD
NW	gamma-Chlordane	EPA 3510C	PREP
NW	gamma-Chlordane	EPA 3520C	PREP
NW	Chlordane Total	EPA 8081A	GC-ECD
NW	Chlordane Total	EPA 3510C	PREP
NW	Chlordane Total	EPA 3520C	PREP
NW	Chlordane Total	EPA 608	GC-ECD
NW	Chlorobenzilate	EPA 8270C	GC-MS
NW	4,4'-DDD	EPA 8081A	GC-ECD
NW	4,4'-DDD	EPA 8081B	GC-ECD
NW	4,4'-DDD	EPA 3510C	PREP
NW	4,4'-DDD	EPA 3520C	PREP
NW	4,4'-DDD	EPA 608	GC-ECD
NW	4,4'-DDE	EPA 8081A	GC-ECD
NW	4,4'-DDE	EPA 8081B	GC-ECD
NW	4,4'-DDE	EPA 3510C	PREP
NW	4,4'-DDE	EPA 3520C	PREP
NW	4,4'-DDE	EPA 608	GC-ECD
NW	4,4'-DDT	EPA 8081A	GC-ECD
NW	4,4'-DDT	EPA 8081B	GC-ECD
NW	4,4'-DDT	EPA 3510C	PREP
NW	4,4'-DDT	EPA 3520C	PREP
NW	4,4'-DDT	EPA 608	GC-ECD
NW	Diallate	EPA 8270C	GC-MS
NW	Dieldrin	EPA 8081A	GC-ECD
NW	Dieldrin	EPA 8081B	GC-ECD
NW	Dieldrin	EPA 3510C	PREP
NW	Dieldrin	EPA 3520C	PREP
NW	Dieldrin	EPA 608	GC-ECD
NW	Endosulfan I	EPA 8081A	GC-ECD
NW	Endosulfan I	EPA 8081B	GC-ECD
NW	Endosulfan I	EPA 3510C	PREP

Matrix	Analyte	Method	Technology
NW	Endosulfan I	EPA 3520C	PREP
NW	Endosulfan I	EPA 608	GC-ECD
NW	Endosulfan II	EPA 8081A	GC-ECD
NW	Endosulfan II	EPA 8081B	GC-ECD
NW	Endosulfan II	EPA 3510C	PREP
NW	Endosulfan II	EPA 3520C	PREP
NW	Endosulfan II	EPA 608	GC-ECD
NW	Endosulfan sulfate	EPA 8081A	GC-ECD
NW	Endosulfan sulfate	EPA 8081B	GC-ECD
NW	Endosulfan sulfate	EPA 3510C	PREP
NW	Endosulfan sulfate	EPA 3520C	PREP
NW	Endosulfan sulfate	EPA 608	GC-ECD
NW	Endrin	EPA 8081A	GC-ECD
NW	Endrin	EPA 8081B	GC-ECD
NW	Endrin	EPA 3510C	PREP
NW	Endrin	EPA 3520C	PREP
NW	Endrin	EPA 608	GC-ECD
NW	Endrin aldehyde	EPA 8081A	GC-ECD
NW	Endrin aldehyde	EPA 8081B	GC-ECD
NW	Endrin aldehyde	EPA 3510C	PREP
NW	Endrin aldehyde	EPA 3520C	PREP
NW	Endrin aldehyde	EPA 608	GC-ECD
NW	Endrin Ketone	EPA 8081A	GC-ECD
NW	Endrin Ketone	EPA 8081B	GC-ECD
NW	Heptachlor	EPA 8081A	GC-ECD
NW	Heptachlor	EPA 8081B	GC-ECD
NW	Heptachlor	EPA 3510C	PREP
NW	Heptachlor	EPA 3520C	PREP
NW	Heptachlor	EPA 608	GC-ECD
NW	Heptachlor epoxide	EPA 8081A	GC-ECD
NW	Heptachlor epoxide	EPA 8081B	GC-ECD
NW	Heptachlor epoxide	EPA 3510C	PREP
NW	Heptachlor epoxide	EPA 3520C	PREP
NW	Heptachlor epoxide	EPA 608	GC-ECD
NW	Isodrin	EPA 8081A	GC-ECD
NW	Isodrin	EPA 8081B	GC-ECD
NW	Isodrin	EPA 8270C	GC-MS
NW	Mirex	SM 18-20 6630B	GC-ECD
NW	Methoxychlor	EPA 8081A	GC-ECD
NW	Methoxychlor	EPA 8081B	GC-ECD
NW	Methoxychlor	EPA 3510C	PREP
NW	Methoxychlor	EPA 3520C	PREP

Matrix	Analyte	Method	Technology
NW	Methoxychlor	EPA 608	GC-ECD
NW	PCNB	EPA 8270C	GC-MS
NW	Toxaphene	EPA 8081A	GC-ECD
NW	Toxaphene	EPA 8081B	GC-ECD
NW	Toxaphene	EPA 3510C	PREP
NW	Toxaphene	EPA 3520C	PREP
NW	Toxaphene	EPA 608	GC-ECD
NW	Chlorophenoxy Acid Pesticides	Method	Technology
NW	2,4-D	EPA 8151A	GC-ECD
NW	2,4-DB	EPA 8151A	GC-ECD
NW	Dalapon	EPA 8151A	GC-ECD
NW	Dicamba	EPA 8151A	GC-ECD
NW	Dinoseb	EPA 8151A	GC-ECD
NW	Dinoseb	EPA 8270C	GC-MS
NW	2,4,5-T	EPA 8151A	GC-ECD
NW	2,4,5-TP (Silvex)	EPA 8151A	GC-ECD
NW	Organophosphate Pesticides	Method	Technology
NW	Atrazine	EPA 8270C	GC-MS
NW	Azinphos methyl	EPA 8141A	GC-NPD
NW	Chlorpyriphos	EPA 8141A	GC-NPD
NW	Diazinon	EPA 8141A	GC-NPD
NW	Disulfoton	EPA 8141A	GC-NPD
NW	Disulfoton	EPA 8270C	GC-MS
NW	Demeton-O	EPA 8141A	GC-NPD
NW	Demeton-S	EPA 8141A	GC-NPD
NW	Dimethoate	EPA 8141A	GC-NPD
NW	Dimethoate	EPA 8270C	GC-MS
NW	Famphur	EPA 8141A	GC-NPD
NW	Malathion	EPA 8141A	GC-NPD
NW	Parathion ethyl	EPA 8141A	GC-NPD
NW	Parathion ethyl	EPA 8270C	GC-MS
NW	Parathion methyl	EPA 8141A	GC-NPD
NW	Phorate	EPA 8141A	GC-NPD
NW	Phorate	EPA 8270C	GC-MS
NW	Thionazin	EPA 8270C	GC-MS
NW	Volatile Chlorinated Organics	Method	Technology
NW	Benzyl chloride	EPA 8260B	GC-MS
NW	Wastewater Miscellaneous	Method	Technology
NW	Turbidity	EPA 180.1 Rev. 2.0	COLOR
NW	Total Residual Chlorine	SM 18-21 4500-Cl G (00)	COLOR
NW	Total Chlorine Residual, Low Level	SM 18-21 4500-Cl G (00)	COLOR
NW	Boron, Total	EPA 200.7 Rev. 4.4	ICP-AES

Matrix	Analyte	Method	Technology
NW	Boron, Total	EPA 3010A	PREP
NW	Boron, Total	EPA 3005A	PREP
NW	Boron, Total	EPA 6010B	ICP-AES
NW	Boron, Total	EPA 6010C	ICP-AES
NW	Bromide	EPA 300.0 Rev. 2.1	IC-COND
NW	Bromide	EPA 9056A	IC-COND
NW	Color	SM 18-21 2120B (01)	COLOR
NW	Corrosivity	SM 18-19 2330	CALC
NW	Cyanide, Total	SM 18-20 4500-CN C	PREP
NW	Cyanide, Total	EPA 9010B	PREP
NW	Cyanide, Total	EPA 9014	COLOR
NW	Cyanide, Total	SM 18-21 4500-CN E (99)	COLOR
NW	Cyanide, Total	SM 18-21 4500-CN G (99)	COLOR
NW	Hydrogen Ion (pH)	EPA 9040B	POT
NW	Hydrogen Ion (pH)	SM 18-21 4500-H B (00)	POT
NW	Oil & Grease Total Recoverable (HEM)	EPA 1664A	GRAV
NW	Organic Carbon, Total	SM 18-21 5310B (00)	IR
NW	Perchlorate	EPA 314.0	IC-COND
NW	Phenols	EPA 420.1 Rev. 1978	COLOR
NW	Phenols	EPA 9065	COLOR
NW	Silica, Dissolved	EPA 200.7 Rev. 4.4	ICP-AES
NW	Silica, Dissolved	EPA 6010B	ICP-AES
NW	Specific Conductance	EPA 120.1 Rev. 1982	COND
NW	Surfactant (MBAS)	SM 18-21 5540C (00)	COLOR
NW	Sulfide (as S)	EPA 9030B	PREP
NW	Sulfide (as S)	EPA 9034	TITR
NW	Sulfide (as S)	SM 18 4500-S E	TITR
NW	Temperature	SM 18-21 2550B (00)	99
NW	Total Petroleum Hydrocarbons	EPA 1664A	GRAV
NW	Amines	Method	Technology
NW	Aniline	EPA 625	GC-MS
NW	Aniline	EPA 8270C	GC-MS
NW	4-Chloroaniline	EPA 8270C	GC-MS
NW	1-Naphthylamine	EPA 8270C	GC-MS
NW	1,2-Diphenylhydrazine	EPA 8270C	GC-MS
NW	1,2-Diphenylhydrazine	EPA 8270D	GC-MS
NW	2-Naphthylamine	EPA 8270C	GC-MS
NW	2-Nitroaniline	EPA 8270C	GC-MS
NW	3-Nitroaniline	EPA 8270C	GC-MS
NW	4-Nitroaniline	EPA 8270C	GC-MS
NW	5-Nitro-o-toluidine	EPA 8270C	GC-MS
NW	Carbazole	EPA 8270C	GC-MS

Matrix	Analyte	Method	Technology
NW	Diphenylamine	EPA 8270C	GC-MS
NW	Methapyrilene	EPA 8270C	GC-MS
NW	1,4-Phenylenediamine	EPA 8270C	GC-MS
NW	Pronamide	EPA 8270C	GC-MS
NW	Propionitrile	EPA 8260B	GC-MS
NW	Pyridine	EPA 8260B	GC-MS
NW	Pyridine	EPA 625	GC-MS
NW	Pyridine	EPA 8270C	GC-MS
NW	Volatiles Organics	Method	Technology
NW	Acetone	EPA 5030B	PREP
NW	Acetone	EPA 8260C	GC-MS
NW	Acetone	EPA 8260B	GC-MS
NW	Acetonitrile	EPA 8260B	GC-MS
NW	2-Butanone (Methylethyl ketone)	EPA 5030B	PREP
NW	2-Butanone (Methylethyl ketone)	EPA 8260C	GC-MS
NW	2-Butanone (Methylethyl ketone)	EPA 8260B	GC-MS
NW	Carbon Disulfide	EPA 8260C	GC-MS
NW	Carbon Disulfide	EPA 8260B	GC-MS
NW	Cyclohexane	EPA 8260C	GC-MS
NW	Cyclohexane	EPA 8260B	GC-MS
NW	Di-ethyl ether	EPA 8260C	GC-MS
NW	Di-ethyl ether	EPA 8260B	GC-MS
NW	1,4-Dioxane	EPA 8260C	GC-MS
NW	1,4-Dioxane	EPA 8260B	GC-MS
NW	Ethyl Acetate	EPA 8260B	GC-MS
NW	Isopropanol	EPA 8260C	GC-MS
NW	Isopropanol	EPA 8260B	GC-MS
NW	Methyl acetate	EPA 8260C	GC-MS
NW	Methyl acetate	EPA 8260B	GC-MS
NW	2-Hexanone	EPA 8260C	GC-MS
NW	2-Hexanone	EPA 8260B	GC-MS
NW	Isobutyl alcohol	EPA 8260C	GC-MS
NW	Isobutyl alcohol	EPA 8260B	GC-MS
NW	Methyl cyclohexane	EPA 8260C	GC-MS
NW	Methyl cyclohexane	EPA 8260B	GC-MS
NW	Methyl cyclohexane	EPA 8270C	GC-MS
NW	4-Methyl-2-Pentanone	EPA 8260C	GC-MS
NW	4-Methyl-2-Pentanone	EPA 8260B	GC-MS
NW	2-Nitropropane	EPA 8260C	GC-MS
NW	2-Nitropropane	EPA 8260B	GC-MS
NW	o-Toluidine	EPA 8270C	GC-MS
NW	Vinyl acetate	EPA 5030B	PREP

Matrix	Analyte	Method	Technology
NW	Vinyl acetate	EPA 8260B	GC-MS
NW	Semi-Volatile Organics	Method	Technology
NW	Acetophenone	EPA 625	GC-MS
NW	Acetophenone	EPA 8270C	GC-MS
NW	4-Amino biphenyl	EPA 8270C	GC-MS
NW	Aramite	EPA 8270C	GC-MS
NW	Benzoic Acid	EPA 8270C	GC-MS
NW	Benzoic Acid	EPA 8270D	GC-MS
NW	Benzyl alcohol	EPA 8270C	GC-MS
NW	Benzyl alcohol	EPA 8270D	GC-MS
NW	Benzaldehyde	EPA 8270C	GC-MS
NW	1,1'-Biphenyl	EPA 8270C	GC-MS
NW	Caprolactam	EPA 8270C	GC-MS
NW	1,2-Dichlorobenzene, Semi-volatile	EPA 3510C	PREP
NW	1,2-Dichlorobenzene, Semi-volatile	EPA 3520C	PREP
NW	1,2-Dichlorobenzene, Semi-volatile	EPA 8270C	GC-MS
NW	1,3-Dichlorobenzene, Semi-volatile	EPA 3510C	PREP
NW	1,3-Dichlorobenzene, Semi-volatile	EPA 3520C	PREP
NW	1,3-Dichlorobenzene, Semi-volatile	EPA 8270C	GC-MS
NW	1,4-Dichlorobenzene, Semi-volatile	EPA 3510C	PREP
NW	1,4-Dichlorobenzene, Semi-volatile	EPA 3520C	PREP
NW	1,4-Dichlorobenzene, Semi-volatile	EPA 8270C	GC-MS
NW	Dibenzofuran	EPA 3510C	PREP
NW	Dibenzofuran	EPA 3520C	PREP
NW	Dibenzofuran	EPA 8270C	GC-MS
NW	p-Dimethylaminoazobenzene	EPA 8270C	GC-MS
NW	Ethyl methanesulfonate	EPA 8270C	GC-MS
NW	Ethyl methanesulfonate	EPA 8270D	GC-MS
NW	Isosafrole	EPA 8270C	GC-MS
NW	Methyl methanesulfonate	EPA 8270C	GC-MS
NW	Methyl methanesulfonate	EPA 8270D	GC-MS
NW	2-Methylnaphthalene	EPA 3510C	PREP
NW	2-Methylnaphthalene	EPA 3520C	PREP
NW	2-Methylnaphthalene	EPA 8270C	GC-MS
NW	2-Picoline	EPA 8270C	GC-MS
NW	Phenacetin	EPA 8270C	GC-MS
NW	Safrole	EPA 8270C	GC-MS
NW	O,O,O-Triethyl phosphorothioate	EPA 8270C	GC-MS
NW	Carbamate Pesticides	Method	Technology
NW	Aldicarb Sulfone	EPA 8318	HPLC-FLUOR
NW	Aldicarb	EPA 8318	HPLC-FLUOR
NW	Carbofuran	EPA 8318	HPLC-FLUOR

Matrix	Analyte	Method	Technology
NW	Fuel Oxygenates	Method	Technology
NW	Di-isopropyl ether	EPA 8260B	GC-MS
NW	Ethanol	EPA 8260B	GC-MS
NW	tert-butyl ethyl ether (ETBE)	EPA 8260B	GC-MS
NW	Methyl tert-butyl ether	EPA 5030B	PREP
NW	Methyl tert-butyl ether	EPA 8260C	GC-MS
NW	Methyl tert-butyl ether	EPA 8260B	GC-MS
NW	Methyl tert-butyl ether	EPA 8021B	GCELCD/PID
NW	tert-amyl alcohol	EPA 8260B	GC-MS
NW	tert-amyl methyl ether (TAME)	EPA 8260B	GC-MS
NW	tert-butyl alcohol	EPA 8260B	GC-MS
NW	Dissolved Gases	Method	Technology
NW	Acetylene	RSK-175	GC-FID
NW	Ethane	RSK-175	GC-FID
NW	Ethene (Ethylene)	RSK-175	GC-FID
NW	Methane	RSK-175	GC-FID
NW	Propane	RSK-175	GC-FID
PW	PW		
PW	Drinking Water Bacteriology	Method	Technology
PW	Coliform, Total / E. coli (Qualitative)	Readycult Coliforms 100 P/A Test	CF-QL
PW	Coliform, Total / E. coli (Qualitative)	SM 18-21 9223B (97) (Colilert)	CF-QL
PW	Standard Plate Count	SM 18-21 9215B	PP-QN
PW	Drinking Water Metals I	Method	Technology
PW	Arsenic, Total	EPA 200.8 Rev. 5.4	ICP-MS
PW	Barium, Total	EPA 200.7 Rev. 4.4	ICP-AES
PW	Barium, Total	EPA 200.8 Rev. 5.4	ICP-MS
PW	Cadmium, Total	EPA 200.7 Rev. 4.4	ICP-AES
PW	Cadmium, Total	EPA 200.8 Rev. 5.4	ICP-MS
PW	Chromium, Total	EPA 200.7 Rev. 4.4	ICP-AES
PW	Chromium, Total	EPA 200.8 Rev. 5.4	ICP-MS
PW	Copper, Total	EPA 200.7 Rev. 4.4	ICP-AES
PW	Copper, Total	EPA 200.8 Rev. 5.4	ICP-MS
PW	Iron, Total	EPA 200.7 Rev. 4.4	ICP-AES
PW	Lead, Total	EPA 200.8 Rev. 5.4	ICP-MS
PW	Mercury, Total	EPA 245.1 Rev. 3.0	CVAAS
PW	Mercury, Total	EPA 200.8 Rev. 5.4	ICP-MS
PW	Manganese, Total	EPA 200.7 Rev. 4.4	ICP-AES
PW	Manganese, Total	EPA 200.8 Rev. 5.4	ICP-MS
PW	Selenium, Total	EPA 200.8 Rev. 5.4	ICP-MS
PW	Silver, Total	EPA 200.7 Rev. 4.4	ICP-AES
PW	Silver, Total	EPA 200.8 Rev. 5.4	ICP-MS

Matrix	Analyte	Method	Technology
PW	Zinc, Total	EPA 200.7 Rev. 4.4	ICP-AES
PW	Zinc, Total	EPA 200.8 Rev. 5.4	ICP-MS
PW	Drinking Water Metals II	Method	Technology
PW	Aluminum, Total	EPA 200.7 Rev. 4.4	ICP-AES
PW	Aluminum, Total	EPA 200.8 Rev. 5.4	ICP-MS
PW	Antimony, Total	EPA 200.8 Rev. 5.4	ICP-MS
PW	Beryllium, Total	EPA 200.7 Rev. 4.4	ICP-AES
PW	Beryllium, Total	EPA 200.8 Rev. 5.4	ICP-MS
PW	Molybdenum, Total	EPA 200.7 Rev. 4.4	ICP-AES
PW	Molybdenum, Total	EPA 200.8 Rev. 5.4	ICP-MS
PW	Nickel, Total	EPA 200.7 Rev. 4.4	ICP-AES
PW	Nickel, Total	EPA 200.8 Rev. 5.4	ICP-MS
PW	Thallium, Total	EPA 200.8 Rev. 5.4	ICP-MS
PW	Vanadium, Total	EPA 200.7 Rev. 4.4	ICP-AES
PW	Vanadium, Total	EPA 200.8 Rev. 5.4	ICP-MS
PW	Drinking Water Metals III	Method	Technology
PW	Boron, Total	EPA 200.7 Rev. 4.4	ICP-AES
PW	Calcium, Total	EPA 200.7 Rev. 4.4	ICP-AES
PW	Magnesium, Total	EPA 200.7 Rev. 4.4	ICP-AES
PW	Potassium, Total	EPA 200.7 Rev. 4.4	ICP-AES
PW	Sodium, Total	EPA 200.7 Rev. 4.4	ICP-AES
PW	Drinking Water Non-Metals	Method	Technology
PW	Alkalinity	SM 18-21 2320B (97)	TITR
PW	Chloride	EPA 300.0 Rev. 2.1	IC-COND
PW	Chloride	SM 18-21 4500-Cl- E (97)	COLOR
PW	Color	SM 18-21 2120B (01)	COLOR
PW	Corrosivity	SM 18-19 2330	CALC
PW	Specific Conductance	EPA 120.1 Rev. 1982	COND
PW	Specific Conductance	SM 18-21 2510B (97)	COND
PW	Cyanide	SM 18-20 4500-CN C	PREP
PW	Cyanide	SM 18-21 4500-CN E (99)	COLOR
PW	Cyanide	SM 18-21 4500-CN G (99)	COLOR
PW	Fluoride, Total	EPA 300.0 Rev. 2.1	IC-COND
PW	Calcium Hardness	EPA 200.7 Rev. 4.4	ICP-AES
PW	Hydrogen Ion (pH)	SM 18-21 4500-H B (00)	POT
PW	Nitrate (as N)	EPA 353.2 Rev. 2.0	AUTO
PW	Nitrate (as N)	EPA 300.0 Rev. 2.1	IC-COND
PW	Nitrite (as N)	EPA 353.2 Rev. 2.0	AUTO
PW	Nitrite (as N)	EPA 300.0 Rev. 2.1	IC-COND
PW	Orthophosphate (as P)	EPA 300.0 Rev. 2.1	IC-COND
PW	Orthophosphate (as P)	SM 18-21 4500-P E	COLOR
PW	Silica, Dissolved	EPA 200.7 Rev. 4.4	ICP-AES

Matrix	Analyte	Method	Technology
PW	Solids, Total Dissolved	SM 18-21 2540C (97)	GRAV
PW	Sulfate (as SO4)	EPA 300.0 Rev. 2.1	IC-COND
PW	Sulfate (as SO4)	SM 18-21 4500-SO4 E (97)	COLOR
PW	Drinking Water Chlorinated Acids	Method	Technology
PW	2,4-D	EPA 515.1	GC-ECD
PW	Dalapon	EPA 515.1	GC-ECD
PW	Dicamba	EPA 515.1	GC-ECD
PW	Dinoseb	EPA 515.1	GC-ECD
PW	Pentachlorophenol	EPA 515.1	GC-ECD
PW	Pentachlorophenol	EPA 525.2	GC-MS
PW	Picloram	EPA 515.1	GC-ECD
PW	2,4,5-TP (Silvex)	EPA 515.1	GC-ECD
PW	Drinking Water Organohalide Pesticides	Method	Technology
PW	Alachlor	EPA 505	GC-ECD
PW	Alachlor	EPA 508.1	GC-ECD
PW	Alachlor	EPA 525.2	GC-MS
PW	Aldrin	EPA 505	GC-ECD
PW	Aldrin	EPA 508.1	GC-ECD
PW	Aldrin	EPA 525.2	GC-MS
PW	Atrazine	EPA 505	GC-ECD
PW	Atrazine	EPA 525.2	GC-MS
PW	Butachlor	EPA 525.2	GC-MS
PW	Chlordane Total	EPA 505	GC-ECD
PW	Chlordane Total	EPA 508.1	GC-ECD
PW	Chlordane Total	EPA 525.2	GC-MS
PW	Dieldrin	EPA 505	GC-ECD
PW	Dieldrin	EPA 508.1	GC-ECD
PW	Dieldrin	EPA 525.2	GC-MS
PW	Endrin	EPA 505	GC-ECD
PW	Endrin	EPA 508.1	GC-ECD
PW	Endrin	EPA 525.2	GC-MS
PW	Heptachlor	EPA 505	GC-ECD
PW	Heptachlor	EPA 508.1	GC-ECD
PW	Heptachlor	EPA 525.2	GC-MS
PW	Heptachlor epoxide	EPA 505	GC-ECD
PW	Heptachlor epoxide	EPA 508.1	GC-ECD
PW	Heptachlor epoxide	EPA 525.2	GC-MS
PW	Lindane	EPA 505	GC-ECD
PW	Lindane	EPA 508.1	GC-ECD
PW	Lindane	EPA 525.2	GC-MS
PW	Methoxychlor	EPA 505	GC-ECD
PW	Methoxychlor	EPA 508.1	GC-ECD

Matrix	Analyte	Method	Technology
PW	Methoxychlor	EPA 525.2	GC-MS
PW	Metolachlor	EPA 525.2	GC-MS
PW	Metribuzin	EPA 525.2	GC-MS
PW	Propachlor	EPA 525.2	GC-MS
PW	Simazine	EPA 505	GC-ECD
PW	Simazine	EPA 525.2	GC-MS
PW	Toxaphene	EPA 505	GC-ECD
PW	Toxaphene	EPA 508.1	GC-ECD
PW	Trifluralin	EPA 525.2	GC-MS
PW	D. W. Methylcarbamate Pesticides	Method	Technology
PW	Aldicarb	EPA 531.1	HPLC-FLUOR
PW	Aldicarb Sulfone	EPA 531.1	HPLC-FLUOR
PW	Aldicarb Sulfoxide	EPA 531.1	HPLC-FLUOR
PW	Carbaryl	EPA 531.1	HPLC-FLUOR
PW	Carbofuran	EPA 531.1	HPLC-FLUOR
PW	3-Hydroxy Carbofuran	EPA 531.1	HPLC-FLUOR
PW	Methomyl	EPA 531.1	HPLC-FLUOR
PW	Oxamyl	EPA 531.1	HPLC-FLUOR
PW	Drinking Water Miscellaneous	Method	Technology
PW	Turbidity	EPA 180.1 Rev. 2.0	COLOR
PW	Benzo(a)pyrene	EPA 525.2	GC-MS
PW	Di (2-ethylhexyl) adipate	EPA 525.2	GC-MS
PW	Bis(2-ethylhexyl) phthalate	EPA 525.2	GC-MS
PW	Diquat	EPA 549.2	HPLC-UV
PW	Endothall	EPA 548.1	GC-MS
PW	Glyphosate	EPA 547	HPLC-UV
PW	Hexachlorobenzene	EPA 505	GC-ECD
PW	Hexachlorobenzene	EPA 525.2	GC-MS
PW	Hexachlorocyclopentadiene	EPA 505	GC-ECD
PW	Hexachlorocyclopentadiene	EPA 525.2	GC-MS
PW	Odor	EPA 140.1	99
PW	Organic Carbon, Total	SM 18-21 5310B (00)	IR
PW	Perchlorate	EPA 314.0	IC-COND
PW	Temperature	SM 18-21 2550B (00)	99
PW	Surfactant (MBAS)	SM 18-21 5540C (00)	COLOR
PW	UV 254	SM 19-21 5910B	COLOR
PW	Polychlorinated Biphenyls	Method	Technology
PW	PCB Screen	EPA 505	GC-ECD
PW	PCB Screen	EPA 508.1	GC-ECD
PW	PCB Screen	EPA 525.2	GC-MS
PW	PCB,Total (as decachlorobiphenyl)	EPA 508A	GC-ECD
PW	Drinking Water Trihalomethanes	Method	Technology

Matrix	Analyte	Method	Technology
PW	Bromodichloromethane	EPA 524.2	GC-MS
PW	Bromoform	EPA 524.2	GC-MS
PW	Dibromochloromethane	EPA 524.2	GC-MS
PW	Chloroform	EPA 524.2	GC-MS
PW	Total Trihalomethanes	EPA 524.2	GC-MS
PW	Volatile Halocarbons	Method	Technology
PW	Bromochloromethane	EPA 524.2	GC-MS
PW	Bromomethane	EPA 502.2	GCELCD/PID
PW	Bromomethane	EPA 524.2	GC-MS
PW	Carbon tetrachloride	EPA 524.2	GC-MS
PW	Chloroethane	EPA 524.2	GC-MS
PW	Chloromethane	EPA 524.2	GC-MS
PW	Dibromomethane	EPA 524.2	GC-MS
PW	Dichlorodifluoromethane	EPA 524.2	GC-MS
PW	1,1-Dichloroethane	EPA 524.2	GC-MS
PW	1,2-Dichloroethane	EPA 524.2	GC-MS
PW	1,1-Dichloroethene	EPA 524.2	GC-MS
PW	cis-1,2-Dichloroethene	EPA 524.2	GC-MS
PW	trans-1,2-Dichloroethene	EPA 524.2	GC-MS
PW	1,2-Dichloropropane	EPA 524.2	GC-MS
PW	1,3-Dichloropropane	EPA 524.2	GC-MS
PW	2,2-Dichloropropane	EPA 524.2	GC-MS
PW	1,1-Dichloropropene	EPA 524.2	GC-MS
PW	cis-1,3-Dichloropropene	EPA 524.2	GC-MS
PW	trans-1,3-Dichloropropene	EPA 524.2	GC-MS
PW	Methylene chloride	EPA 502.2	GCELCD/PID
PW	Methylene chloride	EPA 524.2	GC-MS
PW	1,1,1,2-Tetrachloroethane	EPA 524.2	GC-MS
PW	1,1,2,2-Tetrachloroethane	EPA 524.2	GC-MS
PW	Tetrachloroethene	EPA 524.2	GC-MS
PW	1,1,1-Trichloroethane	EPA 524.2	GC-MS
PW	1,1,2-Trichloroethane	EPA 524.2	GC-MS
PW	Trichloroethene	EPA 524.2	GC-MS
PW	Trichlorofluoromethane	EPA 524.2	GC-MS
PW	1,2,3-Trichloropropane	EPA 504.1	GC-ECD
PW	1,2,3-Trichloropropane	EPA 524.2	GC-MS
PW	Vinyl chloride	EPA 524.2	GC-MS
PW	Volatile Aromatics	Method	Technology
PW	Benzene	EPA 524.2	GC-MS
PW	Bromobenzene	EPA 524.2	GC-MS
PW	n-Butylbenzene	EPA 524.2	GC-MS
PW	sec-Butylbenzene	EPA 524.2	GC-MS

Matrix	Analyte	Method	Technology
PW	tert-Butylbenzene	EPA 524.2	GC-MS
PW	Chlorobenzene	EPA 524.2	GC-MS
PW	2-Chlorotoluene	EPA 524.2	GC-MS
PW	4-Chlorotoluene	EPA 524.2	GC-MS
PW	1,2-Dichlorobenzene	EPA 524.2	GC-MS
PW	1,3-Dichlorobenzene	EPA 524.2	GC-MS
PW	1,4-Dichlorobenzene	EPA 524.2	GC-MS
PW	Ethyl benzene	EPA 524.2	GC-MS
PW	Hexachlorobutadiene	EPA 524.2	GC-MS
PW	Isopropylbenzene	EPA 524.2	GC-MS
PW	p-Isopropyltoluene (P-Cymene)	EPA 524.2	GC-MS
PW	n-Propylbenzene	EPA 524.2	GC-MS
PW	Styrene	EPA 524.2	GC-MS
PW	Toluene	EPA 524.2	GC-MS
PW	1,2,3-Trichlorobenzene	EPA 524.2	GC-MS
PW	1,2,4-Trichlorobenzene	EPA 524.2	GC-MS
PW	1,2,4-Trimethylbenzene	EPA 524.2	GC-MS
PW	1,3,5-Trimethylbenzene	EPA 524.2	GC-MS
PW	Total Xylenes	EPA 524.2	GC-MS
PW	Microextractibles	Method	Technology
PW	1,2-Dibromoethane	EPA 504.1	GC-ECD
PW	1,2-Dibromo-3-chloropropane	EPA 504.1	GC-ECD
PW	Disinfection By-products	Method	Technology
PW	Free Residual Chlorine	SM 18-21 4500-Cl G (00)	COLOR
PW	Total Residual Chlorine	SM 18-21 4500-Cl G (00)	COLOR
PW	Bromide	EPA 300.0 Rev. 2.1	IC-COND
PW	Dibromoacetic acid	EPA 552.2	GC-ECD
PW	Dichloroacetic acid	EPA 552.2	GC-ECD
PW	Monobromoacetic acid	EPA 552.2	GC-ECD
PW	Monochloroacetic acid	EPA 552.2	GC-ECD
PW	Trichloroacetic acid	EPA 552.2	GC-ECD
PW	Bromochloroacetic acid	EPA 552.2	GC-ECD
PW	Fuel Additives	Method	Technology
PW	Naphthalene	EPA 524.2	GC-MS
PW	Methyl tert-butyl ether	EPA 524.2	GC-MS
PW	Dissolved Gases	Method	Technology
PW	Acetylene	RSK-175	GC-FID
PW	Ethane	RSK-175	GC-FID
PW	Ethene (Ethylene)	RSK-175	GC-FID
PW	Methane	RSK-175	GC-FID
PW	Propane	RSK-175	GC-FID
AI	AI		

Matrix	Analyte	Method	Technology
AI	Chlorinated Hydrocarbons	Method	Technology
AI	Hexachlorobutadiene	EPA TO-15	GC-MS
AI	Hexachloroethane	EPA TO-15	GC-MS
AI	1,2,4-Trichlorobenzene	EPA TO-17	GC-MS
AI	1,2,4-Trichlorobenzene	EPA TO-15	GC-MS
AI	Purgeable Halocarbons	Method	Technology
AI	Bromodichloromethane	EPA TO-15	GC-MS
AI	Bromoform	EPA TO-15	GC-MS
AI	Bromomethane	EPA TO-15	GC-MS
AI	Carbon tetrachloride	EPA TO-17	GC-MS
AI	Carbon tetrachloride	EPA TO-15	GC-MS
AI	Chloroform	EPA TO-17	GC-MS
AI	Chloroform	EPA TO-15	GC-MS
AI	Chloroethane	EPA TO-15	GC-MS
AI	Chloromethane	EPA TO-15	GC-MS
AI	Dibromochloromethane	EPA TO-15	GC-MS
AI	Dichlorodifluoromethane	EPA TO-15	GC-MS
AI	1,2-Dibromoethane	EPA TO-17	GC-MS
AI	1,2-Dibromoethane	EPA TO-15	GC-MS
AI	1,1-Dichloroethane	EPA TO-17	GC-MS
AI	1,1-Dichloroethane	EPA TO-15	GC-MS
AI	1,2-Dichloroethane	EPA TO-17	GC-MS
AI	1,2-Dichloroethane	EPA TO-15	GC-MS
AI	cis-1,2-Dichloroethene	EPA TO-17	GC-MS
AI	cis-1,2-Dichloroethene	EPA TO-15	GC-MS
AI	trans-1,2-Dichloroethene	EPA TO-15	GC-MS
AI	1,1-Dichloroethene	EPA TO-17	GC-MS
AI	1,1-Dichloroethene	EPA TO-15	GC-MS
AI	1,2-Dichloropropane	EPA TO-17	GC-MS
AI	1,2-Dichloropropane	EPA TO-15	GC-MS
AI	cis-1,3-Dichloropropene	EPA TO-17	GC-MS
AI	cis-1,3-Dichloropropene	EPA TO-15	GC-MS
AI	trans-1,3-Dichloropropene	EPA TO-17	GC-MS
AI	trans-1,3-Dichloropropene	EPA TO-15	GC-MS
AI	Methylene chloride	EPA TO-17	GC-MS
AI	Methylene chloride	EPA TO-15	GC-MS
AI	1,1,2,2-Tetrachloroethane	EPA TO-17	GC-MS
AI	1,1,2,2-Tetrachloroethane	EPA TO-15	GC-MS
AI	Tetrachloroethene	EPA TO-17	GC-MS
AI	Tetrachloroethene	EPA TO-15	GC-MS
AI	1,1,1-Trichloroethane	EPA TO-17	GC-MS
AI	1,1,1-Trichloroethane	EPA TO-15	GC-MS

Matrix	Analyte	Method	Technology
AI	1,1,2-Trichloroethane	EPA TO-15	GC-MS
AI	Trichloroethene	EPA TO-15	GC-MS
AI	Trichlorofluoromethane	EPA TO-15	GC-MS
AI	1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA TO-15	GC-MS
AI	Vinyl bromide	EPA TO-17	GC-MS
AI	Vinyl bromide	EPA TO-15	GC-MS
AI	Vinyl chloride	EPA TO-15	GC-MS
AI	Volatile Chlorinated Organics	Method	Technology
AI	Benzyl chloride	EPA TO-15	GC-MS
AI	Polynuclear Aromatics	Method	Technology
AI	Naphthalene	EPA TO-15	GC-MS
AI	Purgeable Aromatics	Method	Technology
AI	Benzene	EPA TO-17	GC-MS
AI	Benzene	EPA TO-15	GC-MS
AI	Chlorobenzene	EPA TO-17	GC-MS
AI	Chlorobenzene	EPA TO-15	GC-MS
AI	2-Chlorotoluene	EPA TO-15	GC-MS
AI	1,2-Dichlorobenzene	EPA TO-17	GC-MS
AI	1,2-Dichlorobenzene	EPA TO-15	GC-MS
AI	1,4-Dichlorobenzene	EPA TO-17	GC-MS
AI	1,4-Dichlorobenzene	EPA TO-15	GC-MS
AI	1,3-Dichlorobenzene	EPA TO-17	GC-MS
AI	1,3-Dichlorobenzene	EPA TO-15	GC-MS
AI	Ethyl benzene	EPA TO-17	GC-MS
AI	Ethyl benzene	EPA TO-15	GC-MS
AI	Isopropylbenzene	EPA TO-17	GC-MS
AI	Isopropylbenzene	EPA TO-15	GC-MS
AI	Toluene	EPA TO-17	GC-MS
AI	Toluene	EPA TO-15	GC-MS
AI	Total Xylenes	EPA TO-17	GC-MS
AI	Total Xylenes	EPA TO-15	GC-MS
AI	o-Xylene	EPA TO-17	GC-MS
AI	o-Xylene	EPA TO-15	GC-MS
AI	m/p-Xylenes	EPA TO-17	GC-MS
AI	m/p-Xylenes	EPA TO-15	GC-MS
AI	1,2,4-Trimethylbenzene	EPA TO-15	GC-MS
AI	1,3,5-Trimethylbenzene	EPA TO-15	GC-MS
AI	Styrene	EPA TO-17	GC-MS
AI	Styrene	EPA TO-15	GC-MS
AI	Volatile Organics	Method	Technology
AI	Acetone	EPA TO-17	GC-MS
AI	Acetone	EPA TO-15	GC-MS

Matrix	Analyte	Method	Technology
AI	1,3-Butadiene	EPA TO-15	GC-MS
AI	2-Butanone (Methylethyl ketone)	EPA TO-17	GC-MS
AI	2-Butanone (Methylethyl ketone)	EPA TO-15	GC-MS
AI	Carbon Disulfide	EPA TO-17	GC-MS
AI	Carbon Disulfide	EPA TO-15	GC-MS
AI	Cyclohexane	EPA TO-15	GC-MS
AI	1,2-Dichlorotetrafluoroethane	EPA TO-15	GC-MS
AI	1,4-Dioxane	EPA TO-17	GC-MS
AI	1,4-Dioxane	EPA TO-15	GC-MS
AI	Hexane	EPA TO-15	GC-MS
AI	n-Heptane	EPA TO-15	GC-MS
AI	Isopropanol	EPA TO-15	GC-MS
AI	4-Methyl-2-Pentanone	EPA TO-17	GC-MS
AI	4-Methyl-2-Pentanone	EPA TO-15	GC-MS
AI	Methyl tert-butyl ether	EPA TO-17	GC-MS
AI	Methyl tert-butyl ether	EPA TO-15	GC-MS
AI	tert-butyl alcohol	EPA TO-15	GC-MS
AI	2,2,4-Trimethylpentane	EPA TO-15	GC-MS
AI	Vinyl acetate	EPA TO-15	GC-MS
AI	Acrylates	Method	Technology
AI	Acrylonitrile	EPA TO-15	GC-MS
AI	Methyl methacrylate	EPA TO-15	GC-MS
SW	SW		
SW	Characteristic Testing	Method	Technology
SW	Ignitability	EPA 1010	99
SW	Corrosivity	EPA 1110	GRAV
SW	Corrosivity	EPA 9045C	POT
SW	Corrosivity	EPA 9040B	POT
SW	Reactivity	SW-846 Ch7 Sec. 7.3	TITR
SW	TCLP	EPA 1311	PREP
SW	Synthetic Precipitation Leaching Proc.	EPA 1312	PREP
SW	Free Liquids	EPA 9095A	PA
SW	Metals I	Method	Technology
SW	Barium, Total	EPA 3010A	PREP
SW	Barium, Total	EPA 3005A	PREP
SW	Barium, Total	EPA 3050B	PREP
SW	Barium, Total	EPA 6010B	ICP-AES
SW	Barium, Total	EPA 6020A	ICP-MS
SW	Barium, Total	EPA 6020	ICP-MS
SW	Cadmium, Total	EPA 3010A	PREP
SW	Cadmium, Total	EPA 3005A	PREP

Matrix	Analyte	Method	Technology
SW	Cadmium, Total	EPA 3050B	PREP
SW	Cadmium, Total	EPA 6010B	ICP-AES
SW	Cadmium, Total	EPA 6020A	ICP-MS
SW	Cadmium, Total	EPA 6020	ICP-MS
SW	Calcium, Total	EPA 3010A	PREP
SW	Calcium, Total	EPA 3005A	PREP
SW	Calcium, Total	EPA 3050B	PREP
SW	Calcium, Total	EPA 6010B	ICP-AES
SW	Chromium, Total	EPA 3010A	PREP
SW	Chromium, Total	EPA 3005A	PREP
SW	Chromium, Total	EPA 3050B	PREP
SW	Chromium, Total	EPA 6010B	ICP-AES
SW	Chromium, Total	EPA 6020A	ICP-MS
SW	Chromium, Total	EPA 6020	ICP-MS
SW	Copper, Total	EPA 3010A	PREP
SW	Copper, Total	EPA 3005A	PREP
SW	Copper, Total	EPA 3050B	PREP
SW	Copper, Total	EPA 6010B	ICP-AES
SW	Copper, Total	EPA 6020A	ICP-MS
SW	Copper, Total	EPA 6020	ICP-MS
SW	Iron, Total	EPA 6010B	ICP-AES
SW	Lead, Total	EPA 3010A	PREP
SW	Lead, Total	EPA 3005A	PREP
SW	Lead, Total	EPA 3050B	PREP
SW	Lead, Total	EPA 6010B	ICP-AES
SW	Lead, Total	EPA 6020A	ICP-MS
SW	Lead, Total	EPA 6020	ICP-MS
SW	Nickel, Total	EPA 3010A	PREP
SW	Nickel, Total	EPA 3005A	PREP
SW	Nickel, Total	EPA 3050B	PREP
SW	Nickel, Total	EPA 6010B	ICP-AES
SW	Nickel, Total	EPA 6020A	ICP-MS
SW	Nickel, Total	EPA 6020	ICP-MS
SW	Magnesium, Total	EPA 3010A	PREP
SW	Magnesium, Total	EPA 3005A	PREP
SW	Magnesium, Total	EPA 3050B	PREP
SW	Magnesium, Total	EPA 6010B	ICP-AES
SW	Manganese, Total	EPA 3010A	PREP
SW	Manganese, Total	EPA 3005A	PREP
SW	Manganese, Total	EPA 3050B	PREP
SW	Manganese, Total	EPA 6010B	ICP-AES
SW	Manganese, Total	EPA 6020A	ICP-MS

Matrix	Analyte	Method	Technology
SW	Manganese, Total	EPA 6020	ICP-MS
SW	Potassium, Total	EPA 3010A	PREP
SW	Potassium, Total	EPA 3005A	PREP
SW	Potassium, Total	EPA 3050B	PREP
SW	Potassium, Total	EPA 6010B	ICP-AES
SW	Silver, Total	EPA 3005A	PREP
SW	Silver, Total	EPA 3050B	PREP
SW	Silver, Total	EPA 6010B	ICP-AES
SW	Silver, Total	EPA 6020	ICP-MS
SW	Sodium, Total	EPA 3050B	PREP
SW	Sodium, Total	EPA 6010B	ICP-AES
SW	Strontium, Total	EPA 3010A	PREP
SW	Strontium, Total	EPA 3005A	PREP
SW	Strontium, Total	EPA 3050B	PREP
SW	Strontium, Total	EPA 6010B	ICP-AES
SW	Metals II	Method	Technology
SW	Aluminum, Total	EPA 3010A	PREP
SW	Aluminum, Total	EPA 3005A	PREP
SW	Aluminum, Total	EPA 3050B	PREP
SW	Aluminum, Total	EPA 6010B	ICP-AES
SW	Aluminum, Total	EPA 6020	ICP-MS
SW	Antimony, Total	EPA 3005A	PREP
SW	Antimony, Total	EPA 3050B	PREP
SW	Antimony, Total	EPA 6010B	ICP-AES
SW	Antimony, Total	EPA 6020A	ICP-MS
SW	Antimony, Total	EPA 6020	ICP-MS
SW	Arsenic, Total	EPA 3010A	PREP
SW	Arsenic, Total	EPA 3005A	PREP
SW	Arsenic, Total	EPA 3050B	PREP
SW	Arsenic, Total	EPA 6010B	ICP-AES
SW	Arsenic, Total	EPA 6020A	ICP-MS
SW	Arsenic, Total	EPA 6020	ICP-MS
SW	Beryllium, Total	EPA 3010A	PREP
SW	Beryllium, Total	EPA 3005A	PREP
SW	Beryllium, Total	EPA 3050B	PREP
SW	Beryllium, Total	EPA 6010B	ICP-AES
SW	Beryllium, Total	EPA 6020A	ICP-MS
SW	Beryllium, Total	EPA 6020	ICP-MS
SW	Chromium VI	EPA 7196A	COLOR
SW	Chromium VI	EPA 3060A	PREP
SW	Mercury, Total	EPA 7471A	CVAAS
SW	Mercury, Total	EPA 7471B	CVAAS

Matrix	Analyte	Method	Technology
SW	Selenium, Total	EPA 3010A	PREP
SW	Selenium, Total	EPA 3005A	PREP
SW	Selenium, Total	EPA 3050B	PREP
SW	Selenium, Total	EPA 6010B	ICP-AES
SW	Selenium, Total	EPA 6020A	ICP-MS
SW	Selenium, Total	EPA 6020	ICP-MS
SW	Vanadium, Total	EPA 3010A	PREP
SW	Vanadium, Total	EPA 3005A	PREP
SW	Vanadium, Total	EPA 3050B	PREP
SW	Vanadium, Total	EPA 6010B	ICP-AES
SW	Vanadium, Total	EPA 6020	ICP-MS
SW	Zinc, Total	EPA 3010A	PREP
SW	Zinc, Total	EPA 3005A	PREP
SW	Zinc, Total	EPA 3050B	PREP
SW	Zinc, Total	EPA 6010B	ICP-AES
SW	Zinc, Total	EPA 6020	ICP-MS
SW	Metals III	Method	Technology
SW	Cobalt, Total	EPA 3010A	PREP
SW	Cobalt, Total	EPA 3005A	PREP
SW	Cobalt, Total	EPA 3050B	PREP
SW	Cobalt, Total	EPA 6010B	ICP-AES
SW	Cobalt, Total	EPA 6020	ICP-MS
SW	Molybdenum, Total	EPA 3010A	PREP
SW	Molybdenum, Total	EPA 3005A	PREP
SW	Molybdenum, Total	EPA 3050B	PREP
SW	Molybdenum, Total	EPA 6010B	ICP-AES
SW	Molybdenum, Total	EPA 6020	ICP-MS
SW	Thallium, Total	EPA 3010A	PREP
SW	Thallium, Total	EPA 3005A	PREP
SW	Thallium, Total	EPA 3050B	PREP
SW	Thallium, Total	EPA 6010B	ICP-AES
SW	Thallium, Total	EPA 6020	ICP-MS
SW	Tin, Total	EPA 3010A	PREP
SW	Tin, Total	EPA 3005A	PREP
SW	Tin, Total	EPA 3050B	PREP
SW	Tin, Total	EPA 6010B	ICP-AES
SW	Titanium, Total	EPA 3010A	PREP
SW	Titanium, Total	EPA 3005A	PREP
SW	Titanium, Total	EPA 3050B	PREP
SW	Titanium, Total	EPA 6010B	ICP-AES
SW	Acrylates	Method	Technology
SW	Acrolein (Propenal)	EPA 5030B	PREP

Matrix	Analyte	Method	Technology
SW	Acrolein (Propenal)	EPA 8260B	GC-MS
SW	Acrolein (Propenal)	EPA 5035	PREP
SW	Acrylonitrile	EPA 5030B	PREP
SW	Acrylonitrile	EPA 8260B	GC-MS
SW	Acrylonitrile	EPA 5035	PREP
SW	Ethyl methacrylate	EPA 8260B	GC-MS
SW	Methyl acrylonitrile	EPA 8260B	GC-MS
SW	Methyl methacrylate	EPA 8260B	GC-MS
SW	Chlorinated Hydrocarbons	Method	Technology
SW	1-Chloronaphthalene	EPA 8270C	GC-MS
SW	2-Chloronaphthalene	EPA 3545	PREP
SW	2-Chloronaphthalene	EPA 8121	GC-ECD
SW	2-Chloronaphthalene	EPA 8270C	GC-MS
SW	2-Chloronaphthalene	EPA 8270D	GC-MS
SW	Hexachlorobenzene	EPA 3545	PREP
SW	Hexachlorobenzene	EPA 8121	GC-ECD
SW	Hexachlorobenzene	EPA 8270C	GC-MS
SW	Hexachlorobenzene	EPA 8270D	GC-MS
SW	Hexachlorobutadiene	EPA 3545	PREP
SW	Hexachlorobutadiene	EPA 8121	GC-ECD
SW	Hexachlorobutadiene	EPA 8270C	GC-MS
SW	Hexachlorobutadiene	EPA 8270D	GC-MS
SW	Hexachlorocyclopentadiene	EPA 3545	PREP
SW	Hexachlorocyclopentadiene	EPA 8121	GC-ECD
SW	Hexachlorocyclopentadiene	EPA 8270C	GC-MS
SW	Hexachlorocyclopentadiene	EPA 8270D	GC-MS
SW	Hexachloroethane	EPA 3545	PREP
SW	Hexachloroethane	EPA 8121	GC-ECD
SW	Hexachloroethane	EPA 8270C	GC-MS
SW	Hexachloroethane	EPA 8270D	GC-MS
SW	Hexachloropropene	EPA 8270C	GC-MS
SW	Pentachlorobenzene	EPA 8270C	GC-MS
SW	1,2,4,5-Tetrachlorobenzene	EPA 8270C	GC-MS
SW	1,2,3-Trichlorobenzene	EPA 5030B	PREP
SW	1,2,3-Trichlorobenzene	EPA 8260B	GC-MS
SW	1,2,4-Trichlorobenzene	EPA 3545	PREP
SW	1,2,4-Trichlorobenzene	EPA 8121	GC-ECD
SW	1,2,4-Trichlorobenzene	EPA 8270C	GC-MS
SW	1,2,4-Trichlorobenzene	EPA 8270D	GC-MS
SW	Haloethers	Method	Technology
SW	Bis(2-chloroethyl)ether	EPA 8270C	GC-MS
SW	Bis(2-chloroethyl)ether	EPA 8270D	GC-MS

Matrix	Analyte	Method	Technology
SW	Bis(2-chloroethoxy)methane	EPA 3545	PREP
SW	Bis(2-chloroethoxy)methane	EPA 8270C	GC-MS
SW	Bis(2-chloroethoxy)methane	EPA 8270D	GC-MS
SW	Bis (2-chloroisopropyl) ether	EPA 3545	PREP
SW	Bis (2-chloroisopropyl) ether	EPA 8270C	GC-MS
SW	Bis (2-chloroisopropyl) ether	EPA 8270D	GC-MS
SW	4-Bromophenylphenyl ether	EPA 3545	PREP
SW	4-Bromophenylphenyl ether	EPA 8270C	GC-MS
SW	4-Bromophenylphenyl ether	EPA 8270D	GC-MS
SW	4-Chlorophenylphenyl ether	EPA 3545	PREP
SW	4-Chlorophenylphenyl ether	EPA 8270C	GC-MS
SW	4-Chlorophenylphenyl ether	EPA 8270D	GC-MS
SW	Nitroaromatics and Isophorone	Method	Technology
SW	2,4-Dinitrotoluene	EPA 3545	PREP
SW	2,4-Dinitrotoluene	EPA 8270C	GC-MS
SW	2,4-Dinitrotoluene	EPA 8270D	GC-MS
SW	2,6-Dinitrotoluene	EPA 3545	PREP
SW	2,6-Dinitrotoluene	EPA 8270C	GC-MS
SW	2,6-Dinitrotoluene	EPA 8270D	GC-MS
SW	Isophorone	EPA 3545	PREP
SW	Isophorone	EPA 8270C	GC-MS
SW	Isophorone	EPA 8270D	GC-MS
SW	1,4-Naphthoquinone	EPA 8270C	GC-MS
SW	Nitrobenzene	EPA 3545	PREP
SW	Nitrobenzene	EPA 8270C	GC-MS
SW	Nitrobenzene	EPA 8270D	GC-MS
SW	Pyridine	EPA 8270C	GC-MS
SW	Pyridine	EPA 8270D	GC-MS
SW	1,3,5-Trinitrobenzene	EPA 8270C	GC-MS
SW	Phthalate Esters	Method	Technology
SW	Benzyl butyl phthalate	EPA 3545	PREP
SW	Benzyl butyl phthalate	EPA 8270C	GC-MS
SW	Benzyl butyl phthalate	EPA 8270D	GC-MS
SW	Bis(2-ethylhexyl) phthalate	EPA 3545	PREP
SW	Bis(2-ethylhexyl) phthalate	EPA 8270C	GC-MS
SW	Bis(2-ethylhexyl) phthalate	EPA 8270D	GC-MS
SW	Diethyl phthalate	EPA 3545	PREP
SW	Diethyl phthalate	EPA 8270C	GC-MS
SW	Diethyl phthalate	EPA 8270D	GC-MS
SW	Dimethyl phthalate	EPA 3545	PREP
SW	Dimethyl phthalate	EPA 8270C	GC-MS
SW	Dimethyl phthalate	EPA 8270D	GC-MS

Matrix	Analyte	Method	Technology
SW	Di-n-butyl phthalate	EPA 3545	PREP
SW	Di-n-butyl phthalate	EPA 8270C	GC-MS
SW	Di-n-butyl phthalate	EPA 8270D	GC-MS
SW	Di-n-octyl phthalate	EPA 3545	PREP
SW	Di-n-octyl phthalate	EPA 8270C	GC-MS
SW	Di-n-octyl phthalate	EPA 8270D	GC-MS
SW	Polychlorinated Biphenyls	Method	Technology
SW	PCB-1016	EPA 3580	PREP
SW	PCB-1016	EPA 3545	PREP
SW	PCB-1016	EPA 8082	GC-ECD
SW	PCB-1016	EPA 8082A	GC-ECD
SW	PCB-1221	EPA 3580	PREP
SW	PCB-1221	EPA 3545	PREP
SW	PCB-1221	EPA 8082	GC-ECD
SW	PCB-1221	EPA 8082A	GC-ECD
SW	PCB-1232	EPA 3580	PREP
SW	PCB-1232	EPA 3545	PREP
SW	PCB-1232	EPA 8082	GC-ECD
SW	PCB-1232	EPA 8082A	GC-ECD
SW	PCB-1242	EPA 3580	PREP
SW	PCB-1242	EPA 3545	PREP
SW	PCB-1242	EPA 8082	GC-ECD
SW	PCB-1242	EPA 8082A	GC-ECD
SW	PCB-1248	EPA 3580	PREP
SW	PCB-1248	EPA 3545	PREP
SW	PCB-1248	EPA 8082	GC-ECD
SW	PCB-1248	EPA 8082A	GC-ECD
SW	PCB-1254	EPA 3580	PREP
SW	PCB-1254	EPA 3545	PREP
SW	PCB-1254	EPA 8082	GC-ECD
SW	PCB-1254	EPA 8082A	GC-ECD
SW	PCB-1260	EPA 3580	PREP
SW	PCB-1260	EPA 3545	PREP
SW	PCB-1260	EPA 8082	GC-ECD
SW	PCB-1260	EPA 8082A	GC-ECD
SW	PCB-1262	EPA 8082	GC-ECD
SW	PCB-1262	EPA 8082A	GC-ECD
SW	PCB-1268	EPA 8082	GC-ECD
SW	PCB-1268	EPA 8082A	GC-ECD
SW	Polynuclear Aromatic Hydrocarbons	Method	Technology
SW	2-Acetylaminofluorene	EPA 8270C	GC-MS
SW	Acenaphthene	EPA 3550B	PREP

Matrix	Analyte	Method	Technology
SW	Acenaphthene	EPA 3545	PREP
SW	Acenaphthene	EPA 8270C	GC-MS
SW	Acenaphthene	EPA 8270D	GC-MS
SW	Anthracene	EPA 3550B	PREP
SW	Anthracene	EPA 3545	PREP
SW	Anthracene	EPA 8270C	GC-MS
SW	Anthracene	EPA 8270D	GC-MS
SW	Acenaphthylene	EPA 3550B	PREP
SW	Acenaphthylene	EPA 3545	PREP
SW	Acenaphthylene	EPA 8270C	GC-MS
SW	Acenaphthylene	EPA 8270D	GC-MS
SW	Benzo(a)anthracene	EPA 3550B	PREP
SW	Benzo(a)anthracene	EPA 3545	PREP
SW	Benzo(a)anthracene	EPA 8270C	GC-MS
SW	Benzo(a)anthracene	EPA 8270D	GC-MS
SW	Benzo(a)pyrene	EPA 3550B	PREP
SW	Benzo(a)pyrene	EPA 3545	PREP
SW	Benzo(a)pyrene	EPA 8270C	GC-MS
SW	Benzo(a)pyrene	EPA 8270D	GC-MS
SW	Benzo(b)fluoranthene	EPA 3550B	PREP
SW	Benzo(b)fluoranthene	EPA 3545	PREP
SW	Benzo(b)fluoranthene	EPA 8270C	GC-MS
SW	Benzo(b)fluoranthene	EPA 8270D	GC-MS
SW	Benzo(ghi)perylene	EPA 3550B	PREP
SW	Benzo(ghi)perylene	EPA 3545	PREP
SW	Benzo(ghi)perylene	EPA 8270C	GC-MS
SW	Benzo(ghi)perylene	EPA 8270D	GC-MS
SW	Benzo(k)fluoranthene	EPA 3550B	PREP
SW	Benzo(k)fluoranthene	EPA 3545	PREP
SW	Benzo(k)fluoranthene	EPA 8270C	GC-MS
SW	Benzo(k)fluoranthene	EPA 8270D	GC-MS
SW	Chrysene	EPA 3550B	PREP
SW	Chrysene	EPA 3545	PREP
SW	Chrysene	EPA 8270C	GC-MS
SW	Chrysene	EPA 8270D	GC-MS
SW	Dibenzo(a,h)anthracene	EPA 3550B	PREP
SW	Dibenzo(a,h)anthracene	EPA 3545	PREP
SW	Dibenzo(a,h)anthracene	EPA 8270C	GC-MS
SW	Dibenzo(a,h)anthracene	EPA 8270D	GC-MS
SW	7,12-Dimethylbenzyl (a) anthracene	EPA 8270C	GC-MS
SW	Fluoranthene	EPA 3550B	PREP
SW	Fluoranthene	EPA 3545	PREP

Matrix	Analyte	Method	Technology
SW	Fluoranthene	EPA 8270C	GC-MS
SW	Fluoranthene	EPA 8270D	GC-MS
SW	Fluorene	EPA 3550B	PREP
SW	Fluorene	EPA 3545	PREP
SW	Fluorene	EPA 8270C	GC-MS
SW	Fluorene	EPA 8270D	GC-MS
SW	Indeno(1,2,3-cd)pyrene	EPA 3550B	PREP
SW	Indeno(1,2,3-cd)pyrene	EPA 3545	PREP
SW	Indeno(1,2,3-cd)pyrene	EPA 8270C	GC-MS
SW	Indeno(1,2,3-cd)pyrene	EPA 8270D	GC-MS
SW	3-Methylcholanthrene	EPA 8270C	GC-MS
SW	Naphthalene	EPA 3550B	PREP
SW	Naphthalene	EPA 3545	PREP
SW	Naphthalene	EPA 8270C	GC-MS
SW	Naphthalene	EPA 8270D	GC-MS
SW	Phenanthrene	EPA 3550B	PREP
SW	Phenanthrene	EPA 3545	PREP
SW	Phenanthrene	EPA 8270C	GC-MS
SW	Phenanthrene	EPA 8270D	GC-MS
SW	Pyrene	EPA 3550B	PREP
SW	Pyrene	EPA 3545	PREP
SW	Pyrene	EPA 8270C	GC-MS
SW	Pyrene	EPA 8270D	GC-MS
SW	Low Level Polynuclear Aromatic Hydrocarbons	Method	Technology
SW	Acenaphthylene	EPA 8270C SIM	GC-MS
SW	Acenaphthene	EPA 8270C SIM	GC-MS
SW	Anthracene	EPA 8270C SIM	GC-MS
SW	Benzo(a)anthracene	EPA 8270C SIM	GC-MS
SW	Benzo(b)fluoranthene	EPA 8270C SIM	GC-MS
SW	Benzo(k)fluoroanthene	EPA 8270C SIM	GC-MS
SW	Benzo(g,h,i)perylene	EPA 8270C SIM	GC-MS
SW	Benzo(a)pyrene	EPA 8270C SIM	GC-MS
SW	Chrysene	EPA 8270C SIM	GC-MS
SW	Dibenzo(a,h)anthracene	EPA 8270C SIM	GC-MS
SW	Fluoranthene	EPA 8270C SIM	GC-MS
SW	Fluorene	EPA 8270C SIM	GC-MS
SW	Indeno(1,2,3-cd)pyrene	EPA 8270C SIM	GC-MS
SW	Naphthalene	EPA 8270C SIM	GC-MS
SW	Phenanthrene	EPA 8270C SIM	GC-MS
SW	Pyrene	EPA 8270C SIM	GC-MS
SW	Priority Pollutant Phenols	Method	Technology
SW	4-Chloro-3-methylphenol	EPA 3545	PREP

Matrix	Analyte	Method	Technology
SW	4-Chloro-3-methylphenol	EPA 8270C	GC-MS
SW	4-Chloro-3-methylphenol	EPA 8270D	GC-MS
SW	2-Chlorophenol	EPA 3545	PREP
SW	2-Chlorophenol	EPA 8270C	GC-MS
SW	2-Chlorophenol	EPA 8270D	GC-MS
SW	2,4-Dichlorophenol	EPA 3545	PREP
SW	2,4-Dichlorophenol	EPA 8270C	GC-MS
SW	2,4-Dichlorophenol	EPA 8270D	GC-MS
SW	2,6-Dichlorophenol	EPA 8270C	GC-MS
SW	2,6-Dichlorophenol	EPA 8270D	GC-MS
SW	2,4-Dimethylphenol	EPA 3545	PREP
SW	2,4-Dimethylphenol	EPA 8270C	GC-MS
SW	2,4-Dimethylphenol	EPA 8270D	GC-MS
SW	2,4-Dinitrophenol	EPA 3545	PREP
SW	2,4-Dinitrophenol	EPA 8270C	GC-MS
SW	2,4-Dinitrophenol	EPA 8270D	GC-MS
SW	2-Methylphenol	EPA 3545	PREP
SW	2-Methylphenol	EPA 8270C	GC-MS
SW	2-Methylphenol	EPA 8270D	GC-MS
SW	3-Methylphenol	EPA 8270C	GC-MS
SW	3-Methylphenol	EPA 8270D	GC-MS
SW	4-Methylphenol	EPA 8270C	GC-MS
SW	4-Methylphenol	EPA 8270D	GC-MS
SW	2-Methyl-4,6-dinitrophenol	EPA 3545	PREP
SW	2-Methyl-4,6-dinitrophenol	EPA 8270C	GC-MS
SW	2-Methyl-4,6-dinitrophenol	EPA 8270D	GC-MS
SW	2-Nitrophenol	EPA 3545	PREP
SW	2-Nitrophenol	EPA 8270C	GC-MS
SW	2-Nitrophenol	EPA 8270D	GC-MS
SW	4-Nitrophenol	EPA 3545	PREP
SW	4-Nitrophenol	EPA 8270C	GC-MS
SW	4-Nitrophenol	EPA 8270D	GC-MS
SW	Pentachlorophenol	EPA 3545	PREP
SW	Pentachlorophenol	EPA 8270C	GC-MS
SW	Pentachlorophenol	EPA 8270D	GC-MS
SW	Phenol	EPA 3545	PREP
SW	Phenol	EPA 8270C	GC-MS
SW	Phenol	EPA 8270D	GC-MS
SW	2,3,4,6 Tetrachlorophenol	EPA 8270C	GC-MS
SW	2,3,4,6 Tetrachlorophenol	EPA 8270D	GC-MS
SW	2,4,6-Trichlorophenol	EPA 3545	PREP
SW	2,4,6-Trichlorophenol	EPA 8270C	GC-MS

Matrix	Analyte	Method	Technology
SW	2,4,6-Trichlorophenol	EPA 8270D	GC-MS
SW	2,4,5-Trichlorophenol	EPA 3545	PREP
SW	2,4,5-Trichlorophenol	EPA 8270C	GC-MS
SW	2,4,5-Trichlorophenol	EPA 8270D	GC-MS
SW	Volatile Aromatics	Method	Technology
SW	1,2,4-Trichlorobenzene, Volatile	EPA 5030B	PREP
SW	1,2,4-Trichlorobenzene, Volatile	EPA 8260C	GC-MS
SW	1,2,4-Trichlorobenzene, Volatile	EPA 8260B	GC-MS
SW	1,2,4-Trichlorobenzene, Volatile	EPA 8021B	GCELCD/PID
SW	Benzene	EPA 5030B	PREP
SW	Benzene	EPA 8260C	GC-MS
SW	Benzene	EPA 8260B	GC-MS
SW	Benzene	EPA 8021B	GCELCD/PID
SW	Benzene	EPA 5035	PREP
SW	Benzene	EPA 3585	PREP
SW	n-Butylbenzene	EPA 5030B	PREP
SW	n-Butylbenzene	EPA 8260B	GC-MS
SW	n-Butylbenzene	EPA 8021B	GCELCD/PID
SW	n-Butylbenzene	EPA 5035	PREP
SW	sec-Butylbenzene	EPA 5030B	PREP
SW	sec-Butylbenzene	EPA 8260B	GC-MS
SW	sec-Butylbenzene	EPA 8021B	GCELCD/PID
SW	sec-Butylbenzene	EPA 5035	PREP
SW	tert-Butylbenzene	EPA 5030B	PREP
SW	tert-Butylbenzene	EPA 8260B	GC-MS
SW	tert-Butylbenzene	EPA 8021B	GCELCD/PID
SW	tert-Butylbenzene	EPA 5035	PREP
SW	Bromobenzene	EPA 5030B	PREP
SW	Bromobenzene	EPA 8260B	GC-MS
SW	Bromobenzene	EPA 8021B	GCELCD/PID
SW	Bromobenzene	EPA 5035	PREP
SW	Chlorobenzene	EPA 5030B	PREP
SW	Chlorobenzene	EPA 8260C	GC-MS
SW	Chlorobenzene	EPA 8260B	GC-MS
SW	Chlorobenzene	EPA 8021B	GCELCD/PID
SW	Chlorobenzene	EPA 5035	PREP
SW	Chlorobenzene	EPA 3585	PREP
SW	2-Chlorotoluene	EPA 8260B	GC-MS
SW	2-Chlorotoluene	EPA 8021B	GCELCD/PID
SW	4-Chlorotoluene	EPA 8260B	GC-MS
SW	4-Chlorotoluene	EPA 8021B	GCELCD/PID
SW	1,2-Dichlorobenzene	EPA 5030B	PREP

Matrix	Analyte	Method	Technology
SW	1,2-Dichlorobenzene	EPA 8260C	GC-MS
SW	1,2-Dichlorobenzene	EPA 8260B	GC-MS
SW	1,2-Dichlorobenzene	EPA 8021B	GCELCD/PID
SW	1,2-Dichlorobenzene	EPA 5035	PREP
SW	1,2-Dichlorobenzene	EPA 3585	PREP
SW	1,3-Dichlorobenzene	EPA 5030B	PREP
SW	1,3-Dichlorobenzene	EPA 8260C	GC-MS
SW	1,3-Dichlorobenzene	EPA 8260B	GC-MS
SW	1,3-Dichlorobenzene	EPA 8021B	GCELCD/PID
SW	1,3-Dichlorobenzene	EPA 5035	PREP
SW	1,3-Dichlorobenzene	EPA 3585	PREP
SW	1,4-Dichlorobenzene	EPA 5030B	PREP
SW	1,4-Dichlorobenzene	EPA 8260C	GC-MS
SW	1,4-Dichlorobenzene	EPA 8260B	GC-MS
SW	1,4-Dichlorobenzene	EPA 8021B	GCELCD/PID
SW	1,4-Dichlorobenzene	EPA 5035	PREP
SW	1,4-Dichlorobenzene	EPA 3585	PREP
SW	Ethyl benzene	EPA 5030B	PREP
SW	Ethyl benzene	EPA 8260C	GC-MS
SW	Ethyl benzene	EPA 8260B	GC-MS
SW	Ethyl benzene	EPA 8021B	GCELCD/PID
SW	Ethyl benzene	EPA 5035	PREP
SW	Ethyl benzene	EPA 3585	PREP
SW	Isopropylbenzene	EPA 5030B	PREP
SW	Isopropylbenzene	EPA 8260C	GC-MS
SW	Isopropylbenzene	EPA 8260B	GC-MS
SW	Isopropylbenzene	EPA 8021B	GCELCD/PID
SW	Isopropylbenzene	EPA 5035	PREP
SW	p-Isopropyltoluene (P-Cymene)	EPA 5030B	PREP
SW	p-Isopropyltoluene (P-Cymene)	EPA 8260B	GC-MS
SW	p-Isopropyltoluene (P-Cymene)	EPA 8021B	GCELCD/PID
SW	p-Isopropyltoluene (P-Cymene)	EPA 5035	PREP
SW	Naphthalene, Volatile	EPA 8260B	GC-MS
SW	Naphthalene, Volatile	EPA 8021B	GCELCD/PID
SW	n-Propylbenzene	EPA 5030B	PREP
SW	n-Propylbenzene	EPA 8260B	GC-MS
SW	n-Propylbenzene	EPA 8021B	GCELCD/PID
SW	n-Propylbenzene	EPA 5035	PREP
SW	Toluene	EPA 5030B	PREP
SW	Toluene	EPA 8260C	GC-MS
SW	Toluene	EPA 8260B	GC-MS
SW	Toluene	EPA 8021B	GCELCD/PID

Matrix	Analyte	Method	Technology
SW	Toluene	EPA 5035	PREP
SW	Toluene	EPA 3585	PREP
SW	Total Xylenes	EPA 5030B	PREP
SW	Total Xylenes	EPA 8260C	GC-MS
SW	Total Xylenes	EPA 8260B	GC-MS
SW	Total Xylenes	EPA 8021B	GCELCD/PID
SW	Total Xylenes	EPA 5035	PREP
SW	Total Xylenes	EPA 3585	PREP
SW	1,2,4-Trimethylbenzene	EPA 8260B	GC-MS
SW	1,2,4-Trimethylbenzene	EPA 8021B	GCELCD/PID
SW	1,3,5-Trimethylbenzene	EPA 8260B	GC-MS
SW	1,3,5-Trimethylbenzene	EPA 8021B	GCELCD/PID
SW	Styrene	EPA 5030B	PREP
SW	Styrene	EPA 8260C	GC-MS
SW	Styrene	EPA 8260B	GC-MS
SW	Styrene	EPA 8021B	GCELCD/PID
SW	Styrene	EPA 5035	PREP
SW	Volatile Halocarbons	Method	Technology
SW	Bromochloromethane	EPA 5030B	PREP
SW	Bromochloromethane	EPA 8260B	GC-MS
SW	Bromochloromethane	EPA 8021B	GCELCD/PID
SW	Bromochloromethane	EPA 5035	PREP
SW	Bromodichloromethane	EPA 5030B	PREP
SW	Bromodichloromethane	EPA 8260C	GC-MS
SW	Bromodichloromethane	EPA 8260B	GC-MS
SW	Bromodichloromethane	EPA 8021B	GCELCD/PID
SW	Bromodichloromethane	EPA 5035	PREP
SW	Bromodichloromethane	EPA 3585	PREP
SW	Bromoform	EPA 5030B	PREP
SW	Bromoform	EPA 8260C	GC-MS
SW	Bromoform	EPA 8260B	GC-MS
SW	Bromoform	EPA 8021B	GCELCD/PID
SW	Bromoform	EPA 5035	PREP
SW	Bromoform	EPA 3585	PREP
SW	Bromomethane	EPA 5030B	PREP
SW	Bromomethane	EPA 8260C	GC-MS
SW	Bromomethane	EPA 8260B	GC-MS
SW	Bromomethane	EPA 8021B	GCELCD/PID
SW	Bromomethane	EPA 5035	PREP
SW	Carbon tetrachloride	EPA 5030B	PREP
SW	Carbon tetrachloride	EPA 8260C	GC-MS
SW	Carbon tetrachloride	EPA 8260B	GC-MS

Matrix	Analyte	Method	Technology
SW	Carbon tetrachloride	EPA 8021B	GCELCD/PID
SW	Carbon tetrachloride	EPA 5035	PREP
SW	Carbon tetrachloride	EPA 3585	PREP
SW	Chloroethane	EPA 5030B	PREP
SW	Chloroethane	EPA 8260C	GC-MS
SW	Chloroethane	EPA 8260B	GC-MS
SW	Chloroethane	EPA 8021B	GCELCD/PID
SW	Chloroethane	EPA 5035	PREP
SW	2-Chloro-1,3-butadiene (Chloroprene)	EPA 5030B	PREP
SW	2-Chloro-1,3-butadiene (Chloroprene)	EPA 8260B	GC-MS
SW	2-Chloro-1,3-butadiene (Chloroprene)	EPA 5035	PREP
SW	2-Chloroethylvinyl ether	EPA 5030B	PREP
SW	2-Chloroethylvinyl ether	EPA 8260B	GC-MS
SW	2-Chloroethylvinyl ether	EPA 8021B	GCELCD/PID
SW	2-Chloroethylvinyl ether	EPA 5035	PREP
SW	Chloroform	EPA 5030B	PREP
SW	Chloroform	EPA 8260C	GC-MS
SW	Chloroform	EPA 8260B	GC-MS
SW	Chloroform	EPA 8021B	GCELCD/PID
SW	Chloroform	EPA 5035	PREP
SW	Chloroform	EPA 3585	PREP
SW	Chloromethane	EPA 5030B	PREP
SW	Chloromethane	EPA 8260C	GC-MS
SW	Chloromethane	EPA 8260B	GC-MS
SW	Chloromethane	EPA 8021B	GCELCD/PID
SW	Chloromethane	EPA 5035	PREP
SW	trans-1,4-Dichloro-2-butene	EPA 8260B	GC-MS
SW	1,2-Dibromo-3-chloropropane	EPA 5030B	PREP
SW	1,2-Dibromo-3-chloropropane	EPA 8260C	GC-MS
SW	1,2-Dibromo-3-chloropropane	EPA 8260B	GC-MS
SW	1,2-Dibromo-3-chloropropane	EPA 8021B	GCELCD/PID
SW	1,2-Dibromo-3-chloropropane	EPA 5035	PREP
SW	1,2-Dibromoethane	EPA 5030B	PREP
SW	1,2-Dibromoethane	EPA 8260C	GC-MS
SW	1,2-Dibromoethane	EPA 8260B	GC-MS
SW	1,2-Dibromoethane	EPA 8021B	GCELCD/PID
SW	1,2-Dibromoethane	EPA 5035	PREP
SW	3-Chloropropene (Allyl chloride)	EPA 8260B	GC-MS
SW	3-Chloropropene (Allyl chloride)	EPA 5035	PREP
SW	cis-1,3-Dichloropropene	EPA 5030B	PREP
SW	cis-1,3-Dichloropropene	EPA 8260C	GC-MS
SW	cis-1,3-Dichloropropene	EPA 8260B	GC-MS

Matrix	Analyte	Method	Technology
SW	cis-1,3-Dichloropropene	EPA 8021B	GCELCD/PID
SW	cis-1,3-Dichloropropene	EPA 5035	PREP
SW	trans-1,3-Dichloropropene	EPA 5030B	PREP
SW	trans-1,3-Dichloropropene	EPA 8260C	GC-MS
SW	trans-1,3-Dichloropropene	EPA 8260B	GC-MS
SW	trans-1,3-Dichloropropene	EPA 8021B	GCELCD/PID
SW	trans-1,3-Dichloropropene	EPA 5035	PREP
SW	Dibromochloromethane	EPA 5030B	PREP
SW	Dibromochloromethane	EPA 8260C	GC-MS
SW	Dibromochloromethane	EPA 8260B	GC-MS
SW	Dibromochloromethane	EPA 8021B	GCELCD/PID
SW	Dibromochloromethane	EPA 5035	PREP
SW	Dibromochloromethane	EPA 3585	PREP
SW	Dibromomethane	EPA 5030B	PREP
SW	Dibromomethane	EPA 8260B	GC-MS
SW	Dibromomethane	EPA 8021B	GCELCD/PID
SW	Dibromomethane	EPA 5035	PREP
SW	Dichlorodifluoromethane	EPA 5030B	PREP
SW	Dichlorodifluoromethane	EPA 8260C	GC-MS
SW	Dichlorodifluoromethane	EPA 8260B	GC-MS
SW	Dichlorodifluoromethane	EPA 8021B	GCELCD/PID
SW	Dichlorodifluoromethane	EPA 5035	PREP
SW	1,1-Dichloroethane	EPA 5030B	PREP
SW	1,1-Dichloroethane	EPA 8260C	GC-MS
SW	1,1-Dichloroethane	EPA 8260B	GC-MS
SW	1,1-Dichloroethane	EPA 8021B	GCELCD/PID
SW	1,1-Dichloroethane	EPA 5035	PREP
SW	1,1-Dichloroethane	EPA 3585	PREP
SW	1,2-Dichloroethane	EPA 5030B	PREP
SW	1,2-Dichloroethane	EPA 8260C	GC-MS
SW	1,2-Dichloroethane	EPA 8260B	GC-MS
SW	1,2-Dichloroethane	EPA 8021B	GCELCD/PID
SW	1,2-Dichloroethane	EPA 5035	PREP
SW	1,2-Dichloroethane	EPA 3585	PREP
SW	1,1-Dichloroethene	EPA 5030B	PREP
SW	1,1-Dichloroethene	EPA 8260C	GC-MS
SW	1,1-Dichloroethene	EPA 8260B	GC-MS
SW	1,1-Dichloroethene	EPA 8021B	GCELCD/PID
SW	1,1-Dichloroethene	EPA 5035	PREP
SW	cis-1,2-Dichloroethene	EPA 5030B	PREP
SW	cis-1,2-Dichloroethene	EPA 8260C	GC-MS
SW	cis-1,2-Dichloroethene	EPA 8260B	GC-MS

Matrix	Analyte	Method	Technology
SW	cis-1,2-Dichloroethene	EPA 8021B	GCELCD/PID
SW	cis-1,2-Dichloroethene	EPA 5035	PREP
SW	trans-1,2-Dichloroethene	EPA 5030B	PREP
SW	trans-1,2-Dichloroethene	EPA 8260C	GC-MS
SW	trans-1,2-Dichloroethene	EPA 8260B	GC-MS
SW	trans-1,2-Dichloroethene	EPA 8021B	GCELCD/PID
SW	trans-1,2-Dichloroethene	EPA 5035	PREP
SW	1,1-Dichloropropene	EPA 5030B	PREP
SW	1,1-Dichloropropene	EPA 8260B	GC-MS
SW	1,1-Dichloropropene	EPA 8021B	GCELCD/PID
SW	1,1-Dichloropropene	EPA 5035	PREP
SW	1,2-Dichloropropane	EPA 5030B	PREP
SW	1,2-Dichloropropane	EPA 8260C	GC-MS
SW	1,2-Dichloropropane	EPA 8260B	GC-MS
SW	1,2-Dichloropropane	EPA 8021B	GCELCD/PID
SW	1,2-Dichloropropane	EPA 5035	PREP
SW	1,3-Dichloropropane	EPA 5030B	PREP
SW	1,3-Dichloropropane	EPA 8260B	GC-MS
SW	1,3-Dichloropropane	EPA 8021B	GCELCD/PID
SW	1,3-Dichloropropane	EPA 5035	PREP
SW	2,2-Dichloropropane	EPA 5030B	PREP
SW	2,2-Dichloropropane	EPA 8260B	GC-MS
SW	2,2-Dichloropropane	EPA 8021B	GCELCD/PID
SW	2,2-Dichloropropane	EPA 5035	PREP
SW	Hexachlorobutadiene, Volatile	EPA 8260B	GC-MS
SW	Methylene chloride	EPA 5030B	PREP
SW	Methylene chloride	EPA 8260C	GC-MS
SW	Methylene chloride	EPA 8260B	GC-MS
SW	Methylene chloride	EPA 8021B	GCELCD/PID
SW	Methylene chloride	EPA 5035	PREP
SW	Methylene chloride	EPA 3585	PREP
SW	Methyl iodide	EPA 8260B	GC-MS
SW	1,1,1,2-Tetrachloroethane	EPA 5030B	PREP
SW	1,1,1,2-Tetrachloroethane	EPA 8260B	GC-MS
SW	1,1,1,2-Tetrachloroethane	EPA 8021B	GCELCD/PID
SW	1,1,1,2-Tetrachloroethane	EPA 5035	PREP
SW	1,1,1,2-Tetrachloroethane	EPA 3585	PREP
SW	1,1,2,2-Tetrachloroethane	EPA 5030B	PREP
SW	1,1,2,2-Tetrachloroethane	EPA 8260C	GC-MS
SW	1,1,2,2-Tetrachloroethane	EPA 8260B	GC-MS
SW	1,1,2,2-Tetrachloroethane	EPA 8021B	GCELCD/PID
SW	1,1,2,2-Tetrachloroethane	EPA 5035	PREP

Matrix	Analyte	Method	Technology
SW	1,1,2,2-Tetrachloroethane	EPA 3585	PREP
SW	Tetrachloroethene	EPA 5030B	PREP
SW	Tetrachloroethene	EPA 8260C	GC-MS
SW	Tetrachloroethene	EPA 8260B	GC-MS
SW	Tetrachloroethene	EPA 8021B	GCELCD/PID
SW	Tetrachloroethene	EPA 5035	PREP
SW	Tetrachloroethene	EPA 3585	PREP
SW	1,1,1-Trichloroethane	EPA 5030B	PREP
SW	1,1,1-Trichloroethane	EPA 8260C	GC-MS
SW	1,1,1-Trichloroethane	EPA 8260B	GC-MS
SW	1,1,1-Trichloroethane	EPA 8021B	GCELCD/PID
SW	1,1,1-Trichloroethane	EPA 5035	PREP
SW	1,1,1-Trichloroethane	EPA 3585	PREP
SW	1,1,2-Trichloroethane	EPA 5030B	PREP
SW	1,1,2-Trichloroethane	EPA 8260C	GC-MS
SW	1,1,2-Trichloroethane	EPA 8260B	GC-MS
SW	1,1,2-Trichloroethane	EPA 8021B	GCELCD/PID
SW	1,1,2-Trichloroethane	EPA 5035	PREP
SW	Trichloroethene	EPA 5030B	PREP
SW	Trichloroethene	EPA 8260C	GC-MS
SW	Trichloroethene	EPA 8260B	GC-MS
SW	Trichloroethene	EPA 8021B	GCELCD/PID
SW	Trichloroethene	EPA 5035	PREP
SW	Trichloroethene	EPA 3585	PREP
SW	Trichlorofluoromethane	EPA 5030B	PREP
SW	Trichlorofluoromethane	EPA 8260C	GC-MS
SW	Trichlorofluoromethane	EPA 8260B	GC-MS
SW	Trichlorofluoromethane	EPA 8021B	GCELCD/PID
SW	Trichlorofluoromethane	EPA 5035	PREP
SW	1,2,3-Trichloropropane	EPA 5030B	PREP
SW	1,2,3-Trichloropropane	EPA 8260B	GC-MS
SW	1,2,3-Trichloropropane	EPA 8021B	GCELCD/PID
SW	1,2,3-Trichloropropane	EPA 5035	PREP
SW	1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260C	GC-MS
SW	1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260B	GC-MS
SW	Vinyl chloride	EPA 5030B	PREP
SW	Vinyl chloride	EPA 8260C	GC-MS
SW	Vinyl chloride	EPA 8260B	GC-MS
SW	Vinyl chloride	EPA 8021B	GCELCD/PID
SW	Vinyl chloride	EPA 5035	PREP
SW	Chlorinated Hydrocarbon Pesticides	Method	Technology
SW	Aldrin	EPA 8081A	GC-ECD

Matrix	Analyte	Method	Technology
SW	Aldrin	EPA 8081B	GC-ECD
SW	Aldrin	EPA 3545	PREP
SW	Atrazine	EPA 8270C	GC-MS
SW	alpha-BHC	EPA 8081A	GC-ECD
SW	alpha-BHC	EPA 8081B	GC-ECD
SW	alpha-BHC	EPA 3545	PREP
SW	beta-BHC	EPA 8081A	GC-ECD
SW	beta-BHC	EPA 8081B	GC-ECD
SW	beta-BHC	EPA 3545	PREP
SW	delta-BHC	EPA 8081A	GC-ECD
SW	delta-BHC	EPA 8081B	GC-ECD
SW	delta-BHC	EPA 3545	PREP
SW	Lindane	EPA 8081A	GC-ECD
SW	Lindane	EPA 8081B	GC-ECD
SW	Lindane	EPA 3545	PREP
SW	alpha-Chlordane	EPA 8081A	GC-ECD
SW	alpha-Chlordane	EPA 8081B	GC-ECD
SW	gamma-Chlordane	EPA 8081A	GC-ECD
SW	gamma-Chlordane	EPA 8081B	GC-ECD
SW	Chlordane Total	EPA 8081A	GC-ECD
SW	Chlordane Total	EPA 3545	PREP
SW	Chlorobenzilate	EPA 8270C	GC-MS
SW	4,4'-DDD	EPA 8081A	GC-ECD
SW	4,4'-DDD	EPA 8081B	GC-ECD
SW	4,4'-DDD	EPA 3545	PREP
SW	4,4'-DDE	EPA 8081A	GC-ECD
SW	4,4'-DDE	EPA 8081B	GC-ECD
SW	4,4'-DDE	EPA 3545	PREP
SW	4,4'-DDT	EPA 8081A	GC-ECD
SW	4,4'-DDT	EPA 8081B	GC-ECD
SW	4,4'-DDT	EPA 3545	PREP
SW	Diallate	EPA 8270C	GC-MS
SW	Dieldrin	EPA 8081A	GC-ECD
SW	Dieldrin	EPA 8081B	GC-ECD
SW	Dieldrin	EPA 3545	PREP
SW	Endosulfan I	EPA 8081A	GC-ECD
SW	Endosulfan I	EPA 8081B	GC-ECD
SW	Endosulfan I	EPA 3545	PREP
SW	Endosulfan II	EPA 8081A	GC-ECD
SW	Endosulfan II	EPA 8081B	GC-ECD
SW	Endosulfan II	EPA 3545	PREP
SW	Endosulfan sulfate	EPA 8081A	GC-ECD

Matrix	Analyte	Method	Technology
SW	Endosulfan sulfate	EPA 8081B	GC-ECD
SW	Endosulfan sulfate	EPA 3545	PREP
SW	Endrin	EPA 8081A	GC-ECD
SW	Endrin	EPA 8081B	GC-ECD
SW	Endrin	EPA 3545	PREP
SW	Endrin aldehyde	EPA 8081A	GC-ECD
SW	Endrin aldehyde	EPA 8081B	GC-ECD
SW	Endrin aldehyde	EPA 3545	PREP
SW	Endrin Ketone	EPA 8081A	GC-ECD
SW	Endrin Ketone	EPA 8081B	GC-ECD
SW	Heptachlor	EPA 8081A	GC-ECD
SW	Heptachlor	EPA 8081B	GC-ECD
SW	Heptachlor	EPA 3545	PREP
SW	Heptachlor epoxide	EPA 8081A	GC-ECD
SW	Heptachlor epoxide	EPA 8081B	GC-ECD
SW	Heptachlor epoxide	EPA 3545	PREP
SW	Isodrin	EPA 8270C	GC-MS
SW	Methoxychlor	EPA 8081A	GC-ECD
SW	Methoxychlor	EPA 8081B	GC-ECD
SW	Methoxychlor	EPA 3545	PREP
SW	Toxaphene	EPA 8081A	GC-ECD
SW	Toxaphene	EPA 8081B	GC-ECD
SW	Toxaphene	EPA 3545	PREP
SW	Pentachloronitrobenzene	EPA 8270C	GC-MS
SW	Chlorophenoxy Acid Pesticides	Method	Technology
SW	2,4-DB	EPA 8151A	GC-ECD
SW	2,4-D	EPA 8151A	GC-ECD
SW	2,4,5-T	EPA 8151A	GC-ECD
SW	2,4,5-TP (Silvex)	EPA 8151A	GC-ECD
SW	Dicamba	EPA 8151A	GC-ECD
SW	Dinoseb	EPA 8151A	GC-ECD
SW	Dalapon	EPA 8151A	GC-ECD
SW	Organophosphate Pesticides	Method	Technology
SW	Azinphos methyl	EPA 8141A	GC-NPD
SW	Demeton-O	EPA 8141A	GC-NPD
SW	Demeton-S	EPA 8141A	GC-NPD
SW	Diazinon	EPA 8141A	GC-NPD
SW	Dimethoate	EPA 8141A	GC-NPD
SW	Dimethoate	EPA 8270C	GC-MS
SW	Dioxathion	EPA 8141A	GC-NPD
SW	Disulfoton	EPA 3545	PREP
SW	Disulfoton	EPA 8141A	GC-NPD

Matrix	Analyte	Method	Technology
SW	Disulfoton	EPA 8270C	GC-MS
SW	Ethion	EPA 8141A	GC-NPD
SW	Famphur	EPA 8141A	GC-NPD
SW	Malathion	EPA 8141A	GC-NPD
SW	Parathion ethyl	EPA 8141A	GC-NPD
SW	Parathion ethyl	EPA 8270C	GC-MS
SW	Parathion methyl	EPA 8141A	GC-NPD
SW	Phorate	EPA 8141A	GC-NPD
SW	Phorate	EPA 8270C	GC-MS
SW	Sulfotepp	EPA 8141A	GC-NPD
SW	Thionazin	EPA 8141A	GC-NPD
SW	Thionazin	EPA 8270C	GC-MS
SW	Volatile Chlorinated Organics	Method	Technology
SW	Benzyl chloride	EPA 8260B	GC-MS
SW	Miscellaneous	Method	Technology
SW	Boron, Total	EPA 6010B	ICP-AES
SW	Cyanide, Total	EPA 9010B	PREP
SW	Cyanide, Total	EPA 9014	COLOR
SW	Hydrogen Ion (pH)	EPA 9045C	POT
SW	Hydrogen Ion (pH)	EPA 9040B	POT
SW	Lead in Paint	EPA 6010B	ICP-AES
SW	Lead in Dust Wipes	EPA 6010B	ICP-AES
SW	Phenols	EPA 9065	COLOR
SW	Sulfide (as S)	EPA 9030B	PREP
SW	Sulfide (as S)	EPA 9034	TITR
SW	Benzidines	Method	Technology
SW	Benzidine	EPA 8270C	GC-MS
SW	Benzidine	EPA 8270D	GC-MS
SW	3,3'-Dichlorobenzidine	EPA 8270C	GC-MS
SW	3,3'-Dichlorobenzidine	EPA 8270D	GC-MS
SW	3,3'-Dimethylbenzidine	EPA 8270C	GC-MS
SW	Volatile Organics	Method	Technology
SW	Acetone	EPA 5030B	PREP
SW	Acetone	EPA 8260C	GC-MS
SW	Acetone	EPA 8260B	GC-MS
SW	Acetone	EPA 5035	PREP
SW	Acetonitrile	EPA 8260B	GC-MS
SW	Carbon Disulfide	EPA 8260C	GC-MS
SW	Carbon Disulfide	EPA 8260B	GC-MS
SW	Cyclohexane	EPA 8260C	GC-MS
SW	Cyclohexane	EPA 8260B	GC-MS
SW	Di-ethyl ether	EPA 8260C	GC-MS

Matrix	Analyte	Method	Technology
SW	Di-ethyl ether	EPA 8260B	GC-MS
SW	1,4-Dioxane	EPA 8260B	GC-MS
SW	Isobutyl alcohol	EPA 8260B	GC-MS
SW	Isopropanol	EPA 8260C	GC-MS
SW	Isopropanol	EPA 8260B	GC-MS
SW	2-Hexanone	EPA 8260C	GC-MS
SW	2-Hexanone	EPA 8260B	GC-MS
SW	2-Butanone (Methylethyl ketone)	EPA 5030B	PREP
SW	2-Butanone (Methylethyl ketone)	EPA 8260C	GC-MS
SW	2-Butanone (Methylethyl ketone)	EPA 8260B	GC-MS
SW	2-Butanone (Methylethyl ketone)	EPA 5035	PREP
SW	Methyl acetate	EPA 8260B	GC-MS
SW	Methyl cyclohexane	EPA 8260B	GC-MS
SW	Methyl cyclohexane	EPA 8270C	GC-MS
SW	Methyl tert-butyl ether	EPA 5030B	PREP
SW	Methyl tert-butyl ether	EPA 8260C	GC-MS
SW	Methyl tert-butyl ether	EPA 8260B	GC-MS
SW	Methyl tert-butyl ether	EPA 8021B	GCELCD/PID
SW	Methyl tert-butyl ether	EPA 5035	PREP
SW	4-Methyl-2-Pentanone	EPA 8260C	GC-MS
SW	4-Methyl-2-Pentanone	EPA 8260B	GC-MS
SW	4-Methyl-2-Pentanone	EPA 5035	PREP
SW	4-Methyl-2-Pentanone	EPA 3585	PREP
SW	2-Nitropropane	EPA 8260C	GC-MS
SW	2-Nitropropane	EPA 8260B	GC-MS
SW	Propionitrile	EPA 8260B	GC-MS
SW	o-Toluidine	EPA 8270C	GC-MS
SW	tert-butyl alcohol	EPA 8260B	GC-MS
SW	Vinyl acetate	EPA 5030B	PREP
SW	Vinyl acetate	EPA 8260B	GC-MS
SW	Vinyl acetate	EPA 5035	PREP
SW	Semi-Volatile Organics	Method	Technology
SW	Acetophenone	EPA 8270C	GC-MS
SW	4-Amino biphenyl	EPA 8270C	GC-MS
SW	Aramite	EPA 8270C	GC-MS
SW	Benzoic Acid	EPA 8270C	GC-MS
SW	Benzoic Acid	EPA 8270D	GC-MS
SW	Benzyl alcohol	EPA 8270C	GC-MS
SW	Benzyl alcohol	EPA 8270D	GC-MS
SW	Benzaldehyde	EPA 8270C	GC-MS
SW	1,1'-Biphenyl	EPA 8270C	GC-MS
SW	Caprolactam	EPA 8270C	GC-MS

Matrix	Analyte	Method	Technology
SW	1,2-Dichlorobenzene, Semi-volatile	EPA 8270C	GC-MS
SW	1,2-Dichlorobenzene, Semi-volatile	EPA 8270D	GC-MS
SW	1,3-Dichlorobenzene, Semi-volatile	EPA 8270C	GC-MS
SW	1,3-Dichlorobenzene, Semi-volatile	EPA 8270D	GC-MS
SW	1,4-Dichlorobenzene, Semi-volatile	EPA 8270C	GC-MS
SW	1,4-Dichlorobenzene, Semi-volatile	EPA 8270D	GC-MS
SW	Dibenzofuran	EPA 3545	PREP
SW	Dibenzofuran	EPA 8270C	GC-MS
SW	Dibenzofuran	EPA 8270D	GC-MS
SW	Ethyl methanesulfonate	EPA 8270C	GC-MS
SW	Ethyl methanesulfonate	EPA 8270D	GC-MS
SW	Isosafrole	EPA 8270C	GC-MS
SW	2-Methylnaphthalene	EPA 8270C	GC-MS
SW	2-Methylnaphthalene	EPA 8270D	GC-MS
SW	Methyl methanesulfonate	EPA 8270C	GC-MS
SW	Methyl methanesulfonate	EPA 8270D	GC-MS
SW	Phenacetin	EPA 8270C	GC-MS
SW	2-Picoline	EPA 8270C	GC-MS
SW	Safrole	EPA 8270C	GC-MS
SW	O,O,O-Triethyl phosphorothioate	EPA 8270C	GC-MS
SW	Amines	Method	Technology
SW	Aniline	EPA 8270C	GC-MS
SW	Carbazole	EPA 8270C	GC-MS
SW	Carbazole	EPA 8270D	GC-MS
SW	4-Chloroaniline	EPA 8270C	GC-MS
SW	4-Chloroaniline	EPA 8270D	GC-MS
SW	Diphenylamine	EPA 8270C	GC-MS
SW	1-Naphthylamine	EPA 8270C	GC-MS
SW	2-Naphthylamine	EPA 8270C	GC-MS
SW	2-Nitroaniline	EPA 8270C	GC-MS
SW	2-Nitroaniline	EPA 8270D	GC-MS
SW	3-Nitroaniline	EPA 8270C	GC-MS
SW	3-Nitroaniline	EPA 8270D	GC-MS
SW	4-Nitroaniline	EPA 8270C	GC-MS
SW	4-Nitroaniline	EPA 8270D	GC-MS
SW	5-Nitro-o-toluidine	EPA 8270C	GC-MS
SW	Methapyrilene	EPA 8270C	GC-MS
SW	1,4-Phenylenediamine	EPA 8270C	GC-MS
SW	1,2-Diphenylhydrazine	EPA 8270C	GC-MS
SW	1,2-Diphenylhydrazine	EPA 8270D	GC-MS
SW	Pronamide	EPA 8270C	GC-MS
SW	Carbamate Pesticides	Method	Technology

Matrix	Analyte	Method	Technology
SW	Aldicarb	EPA 8318	HPLC-FLUOR
SW	Aldicarb Sulfone	EPA 8318	HPLC-FLUOR
SW	Carbofuran	EPA 8318	HPLC-FLUOR
SW	Nitrosoamines	Method	Technology
SW	N-Nitrosodiphenylamine	EPA 8270C	GC-MS
SW	N-Nitrosodiphenylamine	EPA 8270D	GC-MS
SW	N-Nitrosodimethylamine	EPA 8270C	GC-MS
SW	N-Nitrosodimethylamine	EPA 8270D	GC-MS
SW	N-Nitrosodiethylamine	EPA 8270C	GC-MS
SW	N-nitrosomethylethylamine	EPA 8270C	GC-MS
SW	N-Nitrosodi-n-butylamine	EPA 8270C	GC-MS
SW	N-Nitrosodi-n-propylamine	EPA 3545	PREP
SW	N-Nitrosodi-n-propylamine	EPA 8270C	GC-MS
SW	N-Nitrosodi-n-propylamine	EPA 8270D	GC-MS
SW	N-nitrosomorpholine	EPA 8270C	GC-MS
SW	N-nitrosopiperidine	EPA 8270C	GC-MS
SW	N-Nitrosopyrrolidine	EPA 8270C	GC-MS
SW	Minerals	Method	Technology
SW	Bromide	EPA 9056A	IC-COND
SW	Chloride	EPA 9250	COLOR
SW	Chloride	EPA 9056A	IC-COND
SW	Fluoride, Total	EPA 9056A	IC-COND
SW	Sulfate (as SO4)	EPA 9038	COLOR
SW	Sulfate (as SO4)	EPA 9056A	IC-COND
SW	Nutrients	Method	Technology
SW	Nitrate (as N)	EPA 9056A	IC-COND
SW	Nitrite (as N)	EPA 9056A	IC-COND
SW	Orthophosphate (as P)	EPA 9056A	IC-COND
SW	Petroleum Hydrocarbons	Method	Technology
SW	Diesel Range Organics	EPA 8270C	GC-MS
SW	Diesel Range Organics	EPA 8015 B	GC-FID
SW	Diesel Range Organics	EPA 8015C	GC-FID
SW	Gasoline Range Organics	EPA 8260B	GC-MS
SW	Gasoline Range Organics	EPA 8015 B	GC-FID
SW	Gasoline Range Organics	EPA 8015C	GC-FID
SW	Oil & Grease Total Recoverable (HEM)	EPA 9071 (Solvent:Hexane)	GRAV

Section 5.0 Vendor Listing

VendorID	Company	Address	Address2	State	City	Zip	Phone	Fax	Representative
Absolute Standard							203-281-2917		
Accustandard	Accustandard	25 Science Park	Suite 687	Conn.	New Haven	06511	800-442-5290		
Andrews Glass Co. Inc.	Andrews Glass Co. Inc.	3740 Northwest Boulevard		New Jersey	Vineland	08360	8566924435	8566925357	
Airweld, Inc.	Airweld, Inc.	94 Marine Street		NY	Farmingdale	11735	631-694-4343		Rich Graziano
bioMerieux, Inc.	bioMerieux, Inc.						8006347656		
Bulbtronics	Bulbtronics						6312492272		
Chemical Research Supplies	Chemical Research Supplies	P.O. Box 888		IL	Addison	60101	8003273800		
Compco	Compco Analytical, Inc.	215 Gates Road	Unit U	NJ	Little Ferry	07643	201-641-3936		
Dionex	Dionex Corporation	1228 Titan Way		CA	Sunnyvale	940883603	8003466390		
Entech Instruments	Entech Instruments						1-805-527-5939		Tom Wilber
Environmental Express	Environmental Express LTD	490 Wando Park Blvd.		SC	Mt. Pleasant	29464	8003435319		Les Orr
Environmental Resource Associates	Environmental Resource Associates	6000 West 54th Avenue		CO	Arvada	80002	8003720122	3034210159	
Environmental Sample Technology	Environmental Sample Technology						8002833510		
Thermo Fisher Scientific	Fisher Scientific						8007667000		
Glove Planet	Glove Planet						1-800-848-0616		Louie LeMieux
Grainger	Grainger						6313913030		
Grasby Nutech	Grasby Nutech						8006376312		
Hach Co.	Hach Company	P.O. Box 389		Colorado	Loveland	80539	8002274224		

VendorID	Company	Address	Address2	State	City	Zip	Phone	Fax	Representative
High Purity Stds	High Purity Standards	P.O. Box 41727		SC	Charleston	29423	8437677900	8437677906	
Horizon Technologies	Horizon Technologies	8 Commerce Drive		NH	Atkinson	03811	8009972997		Justine ext 12 or Ann Vachon ext. 11
Idexx Laboratories	Idexx Laboratories	One Idexx Drive		ME	Westbrook	04092	1-800-551-0998		Dave Jefferson
Inorganic Ventures	Inorganic Ventures						8006696799		
Inorganics Standards Service	Inorganic Standards Service						8009960980	2154899577	Arlene & Fred
J2 Scientific	J2 Scientific						5732140472		
JE Meinhard Associates, Inc.	JE Meinhard Associates, Inc.						8006346427		
LaMotte Company	Lamotte Company						8003443100	4107786394	
Teledyne Leeman Labs, Inc.	Leeman Labs, Inc.	6 Wentworth Drive		NH	Hudson	03051	8005336267	6038864322	Donald Miller
Man-Tech Associates	Man-Tech Associates						1/800-206-8116		
M & M (Marsid) Printing	Marsid-M & M Group	245 Westbury Avenue		NY	Carle Place	11514	5167963020		
Marquardt & Company	Marquardt & Company	60 MC Clellan St.		New Jersey	Newark	071142112	1-516-796-3020		Frank Fields & Elaine
Millipore Corp	Millipore Corp.	2736 Paysphere Circle		IL	Chicago	60674	8006455476		
MV Labs	MV Laboratories, Inc.	P.O. Box 370		NJ	Three Bridges	08887	9089966633		Marge & Warren
Office Depot	Office Depot	110 Bi-County Blvd.	Suite 122	NY	Famindale	11735	516-454-4606		Alex Coules
Perkin Elmer	Perkin Elmer	761 Main Avenue		Conn.	Newark	06859-0156	1-800-762-4000		
Phenomenex	Phenomenex	411 Madrid Avenue		CA	Torrance	905011430	3103287768		Eric Kwak
Pickering Labs	Pickering Laboratories	1951 Colony St.		CA	Mountain View	94043	8006543330		Can order thru VWR @ same price

VendorID	Company	Address	Address2	State	City	Zip	Phone	Fax	Representative
Remel	Remel, Inc.	12076 Santa Fe Drive		Kansas	Lenexa	66215	8002556730		Robin Swank, John Demurse
Restek Corp.	Restek Corporation	P.O. Box 8500-6215		PA	Philadelphia	191786215	8003561688		Mark Lawrence
Spex CertiPrep	Spex CertiPrep Group	203 Norcross Avenue.		NJ	Metuchen				
Tridon Chemical	Tridon Chemical			NY			242-6924		Beth Catalano
Ultra	Ultra Scientific	250 Smith St.		RI	N. Kingston	02852	8003381754		Paul Jennings
Veolia	Veolia Environmental Services	1 Eden Lane		NJ	Flanders	07836	866-435-9256		Bill Sanchez
VWR	VWR International								James Wall
Waters	Waters Corp.	34 Maple Street		MA	Milford	01757	1-800-252-4752		Frank Gagliardi
Wrap N Pack	Wrap N Pack	21 Executive Blvd.		NY	Farmingdale	11735	631-756-0440		Joe Razzano

Section 6.0 Equipment Listing and Maintenance

Section	Instrument Type	Manufacturer	Model #	Preventative Maintenance	Manual location	Serial #	Date Rec'd.	Condi-tion when rec'd.
GC/MS	Gas Chromatograph	Hewlett Packard	5890		North Cabinet	2908A-21584	1987	New
GC/MS	Gas Chromatograph	Hewlett Packard	5890 Series II		North Cabinet	3310A-47249	1995	New
GC/MS	Gas Chromatograph	Hewlett Packard	5890 Series II		North Cabinet	3310A-48125	2007	Refurb
GC/MS	Gas Chromatograph	Hewlett Packard	5890 Series II		North Cabinet		2008	
GC/MS	Gas Chromatograph	Hewlett Packard	5890 Series II		North Cabinet		2009	
GC/MS	Gas Chromatograph	Hewlett Packard	6890N		Drawer below instrument		2001	New
GC/MS	Gas Chromatograph	Hewlett Packard	6890N				1998	New
GC/MS	Gas Chromatograph	Hewlett Packard	6890N				2005	
GC/MS	Gas Chromatograph	Hewlett Packard	6890N				2009	
GC/MS	GC/MS	Hewlett Packard	5996A	As needed: Clean source, clip column, swab injection port liner Daily: change insert, replace septa, check mass calibration Annually: change vacuum pump oil	East Shelf	2217A-00303	1984	New
GC/MS	GC/MS	Hewlett Packard	5970		North Cabinet	2637A-01851	1990	New
GC/MS	GC/MS	Hewlett Packard	5971		East Shelf	3304A-04413	1993	New
GC/MS	GC/MS	Hewlett Packard	5972		Drawer below instr.	3501A-02544	1995	New
GC/MS	GC/MS	Hewlett Packard	5972			4W43-148	2007	Refurb.
GC/MS	GC/MS	Hewlett Packard	5972				2008	
GC/MS	GC/MS	Hewlett Packard	5972				2009	

Section	Instrument Type	Manufacturer	Model #	Preventative Maintenance	Manual location	Serial #	Date Rec'd.	Condition when rec'd.
GC/MS	GC/MS	Hewlett Packard	5973			U5638-10174	1998	New
GC/MS	GC/MS	Hewlett Packard	5973N		Drawer below instr.	U5104-51830	2001	New
GC/MS	GC/MS	Hewlett Packard	5973i			U5446-21373	2005	New
GC/MS	Auto- injector	Hewlett Packard	7673A	Daily: check needles and lines	North Cabinet	3042A-23605	1989	New
GC/MS	Auto- injector	Hewlett Packard	7673A		North Cabinet	2628A-03701	1990	New
GC/MS	Auto- injector	Hewlett Packard	7683			13822-158	2001	New
GC/MS	Injector Modules	Hewlett Packard	18593A			2843A-12464		New
GC/MS	Injector Modules	Hewlett Packard	18593A			2843A-12474		New
GC/MS	Liquid Samplers	Tekmar	ALS2016		East Shelf	90052025	1989	New
GC/MS	Liquid Samplers	Env. Sample Tech. Inc.	Archon		East Shelf	12578	1998	New
GC/MS	Liquid Samplers	Env. Sample Tech. Inc.	Archon				2009	
GC/MS	Liquid Samplers	Varian	Archon		East Shelf	12565	1998	New
GC/MS	Liquid Samplers	Varian	Archon		East Shelf	15045	2007	New
GC/MS	Liquid Samplers	Varian	Archon		East Shelf	15046	2007	
GC/MS	Liquid Samplers	Teledyne Tekmar	SOLA Tek 72			U50515-1007	2005	New
GC/MS	Auto- sampler	Custom	Custom		East Shelf		1995	New
GC/MS	Cryogenic Cap. Interface	Tekmar	M2000			H2M-40099	1987	New
GC/MS	Liquid Sample Concentrators	Tekmar	LCS2000		North Cabinet	88041019	1988	New

Section	Instrument Type	Manufacturer	Model #	Preventative Maintenance	Manual location	Serial #	Date Rec'd.	Condi-tion when rec'd.
GC/MS	Liquid Sample Concentrators	Tekmar	LCS2000		North Cabinet	92086007	1989	
GC/MS	Liquid Sample Concentrators	Tekmar	LCS2000		East Shelf	90088002		New
GC/MS	Liquid Sample Concentrators	Tekmar	LCS2000			97203002		
GC/MS	Liquid Sample Concentrators	Tekmar	LCS3000		East shelf	94238021	2007	Refurb
GC/MS	Liquid Sample Concentrators	Tekmar	LCS3000		East shelf	97203002	2007	Refurb
GC/MS	Liquid Sample Concentrators	Tekmar	LCS3000				2008	
GC/MS	Liquid Sample Concentrators	Tekmar	LCS3000				2009	
GC/MS	Liquid Sample Concentrators	Tekmar	Velocity XP			3631a-10564	2005	Refurb
GC/MS	Moisture Control Module	Tekmar	14-4700				1990	New
GC/MS	Tube Desorber	Envirochem	8916		Drawer by RTE	142-1015	1992	New
GC/MS	Concentrator	Entech	7100A				2005	New
GC/MS	Tube Assembly	Entech	7100			1255	2005	New
GC/MS	Autosampler	Entech	7032-L			1051	2005	New
GC/MS	Oven Can Cleaning System	Entech	3106A			1154	2005	New
GC/MS	Dynamic Diluter	Entech	4601A			1105	2005	New
GC/MS	Mass Spectral Library NIST 2008	Hewlett Packard	G1033A		GKB Office	(reg.#) 88XA-222L9-ZK577-	2008	New

Section	Instrument Type	Manufacturer	Model #	Preventative Maintenance	Manual location	Serial #	Date Rec'd.	Condi-tion when rec'd.
						362S2		
INORG	TOC Analyzer	Teledyne/Tekmar	Torch	Monthly: Change injection needle, clean injection port, change catalyst. Semi-annually: Inspect combustion tube	Drawer by inst.		2011	New
INORG	DO Meter	YSI	52	Daily:Check solution and membrane	Upper cabinet	0602377	2006	New
INORG	DO Meter	YSI	5000		File cabinet in office		2002	New
INORG	COD Apparatus	Hach	Micro Block		File Cabinet	87120-9870	1988	New
INORG	Chlorine Meter	LaMotte	1200				2006	
INORG	Chlorine Meter	LaMotte	1200				2008	
INORG	pH Meter	Orion	420A	Electronics Checked Daily			2000	
INORG	pH Meter	VWR	8000		File cabinet	1370	2005	New
INORG	pH Meter	VWR	Symphony SP70P				2009	
INORG	pH Meter	Corning	Scholar 425		File cabinet	06999	2002	New
INORG	pH Meter	WTW Measurement Systems	Scholar 425				2006	
INORG	Spectrophotometer	Milton Roy	Genesys 5		File cabinet	3V062-77019	1995	
INORG	Spectrophotometer	Thermo Spectronic	Spectronic 20DX		In office	3DV103-51004	2002	New
INORG	Spectrophotometer	Thermo Spectronic	Spectronic 20DX		In office	3DUG3-35015	2005	New
INORG	Ion Chromatograph	Dionex	ICS 2000		Bookshelf	0605-0717	2005	New
INORG	Analytical	Hach	2424				1977	

Section	Instrument Type	Manufacturer	Model #	Preventative Maintenance	Manual location	Serial #	Date Rec'd.	Condition when rec'd.
	Nephelometer							
INORG	Specfic Ion Electrodes	Cole Palmer	2750231				2000	
INORG	Distillation Systems	Westco	East Dist		File cabinet	1130	1996	New
INORG	Distillation Systems	Westco	East Dist		Drawer by instru.	1130	2005	New
INORG	Conductivity Meter	VWR Scientific	2052	Daily: check probe and cable	File cabinet	0103009	2000	New
INORG	Conductivity Meter	VWR Scientific	2052		File cabinet	0212006	2002	New
INORG	Solid Phase Extractor and Controller for Oil and Grease	Horizon	3000XL		Drawer by instru.	0210166	2010	New
INORG	Solid Phase Extractor and Controller for Oil and Grease	Horizon	3000XL		Drawer by instru.	07-1431	2007	New
INORG	Microscope	Nikon	Labobot 104	Monthly: Clean optics	File cabinet	214700	1983	New
INORG	COD Apparatus	Hach	DRB200		By meter	1122349	2004	New
INORG	TALK Instrument	Schott	Titroline Alphaplus		Drawer by instru.	065719	2004	New
INORG	Flow Injection Analysis System with Automated Ion Analyzer	Lachat	QuickChem 8500		Top shelf	051100-000231	2006	New
INORG	Flow Injection Analysis System with Automated Ion Analyzer	Lachat	QuickChem 8500		Top shelf		2009	New
INORG	BOD Assay Plus	Man-Tech	Release		BOD Bench		2006	New

Section	Instrument Type	Manufacturer	Model #	Preventative Maintenance	Manual location	Serial #	Date Rec'd.	Condition when rec'd.
			version 11/7/03					
INORG	Coliform Incubator Bath	Thermoscientific	2862				2010	
INORG	BOD Incubator	Thermoscientific (Precision)	30mr				2011	
HPLC	HPLC System for Carbamate 531 and Post Column Derivatizer for 547	Pickering	PCX-5200			0401212	2001	
HPLC	System Controller	Shimadzu	SCL-10AVP			C2101350 2013SA	2001	
HPLC	Liquid Chromatograph	Shimadzu	LC-10ADVP			C2096350 2299KG	2001	
HPLC	Mixer	Shimadzu	FCV-10ALVP			C2108360 1369KG	2001	
HPLC	Degasser	Shimadzu	DGU-14A			SS111311	2001	
HPLC	Auto Injector	Shimadzu	SIL-10ADVP			C2105375 0408US	2001	
HPLC	Fluorescence Detector	Shimadzu	RF-10AXL			C2095385 0296US	2001	
HPLC	HPLC System for 549	Agilent	HP1100		On desktop of computer next to inst.		2011	
HPLC	Degasser	Agilent	G1322A			JP63203191	2011	
HPLC	Binary LC Pump	Agilent	G1312A			DE91605129	2011	
HPLC	Autosampler	Agilent	G1313A			DE14917148	2011	
HPLC	Column Com.	Agilent	G1316A			DE91615	2011	

Section	Instrument Type	Manufacturer	Model #	Preventative Maintenance	Manual location	Serial #	Date Rec'd.	Condi-tion when rec'd.
						431		
HPLC	Detector	Agilent	G1315A			DE91605880	2011	
GC	Gas Chromatograph	Perkin Elmer	Clarus 500	As needed: change column Monthly: PID lamp cleanup, Septa change, change injection port liner, clip column ECD Detectors: Annually: Wipe test If needed: Return to factory to refoil.	Bookshelf Next to Refrig#2		2004	
GC	Gas Chromatograph	Hewlett Packard	6890		Bookshelf Next to Refrig#2		1998	
GC	Gas Chromatograph	Hewlett Packard	6890		Bookshelf Next to Refrig#2		2000	
GC	Gas Chromatograph	Hewlett Packard	6890		Bookshelf Next to Refrig#2	US00023151	2002	Used
GC	Gas Chromatograph	Hewlett Packard	6890		Bookshelf Next to Refrig#2	US10221098	2008	Used
GC	Gas Chromatograph	Perkin Elmer	Autosystem		Bookshelf Next to Refrig#2	610N2120204	1992	New
GC	Gas Chromatograph	Perkin Elmer	Autosystem		Bookshelf Next to Refrig#2	610N2121406	1993	New
GC	Electrolytic Conductivity Detectors	Perkin Elmer	1000		Bookshelf Next to Refrig#2	920057	1993	New
GC	Electrolytic Conductivity Detectors	Perkin Elmer	2000		Bookshelf Next to Refrig#2		2004	New

Section	Instrument Type	Manufacturer	Model #	Preventative Maintenance	Manual location	Serial #	Date Rec'd.	Condition when rec'd.
GC	Flame Ionization Detectors	Perkin Elmer	N611		Bookshelf Next to Refrig#2		1993	New
GC	Flame Ionization Detectors	Agilent	G1530N		Bookshelf Next to Refrig#2		2011	
GC	PID Photo Ionization Detector	HNU			Bookshelf Next to Refrig#2		1993	New
GC	PID Photo Ionization Detector	HNU			Bookshelf Next to Refrig#2		2004	New
GC	Micro Electron Capture Detector	Hewlett Packard			Bookshelf Next to Refrig#2	43366U2256	2000	New
GC	Micro Electron Capture Detector	Hewlett Packard			Bookshelf Next to Refrig#2	U1789U1790	2002	New
GC	Micro Electron Capture Detector	Hewlett Packard			Bookshelf Next to Refrig#2	U0744U0712	2008	New
GC	Nitrogen Phosphorus Detector	Perkin Elmer			Bookshelf Next to Refrig#2		1992	New
GC	Autoinjector	Hewlett Packard	7683		Bookshelf Next to Refrig#2	US94910497	1998	New
GC	Autoinjector	Hewlett Packard	7683		Bookshelf Next to Refrig#2	US02013524	2000	New
GC	Autoinjector	Hewlett Packard	7683		Bookshelf	US951109	2002	New

Section	Instrument Type	Manufacturer	Model #	Preventative Maintenance	Manual location	Serial #	Date Rec'd.	Condi-tion when rec'd.
					Next to Refrig#2	02		
GC	Autoinjector	Perkin Elmer	Autosystem		Bookshelf Next to Refrig#2		1992	New
GC	Purging Apparatus	Teledyne-Tekmar	Velocity XPT		Bookshelf Next to Refrig#2	US04224008	2004	New
GC	Purging Apparatus	Teledyne-Tekmar	Stratum		Bookshelf Next to Refrig#2	US08059005	2008	New
GC	Automated Liquid Sampler	Teledyne-Tekmar	Solatek 72		Bookshelf Next to Refrig#2	US04238003	2004	New
GC	Automated Liquid Sampler	Teledyne-Tekmar	Solatek 72		Bookshelf Next to Refrig#2	US08044003	2008	New
GC	Gas Chromatograph	Hewlett Packard			Bookshelf Next to Refrig#2	U14239U14322		New
GC	Thermal Conductivity Detector	Agilent			Bookshelf Next to Refrig#2		2010	
METAL	Automated Mercury System	Leeman	Hydra AA	Daily: Check for leaks Monthly: Clean Autosampler and check tubing for wear and discoloration	Next to instrument	HA4001	2004	New
METAL	Inductively Coupled Plasma (ICP)	Thermo-Fisher ICAP	6300 Duo MFC		On shelf opposite of ICAP	20081811	2008	New

Section	Instrument Type	Manufacturer	Model #	Preventative Maintenance	Manual location	Serial #	Date Rec'd.	Condition when rec'd.
METAL	Inductively Coupled Plasma (ICP)	Thermo-Fisher ICAP	6300 Duo MFC		On shelf next to ICAP	20095008	2009	New
METAL	Autosampler for 6300 Duo ICAP	Cetac Techologies	ASX-520		Opposite instru. On shelf	050773A520	2008	New
METAL	ICP-MS	ThermalElemental	X7		Next to instru.	X0129	2002	New
METAL	Autosampler for ICP-MS	Cetac Technologies	ASX-510		Next to instru.	020201ASX	2002	New
METAL	Turbidity Meter	VWR	66120-200		Drawer next to inst.	TUR8002331	2009	New
METAL	Hotblock	Environmental Express	SC154		On desk in Dig room		2002	New
METAL	Hotblock	Environmental Express	SC154		On desk in Dig room		2007	New
PREP	Dishwasher	Lab Conco	Flask Scrubber		Kiln room cabinet	041027886	2004	New
PREP	AccuPrep GPC System	JZ Scientific	04A-1094-3.1				2004	
PREP	TCLP Tumbler	Environmental Express	10-Position				1990	
PREP	TCLP Tumbler	Analytical Testing	4-position				1987	
PREP	TCLP Tumbler	Environmental Express	Item#LE1002 12-position				2006	
PREP	Zero Headspace Extractor	Environmental Express					1990	
PREP	Zero Headspace Extractor	Analytical Testing	C-102				1987	
PREP	Zero Headspace	Analytical Testing	C-102				1989	

Section	Instrument Type	Manufacturer	Model #	Preventative Maintenance	Manual location	Serial #	Date Rec'd.	Condi-tion when rec'd.
	Extractor							
PREP	Continuous Liquid/Liquid Extractor	Organomation	Rot-X-Tracth		Drawer near hood#16	20558	2009	New
PREP	Continuous Liquid/Liquid Extractor	Organomation	Rot-X-Tracth		Drawer near hood#16	9878	1997	New
PREP	Agitator	Analytical Testing	DC-18		Kiln room	252392	1987	New
PREP	Sonic Disruptors	Tekmar	TSDB-500	Not in use			1986	
PREP	Sonic Disruptors	Tekmar	TSD-602	Not in use			1994	
PREP	Concentrator	Zymark	Turbo-vap		Kiln room cabinet	TV0639-R7075	1996	New
PREP	Evaporators	Organomation	PN-Evap, 12 position		Kiln room cabinet	14430	1992	New
PREP	Automated Solvent Extractor	Dionex	ASE2000		Desk near hood#8	3010457	2003	New
PREP	Automated Solid Phase Extractor	Horizon	SPE-DEX 4790		Kiln room cabinet		2001	
PREP	Automated Solid Phase Extractor	Horizon	SPE-DEX 4790		Kiln room cabinet		2001	
PREP	Automated Solid Phase Extractor Controller	Horizon	SPE-DEX		Kiln room cabinet	01-0333	2001	
PREP	Dry Disk	Horizon	SDS-100		Shelf near hood#11		2001	
PREP	Dry Disk	Horizon	SDS-100		Shelf near hood#11		2001	
PREP	Pensky-Martens Flash Point Tester	Petrotest	12-1624		Kiln room cabinet	0726021501	2002	New

Section	Instrument Type	Manufacturer	Model #	Preventative Maintenance	Manual location	Serial #	Date Rec'd.	Condi-tion when rec'd.
PREP	Heating block	Barnstead International	DB28125		Kiln room cabinet	823040-705627	2004	New
PREP	Sonicator	Branson	1210	Not in use				New
PREP	Evaporators	Organomation	PN EVAP-12 Position		Drawer near hood#16	20638	2009	New

Support Equipment/Computers

Section	Instrument Type	Manufacturer	Model #	Preventative Maintenance	Manual location	Serial #	Date Rec'd.	Condi-tion when rec'd.
GCMS	Combined Wiley and NBS Data Base with Wiswisser Line Notation	Hewlett Packard	59868A				1984	
GCMS	Aquarius Software	Hewlett Packard					1984	
GCMS	Winchester Disk Drive	Hewlett Packard					1984	
GCMS	Printer	Hewlett Packard	LaserJet 4				1995	
GCMS	Printer	Hewlett Packard	LaserJet 4				1995	
GCMS	Printer	Hewlett Packard	LaserJet 4				1995	
GCMS	Printer	Hewlett Packard	LaserJet 4				1995	
GCMS	Printer	Hewlett Packard	LaserJet 4				1995	

Section	Instrument Type	Manufacturer	Model #	Preventative Maintenance	Manual location	Serial #	Date Rec'd.	Condi-tion when rec'd.
GCMS	GC/MS A Series Data System with Micro 24 SPU and 304 Mb Disk Drive	Hewlett Packard	59870C				1990	
GCMS	GC/LC/MS Software	Hewlett Packard	59872C				1990	
GCMS	Mass Spectral Library	Hewlett Packard	59868C				1990	
GCMS	Chemstation/ Enviroquant	Hewlett Packard	1701AA				1998	
GCMS	Chemstation/ Enviroquant	Hewlett Packard	1701AA				1998	
GCMS	Chemstation/ Enviroquant	Hewlett Packard	1701AA				1998	
GCMS	Chemstation/ Enviroquant	Hewlett Packard	1701AA				1998	
GCMS	Chemstation/ Enviroquant	Hewlett Packard	1701AA				1998	
GCMS	Chemstation/ Enviroquant	Hewlett Packard	1701CA, BA				2001	
GCMS	Chemstation/ Enviroquant	Hewlett Packard	MSD D.01.02 06				2005	
GCMS	Graphics Display Terminal	Hewlett Packard	2393A				2001	
GCMS	Printer	Hewlett Packard	LaserJet 5				1998	
GCMS	Printer	Hewlett Packard	LaserJet 4100				2001	
GCMS	Printer	Hewlett Packard	LaserJet 4250				2005	
GCMS	Printer	Hewlett Packard	LaserJet				2005	

Section	Instrument Type	Manufacturer	Model #	Preventative Maintenance	Manual location	Serial #	Date Rec'd.	Condi-tion when rec'd.
			4250					
GCMS	Printer	Hewlett Packard	LaserJet 4250				2005	
INORG	Balance	Mettler Toledo	AX304		File cabinet	1125121429	2004	New
INORG	Balance	Ohaus	CS200				2002	
INORG	Balance	Ohaus	CS200				2004	
INORG	Balance	Ohaus	GT4100	Out of service			1999	
INORG	Balance	Westco	40/20				2004	
INORG	Balance	Lachat	BD_46				2007	
INORG	Refrigerator-Walk-in			Daily: Record and Verify temperature setting. Monthly: Clean interior Annually: check thermometer against NIST certified thermometer			1998	
INORG	Refrigerator Locking (no spark interior)	Fisher Scientific					1984	
INORG	Refrigerator Locking	Fisher Scientific					1989	
INORG	Centrifuge	Fisher Scientific					1957	
INORG	Drying Ovens	Fisher Scientific	CL ISOTEMP500	Daily: Record and Verify temperature setting. Monthly: clean interior Annually: check thermometer against NIST certified thermometer			1980	
INORG	Dessicator	Boekel					1997	
INORG	Muffle Furnace	Thermoline			File cabinet		1997	

Section	Instrument Type	Manufacturer	Model #	Preventative Maintenance	Manual location	Serial #	Date Rec'd.	Condi-tion when rec'd.
INORG	Autoclave	Market Forge	STM-E Type C	Daily: Sterilization indicator tape Monthly: Clean interior	File cabinet	150790	1987	New
INORG	Autoclave	Market Forge	STM-E Type C		File cabinet	213371	2003	New
INORG	Solid Phase Extraction Controller	Horizon	3000XL		Drawer by instru.	07-0166	2002	New
INORG	Solid Phase Extraction Controller	Horizon	3000XL		Drawer by instru.	07-1431	2007	New
INORG	Automatic Pipetting Machine	Scientific Equip. Prod.	40		File cabinet	2064	1983	New
INORG	Automatic Pipetting Machine	Scientific Equip. Prod.	40	Not in service			1984	
INORG	Auto Titrator	Visco	Titroline Alpha		Drawer by instru.		1998	
INORG	Coliform Incubator Bath	Labline	Aquabat	Daily: Record and Verify temperature setting. Monthly: clean interior Annually: check thermometer against NIST certified thermometer	File cabinet	10-01	2001	New
INORG	BOD Incubators	VWR-Sheldon Manufacturing, Inc.	2030		Office file cabinet	08006405	2005	New
INORG	BOD Incubators	VWR-Sheldon Manufacturing, Inc.	2030		Office file cabinet	07045306	2007	New
INORG	Water Purification System	Millipore	Alpha Q		File cabinet in office	F6CM10889K	1997	New
INORG	Dishwasher	Kenmore	Ultrawash		File cabinet		2000	New

Section	Instrument Type	Manufacturer	Model #	Preventative Maintenance	Manual location	Serial #	Date Rec'd.	Condi-tion when rec'd.
			665					
INORG	Quant-Tray Sealer	IDEXX	2X		File cabinet	03177	2004	New
INORG	Incubator	Labline	100	Daily: Record and Verify temperature setting. Monthly: clean interior Annually: check thermometer against NIST certified thermometer		0493-0002	1993	New
INORG		Precision	815		File cabinet	604011627		New
INORG		Precision	815		File cabinet	602041661	2004	New
INORG		Precision				600101596	2005	Used
INORG	Infrared Thermometer	VWR	12777-846				2004	
INORG	UV Light	UVP	UVL-56		File Cabinet	2064	1990	New
RECV	Refrigerator	Welbilt	W8/210G					
INORG	Boat Sampling Module		183		Drawer by instru.		1991	
METAL	CLP Reporting Software	Khemia	Omega				2000	
METAL	Water Bath	Precision	280 Series		Metals room		2007	New
METAL	Hotblock	Envrionmental Express	SC154		Dig. Room		2002	New
METAL	Hotblock	Environmental Express	SC154		Dig. Room		2007	New
METAL	Balance	Sartorius	TE153S		Metals room		2007	New
PREP	Data System	Omega					2000	
PREP	ICC Clinical	Int'l. Equipment Co.	ICC Clinical				1985	

Section	Instrument Type	Manufacturer	Model #	Preventative Maintenance	Manual location	Serial #	Date Rec'd.	Condi-tion when rec'd.
	Centrifuge							
PREP	Balance	Ohaus	CS-20000				2000	
INORG	Balance	Ohaus	Scout Pro SP202		File cabinet	7125080183	2005	New
PREP	Blue M Oven	General Signal		Daily: Record and Verify temperature setting. Monthly: Clean interior Annually: check thermometer against NIST certified thermometer			1986	
PREP	Water Bath	Precision Scientific	Thelco84				1984	
PREP	Water Bath	VWR	1245-PC				2003	
PREP	Kiln	Cress	Firemate FE27				1989	
PREP	Kiln	Cress	Firemate FE27				2002	
PREP	Balance	Sartorius	BL150S				1998	
HPLC	Water Purification System	Barnstead	Nanopure II				1989	
GC	CLP Reporting Software	Khemia	Omega				1994	
GC	Computing Integrators/Data System	Perkin Elmer/Nelson	Total Chrom 6.3X				2005	
GC	Computing Integrators/Data System	Perkin Elmer/Nelson	Total Chrom				2005	

Section	Instrument Type	Manufacturer	Model #	Preventative Maintenance	Manual location	Serial #	Date Rec'd.	Condi-tion when rec'd.
			6.3X					
GC	Computing Integrators/Data System	Perkin Elmer/Nelson	Total Chrom 6.3X				2005	
GC	Computing Integrators/Data System	Perkin Elmer/Nelson	Total Chrom 6.3X				2005	
GC	Computing Integrators/Data System	Perkin Elmer/Nelson	Total Chrom 6.3X				2005	
GC	Computing Integrators/Data System	Perkin Elmer/Nelson	Total Chrom 6.3X				2005	
GC	Balance	Ohaus	CS 200				2002	
GC	Balance	Ohaus	CS 2000				2007	

Section 7.0 Documents

SOP TITLE	SOP NUMBER	REVISION NUMBER AND DATE
Colilert 18 Method for the Analysis of Total Coliform and E. Coli in Water Method 9223B	COLILERT 18	2-5/26/09
Colilert Coliform and E. Coli Water Analysis - 9223	COLILERT	3-6/1/06
Colisure Method for the Analysis of Total Coliform and E. Coli in Water Method 9223B	COLISURE	1-10/16/06
Enterococcus Analysis Method - D6503-99	ENTERO	1-6/2/06
Heterotropic Plate Count - Method 9215D	HPC	5-10/16/06
Method 9221Dand 40CFR,141.21(f)6i Presence and Absence Coliform and E.Coli Water Analysis	PA	2-10/16/06
Multiple Tube Fermentation Technique for Members of the Coliform Group - Method 9221 B, C and E	MPN	6-9/21/11
Preparations of Bacterial Cultures for use in Quality Control Testing	QCULT	0-7/15/09
Readyicult Coliform and E.Coli Water Analysis	9223B	1-6/1/06
1,2-Dibromoethane (EDB) and 1,2-Dibromo-3-chloropropane (DBCP) by Microextraction and Gas Chromatography	8011	1-5/27/09
Analysis of Total Petroleum Hydrocarbons by GC with FID or by GC/MS -EPA Method 8015M	8015BC	8-7/1/11
Analysis of Total Petroleum Hydrocarbons by GC with FID or by GC/MS -EPA Method 8015M	8015B	6-5/21/09
Analysis of Volatile Organics by GC with PID/Hall Detectors - EPA Method 8021B	8021B	7-5/21/09
Analysis of Volatile Organics in Drinking Water GC with PID/ELCD IN Series - EPA Method 502.2	502.2	7-5/18/09
Determination of Haloacetic Acids in Drinking Water by Liquid/Liquid Extraction, Derivatization and GC/ECD Analysis Method 552.2	552.2	3-5/21/09
Method 601 Analysis of Volatile Organics in Wastewater by GC-HALL Detector	601	4-5/25/09
Method 602 Analysis of Aromatics in Waste Water by GC/PID	602	4-5/25/09

SOP TITLE	SOP NUMBER	REVISION NUMBER AND DATE
Method 608 - Sample Preparation and Analysis of Chlorinated Pesticides in Wastewater	608	6-5/21/09
Method RSK-175 Analysis of Dissolved Gases in Water by FID	RSK175	3-7/6/11
Sample Preparation and Analysis of 1,2-Dibromoethane and 1,2-Dibromo-3-chloro-propane	504.1	7-9/21/11
Sample Preparation and Analysis of Chlorinated Herbicides in Drinking Water - EPA Method 515.1	515.1	9-9/20/11
Sample Preparation and Analysis of Chlorinated Herbicides: EPA Method 8151A Modified	8151A	5-5/14/09
Sample Preparation and Analysis of Chlorinated Hydrocarbons in Water and Soil Method 8121	8121	2-5/18/09
Sample Preparation and Analysis of Chlorinated Hydrocarbons in Water Method 612	612	1-8/7/08
Sample Preparation and Analysis of Chlorinated Pesticides - Method 8081A	8081A	11-5/18/09
Sample Preparation and Analysis of Chlorinated Pesticides - Method 8081A	8081AB	13-6/21/11
Sample Preparation and Analysis of Chlorinated Pesticides and PCBS - Method OLM04.2	OLMO4.2 PEST/PCB	2-2/28/03
Sample Preparation and Analysis of Chlorinated Pesticides and PCB's in Drinking Water by Liquid/ Solid Extraction and GC/ECD Analysis	508.1	3-5/27/09
Sample Preparation and Analysis of Chlorinated Pesticides and PCBs: Method 95-3	ASP 95-3	7-1/24/06
Sample Preparation and Analysis of Organo phosphorous Pesticides: EPA Method 8141A	8141A	4-5/21/09
Sample Preparation and Analysis of Organohalide Pesticides and Commercial PCB Products	505	7-5/25/09
Sample Preparation and Analysis of Polychlorinated Biphenyls - Method 8082	8082	8-5/21/09

SOP TITLE	SOP NUMBER	REVISION NUMBER AND DATE
Sample Preparation and Analysis of Polychlorinated Biphenyls - Method 8082	8082A	9-3/14/11
Sample Preparation and Analysis of Polychlorinated Biphenyls as Decachlorobiphenyl- EPA Method 508A	508A	4-5/27/09
Sample Preparation and Analysis of Polychlorinated Biphenyls in Air	PCB311-1	1-2/12/07
SM18 6630B and 6630C Sample Preparation and Analysis of Chlorinated Pesticides in Waste Water	6630B-C	2-5/21/09
Analysis of Extractable Total Petroleum Hydrocarbon compounds (EPH) by GC/FID	EPH_r1	1-3/6/12
Analysis of Dielectric Fluids and Petroleum Products by GCMS	8100	1-8/10/10
Analysis of Volatile Organics by GC/MS - EPA CLP (Combined with 4.2)	OLM04.3V	2-6/12/06
Analysis of Volatile Organics in Ambient Air Using Summa or Other Seciality Prepared Canisters by GCMS/SCAN/SIM	TO-14A	0-1/12/04
Analysis of Volatile Organics in Ambient Air Using Summa or Other Specially Prepared Canisters by GCMS	NJDEPLLTO-15	3-9/3/09
Analysis of Volatile Organics in Ambient Air Using Summa or Other Specially Prepared Canisters by GCMS/SCAN/SIM	TO-15	2-2/15/07
Analysis of Volatile Organics in Drinking Water by GC/MS	524.2	7-9/20/11
Analysis of Volatile Organics on Sorbent Cartridges from Volatile Organic Sampling Train (VOST)	5041	2-10/21/09
Analysis of Volatile Organics on Sorbent Tubes by EPA Method TO-17	TO-17	1-2/15/07
Determination of Endothall in Drinking Water by Ion Exchange Extraction and GC/MS Analysis	548.1	2-5/21/09
Determination of Organic Compounds in Drinking Water by Liquid Solid Extraction and GC/MS Analysis	525.2	5-9/19/11
Gasoline Range Organics (GRO) by EPA 8260B and Diesel Range Organics (DRO) by EPA Method 8270C	GRO_DRO	1-8/18/10

SOP TITLE	SOP NUMBER	REVISION NUMBER AND DATE
Method 624 Sample Preparation and Analysis of Purgeables in Wastewater by GC/MS	624	6-5/21/09
Method 625 - Sample Preparation and Analysis of Base/Neutral Acid Extractable in Water	625	6-9/10/07
Preparation and Analysis of Semi-Volatile Organics by GC/MS - EPA CLP (Combined with 4.2)	OLM04.3S	3-4/26/06
Sample Preparation and Analysis of Semivolatile Organics by GC/MS - Method 8270C	8270C	7-7/14/09
Sample Preparation and Analysis of Semivolatile Organics by GC/MS - Method 8270C	8270CD	10-9/21/11
Sample Preparation and Analysis of Semivolatile Organics by GC/MS - Method 8270C-SIM	8270CD_SIM	1-9/14/11
Sample Preparation and Analysis of Semivolatile Organics by GC/MS: Method 95-2	ASP 95-2	6-5/3/06
Sample Preparation and Analysis of Volatile Organics by GC/MS - Method 5030B/8260B	8260B	10-6/2/09
Sample Preparation and Analysis of Volatile Organics by GC/MS - Method 5030B/8260B	8260BC	12-6/21/11
Sample Preparation and Analysis of Volatile Organics by GC/MS in Air	Meth 18-106	1-5/11/06
Sample Preparation and Analysis of Volatile Organics by GC/MS: Method 95-1	ASP 95-1	4-4/17/02
Analysis of Diquat in Drinking Water by HPLC	549.2	6-7/16/09
Determination of N-Methylcarbamoyloximes and N-Methylcarbamates in Drinking Water by HPLC	531.1	4-1/12/09
Glyphosate	547	4-5/21/09
N-Methylcarbonoyloximes and N-Methylcarbamates in Water and Soil by HPLC - Method 8318	8318	0-7/9/07
Preparation of Air Filters and Wipes for Lead Analysis by Method 200.7 or 6010B.	Pb-Air-Wipe	0-5/20/09

SOP TITLE	SOP NUMBER	REVISION NUMBER AND DATE
Sample Preparation and Analysis of Mercury Analysis in Soil/Sediment by Manual Cold Vapor Technique - Method 245.5-CLP-M	245.5CLPM	3-6/1/09
Sample Preparation and Analysis of Mercury in Soil/Sediment - Method 7471A	7471A	3-6/1/09
Sample Preparation and Analysis of Mercury in Soil/Sediment by Manual Vapor Technique- Method 7471B	7471B	1-10/14/10
Sample Preparation and Analysis of Mercury in Water by Manual Cold Vapor Technique - Method 245.1	245.1	5-9/20/11
Sample Preparation and Analysis of Mercury in Water by Manual Cold Vapor Technique - Method 7470A	7470A	3-6/1/09
Sample Preparation and Analysis of the Determination of Trace Metals by Inductively Coupled Plasma Atomic Emission Spectroscopy - Method 6010B and Prep. Methods 3005A, 3010A and 3050B	6010B	5-5/31/09
Sample Preparation and Analysis of the Determination of Trace Metals by Inductively Coupled Plasma Atomic Emission Spectroscopy - Method 6010C and Prep. Methods 3005A, 3010A and 3050B	6010C	2-10/28/10
Sample Preparation and Analysis of the Determination of Trace Metals by Inductively Coupled Plasma Atomic Emission Spectroscopy with Hardness Calculation - Method 200.7	200.7	5-9/20/11
Sample Preparation and Analysis of the Determination of Trace Metals by Inductively Coupled Plasma Atomic Emission Spectroscopy/Mass Spectrometry - Method 6020 and Prep. Methods 3005A, 3010A and 3050B	6020	1-10/19/06
Sample Preparation and Analysis of the Determination of Trace Metals by Inductively Coupled Plasma Atomic Emission Spectroscopy/Mass Spectrometry - Method 6020 and Prep. Methods 3005A, 3010A and 3050B	6020A	1-10/26/10

SOP TITLE	SOP NUMBER	REVISION NUMBER AND DATE
Sample Preparation and Analysis of the Determination of Trace Metals by Inductively Coupled Plasma Atomic/ Emission Spectroscopy /Mass Spectroscopy- Method 200.8	200.8	2-10/16/06
AECOM Electronic Data Deliverable	AECOM	1-1/24/2011
Attaching External Files to Omega	Attaching External Files to Om	1-1/26/2011
BO-70/C5-70/RT-70 Package Instructions	70 Packages	1-5/12/2009
Bookmarking Data Packages	Bookmarking	1-3/10/2009
Brookhaven National Laboratory (BNLS) Electronic Data Deliverable	BNLS EDD	2-1/24/2011
Con Edison Login Review	Con Edison Login Review	1-1/20/2011
Conestoga-Rovers and Associates (CRA) Electronic Data Deliverable	CRA	1-1/24/2011
DECO (BO5-10) Package Instructions	DECO Package	1-5/12/2009
DECO Electronic Data Deliverable	DECO	1-7/2/2010
Department of Environmental Conservation (DEC) Electronic Data Deliv	DEC	1-7/2/2010
Freshkills Landfill Electronic Data Deliverable	Freshkills	2-1/24/2011
Generic Excel Electronic Data Deliverable	Generic Excel	1-5/14/2009
Glenn Springs Holdings (GSH) Electronic Data Deliverable	GSH	1-1/24/2011
Key Login Review	Key Login Review	1-1/19/2011
Keyspan & Con Ed Routine EDD	KEY/CON	1-1/20/2011
KEY-URS Corporation Electronic Data Deliverable	KEY-URS	1-2/23/2009
National Grid (GEI) Electronic Data Deliverable	GEI	1-1/24/2011
National Grid (GEI) Routine Electronic Data Deliverable	GEI Routine	2-1/25/2011
New Jersey Electronic Data Deliverable	NJ EDD	1-1/24/2011
NJ-60 Package Instructions	NJ-60 Package	1-9/21/2010
Paginating/Inserting/Replacing Pages in Data Packages	SPCB	1-3/9/2009
RT-20 Data Package Instructions	RT-20 Package	1-5/11/2009
RT-25 Data Package Instructions	RT-25 Package	1-2/24/2009
SDG Summary Breakdown Instructions	SDG Summaries	1-7/6/2010
Sending Trans Canada Results	TCR Results	1-1/26/2011
Typing SDG Narratives	SDG Narratives	1-7/2/2010
pH Analysis in Water by Electrometric Technique SM4500-H B	pH 4500-H B	2-7/11/11

SOP TITLE	SOP NUMBER	REVISION NUMBER AND DATE
Sample Prep and Analysis Chlorine Residual DPD Method	Cl2 4500Cl G	4-6/22/11
EPA SW846 Method 1110 Corrosivity Towards Steel	Corr1110	1-5/14/09
Pensky-Martens Closed-Cup method for Determining Ignitability - Method 1010	1010	1-5/27/09
Synthetic Precipitation Leaching Procedure - Method 1312	1312	2-3/15/11
Toxicity Characteristic Leaching Procedure - Method 1311	1311	6-9/23/11
Acidity Analysis in Water by Titrimetric Technique SM2310B	Acidity 2310B	0-3/22/07
Alkaline Digestion for Hexavalent Chromium	3060A-CR^	0-6/20/02
Analysis of MBAS: Standard Method 5540C	MBAS SM5540C	2-1/24/11
Analysis of Organic Nitrogen (by Calculation)	ORG-NIT	1-5/31/09
Bromide Analysis by Titrimetric Technique: Standard Method 15th Edition p.S44	Br 15 S44	1-2/25/09
Chemical Oxygen Demand Analysis by Manual Colorimetric Technique: Method 410.4	COD 410.4	7-6/2/09
Conductivity Analysis in Water by Electrometric Technique EPA Method - 120.1	COND 120.1	4-9/19/11
Conductivity Analysis in Water by Electrometric Technique SM18.2510B	COND 2510B	3-9/19/11
Corrosivity SM2330B Langlelier	CorrSM2330B	1-5/14/2009
Determination and Analysis of Perchlorate by Ion Chromatography EPA Method 314.0	314.0	3-9/20/11
Determination of Ammonia by Continuous Flow Phenate Analysis: SM4500-NH3 B H	NH3 SM4500-B H	4-1/19/11
Determination of Ammonia by Lachat Continuous Flow Phenate Analysis : Method 350.1	NH3 350.1	5-9/20/11
Determination of Chloride by Continuous Flow Injection Analysis Low Flow Method 9250	Cl 9250	0-3/6/07
Determination of Chloride by Continuous Flow Injection Analysis SM4500-Cl E	4500-Cl E	1-3/23/09

SOP TITLE	SOP NUMBER	REVISION NUMBER AND DATE
Determination of Nitrate/Nitrite by Lachat Continuous Flow Cadmium Reduction Analysis Method 353.2	353.2 Lachat	4-7/7/11
Fluoride Analysis in Water by Ion Selective Electrode - EPA 9214	Fl 9214	0-2/6/07
Hexavalent Chromium Analysis by Colorimetric Technique: Method 3500 CR-D (water)	Cr6 3500 CrD	6-5/13/09
Hexavalent Chromium Analysis by Colorimetric Technique: Method 7196A (soil)	CR6 7196A	2-11/19/09
Method 1664A Total Recoverable Oil and Grease and Petroleum Hydrocarbon Analysis in Waters N-Hexane Extractable Material(SGT_HEM) by Extraction and Gravimetry	O&G1664	4-7/23/09
Method 9071A (Modified) Total Recoverable Oil and Grease and Petroleum Hydrocarbon Analysis in Soils/Sediments N-Hexane Extractable Material(SGT_HEM) by Extraction and Gravimetry	9071AMod	6-7/7/11
Paint Filter Liquids Test	FL EPA9095A	0-10/18/10
pH Analysis in Soils, Sediments and Sludges by Electrometric TechniqueEPA Method 9045C	pH 9045C	2-1/26/11
Phosphorous, All Forms Colorimetric Ascorbic Acid SM 18 4500-PE	Phos-4500PE	3-6/14/11
Sample Preparation and Analysis of Biological Oxygen Demand (BOD) SM 5210B	BOD/CBOD SM 5210	6-1/6/11
Sample Preparation and Analysis of Color Method 2120B	2120B	0-3/13/09
Sample Preparation and Analysis of Odor Method 140.1	Odor 140.1	1-1/31/07
Sample Preparation and Analysis of pH Electrometric Measurement - Method 9040B	pH 9040B	2-1/26/11
Sample Preparation and Analysis of Settleable Solids: SM 2540 F	SS 2540F	0-10/11/07
Sample Preparation and Analysis of Sulfate (Turbidimetric) SW846 9038	SO4 9038	1-2/7/07

SOP TITLE	SOP NUMBER	REVISION NUMBER AND DATE
Sample Preparation and Analysis of Sulfate (Turbidimetric) SM 18-19 4500-E	SO4 4500-E	1-2/7/07
Sample Preparation and Analysis of Sulfide (Titrimetric, Iodine) - Method 9034	S 9034	1-2/28/07
Sample Preparation and Analysis of Sulfide (Titrimetric, Iodine) - SM4500-S E	S 4500-S E	2-7/7/11
Sample Preparation and Analysis of Sulfide in Soil - Method 9030B Modified	S 9030B	1-5/12/09
Sample Preparation and Analysis of Sulfide: Method 376.1	S 376.1	7-7/7/11
Sample Preparation and Analysis of Total Dissolved Solids - Method 2540C	TDS 2540C	3-3/24/09
Sample Preparation and Analysis of Total Solids - Method 2540B	TS 2540B	0-9/20/07
Sample Preparation and Analysis of Total Suspended Solids (Nonfilterable Residue - Gravimetric): SM2540D	TSS2540D	1-3/24/09
Sample Preparation and Analysis of Turbidity: Method 180.1 (Nephelometric)	180.1	5-5/10/07
Sample Preparation and Analysis of Volatile Solids: Method 160.4	Vsolids160.4	1-5/31/07
Sample Preparation and Analysis UV254	UV254 5910B	9-9/20/11
Sample Preparation of Cyanide and Sulfide Reactivity	REACTIVITY	1-5/18/09
Temperature (Thermometric) SM2550B	TEMP 2550B	0-9/20/07
The Determination of Inorganic Anions by Ion Chromatography Lachat QuickChem Method 19-510-00-1-A	300.0 Lachat	2-9/21/11
The Determination of Inorganic Anions in Water by Ion Chromatography	9056 Lachat	1-7/7/11
Total Alkalinity Analysis in Water by Titrimetric technique (pH4.5) - Method 2320B	TALK2320B	3-3/25/09

SOP TITLE	SOP NUMBER	REVISION NUMBER AND DATE
Total Cyanide Analysis in Water and Soils by Manual Spectrophotometric Technique with Midi-Distillation - Method 9014 with 9010 Distillation	CN9014/9010	5-9/11/07
Total Cyanide and Cyanide Amenable to Chlorination in Water and Soils by Manual Spectrophotometric Technique with Midi-Distillation - SM4500-C E,G	CNA4500CEG	3-6/14/11
Total Hardness Analysis in Waters by Manual Titrimetric (EDTA) Technique SM 18-20 2340C	Hard 2340C	1-3/24/98
Total Kjeldahl Nitrogen (TKN) Analysis by Semi-Automated Colorimetric Technique: Method 351.2	TKN 351.2	12-7/7/11
Total Organic Carbon Analysis in Water by Combustion Infrared Technique -Method 9060	TOC 9060	1-4/28/11
Total Organic Carbon Analysis in Water by Combustion Infrared Technique: SM5310B	TOC 5310B	1-3/30/09
Total Recoverable Phenol Analysis by Manual Colorimetric Technique with Mini-Distillation: Method 420.1	420.1	6-9/13/06
Total Recoverable Phenol Analysis by Manual Colorimetric Technique with Mini-Distillation: Method 9065	Phenols 9065	2-7/7/11
Chemical Hygiene Plan	CHP	2-5/16/09
Computers and Programs	ADMIN002	1-7/7/11
Hazard Communication Program	HCP	2-5/7/09
Manual Integration Organic Analysis for GC, GCMS, HPLC	Integration	2-3/1/07
Methylene Chloride Plan	MC	2-5/16/09
New Employee Handbook	NEW	2-5/16/09
Plan for Going Out of Business or Transfer of Ownership	ADMIN001	1-7/7/11
Preparation of Standards and Reagents, Cleaning of Containers	Materials	2-5/25/09
Procedure for the Measurement of Uncertainty	UNCERT	0-3/5/07
Procedure to Select Samples for use as MS/MSD Analyses	QC Select	0-6/27/02
Quality Assurance Quality Control Manual	QAM012	12-9/23/11

REMEDIAL INVESTIGATION WORK PLAN (RIWP)
FORMER DRY CLEANERS
495 HOWARD AVENUE
BROOKLYN, NEW YORK
MAY 2013

Appendix E

Community Air Monitoring Plan

Appendix 1A
New York State Department of Health
Generic Community Air Monitoring Plan

Overview

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 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 DEC/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, particularly if wind direction changes. 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.

1. 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.

2. 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.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) 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.

1. 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.

2. 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.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

December 2009

REMEDIAL INVESTIGATION WORK PLAN (RIWP)
FORMER DRY CLEANERS
495 HOWARD AVENUE
BROOKLYN, NEW YORK
MAY 2013

Appendix F

Potential Remediation Techniques

GEI Consultants

POTENTIAL REMEDIATION TECHNIQUES

Pump and Treat (P&T)

P&T is one of the most common methods for remediation of groundwater impacted by VOCs. However, this method suffers from serious disadvantages, due a series of subsurface processes. Using experimental data and mathematical model simulations, the role of sorption/desorption and dissolution of non-aqueous phase liquids on the effectiveness of P&T remediation was examined. The results showed that the remediation of groundwater depends directly on the physical/chemical properties of the contaminants and the hydrogeology of the site. P&T can be prohibitively expensive.

Monitored Natural Attenuation (MNA)

MNA refers to monitoring a combination of natural processes such as biodegradation, sorption, dispersion and dilution, chemical reactions, and volatilization. Monitoring these processes can estimate degradation rates and evaluate the ability of the aquifer to achieve site-specific clean-up standards on its own. For the types of VOC contamination onsite which is believed to be primarily PCE, the natural attenuation processes largely responsible for attenuating the PCE is reductive dechlorination. This is a biochemical process that occurs when anaerobic bacteria remove electrons from low molecular weight compounds and replaces a chlorine atom of the contaminant. In reductive dechlorination, the anaerobic bacteria uses hydrogen gas (H_2) as their electron donor, and ultimately replaces chlorine atoms in the chloroethenes with the hydrogen atoms via hydrogenolytic reductive dechlorination. In the presence of ample amounts of anaerobic bacteria, carbon sources, nutrients and electron donors, this process can theoretically proceed until all of the chlorine atoms are removed and PCE is completely dechlorinated to harmless end-products. To date, only microorganisms from a specific and relatively uncommon group, the *Dehalococcoides* group, have been shown to have the capability to transform PCE to vinyl chloride and ethylene. Its presence in groundwater may be necessary for proper bioremediation and MNA of the site.

In-Situ Soil Flushing

In-situ soil flushing is a treatment technology that floods contaminated soils with an injection solution that leaches, displaces, and transports soil and groundwater impacts to an area where they are captured and removed by extraction wells.

To aid in the process, a pressure-pulse injection tool is available and recommended. The Primawave technology utilizes patented injection equipment, referred to as the “Hornet” tool system, to inject water at high acceleration impulses (pressure-pulsing). The impulses momentarily expands or dilates the pore spaces of the target formation, which in turn, momentarily reduces the capillary pressure associated with those pore spaces. The momentary reduction in capillary pressure increases the mobility of free-product present within those pore spaces and can remobilize some residual product that would otherwise be trapped at residual saturation. This allows the displacement to advance more uniformly. Primawave can also assist in slurry injection applications because the pressure-pulses and induced pore dilation can improve media distribution.

Primawave pulses injection liquids into the aquifer at rates designed specifically for site aquifer characteristics (i.e. permeability and fluid viscosity). Primawave delivers these fluid pulses by rapidly opening and closing a highly specialized rotary valve embedded in the tool. The generated fluid pulses are highly effective in controlling fluid injection because:

- The Primawave pulses force fluid into the spaces between the grains of sand, causing a very small, and completely harmless, expansion and contraction of this space. Thereby giving rise to an improved dynamic permeability.

- Primawave creates fluid displacement pulses that actually push fluid through the sand. Traveling at speeds between 80 to 300 meters per second, fluids accelerate through the pore openings and force trapped fluids out of the pore spaces. This increase in dynamic permeability and the fluid displacement pulses allows the fluid to travel more evenly through the aquifer. In addition to creating a more uniform fluid dispersal in the target zone, the continuous rapid expansion and contractions produced by the Primawave system can also accelerate the movement of all fluids toward recovery wells.

In-situ soil flushing utilizing the Hornet tool may be a viable option if residual source is determined to remain; either in the vadose or saturated zone. The Hornet tool may increase the distribution of the injected water; thereby reducing costs and increasing the viability of flushing residual material from otherwise inaccessible areas. Any further evaluation must require a careful interpretation of the onsite groundwater modeling as it relates to existing extraction wells that are utilized for the dissolved contaminant removal.

Air Sparging (AS) / Soil Vapor Extraction (SVE)

AS is the process of injecting air directly into groundwater to volatilize dissolved contaminants for subsequent capture by an induced vacuum from SVE wells. As a secondary mechanism, AS also enhances biodegradation by increasing the groundwater DO.

The most important characteristic to evaluate the ability of a particular contaminant to partition from dissolved phase to vapor phase is the Henry's law constant. Henry's law states that, for ideal gases and solutions under equilibrium conditions, the ratio of the partial pressure of a constituent in the vapor phase to the concentration of the constituent in the dissolved phase is constant. The Henry’s law constant for PCE is 0.555, which is compatible with an AS application.

In-Situ Chemical Oxidation Utilizing Ozone

Utilizing ozone gas as an oxidizer as part of an in-situ chemical oxidation (ISCO) remedy has proven successful in the remediation of chlorinated solvents including PCE. Ozone gas is typically generated onsite and directly injected through a series of stainless steel injection wells. Systems are readily available for purchase or for rent. The main advantage to using Ozone gas in an ISCO application is that the oxidant can be delivered to the contaminant with greater confidence than relying on liquid injection, groundwater flow, and dispersion to bring the oxidant in contact with the contaminant.

Ozone injection is typically implemented in conjunction with SVE. An SVE system is needed to capture any excess ozone that reaches the vadose zone during the injection process.

Zero-Valent Iron (ZVI) & Nanoscale Zero-Valent Iron (NZVI)

ZVI or elemental iron (Fe^o) is a strong reducing agent. In the past 10 years, granular (coarse sand-sized) ZVI has been successfully used in permeable reactive barrier (PRB) applications to treat PCE in groundwater. As the dissolved-phase contamination flows through the PRB, PCE is destroyed primarily by abiotic reduction. Most of the PCE is converted to ethene and chloride by beta-elimination reactions, which proceed with the formation of short-lived intermediates, such as acetylene.

The granular (coarse) nature of the ZVI particles used in PRBs ensures that adequate hydraulic flow retention is achieved through the barrier to facilitate the beta-elimination reactions. In doing so, contamination migrating from the source area is reduced and mitigated. Because of its extremely small size and high surface area, nanoscale zero-valent iron (NZVI) is thought to be a more effective technology than ZVI. The high surface area allows NZVI particles to react at a much higher rate with PCE and ultimately increases its remediation efficiency with higher concentrations. The smaller particle size also creates a higher mobility of the material within the aquifer soil formation during injection applications. When injected, the NZVI can migrate and fill the porosity of the soil formation more easily than the granular form. This application can be utilized in shallow and/or deep aquifers. As PCE reacts with the iron particles in the treatment zone, a strongly negative redox condition is created within the aquifer in the vicinity of injection points. This type of condition creates an anaerobic environment that can further enhance the biodegradation of PCE (ITRC, 2005; Gu et al., 2002).

EHC®

EHC® is an integrated combination of controlled-release plant-derived carbon and NZVI used for the in-situ chemical reduction of normally recalcitrant VOCs such as PCE without the formation of potentially problematic intermediates (i.e. DCE and vinyl chloride [VC] from the anaerobic degradation of PCE). The carbon component of EHC is comprised of fine-grained plant-derived fibrous organic carbon particles. Due to the predominance of cellulose and hemicellulose, these particles will degrade more slowly and last longer than other more soluble forms of carbon such as lactates, oils, and other glucose based amendments. Additionally, the achievable ORP (-500 to -650 millivolts [mV]) is significantly lower than that achieved when using either organic materials (lactate, molasses, and sugars) or reduced metals alone.

EHC® is the subject of a patent owned by Adventus Intellectual Properties, Inc. (Adventus).

REMEDIAL INVESTIGATION WORK PLAN (RIWP)
FORMER DRY CLEANERS
495 HOWARD AVENUE
BROOKLYN, NEW YORK
MAY 2013

Appendix G

Health and Safety Plan

GEI Consultants

GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

DRAFT

Health and Safety Plan

Former Dry Cleaners
495 Howard Avenue
Brooklyn, New York

Submitted to:
New York State Department of Environmental Conservation
Region 2
1 Hunters Point Plaza
47-40 21st Street
Long Island City, NY 11101

Submitted by:
GEI Consultants, Inc.
110 Walt Whitman Road, Suite 204 Hicksville, NY 11801
Huntington Station, New York 11746
631-760-9300

March 2012

Project 121910

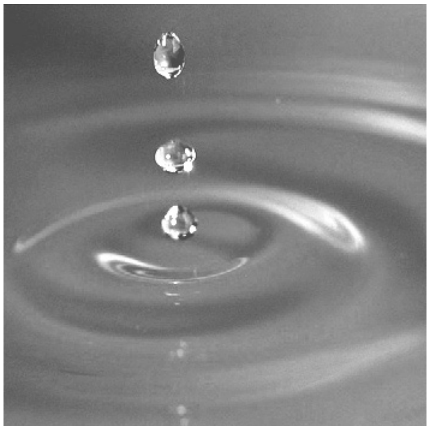


Table of Contents

Abbreviations and Acronyms iv

1. Background Information 1
- 1.1 General 1
- 1.2 Project Description 1
- 1.3 Site Description 1

2. Statement of Safety and Health Policy 4

3. Hazard/Risk Analysis 5
- 3.1 Personal Safety 5
- 3.2 Activity Hazard Analysis 6
  - 3.2.1 Activity Hazard Analysis Table 7
  - 3.2.2 Handling Drums and Containers 8
  - 3.2.3 Precautions for Working in Confined Spaces 9
- 3.3 Evaluation of Potential Chemical Hazards 9
  - 3.3.1 Volatile Organic Compounds (VOCs) 9
  - 3.3.2 Evaluation of Organic Vapor Exposure 9
- 3.3.3 Evaluation of Skin Contact and Absorption 10
- 3.4 Biological Hazards 15
- 3.4.1 Poisonous Plants 15
- 3.4.2 Ticks 15
- 3.4.3 Mosquito- Borne Disease - West Nile Virus 17
- 3.4.4 Wasps and Bees 17
- 3.4.5 Sun Exposure 18

4. Personal Protective Equipment 19

5. Key Project Personnel/Responsibilities and Lines of Authority 21
- 5.1 GEI Personnel 21
- 5.1.1 GEI Project Manager 21
- 5.1.2 GEI Corporate Health and Safety Officer 22
- 5.1.3 GEI Site Safety Officer 22
- 5.1.4 GEI Field Personnel 23
- 5.2. Subcontractors 24
- 5.3 Emergency Contact List 25

6. Training Program 26
- 6.1 HAZWOPER Training 26

6.2 Annual Eight-Hour Refresher Training 26
6.3 Supervisor Training 26
6.4 Site-Specific Training 26
6.5 On-Site Safety Briefings 26
6.6 First Aid and CPR 27

7. Medical Surveillance Program 28

8. Monitoring 29

9. Site Control Measures 31
9.1 Site Zones 31
9.2 Buddy System 32
9.3 Sanitation for Temporary Work Sites 32
9.4 Illumination 32
9.5 Utilities 32
9.5.1 Underground Utilities 32
9.5.2 Overhead Utilities 33

10. Accident Reporting 34

11. Decontamination Procedures 35
11.1 Personnel Decontamination 35
11.2 Heavy Equipment Decontamination 35
11.3 Decontamination Equipment Requirements 35

12. Supplemental Contingency Plan Procedures 36
12.1 Hazard Communication Plan 36
12.2 Fire 36
12.3 Medical Support 36
12.4 Severe Weather 36
12.5 Spills or Material Release 37
12.6 Alcohol and Drug Abuse Prevention 37

Health and Safety Plan Sign-Off 38

Appendices

A – Map to Hospital
B – Heat Stress/Cold Stress Guidelines

Abbreviations and Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
BTEX	Benzene, Toluene, Ethylbenzene, Total Xylenes
CHSO	Corporate Health and Safety Officer
CMS	Chip Measurement System
CNS	Central Nervous System
COC	Compounds of Concern
CRZ	Contamination Reduction Zone
CSO	Combined Sewer Overflow
EPA	United States Environmental Protection Agency
EZ	Exclusion Zone
FID	Flame Ionization Detector
GEI	GEI Consultants, Inc.
GFCI	Ground Fault Circuit Interrupter
HASP	Health and Safety Plan
LEL	Lower Explosive Limit
MGP	Manufactured Gas Plant
MSDS	Material Safety Data Sheet
NAPL	Non-aqueous Phase Liquid
NFPA	National Fire Protection Association
NYSDEC	New York State Department of Environmental Conservation
NYSEG	New York State Electric and Gas Corporation
OSHA	Occupational Health and Safety Administration
PAHs	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated bipenyls
PEL	Permissible Exposure Level
PID	Photoionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
RG&E	Rochester Gas and Electric Corporation
SSO	Site Safety Officer
SVOC	Semivolatile Organic Compound
SZ	Support Zone
USCG	United States Coast Guard
VOC	Volatile Organic Compounds
WNV	West Nile Virus

1. Background Information

1.1 General

Engineer	GEI Consultants, Inc. 110 Walt Whitman Road, Suite 110 Huntington Station, New York 11746
Project Name	Former Dry Cleaners 495 Howard Avenue Brooklyn, New York

This Health and Safety Plan (HASP) establishes policies and procedures to protect GEI personnel from the potential hazards posed by the activities at the Former Dry Cleaners located at 495 Howard Avenue, Brooklyn, NY (the site). Reading of the HASP is required of all onsite GEI personnel and GEI subcontractors. All subcontractors will prepare their own site-specific HASP and may use this as a guide. The plan identifies measures to minimize accidents and injuries, which may result from project activities or during adverse weather conditions.

1.2 Project Description

A remedial investigation will be performed in accordance with the Remedial Investigation Work Plan (RIWP) dated March 20, 2012. The RIWP will include soil boring advancement, soil sampling, groundwater monitoring well installations, and groundwater sampling.

1.3 Site Description

Based upon historical Sanborn atlases and historic reverse address directories of the Phase I ESA, a dry-cleaning operation had been identified in a former building on this site in the 1960’s. Dry cleaning establishments are types of businesses that typically store and use toxic or hazardous materials, and generate toxic or hazardous wastes (i.e., dry cleaning solvents and wastes, spot cleaners, and contaminated dry cleaning machine components such as machine filter cartridges).

Based upon the historical use identified, EEA performed a Phase II investigation and the *Phase II Environmental Subsurface Investigation Report* was submitted in December 2011. The following results are from the *Phase II Environmental Subsurface Investigation Report* dated December 2011 by EEA.

Soil Analytical Results

Results of analytical laboratory sampling at three soil test borings B-1 (21 ft bg), B-2 (60 ft bg), and B-3 (25 ft bg) indicated that tetrachloroethene (PCE) was detected above laboratory method detection limits in the deep soil samples collected from soil test boring location B-2. Soil samples collected from B-1 and B-2 did not indicate any concentrations of PCE above laboratory detection limitations.

The PCE concentrations in soil and soil stratigraphy for deep soil boring B-2 were as follows:

Table A: Soil Analytical Results

Boring Location	Sample Depth (ft)	PCE Concentration (µg/kg)
B-2	20	7
B-2	30	36
B-2	40	63
B-2	50	640
B-2	60	<5.2

Notes

µg/kg = micrograms per liter

The location of elevated PCE results (B-2) coincides with locations of the property where historical dry-cleaning operations were performed and indicates that the former dry-cleaning operations likely had a release of dry-cleaning chemical compounds into the subsurface during past operations. The concentration of PCE increases with depth until the soil formation change from glacial till to a more permeable sand layer at a depth of approximately 55 ft bg.

The soil sample collected from 60 feet consisted of saturated permeable sand and is likely within the regional ground water aquifer. No concentration of PCE (B-2 60ft <5.2 µg/kg) was found at this depth in this formation.

Groundwater Analytical Results

Groundwater quality laboratory results collected from two locations B-1 (GW-1) and B-3 (GW-3) show concentrations of PCE above the New York State Department of Environmental Conservation (NYSDEC) Groundwater Quality Standards.

Additionally, PCE was detected in onsite groundwater above the *New York State Ambient Water Quality Standards (AWQS) and Guidance Values for Class GA Groundwater* as summarized below.

Table B: Groundwater Analytical Results

Sample Location	AWQS	PCE Concentration (µg/kg)
GW-1	5 ug/L	24
GW-3		36

Notes

New York State Ambient Water Quality Standards (AWQS) and Guidance Values for Class GA Groundwater

2. Statement of Safety and Health Policy

GEI is committed to providing a safe and healthy work environment for its employees. To maintain a safe work environment, GEI has established an organizational structure and a Corporate Health and Safety Program to promote the following objectives:

- Reduce the risk of injury, illness, and loss of life to GEI employees.
- Maintain compliance with federal, state, and other applicable safety regulations; and minimize GEI employees' work exposure to potential physical, chemical, biological, and radiological hazards.

3. Hazard/Risk Analysis

Physical hazards associated with heavy equipment and demolition operations are present. The heavy equipment associated with this project will include drill rigs and heavy trucks. Some of the hazards associated with this equipment include crushing of limbs, slipping, tripping, or falling, and heavy lifting.

The Contractor should verify that all electric, gas, water, steam, sewer, and other services lines should be shut off, capped, or otherwise controlled, at or outside the building before demolition work is started. In each case, any utility company that is involved should be notified in advance by the Contractor, and its approval or services, if necessary, shall be obtained.

Smoking is prohibited at or in the vicinity of hazardous operations or materials. Where smoking is permitted, safe receptacles shall be provided for smoking materials. The hazards for this operation are listed in the following Activity Hazard Analysis and Site Hazards sections.

3.1 Personal Safety

Field activities have the potential to take site workers into areas which may pose a risk to personal safety. The following websites (sources) have been researched to identify potential crime activity in the area of the project:

- www.crimereports.com
- www.cityrating.com/crimestatistics.asp
- www.crimemapping.com

One incident was displayed on the www.crimereports.com map near the site. Zero incidents were reported on www.crimemapping.com. However, the area is known to be dangerous.

To protect yourself, take the following precautions:

- Use the buddy system (teams of a minimum of two persons present);
- Let the Site Safety Officer (SSO) know when you begin work in these areas and when you leave;
- Call in regularly;
- Pay attention to what is going on around you; and
- If you arrive in an area and it does not look safe to get out of your vehicle, lock the doors and drive off quickly but safely.

Site workers must not knowingly enter into a situation where there is the potential for physical and violent behaviors to occur. If site workers encounter hostile individuals or a confrontation develops in the work area, suspend work activities, immediately leave the area of concern, and contact local 911 for assistance. Notify the SSO and CHSO of any incidents once you are out of potential danger.

In the event of an emergency, prompt communications with local emergency responders is essential. At least one charged and otherwise functioning cell phone to facilitate emergency communications will be on site. Confirmation of cellular phone operation and site worker safety will be confirmed at the start, mid-point, and near the end of each working day.

3.2 Activity Hazard Analysis

The potential hazards for this project have been categorized into site and activity hazards. Site hazards are those hazards associated with site conditions, and activity hazards are associated with GEI on-site activities. The potential hazards and control measures established to reduce the risk of injury or illness are identified in the following tables. Safe operating procedures established for routine hazards and common site conditions are included in the table below, or contained in the GEI Corporate Health and Safety Manual.

3.2.1 Activity Hazard Analysis Table

SITE HAZARDS	
Potential Hazard	**Control Measures**
Construction Safety	▪ Identify yourself and your work location to heavy equipment operators, so they may incorporate you into their operations. Coordinate hand signals with operators. ▪ Stay Alert! Pay attention to equipment backup alarms and swing radii. ▪ Wear a high visibility vest when working near equipment or motor vehicle traffic. ▪ Position yourself in a safe location when filling out logs and talking with the contractor. ▪ Notify the contractor immediately if any problems arise. ▪ Do not stand or sit under suspended loads or near any pressurized equipment lines. ▪ Do not operate cellular telephones in the vicinity of heavy equipment operation.
Physical Injury	▪ Wear work boots in good condition with non-slip soles. ▪ Maintain good visibility of the work area. ▪ Avoid walking on uneven or debris ridden ground surfaces.
Noise	▪ Wear hearing protection when near loud noises. ▪ Wear hearing protection whenever you need to raise your voice above normal conversational speech due to a loud noise source; this much noise indicates the need for protection.
Heat Stress	• Increase water intake while working. • Increase number of rest breaks and/or rotate workers in shorter work shifts. Rest in cool, dry areas. • Watch for signs and symptoms of heat exhaustion and fatigue. • In the event of heat stroke, bring the victim to a cool environment, call for help, and initiate first aid procedures. • See Heat Stress Guidelines in Appendix C.
Vehicular Traffic	▪ Wear traffic safety vest at all times. ▪ Use cones, flags, barricades, and caution tape to define work area. ▪ Use a "spotter" to locate oncoming vehicles. ▪ Use vehicle to block work area. ▪ Engage police detail if needed.

Utilities	▪ Check that contactor has cleared underground utilities before any intrusive activities, and that contractor has coordinate with utility locating services, property owner(s) or utility companies. ▪ Utilities are to be considered live or active until documented otherwise. ▪ For overhead utilities within 50 feet, have contractor determine with the utility company the appropriate safe distance. Minimum distance for clearance is based on voltage of the line. ▪ An observer will be established when operating drilling rigs near overhead utilities.

ACTIVITY HAZARDS		
Activity	**Potential Hazards**	**Protective Equipment**
Entering Construction Site	Heavy equipment, dust, noise.	Hardhat, orange safety vest, steel-toed, steel-shank boots, safety glasses, latex/neoprene gloves, and earplugs.
Drilling	Heavy equipment, dust, noise.	In addition to the PPE listed above for “Entering Construction Site:” hearing protection (ear plugs or ear muffs).
Personal Protective Equipment (PPE) is the *initial level of protection* based on the activity hazards and Site conditions which have been identified. *Upgrades to respiratory protection may be required based on the designated action levels.* General on site provisions shall include: extra nitrile, leather, and/or Kevlar gloves, extra protective coveralls (e.g. Tyvek ®) with boot covers, drinking water and electrolyte fluids, reflective vest, first aid kit, hearing protection and washing facilities.		

If site conditions suggest the existence of a situation more hazardous than anticipated, the site personnel shall evacuate the immediate area. The hazard, the level of precautions, and the Personal Protection Equipment (PPE) shall then be reevaluated with the assistance and approval of the GEI Corporate Health and Safety Officer (Robin DeHate) and Project Manager.

3.2.2 Handling Drums and Containers

Regulations for handling drums and containers are specified by OSHA 29 CFR 1910.120(j). Potential hazards associated with handling drums include vapor generation, fire, explosions, and possible physical injury. Handling of drums/containers during the site investigation and remediation activities may be necessary. If drum/container handling is necessary, it will be performed in accordance with all applicable regulations.

3.2.3 Precautions for Working in Confined Spaces

The site remediation work does not call for performing any specific work in confined spaces. However, if any work in confined spaces is required, it will be performed in accordance with 29 CFR 1910.146 (effective April 15, 1993), as applicable. Copies of the standards will be kept on file in GEI's main office. Confined space work will not be performed without first notifying and receiving approval from the CHSO.

3.3 Evaluation of Potential Chemical Hazards

The characteristics of compounds at the Site are discussed below for information purposes. Adherence to the safety and health guidelines in this HASP should reduce the potential for exposure to the compounds discussed below.

3.3.1 Volatile Organic Compounds (VOCs)

Volatile organic chemicals (VOCs), such as PCE are present as soil and groundwater contaminants. These compounds generally have a depressant effect on the CNS, may cause chronic liver and kidney damage, and some are suspected human carcinogens.

3.3.2 Evaluation of Organic Vapor Exposure

Air monitoring reduces the risk of overexposure by indicating when action levels have been exceeded and when personal protective equipment (PPE) must be upgraded or changed. Action levels for volatile organic compounds and associated contingency plans for the work zone are discussed within Section 8.0 of this Health and Safety Plan.

Exposure to organic vapors shall be evaluated and/or controlled by:

- Monitoring air concentrations for organic vapors in the breathing zone with a photo-ionization detector (PID) or a flame ionizing detector (FID)
- When possible, engineering control measures will be utilized to suppress the volatile organic vapors. Engineering methods can include utilizing a fan to promote air circulation, utilizing volatile suppressant foam, providing artificial ground cover or covering up the impacted material with a tarp to mitigate volatile odors.
- When volatile suppression engineering controls are not effective and organic vapor meters indicate concentrations above the action levels, then appropriate respiratory protection (i.e. air purifying respirator with organic vapor cartridge) will be employed.

3.3.3 Evaluation of Skin Contact and Absorption

Skin contact by contaminants may be controlled by use of proper hygiene practices, PPE, and good housekeeping procedures. The proper PPE (e.g., Tyvek®, gloves, safety glasses) as described in Section 1.8 will be worn for all activities where contact with potential contaminated media or materials are expected.

Material Safety Data Sheets (MSDS) (as available) and/or Occupational Health Guidelines for decontamination chemicals and laboratory reagents that may be used on site are included in Appendix B. Specific chemical hazards information from the MSDS and Occupational Health Guidelines are summarized in Table 1.

Table 1
Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Asbestos	1332-21-4	0.1 f/cc	0.1 f/cc over 8 hr period or 1.0f/cc over 30 min.	Inhalation Ingestion Skin Contact	Asbestosis (chronic exposure); mesothelioma, breathing difficulty, interstitial fibrosis' restricted pulmonary function, finger clubbing; irritate eyes, known human carcinogen	Respiratory system, eyes	White, greenish, blue, or gray-green fibrous solids FP: NA LEL: NA UEL NA VP: 0 mm
Arsenic	7440-38-2	0.01 mg/m^3	0.01 mg/m^3 A.L. .005mg/m3	Inhalation Skin Absorption Ingestion Skin Contact	Ulceration of nasal septum, dermatitis, GI disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin, potential carcinogen	Liver, kidneys, skin, lungs, lymphatic system	Metal: Silver-gray or tin-white, brittle, odorless solid FP: NA LEL: NA UEL: NA VP: 0 mm
Benzene	71-43-2	0.5 ppm (Skin)	1 ppm TWA 5 ppm STEL	Inhalation Skin Absorption Ingestion Skin Contact	Irritation of eyes, skin, nose, respiratory system, giddiness, headache, nausea; staggering gait, fatigue, anorexia, weakness, dermatitis, bone marrow depression, known human carcinogen	Eyes, skin, CNS, bone marrow, blood	FP: 12^{o} F LEL: 1.2% UEL:7.8% VP: 75 mm
Chromium (Chromic Acid and Chromates)	1333-82-0	0.05 mg/m^3	0.1 mg/m^3	Inhalation Ingestion Skin Contact	Irritates respiratory system, nasal, septum perforation, liver and kidney damage, leucocytosis (increased blood leucocytes), leukopenia (reduced blood leucocytes), moncytosis (increased monocytes), Eosinophilia, eye injury, conjunctivitis, skin ulcer, sensitivity dermatitis, potential carcinogen	Blood, respiratory system, liver, kidney, eyes, skin, lung cancer	FP:NA VP: Very Low LEL: NA UEL: NA

Table 1
Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Ethylbenzene	100-41-4	100 ppm	100 ppm	Inhalation Ingestion Skin Contact	Eye, skin, mucous membrane irritation; headache; dermatitis, narcosis; coma	Eyes, skin, respiratory system, Central Nervous System	FP: 55^{o} F LEL: 0.8% UEL:6.7% VP: 7 mm
Hydrogen cyanide	74-90-8	4.7 ppm (5 mg/m^3) STEL [skin]	10 ppm (11 mg/m^3) [skin]	Inhalation Ingestion Absorption Skin/Eye Contact	Asphyxia; weakness, headache, confusion; nausea, vomiting; increased rate and depth of respiration or respiration slow and gasping; thyroid, blood changes	Central Nervous System, Cardiovascular system, thyroid, blood	Colorless or pale-blue liquid or gas (above 78°F) with a bitter, almond-like odor. VP: 630 mmHg
Hydrogen sulfide	7783-06-4	10 ppm TWA, 15 ppm STEL	20 ppm C, 50 ppm [10-min. Maximum peak]	Inhalation Skin/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, fatigue, irritability, insomnia; gastrointestinal disturbance; liquid: frostbite	Eyes, respiratory system, Central Nervous System	Colorless gas with a strong odor of rotten eggs. VP: 17.6 atm
Lead	7439-92-1	0.050 mg/m^3	0.05 mg/m^3 A.L. 0.03 mg/m3	Inhalation Ingestion Skin Contact	Weakness, insomnia; facial pallor; pal eye, anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis of wrist and ankles; irritates eyes, hypo tension	Eyes, GI tract, Central Nervous System, kidneys, blood, gingival tissue	A heavy, ductile, soft, gray solid. FP: NA LEL: NA UEL: NA VP: 0 mm

Table 1
Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Mercury	7439-97-6	0.025 mg/m^3	0.10 mg/m3	Inhalation Ingestion Skin Contact Skin Absorption	Irritates eyes and skin, chest pain, cough, difficulty breathing, bronchitis, pneumonitis, tremor, insomnia, irritability, indecision, headache, fatigue, weakness, stomatitis, salivation, Gastrointestinal disturbance, weight loss, proteinuria	Eyes, skin, respiratory tract, central nervous system	Silver-white, heavy odorless liquid FP: NA LEL: NA UEL:NA VP: 0.0012 mm
Naphthalene	91-20-3		10 ppm (50 mg/m^3) TWA	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	FP: 174 F IP: 8.12 eV, LEL: 0.8% UEL:6.7%, VP: 0.08 mm
PAH's as Coal tar pitch Volatiles (CTPV)	65996-93-2	0.2 mg/m3	0.2 mg/m3	Inhalation Skin contact Ingestion	Irritant to eyes, swelling, acne contact dermatitis, chronic bronchitis	Respiratory system, Central Nervous System, liver, kidneys, skin, bladder,	Black or dark brown amorphous residue.
PCBs	11097-69-1	0.5 mg/m^3 (Skin)	0.5 mg/m^3 (Skin)	Inhalation Skin Absorption Ingestion Skin Contact	Irritate eyes; chloracne; liver damage;	Skin, eyes, liver, reproductive system	Colorless liquid or solid with a mild, hydro-carbon odor VP = 0.00006 mm
Phenol	108-95-2	10 ppm (skin)	5 ppm (19 mg/m^3) [skin]	Inhalation Skin Absorption Ingestion Skin Contact	Irritates eyes, nose, throat, anorexia, weight loss, weakness, muscle ache, pain, dark urine, cyanosis, liver and kidney	Eyes, skin, respiratory system, liver, kidneys	Colorless to light pink crystalline solid with sweet, acrid odor. FP:175 °F IP:8.5

Table 1
Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
					damage, skin burns, dermatitis, tremors, convulsions, twitching,		LEL:1.8% UEL: 8.6% VP: 0.4 mm
Selenium	7782-49-2	0.2 mg/m^3	0.2 mg/m^3	Inhalation Ingestion Skin Contact	Irritant to eyes, skin, nose and throat, visual disturbance, headache, chills, fever, breathing difficulty, bronchitis, metallic taste, garlic breath, GI disturbance, dermatitis, eye and skin burns,	Eyes, skin, respiratory system, liver, kidneys, blood spleen	Amphorous or crystalline, red to gray solid FP: NA LEL: NA UEL: NA VP: 0 mm
Toluene	108-88-3	50 ppm	200 ppm	Inhalation Skin Absorption Ingestion Skin Contact	Eye, nose irritation; fatigue, weakness, confusion, euphoria, dizziness, headache; dilated pupils, tearing of eyes; nervousness, muscle fatigue, insomnia, tingling in limbs; dermatitis	Eyes, skin, respiratory system, Central Nervous System, liver, kidneys	FP: 40^o F LEL: 1.1% UEL:7.1% VP: 21 mm
Xylene	1330-20-7	100 ppm	100 ppm	Inhalation Skin Absorption Ingestion Skin Contact	Eye, skin, nose, throat irritation; dizziness, excitement, drowsiness; incoordination, staggering gait; corneal damage; appetite loss, nausea, vomiting, abdominal pain; dermatitis	Eyes, skin, respiratory system, Central Nervous System, GI tract, blood, liver, kidneys	FP: 90^o F LEL: 0.9% UEL: 6.7% VP: 9 mm

Abbreviations	
A.L. Action Level	ppm = parts per million
C = ceiling limit, not to be exceeded	STEL = Short-term exposure limit (15 minutes)
FP = Flash point	TWA = Time-weighted average (8 hours)
GI = Gastro-intestinal	UEL = Upper explosive limit
LEL = Lower explosive limit	VP = vapor pressure approximately 68° F in mm Hg (mercury)
mm = millimeter	

3.4 Biological Hazards

3.4.1 Poisonous Plants

Persons working on the site should be aware of the possible presence of poisonous plants and insects. Poison ivy is a climbing plant with leaves that consist of three glossy, greenish leaflets. Poison ivy has conspicuous red foliage in the fall. Small yellowish-white flowers appear in May through July at the lower leaf axils of the plant. White berries appear from August through November. Poison ivy is typically found east of the Rockies. Poison oak is similar to poison ivy but its leaves are oak-like in form. Poison oak occurs mainly in the south and southwest. Poison sumac typically occurs as a small tree or shrub and may be 6-20 feet in height. The bark is smooth, dark and speckled with darker spots. Poison sumac is typically found in swampy areas and east of the Mississippi. The leaves have 7-13 smooth-edged leaflets and drooping clusters of ivory-white berries appear in August and last through spring.

The leaves, roots, stems and fruit of these poisonous plants contain urushiol. Contact with the irritating oil causes an intensely itching skin rash and characteristic, blister-like lesions. The oil can be transmitted on soot particles when burned and may be carried on the fur of animals, equipment and apparel.

Proper identification of these plants is the key to preventing contact and subsequent dermatitis. Wear long sleeves and pants when working in wooded areas. In areas of known infestation, wear Tyvek coveralls and gloves. Oils are easily transferred from one surface to another. If you come in contact with these poisonous plants, wash all exposed areas immediately with cool water to remove the oils. Some commercial products such as Tecnu's Poison Oak-n-Ivy Cleanser claim to further help with the removal of oils.

3.4.2 Ticks

Lyme Disease
Ticks are bloodsuckers, attaching themselves to warm-blooded vertebrates to feed. Deer ticks, are associated with the transmission the bacteria that causes Lyme Disease. Female deer ticks are about one-quarter inch in length and are black and brick red in color. Males are smaller and all black. If a tick is not removed, or if the tick is allowed to remain for days feeding on human blood, a condition known as tick paralysis can develop. This is due to a neurotoxin, which the tick apparently injects while engorging. This neurotoxin acts upon the spinal cord causing incoordination, weakness and paralysis.

The early stages of Lyme disease, which can develop within a week to a few weeks of the tick bite, are usually marked by one or more of these signs and symptoms:

- Tiredness
- Chills and fever
- Headache
- Muscle and/or join pain
- Swollen lymph glands
- Characteristic skin rash (i.e. bullseye rash)

Rocky Mountain Spotted Fever

Rocky Mountain spotted fever is spread by the American dog tick, the lone-star tick, and the wood tick, all of which like to live in wooded areas and tall, grassy fields. The disease is most common in the spring and summer when these ticks are active, but it can occur anytime during the year when the weather is warm.

Initial signs and symptoms of the disease include sudden onset of fever, headache, and muscle pain, followed by development of rash. Initial symptoms may include fever, nausea, vomiting, severe headache, muscle pain, lack of appetite.

The rash first appears 2-5 days after the onset of fever and is often not present or may be very subtle. Most often it begins as small, flat, pink, non-itchy spots on the wrists, forearms, and ankles. These spots turn pale when pressure is applied and eventually become raised on the skin. Later signs and symptoms include rash, abdominal pain, joint pain, diarrhea.

The characteristic red, spotted rash of Rocky Mountain spotted fever is usually not seen until the sixth day or later after onset of symptoms, and this type of rash occurs in only 35% to 60% of patients with Rocky Mountain spotted fever. The rash involves the palms or soles in as many as 50% to 80% of patients; however, this distribution may not occur until later in the course of the disease.

Prevention

Tick season lasts from April through October; peak season is May through July. You can reduce your risk by taking these precautions:

- During outside activities, wear long sleeves and long pants tucked into socks. Wear a hat, and tie hair back.
- Use insecticides to repel or kill ticks. Repellents containing the compound DEET can be used on exposed skin except for the face, but they do not kill ticks and are not 100% effective in discouraging ticks from biting. Products containing permethrin kill

ticks, but they cannot be used on the skin -- only on clothing. When using any of these chemicals, follow label directions carefully.

- After outdoor activities, perform a tick check. Check body areas where ticks are commonly found: behind the knees, between the fingers and toes, under the arms, in and behind the ears, and on the neck, hairline, and top of the head. Check places where clothing presses on the skin.
- Remove attached ticks promptly. Removing a tick before it has been attached for more than 24 hours greatly reduces the risk of infection. Use tweezers, and grab as closely to the skin as possible. Do not try to remove ticks by squeezing them, coating them with petroleum jelly, or burning them with a match. Keep ticks in a zip-lock baggie in case testing needs to be performed.
- Report any of the above symptoms and all tick bites to the PM and CHSO for evaluation.

3.4.3 Mosquito- Borne Disease - West Nile Virus

West Nile encephalitis is an infection of the brain caused by the West Nile virus, which is transmitted by infected mosquitoes. Following transmission from an infected mosquito, West Nile virus multiplies in the person's blood system and crosses the blood-brain barrier to reach the brain. The virus interferes with normal central nervous system functioning and causes inflammation of the brain tissue. However, most infections are mild and symptoms include fever, headache and body aches. More severe infections may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis and rarely, death. Persons over the age of 50 have the highest risk of severe disease.

Prevention centers on public health action to control mosquitoes and on individual action to avoid mosquito bites. To avoid being bitten by the mosquitoes that cause the disease, use the following control measures:

If possible, stay inside between dusk and dark. This is when mosquitoes are most active. When outside between dusk and dark, wear long pants and long-sleeved shirts. Spray exposed skin with an insect repellent, preferably containing DEET.

3.4.4 Wasps and Bees

Wasps (hornets and yellow-jackets) and bees (honeybees and bumblebees) are common insects that may pose a potential hazard to the field team if work is performed during spring, summer or fall. Bees normally build their nests in the soil. However, they use other natural holes such as abandoned rodent nests or tree hollows. Wasps make a football-shaped, paper-like nest either below or above the ground. Yellow-jackets tend to build their nests in the ground but hornets tend to build their nests in trees and shrubbery. Bees are generally more mild-mannered than wasps and are less likely to sting. Bees can only sting once while wasps sting multiple times because their stinger is barbless. Wasps sting when they feel threatened. By remaining calm and not annoying wasps by swatting, you lessen the chance of being stung.

Wasps and bees inject a venomous fluid under the skin when they sting. The venom causes a painful swelling that may last for several days. If the stinger is still present, carefully remove it with tweezers. Some people may develop an allergic reaction (i.e. anaphylatic shock) to a wasp or bee sting. If such a reaction develops, seek medical attention at once.

3.4.5 Sun Exposure

Employees are encouraged to liberally apply sunscreen, with a minimum sun protection factor (SPF) of 15, when working outdoors to avoid sunburn and potential skin cancer, which is associated with excessive sun exposure to unprotected skin. Additionally, employees should wear safety glasses that offer protection from UVA/UVB rays.

4. Personal Protective Equipment

The PPE specified in Table 2 represents PPE selection required by 29 CFR 1910.132, and is based on the AHA of Section 3. Specific information on the selection rationale activity can be found in the GEI Health and Safety Manual.

The PPE program addresses elements, such as PPE selection based on site hazards, use and limitations, donning and doffing procedures, maintenance and storage, decontamination and disposal, training and proper fitting, inspection procedures prior to / during / and after use, evaluation of the effectiveness of the PPE program, and limitations during temperature extremes, heat stress, and other appropriate medical considerations.

A summary of PPE for each level of protection is as follows:

Table 2

Safety Equipment	Level A	Level B	Level C	Level D
TyvekTM suit or work overalls				●
Hard hats with splash shields or safety glasses			●	●
Steel-toe/shank boots with overboots			●	●
Chemical-resistant gloves as appropriate for work being performed and materials handled			●	●
Half- or full-face respirators with appropriate cartridges as approved by the CHSO			●	
TyvekTM splash-resistant suit			●	
Chemical-resistant clothing		●		
Pressure-demand, full-face SCBA or pressure-demand supplied air respirator with escape SCBA	●	●		
Inner and outer chemical-resistant gloves	●	●		
Chemical-resistant safety boots or shoes	●	●		
Two-way radio	●	●		
Hard hat	●	●		
Fully encapsulating chemical-resistant suit	●			
Reflective vest	●	●	●	●

PPE requirements for field activities are as follows.

Activity	Level of Protection	Backup Protection
Soil Boring and Well Installation	D	C
Soil Sampling	D	C
Groundwater Sampling	D	C

Use of Level A or Level B PPE is not anticipated. If conditions indicating the need for Level A or Level B PPE are encountered, personnel will leave the exclusion zone and this HASP will be revised with oversight of the CHSO or GEI personnel will not re-enter the exclusion zone until conditions allow.

OSHA Requirements for Personal Protective Equipment

All personal protective equipment used during the course of this field investigation must meet the following OSHA standards:

Type of Protection	Regulation	Source
Eye and Face	29 CFR 1910.133	ANSI Z87.1 1968
Respiratory	29 CFR 1910.134	ANSI Z88.1 1980
Head	29 CFR 1910.135	ANSI Z89.1 1969
Foot	29 CFR 1910.136	ANSI Z41.1 1967

ANSI = American National Standards Institute

5. Key Project Personnel/Responsibilities and Lines of Authority

5.1 GEI Personnel

Nick Recchia	GEI Project Manager
Brandon Nathe	GEI Project Engineer
Brandon Nathe/ Chris Anastasiou	GEI Site Safety Officer
Brandon Nathe/ Chris Anatasiou	GEI Field Representative
Robin DeHate	GEI Corporate Health and Safety Officer
Steven Hawkins	Regional Health and Safety Officer

The implementation of health and safety at this project location will be the shared responsibility of the GEI Project Manager (PM), the GEI Corporate Health and Safety Officer (CHSO), the GEI Project Site Safety Officer (SSO), other GEI personnel implementing the proposed scope of work.

5.1.1 GEI Project Manager

The GEI Project Manager is responsible for ensuring that the requirements of this HASP are implemented. Some of the PM's specific responsibilities include:

- Verifying that the GEI staff selected to work on this program are sufficiently trained for the sampling activities;
- Assuring that all personnel to whom this HASP applies, including subcontractor personnel, have received a copy of it;
- Providing the CHSO with updated information regarding conditions at the site and the scope of site work;
- Providing adequate authority and resources to the on-site SSO to allow for the successful implementation of all necessary safety procedures;
- Supporting the decisions made by the SSO and CHSO;
- Maintaining regular communications with the SSO and, if necessary, the CHSO;
- Verifying that the subcontractors selected by GEI to work on this program have completed GEI environmental, health and safety requirements and has been deemed acceptable for the proposed scope of work; and,

- Coordinating the activities of all GEI subcontractors and ensuring that they are aware of the pertinent health and safety requirements for this project.

5.1.2 GEI Corporate Health and Safety Officer

The GEI CHSO, Robin DeHate, is the individual responsible for the review, interpretation and modification of this HASP. Modifications to this HASP which may result in less stringent precautions cannot be undertaken by the PM or the SSO without the approval of the CHSO. Specific duties of the CHSO include:

1. Writing, approving and amending the HASP for this project;
2. Advising the PM and SSO on matters relating to health and safety on this site;
3. Recommending appropriate personal protective equipment (PPE) and safety equipment to protect personnel from potential site hazards;
4. Conducting accident investigations; and,
5. Maintaining regular contact with the PM and SSO to evaluate site conditions and new information which might require modifications to the HASP.

5.1.3 GEI Site Safety Officer

All GEI field staff are responsible for implementing the safety requirements specified in this HASP. However, one person will serve as the SSO. For this program, the Field Team Leader (Brandon Nathe/Chris Anastasiou) will serve as the SSO. The SSO will be on-site during all activities covered by this HASP. The SSO is responsible for enforcing the requirements of this HASP once work begins. The SSO has the authority to immediately correct all situations where noncompliance with this HASP is noted and to immediately stop work in cases where an immediate danger is perceived. Some of the SSO's specific responsibilities include:

- Assuring that all personnel to whom this HASP applies, including subcontractors, have submitted a completed copy of the HASP receipt and acceptance form;
- Conducting the pre-entry briefing prior to beginning work, and subsequent safety meetings as necessary;
- Conduct daily Safety Tailboard meeting in accordance with RG&E (can be combined with “pre-entry”) briefing for river related work;
- Assuring that all personnel to whom this HASP applies have attended and actively participated in a pre-entry briefing and any subsequent safety meetings that are conducted during the implementation of the program;

- Maintaining a high level of health and safety consciousness among employees implementing the proposed activities;
- Procuring the air monitoring instrumentation required and performing air monitoring for investigative activities;
- Procuring and distributing the PPE and safety equipment needed for this project for GEI employees;
- Verifying that all PPE and health and safety equipment used by GEI is in good working order;
- Verifying that the selected contractors are prepared with the correct PPE and safety equipment and supplies;
- Notifying the PM of all noncompliance situations and stopping work in the event that an immediate danger situation is perceived;
- Monitoring and controlling the safety performance of all personnel within the established restricted areas to ensure that required safety and health procedures are being followed;
- Stopping work in the event that an immediate danger situation is perceived;
- Conducting accident/incident investigations and preparing accident/incident investigation reports; and,

6. Initiating emergency response procedures in conjunction with the marine subcontractor’s boat captains and in accordance with Section 11.0 of this HASP.

5.1.4 GEI Field Personnel

All GEI field personnel covered by this HASP are responsible for following the health and safety procedures specified in this HASP and for performing their work in a safe and responsible manner. Some of the specific responsibilities of the field personnel are as follows:

- Reading the HASP in its entirety prior to the start of on-site work;
- Submitting a completed HASP Acceptance Form to the GEI SSO prior to the start of work;
- Attending and actively participating in the required pre-entry briefing prior to beginning on-site work and any subsequent safety meetings that are conducted during the implementation of the program;
- Stopping work in the event that an immediate danger situation is perceived;
- Bringing forth any questions or concerns regarding the content of the HASP to the PM or the SSO prior to the start of work;

- Reporting all accidents, injuries and illnesses, regardless of their severity, to the GEI SSO; and,
- Complying with the requirements of this HASP and the requests of the SSO and boat captain.

Lines of Authority will be as follows:

On site – GEI will have responsibility for safety of its employees during the work performed at the site. GEI's field representative will have a cell phone available to contact the appropriate local authorities, in the event of an emergency. GEI's field representative will be available for communication with the GEI Project Manager and with the Client representative.

5.2. Subcontractors

GEI has subcontracted the following firms to assist in performing work on this project:

Tri-State Drilling Technologies, Inc.	55 Hilton Avenue, Garden City, New York 11530 (516) 294-6400
X-Ray Locating Service, Inc.	173 Terry Road, Smithtown, New York 11787 (631) 979-2890

GEI requires its subcontractors to work in a responsible and safe manner. Subcontractors for this project will be required to develop their own HASP for projection of their employees but at a minimum must adhere to applicable requirements set forth in this HASP.

5.3 Emergency Contact List

EMERGENCY INFORMATION		
Important Phone Numbers		Directions to Hospital
Local Police	911	**1.** Head **north** on **Howard Ave** toward **Park Pl** **2.** Take the 1st right onto **Park Pl** **3.** Slight left onto **Eastern Parkway Extension/Eastern Pkwy** **4.** Turn right onto **Rockaway Ave** **5.** Turn right onto **Linden Blvd** Destination will be on the right **Brookdale University Hospital and Medical Center** One Brookdale Plaza Brooklyn, NY 11212
Fire Department	911	
Ambulance	911	
State Police or County Sheriff	911	
Local Hospital Brookdale University Hospital	(718) 240-5000	
Project Manager	(516) 395-8763	
Corporate Health and Safety Officer Robin DeHate	(813) 774-6564 office (813) 323-6220 cell	
Regional Health and Safety Officer	(860) 916-4167	
Client Contact	TBD	
Utility Clearance Permit #	TBD	
Nearest Telephone Location: Onsite cellular		

6. Training Program

6.1 HAZWOPER Training

In accordance with 29 CFR 1910.120, hazardous waste site workers shall, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations. At a minimum, the training shall have consisted of instruction in the topics outlined in the standard. Personnel who have not met the requirements for initial training shall not be allowed to work in any site activities in which they may be exposed to hazards (chemical or physical). Proof of training shall be submitted to the GEI CHSO or her representative prior to the start of field activities.

6.2 Annual Eight-Hour Refresher Training

Annual eight-hour refresher training will be required of all hazardous waste site field personnel in order to maintain their qualifications for fieldwork. The training will cover a review of 29 CFR 1910.120 requirements and related company programs and procedures. Proof of current 8-hour refresher training shall be submitted to the GEI CHSO or her representative prior to the start of field activities.

6.3 Supervisor Training

Personnel acting in a supervisory capacity shall have received 8 hours of instruction in addition to the initial 40 hours training. In addition supervisors shall have one year of field experience and training specific to work activities (i.e., sampling, construction observation, etc.)

6.4 Site-Specific Training

Prior to commencement of field activities, the GEI CHSO or her representative will ensure all field personnel assigned to the project will have completed training that will specifically address the activities, procedures, monitoring, and equipment used in the site operations. It will include site and facility layout, hazards 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. Personnel that have not received site-specific training will not be allowed on-site.

6.5 On-Site Safety Briefings

Other GEI personnel will be given health and safety briefings daily by GEI’s field representative to assist GEI personnel in safely conducting work activities. The briefings will include information on new operations to be conducted, changes in work practices or changes in the site's environmental conditions, as well as periodic reinforcement of previously discussed topics. 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 inspections. Documentation of these briefings will e recorded in the GEI field book. The meetings will also be an opportunity to periodically update the workers on monitoring results. In addition, all GEI personnel shall sign the HASP to document that they understand the hazards and control measures presented and agree to comply with the procedures established in the plan.

6.6 First Aid and CPR

The PM will identify individuals certified in first aid and CPR, or identify individuals for such 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.

7. Medical Surveillance Program

GEI maintains a continuous, corporate, medical surveillance program that includes a plan designed specifically for field personnel engaged in work at sites where hazardous or toxic materials may be present. Dr. Robin DeHate is GEI's CHSO and is responsible for the administration and coordination of medical evaluations conducted for GEI's employees at all branch office locations. Comprehensive examinations are given to all GEI field personnel participating in hazardous waste operations on an annual or biennial basis (as determined to be appropriate by the CHSO). The medical results of the examinations aid in determining the overall fitness of employees participating in field activities.

Dr. Robin DeHate's telephone number is:
Telephone: (183) 774-6564 (office) or (813) 323-6220 (cell)

Under the CHSO's supervision, all field personnel undergo a complete initial physical examination, including a detailed medical and occupational history, before they participate in hazardous waste site investigations. Extensive annual/biennial reexaminations are also performed. Upon completion of these tests, personnel are certified by an occupational health physician as to whether they are fit for field work in general, and fit to use all levels of respiratory protection, in particular.

If a GEI employee or other project worker shows symptoms of exposure to a hazardous substance and wishes to be rechecked, he/she will be directed to the nearest area hospital or medical facility.

All GEI subcontractor personnel that will enter any active waste handling or other active non-"clean" area must certify that they are participating in a medical surveillance program that complies with OSHA regulations for hazardous waste operations (i.e., 29 CFR 1910.120 and 29 CFR 1926.65). Proof of medical clearance shall be submitted to the GEI CHSO or her representative prior to the start of field activities.

8. Monitoring

Monitoring shall be performed to identify and quantify airborne levels of hazardous substances and safety and health hazards in order to determine the appropriate level of worker protection needed on site.

GEI will conduct perimeter air monitoring, and work zone monitoring for on-site workers. GEI will monitor and document daily site conditions and operations and inform field representative of results. If action levels are exceeded GEI's field representative will immediately implement dust suppression activities and notify GEI's Project Manager.

GEI will provide the following equipment for health and safety monitoring of on-site personnel:

- Particulate Meter (PM-10 capable)
- Sound Level Meter if deemed necessary by the CHSO or PM (type to be appropriate to the activities performed)

The perimeter and work zone air monitoring will be conducted during demolition activities. Table 3 provides a summary of real time air monitoring action levels and contingency plans for work zone activities.

Table 3
Work Zone Air Monitoring Action Levels

Air Monitoring Instrument	**Monitoring Location**	**Action Level**	**Site Action**
PID	Breathing Zone	0.5 ppm	Use Dräger Chip Measurement System (CMS) tube for benzene or Z-nose® to verify if concentration is benzene.
PID	Breathing Zone	0 - 10 ppm	No respiratory protection is required.
		10 - 250 ppm	Stop work, withdrawal from work area, institute engineering controls, if levels persist Upgrade to Level C.
		> 250 ppm	Stop work, withdraw from work area; notify PM & CHSO.
Oxygen meter (O_2)	Breathing Zone	< 20.75%	Stop work; withdraw from work area; ventilate area, notify PM & CHSO.
		> 21.1%	Stop work; withdraw from work area; notify PM & CHSO.
Hydrogen Sulfide (H_2S) meter	Breathing Zone	<5 ppm	No respiratory protection is required.
		>5 ppm	Stop work, cover excavation, withdraw from work area, institute engineering controls, and notify PM & CHSO.
Hydrogen Cyanide (HCN) meter	Breathing Zone	<1.0 ppm	Run CMS Dräger tube, continue monitoring with real time meter, and continue work if CMS Dräger Tube Reading is less than 2ppm.

Table 3
Work Zone Air Monitoring Action Levels

Air Monitoring Instrument	Monitoring Location	Action Level	Site Action
		1.0< HCN <2.0 ppm	Run CMS Dräger tube and confirm concentration is less than 2.0 ppm, notify SSO and CESM. Run CMS Dräger tube for sulfur dioxide, hydrogen sulfide, and phosphine chip potential interferences. Continue to monitor with real time meter.
		>2.0 ppm	Stop work, and move (with continuous HCN monitoring meter) at least 25 feet upwind of the excavation until continuous meter reads less than 1 ppm, Notify PM & CHSO. Run CMS Dräger hydrogen cyanide chip and re-evaluate activity, continue monitoring with a real time meter, resume work if concentrations read less than 1.0 ppm.
Combustible Gas Indicator (CGI)	Excavation/ Work Zone	< 10 % Lower Explosive Limit (LEL)	Investigate possible causes, allow excavation to ventilate; use caution during procedures.
		> 10% LEL	Stop work; allow excavation, borehole to ventilate to < 10% LEL; if ventilation does not result in a decrease to < 10% LEL, withdraw from work area; notify PM & CHSO.
Particulate Meter	Excavation/ Work Zone	0.150 ug/m^3	Implement work practices to reduce/minimize airborne dust generation, e.g., spray/misting of soil with water.

9. Site Control Measures

9.1 Site Zones

Site zones are intended to control the potential spread of contamination and to assure that only authorized individuals are permitted into potentially hazardous areas. A three-zone approach will be utilized. It shall include an Exclusion Zone (EZ), Contamination Reduction Zone (CRZ) and a Support Zone (SZ). Specific zones shall be established on the work site by the Contractor when operations begin for each task requiring such delineation. Maps depicting the zones will be available at the Site.

This project is being conducted under the requirements of 29 CFR 1910.120, and any personnel working in an area where the potential for exposure to site contaminants exists, will only be allowed access after proper training and medical documentation.

The following shall be used for guidance in revising these preliminary zone designations, if necessary.

Support Zone - The SZ is an uncontaminated area that will be the field support area for most operations. The SZ provides for field team communications and staging for medical emergency. Appropriate sanitary facilities and safety equipment will be located in this zone. Potentially contaminated personnel/materials are not allowed in this zone.

Contamination Reduction Zone - The CRZ is established between the EZ and the SZ. The CRZ contains the contamination reduction corridor and provides an area for decontamination of personnel and portable hand-held equipment, tools and heavy equipment. A personnel decontamination area will be prepared at each exclusion zone. The CRZ will be used for Exclusion Zone entry and egress in addition to access for heavy equipment and emergency support services.

Exclusion Zone - All activities which may involve exposure to site contaminants, hazardous materials and/or conditions should be considered an exclusion zone. This zone will be clearly delineated by cones, tapes or other means. The Contractor may establish more than one EZ where different levels of protection may be employed or different hazards exist. The size of the EZ shall be determined by the Contractor allowing adequate space for the activity to be completed, field members and emergency equipment.

The Contractor is responsible for constructing, maintaining, and enforcing the zones.

9.2 Buddy System

GEI personnel should be in line-of-site or communication contact with another on-site person. The other on-site personnel should be aware of their role as a "buddy" and be able to provide assistance in the event of an emergency. A copy of this plan shall be given to any person acting as a GEI "buddy" for informational purposes.

9.3 Sanitation for Temporary Work Sites

Temporary sanitary facilities including toilets will be available on site.

9.4 Illumination

Illumination requirements identified by OSHA are directed to work efforts inside buildings and/or during non-daylight hours. All activities planned for the site are anticipated to occur outside during daylight hours. However, if yard areas are used after dark they will be equipped with illumination that meets or exceeds requirements specified in 29 CFR 1926.56, Illumination.

9.5 Utilities

The site may have shallow, buried utilities and also overhead utilities in certain areas. It will be necessary for all parties disturbing the existing ground surface and conducting operations with heavy equipment having high clearances to exercise a high degree of caution in performing project-related work with respect to the presence of utilities. Utility companies with active buried lines in the site area will be asked to mark all of their facilities as necessary. Site workers will use these data to choose apparently safe work locations.

9.5.1 Underground Utilities

No excavating, drilling, boring or other intrusive activities will be performed until a thorough underground utility survey, conducted by knowledgeable persons or agencies, has been made and it is found safe to begin. This survey will identify any underground and in-workplace utilities such as the following.

- Electrical lines and appliances
- Telephone lines
- Cable television lines
- Gas lines
- Pipelines
- Steam lines
- Water lines

- Sewer lines
- Pressurized air lines

The location of any utility that could pose a risk to workers must be communicated to all workers during site safety indoctrination. Utilities should be marked or access otherwise restricted to avoid change of accidental contact.

Even when a utility search has been completed, drilling, boring and excavation should commence with caution until advanced beyond the depth at which such utilities are usually located. All utilities shall be considered “live” or active until reliable sources demonstrate otherwise.

9.5.2 Overhead Utilities

Overhead transmission and distribution lines will be carried on towers and poles which provide adequate safety clearance over roadways and structures. Clearances will be adequate for the safe movement of vehicles and for the operation of construction equipment.

Overhead or above-ground electric lines should be considered active until a reliable source has documented them to be otherwise. Elevated work platforms, ladders, scaffolding, man-lifts, and drill or vehicle superstructures shall be erected a minimum of 20 feet (the actual distance is dependent upon the voltage of the line) from overhead electrical lines until the line is de-energized, grounded or shielded and a competent electrician has certified that arcing cannot occur between the work location or superstructure.

10. Accident Reporting

GEI will report incidents involving GEI personnel or subcontractor personnel, such as: lost time injuries, injuries requiring medical attention, near miss incidents, fires, fatalities, accidents involving the public, and property damage. The report shall be made to the GEI Project Manager verbally within 2 hours of the incident. The Project Manager will immediately inform the CHSO and the Director of Human Resources of the incident. An Accident Report Form will be completed and submitted to the CHSO and the Director of Human Resources within 24 hours of the incident

11. Decontamination Procedures

11.1 Personnel Decontamination

Contaminated PPE (gloves, suits, etc.) will be placed in plastic bags (or other appropriate container) and disposed of in an approved facility.

Decontamination wastewater and used cleaning fluids will be collected and disposed of in accordance with all applicable state and federal regulations.

11.2 Heavy Equipment Decontamination

Heavy equipment decontamination will be performed by the Contractor within the limits of the on-site decontamination pad in accordance with the contract specifications. A steam generator and brushes will be used to clean demolition equipment and other tools. No heavy equipment will be permitted to leave the site unless it has been thoroughly decontaminated.

Wastewater from the heavy equipment and personnel decontamination areas will be collected and disposed of in accordance with all applicable state and federal regulations. The Contractor will be responsible for ultimate disposal of investigation-derived wastes.

11.3 Decontamination Equipment Requirements

The following equipment, if required, should be in sufficient supply to implement decontamination procedures for GEI’s equipment.

- Buckets
- Alconox™ detergent concentrate
- Hand pump sprayers
- Long handle soft bristle brushes
- Large sponges
- Cleaning wipes for respirators
- Bench or stool(s)
- Methanol
- Liquid detergent and paper towels
- Plastic trash bags

The Contractor performing decontamination procedures is responsible for ensuring that the above materials, as required for their operation, are in sufficient supply.

12. Supplemental Contingency Plan Procedures

12.1 Hazard Communication Plan

GEI personnel have received hazard communication training as part of their 40-hour HAZWOPER training. All hazardous materials used on the site will be properly labeled, stored, and handled. Material Safety Data sheets (MSDS) will be available to all potentially exposed employees.

12.2 Fire

In the event of a fire all personnel will evacuate the area. GEI's field representative will contact the local fire department with jurisdiction and report the fire. Notification of evacuation will be made to the GEI Project Manager and the CHSO. The field representative will account for GEI personnel and subcontractor personnel and report their status to the GEI Project Manager.

12.3 Medical Support

In case of minor injuries, on site care shall be administered with the site first aid kit. For serious injuries, call 911 and request emergency medical assistance. Seriously injured persons should not be moved, unless they are in immediate danger.

Section 5 of this HASP contains detailed emergency information, including directions to the nearest hospital, and a list of emergency services and their telephone numbers. GEI field personnel will carry a cellular telephone.

12.4 Severe Weather

The contingency plan for severe weather includes reviewing the expected weather to determine if severe weather is in the forecast. Severe weather includes high winds over 30 mph, heavy rains or snow squalls, thunderstorms, hurricanes, and lightning storms. If severe weather is approaching, the decision to evacuate GEI personnel and subcontractor personnel from the site will be the responsibility of GEI's field representative. Notification of evacuation will be made to the GEI Project Manager and the CHSO. The field representative will account for GEI personnel and subcontractor personnel and report their status to the GEI Project Manager.

12.5 Spills or Material Release

If a hazardous waste spill or material release, the SSO or his representative will immediately assess the magnitude and potential seriousness of the spill or release based on the following.

- MSDS for the material spilled or released
- Source of the release or spillage of hazardous material
- An estimate of the quantity released and the rate at which it is being released
- The direction in which the spill or air release is moving
- Personnel who may be or may have been in contact with the material, or air release, and possible injury or sickness as a result
- Potential for fire and/or explosion resulting from the situation
- Estimates of area under influence of release

If the spill or release is determined to be within the on-site emergency response capabilities, the SSO will ensure implementation of the necessary remedial action. If the release is beyond the capabilities of the site personnel, all personnel will be evacuated from the immediate area and the local fire department will be contacted. The SSO will notify the PM and the CHSO.

12.6 Alcohol and Drug Abuse Prevention

Alcohol and drugs will not be allowed on the work site. Project personnel under the influence of alcohol or drugs will not be allowed to enter the site.

Health and Safety Plan Sign-Off

All GEI personnel conducting site activities must read the Health and Safety Plan, be familiar with its requirements, and agree to its implementation.

Once the Health and Safety Plan has been read, complete this sign-off sheet, and return it to the Project Manager.

Site Name:
495 Howard Avenue
Brooklyn, New York

Investigation:
Soil boring installation, groundwater monitoring well installation, soil sampling, groundwater sampling

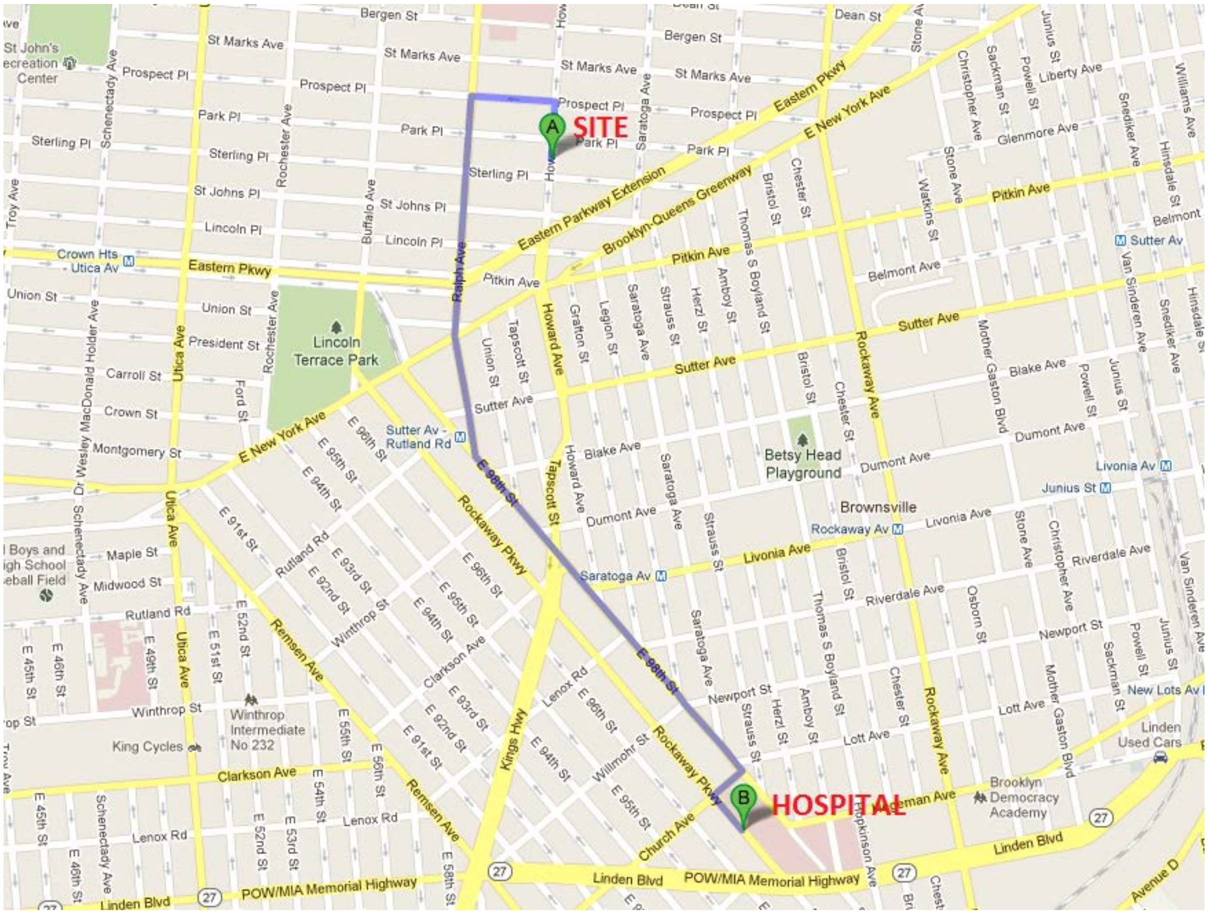
GEI Project No: TBD

I have received and read the Health and Safety Plan, been briefed on it, and agree to its implementation.

Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:

APPENDIX A
MAP TO HOSPITAL

MAP TO HOSPITAL



Brookdale University Hospital and Medical Center

One Brookdale Plaza
Brooklyn, NY 11212

APPENDIX B
HEAT STRESS/COLD STRESS GUIDELINES

Cold Stress Guidelines

	Symptoms	What to do
Mild Hypothermia	• Body Temp 98-90°F • Shivering • Lack of coordination, stumbling, fumbling hands • Slurred speech • Memory loss • Pale, cold skin	• Move to warm area • Stay active • Remove we clothes and replace with dry clothes of blankets • Cover the head • Drink warm (not hot) sugary drink
Moderate Hypothermia	• Body temp 90-86°F • Shivering stops • Unable to walk of stand • Confused irrational	• All of the above, plus: • Call 911 • Cover all extremities complexly • Place very warm objects, such as hot packs on the victim's head, neck, chest and groin
Severe Hypothermia	• Body temp 86-78°F • Severe muscle stiffness • Very sleepy or unconscious • Ice cold skin • Death	• Call 911 • Treat victim very gently • Do not attempt to re-warm
Frostbite	• Cold, tingling, stinging or aching feeling in the frostbitten area, followed by numbness • Skin color turns red, then purple, then white or very pale skin • Cold to the touch • Blisters in severe cases	• Call 911 • Don not rub the area • Wrap in soft cloth • If help is delayed, immerse in warm, not hot, water
Trench Foot	• Tingling, itching or burning sensation • Blisters	• Soak feet in warm water, then wrap with dry cloth bandages • Drink a warm sugary drink

HEAT STRESS GUIDELINES

Form	Signs & Symptoms	Care	Prevention[3]
Heat Rash	Tiny red vesicles in affected skin area. If the area is extensive, sweating can be impaired.	Apply mild lotions and cleanse the affected area.	Cool resting and sleeping areas to permit skin to dry between heat exposures
Heat Cramps	Spasm, muscular pain (cramps) in stomach area and extremities (arms and legs).	Provide replacement fluids with minerals (salt) such as Gatorade.	Adequate salt intake with meals[1] ACCLIMATIZATION[2]
Heat Exhaustion	Profuse sweating, cool (clammy) moist skin, dizziness, confusion, pale skin color, faint, rapid shallow breathing, headache, weakness, muscle cramps.	Remove from heat, sit or lie down, rest, replace lost water with electrolyte replacement fluids (water, Gatorade) take frequent sips of liquids in amounts greater than required to satisfy thirst.	ACCLIMATIZATION[2] Adequate salt intake with meals [1] only during early part of heat season. Ample water intake, frequently during the day
Heat Stroke	HOT Dry Skin. Sweating has stopped. Mental confusion, dizziness, nausea, severe headache, collapse, delirium, coma.	HEAT STROKE IS A MEDICAL EMERGENCY - Remove from heat. - COOL THE BODY AS RAPIDLY AS POSSIBLE by immersing in cold (or cool) water, or splash with water and fan. Call for Emergency Assistance. Observe for signs of shock.	ACCLIMATIZATION[2] Initially moderate workload in heat (8 to 14 days). Monitor worker's activities.

Footnotes:

1.) American diets are normally high in salt, sufficient to aid acclimatization. However, during the early part of the heat season, (May, June), one extra shake of salt during one to two meals per day may help, so long as this is permitted by your physician. Check with your personal physician.

2.) ACCLIMATIZATION - The process of adapting to heat is indicated by worker's ability to perform hot jobs less fluid loss, lower concentrations of salt loss in sweat, and a reduced core (body) temperature and heart rate.

3.) Method to Achieve Acclimatization - Moderate work or exercise in hot temperatures during early part of heat season. Adequate salt (mineral) and water intake. Gradually increasing work time in hot temperatures. Avoid alcohol. Normally takes 8 to 14 days to achieve acclimatization. Lost rapidly, if removed from strenuous work (or exercise) in hot temperature for more than approximately five days.