GREENPOINT FERRY SITE

KINGS COUNTY

BROOKLYN, NEW YORK

SITE MANAGEMENT PLAN

NYSDEC Site Number: C224272

Prepared for:

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Revisions to Final Approved Site Management Plan:

Revision No.	Date Submitted	Summary of Revision	NYSDEC Approval Date

DECEMBER 2025

CERTIFICATION STATEMENT

I, Paul Martorano, P.E., certify that I am currently a NYS registered professional engineer and that this Site Management Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10) and Green Remediation (DER-31).

Paul Martorano PE

December 29, 2025 DATE



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LIST OF ACRONYMS

AS	Air Sparging
ASP	Analytical Services Protocol
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
BMP	Best Management Practice
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CAMP	Community Air Monitoring Plan
C/D	Construction and Demolition
CFR	Code of Federal Regulation
CLP	Contract Laboratory Program
COC	Certificate of Completion
CO2	Carbon Dioxide
CP	Commissioner Policy
DER	Division of Environmental Remediation
DUSR	Data Usability Summary Report
EC	Engineering Control
ECL	Environmental Conservation Law
ELAP	Environmental Laboratory Approval Program
ERP	Environmental Restoration Program
EWP	Excavation Work Plan
GHG	Greenhouse Gas
GWE&T	Groundwater Extraction and Treatment
HASP	Health and Safety Plan
IC	Institutional Control
Iwc	Inches of water column
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYCRR	New York Codes, Rules and Regulations
O&M	Operation and Maintenance
OM&M	Operation, Maintenance and Monitoring
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
P.E. or PE	Professional Engineer
PFAS	Per- and Polyfluoroalkyl Substances
PID	Photoionization Detector
PRP	Potentially Responsible Party
PRR	Periodic Review Report
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QEP	Qualified Environmental Professional
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study

ROD	Record of Decision
RP	Remedial Party
RSO	Remedial System Optimization
SAC	State Assistance Contract
SCG	Standards, Criteria and Guidelines
SCO	Soil Cleanup Objective
SMP	Site Management Plan
SOP	Standard Operating Procedures
SOW	Statement of Work
SPDES	State Pollutant Discharge Elimination System
SSD	Sub-slab Depressurization
SVE	Soil Vapor Extraction
SVI	Soil Vapor Intrusion
SVOCs	Semi-Volatile Organic Compounds
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leachate Procedure
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VCA	Voluntary Cleanup Agreement
VCP	Voluntary Cleanup Program
VOCs	Volatile Organic Compounds

ES EXECUTIVE SUMMARY

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

Site Identification: C224272, Greenpoint Ferry Site, Brooklyn, New York

Institutional Controls:	1. The property may be used for restricted-residential, commercial, or industrial use;
	2. All Engineering Controls (ECs) must be operated and maintained as specified in the Site Management Plan (SMP);
	3. All ECs must be inspected at a frequency and in a manner defined in the SMP;
	4. The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the New York City Department of Health and Mental Hygiene to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;
	5. Groundwater and other environmental or public health monitoring must be performed as defined in the SMP;
	6. Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in the SMP;
	7. All future activities on the property that will disturb remaining contaminated material must be conducted in accordance with the SMP;
	8. Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in the SMP;
	9. Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical components of the remedy shall be performed as defined in the SMP;

Site Identification: C224272, Greenpoint Ferry Site, Brooklyn, New York

	10. Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by this Environmental Easement.
	11. The potential for vapor intrusion must be evaluated as defined in the SMP for any buildings developed in the area within the IC boundaries noted on Figure 6A, and any potential impacts that are identified must be monitored or mitigated;
	12. Vegetable gardens and farming on the site are prohibited.
Engineering Controls:	1. Site Cover System 2. Active Sub-Slab Depressurization System (SSDS)

Inspections:	**Frequency**
1. Cover System and Site Wide Inspection	First inspection due sixteen (16) months after the Certificate of Completion is issued, then annually thereafter or as otherwise determined by the NYSDEC.
Monitoring:	
1. Groundwater Monitoring Wells MW-1, MW-2 and MW-3	Semi-annual
2. SSDS Performance Criteria (Monitoring Points, Vacuum Blower, Piping)	Monthly: Blower condition and vacuum measurements, exposed piping/appurtenances. Following Start-Up and Annually: Soil vapor monitoring point vacuum measurements, overall system condition. Following Start-Up: effluent stack sampling
3. Indoor Air (IA-1, IA-2, IA-3, IA-4, IA-5, IA-6, IA-7, IA-8, IA-9) and ambient (AA-1)	Following NYSDEC approval of Post-Mitigation Sampling Work Plan
Maintenance:	
1. Cover System	As Needed
2. SSDS Routine/Non-Routine	Monthly, As Needed

Site Identification: C224272, Greenpoint Ferry Site, Brooklyn, New York

Reporting:	
1. Groundwater Monitoring Report	Semi-annual until NYSDEC approved cessation of monitoring.
2. Periodic Review Report	First report due sixteen (16) months after the Certificate of Completion is issued, then due annually thereafter or as otherwise determined by the NYSDEC.
3. SSDS Operating Log	Inspections to occur monthly and reported in the Periodic Review Report.

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

1.0 INTRODUCTION

1.1 General

This Site Management Plan (SMP) is a required element of the remedial program for the Greenpoint Ferry Site located in the Greenpoint section of Brooklyn, Kings County, New York (hereinafter referred to as the "Site"). See Figure 1. The Site is currently in the New York State (NYS) Brownfield Cleanup Program (BCP), Site No. C224272,which is administered by New York State Department of Environmental Conservation (NYSDEC or Department).

Stiles Properties, LLC entered into a Brownfield Cleanup Agreement (BCA) on October 31, 2018 with the NYSDEC to remediate the site. Following a change of property ownership, 1 Java Owner LLC submitted a BCP Application to Amend the BCA, and was subsequently added as a Participant, and the BCA was amended and executed on January 8, 2021. 1 Java Owner LLC submitted a BCP Application to Amend the BCA to reduce the total Site acreage by 0.2 acres, and the BCA was amended on October 15, 2024. A figure showing the site location and boundaries of this site is provided in Figure 2. The boundaries of the site are more fully described in the metes and bounds site description that is part of the Environmental Easement provided in Appendix A.

After completion of the remedial work, some contamination was left at this site, which is hereafter referred to as "remaining contamination". Institutional and Engineering Controls (ICs and ECs) have been incorporated into the site remedy to control exposure to remaining contamination to ensure protection of public health and the environment. An Environmental Easement granted to the NYSDEC, and recorded with the New York City Office of the City Register, requires compliance with this SMP and all ECs and ICs placed on the site.

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

It is important to note that:

- This SMP details the site-specific implementation procedures that are required by the Environmental Easement. Failure to properly implement the SMP is a violation of the Environmental Easement, which is grounds for revocation of the Certificate of Completion (COC); and
- Failure to comply with this SMP is also a violation of Environmental Conservation Law, 6 NYCRR Part 375 and the BCA (Index #C224272-08-15; Site #C224272) for the site, and thereby subject to applicable penalties.

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

This SMP was prepared by Roux Environmental Engineering and Geology, D.P.C., on behalf of 1 Java Owner LLC, in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), revised April 2019, and the guidelines provided by the NYSDEC. This SMP addresses the means for implementing the ICs and/or ECs that are required by the Environmental Easement for the site.

1.2 Revisions and Alterations

Revisions and alterations to this plan will be proposed in writing to the NYSDEC's project manager. The NYSDEC can also make changes to the SMP or request revisions from the remedial party. Revisions will be necessary upon, but not limited to, the following occurring: a change in media monitoring requirements, upgrades to or shutdown of a remedial system, post-remedial removal of contaminated sediment or soil, or other significant change to the site conditions. All approved alterations must conform with Article 145 Section 7209 of the Education Law regarding the application of professional seals and alterations. For example, any changes to as-built drawings must be stamped by a New York State Professional Engineer. In accordance with the Environmental Easement for the site, the NYSDEC project manager will provide a notice of any approved changes to the SMP, and append these notices to the SMP that is retained in its files.

1.3 Notifications

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

1. 60-day advance notice of any proposed changes in site use that are required under the terms of the BCA, 6 NYCRR Part 375 and/or Environmental Conservation Law.
2. 7-day advance notice of any field activity associated with the remedial program.
3. 15-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan. If the ground-intrusive activity qualifies as a change of use as defined in 6 NYCRR Part 375, the above mentioned 60-day advance notice is also required.
4. Notice within 48 hours of any damage or defect to the foundation, structures or EC that reduces or has the potential to reduce the effectiveness of an EC, and likewise, any action to be taken to mitigate the damage or defect.
5. Notice within 48 hours of any non-routine maintenance activities.
6. Verbal notice by noon of the following day of any emergency, such as a fire; flood; or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the site, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.
7. Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action submitted to the NYSDEC within 45 days describing and documenting actions taken to restore the effectiveness of the ECs.

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

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

Table 1.3 on the following page includes contact information for the above notifications. The information on this table will be updated as necessary to provide accurate contact information. A full listing of site-related contact information is provided in Appendix B.

Table 1.3: Notifications*

Name	**Contact Information**	**Required Notification****
Richard P Mustico	(518) 402-9647 richard.mustico1@dec.ny.gov	All Notifications
William Bennett	(518) 402-9659 william.bennett@dec.ny.gov	All Notifications
NYSDEC Site Control	(518) 402-9543 DERSiteControl@dec.ny.gov	Notifications 1 and 8
Johnathan Robinson	(518) 402-7881 Johnathan.robinson@health.ny.gov	Notifications 4, 6, and 7

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

** Note: Numbers in this column reference the numbered bullets in the notification list in this section.

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

2.1 Site Location and Description

The site is located in Brooklyn, Kings County, New York and is identified as the upland portion of Section 3 Block 2538 and Lot 1 on the New York City Brooklyn Tax Map. The site is an approximately 2.42 acre area and is bounded by India Street to the north, Java Street to the south, West Street to the east, and the East River to the west (see Figure 2 – Site Layout Map). The boundaries of the site are more fully described in Appendix A –Environmental Easement. The owner(s) of the site parcel(s) at the time of issuance of this SMP is:1 Java Owner LLC.

2.2 Physical Setting

2.2.1 Land Use

The Site consists of the following: a mixed commercial, residential, and recreational building with parking and a recreational area and public waterfront access. The western end of the property is improved with an active New York City East River ferry terminal. The Site is zoned for R8 and R6, both residential districts, with a commercial overlay of C2-4 and is currently undergoing build out of the interior spaces. The Site features a vertical closed loop geothermal system.

The properties adjoining the Site and in the neighborhood surrounding the Site primarily include commercial and residential properties. The properties immediately south of the Site include commercial properties; the properties immediately north of the Site include residential and commercial properties; the properties immediately east of the Site include mixed use commercial and residential properties; and to the west of the Site is the East River.

2.2.2 Geology

Based on the environmental and geotechnical soil borings completed, the entire site was covered with contaminated fill material, containing fine to medium sand with varying amounts of course sand, silt, gravel, tar, brick and concrete fragments ranging in thickness of up to 15 to 20 feet throughout most of the Site, and deeper near the waterfront. This fill layer was underlain by a native glacial silty fine to medium sand stratum with varying amounts of gravel and silt.

2.2.3 Hydrogeology

The depth to groundwater observed in monitoring wells onsite is between approximately 5 and 10 ft below land surface (bls). Based on this data, groundwater is presumed to flow west toward the East River. Groundwater elevation data is provided in Table 2 of the RAWP. Groundwater monitoring well construction logs are provided in Appendix C.

2.3 Investigation and Remedial History

Historical Site uses include: lumber storage (including presence of a drying kiln) and planing mill (western portion of the Site) between 1887 until the 1940s; an Independent Energy Plant (IEP); a sash, door and blind factory; sheet metal works (fabrication); truck repair; gasoline tank and pumps for fueling; bottling plant warehouse; plastics manufacturer; cargo storage; and parking. Prior to demolition to enable remediation activities, the Site was improved with two connected warehouse-style buildings that were vacant. An active New York City (NYC) East River ferry terminal remains on the western portion of the property. The two demolished Site buildings were constructed by circa 1942 (western Site building; C/O confirmed construction to be May 1935) and 1953 (eastern Site building). As of 1951, piers/docks are noted at the end of each street along the shoreline of the East River from Green Street (to the north) to Milton Street (to the south), including India Street. All the piers/docks, except for the pier/dock at the end of Green Street, were no longer depicted by 2006. By 2011, a new pier/dock at the end of India Street was noted (current pier used as NYC ferry terminal).

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

A detailed description of previous environmental reports was included in the Remedial Action Work Plan prepared by Roux dated May 2021 and revised February 2022, and a summary is provided below. Previous environmental assessment activities and reports that have been completed at the Site include:

- November 2005 Phase I and II Environmental Site Assessment (ESA) prepared by EWMA (EWMA Phase I and II);
- July 2012 Phase I ESA prepared by AKRF (AKRF Phase I ESA);

- March 2015 Phase I ESA prepared by IVI (IVI Phase I ESA);
- August 2018 Phase I ESA prepared by Roux (Roux 2018 Phase I ESA);
- March 2020 Remedial Investigation Report (RI) prepared by Roux (Roux RI);
- October 2020 Phase I ESA prepared by Roux (Roux 2020 Phase I ESA); and
- October 2022 Phase I ESA prepared by Roux (Roux 2022 Phase I ESA).

A summary of the findings of these assessments is provided below.

2005-2015 Phase I and II ESAs by Others

The Phase I & II ESA completed by EWMA, identified the Site's historic industrial use as a REC. In order to conduct a general screening of the Site, given its past industrial use, EWMA conducted a Phase II ESA on October 20, 2005. Phase II activities consisted of a limited geophysical survey and shallow subsurface soil quality investigation through the installation of five soil borings inside the warehouse portion of the Site. The results of the geophysical survey revealed no anomalies in the vicinity of the proposed boring locations. One soil sample was collected from each of the five soil borings and was analyzed for priority pollutant metals, New York Stars-list VOCs, New York Stars-list BNs, and PCBs. The Phase II results indicated detections of SVOCs including benzo[a]anthracene, chrysene, Benzo[b]fluoranthene, Benzo[klfluoranthene, Benzo[a]pyrene, and Dibenz[a,h]anthracene and metals including cadmium, copper, mercury and zinc. The EWMA report was included in the BCP Application package sent to NYSDEC.

The IVI Phase I ESA identified four RECs at the Site: 1) Historic Site Use and USTs, 2) Historic On-site Fill, 3) New York City "E" Designation, and 4) Adjacent Sites with RECs. LBP and ACM were identified as BERs. Note that the AKRF Phase I ESA dated July 13, 2012 is provided in Appendix G of the IVI Phase I ESA.

2018 Roux Phase I ESA

The Roux 2018 Phase I ESA describes the Site as being currently improved with two warehouse-style buildings utilized as storage by respective movie prop storage companies; and an active New York City East River ferry terminal on the western portion of the Site. Roux did not identify any Controlled Recognized Environmental Conditions (CRECs) in relation with the Site; however, three Recognized Environmental Conditions (RECs), one Historical Recognized Environmental Condition (HREC), and four Business Environmental Risk (BERs) were identified. RECs include former Site usage, potential historic use of petroleum storage tank(s), and an adjacent property

(Huxley Envelope BCP Site located at 145 West Street) that underwent light non-aqueous phase liquid (LNAPL) remediation during site redevelopment; the HREC is related to historic spill incident related to the Site; and the BERs include the presence of historic fill, E-designations associated with the Site, and potential presence of asbestos containing material and lead based paint.

2020 Roux RI

Soil Results

The following subsections summarize the soil quality based on laboratory analytical data that was generated during the RI.

Laboratory analytical data for soil samples are summarized in Tables 4 through 9 of the RIR and compared to NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives (SCOs), the Part 375 Protection of Groundwater SCOs and the Part 375 Restricted Residential SCOs. Analytical results are described below:

- Two VOCs (acetone and naphthalene) were detected above the Protection of Groundwater SCOs, and/or Restricted Residential SCOs;
- Nine SVOCs (3- and 4-methylphenol (total), benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene and Phenanthrene), predominantly polycyclic aromatic hydrocarbons (PAHs), were detected above the Protection of Groundwater SCOs and/or Restricted Residential SCOs;
- Five metals (arsenic, cadmium, copper, lead, and mercury) were detected above the Protection of Groundwater SCOs and/or the Restricted Residential SCOs; and
- There were minor detections of PCBs and pesticides, however, all detections were below all applicable SCOs.

In addition to the RI sampling, two *in situ* soil waste characterization sampling programs were completed by Roux in 2018 and 2021 to support the redevelopment of the Site. During the 2021 waste characterization sampling, a lead hotspot was identified within waste characterization grid SC-5 (located in the western portion of the Site), based on one composite soil sample exceeded the USEPA Resource Conservation and Recovery Act (RCRA) Characteristic Waste for Toxicity standard for lead. The remaining sampling results of the waste characterization sampling programs were generally consistent with the RI sampling.

Groundwater Results

Laboratory analytical data for groundwater samples are summarized in Tables 10 through 14 of the RIR and are compared to NYSDEC Ambient Water Quality Standards and Guidance Values (AWQSGVs) for Class GA groundwater. Analytical results are described below:

- There were no detections of VOCs exceeding the AWQSGVs;
- A total of four SVOCs, including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene and indeno(1,2,3-c,d)pyrene were found exceeding their AWQSGVs. These detections were relatively low and estimated by the laboratory since they were below reporting limits. These detections are related to the historic fill placed at the Site below the water table.
- Five metals including antimony, iron, magnesium, manganese and sodium were detected above the AWQSGVs. Note that these are all naturally occurring metals, commonly found in groundwater. Laboratory analysis for the field filtered and unfiltered samples yielded fairly consistent results.
- PCBs and pesticides were not detected in any of the groundwater samples collected during the RI.

Soil Vapor Results

Ten soil vapor samples were collected from locations beneath the existing warehouse buildings, as shown on Figure 2 of the RIR and submitted for analysis for VOCs. In total, 25 compounds were detected in the 10 soil vapor samples collected. Laboratory analytical results for soil vapor samples are summarized in Table 15 of the RIR.

There are currently no standards for soil vapor established by either NYSDEC or the NYSDOH. The NYSDOH has established guidance for evaluating soil vapor intrusion in which the results of soil vapor samples are compared to corresponding indoor air quality results. At the time of the RI, the guidance was presented in Matrix A, Matrix B, and Matrix C from the NYSDOH Center for Environmental Health (CEH) Bureau of Environmental Exposure Investigation (BEEI) Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006 (matrices were updated in May 2017). These matrices provide guidance relative to carbon tetrachloride, cis-1,2-dichloroethene, 1,1-dichloroethene, trichloroethene (TCE), tetrachloroethene (PCE), 1,1,1-trichloroethane, methylene chloride, and vinyl chloride. Analytical results indicated detections of all Matrix A, B and C compounds except for carbon tetrachloride in the soil vapor samples.

Additionally, chloroform was detected in excess of the USEPA Target Sub-Slab Concentration of 4.1 ug/m3 in seven samples.

2020 Roux Phase I ESA

The Roux 2020 Phase I ESA describes the Site as being currently improved with two warehouse-style buildings which did not have any active tenants; and an active New York City East River ferry terminal on the western portion of the Site. Roux did not identify any CRECs in relation with the Site; however, three RECs, one HREC, and four BERs were identified. RECs include historic Site usage, suspected presence of petroleum storage tank(s), and presence of contaminated fill material; the HREC is related to historic spill incident related to the Site; and the BERs include E-designations associated with the Site, NYSDEC BCP status, and suspected presence of hazardous building materials (HBMs).

2022 Roux Phase I ESA

The Roux 2022 Phase I ESA describes the Site as undergoing remedial construction consisting mainly of site preparation for excavation. The former buildings were demolished, and portions of the building slabs remained, and an active New York City East River ferry terminal operates on the western portion of the Site. Roux did not identify any CRECs in relation with the Site; however, two RECs, one HREC, and four BERs were identified. RECs include historic Site usage and presence of contaminated fill material; the HREC is related to historic spill incident related to the Site; and the BERs include E-designations associated with the Site, NYSDEC BCP status, and suspected presence of petroleum tank(s).

2.4 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the Site as listed in the Decision Document dated February 18, 2022 are as follows:

Groundwater

RAOs for Public Health Protection

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

RAOs for Environmental Protection

- Remove the source of ground or surface water contamination.

Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.
- Prevent inhalation of or exposure from contaminants volatilizing from contaminants in soil.

RAOs for Environmental Protection

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

Soil Vapor

RAOs for Public Health Protection

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

2.5 Remaining Contamination

2.5.1 Soil

Remedial soil excavation and off-site disposal activities occurred concurrent with mass excavation activities necessary to achieve the design of the new building construction. In general, soils were excavated to depths ranging between 2 and 5 ft bls resulting in the removal of impacted source material in these intervals including one hazardous lead hotspot excavated to 5 ft bls located in the south portion of the Site and one hazardous lead soil hotspot excavated to 8 ft bls located in the northern portion of the Site.

After mass excavation activities were completed, soil samples were collected from the bottom areas of the Site-wide excavation at various depths to serve as post-remediation documentation samples. After lead hotspot excavation activities were completed, soil samples were collected from the sidewall and bottom areas of the hotspot excavations to serve as post-remediation documentation and confirmation samples. Soil results for lead sidewall samples and sample intervals at or below the post-excavation bottom depth were compared to NYSDEC Part 375 UUSCOs, RRSCOs, and Protection of Groundwater SCOs (PGWSCOs). In general, soil remaining after completion of the Track 4 cleanup contained VOC, SVOCs, metals, PCBs and pesticides at concentrations in exceedance of one or more of the above-stated SCOs at depths

ranging from 2 to 8 ft bls. Tables 1 through 5 and Figure 3 provide a detailed results summary for soil remaining on-Site after completion of the Remedial Action inclusive of the post excavation bottom endpoints and lead hotspot sidewall and bottom endpoints.

The engineered composite cover system installed at the Site as described below in Section 3.3.1 precludes the potential for future exposure to residual impacted soil. The Excavation Work Plan provided in Appendix D will govern any future ground-intrusive activities that may occur beneath the engineered cover system during the SMP phase in order to mitigate the potential for exposure to residual impacted site soil.

2.5.2 Groundwater

The groundwater contamination remaining after the remedial action was completed is limited to metals that are primarily naturally occurring. The metals detected above AWQSGVs include antimony, iron, lead, magnesium, manganese, and sodium.

Table 2.5.2: Summary of Exceedances in Groundwater

Analyte	Total Range in Concentration Above NYSDEC AWQSGVs (µg/L)	Dissolved Range in Concentration Above NYSDEC AWQSGVs (µg/L)
Metals		
Antimony	3.6 – 4.0	3.7 – 4.2
Iron	1,000 - 7,190	NA
Lead	38.9 – 41.7	NA
Magnesium	45,400 – 46,800	42,800 – 45,200
Manganese	421 – 1,190	398 – 1,070
Sodium	216,000 – 278,000	212,000 – 275,000

*NA – not applicable.

Two metals (arsenic and mercury) were detected in soil at concentrations above NYSDEC PGWSCOs, but were not detected in groundwater, indicating that metals in soil are not a source of groundwater contamination at the Site. Table 6 and Figure 4 summarize the results of all samples of groundwater that exceed the SCGs after completion of the remedial action. Groundwater at the Site is not intended for potable or non-potable use which precludes the potential for future exposure to residual impacted groundwater.

2.5.3 Soil Vapor

The remedial elements that have been implemented, including soil excavation and offsite disposal, have reduced the potential for soil vapor intrusion. In addition, the active sub-slab depressurization system (SSDS), including a vapor barrier and waterproofing elements, were installed below the foundation as an engineering control to mitigate the potential for vapor intrusion into the building. Soil vapor intrusion sampling performed during three events, in July, September, and November 2025, are discussed below.

July 2025 Sampling

A soil vapor intrusion (SVI) evaluation was completed in July 2025 which included collection of soil vapor samples from all seven soil vapor monitoring points (SVMPs) and collection of co-located concurrent indoor air samples (IAs) at all locations except for IA-6 due to summa canister malfunction. The locations of all soil vapor monitoring points and SSDS subgrade piping are shown on Figure 5. The soil vapor and indoor air samples were collected in batch-certified 6L summa canisters over an 8-hr period and analyzed at an ELAP certified laboratory for TO-15. At the time of sampling, finish work within the building was not complete and various construction materials were stored throughout the sampling areas. Additionally, the windows and doors were not completely installed in all areas, and the heating, ventilation, and air conditioning (HVAC) system was not operational. Despite these conditions, Roux performed soil vapor intrusion evaluation sampling with results discussed below.

The results of the SVI evaluation were compared to the NYSDOH Soil Vapor Intrusion Guidance (updated February 2024) matrices A through F. These matrices provide guidance relative to chlorinated VOCs (CVOCs) and petroleum-related VOCs including carbon tetrachloride, cis-1,2-dichloroethene, 1,1-dichloroethene, trichloroethene (TCE), tetrachloroethene (PCE), 1,1,1-trichloroethane, methylene chloride, and vinyl chloride, benzene, ethylbenzene, naphthalene, cyclohexane, isooctane (2,2,4 – trimethylpentane), 1,2,4 – trimethylbenzene ,1,3,5 – trimethylbenzene, o – xylene, m – xylene, p – xylene, heptane, hexane and toluene.

When compared to the matrices, the July SVI evaluation results indicate SVMP-1/IA-1, SVMP-2/IA-2, and SVMP-6 require no further action. SVMP-3/IA-3 and SVMP-4/IA-4 fall into the category with the recommendation to identify sources and resample or mitigate due to

concentrations of n-hexane and toluene in IA-3 and concentrations of cyclohexane in IA-4. The sub-slab concentrations of these compounds are orders of magnitude lower than indoor air concentrations, indicating that the SVMPs are sealed air-tight and that these exceedances are a result of the indoor conditions present at the time of sampling. SVMP-5/IA-5 and SVMP-7/IA-7 fall into the category of a recommendation to mitigate and monitor, respectively, due to concentrations of cyclohexane detected in each SVMP.

September 2025 Sampling

A second SVI evaluation was completed in September 2025 which included collection of soil vapor samples from two SVMPs (SVMP-3 and SVMP-4) and collection of co-located concurrent IAs (IA-3 and IA-4) to cover the areas ready for immediate occupancy. The locations of all soil vapor monitoring points and SSDS subgrade piping are shown on Figure 5. The soil vapor and indoor air samples were collected in batch-certified 6L summa canisters over an 8-hr period and analyzed at an ELAP certified laboratory for TO-15. At the time of sampling, finish work within the building was not complete and odors from recent paint/VOC-containing product application were observed. Additionally, the HVAC system was not operational. Despite these conditions, Roux performed soil vapor intrusion evaluation sampling with results discussed below.

When compared to the matrices, the September SVI evaluation results indicate SVMP-3/IA-3 and SVMP-4/IA-4 fall into the category with the recommendation to identify sources and resample or mitigate due to concentrations of 1,2,4-trimethylbenzene in IA-3 and IA-4 and m/p-xylene in IA-4. The sub-slab concentrations of these compounds were orders of magnitude lower than indoor air concentrations, indicating that the SVMPs are sealed air-tight and that these exceedances are a result of the indoor conditions present at the time of sampling.

November 2025 Sampling

Based on the conditions present during the July and September SVI sampling events and the analytical results, NYSDEC required a Soil Vapor Intrusion Evaluation Work Plan (SVIEWP) to be prepared and approved prior to additional SVI sampling occurring during the heating season. The SVIEWP was submitted to NYSDEC on October 27, 2025, and was revised following NYSDEC comments and resubmitted on November 4, 2025. The scope of work outlined in the SVIEWP included the installation of an additional SVMP (SVMP-8) and SVI sampling during the

heating season with the HVAC system operating as it will under building occupancy conditions. NYSDEC approved the revised SVIEWP on November 17, 2025.

An additional SVMP, designated as SVMP-8, was installed within the parking garage on November 12, 2025. The schedule for implementing the SVI sampling included a tiered approach aligned with the building's phased construction and occupancy schedule. The first phase of SVI sampling was conducted on November 18-19, 2025, and included collection of samples from SVMP-3, SVMP-4, SVMP-7 and SVMP-8 with co-located indoor air samples IA-1 through IA-8 collected concurrently and a standalone concurrent sample IA-9 collected from the bike room located in the western cellar portion of the building. All work was completed in accordance with the approved SVIEWP. The locations of all soil vapor monitoring points and SSDS components are shown on Figure 5. The soil vapor and indoor air samples were collected in batch-certified 6L summa canisters over a 24-hr period and analyzed at an ELAP certified laboratory for TO-15.

When compared to the matrices, the November SVI evaluation results indicate that no further action is required, except for SVMP-4/IA-4 which fall into the category with the recommendation to mitigate due to concentrations of PCE in IA-4. Carbon tetrachloride was detected in IA-9 at a concentration of 3.7 ug/m3. Roux believes the elevated detection of PCE in IA-4, PCE detections in other IA samples and the carbon tetrachloride detection in IA-9 were caused by recent applications of VOC-containing products including concrete water-resistant sealants, paints, epoxy, etc. and are not indicative of a SVI issue. However, to mitigate potential exposures, the passive SSDS was modified to become an active SSDS, as discussed further below in Section 4.12.

Table 7 contains all SVI evaluation data and Figure 5 displays the detections of VOCs at each SVMP and IA location.

3.0 INSTITUTIONAL AND ENGINEERING CONTROL PLAN

3.1 General

Since remaining contamination exists at the site, Institutional Controls (ICs) and Engineering Controls (ECs) are required to protect human health and the environment. This IC/EC Plan describes the procedures for the implementation and management of all IC/ECs at the site. The IC/EC Plan is one component of the SMP and is subject to revision by the NYSDEC project manager.

This plan provides:

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

3.2 Institutional Controls

A series of ICs is required by the Decision Document to: (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining contamination; and, (3) limit the use and development of the site to restricted residential uses only. Adherence to these ICs on the site is required by the Environmental Easement and will be implemented under this SMP. ICs identified in the Environmental Easement may not be discontinued without an amendment to or extinguishment of the Environmental Easement. The IC boundaries are shown on Figure 6A. These ICs are:

- The property may be used for: restricted residential, commercial, or industrial use;
- All ECs must be operated and maintained as specified in this SMP;
- All ECs must be inspected at a frequency and in a manner defined in the SMP;

- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the New York City Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;
- Groundwater and other environmental or public health monitoring must be performed as defined in this SMP;
- Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP;
- All future activities that will disturb remaining contaminated material must be conducted in accordance with this SMP;
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP;
- Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in this SMP;
- Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Easement;
- The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted on Figure 6A, and any potential impacts that are identified must be monitored or mitigated; and
- Vegetable gardens and farming on the site are prohibited.

3.3 Engineering Controls

3.3.1 Cover System

Exposure to remaining contamination at the site is prevented by a cover system placed over the site. The cover system was completed on October 21, 2024. The cover system is comprised of concrete-covered sidewalks, landscaped or gravel covered areas (with a minimum of 24 inches of clean fill over Site soils) and concrete building foundations. Figures 6A shows the as-built cross sections for each remedial cover type used on the Site and location of each cover type built at the Site. Additional detailed building construction documentation is provided in Appendix G. The Excavation Work Plan (EWP) provided in Appendix D outlines the procedures required to be implemented in the event the cover system is breached, penetrated or temporarily removed. Procedures for the inspection of this cover are provided in the Monitoring and Sampling Plan included in Section 4.0 of this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and Safety Plan (HASP) and associated Community Air Monitoring Plan (CAMP) prepared for the site and provided in

Appendix E. Any breach of the site's cover system must be overseen by a Professional Engineer (PE) who is licensed and registered in New York State or a qualified person who directly reports to a PE who is licensed and registered in New York State.

3.3.2 Active Sub-Slab Depressurization System (SSDS)

An active sub-slab depressurization system (SSDS) is installed under the building foundation slab and includes a vapor barrier system to prevent the potential migration of vapors into the building. The SSDS was incorporated into the design of the new building and installed during construction. The results of the November 2025 SVI sampling indicated the need for mitigation and the SSDS was upgraded to an active system in December 2025.

The vapor barrier for under slab applications is Grace Preprufe® 300R and for vertical areas is Grace Preprufe® 160R. All vapor barriers were installed in accordance with Manufacturer's recommendations including, but not limited to, recommended overlapping distance, tape seam installation, tape seam products, subbase layer preparation, and material.

The active SSDS includes a network of trenches (i.e., branches) of 4" perforated polyvinyl chloride (PVC) piping within 12-inch thick gravel bedding trenches. The sub-slab piping network is connected to five (5) steel discharge stacks which terminate on the roof of the 7th or 21st floor. An electric powered radial blower (Obar GBR76UD) is installed at the top of each stack. Each blower can provide between 0 and 40 inches of water column (iwc) pressure at a max flow of 195 cubic feet per minute (cfm). The blower has a low vacuum switch and a loss of power alarm, which are connected to a control panel in the building. The control panel is equipped with a visible and audible warning to allow for the notification of the building operations staff if the blower is not operating at the required vacuum or if the blower loses power.

A total of eight sub-slab SVMPs were also installed within the first floor to monitor the effectiveness of the active SSDS on a periodic basis. The active SSDS was successfully activated on December 10, 2025, indicated by visual inspection and vacuum readings greater than -0.004 iwc at each SVMP and extraction point, which was conveyed to the NYSDEC in a memo dated December 11, 2025, and is included in Appendix F.

Procedures for operating and maintaining the SSDS are documented in the Operation and Maintenance Plan (Section 5.0 of this SMP). As-built drawings, signed and sealed by a PE who is licensed and registered in New York State, are included in Appendix G. Figures 6A and 6B show the location of the ECs for the site.

3.3.3 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when monitoring indicates that the remedy has achieved the remedial action objectives identified by the decision document. The framework for determining when remedial processes are complete is provided in Section 6.4 of NYSDEC DER-10. Unless waived by the NYSDEC, confirmation samples of applicable environmental media are required before terminating any remedial actions at the site. Confirmation samples require Category B deliverables and a Data Usability Summary Report (DUSR).

As discussed below, the NYSDEC may approve termination of a groundwater monitoring program. When a remedial party receives this approval, the remedial party will decommission all site-related monitoring, injection and recovery wells as per the NYSDEC CP-43 policy.

The remedial party will also conduct any needed site restoration activities, such as asphalt patching and decommissioning treatment system equipment. In addition, the remedial party will conduct any necessary restoration of vegetation coverage, trees and wetlands, and will comply with NYSDEC and United States Army Corps of Engineers regulations and guidance. Also, the remedial party will ensure that no ongoing erosion is occurring on the site.

3.3.3.1 – Cover System

The composite cover system is a permanent control and the quality and integrity of this system will be inspected at defined, regular intervals in accordance with this SMP in perpetuity. If the inspection indicates the site cover is damaged or compromised that actions to repair the engineering control will be conducted with consultation and approval from NYSDEC and NYSDOH.

3.3.3.2 – Sub-Slab Depressurization System

The SSDS will not be discontinued unless prior written approval is granted by the NYSDEC and the NYSDOH project managers. If monitoring data indicates that the SSDS may no

longer be required, a work plan to discontinue the SSDS will be submitted by the remedial party to the NYSDEC and NYSDOH project managers. The work plan must include soil vapor intrusion sampling to verify that the SSDS is no longer needed and must comply with the NYSDOH Soil Vapor Intrusion Guidance.

If the NYSDEC project manager approves termination of operation and maintenance of an SSDS, the remedial party will notify the property owner and ask whether the property owner wants to keep the SSDS. If the property owner elects to keep the system, the property owner will be responsible for the operation and maintenance of the system going forward. If the property owner wants the system removed, the remedial party will remove and dispose of the system and repair any parts of the structure that were altered or modified by the SSDS, such as holes in the basement floor or walls.

3.3.3.3 – Monitoring Wells associated with the Site

Groundwater monitoring activities associated with the Site will continue, as determined by the NYSDEC project manager in consultation with NYSDOH project manager, until residual groundwater concentrations are found to be consistently below ambient water quality standards, the site SCGs, or have become asymptotic at an acceptable level over an extended period. If monitoring data indicates that monitoring may no longer be required, a proposal to discontinue the monitoring will be submitted by the remedial party. Monitoring will continue until permission to discontinue is granted in writing by the NYSDEC project manager. If groundwater contaminant levels become asymptotic at a level that is not acceptable to the NYSDEC, additional source removal, treatment and/or control measures will be evaluated.

4.0 MONITORING AND SAMPLING PLAN

4.1 General

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

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

- Sampling and analysis of all appropriate media (e.g., groundwater, indoor air, soil vapor, soils);
- Assessing compliance with applicable NYSDEC standards, criteria and guidance (SCGs), particularly groundwater standards and Part 375 SCOs for soil; and
- Evaluating site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment.

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

- Sampling locations, protocol and frequency;
- Information on all designed monitoring systems;
- Analytical sampling program requirements;
- Inspection and maintenance requirements for monitoring wells;
- Monitoring well decommissioning procedures; and
- Annual inspection and periodic certification.

Reporting requirements are provided in Section 7.0 of this SMP.

4.2 Site – wide Inspection

Site-wide inspections will be performed at a minimum of once per year. These periodic inspections must be conducted when the ground surface is visible (i.e. no snow cover). Site-wide inspections will be performed by a qualified environmental professional as defined in 6 NYCRR Part 375, a Professional Engineer (PE) who is licensed and registered in New York State, or a qualified person who directly reports to a PE who is licensed and registered in New York State. Modification to the frequency or duration of the inspections will require approval from the

NYSDEC project manager. Site-wide inspections will also be performed after all severe weather conditions that may affect ECs or monitoring devices. During these inspections, an inspection form will be completed as provided in Appendix I – Site Management Forms. The form will compile sufficient information to assess the following:

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

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

- Whether ECs continue to perform as designed;
- If these controls continue to be protective of human health and the environment;
- Compliance with requirements of this SMP and the Environmental Easement;
- Achievement of remedial performance criteria; and
- If site records are complete and up to date.

Reporting requirements are outlined in Section 7.0 of this plan.

Inspections will also be performed in the event of an emergency. If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs that reduces or has the potential to reduce the effectiveness of ECs in place at the site, verbal notice to the NYSDEC project manager must be given by noon of the following day. In addition, an inspection of the site will be conducted within 5 days of the event to verify the effectiveness of the IC/ECs implemented at the site by a qualified environmental professional, as defined in 6 NYCCR Part 375. Written confirmation must be provided to the NYSDEC project manager within 7 days of the event that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public. The remedial party will submit follow-up status reports to the NYSDEC within 45 days of the event

on actions taken to respond to any emergency event requiring ongoing responsive action, describing and documenting actions taken to restore the effectiveness of the ECs.

The remedial party will conduct exterior inspections and blower vacuum/pressure readings of the SSDS monthly and perform a comprehensive site inspection annually. Exterior inspections will include: confirming that the blowers are running correctly, determining whether there is damage to the stacks or other exterior system components, and determining whether there have been structural changes, such as an addition to the structure. Comprehensive inspections include all of the activities required in the exterior inspection and an interior inspection, which includes: confirming a pressure differential on the manometer, inspecting the interior components for damage, recording vacuum readings from SVMPs, and inspecting the first floor and cellar areas for cracks in the floors and walls that may have developed since the SSDS was installed. The remedial party will notify the DEC project manager about any problems within three days of inspections. Inspection reports will be emailed to the DEC Project Manager and included in the next PRR. Any needed repairs will be made promptly according to the procedures in the Operation and Maintenance Plan (Section 5.0).

4.3 Treatment System Monitoring and Sampling

4.3.1 SSDS Monitoring

Monitoring of the SSDS will be performed on a routine basis, as identified in Table 4.3.1 Remedial System Monitoring Requirements and Schedule (see below). The monitoring of remedial systems must be conducted by a qualified environmental professional as defined in 6 NYCRR Part 375, a Professional Engineer (PE) who is licensed and registered in New York State, or a qualified person who directly reports to a PE who is licensed and registered in New York State. Modification to the frequency or sampling requirements will require approval from the NYSDEC project manager. A visual inspection of the complete system will be conducted during each monitoring event. Unscheduled inspections and/or sampling may take place when a suspected failure of the SSDS has been reported or an emergency occurs that is deemed likely to affect the operation of the system. SSDS components to be monitored include, but are not limited to, the components included in Table 4.3.1 below.

Table 4.3.1 – Remedial System Monitoring Requirements and Schedule

SSDS Component	Monitoring Parameter	Operating Range	Monitoring Schedule
Monitoring Points	Vacuum	>-0.004 iwc	Annually
Vacuum Blower	Flow Rate/ Vacuum/Pressure	195 cfm max 0-40 iwc	Monthly
Piping	Visual Inspection	Not Applicable	Monthly
Building Slab	Visual Inspection	Not Applicable	Annually

A complete list of components to be inspected is provided in the Inspection Checklist, provided in Appendix I – Site Management Forms. If any equipment readings are not within their specified operation range, any equipment is observed to be malfunctioning or the system is not performing within specifications; maintenance and repair, as per the Operation and Maintenance Plan, is required immediately.

4.3.2 SSDS Sampling

Samples shall be collected from the blower effluent and indoor air sample locations in 2026 following NYSDEC approval of a post mitigation sampling workplan that will be submitted by Roux. Sampling locations, required analytical parameters, and schedule are provided in Table 4.3.2 – SSDS Sampling Requirements and Schedule below. Modification to the frequency or sampling requirements will require approval from the NYSDEC project manager.

Table 4.3.2 - SSDS Sampling Requirements and Schedule

Region of Site	Sample Identification	Sample Location	Sampling Schedule
System Air Effluent Points	EFF-1, EFF-2, EFF-3, EFF-4, EFF-5	Discharge Stacks	Following start-up
Indoor Air	IA-1, IA-2, IA-3, IA-4, IA-5, IA-6, IA-7, IA-8, IA-9	Breathing Zone	Following NYSDEC approval of Post-Mitigation Sampling Work Plan

Detailed sample collection and analytical procedures and protocols are provided in Appendix H – Quality Assurance Project Plan/Field Sampling Plan.

The remedial party will properly dispose of all wastes generated by the remedial system at off-site disposal facilities according to local, state and federal laws and regulations. Wastes will be tested before disposal to comply with the permit conditions of the disposal facility. Wastes will not be generated at this site.

4.4 Post-Remediation Media Monitoring and Sampling

Samples shall be collected from the groundwater monitoring wells on a routine basis and from the blower effluent and indoor air sample locations following NYSDEC approval of a post mitigation sampling workplan that will be submitted by Roux. Sampling locations, required analytical parameters and schedule are provided in Table 4.4 – Post Remediation Sampling Requirements and Schedule below. Modification to the frequency or sampling requirements will require approval from the NYSDEC project manager.

Table 4.4 – Post Remediation Sampling Requirements and Schedule

Sampling Location	**Analytical Parameters (EPA Method)**		**Schedule**
	VOCs (8260D) SVOCs (8270E/SIM) TAL Metals (6020B and 7470A) PCBs (8082A) Pesticides (8081B)	VOCs (TO-15 SIM)	
Monitoring Wells (MW-1, MW-2, and MW-3)	X		Semi-annual
Blower Effluent (EFF-1 through 5)		X	Following start-up
Indoor air (IA-1 through 9) and ambient air (AA-1)		X	Following NYSDEC approval of a post mitigation sampling workplan, then as needed based on results

Detailed sample collection and analytical procedures and protocols are provided in Appendix H – Quality Assurance Project Plan/Field Sampling Plan.

4.4.1 Groundwater Sampling

Groundwater monitoring will be performed semi-annually to assess the performance of the remedy. Modification to the frequency or sampling requirements will require approval from the NYSDEC project manager.

Table 4.4.1 summarizes the wells' identification numbers, as well as the purpose, location, depths, diameter and screened intervals of the wells. As part of the groundwater monitoring, 1 upgradient well and 2 downgradient wells, all located onsite, are sampled to evaluate the effectiveness of the remedial system. The remedial party will measure depth to the water table for each monitoring well in the network before sampling.

Table 4.4.1 – Monitoring Well Construction Details

Monitoring Well ID	Well Location	Coordinates (longitude/ latitude) (NAD83)	Well Diameter (inches)	Elevation (NAVD88)		Depth (ft bls)	
				Casing	Surface	Screen Top	Screen Bottom
MW-1	Upgradient	40.7313° N, 73.9596° W	2	14.13	16.70	7	17
MW-2	Down-gradient	40.7315° N, 73.9615° W	2	8.44	8.74	2	12
MW-3	Down-gradient	40.7311° N, 73.9614° W	2	8.60	8.84	2	12

The monitoring wells are constructed of 2-inch PVC with 10 feet of 0.020-inch slot screens, set approximately seven feet below the water table and three feet above the water table at each location. The annular space surrounding the well screens were backfilled with sand and a grout seal at least eight inches thick. MW-1 is a stickup well protected by a bollard located in the southeast portion of the Site near West Street. Both MW-2 and MW-3 have a flush-mounted steel well cover at grade and are located in the waterfront park area in the west portion of the Site. Monitoring well construction logs are included in Appendix C and groundwater monitoring well locations are shown on Figure 4.

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

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

The NYSDEC project manager will be notified prior to any repair or decommissioning of any monitoring well for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent Periodic Review Report. Well decommissioning without replacement will be done only with the prior approval of the NYSDEC project manager. Well abandonment will be performed in accordance with NYSDEC's guidance entitled "CP-43: Groundwater Monitoring Well Decommissioning Procedures." Monitoring wells that are decommissioned because they have been rendered unusable will be replaced in kind in the nearest available location, unless otherwise approved by the NYSDEC project manager.

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

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

4.4.2 Post Mitigation Sampling

Post mitigation sampling will be performed following NYSDEC approval of Roux's post mitigation sampling work plan to assess the performance of the remedy. The post mitigation sampling work plan will include details related to the sampling locations, analysis, etc. Detailed sample collection and analytical procedures and protocols including laboratory detection and reporting limits are provided in Appendix H – Quality Assurance Project Plan/Field Sampling Plan. Modification to the frequency or sampling requirements will require approval from the NYSDEC project manager.

4.4.3 Monitoring and Sampling Protocol

All sampling activities will be recorded in a field book and associated sampling log as provided in Appendix I – Site Management Forms. Other observations (e.g., groundwater monitoring well integrity) will be noted on the sampling log. The sampling log will serve as the inspection form for the monitoring network. Additional detail regarding monitoring and sampling protocols are provided in the site-specific Quality Assurance Project Plan/Field Sampling Plan provided as Appendix H of this document.

5.0 OPERATION AND MAINTENANCE PLAN

5.1 General

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

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

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

5.2 SSDS Performance Criteria

The SSDS blower assembly will include an Obar Model GBR76UD radial blower with a low vacuum switch and power alarm. The blower assembly will be able to provide a suction of 0-40 iwc at a max flowrate of 195 cfm to meet the design needs of the system. If adequate depressurization (e.g., vacuum influence) is not occurring, the cause for the lack of depressurization will be investigated and repaired, and measurements will be collected again. Each soil vapor monitoring point shall have a minimum pressure differential of -0.004 iwc across the slab. These values are provided in Table 5.2 below:

Table 5.2 – SSDS Performance Criteria

SSDS/SVE Component	Monitoring Parameter	Operating Range
Monitoring Points	Vacuum	>-0.004 iwc
Vacuum Blower	Flow Rate/Vacuum	~195 cfm max 0-40 iwc

To determine if the effluent can be discharged to the atmosphere without additional treatment, Roux will collect effluent air samples and calculate potential emission rates for each chemical

detected in accordance with the NYSDEC's Guidelines for the Evaluation and Control of Ambient Air Contaminants Under 6NYCRR Part 212 (DAR-1).

5.3 Operation and Maintenance of SSDS

The following sections provide a description of the operations and maintenance of SSDS. Cut-sheets and as-built drawings for SSDS are shown on Figure 6B and provided in Appendix G – As Builts and Component Manuals.

5.3.1 System Start-Up and Testing

Upon completion of the new building construction and installation of the SSDS blower, the SSDS was tested during start-up on December 10, 2025. The blower assembly inlet vacuum was measured with the control valve set to 100% open to document the baseline vacuum. The eight sub-slab vapor monitoring points (SV-01 through SV-08) were tested with a micromanometer to measure the sub-slab vacuum readings and documented accordingly on an inspection form and field book. All soil vapor monitoring point and extraction point readings were greater than 0.004 inches of water column and are documented in Roux's Active SSDS Start-Up Certification memo dated December 11, 2025, which is provided in Appendix F.

Nine indoor air samples (IA-01 through IA-09) will also be collected to document indoor air conditions in 2026. As described in Section 4.3.2, an air effluent sample will be collected from the system discharge stack in 2026 to determine whether vapor treatment is needed.

The system testing described above will be conducted if, in the course of the SSDS lifetime, the system goes down or significant changes are made to the system and the system must be restarted.

5.3.2 Routine System Operation and Maintenance

The routine maintenance activities include monthly visual inspections, operating data collection and general maintenance by building management personnel, who will serve as the SSDS operators, and who will report the monthly inspection and maintenance results to the Engineer of Record. Visual inspection will be implemented as a routine part of the SSDS operator's activities. The system operator will note any conditions which present a potential hazard or could cause future system shutdown on an Operating Log included in Appendix I.

Routine system maintenance will be performed in accordance with the manufacturer's requirements as provided in the as-built component manual included in Appendix G. Vacuum measurements will be measured at the monitoring points on an annual basis during the Site cover and comprehensive remedial system inspection. In the field, special attention will be paid to the condition of the blower and appurtenances, and the above slab discharge piping and supports. Special attention should be given to any unusual or excessive noise or vibrations from the piping and blower. The piping and valves will be inspected for leaks.

All equipment maintenance will be performed in accordance with manufacturer's instructions. Specific routine maintenance tasks to be performed on a monthly basis are outlined below:

- Inspect blower piping to confirm operation of appropriate valves (i.e., control valve)
- Inspect vacuum/pressure gauges for proper operation

A copy of the As-Built and Component Manual specific to the remedial system functioning at the Site is provided in Appendix G.

5.3.3 Non-Routine Operation and Maintenance

Non-routine equipment maintenance consists of maintenance activities that will be performed with less frequency than the routine maintenance (i.e., semi-annually) on several system components. Non-routine equipment maintenance will be performed as needed based on monitoring and will be recorded on a Non-routine Maintenance Form provided in Appendix I. Table 5.3.3 provided below summarizes routine Site monitoring, inspection, and sampling activities including routine maintenance.

Table 5.3.3 - Monitoring, Inspection, and Sampling Schedule

Monitoring Program	Frequency*
Site-Wide Inspection	Annually. First inspection no more than 16 months after issuance of the COC. After emergencies (e.g. fire or flood) and after a severe weather event.
SSDS System Status	Alarm light located in the building - to be monitored by superintendent. After discovery of any damage or defect to SSDS system.

Monitoring Program	Frequency*
Routine SSDS Detailed Operation Inspection	Monthly
Non-Routine SSDS Detailed Operation Inspection	As needed

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

In the event that low SSDS system air flow rates or vacuum are observed anywhere in the system, further system balancing may be necessary, to ensure that the combined air flow rates and vacuum in a given area of the site achieve the minimum design requirements.

5.3.4 System Monitoring Devices and Alarms

The SSDS will have a warning device to indicate that the system is not operating properly, a low vacuum condition is noted, or the blower loses power. In the event that a warning device is activated, a local visual and audible alarm will be triggered and a call-out to building management will be completed by an auto dialer device. Following response to the alarm, applicable maintenance and repairs will be conducted, as specified in the Operation and Maintenance Plan, and the SSDS will be restarted. Operational problems will be noted in the Periodic Review Report to be prepared for that reporting period.

5.3.5 Fire Safety

All fire protection and life safety systems including maintenance, inspection, and record keeping requirements will meet or exceed the minimum requirements for buildings as described in the Fire Code of New York State. All fire safety items shall comply with federal and state laws as well as local ordinances and building codes. The maintenance and inspections shall conform to NFPA 1584 guidance.

The remedial party will conduct an annual facility walk with the local fire chief and/or fire suppression team. The site walk will allow for the addition of the facility to any local preplanning efforts. The NYSDEC project manager will be provided with the local fire chief's/fire suppression team's recommendations as soon as they become available. Following review, the NYSDEC project manager may direct the remedial party to implement the recommendations and/or revise the SMP.

6.0 PERIODIC ASSESSMENTS/EVALUATIONS

6.1 Climate Change Vulnerability Assessment

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

This section provides a current vulnerability assessment that evaluates the vulnerability of the site and/or engineering controls to severe storms/weather events and associated flooding. This section also identifies vulnerability assessment updates that will be conducted for the site in Periodic Review Reports.

- Flood Plain and Sea Level Rise: The Site is located in a 100-year flood zone, primarily within the AE flood zone with V zone subject to wave action. In an effort to future-proof the Site against flooding associated with climate change, the waterfront area features an elevated ground plane and living shoreline that emerges and submerges with the tide. Native plantings will restore coastal habitats and help to dissipate waves to protect the Site from rising water levels and flood events. The living shoreline will serve as an amenity for the community and building residents alike, connecting to the adjacent India Street Pier. Additionally, the building was designed for flood and natural disaster resiliency, recovery, and adaptation. The design addresses resiliency planning and provides flood resistant construction per the NYCBC Appendix G and ASCE 24. The project will pursue WEDG Certification as well to ensure the shoreline design is robust and resilient.
- Site Drainage and Storm Water Management: During construction, adequate storm management systems were constructed for the building and Site; therefore, flooding is not anticipated.
- Erosion: The Site will be entirely covered by the building footprint, walkways, and landscaping, therefore, erosion at the Site is not anticipated during periods of severe rain events.
- High Wind: No areas of the Site have been identified which may be susceptible to damage from the wind itself or falling objects, such as trees or utility structures during periods of high wind.
- Drought: The majority of the site is covered by hardscape, concrete or the building, which are not susceptible to drought. Landscaped areas will be regularly maintained to ensure

they are provided with adequate plantings that can withstand the weather and these areas will be maintained by building maintenance personnel.

- Electricity: The Site is potentially susceptible to power loss and/or dips/surges in voltage during severe weather events, including lightning strikes, and the associated impact on Site equipment and operations. However, the surrounding area is highly developed and power outages will be rectified as soon as possible by the electricity provider. Due to the variability in annual weather patterns, it is assumed that emergency weather situations will be infrequent, and damages rectified by the appropriate relief agency.
- Spill/Contaminant Release: No areas of the Site have been identified that may be susceptible to a spill or other contaminant release due to storm-related damage caused by flooding, erosion, high winds, loss of power etc.
- Wildfires: The immediate area surrounding the Site is not wooded and therefore there is no wildfire risk.

6.2 Green Remediation Evaluation

NYSDEC's DER-31 Green Remediation requires that green remediation concepts and techniques be considered during all stages of the remedial program including site management, with the goal of improving the sustainability of the cleanup and summarizing the net environmental benefit of any implemented green technology. At the time when the RIR/RAWP was prepared, no environmental footprint analysis was required or completed prior to the implementation of the remedial action. As part of the FER, SiteWise will be used to calculate the carbon footprint of the Remedial Action that was implemented. This section provides an environmental footprint analysis of the remedy, as implemented at the time of this SMP. This section of the SMP also provides a summary of green remediation evaluations to be completed for the site during site management and reported in Periodic Review Reports (PRRs).

6.2.1 Timing of Green Remediation Evaluations

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

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

6.2.2 Building Operations

Structures including buildings and sheds will be operated and maintained to provide for the most efficient operation of the remedy, while minimizing energy, waste generation and water consumption.

The redevelopment of the Site was designed with environment efficiency and sustainability as top priority and strives to reduce the building's carbon footprint. The Site is the largest multifamily project in New York State to use a geothermal heat exchange system. The geothermal system features a closed-loop water-source heat-pump system that will reduce the building's annual carbon emissions produced from heating and cooling by 53 percent compared oil or gas systems. Rock dust generated during bedrock drilling for geothermal well installation was utilized as a subbase for utility trenches following NYSDEC approval which reduced the need for disposal and importation of other subbase material. Furthermore, the building will be fully electric in compliance with Local Law 154 including electric stoves, which increases energy efficiency and mitigates gas exposure to residents produced by gas stoves.

The SSDS is a passive component of building construction that was designed with energy efficiency in mind. Rather than an active electrically powered blower, a wind driven turbine fan sits on top of the exhaust pipe located on the roof, which will move air through the pipes without the need for electricity.

A Track 4 cleanup was chosen for the Site which is the most energy, waste and water efficient remedy option. The passive remedy utilizes the Site's hardscape including the building foundation slab and concrete walkways, which is easy to maintain and doesn't require watering while still being protective of human health.

6.2.3 Frequency of System Checks, Sampling and Other Periodic Activities

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

6.2.4 Metrics and Reporting

As discussed in Section 7.0 and as shown in Appendix I – Site Management Forms, information on energy usage, solid waste generation, transportation and shipping, water usage and land use and ecosystems will be recorded to facilitate and document consistent implementation of green remediation during site management and to identify corresponding benefits. A set of metrics has been developed and will be evaluated over time to ensure that green remediation actions are achieving the desired results.

6.3 Remedial System Optimization

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

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

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

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

7.0. REPORTING REQUIREMENTS

7.1 Site Management Reports

All site management inspection, maintenance and monitoring events will be recorded on the appropriate site management forms provided in Appendix I. These forms are subject to NYSDEC revision. All site management inspection, maintenance, and monitoring events will be conducted by a qualified environmental professional as defined in 6 NYCRR Part 375, a Professional Engineer (PE) who is licensed and registered in New York State, or a qualified person who directly reports to a PE who is licensed and registered in New York State.

All applicable inspection forms and other records, including media sampling data and system maintenance reports, generated for the site during the reporting period will be provided in electronic format to the NYSDEC in accordance with the requirements of Table 7.1 and summarized in the Periodic Review Report.

Table 7.1: Schedule of Interim Monitoring/Inspection Reports

Task/Report	Reporting Frequency*
Groundwater Monitoring Report	Semi-annual until NYSDEC approved cessation of monitoring.
Post-Mitigation Sampling Report	One-time report after sampling occurs.
Periodic Review Report	First report 16 months after COC is issued, then annually until remedial action objectives are achieved, then every 5 years thereafter.

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

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

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

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

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

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

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

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

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

Completion of the Site Management Forms is one of the owner's responsibilities, listed in **Appendix I**.

7.2 Periodic Review Report

A Periodic Review Report (PRR) will be submitted to the NYSDEC project manager beginning sixteen (16) months after the Certificate of Completion is issued. After submittal of the initial Periodic Review Report, the next PRR shall be submitted annually until remedial action objectives are achieved, then every 5 years thereafter the NYSDEC project manager or at another frequency as may be required by the NYSDEC project manager. In the event that the site is subdivided into separate parcels with different ownership, a single Periodic Review Report will be prepared that addresses the site described in Appendix A -Environmental Easement. The report will be prepared in accordance with NYSDEC's DER-10 and submitted within 30 days of the end of each certification period. Media sampling results will also be incorporated into the Periodic Review Report. The report will include:

- Identification, assessment and certification of all ECs/ICs required by the remedy for the site.
- Results of the required annual site inspections, fire inspections and severe condition inspections, if applicable.
- Description of any change of use, import of materials, or excavation that occurred during the certifying period.
- All applicable site management forms and other records generated for the site during the reporting period in the NYSDEC-approved electronic format, if not previously submitted.
- Identification of any wastes generated during the reporting period, along with waste characterization data, manifests, and disposal documentation.
- A summary of any discharge monitoring data and/or information generated during the reporting period, with comments and conclusions.
- Data summary tables and graphical representations of contaminants of concern by media (groundwater, soil vapor, etc.), which include a listing of all compounds analyzed, along with the applicable standards, with all exceedances highlighted. These tables and figures will include a presentation of past data as part of an evaluation of contaminant concentration trends, including but not limited to:
  - Trend monitoring graphs that present groundwater contaminant levels from before the start of the remedy implementation to the most current sampling data;
  - Trend monitoring graphs depicting system influent analytical data on a per event and cumulative basis;
  - O&M data summary tables;
  - A current plume map for sites with remaining groundwater contamination; and
  - A groundwater elevation contour map for each gauging event.

- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted in digital format as determined by the NYSDEC. Currently, data is supplied electronically and submitted to the NYSDEC EQuIS^{TM} database in accordance with the requirements found at this link: http://www.dec.ny.gov/chemical/62440.html.
- A site evaluation, which includes the following:
  - The compliance of the remedy with the requirements of the site-specific Remedial Action Work Plan (RAWP), ROD or Decision Document;
  - The operation and the effectiveness of all treatment units, etc., including identification of any needed repairs or modifications;
  - Any new conclusions or observations regarding site contamination based on inspections or data generated by the Monitoring and Sampling Plan for the media being monitored;
  - Recommendations regarding any necessary changes to the remedy and/or Monitoring and Sampling Plan;
  - An update to the climate change vulnerability assessment if site or external conditions have changed since the previous assessment, and recommendations to address vulnerabilities.
  - A summary of the Green Remediation evaluation, including a quantitative and qualitative overview of a site's environmental impacts and recommendations to improve the remedy's environmental footprint. The PRR will include the completed Summary of Green Remediation Metrics form provided in Appendix G.
  - An evaluation of trends in contaminant levels in the affected media to determine if the remedy continues to be effective in achieving remedial goals as specified by the RAWP, ROD or Decision Document; and
  - The overall performance and effectiveness of the remedy.

7.2.1 Certification of Institutional and Engineering Controls

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

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

- *The inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;*
- *The institutional control and/or engineering control employed at this site is unchanged from the date the control was put in place, or last approved by the Department;*
- *Nothing has occurred that would impair the ability of the control to protect the public health and environment;*

- *Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;*
- *Access to the site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control;*
- *If a financial assurance mechanism is required under the oversight document for the site, the mechanism remains valid and sufficient for the intended purpose under the document;*
- *Use of the site is compliant with the environmental easement;*
- *The engineering control systems are performing as designed and are effective;*
- *No new information has come to the site owner`s attention, including groundwater monitoring data from wells located at the site boundary, to indicate that the assumptions made in the qualitative exposure assessment of off-site contamination are no longer valid;*
- *To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program; and*
- *The information presented in this report is accurate and complete.*

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, [name], of [business address], am certifying as [Owner/Remedial Party or Owner's/Remedial Party's Designated Site Representative] for the site.

I certify that the New York State Education Department has granted a Certificate of Authorization to provide Professional Engineering services to the firm that prepared this Periodic Review Report."

For BCP projects, every five years the following certification will be added:

"The assumptions made in the qualitative exposure assessment remain valid."

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

The Periodic Review Report will be submitted, in electronic format, to the NYSDEC project manager and the NYSDOH project manager. The Periodic Review Report may also need to be submitted in hard-copy format if requested by the NYSDEC project manager.

7.3 Corrective Measures Work Plan

If any component of the remedy is found to have failed, or if the periodic certification cannot be provided due to the failure of an institutional or engineering control or failure to conduct site management activities, a Corrective Measures Work Plan will be submitted to the NYSDEC project manager for approval. This plan will explain the failure and provide the details and

schedule for performing work necessary to correct the failure. Unless an emergency condition exists, no work will be performed pursuant to the Corrective Measures Work Plan until it has been approved by the NYSDEC project manager.

7.4 Remedial System Optimization Report

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

The RSO report will be submitted, in electronic format, to the NYSDEC project manager and the NYSDOH project manager.

8.0 REFERENCES

- Roux, Phase I Environmental Site Assessment, on behalf of Lendlease Development Inc., dated May 2020
- Roux, Phase I Environmental Site Assessment, on behalf of 1 Java Street Owner, LLC, dated July 2022 and revised October 2022
- Roux, Remedial Action Work Plan, on behalf of 1 Java Street Owner, LLC, dated May 2021 and revised February 2022
- NYS Division of Environmental Remediation, NYS Department of Environmental Conservation Decision Document (DD), dated February 18, 2022
- 6 NYCRR Part 375, Environmental Remediation Programs. December 14, 2006
- NYSDEC DER-10 – "Technical Guidance for Site Investigation and Remediation"
- NYSDEC, 1998. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1. June 1998 (April 2000 addendum)

TABLES

1. Summary of Volatile Organic Compounds in Remaining Soil
2. Summary of Semivolatile Organic Compounds in Remaining Soil
3. Summary of Metals in Remaining Soil
4. Summary of Polychlorinated Biphenyls in Remaining Soil
5. Summary of Pesticides and Herbicides in Remaining Soil
6. Summary of Metals in Groundwater
7. Summary of Volatile Organic Compounds in Soil Vapor

Notes Utilized Throughout Tables
Soil Tables
J - Estimated value
J+ - Estimated value, high bias
J- - Estimated value, low bias
U - The analyte was analyzed for, but was not detected above the level of the associated reported quantitation limit
UJ - Analyte was not detected. The associated reported quantitation limit is an estimate
R - Sample results rejected by validator
B - The analyte was found in an associated blank as well as in the sample
P - Concentration difference between the primary and confirmation column >40%. The lower result is reported
T - Indicates that a quality control parameter has exceeded laboratory limits
NA - Compound was not analyzed for by laboratory
FD - Duplicate sample
mg/kg - Milligrams per kilogram
NYSDEC - New York State Department of Environmental Conservation
SCO - Soil Cleanup Objectives
-- No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Unrestricted Use SCO
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO
Red data indicates that parameter was detected above the NYSDEC Part 375 Commercial SCO
TCLP Tables
mg/L - Milligrams per liter
USEPA - United States Environmental Protection Agency
TCLP - Toxicity Characteristic Leaching Procedure
USEPA Regulatory Levels - United States Environmental Protection Agency Limits for RCRA Characteristic Waste for Toxicity
RCRA - Resource Conservation and Recovery Act
Bold - Parameter was detected above USEPA Regulatory Levels
Groundwater Tables
J - Estimated Value
U - The analyte was analyzed for, but was not detected above the level of the associated reported quantitation limit
T - Indicates that a quality control parameter has exceeded laboratory limits
µg/L - Micrograms per liter
NYSDEC - New York State Department of Environmental Conservation
AWQSGVs - Ambient Water-Quality Standards and Guidance Values
-- No NYSDEC AWQSGV available
Bold data indicates that parameter was detected above the NYSDEC AWQSGVs
Soil Vapor/Ambient Air
J - Estimated value
J- - Estimated value, low bias
J+ - Estimated value, high bias
U - The analyte was analyzed for, but was not detected above the level of the associated reported quantitation limit
D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte
FD - Duplicate sample
ug/m3 - Micrograms per cubic meter
Bold data indicates that parameter was detected

Table 1. Summary of Volatile Organic Compounds in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units	EP-1	EP-2	EP-3	EP-4	EP-5	EP-6	EP-7	EP-8	EP-9	EP-10	EP-10	EP-11	EP-12
Sample Designation:					EP-1	EP-2	EP-3	EP-4	EP-5	EP-6	EP-7	EP-8	EP-9	EP-10	EP-10	EP-11	EP-12
Sample Date:					04/25/2023	04/27/2023	04/25/2023	04/27/2023	04/27/2023	06/05/2023	06/05/2023	06/23/2023	12/07/2023	04/25/2023	04/25/2023	04/25/2023	04/25/2023
Sample Depth (ft bls):					0.0 - 0.5	3.0 - 3.5	2.5 - 3.0	4.5 - 5.0	4.5 - 5.0	7.5 - 8.0	7.0 - 7.5	6.5 - 7.0	1.5 - 2.0	30 - 3.5	30 - 3.5	0.5 - 1.0	3.5 - 4.0
Normal Sample or Field Duplicate:					N	N	N	N	N	N	N	N	N	N	FD	N	N
1,1,1-Trichloroethane (TCA)	0.68	100	0.68	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
1,1,2,2-Tetrachloroethane	--	--	--	MG/KG	0.0014 U	0.0014 UJ	0.0011 U	0.0013 UJ	0.0012 UJ	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	--	--	--	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
1,1,2-Trichloroethane	--	--	--	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
1,1-Dichloroethane	0.27	26	0.27	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
1,1-Dichloroethene	0.33	100	0.33	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
1,2,3-Trichlorobenzene	--	--	--	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
1,2,4-Trichlorobenzene	--	--	--	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 UJ	0.0013 U	0.0013 U	0.0012 UJ	0.0012 U
1,2-Dibromo-3-Chloropropane	--	--	--	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
1,2-Dibromoethane (Ethylene Dibromide)	--	--	--	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 UJ	0.0012 U
1,2-Dichlorobenzene	1.1	100	1.1	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 UJ	0.0012 U
1,2-Dichloroethane	0.02	3.1	0.02	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
1,2-Dichloropropane	--	--	--	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
1,3-Dichlorobenzene	2.4	49	2.4	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 UJ	0.0012 U
1,4-Dichlorobenzene	1.8	13	1.8	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 UJ	0.0012 U
2-Hexanone	--	--	--	MG/KG	0.0068 U	0.0072 U	0.0053 U	0.0067 U	0.0058 U	0.007 U	0.0056 U	0.0053 U	0.0052 U	0.0063 U	0.0063 U	0.006 U	0.0059 U
Acetone	**0.05**	100	0.05	MG/KG	0.0081 U	0.0086 U	0.015	0.008 U	0.007 U	0.0084 U	0.0067 U	0.0064 U	0.016	0.0076 U	0.0076 U	0.0072 U	0.007 U
Benzene	0.06	4.8	0.06	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
Bromochloromethane	--	--	--	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
Bromodichloromethane	--	--	--	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
Bromoform	--	--	--	MG/KG	0.0014 UJ	0.0014 U	0.0011 UJ	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 UJ	0.0013 UJ	0.0012 UJ	0.0012 UJ
Bromomethane	--	--	--	MG/KG	0.0027 U	0.0029 U	0.0021 U	0.0027 U	0.0023 U	0.0028 U	0.0022 U	0.0021 U	0.0021 U	0.0025 U	0.0025 U	0.0024 U	0.0023 U
Carbon Disulfide	--	--	--	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
Carbon Tetrachloride	0.76	2.4	0.76	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
Chlorobenzene	1.1	100	1.1	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 UJ	0.0012 U
Chloroethane	--	--	--	MG/KG	0.0014 U	0.0014 UT	0.0011 U	0.0013 UT	0.0012 UT	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
Chloroform	0.37	49	0.37	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
Chloromethane	--	--	--	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
Cis-1,2-Dichloroethylene	0.25	100	0.25	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
Cis-1,3-Dichloropropene	--	--	--	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
Cyclohexane	--	--	--	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
Dibromochloromethane	--	--	--	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 UJ	0.0012 U
Dichlorodifluoromethane	--	--	--	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
Ethylbenzene	1	41	1	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
Isopropylbenzene (Cumene)	--	--	--	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 UJ	0.0012 U
m,p-Xylene	--	--	--	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.00019 J	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
Methyl Acetate	--	--	--	MG/KG	0.0068 U	0.0072 U	0.0053 U	0.0067 U	0.0058 U	0.007 U	0.0056 U	0.0053 U	0.0052 U	0.0063 U	0.0063 U	0.006 U	0.0059 U
Methyl Ethyl Ketone (2-Butanone)	0.12	100	0.12	MG/KG	0.0068 U	0.0072 U	0.0053 U	0.0067 U	0.0058 U	0.007 U	0.0056 U	0.0053 U	0.0052 U	0.0063 U	0.0063 U	0.006 U	0.0059 U
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	--	--	--	MG/KG	0.0068 U	0.0072 U	0.0053 U	0.0067 U	0.0058 U	0.007 U	0.0056 U	0.0053 U	0.0052 U	0.0063 U	0.0063 U	0.006 U	0.0059 U
Methylcyclohexane	--	--	--	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 UJ	0.0012 U
Methylene Chloride	0.05	100	0.05	MG/KG	0.0027 U	0.0029 U	0.0021 U	0.0027 U	0.0023 U	0.0028 U	0.0022 U	0.0021 U	0.0021 U	0.0025 U	0.0025 U	0.0024 U	0.0023 U
O-Xylene (1,2-Dimethylbenzene)	--	--	--	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
Styrene	--	--	--	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
Tert-Butyl Methyl Ether	0.93	100	0.93	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
Tetrachloroethylene (PCE)	1.3	19	1.3	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 UJ	0.0012 U
Toluene	0.7	100	0.7	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
Trans-1,2-Dichloroethene	0.19	100	0.19	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U

Table 1. Summary of Volatile Organic Compounds in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

			Sample Designation:	EP-1	EP-2	EP-3	EP-4	EP-5	EP-6	EP-7	EP-8	EP-9	EP-10	EP-10	EP-11	EP-12
			Sample Date:	04/25/2023	04/27/2023	04/25/2023	04/27/2023	04/27/2023	06/05/2023	06/05/2023	06/23/2023	12/07/2023	04/25/2023	04/25/2023	04/25/2023	04/25/2023
			Sample Depth (ft bls):	0.0 - 0.5	3.0 - 3.5	2.5 - 3.0	4.5 - 5.0	4.5 - 5.0	7.5 - 8.0	7.0 - 7.5	6.5 - 7.0	1.5 - 2.0	30 - 3.5	30 - 3.5	0.5 - 1.0	3.5 - 4.0
			Normal Sample or Field Duplicate:	N	N	N	N	N	N	N	N	N	N	FD	N	N
Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units													
Trans-1,3-Dichloropropene	--	--	--	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 UJ	0.0012 U
Trichloroethylene (TCE)	0.47	21	0.47	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U
Trichlorofluoromethane	--	--	--	MG/KG	0.0014 U	0.0014 U	0.0011 U	0.0013 U	0.0012 U	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.001 J	0.0013 U	0.0012 U	0.0012 U
Vinyl Chloride	0.02	0.9	0.02	MG/KG	0.0014 U	0.0014 UJ	0.0011 U	0.0013 UJ	0.0012 UJ	0.0014 U	0.0011 U	0.0011 U	0.001 U	0.0013 U	0.0013 U	0.0012 U	0.0012 U

Table 1. Summary of Volatile Organic Compounds in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units	EP-13	EP-14	EP-15	EP-16	EP-17	EP-18	EP-19	EP-20	EP-21	EP-22	EP-23	EP-24	EP-24
Sample Designation:					EP-13	EP-14	EP-15	EP-16	EP-17	EP-18	EP-19	EP-20	EP-21	EP-22	EP-23	EP-24	EP-24
Sample Date:					04/25/2023	01/03/2024	11/10/2023	06/23/2023	06/23/2023	06/23/2023	07/17/2023	08/10/2023	08/10/2023	07/20/2023	07/20/2023	01/03/2024	01/03/2024
Sample Depth (ft bls):					3.0 - 3.5	7.5 - 8.0	7.5 - 8.0	7.0 - 7.5	7.0 - 7.5	6.0 - 6.5	10.0 - 10.5	10 - 10.5	3 - 3.5	9.5 - 10.0	9.5 - 10.0	7.5 - 8.0	7.5 - 8.0
Normal Sample or Field Duplicate:					N	N	N	N	N	N	N	N	N	N	N	N	FD
1,1,1-Trichloroethane (TCA)	0.68	100	0.68	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.0012 U	0.0014 U	0.0011 U	0.001 U
1,1,2,2-Tetrachloroethane	--	--	--	MG/KG	0.0011 U	0.0011 UJ	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.0012 U	0.0014 U	0.0011 U	0.001 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	--	--	--	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.0012 U	0.0014 U	0.0011 U	0.001 U
1,1,2-Trichloroethane	--	--	--	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.0012 U	0.0014 U	0.0011 U	0.001 U
1,1-Dichloroethane	0.27	26	0.27	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.0012 U	0.0014 U	0.0011 U	0.001 U
1,1-Dichloroethene	0.33	100	0.33	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0018	0.0014 U	0.0012 U	0.0014 U	0.0011 U	0.001 U
1,2,3-Trichlorobenzene	--	--	--	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.0012 U	0.0014 U	0.0011 U	0.001 U
1,2,4-Trichlorobenzene	--	--	--	MG/KG	0.0011 U	0.0011 UJ	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.0012 U	0.0014 U	0.0011 U	0.001 U
1,2-Dibromo-3-Chloropropane	--	--	--	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.0012 U	0.0014 U	0.0011 U	0.001 U
1,2-Dibromoethane (Ethylene Dibromide)	--	--	--	MG/KG	0.0011 U	0.0011 UJ	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.0012 U	0.0014 U	0.0011 U	0.001 U
1,2-Dichlorobenzene	1.1	100	1.1	MG/KG	0.0011 U	0.0011 UJ	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.0012 U	0.0014 U	0.0011 U	0.001 U
1,2-Dichloroethane	0.02	3.1	0.02	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.0012 U	0.0014 U	0.0011 U	0.001 U
1,2-Dichloropropane	--	--	--	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.0012 U	0.0014 U	0.0011 U	0.001 U
1,3-Dichlorobenzene	2.4	49	2.4	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.0012 U	0.0014 U	0.0011 U	0.001 U
1,4-Dichlorobenzene	1.8	13	1.8	MG/KG	0.0011 U	0.0011 UJ	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.0012 U	0.0014 U	0.0011 U	0.001 U
2-Hexanone	--	--	--	MG/KG	0.0057 U	0.0054 U	0.0053 U	0.0062 U	0.0056 U	0.0054 U	0.006 U	0.0056 U	0.0068 UJ	0.0062 U	0.0072 U	0.0055 U	0.005 U
Acetone	**0.05**	100	0.05	MG/KG	0.0068 U	0.028 J+	0.012	0.0074 U	0.0068 U	0.0065 U	0.012	0.0067 U	0.0082 UJ	0.03	0.0086 U	0.014 J+	0.007 J+
Benzene	0.06	4.8	0.06	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.0012 U	0.0014 U	0.0011 U	0.001 U
Bromochloromethane	--	--	--	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.0012 U	0.0014 U	0.0011 U	0.001 U
Bromodichloromethane	--	--	--	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.0012 U	0.0014 U	0.0011 U	0.001 U
Bromoform	--	--	--	MG/KG	0.0011 UJ	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.0012 U	0.0014 U	0.0011 U	0.001 U
Bromomethane	--	--	--	MG/KG	0.0023 U	0.0021 U	0.0021 U	0.0025 U	0.0023 U	0.0022 U	0.0024 U	0.0022 U	0.0027 U	0.0025 U	0.0029 U	0.0022 U	0.002 U
Carbon Disulfide	--	--	--	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.002	0.00057 J	0.0011 U	0.001 U
Carbon Tetrachloride	0.76	2.4	0.76	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.0012 U	0.0014 U	0.0011 U	0.001 U
Chlorobenzene	1.1	100	1.1	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.0012 U	0.0014 U	0.0011 U	0.001 U
Chloroethane	--	--	--	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.0012 U	0.0014 U	0.0011 U	0.001 U
Chloroform	0.37	49	0.37	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.0012 U	0.0014 U	0.0011 U	0.001 U
Chloromethane	--	--	--	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.0012 U	0.0014 U	0.0011 U	0.001 U
Cis-1,2-Dichloroethylene	0.25	100	0.25	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.0012 U	0.0014 U	0.0011 U	0.001 U
Cis-1,3-Dichloropropene	--	--	--	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.0012 U	0.0014 U	0.0011 U	0.001 U
Cyclohexane	--	--	--	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.0012 U	0.0014 U	0.0011 U	0.001 U
Dibromochloromethane	--	--	--	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.0012 U	0.0014 U	0.0011 U	0.001 U
Dichlorodifluoromethane	--	--	--	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.0012 U	0.0014 U	0.0011 U	0.001 U
Ethylbenzene	1	41	1	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.0012 U	0.0014 U	0.0011 U	0.001 U
Isopropylbenzene (Cumene)	--	--	--	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.0012 U	0.0014 U	0.0011 U	0.001 U
m,p-Xylene	--	--	--	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.0012 U	0.0014 U	0.0011 U	0.001 U
Methyl Acetate	--	--	--	MG/KG	0.0057 U	0.0054 U	0.0053 U	0.0062 U	0.0056 U	0.0054 U	0.006 U	0.0056 U	0.0068 UJ	0.0062 U	0.0072 U	0.0055 U	0.005 U
Methyl Ethyl Ketone (2-Butanone)	0.12	100	0.12	MG/KG	0.0057 U	0.0054 UJ	0.0053 U	0.0062 U	0.0056 U	0.0054 U	0.0046 J	0.0056 U	0.0068 UJ	0.0062 U	0.0072 U	0.0055 U	0.005 U
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	--	--	--	MG/KG	0.0057 U	0.0054 U	0.0053 U	0.0062 U	0.0056 U	0.0054 U	0.006 U	0.0056 U	0.0068 UJ	0.0062 U	0.0072 U	0.0055 U	0.005 U
Methylcyclohexane	--	--	--	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.0012 U	0.0014 U	0.0011 U	0.001 U
Methylene Chloride	0.05	100	0.05	MG/KG	0.0023 U	0.0021 U	0.0021 U	0.0025 U	0.0023 U	0.0022 U	0.0024 U	0.0022 U	0.0027 U	0.0025 U	0.0029 U	0.0022 U	0.002 U
O-Xylene (1,2-Dimethylbenzene)	--	--	--	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.0012 U	0.0014 U	0.0011 U	0.001 U
Styrene	--	--	--	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.0012 U	0.0014 U	0.0011 U	0.001 U
Tert-Butyl Methyl Ether	0.93	100	0.93	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.0012 U	0.0014 U	0.0011 U	0.001 U
Tetrachloroethylene (PCE)	1.3	19	1.3	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.0012 U	0.0014 U	0.0011 U	0.001 U
Toluene	0.7	100	0.7	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.0012 U	0.0014 U	0.0011 U	0.001 U
Trans-1,2-Dichloroethene	0.19	100	0.19	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.0012 U	0.0014 U	0.0011 U	0.001 U

Table 1. Summary of Volatile Organic Compounds in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

			Sample Designation:		EP-13	EP-14	EP-15	EP-16	EP-17	EP-18	EP-19	EP-20	EP-21	EP-22	EP-23	EP-24	EP-24
			Sample Date:		04/25/2023	01/03/2024	11/10/2023	06/23/2023	06/23/2023	06/23/2023	07/17/2023	08/10/2023	08/10/2023	07/20/2023	07/20/2023	01/03/2024	01/03/2024
			Sample Depth (ft bls):		3.0 - 3.5	7.5 - 8.0	7.5 - 8.0	7.0 - 7.5	7.0 - 7.5	6.0 - 6.5	10.0 - 10.5	10 - 10.5	3 - 3.5	9.5 - 10.0	9.5 - 10.0	7.5 - 8.0	7.5 - 8.0
			Normal Sample or Field Duplicate:		N	N	N	N	N	N	N	N	N	N	N	N	FD
Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units													
Trans-1,3-Dichloropropene	--	--	--	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.0012 U	0.0014 U	0.0011 U	0.001 U
Trichloroethylene (TCE)	0.47	21	0.47	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 UJ	0.0012 U	0.0014 U	0.0011 U	0.001 U
Trichlorofluoromethane	--	--	--	MG/KG	0.0011 U	0.0013	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.0012 U	0.0014 U	0.0011 U	0.001 U
Vinyl Chloride	0.02	0.9	0.02	MG/KG	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.0012 U	0.0014 U	0.0011 U	0.001 U

Table 1. Summary of Volatile Organic Compounds in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units	EP-25	EP-26	EP-27	EP-28	EP-29	EP-30	EP-31	EP-32	EP-33	EP-34	EP-35	EP-36	EP-37
Sample Designation:					EP-25	EP-26	EP-27	EP-28	EP-29	EP-30	EP-31	EP-32	EP-33	EP-34	EP-35	EP-36	EP-37
Sample Date:					03/19/2024	01/03/2024	11/10/2023	01/29/2024	12/07/2023	11/10/2023	08/22/2023	08/10/2023	06/05/2023	09/15/2023	09/15/2023	11/10/2023	01/29/2024
Sample Depth (ft bls):					3.5 - 4.0	4.5 - 5.0	7.5 - 8.0	6.0 - 6.5	5.5 - 6.0	6.5 - 7.0	9.0 - 9.5	9 - 9.5	4.0 - 4.5	6.5 - 7.0	4.5 - 5.0	7.5 - 8.0	6.5 - 7.0
Normal Sample or Field Duplicate:					N	N	N	N	N	N	N	N	N	N	N	N	N
1,1,1-Trichloroethane (TCA)	0.68	100	0.68	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
1,1,2,2-Tetrachloroethane	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
1,1,2-Trichloroethane	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
1,1-Dichloroethane	0.27	26	0.27	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
1,1-Dichloroethene	0.33	100	0.33	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.00057 J	0.0011 U	0.00082 J	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
1,2,3-Trichlorobenzene	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
1,2,4-Trichlorobenzene	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 UJ	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
1,2-Dibromo-3-Chloropropane	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
1,2-Dibromoethane (Ethylene Dibromide)	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
1,2-Dichlorobenzene	1.1	100	1.1	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
1,2-Dichloroethane	0.02	3.1	0.02	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
1,2-Dichloropropane	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
1,3-Dichlorobenzene	2.4	49	2.4	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
1,4-Dichlorobenzene	1.8	13	1.8	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
2-Hexanone	--	--	--	MG/KG	0.0054 U	0.0051 U	0.005 U	0.0055 U	0.0058 U	0.0059 U	0.0054 U	0.0052 U	0.0065 U	0.0051 U	0.0054 U	0.0051 U	0.0057 U
Acetone	**0.05**	100	0.05	MG/KG	0.0065 U	0.0061 U	0.012	0.0066 U	**0.09**	0.034	0.009	0.047 J+	0.0078 U	0.018	0.016	0.0061 U	0.0082
Benzene	0.06	4.8	0.06	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Bromochloromethane	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Bromodichloromethane	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Bromoform	--	--	--	MG/KG	0.0011 UJ	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Bromomethane	--	--	--	MG/KG	0.0022 U	0.002 U	0.002 U	0.0022 UT	0.0023 U	0.0024 U	0.0022 U	0.0021 U	0.0026 U	0.0021 U	0.0021 U	0.002 U	0.0023 UT
Carbon Disulfide	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0011	0.0013 U	0.00077 J-	0.0013 J-	0.001 U	0.0011 U
Carbon Tetrachloride	0.76	2.4	0.76	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Chlorobenzene	1.1	100	1.1	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Chloroethane	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Chloroform	0.37	49	0.37	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Chloromethane	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Cis-1,2-Dichloroethylene	0.25	100	0.25	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Cis-1,3-Dichloropropene	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Cyclohexane	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Dibromochloromethane	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Dichlorodifluoromethane	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Ethylbenzene	1	41	1	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Isopropylbenzene (Cumene)	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
m,p-Xylene	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Methyl Acetate	--	--	--	MG/KG	0.0054 U	0.0051 U	0.005 U	0.0055 U	0.0058 U	0.0059 U	0.0054 U	0.0052 U	0.0065 U	0.0051 U	0.0054 U	0.0043 J	0.0057 U
Methyl Ethyl Ketone (2-Butanone)	0.12	100	0.12	MG/KG	0.0054 U	0.0051 U	0.005 U	0.0055 U	0.0058 U	0.0059 U	0.0054 U	0.0096	0.0065 U	0.0051 U	0.0054 U	0.0051 U	0.0057 U
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	--	--	--	MG/KG	0.0054 U	0.0051 U	0.005 U	0.0055 U	0.0058 U	0.0059 U	0.0054 U	0.0052 U	0.0065 U	0.0051 U	0.0054 U	0.0051 U	0.0057 U
Methylcyclohexane	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Methylene Chloride	0.05	100	0.05	MG/KG	0.0022 U	0.002 U	0.002 U	0.0022 U	0.0023 U	0.0024 U	0.0022 U	0.0021 U	0.0026 U	0.0021 U	0.0021 U	0.002 U	0.0023 U
O-Xylene (1,2-Dimethylbenzene)	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Styrene	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Tert-Butyl Methyl Ether	0.93	100	0.93	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Tetrachloroethylene (PCE)	1.3	19	1.3	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.00076 J	0.001 UJ	0.0011 U
Toluene	0.7	100	0.7	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.00026 J	0.001 U	0.0011 U
Trans-1,2-Dichloroethene	0.19	100	0.19	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U

Table 1. Summary of Volatile Organic Compounds in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

			Sample Designation:	EP-25	EP-26	EP-27	EP-28	EP-29	EP-30	EP-31	EP-32	EP-33	EP-34	EP-35	EP-36	EP-37
			Sample Date:	03/19/2024	01/03/2024	11/10/2023	01/29/2024	12/07/2023	11/10/2023	08/22/2023	08/10/2023	06/05/2023	09/15/2023	09/15/2023	11/10/2023	01/29/2024
			Sample Depth (ft bls):	3.5 - 4.0	4.5 - 5.0	7.5 - 8.0	6.0 - 6.5	5.5 - 6.0	6.5 - 7.0	9.0 - 9.5	9 - 9.5	4.0 - 4.5	6.5 - 7.0	4.5 - 5.0	7.5 - 8.0	6.5 - 7.0
			Normal Sample or Field Duplicate:	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units													
Trans-1,3-Dichloropropene	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Trichloroethylene (TCE)	0.47	21	0.47	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Trichlorofluoromethane	--	--	--	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 U	0.0011 U
Vinyl Chloride	0.02	0.9	0.02	MG/KG	0.0011 U	0.001 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.001 U	0.0013 U	0.001 U	0.0011 U	0.001 UJ	0.0011 U

Table 1. Summary of Volatile Organic Compounds in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units	Sample Designation:	EP-38	EP-39	EP-39	EP-40	EP-41	EP-42	EP-43	EP-44	EP-45	EP-46	EP-47	EP-48	EP-49
					Sample Date:	05/09/2024	05/09/2024	05/09/2024	05/09/2024	05/09/2024	05/09/2024	01/29/2024	01/29/2024	12/07/2023	11/10/2023	11/10/2023	09/21/2023	09/15/2023
					Sample Depth (ft bls):	5.0 - 5.5	4.5 - 5.0	4.5 - 5.0	3.5 - 4.0	2.0 - 2.5	3.5 - 4.0	8.5 - 9.0	4.5 - 5.0	2.5 - 3.0	5.5 - 6.0	5.5 - 6.0	4.5 - 5.0	6.0 - 6.5
					Normal Sample or Field Duplicate:	N	N	FD	N	N	N	N	N	N	N	N	N	N
1,1,1-Trichloroethane (TCA)	0.68	100	0.68	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
1,1,2,2-Tetrachloroethane	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 UJ	0.0011 U	0.0012 U	0.0011 UJ	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
1,1,2-Trichloroethane	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
1,1-Dichloroethane	0.27	26	0.27	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
1,1-Dichloroethene	0.33	100	0.33	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.00078 J	0.0011 U	0.0011 U	0.0011 U
1,2,3-Trichlorobenzene	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
1,2,4-Trichlorobenzene	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 UJ	0.001 U	0.0011 U	0.0011 U	0.0011 U
1,2-Dibromo-3-Chloropropane	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
1,2-Dibromoethane (Ethylene Dibromide)	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
1,2-Dichlorobenzene	1.1	100	1.1	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
1,2-Dichloroethane	0.02	3.1	0.02	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
1,2-Dichloropropane	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
1,3-Dichlorobenzene	2.4	49	2.4	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
1,4-Dichlorobenzene	1.8	13	1.8	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
2-Hexanone	--	--	--	MG/KG		0.0049 U	0.0052 U	0.0049 U	0.0057 U	0.0062 U	0.0055 U	0.007 U	0.0048 U	0.0054 U	0.0051 U	0.0054 U	0.0057 U	0.0053 U
Acetone	**0.05**	100	0.05	MG/KG		0.0059 U	0.0062 U	0.0059 U	0.0068 U	0.022	0.0066 U	0.032	0.0058 U	0.037	0.019	0.013	0.008	0.0064 U
Benzene	0.06	4.8	0.06	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Bromochloromethane	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Bromodichloromethane	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Bromoform	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Bromomethane	--	--	--	MG/KG		0.002 U	0.0021 U	0.002 U	0.0023 U	0.0025 U	0.0022 U	0.0028 UT	0.0019 UT	0.0022 U	0.002 U	0.0021 U	0.0023 U	0.0021 U
Carbon Disulfide	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.00071 J	0.00039 J	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.00085 J	0.0011 UJ
Carbon Tetrachloride	0.76	2.4	0.76	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Chlorobenzene	1.1	100	1.1	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Chloroethane	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Chloroform	0.37	49	0.37	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Chloromethane	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Cis-1,2-Dichloroethylene	0.25	100	0.25	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Cis-1,3-Dichloropropene	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Cyclohexane	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Dibromochloromethane	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Dichlorodifluoromethane	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Ethylbenzene	1	41	1	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Isopropylbenzene (Cumene)	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
m,p-Xylene	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.00022 J	0.0011 U	0.00028 J	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Methyl Acetate	--	--	--	MG/KG		0.0049 U	0.0052 U	0.0049 U	0.0057 U	0.0062 U	0.0055 U	0.007 U	0.0048 U	0.0054 U	0.0051 U	0.0054 U	0.0057 U	0.0053 U
Methyl Ethyl Ketone (2-Butanone)	0.12	100	0.12	MG/KG		0.0049 U	0.0052 U	0.0049 U	0.0057 U	0.0062 U	0.0055 U	0.007 U	0.0048 U	0.0054 U	0.0051 U	0.0054 U	0.0057 U	0.0053 U
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	--	--	--	MG/KG		0.0049 U	0.0052 U	0.0049 U	0.0057 U	0.0062 U	0.0055 U	0.007 U	0.0048 U	0.0054 U	0.0051 U	0.0054 U	0.0057 U	0.0053 U
Methylcyclohexane	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Methylene Chloride	0.05	100	0.05	MG/KG		0.002 U	0.0021 U	0.002 U	0.0023 U	0.0025 U	0.0022 U	0.0028 U	0.0019 U	0.0022 U	0.002 U	0.0021 U	0.0023 U	0.0021 U
O-Xylene (1,2-Dimethylbenzene)	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Styrene	--	--	--	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Tert-Butyl Methyl Ether	0.93	100	0.93	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Tetrachloroethylene (PCE)	1.3	19	1.3	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 UJ	0.0011 UJ	0.0011 U	0.0011 U
Toluene	0.7	100	0.7	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Trans-1,2-Dichloroethene	0.19	100	0.19	MG/KG		0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U

Table 1. Summary of Volatile Organic Compounds in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

			Sample Designation:		EP-38	EP-39	EP-39	EP-40	EP-41	EP-42	EP-43	EP-44	EP-45	EP-46	EP-47	EP-48	EP-49
			Sample Date:		05/09/2024	05/09/2024	05/09/2024	05/09/2024	05/09/2024	05/09/2024	01/29/2024	01/29/2024	12/07/2023	11/10/2023	11/10/2023	09/21/2023	09/15/2023
			Sample Depth (ft bls):		5.0 - 5.5	4.5 - 5.0	4.5 - 5.0	3.5 - 4.0	2.0 - 2.5	3.5 - 4.0	8.5 - 9.0	4.5 - 5.0	2.5 - 3.0	5.5 - 6.0	5.5 - 6.0	4.5 - 5.0	6.0 - 6.5
			Normal Sample or Field Duplicate:		N	N	FD	N	N	N	N	N	N	N	N	N	N
Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units													
Trans-1,3-Dichloropropene	--	--	--	MG/KG	0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Trichloroethylene (TCE)	0.47	21	0.47	MG/KG	0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Trichlorofluoromethane	--	--	--	MG/KG	0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.0011 U
Vinyl Chloride	0.02	0.9	0.02	MG/KG	0.00099 U	0.001 U	0.00098 U	0.0011 U	0.0012 U	0.0011 U	0.0014 U	0.00097 U	0.0011 U	0.001 UJ	0.0011 UJ	0.0011 U	0.0011 U

Table 1. Summary of Volatile Organic Compounds in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units	WF-A	WF-B	WF-B	WF-C	WF-D	WF-E	WF-F	WF-X
Sample Designation:					WF-A	WF-B	WF-B	WF-C	WF-D	WF-E	WF-F	WF-X
Sample Date:					10/15/2024	10/15/2024	10/15/2024	10/15/2024	10/15/2024	10/18/2024	10/18/2024	10/15/2024
Sample Depth (ft bls):					1.5 - 2	1.5 - 2	1.5 - 2	1 - 1.5	1 - 1.5	3 - 3.5	4 - 4.5	0.5 - 1
Normal Sample or Field Duplicate:					N	N	FD	N	N	N	N	N
1,1,1-Trichloroethane (TCA)	0.68	100	0.68	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
1,1,2,2-Tetrachloroethane	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
1,1,2-Trichloroethane	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
1,1-Dichloroethane	0.27	26	0.27	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
1,1-Dichloroethene	0.33	100	0.33	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
1,2,3-Trichlorobenzene	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
1,2,4-Trichlorobenzene	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
1,2-Dibromo-3-Chloropropane	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
1,2-Dibromoethane (Ethylene Dibromide)	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
1,2-Dichlorobenzene	1.1	100	1.1	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
1,2-Dichloroethane	0.02	3.1	0.02	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
1,2-Dichloropropane	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
1,3-Dichlorobenzene	2.4	49	2.4	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
1,4-Dichlorobenzene	1.8	13	1.8	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
2-Hexanone	--	--	--	MG/KG	0.006 U	0.0062 U	0.0057 U	0.0071 U	0.0077 U	0.0051 U	0.0051 U	0.008 U
Acetone	**0.05**	100	0.05	MG/KG	0.0072 U	0.0075 U	0.0069 U	0.0086 U	0.0093 U	0.0061 U	0.0062 U	0.0097 U
Benzene	0.06	4.8	0.06	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Bromochloromethane	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Bromodichloromethane	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Bromoform	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 UT	0.0014 UT	0.0015 UT	0.001 U	0.001 U	0.0016 UT
Bromomethane	--	--	--	MG/KG	0.0024 U	0.0025 U	0.0023 U	0.0029 U	0.0031 U	0.002 U	0.0021 U	0.0032 U
Carbon Disulfide	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Carbon Tetrachloride	0.76	2.4	0.76	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Chlorobenzene	1.1	100	1.1	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Chloroethane	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Chloroform	0.37	49	0.37	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Chloromethane	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Cis-1,2-Dichloroethylene	0.25	100	0.25	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Cis-1,3-Dichloropropene	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Cyclohexane	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Dibromochloromethane	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Dichlorodifluoromethane	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Ethylbenzene	1	41	1	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Isopropylbenzene (Cumene)	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
m,p-Xylene	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Methyl Acetate	--	--	--	MG/KG	0.006 U	0.0062 U	0.0057 UT	0.0071 UT	0.0077 UT	0.0051 U	0.0051 U	0.008 UT
Methyl Ethyl Ketone (2-Butanone)	0.12	100	0.12	MG/KG	0.006 U	0.0062 U	0.0057 U	0.0071 U	0.0077 U	0.0051 U	0.0051 U	0.008 U
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	--	--	--	MG/KG	0.006 U	0.0062 U	0.0057 U	0.0071 U	0.0077 U	0.0051 U	0.0051 U	0.008 U
Methylcyclohexane	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Methylene Chloride	0.05	100	0.05	MG/KG	0.0024 U	0.0025 U	0.0023 U	0.0029 U	0.0031 U	0.002 U	0.0021 U	0.0032 U
O-Xylene (1,2-Dimethylbenzene)	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Styrene	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Tert-Butyl Methyl Ether	0.93	100	0.93	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Tetrachloroethylene (PCE)	1.3	19	1.3	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Toluene	0.7	100	0.7	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Trans-1,2-Dichloroethene	0.19	100	0.19	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U

Table 1. Summary of Volatile Organic Compounds in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

			Sample Designation:		WF-A	WF-B	WF-B	WF-C	WF-D	WF-E	WF-F	WF-X
			Sample Date:		10/15/2024	10/15/2024	10/15/2024	10/15/2024	10/15/2024	10/18/2024	10/18/2024	10/15/2024
			Sample Depth (ft bls):		1.5 - 2	1.5 - 2	1.5 - 2	1 - 1.5	1 - 1.5	3 - 3.5	4 - 4.5	0.5 - 1
			Normal Sample or Field Duplicate:		N	N	FD	N	N	N	N	N
Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units								
Trans-1,3-Dichloropropene	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Trichloroethylene (TCE)	0.47	21	0.47	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Trichlorofluoromethane	--	--	--	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U
Vinyl Chloride	0.02	0.9	0.02	MG/KG	0.0012 U	0.0012 U	0.0011 U	0.0014 U	0.0015 U	0.001 U	0.001 U	0.0016 U

Table 2. Summary of Semivolatile Organic Compounds in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units	Sample Designation:	EP-1	EP-2	EP-3	EP-4	EP-5	EP-6	EP-7	EP-8	EP-9	EP-10	EP-10	EP-11	EP-12
					Sample Date:	04/25/2023	04/27/2023	04/25/2023	04/27/2023	04/27/2023	06/05/2023	06/05/2023	06/23/2023	12/07/2023	04/25/2023	04/25/2023	04/25/2023	04/25/2023
					Sample Depth (ft bls):	0.0 - 0.5	3.0 - 3.5	2.5 - 3.0	4.5 - 5.0	4.5 - 5.0	7.5 - 8.0	7.0 - 7.5	6.5 - 7.0	1.5 - 2.0	30 - 3.5	30 - 3.5	0.5 - 1.0	3.5 - 4.0
					Normal Sample or Field Duplicate:	N	N	N	N	N	N	N	N	N	N	FD	N	N
1,2,4,5-Tetrachlorobenzene	--	--	--	MG/KG		0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
1,4-Dioxane (P-Dioxane)	0.1	13	0.1	MG/KG		0.038 U	0.039 U	0.039 U	0.038 U	0.04 U	0.04 U	0.04 U	0.035 U	0.037 U	0.038 U	0.039 U	0.038 U	0.039 U
2,3,4,6-Tetrachlorophenol	--	--	--	MG/KG		0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
2,4,5-Trichlorophenol	--	--	--	MG/KG		0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
2,4,6-Trichlorophenol	--	--	--	MG/KG		0.15 U	0.16 U	0.16 U	0.15 U	0.16 U	0.16 U	0.16 U	0.14 U	0.15 U	0.15 U	0.16 U	0.15 U	0.16 U
2,4-Dichlorophenol	--	--	--	MG/KG		0.15 U	0.16 U	0.16 U	0.15 U	0.16 U	0.16 U	0.16 U	0.14 U	0.15 U	0.15 U	0.16 U	0.15 U	0.16 U
2,4-Dimethylphenol	--	--	--	MG/KG		0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
2,4-Dinitrophenol	--	--	--	MG/KG		0.3 U	0.31 U	0.31 U	0.31 U	0.32 U	0.32 U	0.32 U	0.28 U	0.3 U	0.3 U	0.31 U	0.3 U	0.31 U
2,4-Dinitrotoluene	--	--	--	MG/KG		0.076 U	0.079 U	0.079 U	0.078 U	0.081 U	0.082 U	0.081 U	0.071 U	0.075 U	0.077 U	0.079 U	0.077 U	0.079 U
2,6-Dinitrotoluene	--	--	--	MG/KG		0.076 U	0.079 U	0.079 U	0.078 U	0.081 U	0.082 U	0.081 U	0.071 U	0.075 U	0.077 U	0.079 U	0.077 U	0.079 U
2-Chloronaphthalene	--	--	--	MG/KG		0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
2-Chlorophenol	--	--	--	MG/KG		0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
2-Methylnaphthalene	--	--	--	MG/KG		0.016 J	0.025 J	0.39 U	0.083 J	0.074 J	0.4 U	0.4 U	0.35 U	0.027 J	0.14 J	0.21 J	0.012 J	0.39 U
2-Methylphenol (O-Cresol)	0.33	100	0.33	MG/KG		0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
2-Nitroaniline	--	--	--	MG/KG		0.38 U	0.39 UT	0.39 U	0.38 UT	0.4 UT	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
2-Nitrophenol	--	--	--	MG/KG		0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
3,3'-Dichlorobenzidine	--	--	--	MG/KG		0.15 U	0.16 U	0.16 U	0.15 U	0.16 U	0.16 U	0.16 U	0.14 U	0.15 UT	0.15 U	0.16 U	0.15 U	0.16 U
3-Nitroaniline	--	--	--	MG/KG		0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
4,6-Dinitro-2-Methylphenol	--	--	--	MG/KG		0.3 U	0.31 U	0.31 U	0.31 U	0.32 U	0.32 U	0.32 U	0.28 U	0.3 U	0.3 U	0.31 U	0.3 U	0.31 U
4-Bromophenyl Phenyl Ether	--	--	--	MG/KG		0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
4-Chloro-3-Methylphenol	--	--	--	MG/KG		0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
4-Chloroaniline	--	--	--	MG/KG		0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 UT	0.37 UT	0.38 U	0.39 U	0.38 U	0.39 U
4-Chlorophenyl Phenyl Ether	--	--	--	MG/KG		0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
4-Methylphenol (P-Cresol)	0.33	100	0.33	MG/KG		0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.086 J	0.38 U	0.39 U
4-Nitroaniline	--	--	--	MG/KG		0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
4-Nitrophenol	--	--	--	MG/KG		0.76 U	0.79 U	0.79 U	0.78 U	0.81 U	0.82 U	0.81 U	0.71 U	0.75 U	0.77 U	0.79 U	0.77 U	0.79 U
Acenaphthene	20	100	98	MG/KG		0.032 J	0.055 J	0.011 J	0.16 J	0.11 J	0.4 U	0.016 J	0.35 U	0.046 J	0.26 J	0.82	0.035 J	0.029 J
Acenaphthylene	100	100	107	MG/KG		0.013 J	0.053 J	0.011 J	0.07 J	0.22 J	0.4 U	0.034 J	0.35 U	0.083 J	0.053 J	0.04 J	0.019 J	0.39 U
Acetophenone	--	--	--	MG/KG		0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
Anthracene	100	100	1000	MG/KG		0.066 J	0.15 J	0.025 J	0.25 J	0.3 J	0.022 J	0.037 J	0.35 U	0.13 J	0.62 J	1.9 J	0.056 J	0.12 J
Atrazine	--	--	--	MG/KG		0.15 U	0.16 U	0.16 U	0.15 U	0.16 U	0.16 U	0.16 U	0.14 U	0.15 UT	0.15 U	0.16 U	0.15 U	0.16 U
Benzaldehyde	--	--	--	MG/KG		0.38 U	0.39 U	0.39 U	0.38 UJ	0.4 U	0.4 UJ	0.4 UJ	0.35 UJ	0.37 UJ	0.38 U	0.39 U	0.38 U	0.39 U
Benzo(A)Anthracene	**1**	1	1	MG/KG		0.22	0.5	0.12	0.58	0.77	0.061	0.1	0.035 U	0.52	**1.1 J**	**3.5 J**	0.2	0.28
Benzo(A)Pyrene	**1**	1	22	MG/KG		0.24	0.54	0.12	0.59	0.68	0.055	0.097	0.035 U	0.39	**1.1 J**	**3.8 J**	0.2	0.26
Benzo(B)Fluoranthene	**1**	1	1.7	MG/KG		0.26	0.62	0.13	0.76	0.95	0.058	0.13	0.035 U	0.69	**1.3 J**	**4.2 J**	0.23	0.27
Benzo(G,H,I)Perylene	100	100	1000	MG/KG		0.1 J	0.29 J	0.053 J	0.25 J	0.33 J	0.025 J	0.062 J	0.35 U	0.36 J	0.47 J	1.6 J	0.11 J-	0.1 J
Benzo(K)Fluoranthene	**0.8**	3.9	1.7	MG/KG		0.1	0.22	0.051	0.26	0.36	0.022 J	0.043	0.035 U	0.23	0.49 J	**1.5 J**	0.088	0.1
Benzyl Butyl Phthalate	--	--	--	MG/KG		0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
Biphenyl (Diphenyl)	--	--	--	MG/KG		0.38 U	0.39 U	0.39 U	0.028 J	0.017 J	0.4 U	0.4 U	0.35 U	0.37 U	0.039 J	0.076 J	0.38 U	0.39 U
Bis(2-Chloroethoxy) Methane	--	--	--	MG/KG		0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	--	--	--	MG/KG		0.038 U	0.039 U	0.039 U	0.038 U	0.04 U	0.04 U	0.04 U	0.035 U	0.037 U	0.038 U	0.039 U	0.038 U	0.039 U
Bis(2-Chloroisopropyl) Ether	--	--	--	MG/KG		0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
Bis(2-Ethylhexyl) Phthalate	--	--	--	MG/KG		0.38 U	0.39 U	0.39 U	0.024 J	0.4 U	0.4 U	0.4 U	0.35 U	0.038 J	0.021 J	0.39 U	0.38 U	0.39 U
Caprolactam	--	--	--	MG/KG		0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 UT	0.38 U	0.39 U	0.38 U	0.39 U
Carbazole	--	--	--	MG/KG		0.033 J	0.05 J	0.39 U	0.076 J	0.093 J	0.4 U	0.4 U	0.35 U	0.044 J	0.27 J	0.59	0.018 J	0.018 J
Chrysene	**1**	3.9	1	MG/KG		0.22 J	0.52	0.12 J	0.59	0.82	0.056 J	0.1 J	0.35 U	0.5	**1.1 J**	**3.2 J**	0.19 J	0.26 J
Dibenz(A,H)Anthracene	**0.33**	0.33	1000	MG/KG		0.03 J	0.069	0.039 U	0.083	0.092	0.04 U	0.04 U	0.035 U	0.11	0.13 J	**0.42 J**	0.026 J	0.027 J
Dibenzofuran	7	59	210	MG/KG		0.016 J	0.038 J	0.39 U	0.13 J	0.091 J	0.4 U	0.4 U	0.35 U	0.037 J	0.26 J	0.56	0.023 J	0.022 J

Table 2. Summary of Semivolatile Organic Compounds in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units	EP-1	EP-2	EP-3	EP-4	EP-5	EP-6	EP-7	EP-8	EP-9	EP-10	EP-10	EP-11	EP-12
Sample Date:					04/25/2023	04/27/2023	04/25/2023	04/27/2023	04/27/2023	06/05/2023	06/05/2023	06/23/2023	12/07/2023	04/25/2023	04/25/2023	04/25/2023	04/25/2023
Sample Depth (ft bls):					0.0 - 0.5	3.0 - 3.5	2.5 - 3.0	4.5 - 5.0	4.5 - 5.0	7.5 - 8.0	7.0 - 7.5	6.5 - 7.0	1.5 - 2.0	30 - 3.5	30 - 3.5	0.5 - 1.0	3.5 - 4.0
Normal Sample or Field Duplicate:					N	N	N	N	N	N	N	N	N	N	FD	N	N
Diethyl Phthalate	--	--	--	MG/KG	0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
Dimethyl Phthalate	--	--	--	MG/KG	0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
Di-N-Butyl Phthalate	--	--	--	MG/KG	0.12 J	0.39 U	0.39 U	0.38 U	0.4 U	0.016 J	0.4 U	0.35 U	0.37 U	0.18 J	0.083 J	0.12 J	0.15 J
Di-N-Octylphthalate	--	--	--	MG/KG	0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
Fluoranthene	100	100	1000	MG/KG	0.46	0.89	0.2 J	1.1	1.2	0.11 J	0.2 J	0.35 U	0.91	2.6 J	7.4 J	0.43	0.59
Fluorene	30	100	386	MG/KG	0.027 J	0.054 J	0.39 U	0.17 J	0.13 J	0.4 U	0.016 J	0.35 U	0.049 J	0.4	0.72	0.032 J	0.04 J
Hexachlorobenzene	0.33	1.2	3.2	MG/KG	0.038 U	0.039 U	0.039 U	0.038 U	0.04 U	0.04 U	0.04 U	0.035 U	0.037 U	0.038 U	0.039 U	0.038 U	0.039 U
Hexachlorobutadiene	--	--	--	MG/KG	0.076 U	0.079 U	0.079 U	0.078 U	0.081 U	0.082 U	0.081 U	0.071 U	0.075 U	0.077 U	0.079 U	0.077 U	0.079 U
Hexachlorocyclopentadiene	--	--	--	MG/KG	0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 UJ	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
Hexachloroethane	--	--	--	MG/KG	0.038 U	0.039 U	0.039 U	0.038 U	0.04 U	0.04 U	0.04 U	0.035 U	0.037 U	0.038 U	0.039 U	0.038 U	0.039 U
Indeno(1,2,3-C,D)Pyrene	**0.5**	0.5	8.2	MG/KG	0.13	0.36	0.062	0.33	0.4	0.031 J	0.075	0.035 U	0.48	**0.59 J**	**2 J**	0.13	0.13
Isophorone	--	--	--	MG/KG	0.15 U	0.16 U	0.16 U	0.15 U	0.16 U	0.16 U	0.16 U	0.14 U	0.15 U	0.15 U	0.16 U	0.15 U	0.16 U
Naphthalene	12	100	12	MG/KG	0.031 J	0.061 J	0.011 J	0.17 J	0.12 J	0.4 U	0.028 J	0.35 U	0.054 J	0.37 J	0.37 J	0.02 J	0.017 J
Nitrobenzene	--	--	--	MG/KG	0.038 U	0.039 U	0.039 U	0.038 U	0.04 U	0.04 U	0.04 U	0.035 U	0.037 U	0.038 U	0.039 U	0.038 U	0.039 U
N-Nitrosodi-N-Propylamine	--	--	--	MG/KG	0.038 U	0.039 U	0.039 U	0.038 U	0.04 U	0.04 U	0.04 U	0.035 U	0.037 U	0.038 U	0.039 U	0.038 U	0.039 U
N-Nitrosodiphenylamine	--	--	--	MG/KG	0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
Pentachlorophenol	0.8	6.7	0.8	MG/KG	0.3 U	0.31 U	0.31 U	0.31 U	0.32 U	0.32 U	0.32 U	0.28 U	0.3 U	0.3 U	0.31 U	0.3 U	0.31 U
Phenanthrene	100	100	1000	MG/KG	0.33 J	0.65	0.12 J	1.2	1	0.088 J	0.15 J	0.35 U	0.53	2.6 J	7.2 J	0.23 J	0.51
Phenol	0.33	100	0.33	MG/KG	0.38 U	0.39 U	0.39 U	0.38 U	0.4 U	0.4 U	0.4 U	0.35 U	0.37 U	0.38 U	0.39 U	0.38 U	0.39 U
Pyrene	100	100	1000	MG/KG	0.45	1	0.22 J	1.3	1.3	0.097 J	0.19 J	0.35 U	0.9 T	2.3 J	6.9 J	0.36 J	0.63

Table 2. Summary of Semivolatile Organic Compounds in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units	Sample Designation:	EP-13	EP-14	EP-15	EP-16	EP-17	EP-18	EP-19	EP-20	EP-21	EP-22	EP-23	EP-24	EP-24
					Sample Date:	04/25/2023	01/03/2024	11/10/2023	06/23/2023	06/23/2023	06/23/2023	07/17/2023	08/10/2023	08/10/2023	07/20/2023	07/20/2023	01/03/2024	01/03/2024
					Sample Depth (ft bls):	3.0 - 3.5	7.5 - 8.0	7.5 - 8.0	7.0 - 7.5	7.0 - 7.5	6.0 - 6.5	10.0 - 10.5	10 - 10.5	3 - 3.5	9.5 - 10.0	9.5 - 10.0	7.5 - 8.0	7.5 - 8.0
					Normal Sample or Field Duplicate:	N	N	N	N	N	N	N	N	N	N	N	N	FD
1,2,4,5-Tetrachlorobenzene	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
1,4-Dioxane (P-Dioxane)	0.1	13	0.1	MG/KG		0.038 U	0.041 U	0.039 U	0.038 U	0.037 U	0.035 U	0.04 UT	0.036 U	0.036 U	0.04 U	0.039 U	0.039 U	0.04 U
2,3,4,6-Tetrachlorophenol	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
2,4,5-Trichlorophenol	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
2,4,6-Trichlorophenol	--	--	--	MG/KG		0.15 U	0.16 U	0.16 U	0.15 U	0.15 U	0.14 U	0.16 U	0.14 U	0.15 U	0.16 U	0.16 U	0.16 U	0.16 U
2,4-Dichlorophenol	--	--	--	MG/KG		0.15 U	0.16 U	0.16 U	0.15 U	0.15 U	0.14 U	0.16 U	0.14 U	0.15 U	0.16 U	0.16 U	0.16 U	0.16 U
2,4-Dimethylphenol	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
2,4-Dinitrophenol	--	--	--	MG/KG		0.31 U	0.33 U	0.32 R	0.31 U	0.3 U	0.28 U	0.33 U	0.29 U	0.29 U	0.32 U	0.31 U	0.32 U	0.32 U
2,4-Dinitrotoluene	--	--	--	MG/KG		0.078 U	0.083 U	0.08 U	0.078 U	0.075 U	0.071 U	0.082 U	0.072 U	0.073 U	0.081 U	0.079 U	0.08 U	0.081 U
2,6-Dinitrotoluene	--	--	--	MG/KG		0.078 U	0.083 U	0.08 U	0.078 U	0.075 U	0.071 U	0.082 U	0.072 U	0.073 U	0.081 U	0.079 U	0.08 U	0.081 U
2-Chloronaphthalene	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
2-Chlorophenol	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
2-Methylnaphthalene	--	--	--	MG/KG		0.017 J	0.41 U	0.057 J	0.38 U	0.37 U	0.024 J	0.027 J	0.024 J	0.028 J	0.053 J	0.014 J	0.39 U	0.4 U
2-Methylphenol (O-Cresol)	0.33	100	0.33	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
2-Nitroaniline	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
2-Nitrophenol	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
3,3'-Dichlorobenzidine	--	--	--	MG/KG		0.15 U	0.16 U	0.16 U	0.15 U	0.15 U	0.14 U	0.16 U	0.14 U	0.15 U	0.16 U	0.16 U	0.16 U	0.16 U
3-Nitroaniline	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
4,6-Dinitro-2-Methylphenol	--	--	--	MG/KG		0.31 U	0.33 U	0.32 R	0.31 U	0.3 U	0.28 U	0.33 U	0.29 U	0.29 U	0.32 U	0.31 U	0.32 U	0.32 U
4-Bromophenyl Phenyl Ether	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
4-Chloro-3-Methylphenol	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
4-Chloroaniline	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 UT	0.37 UT	0.35 UT	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
4-Chlorophenyl Phenyl Ether	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
4-Methylphenol (P-Cresol)	0.33	100	0.33	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.099 J	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
4-Nitroaniline	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
4-Nitrophenol	--	--	--	MG/KG		0.78 U	0.83 U	0.8 U	0.78 U	0.75 U	0.71 U	0.82 U	0.72 U	0.73 U	0.81 U	0.79 U	0.8 U	0.81 U
Acenaphthene	20	100	98	MG/KG		0.026 J	0.41 U	0.12 J	0.38 U	0.37 U	0.051 J	0.063 J	0.044 J	0.073 J	0.16 J	0.033 J	0.39 U	0.4 U
Acenaphthylene	100	100	107	MG/KG		0.38 U	0.41 U	0.036 J	0.38 U	0.37 U	0.018 J	0.02 J	0.036 J	0.043 J	0.035 J	0.02 J	0.39 U	0.4 U
Acetophenone	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
Anthracene	100	100	1000	MG/KG		0.049 J	0.41 U	0.31 J	0.38 U	0.37 U	0.13 J	0.12 J	0.11 J	0.18 J	0.3 J	0.088 J	0.39 U	0.4 U
Atrazine	--	--	--	MG/KG		0.15 U	0.16 U	0.16 UT	0.15 U	0.15 U	0.14 U	0.16 U	0.14 U	0.15 U	0.16 U	0.16 U	0.16 U	0.16 U
Benzaldehyde	--	--	--	MG/KG		0.38 U	0.41 UJ	0.39 U	0.38 UJ	0.37 UJ	0.35 UJ	0.4 U	0.36 UJ	0.36 UJ	0.4 U	0.39 U	0.39 UJ	0.4 UJ
Benzo(A)Anthracene	**1**	1	1	MG/KG		0.081	0.041 U	0.4	0.038 U	0.037 U	0.33	0.26	0.35	0.45	0.62	0.21	0.039 U	0.04 U
Benzo(A)Pyrene	**1**	1	22	MG/KG		0.074	0.024 J	0.37	0.038 U	0.037 U	0.34	0.23	0.42	0.46	0.62	0.21	0.039 U	0.04 U
Benzo(B)Fluoranthene	**1**	1	1.7	MG/KG		0.086	0.025 J	0.38	0.038 U	0.037 U	0.38	0.28	0.45	0.53	0.69	0.25	0.039 U	0.04 U
Benzo(G,H,I)Perylene	100	100	1000	MG/KG		0.03 J	0.014 J	0.21 J	0.38 U	0.37 U	0.17 J	0.12 J	0.26 J	0.27 J	0.32 J	0.13 J	0.39 U	0.4 U
Benzo(K)Fluoranthene	**0.8**	3.9	1.7	MG/KG		0.027 J	0.01 J	0.18	0.038 U	0.037 U	0.13	0.12	0.18	0.2	0.31	0.099	0.039 U	0.04 U
Benzyl Butyl Phthalate	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
Biphenyl (Diphenyl)	--	--	--	MG/KG		0.38 U	0.41 U	0.018 J	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
Bis(2-Chloroethoxy) Methane	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	--	--	--	MG/KG		0.038 U	0.041 U	0.039 U	0.038 U	0.037 U	0.035 U	0.04 U	0.036 U	0.036 U	0.04 U	0.039 U	0.039 U	0.04 U
Bis(2-Chloroisopropyl) Ether	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
Bis(2-Ethylhexyl) Phthalate	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
Caprolactam	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
Carbazole	--	--	--	MG/KG		0.017 J	0.41 U	0.074 J	0.38 U	0.37 U	0.042 J	0.039 J	0.037 J	0.069 J	0.14 J	0.023 J	0.39 U	0.4 U
Chrysene	**1**	3.9	1	MG/KG		0.074 J	0.021 J	0.39	0.38 U	0.37 U	0.33 J	0.24 J	0.37	0.44	0.67	0.23 J	0.39 U	0.4 U
Dibenz(A,H)Anthracene	**0.33**	0.33	1000	MG/KG		0.038 U	0.041 U	0.058	0.038 U	0.037 U	0.043	0.027 J	0.074	0.068	0.081	0.033 J	0.039 U	0.04 U
Dibenzofuran	7	59	210	MG/KG		0.018 J	0.41 U	0.081 J	0.38 U	0.37 U	0.043 J	0.04 J	0.031 J	0.049 J	0.1 J	0.027 J	0.39 U	0.4 U

Table 2. Summary of Semivolatile Organic Compounds in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units	Sample Designation:	EP-13	EP-14	EP-15	EP-16	EP-17	EP-18	EP-19	EP-20	EP-21	EP-22	EP-23	EP-24	EP-24
					Sample Date:	04/25/2023	01/03/2024	11/10/2023	06/23/2023	06/23/2023	06/23/2023	07/17/2023	08/10/2023	08/10/2023	07/20/2023	07/20/2023	01/03/2024	01/03/2024
					Sample Depth (ft bls):	3.0 - 3.5	7.5 - 8.0	7.5 - 8.0	7.0 - 7.5	7.0 - 7.5	6.0 - 6.5	10.0 - 10.5	10 - 10.5	3 - 3.5	9.5 - 10.0	9.5 - 10.0	7.5 - 8.0	7.5 - 8.0
					Normal Sample or Field Duplicate:	N	N	N	N	N	N	N	N	N	N	N	N	FD
Diethyl Phthalate	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
Dimethyl Phthalate	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
Di-N-Butyl Phthalate	--	--	--	MG/KG		0.075 J	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.037 J	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
Di-N-Octylphthalate	--	--	--	MG/KG		0.38 U	0.41 U	0.065 J	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
Fluoranthene	100	100	1000	MG/KG		0.18 J	0.051 J	1	0.38 U	0.37 U	0.65	0.52	0.66	1	1.4	0.43	0.016 J	0.4 U
Fluorene	30	100	386	MG/KG		0.033 J	0.41 U	0.15 J	0.38 U	0.37 U	0.066 J	0.067 J	0.047 J	0.074 J	0.17 J	0.034 J	0.39 U	0.4 U
Hexachlorobenzene	0.33	1.2	3.2	MG/KG		0.038 U	0.041 U	0.039 U	0.038 U	0.037 U	0.035 U	0.04 U	0.036 U	0.036 U	0.04 U	0.039 U	0.039 U	0.04 U
Hexachlorobutadiene	--	--	--	MG/KG		0.078 U	0.083 U	0.08 U	0.078 U	0.075 U	0.071 U	0.082 U	0.072 U	0.073 U	0.081 U	0.079 U	0.08 U	0.081 U
Hexachlorocyclopentadiene	--	--	--	MG/KG		0.38 U	0.41 U	0.39 UJ	0.38 UJ	0.37 UJ	0.35 UJ	0.4 UT	0.36 U	0.36 UJ	0.4 UJ	0.39 UJ	0.39 U	0.4 U
Hexachloroethane	--	--	--	MG/KG		0.038 U	0.041 U	0.039 U	0.038 U	0.037 U	0.035 U	0.04 U	0.036 U	0.036 U	0.04 U	0.039 U	0.039 U	0.04 U
Indeno(1,2,3-C,D)Pyrene	**0.5**	0.5	8.2	MG/KG		0.033 J	0.041 U	0.27	0.038 U	0.037 U	0.2	0.17	0.31	0.31	0.35	0.13	0.039 U	0.04 U
Isophorone	--	--	--	MG/KG		0.15 U	0.16 U	0.16 U	0.15 U	0.15 U	0.14 U	0.16 U	0.14 U	0.15 U	0.16 U	0.16 U	0.16 U	0.16 U
Naphthalene	12	100	12	MG/KG		0.046 J	0.41 U	0.11 J	0.38 U	0.37 U	0.074 J	0.055 J	0.042 J	0.045 J	0.088 J	0.04 J	0.39 U	0.4 U
Nitrobenzene	--	--	--	MG/KG		0.038 U	0.041 U	0.039 U	0.038 U	0.037 U	0.035 U	0.04 U	0.036 U	0.036 U	0.04 U	0.039 U	0.039 U	0.04 U
N-Nitrosodi-N-Propylamine	--	--	--	MG/KG		0.038 U	0.041 U	0.039 U	0.038 U	0.037 U	0.035 U	0.04 U	0.036 U	0.036 U	0.04 U	0.039 U	0.039 U	0.04 U
N-Nitrosodiphenylamine	--	--	--	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
Pentachlorophenol	0.8	6.7	0.8	MG/KG		0.31 U	0.33 U	0.32 U	0.31 U	0.3 U	0.28 U	0.33 U	0.29 U	0.29 U	0.32 U	0.31 U	0.32 U	0.32 U
Phenanthrene	100	100	1000	MG/KG		0.2 J	0.038 J	1.2 J	0.38 U	0.37 U	0.55	0.42	0.45	0.82	1.7	0.39	0.39 U	0.4 U
Phenol	0.33	100	0.33	MG/KG		0.38 U	0.41 U	0.39 U	0.38 U	0.37 U	0.35 U	0.4 U	0.36 U	0.36 U	0.4 U	0.39 U	0.39 U	0.4 U
Pyrene	100	100	1000	MG/KG		0.17 J	0.046 J	0.96	0.38 U	0.37 U	0.68	0.45	0.6	0.89	1.4	0.48	0.017 J	0.4 U

Table 2. Summary of Semivolatile Organic Compounds in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units	Sample Designation:	EP-25	EP-26	EP-27	EP-28	EP-29	EP-30	EP-31	EP-32	EP-33	EP-34	EP-35	EP-36	EP-37
					Sample Date:	03/19/2024	01/03/2024	11/10/2023	01/29/2024	12/07/2023	11/10/2023	08/22/2023	08/10/2023	06/05/2023	09/15/2023	09/15/2023	11/10/2023	01/29/2024
					Sample Depth (ft bls):	3.5 - 4.0	4.5 - 5.0	7.5 - 8.0	6.0 - 6.5	5.5 - 6.0	6.5 - 7.0	9.0 - 9.5	9 - 9.5	4.0 - 4.5	6.5 - 7.0	4.5 - 5.0	7.5 - 8.0	6.5 - 7.0
					Normal Sample or Field Duplicate:	N	N	N	N	N	N	N	N	N	N	N	N	N
1,2,4,5-Tetrachlorobenzene	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
1,4-Dioxane (P-Dioxane)	0.1	13	0.1	MG/KG		0.039 U	0.039 U	0.038 U	0.041 U	0.037 U	0.04 U	0.04 U	0.04 U	0.04 U	0.039 U	0.039 U	0.038 U	0.043 U
2,3,4,6-Tetrachlorophenol	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
2,4,5-Trichlorophenol	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
2,4,6-Trichlorophenol	--	--	--	MG/KG		0.16 U	0.16 U	0.16 U	0.16 U	0.15 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.15 U	0.17 U
2,4-Dichlorophenol	--	--	--	MG/KG		0.16 U	0.16 U	0.16 U	0.16 U	0.15 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.15 U	0.17 U
2,4-Dimethylphenol	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.11 J	0.4 U	0.4 U	0.39 UJ	0.39 UJ	0.38 U	0.43 U
2,4-Dinitrophenol	--	--	--	MG/KG		0.32 U	0.32 U	0.31 U	0.33 U	0.3 U	0.32 U	0.33 U	0.32 U	0.32 U	0.31 U	0.31 U	0.3 U	0.35 U
2,4-Dinitrotoluene	--	--	--	MG/KG		0.079 U	0.08 U	0.078 U	0.083 U	0.075 U	0.081 U	0.082 U	0.082 U	0.081 U	0.079 U	0.079 U	0.076 U	0.087 U
2,6-Dinitrotoluene	--	--	--	MG/KG		0.079 U	0.08 U	0.078 U	0.083 U	0.075 U	0.081 U	0.082 U	0.082 U	0.081 U	0.079 U	0.079 U	0.076 U	0.087 U
2-Chloronaphthalene	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
2-Chlorophenol	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
2-Methylnaphthalene	--	--	--	MG/KG		0.39 U	0.39 U	0.012 J	0.019 J	0.37 U	0.4 U	0.33 J	0.077 J	0.021 J	0.04 J	0.18 J	0.38 U	0.43 U
2-Methylphenol (O-Cresol)	0.33	100	0.33	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.05 J	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
2-Nitroaniline	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
2-Nitrophenol	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
3,3'-Dichlorobenzidine	--	--	--	MG/KG		0.16 U	0.16 U	0.16 U	0.16 U	0.15 UT	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.15 U	0.17 U
3-Nitroaniline	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
4,6-Dinitro-2-Methylphenol	--	--	--	MG/KG		0.32 U	0.32 U	0.31 U	0.33 U	0.3 U	0.32 U	0.33 U	0.32 U	0.32 U	0.31 U	0.31 U	0.3 U	0.35 U
4-Bromophenyl Phenyl Ether	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
4-Chloro-3-Methylphenol	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
4-Chloroaniline	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 UT	0.4 U	0.4 U	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
4-Chlorophenyl Phenyl Ether	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
4-Methylphenol (P-Cresol)	0.33	100	0.33	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.15 J	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
4-Nitroaniline	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
4-Nitrophenol	--	--	--	MG/KG		0.79 U	0.8 U	0.78 U	0.83 U	0.75 U	0.81 U	0.82 U	0.82 U	0.81 U	0.79 U	0.79 U	0.76 U	0.87 U
Acenaphthene	20	100	98	MG/KG		0.39 U	0.39 U	0.031 J	0.06 J	0.37 U	0.4 U	0.47	0.046 J	0.075 J	0.075 J	0.48	0.38 U	0.43 U
Acenaphthylene	100	100	107	MG/KG		0.39 U	0.39 U	0.021 J	0.017 J	0.37 U	0.4 U	0.34 J	0.17 J	0.085 J	0.14 J	0.35 J	0.38 U	0.43 U
Acetophenone	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.031 J	0.063 J	0.38 U	0.43 U
Anthracene	100	100	1000	MG/KG		0.013 J	0.39 U	0.095 J	0.15 J	0.37 U	0.4 U	1.5	0.23 J	0.11 J	0.24 J	1.3	0.38 U	0.43 U
Atrazine	--	--	--	MG/KG		0.16 UT	0.16 U	0.16 UT	0.16 U	0.15 UT	0.16 UT	0.16 U	0.16 U	0.16 U	0.16 UT	0.16 UT	0.15 UT	0.17 U
Benzaldehyde	--	--	--	MG/KG		0.39 UJ	0.39 UJ	0.38 U	0.41 UJ	0.37 UJ	0.4 U	0.4 UJ	0.4 UJ	0.4 UJ	0.39 UJ	0.39 UJ	0.38 U	0.43 UJ
Benzo(A)Anthracene	**1**	1	1	MG/KG		0.048	0.039 U	0.22	0.31	0.037 U	0.04 U	**1.9**	0.67	0.31	0.78	**3.2**	0.038 U	0.042 J
Benzo(A)Pyrene	**1**	1	22	MG/KG		0.037 J	0.039 U	0.23	0.29	0.037 U	0.04 U	**1.5**	0.55	0.35	0.84	**3.2**	0.038 U	0.026 J
Benzo(B)Fluoranthene	**1**	1	1.7	MG/KG		0.045	0.039 U	0.23	0.35	0.037 U	0.04 U	**1.6**	0.59	0.4	0.96	**3.9**	0.038 U	0.035 J
Benzo(G,H,I)Perylene	100	100	1000	MG/KG		0.022 J	0.39 U	0.13 J	0.13 J	0.37 U	0.4 U	0.56	0.3 J	0.18 J	0.52	1.9	0.38 U	0.43 U
Benzo(K)Fluoranthene	**0.8**	3.9	1.7	MG/KG		0.019 J	0.039 U	0.11	0.13	0.037 U	0.04 U	0.62	0.24	0.13	0.36	**1.3**	0.038 U	0.013 J
Benzyl Butyl Phthalate	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
Biphenyl (Diphenyl)	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.068 J	0.019 J	0.4 U	0.39 U	0.057 J	0.38 U	0.43 U
Bis(2-Chloroethoxy) Methane	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	--	--	--	MG/KG		0.039 U	0.039 U	0.038 U	0.041 U	0.037 U	0.04 U	0.04 U	0.04 U	0.04 U	0.039 U	0.039 U	0.038 U	0.043 U
Bis(2-Chloroisopropyl) Ether	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
Bis(2-Ethylhexyl) Phthalate	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.034 J	0.4 U	0.089 J	0.11 J	0.38 U	0.43 U
Caprolactam	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 UT	0.4 U	0.4 U	0.4 U	0.4 U	0.39 U	0.073 J	0.38 U	0.43 U
Carbazole	--	--	--	MG/KG		0.39 U	0.39 U	0.026 J	0.045 J	0.37 U	0.4 U	0.52	0.036 J	0.042 J	0.064 J	0.39	0.38 U	0.43 U
Chrysene	**1**	3.9	1	MG/KG		0.04 J	0.39 U	0.23 J	0.3 J	0.37 U	0.4 U	**1.7**	0.62	0.33 J	0.79	**3.1**	0.38 U	0.037 J
Dibenz(A,H)Anthracene	**0.33**	0.33	1000	MG/KG		0.039 U	0.039 U	0.044	0.044	0.037 U	0.04 U	0.19	0.074	0.048	0.13	**0.54**	0.038 U	0.043 U
Dibenzofuran	7	59	210	MG/KG		0.39 U	0.39 U	0.025 J	0.041 J	0.37 U	0.4 U	0.45	0.034 J	0.032 J	0.048 J	0.31 J	0.38 U	0.43 U

Table 2. Summary of Semivolatile Organic Compounds in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units	Sample Designation:	EP-25	EP-26	EP-27	EP-28	EP-29	EP-30	EP-31	EP-32	EP-33	EP-34	EP-35	EP-36	EP-37
					Sample Date:	03/19/2024	01/03/2024	11/10/2023	01/29/2024	12/07/2023	11/10/2023	08/22/2023	08/10/2023	06/05/2023	09/15/2023	09/15/2023	11/10/2023	01/29/2024
					Sample Depth (ft bls):	3.5 - 4.0	4.5 - 5.0	7.5 - 8.0	6.0 - 6.5	5.5 - 6.0	6.5 - 7.0	9.0 - 9.5	9 - 9.5	4.0 - 4.5	6.5 - 7.0	4.5 - 5.0	7.5 - 8.0	6.5 - 7.0
					Normal Sample or Field Duplicate:	N	N	N	N	N	N	N	N	N	N	N	N	N
Diethyl Phthalate	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
Dimethyl Phthalate	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
Di-N-Butyl Phthalate	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.4 U	0.022 J	0.017 J	0.39 U	0.38 U	0.43 U
Di-N-Octylphthalate	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
Fluoranthene	100	100	1000	MG/KG		0.067 J	0.39 U	0.5	0.62	0.37 U	0.4 U	3.9	1.7	0.69	1.7	7.2	0.38 U	0.05 J
Fluorene	30	100	386	MG/KG		0.39 U	0.39 U	0.038 J	0.069 J	0.37 U	0.4 U	0.87	0.082 J	0.054 J	0.075 J	0.51	0.38 U	0.43 U
Hexachlorobenzene	0.33	1.2	3.2	MG/KG		0.039 U	0.039 U	0.038 U	0.041 U	0.037 U	0.04 U	0.04 U	0.04 U	0.04 U	0.039 U	0.039 U	0.038 U	0.043 U
Hexachlorobutadiene	--	--	--	MG/KG		0.079 U	0.08 U	0.078 U	0.083 U	0.075 U	0.081 U	0.082 U	0.082 U	0.081 U	0.079 U	0.079 U	0.076 U	0.087 U
Hexachlorocyclopentadiene	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.39 UJ	0.39 UJ	0.38 U	0.43 U
Hexachloroethane	--	--	--	MG/KG		0.039 U	0.039 U	0.038 U	0.041 U	0.037 U	0.04 U	0.04 U	0.04 U	0.04 U	0.039 U	0.039 U	0.038 U	0.043 U
Indeno(1,2,3-C,D)Pyrene	**0.5**	0.5	8.2	MG/KG		0.052	0.039 U	0.19	0.16	0.037 U	0.04 U	**0.75**	0.35	0.23	**0.63**	**2.2**	0.038 U	0.043 U
Isophorone	--	--	--	MG/KG		0.16 U	0.16 U	0.16 U	0.16 U	0.15 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.15 U	0.17 U
Naphthalene	12	100	12	MG/KG		0.39 U	0.39 U	0.033 J	0.042 J	0.37 U	0.4 U	0.39 J	0.17 J	0.041 J	0.073 J	0.42	0.38 U	0.43 U
Nitrobenzene	--	--	--	MG/KG		0.039 U	0.039 U	0.038 U	0.041 U	0.037 U	0.04 U	0.04 U	0.04 U	0.04 U	0.039 U	0.039 U	0.038 U	0.043 U
N-Nitrosodi-N-Propylamine	--	--	--	MG/KG		0.039 U	0.039 U	0.038 U	0.041 U	0.037 U	0.04 U	0.04 U	0.04 U	0.04 U	0.039 U	0.039 U	0.038 U	0.043 U
N-Nitrosodiphenylamine	--	--	--	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
Pentachlorophenol	0.8	6.7	0.8	MG/KG		0.32 U	0.32 U	0.31 U	0.33 U	0.3 U	0.32 U	0.33 U	0.32 U	0.32 U	0.31 U	0.31 U	0.3 U	0.35 U
Phenanthrene	100	100	1000	MG/KG		0.036 J	0.39 U	0.34 J	0.58	0.37 U	0.4 U	4.1	1.5	0.53	1	5.5	0.38 U	0.044 J
Phenol	0.33	100	0.33	MG/KG		0.39 U	0.39 U	0.38 U	0.41 U	0.37 U	0.4 U	0.063 J	0.4 U	0.4 U	0.39 U	0.39 U	0.38 U	0.43 U
Pyrene	100	100	1000	MG/KG		0.086 J	0.39 U	0.44	0.64	0.37 UT	0.4 U	3	2	0.61	1.7	7	0.38 U	0.05 J

Table 2. Summary of Semivolatile Organic Compounds in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units	Sample Designation:	EP-38	EP-39	EP-39	EP-40	EP-41	EP-42	EP-43	EP-44	EP-45	EP-46	EP-47	EP-48	EP-49
					Sample Date:	05/09/2024	05/09/2024	05/09/2024	05/09/2024	05/09/2024	05/09/2024	01/29/2024	01/29/2024	12/07/2023	11/10/2023	11/10/2023	09/21/2023	09/15/2023
					Sample Depth (ft bls):	5.0 - 5.5	4.5 - 5.0	4.5 - 5.0	3.5 - 4.0	2.0 - 2.5	3.5 - 4.0	8.5 - 9.0	4.5 - 5.0	2.5 - 3.0	5.5 - 6.0	5.5 - 6.0	4.5 - 5.0	6.0 - 6.5
					Normal Sample or Field Duplicate:	N	N	FD	N	N	N	N	N	N	N	N	N	N
1,2,4,5-Tetrachlorobenzene	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
1,4-Dioxane (P-Dioxane)	0.1	13	0.1	MG/KG		0.037 U	0.039 U	0.039 U	0.036 U	0.037 U	0.039 U	0.041 U	0.038 U	0.039 U	0.038 U	0.04 U	0.041 U	0.04 U
2,3,4,6-Tetrachlorophenol	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
2,4,5-Trichlorophenol	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
2,4,6-Trichlorophenol	--	--	--	MG/KG		0.15 U	0.16 U	0.16 U	0.14 U	0.15 U	0.16 U	0.16 U	0.15 U	0.16 U	0.15 U	0.16 U	0.16 U	0.16 U
2,4-Dichlorophenol	--	--	--	MG/KG		0.15 U	0.16 U	0.16 U	0.14 U	0.15 U	0.16 U	0.16 U	0.15 U	0.16 U	0.15 U	0.16 U	0.16 U	0.16 U
2,4-Dimethylphenol	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 UJ
2,4-Dinitrophenol	--	--	--	MG/KG		0.29 U	0.31 U	0.31 U	0.29 U	0.3 U	0.31 U	0.33 U	0.31 U	0.31 U	0.3 U	0.33 U	0.33 U	0.32 U
2,4-Dinitrotoluene	--	--	--	MG/KG		0.074 U	0.079 U	0.079 U	0.073 U	0.075 U	0.079 U	0.083 U	0.078 U	0.079 U	0.076 U	0.082 U	0.082 U	0.082 U
2,6-Dinitrotoluene	--	--	--	MG/KG		0.074 U	0.079 U	0.079 U	0.073 U	0.075 U	0.079 U	0.083 U	0.078 U	0.079 U	0.076 U	0.082 U	0.082 U	0.082 U
2-Chloronaphthalene	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
2-Chlorophenol	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
2-Methylnaphthalene	--	--	--	MG/KG		0.37 U	0.043 J	0.39 U	0.36 U	0.061 J	0.062 J	0.21 J	0.016 J	0.39 U	0.22 J	0.052 J	0.03 J	0.037 J
2-Methylphenol (O-Cresol)	0.33	100	0.33	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
2-Nitroaniline	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
2-Nitrophenol	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
3,3'-Dichlorobenzidine	--	--	--	MG/KG		0.15 U	0.16 U	0.16 U	0.14 U	0.15 U	0.16 U	0.16 U	0.15 U	0.16 UT	0.15 U	0.16 U	0.16 U	0.16 U
3-Nitroaniline	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
4,6-Dinitro-2-Methylphenol	--	--	--	MG/KG		0.29 U	0.31 U	0.31 U	0.29 U	0.3 U	0.31 U	0.33 U	0.31 U	0.31 U	0.3 U	0.33 U	0.33 U	0.32 U
4-Bromophenyl Phenyl Ether	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
4-Chloro-3-Methylphenol	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
4-Chloroaniline	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 UT	0.38 U	0.4 U	0.41 U	0.4 U
4-Chlorophenyl Phenyl Ether	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
4-Methylphenol (P-Cresol)	0.33	100	0.33	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
4-Nitroaniline	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
4-Nitrophenol	--	--	--	MG/KG		0.74 U	0.79 U	0.79 U	0.73 U	0.75 U	0.79 U	0.83 U	0.78 U	0.79 U	0.76 U	0.82 U	0.82 U	0.82 U
Acenaphthene	20	100	98	MG/KG		0.37 U	0.21 J	0.39 U	0.022 J	0.12 J	0.12 J	0.66	0.057 J	0.39 U	0.44	0.11 J	0.032 J	0.16 J
Acenaphthylene	100	100	107	MG/KG		0.37 U	0.022 J	0.019 J	0.027 J	0.11 J	0.14 J	0.031 J	0.032 J	0.39 U	0.19 J	0.13 J	0.092 J	0.067 J
Acetophenone	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
Anthracene	100	100	1000	MG/KG		0.025 J	0.47	0.042 J	0.067 J	0.34 J	0.33 J	1.2	0.15 J	0.39 U	1.5	0.47	0.14 J	0.36 J
Atrazine	--	--	--	MG/KG		0.15 UT	0.16 UT	0.16 UT	0.14 UT	0.15 UT	0.16 UT	0.16 U	0.15 U	0.16 UT	0.15 UT	0.16 UT	0.16 U	0.16 UT
Benzaldehyde	--	--	--	MG/KG		0.37 UJ	0.39 UJ	0.39 UJ	0.36 UJ	0.37 UJ	0.39 UJ	0.41 UJ	0.38 UJ	0.39 UJ	0.38 U	0.4 U	0.41 UJ	0.4 UJ
Benzo(A)Anthracene	**1**	1	1	MG/KG		0.078	0.83 J	0.14 J	0.23	0.91	**1.1**	**1.9**	0.44	0.039 U	**4.4**	**1.4**	0.47	**1.1**
Benzo(A)Pyrene	**1**	1	22	MG/KG		0.074	0.72 J	0.12 J	0.23	0.9	**1.1**	**1.8**	0.43	0.039 U	**5.9**	**1.4**	0.43	0.98
Benzo(B)Fluoranthene	**1**	1	1.7	MG/KG		0.085	0.8 J	0.17 J	0.28	**1.1**	**1.3**	**2.1**	0.51	0.039 U	**6.5**	**1.7**	0.51	**1.2**
Benzo(G,H,I)Perylene	100	100	1000	MG/KG		0.037 J	0.26 J	0.058 J	0.11 J	0.45	0.49	0.71	0.21 J	0.39 U	3.1	0.82	0.27 J	0.59
Benzo(K)Fluoranthene	**0.8**	3.9	1.7	MG/KG		0.04	0.33 J	0.058 J	0.091	0.36	0.51	0.73	0.17	0.039 U	**2**	0.55	0.24	0.46
Benzyl Butyl Phthalate	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
Biphenyl (Diphenyl)	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.02 J	0.019 J	0.067 J	0.38 U	0.39 U	0.055 J	0.015 J	0.41 U	0.4 U
Bis(2-Chloroethoxy) Methane	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	--	--	--	MG/KG		0.037 U	0.039 U	0.039 U	0.036 U	0.037 U	0.039 U	0.041 U	0.038 U	0.039 U	0.038 U	0.04 U	0.041 U	0.04 U
Bis(2-Chloroisopropyl) Ether	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
Bis(2-Ethylhexyl) Phthalate	--	--	--	MG/KG		0.37 U	0.39 U	0.11 J	0.36 U	0.048 J	0.094 J	0.41 U	0.15 J	0.39 U	0.042 J	0.4 U	0.41 U	0.081 J
Caprolactam	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 UT	0.38 U	0.4 U	0.41 U	0.4 U
Carbazole	--	--	--	MG/KG		0.37 U	0.16 J	0.39 U	0.02 J	0.11 J	0.1 J	0.61	0.048 J	0.39 U	0.59	0.18 J	0.031 J	0.15 J
Chrysene	**1**	3.9	1	MG/KG		0.075 J	0.81	0.13 J	0.24 J	0.91	**1.1**	**1.8**	0.44	0.39 U	**4.1**	**1.3**	0.47	1
Dibenz(A,H)Anthracene	**0.33**	0.33	1000	MG/KG		0.037 U	0.086	0.019 J	0.028 J	0.11	0.14	0.22	0.054	0.039 U	**0.64**	0.22	0.063	0.16
Dibenzofuran	7	59	210	MG/KG		0.37 U	0.11 J	0.39 U	0.015 J	0.1 J	0.089 J	0.48	0.036 J	0.39 U	0.37 J	0.083 J	0.024 J	0.086 J

Table 2. Summary of Semivolatile Organic Compounds in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units	Sample Designation:	EP-38	EP-39	EP-39	EP-40	EP-41	EP-42	EP-43	EP-44	EP-45	EP-46	EP-47	EP-48	EP-49
					Sample Date:	05/09/2024	05/09/2024	05/09/2024	05/09/2024	05/09/2024	05/09/2024	01/29/2024	01/29/2024	12/07/2023	11/10/2023	11/10/2023	09/21/2023	09/15/2023
					Sample Depth (ft bls):	5.0 - 5.5	4.5 - 5.0	4.5 - 5.0	3.5 - 4.0	2.0 - 2.5	3.5 - 4.0	8.5 - 9.0	4.5 - 5.0	2.5 - 3.0	5.5 - 6.0	5.5 - 6.0	4.5 - 5.0	6.0 - 6.5
					Normal Sample or Field Duplicate:	N	N	FD	N	N	N	N	N	N	N	N	N	N
Diethyl Phthalate	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
Dimethyl Phthalate	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
Di-N-Butyl Phthalate	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
Di-N-Octylphthalate	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
Fluoranthene	100	100	1000	MG/KG		0.14 J	1.7 J	0.28 J	0.44	1.8	2	4.4	0.87	0.39 U	7.6	2.5	0.93	2.2
Fluorene	30	100	386	MG/KG		0.37 U	0.22 J	0.015 J	0.023 J	0.16 J	0.14 J	0.71	0.06 J	0.39 U	0.45	0.13 J	0.038 J	0.14 J
Hexachlorobenzene	0.33	1.2	3.2	MG/KG		0.037 U	0.039 U	0.039 U	0.036 U	0.037 U	0.039 U	0.041 U	0.038 U	0.039 U	0.038 U	0.04 U	0.041 U	0.04 U
Hexachlorobutadiene	--	--	--	MG/KG		0.074 U	0.079 U	0.079 U	0.073 U	0.075 U	0.079 U	0.083 U	0.078 U	0.079 U	0.076 U	0.082 U	0.082 U	0.082 U
Hexachlorocyclopentadiene	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 UJ	0.4 UJ
Hexachloroethane	--	--	--	MG/KG		0.037 U	0.039 U	0.039 U	0.036 U	0.037 U	0.039 U	0.041 U	0.038 U	0.039 U	0.038 U	0.04 U	0.041 U	0.04 U
Indeno(1,2,3-C,D)Pyrene	**0.5**	0.5	8.2	MG/KG		0.045	0.35 J	0.057 J	0.13	**0.54**	**0.61**	**0.96**	0.26	0.039 U	**3.8**	**1.1**	0.29	**0.74**
Isophorone	--	--	--	MG/KG		0.15 U	0.16 U	0.16 U	0.14 U	0.15 U	0.16 U	0.16 U	0.15 U	0.16 U	0.15 U	0.16 U	0.16 U	0.16 U
Naphthalene	12	100	12	MG/KG		0.37 U	0.062 J	0.39 U	0.016 J	0.13 J	0.12 J	0.57	0.025 J	0.39 U	0.57	0.1 J	0.065 J	0.062 J
Nitrobenzene	--	--	--	MG/KG		0.037 U	0.039 U	0.039 U	0.036 U	0.037 U	0.039 U	0.041 U	0.038 U	0.039 U	0.038 U	0.04 U	0.041 U	0.04 U
N-Nitrosodi-N-Propylamine	--	--	--	MG/KG		0.037 U	0.039 U	0.039 U	0.036 U	0.037 U	0.039 U	0.041 U	0.038 U	0.039 U	0.038 U	0.04 U	0.041 U	0.04 U
N-Nitrosodiphenylamine	--	--	--	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
Pentachlorophenol	0.8	6.7	0.8	MG/KG		0.29 U	0.31 U	0.31 U	0.29 U	0.3 U	0.31 U	0.33 U	0.31 U	0.31 U	0.3 U	0.33 U	0.33 U	0.32 U
Phenanthrene	100	100	1000	MG/KG		0.091 J	1.7 J	0.17 J	0.26 J	1.3	1.3	4.9	0.72	0.39 U	5.8	1.6	0.5	1.7
Phenol	0.33	100	0.33	MG/KG		0.37 U	0.39 U	0.39 U	0.36 U	0.37 U	0.39 U	0.41 U	0.38 U	0.39 U	0.38 U	0.4 U	0.41 U	0.4 U
Pyrene	100	100	1000	MG/KG		0.14 J	1.6 J	0.27 J	0.45	1.8	2.1	3.9	0.94	0.39 UT	7.1	2.4	1.1	2

Table 2. Summary of Semivolatile Organic Compounds in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units	Sample Designation:	WF-A	WF-B	WF-B	WF-C	WF-D	WF-E	WF-F	WF-X
					Sample Date:	10/15/2024	10/15/2024	10/15/2024	10/15/2024	10/15/2024	10/18/2024	10/18/2024	10/15/2024
					Sample Depth (ft bls):	1.5 - 2	1.5 - 2	1.5 - 2	1 - 1.5	1 - 1.5	3 - 3.5	4 - 4.5	0.5 - 1
					Normal Sample or Field Duplicate:	N	N	FD	N	N	N	N	N
1,2,4,5-Tetrachlorobenzene	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
1,4-Dioxane (P-Dioxane)	0.1	13	0.1	MG/KG	0.034 U	0.033 U	0.033 U	0.035 U	0.035 U	0.033 U	0.034 U	0.034 U
2,3,4,6-Tetrachlorophenol	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
2,4,5-Trichlorophenol	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
2,4,6-Trichlorophenol	--	--	--	MG/KG	0.14 U	0.13 U	0.13 U	0.14 U	0.14 U	0.13 U	0.14 U	0.14 U
2,4-Dichlorophenol	--	--	--	MG/KG	0.14 U	0.13 U	0.13 U	0.14 U	0.14 U	0.13 U	0.14 U	0.14 U
2,4-Dimethylphenol	--	--	--	MG/KG	0.34 UT	0.33 UT	0.33 UT	0.35 UT	0.35 UT	0.33 U	0.34 U	0.34 UT
2,4-Dinitrophenol	--	--	--	MG/KG	0.27 U	0.27 U	0.27 U	0.28 U	0.28 U	0.27 U	0.27 U	0.27 U
2,4-Dinitrotoluene	--	--	--	MG/KG	0.069 U	0.068 U	0.068 U	0.07 U	0.071 U	0.068 U	0.068 U	0.069 U
2,6-Dinitrotoluene	--	--	--	MG/KG	0.069 UT	0.068 UT	0.068 UT	0.07 UT	0.071 UT	0.068 U	0.068 U	0.069 UT
2-Chloronaphthalene	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
2-Chlorophenol	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
2-Methylnaphthalene	--	--	--	MG/KG	0.015 J	0.33 U	0.33 U	0.016 J	0.029 J	0.033 J	0.029 J	0.027 J
2-Methylphenol (O-Cresol)	0.33	100	0.33	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
2-Nitroaniline	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
2-Nitrophenol	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
3,3'-Dichlorobenzidine	--	--	--	MG/KG	0.14 U	0.13 U	0.13 U	0.14 U	0.14 U	0.13 U	0.14 U	0.14 U
3-Nitroaniline	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
4,6-Dinitro-2-Methylphenol	--	--	--	MG/KG	0.27 U	0.27 U	0.27 U	0.28 U	0.28 U	0.27 U	0.27 U	0.27 U
4-Bromophenyl Phenyl Ether	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
4-Chloro-3-Methylphenol	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
4-Chloroaniline	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
4-Chlorophenyl Phenyl Ether	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
4-Methylphenol (P-Cresol)	0.33	100	0.33	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
4-Nitroaniline	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
4-Nitrophenol	--	--	--	MG/KG	0.69 U	0.68 U	0.68 U	0.7 U	0.71 U	0.68 U	0.68 U	0.69 U
Acenaphthene	20	100	98	MG/KG	0.02 J	0.33 U	0.33 U	0.03 J	0.035 J	0.079 J	0.096 J	0.052 J
Acenaphthylene	100	100	107	MG/KG	0.056 J	0.33 U	0.33 U	0.046 J	0.061 J	0.063 J	0.049 J	0.062 J
Acetophenone	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
Anthracene	100	100	1000	MG/KG	0.077 J	0.33 U	0.33 U	0.088 J	0.1 J	0.22 J	0.24 J	0.15 J
Atrazine	--	--	--	MG/KG	0.14 U	0.13 U	0.13 U	0.14 U	0.14 U	0.13 UT	0.14 UT	0.14 U
Benzaldehyde	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 UT	0.34 UT	0.34 U
Benzo(A)Anthracene	**1**	1	1	MG/KG	0.24	0.033 U	0.033 U	0.33	0.38	0.7	0.57	0.46
Benzo(A)Pyrene	**1**	1	22	MG/KG	0.25	0.017 J	0.016 J	0.38	0.4	0.74	0.6	0.46
Benzo(B)Fluoranthene	**1**	1	1.7	MG/KG	0.32	0.022 J	0.022 J	0.43	0.53	0.87	0.7	0.54
Benzo(G,H,I)Perylene	100	100	1000	MG/KG	0.18 JT	0.015 JT	0.013 JT	0.26 JT	0.3 JT	0.42	0.36	0.31 JT
Benzo(K)Fluoranthene	**0.8**	3.9	1.7	MG/KG	0.11	0.012 J	0.0092 J	0.21	0.18	0.32	0.27	0.26
Benzyl Butyl Phthalate	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
Biphenyl (Diphenyl)	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
Bis(2-Chloroethoxy) Methane	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	--	--	--	MG/KG	0.034 U	0.033 U	0.033 U	0.035 U	0.035 U	0.033 U	0.034 U	0.034 U
Bis(2-Chloroisopropyl) Ether	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
Bis(2-Ethylhexyl) Phthalate	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.021 J	0.026 J	0.34 U
Caprolactam	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 UT	0.34 UT	0.34 U
Carbazole	--	--	--	MG/KG	0.02 J	0.33 U	0.33 U	0.03 J	0.028 J	0.078 J	0.085 J	0.038 J
Chrysene	**1**	3.9	1	MG/KG	0.28 J	0.019 J	0.017 J	0.31 J	0.36	0.7	0.58	0.44
Dibenz(A,H)Anthracene	**0.33**	0.33	1000	MG/KG	0.03 J	0.033 U	0.033 U	0.068	0.055	0.12	0.11	0.077
Dibenzofuran	7	59	210	MG/KG	0.018 J	0.33 U	0.33 U	0.023 J	0.026 J	0.054 J	0.061 J	0.038 J

Table 2. Summary of Semivolatile Organic Compounds in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units	WF-A	WF-B	WF-B	WF-C	WF-D	WF-E	WF-F	WF-X
Sample Designation:					WF-A	WF-B	WF-B	WF-C	WF-D	WF-E	WF-F	WF-X
Sample Date:					10/15/2024	10/15/2024	10/15/2024	10/15/2024	10/15/2024	10/18/2024	10/18/2024	10/15/2024
Sample Depth (ft bls):					1.5 - 2	1.5 - 2	1.5 - 2	1 - 1.5	1 - 1.5	3 - 3.5	4 - 4.5	0.5 - 1
Normal Sample or Field Duplicate:					N	N	FD	N	N	N	N	N
Diethyl Phthalate	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
Dimethyl Phthalate	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
Di-N-Butyl Phthalate	--	--	--	MG/KG	0.044 J	0.023 J	0.02 J	0.14 J	0.04 J	0.087 J	0.04 J	0.057 J
Di-N-Octylphthalate	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
Fluoranthene	100	100	1000	MG/KG	0.51	0.031 J	0.023 J	0.56	0.67	1.2	1.1	0.87
Fluorene	30	100	386	MG/KG	0.028 J	0.33 U	0.33 U	0.033 J	0.037 J	0.078 J	0.083 J	0.059 J
Hexachlorobenzene	0.33	1.2	3.2	MG/KG	0.034 U	0.033 U	0.033 U	0.035 U	0.035 U	0.033 U	0.034 U	0.034 U
Hexachlorobutadiene	--	--	--	MG/KG	0.069 U	0.068 U	0.068 U	0.07 U	0.071 U	0.068 U	0.068 U	0.069 U
Hexachlorocyclopentadiene	--	--	--	MG/KG	0.34 UJ	0.33 UJ	0.33 UJ	0.35 UJ	0.35 UJ	0.33 UT	0.34 UT	0.34 UJ
Hexachloroethane	--	--	--	MG/KG	0.034 U	0.033 U	0.033 U	0.035 U	0.035 U	0.033 U	0.034 U	0.034 U
Indeno(1,2,3-C,D)Pyrene	**0.5**	0.5	8.2	MG/KG	0.19	0.032 J	0.031 J	0.29	0.32	0.44	0.38	0.32
Isophorone	--	--	--	MG/KG	0.14 U	0.13 U	0.13 U	0.14 U	0.14 U	0.13 U	0.14 U	0.14 U
Naphthalene	12	100	12	MG/KG	0.038 J	0.33 U	0.33 U	0.034 J	0.038 J	0.063 J	0.061 J	0.052 J
Nitrobenzene	--	--	--	MG/KG	0.034 U	0.033 U	0.033 U	0.035 U	0.035 U	0.033 U	0.034 U	0.034 U
N-Nitrosodi-N-Propylamine	--	--	--	MG/KG	0.034 U	0.033 U	0.033 U	0.035 U	0.035 U	0.033 U	0.034 U	0.034 U
N-Nitrosodiphenylamine	--	--	--	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
Pentachlorophenol	0.8	6.7	0.8	MG/KG	0.27 U	0.27 U	0.27 U	0.28 U	0.28 U	0.27 U	0.27 U	0.27 U
Phenanthrene	100	100	1000	MG/KG	0.34	0.02 J	0.014 J	0.36	0.41	0.85	0.97	0.56
Phenol	0.33	100	0.33	MG/KG	0.34 U	0.33 U	0.33 U	0.35 U	0.35 U	0.33 U	0.34 U	0.34 U
Pyrene	100	100	1000	MG/KG	0.55	0.031 J	0.022 J	0.53	0.64	1.3	1.1	0.8

Table 3. Summary of Metals in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units	EP-1	EP-2	EP-3	EP-4	EP-5	EP-6	EP-7	EP-8	EP-9	EP-10	EP-10	EP-11	EP-12	EP-13	EP-14
Sample Designation:					EP-1	EP-2	EP-3	EP-4	EP-5	EP-6	EP-7	EP-8	EP-9	EP-10	EP-10	EP-11	EP-12	EP-13	EP-14
Sample Date:					04/25/2023	04/27/2023	04/25/2023	04/27/2023	04/27/2023	06/05/2023	06/05/2023	06/23/2023	12/07/2023	04/25/2023	04/25/2023	04/25/2023	04/25/2023	04/25/2023	01/03/2024
Sample Depth (ft bls):					0.0 - 0.5	3.0 - 3.5	2.5 - 3.0	4.5 - 5.0	4.5 - 5.0	7.5 - 8.0	7.0 - 7.5	6.5 - 7.0	1.5 - 2.0	30 - 3.5	30 - 3.5	0.5 - 1.0	3.5 - 4.0	3.0 - 3.5	7.5 - 8.0
Normal Sample or Field Duplicate:					N	N	N	N	N	N	N	N	N	N	FD	N	N	N	N
Aluminum	--	--	--	MG/KG	5720	6280	7560	8220	8440	6240	7290	6540	7780	8390	8730	8750	8570	8790	9910
Antimony	--	--	--	MG/KG	0.43 J	0.6 J	0.19 J	0.33 J	0.32 J	0.88 U	0.92 U	0.78 U	0.3 J-	0.39 J	0.25 J	1.1 UJ	0.91 U	0.96 U	0.26 J
Arsenic	**13**	16	16	MG/KG	5.9	6.6	7.4	5.5	6.6	2.1	4.7	2.5	6.3	7.4	6.5	5.3	3.9	3.9	5.6
Barium	350	400	820	MG/KG	104	130	70.9	95.6	75.8	27.9	54.3	25.4	91.9	74.8	69.5	74.1	51.5	34.6	44.1
Beryllium	7.2	72	47	MG/KG	0.35 J	0.36 J	0.4	0.42	0.43 J	0.27 J	0.35 J	0.3 J	0.4 J	0.38 J	0.4 J	0.38 J	0.37	0.37 J	0.43
Cadmium	2.5	4.3	7.5	MG/KG	0.39 J	1.6	0.21 J	0.17 J	0.25 J	0.88 U	0.92 U	0.78 U	0.23 J	0.17 J	0.17 J	0.23 J	0.91 U	0.96 U	0.96 U
Calcium	--	--	--	MG/KG	7710	10100	14900	6100	6600	1200	3470	200	7010	4660	6030	5330	3720	20800	4400 J
Chromium, Total	**30**	180	--	MG/KG	14.2	17.3	23	19.9	19.6	9.8	14.4	8	20	18	16.7	16	15.8	13.4	16.8
Cobalt	--	--	--	MG/KG	5.5	6.3	4.6	7.2	7.1	5.7	4.9	5.5	7.5	6.2	6.5	6.7	6.2	6.1	6.7
Copper	**50**	270	1720	MG/KG	47.4	**58.8**	28	42.9	42.5	16.5	30.5	10.8	36.4 J	48.3	44.3	37.9	19.3	17.1	18
Iron	--	--	--	MG/KG	15300	17800	19800	18300	18100	12700	15300	13500	18500	18900	18700	17500	15900	16900	17900
Lead	**63**	400	450	MG/KG	**292**	**496**	**148**	**383**	**190**	50.3	49.7	4.9	**136**	**83.6**	**85.9**	**79.2**	18.8	16.1	16.6
Magnesium	--	--	--	MG/KG	2290	2560	2880	3120	2930	1970	2560	2230	3160	2960	3260	3010	2870	13200	3230
Manganese	1600	2000	2000	MG/KG	404	325	206	238	251	327	203	216	295	305	305	373	254	315	356
Mercury	**0.18**	0.81	0.73	MG/KG	**0.54**	**0.55**	**0.2**	**0.37**	**0.63**	0.1	0.17 J	0.021	**0.24**	**1.4**	**1.1**	**0.22**	0.048	0.047	0.025
Nickel	**30**	310	130	MG/KG	12.5	14.9	11.6	17.1	17.8	9.2	12.6	10.7	15.9	15.5	15.8	15.2	13.8	13.4	14.3
Potassium	--	--	--	MG/KG	1040	1150	1090	1540	1250	715	1040	509	1430	1160	1140	1160 J	961	1010	1240
Selenium	3.9	180	4	MG/KG	0.54 J	0.61 J	0.42 J	0.43 J	0.41 J	0.14 J	0.2 J	0.98 U	0.32 J	0.31 J	0.32 J	0.29 J	0.16 J	0.15 J	1.2 U
Silver	2	180	8.3	MG/KG	0.14 J	0.21 J	0.37 U	0.14 J	0.11 J	0.35 U	0.37 U	0.31 U	0.11 J	0.41 U	0.41 U	0.46 U	0.36 U	0.39 U	0.38 U
Sodium	--	--	--	MG/KG	221	222	255	293	242	132	153	47 J	244	198	188	231	182	149	220
Thallium	--	--	--	MG/KG	0.14 J	0.14 J	0.096 J	0.13 J	0.12 J	0.067 J	0.086 J	0.037 J	0.14 J	0.1 J	0.098 J	0.1 J	0.077 J	0.088 J	0.079 J
Vanadium	--	--	--	MG/KG	19.4	24.3	20.2	24.7	22.5	14.1	18.2	10.4	21.4	22.7	24	22.9	19.6	17.8	20.8
Zinc	**109**	10000	2480	MG/KG	**159**	**372**	97.4	**115**	**118**	59.7	58.7	33	98.2	85.6	**123**	100	50.4	58.4	48.2

Table 3. Summary of Metals in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units	Sample Designation:	EP-15	EP-16	EP-17	EP-18	EP-19	EP-20	EP-21	EP-22	EP-23	EP-24	EP-24	EP-25	EP-26	EP-27	EP-28
					Sample Date:	11/10/2023	06/23/2023	06/23/2023	06/23/2023	07/17/2023	08/10/2023	08/10/2023	07/20/2023	07/20/2023	01/03/2024	01/03/2024	03/19/2024	01/03/2024	11/10/2023	01/29/2024
					Sample Depth (ft bls):	7.5 - 8.0	7.0 - 7.5	7.0 - 7.5	6.0 - 6.5	10.0 - 10.5	10 - 10.5	3 - 3.5	9.5 - 10.0	9.5 - 10.0	7.5 - 8.0	7.5 - 8.0	3.5 - 4.0	4.5 - 5.0	7.5 - 8.0	6.0 - 6.5
					Normal Sample or Field Duplicate:	N	N	N	N	N	N	N	N	N	N	FD	N	N	N	N
Aluminum	--	--	--	MG/KG		7920	6910	2800	6300	7380	8010	8670	6650	6490	9760	9230	9060	6410	7280	7490
Antimony	--	--	--	MG/KG		1.1 U	0.98 U	0.86 U	0.38 J	0.29 J	1.4	2.3	0.37 J	0.5 J	0.6 J	0.13 J	0.47 J	0.13 J	1 U	0.17 J
Arsenic	**13**	16	16	MG/KG		4.8	3.1	1.1	5.6	9.1	10.3	12.1	6.7	6.9	4.1	2.4	5.3	2.4	3.5	5
Barium	350	400	820	MG/KG		40.6	48.4	18.6	62	91.7	100	176	99.2	92.2	56.1	59.1	69.5	20.1	35.9	51.3
Beryllium	7.2	72	47	MG/KG		0.33 J	0.25 J	0.28 J	0.33	0.36 J	0.39	0.39	0.35 J	0.33 J	0.35 J	0.38	0.4	0.27 J	0.34 J	0.38 J
Cadmium	2.5	4.3	7.5	MG/KG		1.1 U	0.98 U	0.86 U	0.17 J	1.1 U	0.38 J	0.84 J	0.21 J	0.35 J	0.12 J	0.11 J	0.25 J	0.88 U	1 U	0.13 J
Calcium	--	--	--	MG/KG		4240	498	2400	7000	6290	8330	10600	15500	8400	16900 J	1170 J	5540	419	1980	5360
Chromium, Total	**30**	180	--	MG/KG		15.1	12.4	6.3	14.2	20.9	20.4	23.3	**386**	15.9	**35.2 J**	11.5 J	19.6	10.8	15.4	17.8
Cobalt	--	--	--	MG/KG		5.6	4.8	2.5	5	6.5	6.7	6.8	6.4	5.5	5.2	3.9	6.5	3.5	6.8	5.5
Copper	**50**	270	1720	MG/KG		19.9	17.8	9	27.9	28.1	43.6	**67.1**	41.9	44.4	19.7	12.1	36.2	8.9	18.6	23.8
Iron	--	--	--	MG/KG		16600	16400	8280	12900	17100	16700	21200	52500	14100	13000	11400	20000	13100	38700	15200
Lead	**63**	400	450	MG/KG		19.8	6.3	5.1	**95.9**	**247**	**229**	**443**	**353**	**222**	23.7 J	6.3 J	**83.4**	4.5	32.4	42.6
Magnesium	--	--	--	MG/KG		2880	2440	2380	2660	2940	3220	3620	3070	2620	3720	2880	2990	1880	2610	2770
Manganese	1600	2000	2000	MG/KG		288	283	143	218	296	283	296	495	204	211 J	97.7 J	292	153	366	241
Mercury	**0.18**	0.81	0.73	MG/KG		0.05	0.027	0.017 J	**0.22**	**0.69**	**0.4**	**0.49**	**0.29**	**0.38**	0.011 J	0.02 U	**0.3**	0.019 U	0.05	0.13
Nickel	**30**	310	130	MG/KG		13	11.9	7.4	12.4	14.2	15.4	17.5	29.4	14	18.1	12.6	17.7	10.6	12.7	13.1
Potassium	--	--	--	MG/KG		882	811	604	1010	1710	1950	1930	1270	1290	940	1000	1020	847	740	1160 B
Selenium	3.9	180	4	MG/KG		1.3 U	1.2 U	1.1 U	0.29 J	0.28 J	0.43 J	0.71 J	0.36 J	0.64 J	1.2 U	1.1 U	0.26 J	1.1 U	0.14 J	0.19 J
Silver	2	180	8.3	MG/KG		0.43 U	0.39 U	0.34 U	0.076 J	0.13 J	0.1 J	0.2 J	0.11 J	0.13 J	0.38 U	0.36 U	0.15 J	0.35 U	0.41 U	0.44 U
Sodium	--	--	--	MG/KG		172	128	127	199	248	327	267	304	314	168 J	92.5 J	294	56 J	194	132
Thallium	--	--	--	MG/KG		0.18 J	0.053 J	0.043 J	0.092 J	0.11 J	0.14 J	0.17 J	0.097 J	0.11 J	0.065 J	0.066 J	0.097 J	0.041 J	0.19 J	0.087 J
Vanadium	--	--	--	MG/KG		16.6	12.5	9.8	16.6	21.7	24.8	27.8 J	29	19.3	22.1	16	23.9	16.4	19.9	18.9
Zinc	**109**	10000	2480	MG/KG		48	37.6	18.3	85.5	103	**142**	**352**	93.6	**203**	53.4	40.1	**118**	25.5	57.4	63.4

Table 3. Summary of Metals in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

			Sample Designation:	EP-29	EP-30	EP-31	EP-32	EP-33	EP-34	EP-35	EP-36	EP-37	EP-38	EP-39	EP-39	EP-40	EP-41	EP-42
			Sample Date:	12/07/2023	11/10/2023	08/22/2023	08/10/2023	06/05/2023	09/15/2023	09/15/2023	11/10/2023	01/29/2024	05/09/2024	05/09/2024	05/09/2024	05/09/2024	05/09/2024	05/09/2024
			Sample Depth (ft bls):	5.5 - 6.0	6.5 - 7.0	9.0 - 9.5	9 - 9.5	4.0 - 4.5	6.5 - 7.0	4.5 - 5.0	7.5 - 8.0	6.5 - 7.0	5.0 - 5.5	4.5 - 5.0	4.5 - 5.0	3.5 - 4.0	2.0 - 2.5	3.5 - 4.0
			Normal Sample or Field Duplicate:	N	N	N	N	N	N	N	N	N	N	N	FD	N	N	N
Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units														
Aluminum	--	--	--	MG/KG	4200	4460	5160	8530	7490	7030	7760	5750	9310	7430	10900	8550	6490	8030	8750
Antimony	--	--	--	MG/KG	1 U	1 U	0.29 J	0.81 J	0.36 J	0.36 J	0.47 J	0.91 U	1.3 U	0.26 J	0.36 J	0.29 J	0.38 J	0.86	0.91
Arsenic	**13**	16	16	MG/KG	1.4	1.3	5.7	**13.8**	7.2	7	8.5	2.2	4.8	4.9	7.9	5.5	5.1	**17.7**	**26.4**
Barium	350	400	820	MG/KG	24.1	46.5	31.9	91.1	147	117	138	35.6	33.7	40.5	51.3	50	53	79.4	99.4
Beryllium	7.2	72	47	MG/KG	0.32 J	0.31 J	0.31 J	0.4	0.4 J	0.27 J	0.32 J	0.51	0.44 J	0.34 J	0.57	0.41	0.36	0.38	0.4
Cadmium	2.5	4.3	7.5	MG/KG	1 U	0.25 J	0.14 J	0.16 J	0.23 J	0.27 J	0.28 J	0.11 J	1.3 U	0.88 U	0.098 J	0.12 J	0.42 J	0.14 J	0.16 J
Calcium	--	--	--	MG/KG	805	2420	2350	23400	10600	11900	14200	747	969	3050	2280	3320	10200	9580	7870
Chromium, Total	**30**	180	--	MG/KG	10.5	9.4	8.2	**33.6**	19	19	24.8	19.4	14	13.2	20.4	16	14.5	18.3	21.4
Cobalt	--	--	--	MG/KG	4.5	5.8	4.4	6.4	6.8	6.3	6.3	6.9	8.3	5	9.2 J	5.5 J	5.7	5.9	6.6
Copper	**50**	270	1720	MG/KG	10.1	38.8	**57.7**	36.2	40.4	47.7	40.8	20.8	16.2	22.3	21.6	20.2	**68.1**	36.7	**105**
Iron	--	--	--	MG/KG	12800	9530	9140	18900	14900	15600	16000	23400	19700	14400	20200	17500	15500	15200	26200
Lead	**63**	400	450	MG/KG	4.5	6.4	**82**	**137**	**945**	**219**	**170**	6.9	10.7	30.7	37.1	24.7	52.5	**160**	**179**
Magnesium	--	--	--	MG/KG	1750	2800	1960	4390	3270	4400	4360	2080	3530	2260	2970	2740	3970	2820	3300
Manganese	1600	2000	2000	MG/KG	125	275	89.3	331	328	224	272	862	585	163	308	238	294	214	293
Mercury	**0.18**	0.81	0.73	MG/KG	0.018 U	0.019 U	0.11	**0.68**	**1.3**	**0.3**	**0.37**	0.019 U	0.02	0.054	0.019 J	0.033	0.087	**0.25**	**0.3**
Nickel	**30**	310	130	MG/KG	9.2	16.9	9.3	16.8	16.2	16.6	21.9	13.9	14.9	10.5	14.9	12.4	11.1	14.9	16.9
Potassium	--	--	--	MG/KG	686	1410	754	1870	1400	2000	1830	840	915 B	1120	1220	1380	994	1560	1940
Selenium	3.9	180	4	MG/KG	1.3 U	1.3 U	0.43 J	0.33 J	0.74 J	0.35 J	0.43 J	1.1 U	1.6 U	0.12 J	0.17 J	0.16 J	0.16 J	0.37 J	0.33 J
Silver	2	180	8.3	MG/KG	0.41 U	0.42 U	0.12 J	0.14 J	0.14 J	0.11 J	0.12 J	0.36 U	0.5 U	0.35 U	0.35 U	0.37 U	0.34 U	0.35 U	0.11 J
Sodium	--	--	--	MG/KG	95.1 J	242	150	326	334	270	311	103	71.6 J	146	106	124	156	207	258
Thallium	--	--	--	MG/KG	0.061 J	0.18 J	0.053 J	0.13 J	0.15 J	0.13 J	0.15 J	0.25 J	0.069 J	0.071 J	0.093 J	0.086 J	0.081 J	0.1 J	0.14 J
Vanadium	--	--	--	MG/KG	15.3	13.4	10	26.1	22.4	23.8	23.7	22.3	17.3	27.7	27	22.7	21	22.6	25.9
Zinc	**109**	10000	2480	MG/KG	19.2	97.4	70.9	**112**	**121**	**138**	**119**	29.8	48.1	40.2	64.9 J	49.5 J	**118**	75.9	**122**

Table 3. Summary of Metals in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

				Sample Designation:	EP-43	EP-44	EP-45	EP-46	EP-47	EP-48	EP-49	HS1_B	HS1_SW1	HS1_SW2	HS1_SW3	HS1_SW4	HS1_SW5	HS1_SW6	HS2_B
				Sample Date:	01/29/2024	01/29/2024	12/07/2023	11/10/2023	11/10/2023	09/21/2023	09/15/2023	09/07/2022	09/07/2022	09/07/2022	09/07/2022	09/07/2022	09/07/2022	09/07/2022	11/17/2022
				Sample Depth (ft bls):	8.5 - 9.0	4.5 - 5.0	2.5 - 3.0	5.5 - 6.0	5.5 - 6.0	4.5 - 5.0	6.0 - 6.5	5 - 5	5 - 5	5 - 5	5 - 5	5 - 5	5 - 5	5 - 5	8 - 8.5
				Normal Sample or Field Duplicate:	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units															
Aluminum	--	--	--	MG/KG	8110	8300	11200	7790	8460	6540	7340	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	--	--	--	MG/KG	1 U	0.19 J	1.1 U	0.34 J	0.41 J	0.86 J	0.31 J	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	**13**	16	16	MG/KG	3.8	5.1	3.6	10.3	12.2	6.7	8.6	NA	NA	NA	NA	NA	NA	NA	NA
Barium	350	400	820	MG/KG	52	56.9	32.2	82.1	86	79.2	111	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	7.2	72	47	MG/KG	0.46	0.4 J	0.54	0.39 J	0.4 J	0.28 J	0.31 J	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	2.5	4.3	7.5	MG/KG	1 U	0.16 J	1.1 U	0.36 J	0.32 J	0.14 J	0.21 J	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	--	--	--	MG/KG	2350	9070	904	7320	17500	6510	11100	NA	NA	NA	NA	NA	NA	NA	NA
Chromium, Total	**30**	180	--	MG/KG	19.4	17.7	16.9	16	**58.1**	17.8	19.3	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	--	--	--	MG/KG	6.3	5.7	6.7	6.3	7	7	6.6	NA	NA	NA	NA	NA	NA	NA	NA
Copper	**50**	270	1720	MG/KG	22.6	26.4	14.3	50	**53.7**	30.4	37.9	NA	NA	NA	NA	NA	NA	NA	NA
Iron	--	--	--	MG/KG	18700	16000	18400	15100	17400	13300	15700	NA	NA	NA	NA	NA	NA	NA	NA
Lead	**63**	400	450	MG/KG	30	59.6	9.2	**195**	**133**	**90.6**	**166**	**215**	**163**	**128**	**203**	**147**	**119**	**124**	**448**
Magnesium	--	--	--	MG/KG	2670	3360	3040	2920	5990	3350	4520	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	1600	2000	2000	MG/KG	244	289	419	288	286	192	297	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	**0.18**	0.81	0.73	MG/KG	0.058	0.13	0.019	**5.7**	**0.48**	**0.65**	**0.28**	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	**30**	310	130	MG/KG	13.7	14.5	15.9	14.6	**31.9**	17.7	15.6	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	--	--	--	MG/KG	1250 B	1310 B	850	1200	1100	1990	2220	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	3.9	180	4	MG/KG	0.15 J	0.2 J	0.14 J	0.66 J	0.6 J	0.32 J	0.36 J	NA	NA	NA	NA	NA	NA	NA	NA
Silver	2	180	8.3	MG/KG	0.42 U	0.44 U	0.44 U	0.11 J	0.45 U	0.37 U	0.45 U	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	--	--	MG/KG	148	158	197	215	499	211	271	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	--	--	--	MG/KG	0.12 J	0.11 J	0.088 J	0.3 J	0.2 J	0.12 J	0.15 J	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	--	--	--	MG/KG	25.2	21.5	19.4	19.4	24.3	20.6	24.7	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	**109**	10000	2480	MG/KG	56.3	64.2	36.4	**149**	**137**	74	**110**	NA	NA	NA	NA	NA	NA	NA	NA

Table 3. Summary of Metals in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

			Sample Designation:	HS2_SW1	HS2_SW2	HS2_SW3	HS2_SW4	HS2_SW5	HS2_SW6	HS2_SW7	HS2_SW8	HS2_SW9	HS2_SW10	HS2_SW11	HS2_SW12	HS2_SW13	HS2_SW14	HS2_SW15
			Sample Date:	11/17/2022	11/17/2022	11/17/2022	11/17/2022	11/17/2022	11/17/2022	11/30/2022	11/30/2022	11/30/2022	11/30/2022	12/12/2022	12/12/2022	12/12/2022	12/28/2022	12/28/2022
			Sample Depth (ft bls):	8 - 8.5	8 - 8.5	8 - 8.5	8 - 8.5	8 - 8.5	8 - 8.5	8 - 8.5	8 - 8.5	8 - 8.5	8 - 8.5	8 - 8.5	8 - 8.5	8 - 8.5	8 - 8.5	8 - 8.5
			Normal Sample or Field Duplicate:	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units														
Aluminum	--	--	--	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	--	--	--	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	**13**	16	16	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	350	400	820	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	7.2	72	47	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	2.5	4.3	7.5	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	--	--	--	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium, Total	**30**	180	--	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	--	--	--	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	**50**	270	1720	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	--	--	--	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	**63**	400	450	MG/KG	**356**	**338**	**1130**	**11400**	**513**	**446**	**1250**	**483**	**1300**	**444**	**1580**	**2310**	**2410**	**371**	**251**
Magnesium	--	--	--	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	1600	2000	2000	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	**0.18**	0.81	0.73	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	**30**	310	130	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	--	--	--	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	3.9	180	4	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	2	180	8.3	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	--	--	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	--	--	--	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	--	--	--	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	**109**	10000	2480	MG/KG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 3. Summary of Metals in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units	HS2_SW16	HS2_SW17	WF-A	WF-B	WF-B	WF-C	WF-D	WF-E	WF-F	WF-X
Sample Designation:					HS2_SW16	HS2_SW17	WF-A	WF-B	WF-B	WF-C	WF-D	WF-E	WF-F	WF-X
Sample Date:					12/28/2022	12/28/2022	10/15/2024	10/15/2024	10/15/2024	10/15/2024	10/15/2024	10/18/2024	10/18/2024	10/15/2024
Sample Depth (ft bls):					8 - 8.5	8 - 8.5	1.5 - 2	1.5 - 2	1.5 - 2	1 - 1.5	1 - 1.5	3 - 3.5	4 - 4.5	0.5 - 1
Normal Sample or Field Duplicate:					N	N	N	N	FD	N	N	N	N	N
Aluminum	--	--	--	MG/KG	NA	NA	6300	5250	6820	7320	6530	5260	5580	7390
Antimony	--	--	--	MG/KG	NA	NA	0.71 J	0.76 U	0.78 U	0.89	0.74 J	0.19 J	0.18 J	1.1
Arsenic	**13**	16	16	MG/KG	NA	NA	5.5	1.6	1.4	6.6	9.6	5.4	5.9	12.9
Barium	350	400	820	MG/KG	NA	NA	78.5	63.6	87.9	95.3	97.8	77.1	69.3	104
Beryllium	7.2	72	47	MG/KG	NA	NA	0.26 J	0.18 J	0.15 J	0.3 J	0.31 J	0.22 J	0.31 J	0.36
Cadmium	2.5	4.3	7.5	MG/KG	NA	NA	0.12 J	0.76 U	0.78 U	0.16 J	0.2 J	0.15 J	0.17 J	0.24 J
Calcium	--	--	--	MG/KG	NA	NA	28200	8100	11200	13700	7450	6670	8850	9910
Chromium, Total	**30**	180	--	MG/KG	NA	NA	21.3	19.3 J	**40.6 J**	20.8	25.6	19.7	13.8	29.2
Cobalt	--	--	--	MG/KG	NA	NA	5.2	4.1	5.7	6.3	5.7	4.6	5.4	6.4
Copper	**50**	270	1720	MG/KG	NA	NA	40.6	34.7	38.8	35.9	45.7	30.9	31.6	47.5
Iron	--	--	--	MG/KG	NA	NA	14000	10400	14600	15200	16500	13400	13000	16800
Lead	**63**	400	450	MG/KG	**378**	**449**	**150**	10	14.6	**105**	**163**	**125**	**126**	**231**
Magnesium	--	--	--	MG/KG	NA	NA	15800	4760	6420	7820	3090	3690	3200	3290
Manganese	1600	2000	2000	MG/KG	NA	NA	236	162	191	216	338	185	243	300
Mercury	**0.18**	0.81	0.73	MG/KG	NA	NA	**0.23**	0.017 U	0.0097 J	**0.29**	**0.28**	**1.7**	**1.2**	**0.37**
Nickel	**30**	310	130	MG/KG	NA	NA	14	9.8 J	16.1 J	14.3	15.7	12	11.9	16.2
Potassium	--	--	--	MG/KG	NA	NA	2300	2760 J	4290 J	2890	1810	1750	1400	1800
Selenium	3.9	180	4	MG/KG	NA	NA	0.22 J	0.14 J	0.97 U	0.33 J	0.35 J	0.31 J	0.34 J	0.38 J
Silver	2	180	8.3	MG/KG	NA	NA	0.31 U	0.3 U	0.31 U	0.33 U	0.076 J	0.35 U	0.37 U	0.11 J
Sodium	--	--	--	MG/KG	NA	NA	151	101	107	133	220	109	144	401
Thallium	--	--	--	MG/KG	NA	NA	0.14 J	0.16 J	0.24 J	0.17 J	0.13 J	0.12 J	0.094 J	0.13 J
Vanadium	--	--	--	MG/KG	NA	NA	22.7	20.9	31.4	26.3	23.2	17.4	17.6	23.8
Zinc	**109**	10000	2480	MG/KG	NA	NA	73.4	21.1	24.2	80.2	**118**	**290**	91.3	**112**

Table 4. Summary of Polychlorinated Biphenyls in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

			Sample Designation:	EP-1	EP-2	EP-3	EP-4	EP-5	EP-6	EP-7	EP-8	EP-9	EP-10	EP-10	EP-11	EP-12	EP-13
			Sample Date:	04/25/2023	04/27/2023	04/25/2023	04/27/2023	04/27/2023	06/05/2023	06/05/2023	06/23/2023	12/07/2023	04/25/2023	04/25/2023	04/25/2023	04/25/2023	04/25/2023
			Sample Depth (ft bls):	0.0 - 0.5	3.0 - 3.5	2.5 - 3.0	4.5 - 5.0	4.5 - 5.0	7.5 - 8.0	7.0 - 7.5	6.5 - 7.0	1.5 - 2.0	30 - 3.5	30 - 3.5	0.5 - 1.0	3.5 - 4.0	3.0 - 3.5
			Normal Sample or Field Duplicate:	N	N	N	N	N	N	N	N	N	N	FD	N	N	N
Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units														
PCB-1016 (Aroclor 1016)	--	--	--	MG/KG	0.076 U	0.079 U	0.079 U	0.078 U	0.081 U	0.081 U	0.081 U	0.071 U	0.075 U	0.077 U	0.079 U	0.077 U	0.079 U	0.078 U
PCB-1221 (Aroclor 1221)	--	--	--	MG/KG	0.076 U	0.079 U	0.079 U	0.078 U	0.081 U	0.081 U	0.081 U	0.071 U	0.075 U	0.077 U	0.079 U	0.077 U	0.079 U	0.078 U
PCB-1232 (Aroclor 1232)	--	--	--	MG/KG	0.076 U	0.079 U	0.079 U	0.078 U	0.081 U	0.081 U	0.081 U	0.071 U	0.075 U	0.077 U	0.079 U	0.077 U	0.079 U	0.078 U
PCB-1242 (Aroclor 1242)	--	--	--	MG/KG	0.076 U	0.079 U	0.079 U	0.078 U	0.081 U	0.081 U	0.081 U	0.071 U	0.075 U	0.077 U	0.079 U	0.077 U	0.079 U	0.15
PCB-1248 (Aroclor 1248)	--	--	--	MG/KG	0.076 U	0.079 U	0.079 U	0.078 U	0.081 U	0.081 U	0.081 U	0.071 U	0.075 U	0.077 U	0.079 U	0.077 U	0.079 U	0.078 U
PCB-1254 (Aroclor 1254)	--	--	--	MG/KG	0.076 U	0.079 U	0.079 U	0.078 U	0.081 U	0.081 U	0.081 U	0.071 U	0.075 U	0.077 U	0.079 U	0.077 U	0.079 U	0.078 U
PCB-1260 (Aroclor 1260)	--	--	--	MG/KG	0.076 U	0.079 U	0.079 U	0.078 U	0.081 U	0.081 U	0.081 U	0.071 U	0.075 U	0.077 U	0.079 U	0.077 U	0.079 U	0.078 U
PCB-1262 (Aroclor 1262)	--	--	--	MG/KG	0.076 U	0.079 U	0.079 U	0.078 U	0.081 U	0.081 U	0.081 U	0.071 U	0.075 U	0.077 U	0.079 U	0.077 U	0.079 U	0.078 U
PCB-1268 (Aroclor 1268)	--	--	--	MG/KG	0.076 U	0.079 U	0.079 U	0.078 U	0.081 U	0.081 U	0.081 U	0.071 U	0.075 U	0.077 U	0.079 U	0.077 U	0.079 U	0.078 U
Polychlorinated Biphenyl (PCBs)	**0.1**	1	3.2	MG/KG	0.076 U	0.079 U	0.079 U	0.078 U	0.081 U	0.081 U	0.081 U	0.071 U	0.075 U	0.077 U	0.079 U	0.077 U	0.079 U	**0.15**

Table 4. Summary of Polychlorinated Biphenyls in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

			Sample Designation:		EP-14	EP-15	EP-16	EP-17	EP-18	EP-19	EP-20	EP-21	EP-22	EP-23	EP-24	EP-24	EP-25	EP-26
			Sample Date:		01/03/2024	11/10/2023	06/23/2023	06/23/2023	06/23/2023	07/17/2023	08/10/2023	08/10/2023	07/20/2023	07/20/2023	01/03/2024	01/03/2024	03/19/2024	01/03/2024
			Sample Depth (ft bls):		7.5 - 8.0	7.5 - 8.0	7.0 - 7.5	7.0 - 7.5	6.0 - 6.5	10.0 - 10.5	10 - 10.5	3 - 3.5	9.5 - 10.0	9.5 - 10.0	7.5 - 8.0	7.5 - 8.0	3.5 - 4.0	4.5 - 5.0
			Normal Sample or Field Duplicate:		N	N	N	N	N	N	N	N	N	N	N	FD	N	N
Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units														
PCB-1016 (Aroclor 1016)	--	--	--	MG/KG	0.083 U	0.08 U	0.078 U	0.075 U	0.071 U	0.082 U	0.072 U	0.074 U	0.081 U	0.079 U	0.08 U	0.081 U	0.08 U	0.08 U
PCB-1221 (Aroclor 1221)	--	--	--	MG/KG	0.083 U	0.08 U	0.078 U	0.075 U	0.071 U	0.082 U	0.072 U	0.074 U	0.081 U	0.079 U	0.08 U	0.081 U	0.08 U	0.08 U
PCB-1232 (Aroclor 1232)	--	--	--	MG/KG	0.083 U	0.08 U	0.078 U	0.075 U	0.071 U	0.082 U	0.072 U	0.074 U	0.081 U	0.079 U	0.08 U	0.081 U	0.08 U	0.08 U
PCB-1242 (Aroclor 1242)	--	--	--	MG/KG	0.083 U	0.08 U	0.078 U	0.075 U	0.071 U	0.082 U	0.072 U	0.074 U	0.081 U	0.079 U	0.08 U	0.081 U	0.08 U	0.08 U
PCB-1248 (Aroclor 1248)	--	--	--	MG/KG	0.083 U	0.08 U	0.078 U	0.075 U	0.071 U	0.082 U	0.072 U	0.074 U	0.081 U	0.079 U	0.08 U	0.081 U	0.08 U	0.46
PCB-1254 (Aroclor 1254)	--	--	--	MG/KG	0.083 U	0.08 U	0.078 U	0.075 U	0.071 U	0.082 U	0.072 U	0.074 U	0.081 U	0.079 U	0.08 U	0.081 U	0.08 U	0.08 U
PCB-1260 (Aroclor 1260)	--	--	--	MG/KG	0.083 U	0.08 U	0.078 U	0.075 U	0.071 U	0.082 U	0.072 U	0.074 U	0.081 U	0.079 U	0.08 U	0.081 U	0.08 U	0.08 U
PCB-1262 (Aroclor 1262)	--	--	--	MG/KG	0.083 U	0.08 U	0.078 U	0.075 U	0.071 U	0.082 U	0.072 U	0.074 U	0.081 U	0.079 U	0.08 U	0.081 U	0.08 U	0.08 U
PCB-1268 (Aroclor 1268)	--	--	--	MG/KG	0.083 U	0.08 U	0.078 U	0.075 U	0.071 U	0.082 U	0.072 U	0.074 U	0.081 U	0.079 U	0.08 U	0.081 U	0.08 U	0.08 U
Polychlorinated Biphenyl (PCBs)	**0.1**	1	3.2	MG/KG	0.083 U	0.08 U	0.078 U	0.075 U	0.071 U	0.082 U	0.072 U	0.074 U	0.081 U	0.079 U	0.08 U	0.081 U	0.08 U	**0.46**

Table 4. Summary of Polychlorinated Biphenyls in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

			Sample Designation:		EP-27	EP-28	EP-29	EP-30	EP-31	EP-32	EP-33	EP-34	EP-35	EP-36	EP-37	EP-38	EP-39	EP-39
			Sample Date:		11/10/2023	01/29/2024	12/07/2023	11/10/2023	08/22/2023	08/10/2023	06/05/2023	09/15/2023	09/15/2023	11/10/2023	01/29/2024	05/09/2024	05/09/2024	05/09/2024
			Sample Depth (ft bls):		7.5 - 8.0	6.0 - 6.5	5.5 - 6.0	6.5 - 7.0	9.0 - 9.5	9 - 9.5	4.0 - 4.5	6.5 - 7.0	4.5 - 5.0	7.5 - 8.0	6.5 - 7.0	5.0 - 5.5	4.5 - 5.0	4.5 - 5.0
			Normal Sample or Field Duplicate:		N	N	N	N	N	N	N	N	N	N	N	N	N	FD
Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units														
PCB-1016 (Aroclor 1016)	--	--	--	MG/KG	0.078 U	0.083 U	0.075 U	0.081 U	0.082 U	0.082 U	0.081 U	0.079 U	0.079 U	0.077 U	0.087 U	0.074 U	0.078 U	0.079 U
PCB-1221 (Aroclor 1221)	--	--	--	MG/KG	0.078 U	0.083 U	0.075 U	0.081 U	0.082 U	0.082 U	0.081 U	0.079 U	0.079 U	0.077 U	0.087 U	0.074 U	0.078 U	0.079 U
PCB-1232 (Aroclor 1232)	--	--	--	MG/KG	0.078 U	0.083 U	0.075 U	0.081 U	0.082 U	0.082 U	0.081 U	0.079 U	0.079 U	0.077 U	0.087 U	0.074 U	0.078 U	0.079 U
PCB-1242 (Aroclor 1242)	--	--	--	MG/KG	0.078 U	0.083 U	0.075 U	0.081 U	0.082 U	0.082 U	0.081 U	0.079 U	0.079 U	0.077 U	0.087 U	0.074 U	0.078 U	0.079 U
PCB-1248 (Aroclor 1248)	--	--	--	MG/KG	0.078 U	0.083 U	0.075 U	0.081 U	0.082 U	0.082 U	0.081 U	0.079 U	0.079 U	0.077 U	0.087 U	0.074 U	0.078 U	0.079 U
PCB-1254 (Aroclor 1254)	--	--	--	MG/KG	0.078 U	0.083 U	0.075 U	0.081 U	0.082 U	0.082 U	0.081 U	0.079 U	0.079 U	0.077 U	0.087 U	0.074 U	0.078 U	0.079 U
PCB-1260 (Aroclor 1260)	--	--	--	MG/KG	0.078 U	0.083 U	0.075 U	0.081 U	0.082 U	0.082 U	0.081 U	0.079 U	0.079 U	0.077 U	0.087 U	0.074 U	0.078 U	0.079 U
PCB-1262 (Aroclor 1262)	--	--	--	MG/KG	0.078 U	0.083 U	0.075 U	0.081 U	0.082 U	0.082 U	0.081 U	0.079 U	0.079 U	0.077 U	0.087 U	0.074 U	0.078 U	0.079 U
PCB-1268 (Aroclor 1268)	--	--	--	MG/KG	0.078 U	0.083 U	0.075 U	0.081 U	0.082 U	0.082 U	0.081 U	0.079 U	0.079 U	0.077 U	0.087 U	0.074 U	0.078 U	0.079 U
Polychlorinated Biphenyl (PCBs)	**0.1**	1	3.2	MG/KG	0.078 U	0.083 U	0.075 U	0.081 U	0.082 U	0.082 U	0.081 U	0.079 U	0.079 U	0.077 U	0.087 U	0.074 U	0.078 U	0.079 U

Table 4. Summary of Polychlorinated Biphenyls in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units	EP-40	EP-41	EP-42	EP-43	EP-44	EP-45	EP-46	EP-47	EP-48	EP-49	WF-A	WF-B	WF-B	WF-C
Sample Designation:					EP-40	EP-41	EP-42	EP-43	EP-44	EP-45	EP-46	EP-47	EP-48	EP-49	WF-A	WF-B	WF-B	WF-C
Sample Date:					05/09/2024	05/09/2024	05/09/2024	01/29/2024	01/29/2024	12/07/2023	11/10/2023	11/10/2023	09/21/2023	09/15/2023	10/15/2024	10/15/2024	10/15/2024	10/15/2024
Sample Depth (ft bls):					3.5 - 4.0	2.0 - 2.5	3.5 - 4.0	8.5 - 9.0	4.5 - 5.0	2.5 - 3.0	5.5 - 6.0	5.5 - 6.0	4.5 - 5.0	6.0 - 6.5	1.5 - 2	1.5 - 2	1.5 - 2	1 - 1.5
Normal Sample or Field Duplicate:					N	N	N	N	N	N	N	N	N	N	N	N	FD	N
PCB-1016 (Aroclor 1016)	--	--	--	MG/KG	0.073 U	0.075 U	0.079 U	0.083 U	0.078 U	0.079 U	0.077 U	0.082 U	0.083 U	0.082 U	0.069 U	0.068 U	0.068 U	0.071 U
PCB-1221 (Aroclor 1221)	--	--	--	MG/KG	0.073 U	0.075 U	0.079 U	0.083 U	0.078 U	0.079 U	0.077 U	0.082 U	0.083 U	0.082 U	0.069 U	0.068 U	0.068 U	0.071 U
PCB-1232 (Aroclor 1232)	--	--	--	MG/KG	0.073 U	0.075 U	0.079 U	0.083 U	0.078 U	0.079 U	0.077 U	0.082 U	0.083 U	0.082 U	0.069 U	0.068 U	0.068 U	0.071 U
PCB-1242 (Aroclor 1242)	--	--	--	MG/KG	0.073 U	0.075 U	0.079 U	0.083 U	0.078 U	0.079 U	0.077 U	0.082 U	0.083 U	0.082 U	0.069 U	0.068 U	0.068 U	0.071 U
PCB-1248 (Aroclor 1248)	--	--	--	MG/KG	0.073 U	0.075 U	0.079 U	0.083 U	0.078 U	0.079 U	0.077 U	0.082 U	0.083 U	0.082 U	0.069 U	0.068 U	0.068 U	0.071 U
PCB-1254 (Aroclor 1254)	--	--	--	MG/KG	0.073 U	0.075 U	0.079 U	0.083 U	0.078 U	0.079 U	0.077 U	0.082 U	0.083 U	0.082 U	0.069 U	0.068 U	0.068 U	0.071 U
PCB-1260 (Aroclor 1260)	--	--	--	MG/KG	0.073 U	0.075 U	0.079 U	0.083 U	0.078 U	0.079 U	0.077 U	0.082 U	0.083 U	0.082 U	0.069 U	0.068 U	0.068 U	0.071 U
PCB-1262 (Aroclor 1262)	--	--	--	MG/KG	0.073 U	0.075 U	0.079 U	0.083 U	0.078 U	0.079 U	0.077 U	0.082 U	0.083 U	0.082 U	0.069 U	0.068 U	0.068 U	0.071 U
PCB-1268 (Aroclor 1268)	--	--	--	MG/KG	0.073 U	0.075 U	0.079 U	0.083 U	0.078 U	0.079 U	0.077 U	0.082 U	0.083 U	0.082 U	0.069 U	0.068 U	0.068 U	0.071 U
Polychlorinated Biphenyl (PCBs)	**0.1**	1	3.2	MG/KG	0.073 U	0.075 U	0.079 U	0.083 U	0.078 U	0.079 U	0.077 U	0.082 U	0.083 U	0.082 U	0.069 U	0.068 U	0.068 U	0.071 U

Table 4. Summary of Polychlorinated Biphenyls in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

				Sample Designation:	WF-D	WF-E	WF-F	WF-X
				Sample Date:	10/15/2024	10/18/2024	10/18/2024	10/15/2024
				Sample Depth (ft bls):	1 - 1.5	3 - 3.5	4 - 4.5	0.5 - 1
				Normal Sample or Field Duplicate:	N	N	N	N
Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units				
PCB-1016 (Aroclor 1016)	--	--	--	MG/KG	0.071 U	0.068 U	0.068 U	0.069 U
PCB-1221 (Aroclor 1221)	--	--	--	MG/KG	0.071 U	0.068 U	0.068 U	0.069 U
PCB-1232 (Aroclor 1232)	--	--	--	MG/KG	0.071 U	0.068 U	0.068 U	0.069 U
PCB-1242 (Aroclor 1242)	--	--	--	MG/KG	0.071 U	0.068 U	0.068 U	0.069 U
PCB-1248 (Aroclor 1248)	--	--	--	MG/KG	0.071 U	0.068 U	0.068 U	0.069 U
PCB-1254 (Aroclor 1254)	--	--	--	MG/KG	0.071 U	0.068 U	0.068 U	0.069 U
PCB-1260 (Aroclor 1260)	--	--	--	MG/KG	0.071 U	0.068 U	0.068 U	0.069 U
PCB-1262 (Aroclor 1262)	--	--	--	MG/KG	0.071 U	0.068 U	0.068 U	0.069 U
PCB-1268 (Aroclor 1268)	--	--	--	MG/KG	0.071 U	0.068 U	0.068 U	0.069 U
Polychlorinated Biphenyl (PCBs)	**0.1**	1	3.2	MG/KG	0.071 U	0.068 U	0.068 U	0.069 U

Table 5. Summary of Pesticides and Herbicides in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

			Sample Designation:	EP-1	EP-2	EP-3	EP-4	EP-5	EP-6	EP-7	EP-8	EP-9	EP-10	EP-10	EP-11	EP-12
			Sample Date:	04/25/2023	04/27/2023	04/25/2023	04/27/2023	04/27/2023	06/05/2023	06/05/2023	06/23/2023	12/07/2023	04/25/2023	04/25/2023	04/25/2023	04/25/2023
			Sample Depth (ft bls):	0.0 - 0.5	3.0 - 3.5	2.5 - 3.0	4.5 - 5.0	4.5 - 5.0	7.5 - 8.0	7.0 - 7.5	6.5 - 7.0	1.5 - 2.0	30 - 3.5	30 - 3.5	0.5 - 1.0	3.5 - 4.0
			Normal Sample or Field Duplicate:	N	N	N	N	N	N	N	N	N	N	FD	N	N
Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units													
Aldrin	0.005	0.097	0.19	MG/KG	0.0076 U	0.0079 U	0.0079 U	0.0078 U	0.0081 U	0.0081 U	0.0081 U	0.0071 U	0.0075 U	0.0077 U	0.0079 U	0.0077 U	0.0079 U
Alpha Bhc (Alpha Hexachlorocyclohexane)	0.02	0.48	0.02	MG/KG	0.0023 U	0.0024 U	0.0024 U	0.0023 U	0.0024 U	0.0024 U	0.0024 U	0.0021 U	0.0022 U	0.0023 U	0.0024 U	0.0023 U	0.0023 U
Alpha Endosulfan	2.4	24	102	MG/KG	0.0076 U	0.0079 U	0.0079 U	0.0078 U	0.0081 U	0.0081 U	0.0081 U	0.0071 U	0.0075 U	0.0077 U	0.0079 U	0.0077 U	0.0079 U
Beta Bhc (Beta Hexachlorocyclohexane)	0.036	0.36	0.09	MG/KG	0.0023 U	0.0024 U	0.0024 U	0.0023 U	0.0024 U	0.0024 U	0.0024 U	0.0021 U	0.0022 U	0.0023 U	0.0024 U	0.0023 U	0.0023 U
Beta Endosulfan	2.4	24	102	MG/KG	0.0076 U	0.0079 U	0.0079 U	0.0078 U	0.0081 U	0.0081 U	0.0081 U	0.0071 U	0.0075 U	0.0077 U	0.0079 U	0.0077 U	0.0079 U
Chlordane (Technical)	--	--	--	MG/KG	0.076 U	0.079 U	0.079 U	0.078 U	0.081 U	0.081 U	0.081 U	0.071 U	0.075 U	0.077 U	0.079 U	0.077 U	0.079 U
Delta BHC (Delta Hexachlorocyclohexane)	0.04	100	0.25	MG/KG	0.0023 U	0.0024 U	0.0024 U	0.0023 U	0.0024 U	0.0024 U	0.0024 U	0.0021 U	0.0022 U	0.0023 U	0.0024 U	0.0023 U	0.0023 U
Dieldrin	0.005	0.2	0.1	MG/KG	0.0023 U	0.0024 U	0.0024 U	0.0023 U	0.0024 U	0.0024 U	0.0024 U	0.0021 U	0.0022 U	0.0023 U	0.0024 U	0.0023 U	0.0023 U
Endosulfan Sulfate	2.4	24	1000	MG/KG	0.0076 U	0.0079 U	0.0079 U	0.0078 U	0.0081 U	0.0081 U	0.0081 U	0.0071 UT	0.0075 U	0.0077 U	0.0079 U	0.0077 U	0.0079 U
Endrin	0.014	11	0.06	MG/KG	0.0076 U	0.0079 U	0.0079 U	0.0078 U	0.0081 U	0.0081 U	0.0081 U	0.0071 UT	0.0075 U	0.0077 U	0.0079 U	0.0077 U	0.0079 U
Endrin Aldehyde	--	--	--	MG/KG	0.0076 U	0.0079 U	0.0079 U	0.0078 U	0.0081 U	0.0081 U	0.0081 U	0.0071 U	0.0075 U	0.0077 U	0.0079 U	0.0077 U	0.0079 U
Endrin Ketone	--	--	--	MG/KG	0.0076 U	0.0079 U	0.0079 U	0.0078 U	0.0081 U	0.0081 U	0.0081 U	0.0071 U	0.0075 U	0.0077 U	0.0079 U	0.0077 U	0.0079 U
Gamma Bhc (Lindane)	0.1	1.3	0.1	MG/KG	0.0023 U	0.0024 U	0.0024 U	0.0023 U	0.0024 U	0.0024 U	0.0024 U	0.0021 U	0.0022 U	0.0023 U	0.0024 U	0.0023 U	0.0023 U
Heptachlor	0.042	2.1	0.38	MG/KG	0.0076 U	0.0079 U	0.0079 U	0.0078 U	0.0081 U	0.0081 U	0.0081 U	0.0071 U	0.0075 U	0.0077 U	0.0079 U	0.0077 U	0.0079 U
Heptachlor Epoxide	--	--	--	MG/KG	0.0076 U	0.0079 U	0.0079 U	0.0078 U	0.0081 U	0.0081 U	0.0081 U	0.0071 U	0.0075 U	0.0077 U	0.0079 U	0.0077 U	0.0079 U
Methoxychlor	--	--	--	MG/KG	0.0076 UT	0.0079 U	0.0079 UT	0.0078 U	0.0081 U	0.0081 U	0.0081 U	0.0071 U	0.0075 U	0.0077 UT	0.0079 UT	0.0077 UT	0.0079 UT
P,P'-DDD	0.0033	13	14	MG/KG	0.0032 J	0.0027 J	0.0079 U	0.0078 U	0.0081 U	0.0081 U	0.0081 U	0.0071 U	0.0075 U	0.0077 U	0.0079 U	0.0077 U	0.0079 U
P,P'-DDE	**0.0033**	8.9	17	MG/KG	**0.015**	**0.0084**	0.0079 U	0.0078 U	0.0081 U	0.0081 U	0.0081 U	0.0071 U	0.0029 J	0.0077 U	0.0079 U	0.0077 U	0.0079 U
P,P'-DDT	**0.0033**	7.9	136	MG/KG	**0.039 J**	**0.018 J**	**0.033**	0.0078 U	0.0081 U	0.0081 U	0.0081 U	0.0071 U	0.0032 J	**0.0054 J**	**0.0051 J**	**0.0034 J+**	0.0079 U
Toxaphene	--	--	--	MG/KG	0.076 U	0.079 U	0.079 U	0.078 U	0.081 U	0.081 U	0.081 U	0.071 U	0.075 U	0.077 U	0.079 U	0.077 U	0.079 U

Table 5. Summary of Pesticides and Herbicides in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

			Sample Designation:	EP-13	EP-14	EP-15	EP-16	EP-17	EP-18	EP-19	EP-20	EP-21	EP-22	EP-23	EP-24	EP-24
			Sample Date:	04/25/2023	01/03/2024	11/10/2023	06/23/2023	06/23/2023	06/23/2023	07/17/2023	08/10/2023	08/10/2023	07/20/2023	07/20/2023	01/03/2024	01/03/2024
			Sample Depth (ft bls):	3.0 - 3.5	7.5 - 8.0	7.5 - 8.0	7.0 - 7.5	7.0 - 7.5	6.0 - 6.5	10.0 - 10.5	10 - 10.5	3 - 3.5	9.5 - 10.0	9.5 - 10.0	7.5 - 8.0	7.5 - 8.0
			Normal Sample or Field Duplicate:	N	N	N	N	N	N	N	N	N	N	N	N	FD
Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units													
Aldrin	0.005	0.097	0.19	MG/KG	0.0078 U	0.0083 U	0.008 U	0.0078 U	0.0075 U	0.0071 U	0.0082 U	0.0072 U	0.0074 U	0.0081 U	0.0079 U	0.008 U	0.0081 U
Alpha Bhc (Alpha Hexachlorocyclohexane)	0.02	0.48	0.02	MG/KG	0.0023 U	0.0025 U	0.0024 U	0.0023 U	0.0022 U	0.0021 U	0.0024 U	0.0022 U	0.0022 U	0.0024 U	0.0024 U	0.0024 U	0.0024 U
Alpha Endosulfan	2.4	24	102	MG/KG	0.0078 U	0.0083 U	0.008 U	0.0078 U	0.0075 U	0.0071 U	0.0082 U	0.0072 U	0.0074 U	0.0081 U	0.0079 U	0.008 U	0.0081 U
Beta Bhc (Beta Hexachlorocyclohexane)	0.036	0.36	0.09	MG/KG	0.0023 U	0.0025 U	0.0024 U	0.0023 U	0.0022 U	0.0021 U	0.0024 U	0.0022 U	0.0022 U	0.0024 U	0.0024 U	0.0024 U	0.0024 U
Beta Endosulfan	2.4	24	102	MG/KG	0.0078 U	0.0083 U	0.008 U	0.0078 U	0.0075 U	0.0071 U	0.0082 U	0.0072 U	0.0074 U	0.0081 U	0.0079 U	0.008 U	0.0081 U
Chlordane (Technical)	--	--	--	MG/KG	0.078 U	0.083 U	0.08 U	0.078 U	0.075 U	0.071 U	0.082 U	0.072 U	0.074 U	0.081 U	0.079 U	0.08 U	0.081 U
Delta BHC (Delta Hexachlorocyclohexane)	0.04	100	0.25	MG/KG	0.0023 U	0.0025 U	0.0024 U	0.0023 U	0.0022 U	0.0021 U	0.0024 U	0.0022 U	0.0022 U	0.0024 U	0.0024 U	0.0024 U	0.0024 U
Dieldrin	0.005	0.2	0.1	MG/KG	0.0023 U	0.0025 U	0.0024 U	0.0023 U	0.0022 U	0.0021 U	0.0024 U	0.0022 U	0.0022 U	0.0024 U	0.0024 U	0.0024 U	0.0024 U
Endosulfan Sulfate	2.4	24	1000	MG/KG	0.0078 U	0.0083 U	0.008 U	0.0078 UT	0.0075 UT	0.0071 UT	0.0082 U	0.0072 U	0.0074 U	0.0081 U	0.0079 U	0.008 U	0.0081 U
Endrin	0.014	11	0.06	MG/KG	0.0078 U	0.0083 U	0.008 U	0.0078 UT	0.0075 UT	0.0071 UT	0.0082 U	0.0072 U	0.0074 U	0.0081 U	0.0079 U	0.008 U	0.0081 U
Endrin Aldehyde	--	--	--	MG/KG	0.0078 U	0.0083 U	0.008 U	0.0078 U	0.0075 U	0.0071 U	0.0082 U	0.0072 U	0.0074 U	0.0081 U	0.0079 U	0.008 U	0.0081 U
Endrin Ketone	--	--	--	MG/KG	0.0078 U	0.0083 U	0.008 U	0.0078 U	0.0075 U	0.0071 U	0.0082 U	0.0072 U	0.0074 U	0.0081 U	0.0079 U	0.008 U	0.0081 U
Gamma Bhc (Lindane)	0.1	1.3	0.1	MG/KG	0.0023 U	0.0025 U	0.0024 U	0.0023 U	0.0022 U	0.0021 U	0.0024 U	0.0022 U	0.0022 U	0.0024 U	0.0024 U	0.0024 U	0.0024 U
Heptachlor	0.042	2.1	0.38	MG/KG	0.0078 U	0.0083 U	0.008 U	0.0078 U	0.0075 U	0.0071 U	0.0082 U	0.0072 U	0.0074 U	0.0081 U	0.0079 U	0.008 U	0.0081 U
Heptachlor Epoxide	--	--	--	MG/KG	0.0078 U	0.0083 U	0.008 U	0.0078 U	0.0075 U	0.0071 U	0.0082 U	0.0072 U	0.0074 U	0.0081 U	0.0079 U	0.008 U	0.0081 U
Methoxychlor	--	--	--	MG/KG	0.0078 UT	0.0083 U	0.008 U	0.0078 U	0.0075 U	0.0071 U	0.0082 U	0.0072 U	0.0074 U	0.0081 U	0.0079 U	0.008 U	0.0081 U
P,P'-DDD	0.0033	13	14	MG/KG	0.0078 U	0.0083 U	0.008 U	0.0078 U	0.0075 U	0.0071 U	0.0082 U	0.0072 U	0.0074 U	0.0081 U	0.0079 U	0.008 U	0.0081 U
P,P'-DDE	**0.0033**	8.9	17	MG/KG	0.0078 U	0.0083 U	0.008 U	0.0078 U	0.0075 U	0.0071 U	0.0082 U	0.0031 JP	0.0032 JP	**0.0039 J**	0.0079 U	0.008 U	0.0081 U
P,P'-DDT	**0.0033**	7.9	136	MG/KG	0.0026 J	0.0083 UT	0.008 U	0.0078 U	0.0075 U	0.0071 U	0.0082 U	**0.012**	**0.0095**	**0.0036 J**	0.0079 U	0.008 UT	0.0081 UT
Toxaphene	--	--	--	MG/KG	0.078 U	0.083 U	0.08 U	0.078 U	0.075 U	0.071 U	0.082 U	0.072 U	0.074 U	0.081 U	0.079 U	0.08 U	0.081 U

Table 5. Summary of Pesticides and Herbicides in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

			Sample Designation:	EP-25	EP-26	EP-27	EP-28	EP-29	EP-30	EP-31	EP-32	EP-33	EP-34	EP-35	EP-36	EP-37
			Sample Date:	03/19/2024	01/03/2024	11/10/2023	01/29/2024	12/07/2023	11/10/2023	08/22/2023	08/10/2023	06/05/2023	09/15/2023	09/15/2023	11/10/2023	01/29/2024
			Sample Depth (ft bls):	3.5 - 4.0	4.5 - 5.0	7.5 - 8.0	6.0 - 6.5	5.5 - 6.0	6.5 - 7.0	9.0 - 9.5	9 - 9.5	4.0 - 4.5	6.5 - 7.0	4.5 - 5.0	7.5 - 8.0	6.5 - 7.0
			Normal Sample or Field Duplicate:	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units													
Aldrin	0.005	0.097	0.19	MG/KG	0.008 U	0.008 U	0.0078 U	0.0083 U	0.0075 U	0.0081 U	0.0082 U	0.0082 U	0.0081 U	0.0078 U	0.0079 U	0.0077 U	0.0087 U
Alpha Bhc (Alpha Hexachlorocyclohexane)	0.02	0.48	0.02	MG/KG	0.0024 U	0.0024 U	0.0023 U	0.0025 U	0.0022 U	0.0024 U	0.0024 U	0.0024 U	0.0024 U	0.0023 U	0.0024 U	0.0023 U	0.0026 U
Alpha Endosulfan	2.4	24	102	MG/KG	0.008 U	0.008 U	0.0078 U	0.0083 U	0.0075 U	0.0081 U	0.0082 U	0.0082 U	0.0081 U	0.0078 U	0.0079 U	0.0077 U	0.0087 U
Beta Bhc (Beta Hexachlorocyclohexane)	0.036	0.36	0.09	MG/KG	0.0024 U	0.0024 U	0.0023 U	0.0025 U	0.0022 U	0.0024 U	0.0024 U	0.0024 U	0.0024 U	0.0023 U	0.0024 U	0.0023 U	0.0026 U
Beta Endosulfan	2.4	24	102	MG/KG	0.008 U	0.008 U	0.0078 U	0.0083 U	0.0075 U	0.0081 U	0.0082 U	0.0082 U	0.0081 U	0.0078 U	0.0079 U	0.0077 U	0.0087 U
Chlordane (Technical)	--	--	--	MG/KG	0.08 U	0.08 U	0.078 U	0.083 U	0.075 U	0.081 U	0.082 U	0.082 U	0.081 U	0.078 U	0.079 U	0.077 U	0.087 U
Delta BHC (Delta Hexachlorocyclohexane)	0.04	100	0.25	MG/KG	0.0024 U	0.0024 U	0.0023 U	0.0025 U	0.0022 U	0.0024 U	0.0024 U	0.0024 U	0.0024 U	0.0023 U	0.0024 U	0.0023 U	0.0026 U
Dieldrin	0.005	0.2	0.1	MG/KG	0.0024 U	0.0024 U	0.0023 U	0.0025 U	0.0022 U	0.0024 U	0.0024 U	0.0024 U	0.0024 U	0.0023 U	0.0024 U	0.0023 U	0.0026 U
Endosulfan Sulfate	2.4	24	1000	MG/KG	0.008 U	0.008 U	0.0078 U	0.0083 U	0.0075 U	0.0081 U	0.0082 U	0.0082 U	0.0081 U	0.0078 U	0.0079 U	0.0077 U	0.0087 U
Endrin	0.014	11	0.06	MG/KG	0.008 U	0.008 U	0.0078 U	0.0083 U	0.0075 U	0.0081 U	0.0082 U	0.0082 U	0.0081 U	0.0078 U	0.0079 U	0.0077 U	0.0087 U
Endrin Aldehyde	--	--	--	MG/KG	0.008 U	0.008 U	0.0078 U	0.0083 U	0.0075 U	0.0081 U	0.0082 U	0.0082 U	0.0081 U	0.0078 U	0.0079 U	0.0077 U	0.0087 U
Endrin Ketone	--	--	--	MG/KG	0.008 U	0.008 U	0.0078 U	0.0083 U	0.0075 U	0.0081 U	0.0082 U	0.0082 U	0.0081 U	0.0078 U	0.0079 U	0.0077 U	0.0087 U
Gamma Bhc (Lindane)	0.1	1.3	0.1	MG/KG	0.0024 U	0.0024 U	0.0023 U	0.0025 U	0.0022 U	0.0024 U	0.0024 U	0.0024 U	0.0024 U	0.0023 U	0.0024 U	0.0023 U	0.0026 U
Heptachlor	0.042	2.1	0.38	MG/KG	0.008 U	0.008 U	0.0078 U	0.0083 U	0.0075 U	0.0081 U	0.0082 U	0.0082 U	0.0081 U	0.0078 U	0.0079 U	0.0077 U	0.0087 U
Heptachlor Epoxide	--	--	--	MG/KG	0.008 U	0.008 U	0.0078 U	0.0083 U	0.0075 U	0.0081 U	0.0082 U	0.0082 U	0.0081 U	0.0078 U	0.0079 U	0.0077 U	0.0087 U
Methoxychlor	--	--	--	MG/KG	0.008 U	0.008 U	0.0078 U	0.0083 U	0.0075 U	0.0081 U	0.0082 U	0.0082 U	0.0081 U	0.0078 U	0.0079 U	0.0077 U	0.0087 U
P,P'-DDD	0.0033	13	14	MG/KG	0.008 U	0.008 U	0.0078 U	0.0083 U	0.0075 U	0.0081 U	0.0082 U	0.0082 U	0.0081 U	0.0078 U	0.0079 U	0.0077 U	0.0087 U
P,P'-DDE	**0.0033**	8.9	17	MG/KG	0.008 U	0.008 U	0.0078 U	0.0083 U	0.0075 U	0.0081 U	0.0082 U	0.0082 U	0.0081 U	0.0078 U	**0.0088**	0.0077 U	0.0087 U
P,P'-DDT	**0.0033**	7.9	136	MG/KG	0.008 U	0.008 UT	0.0078 U	0.0083 U	0.0075 U	0.0081 U	0.0082 U	0.0082 U	0.0081 U	**0.0054 J**	**0.024**	0.0077 U	0.0087 U
Toxaphene	--	--	--	MG/KG	0.08 U	0.08 U	0.078 U	0.083 U	0.075 U	0.081 U	0.082 U	0.082 U	0.081 U	0.078 U	0.079 U	0.077 U	0.087 U

Table 5. Summary of Pesticides and Herbicides in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

			Sample Designation:	EP-38	EP-39	EP-39	EP-40	EP-41	EP-42	EP-43	EP-44	EP-45	EP-46	EP-47	EP-48	EP-49
			Sample Date:	05/09/2024	05/09/2024	05/09/2024	05/09/2024	05/09/2024	05/09/2024	01/29/2024	01/29/2024	12/07/2023	11/10/2023	11/10/2023	09/21/2023	09/15/2023
			Sample Depth (ft bls):	5.0 - 5.5	4.5 - 5.0	4.5 - 5.0	3.5 - 4.0	2.0 - 2.5	3.5 - 4.0	8.5 - 9.0	4.5 - 5.0	2.5 - 3.0	5.5 - 6.0	5.5 - 6.0	4.5 - 5.0	6.0 - 6.5
			Normal Sample or Field Duplicate:	N	N	FD	N	N	N	N	N	N	N	N	N	N
Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units													
Aldrin	0.005	0.097	0.19	MG/KG	0.0074 U	0.0078 U	0.0079 U	0.0073 U	0.0075 U	0.0079 U	0.0083 U	0.0078 U	0.0079 U	0.0077 U	0.0082 U	0.0083 U	0.0082 U
Alpha Bhc (Alpha Hexachlorocyclohexane)	0.02	0.48	0.02	MG/KG	0.0022 U	0.0023 U	0.0023 U	0.0022 U	0.0022 U	0.0024 U	0.0025 U	0.0023 U	0.0024 U	0.0023 U	0.0025 U	0.0025 U	0.0024 U
Alpha Endosulfan	2.4	24	102	MG/KG	0.0074 U	0.0078 U	0.0079 U	0.0073 U	0.0075 U	0.0079 U	0.0083 U	0.0078 U	0.0079 U	0.0077 U	0.0082 U	0.0083 U	0.0082 U
Beta Bhc (Beta Hexachlorocyclohexane)	0.036	0.36	0.09	MG/KG	0.0022 U	0.0023 U	0.0023 U	0.0022 U	0.0022 U	0.0024 U	0.0025 U	0.0023 U	0.0024 U	0.0023 U	0.0025 U	0.0025 U	0.0024 U
Beta Endosulfan	2.4	24	102	MG/KG	0.0074 U	0.0078 U	0.0079 U	0.0073 U	0.0075 U	0.0079 U	0.0083 U	0.0078 U	0.0079 U	0.0077 U	0.0082 U	0.0083 U	0.0082 U
Chlordane (Technical)	--	--	--	MG/KG	0.074 U	0.078 U	0.079 U	0.073 U	0.075 U	0.079 U	0.083 U	0.078 U	0.079 U	0.077 U	0.082 U	0.083 U	0.082 U
Delta BHC (Delta Hexachlorocyclohexane)	0.04	100	0.25	MG/KG	0.0022 U	0.0023 U	0.0023 U	0.0022 U	0.0022 U	0.0024 U	0.0025 U	0.0023 U	0.0024 U	0.0023 U	0.0025 U	0.0025 U	0.0024 U
Dieldrin	0.005	0.2	0.1	MG/KG	0.0022 U	0.0023 U	0.0023 U	0.0022 U	0.0022 U	0.0024 U	0.0025 U	0.0023 U	0.0024 U	0.0023 U	0.0025 U	0.0025 U	0.0024 U
Endosulfan Sulfate	2.4	24	1000	MG/KG	0.0074 U	0.0078 U	0.0079 U	0.0073 U	0.0075 U	0.0079 U	0.0083 U	0.0078 U	0.0079 U	0.0077 U	0.0082 U	0.0083 U	0.0082 U
Endrin	0.014	11	0.06	MG/KG	0.0074 U	0.0078 U	0.0079 U	0.0073 U	0.0075 U	0.0079 U	0.0083 U	0.0078 U	0.0079 U	0.0077 U	0.0082 U	0.0083 U	0.0082 U
Endrin Aldehyde	--	--	--	MG/KG	0.0074 U	0.0078 U	0.0079 U	0.0073 U	0.0075 U	0.0079 U	0.0083 U	0.0078 U	0.0079 U	0.0077 U	0.0082 U	0.0083 U	0.0082 U
Endrin Ketone	--	--	--	MG/KG	0.0074 U	0.0078 U	0.0079 U	0.0073 U	0.0075 U	0.0079 U	0.0083 U	0.0078 U	0.0079 U	0.0077 U	0.0082 U	0.0083 U	0.0082 U
Gamma Bhc (Lindane)	0.1	1.3	0.1	MG/KG	0.0022 U	0.0023 U	0.0023 U	0.0022 U	0.0022 U	0.0024 U	0.0025 U	0.0023 U	0.0024 U	0.0023 U	0.0025 U	0.0025 U	0.0024 U
Heptachlor	0.042	2.1	0.38	MG/KG	0.0074 U	0.0078 U	0.0079 U	0.0073 U	0.0075 U	0.0079 U	0.0083 U	0.0078 U	0.0079 U	0.0077 U	0.0082 U	0.0083 U	0.0082 U
Heptachlor Epoxide	--	--	--	MG/KG	0.0074 U	0.0078 U	0.0079 U	0.0073 U	0.0075 U	0.0079 U	0.0083 U	0.0078 U	0.0079 U	0.0077 U	0.0082 U	0.0083 U	0.0082 U
Methoxychlor	--	--	--	MG/KG	0.0074 U	0.0078 U	0.0079 U	0.0073 U	0.0075 U	0.0079 U	0.0083 U	0.0078 U	0.0079 U	0.0077 U	0.0082 U	0.0083 U	0.0082 U
P,P'-DDD	0.0033	13	14	MG/KG	0.0074 U	0.0078 U	0.0079 U	0.0073 U	0.0075 U	0.0079 U	0.0083 U	0.0078 U	0.0079 U	0.0077 U	0.003 J	0.0083 U	0.0082 U
P,P'-DDE	**0.0033**	8.9	17	MG/KG	0.0074 U	0.0078 U	0.0079 U	0.0073 U	0.0075 U	0.0079 U	0.0083 U	0.0078 U	0.0079 U	0.0077 U	**0.0063 J**	0.0083 U	0.0082 U
P,P'-DDT	**0.0033**	7.9	136	MG/KG	0.0074 U	0.0078 U	0.0079 U	0.0073 U	0.0075 U	0.0079 U	0.0083 U	0.0078 U	0.0079 U	0.0077 U	**0.0066 J**	0.0083 U	**0.0035 J**
Toxaphene	--	--	--	MG/KG	0.074 U	0.078 U	0.079 U	0.073 U	0.075 U	0.079 U	0.083 U	0.078 U	0.079 U	0.077 U	0.082 U	0.083 U	0.082 U

Table 5. Summary of Pesticides and Herbicides in Endpoint Soil Samples, 1 Java Street, Brooklyn, New York

				Sample Designation:	WF-A	WF-B	WF-B	WF-C	WF-D	WF-E	WF-F	WF-X
				Sample Date:	10/15/2024	10/15/2024	10/15/2024	10/15/2024	10/15/2024	10/18/2024	10/18/2024	10/15/2024
				Sample Depth (ft bls):	1.5 - 2	1.5 - 2	1.5 - 2	1 - 1.5	1 - 1.5	3 - 3.5	4 - 4.5	0.5 - 1
				Normal Sample or Field Duplicate:	N	N	FD	N	N	N	N	N
Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Units								
Aldrin	0.005	0.097	0.19	MG/KG	0.0069 U	0.0068 U	0.0068 U	0.0071 U	0.0071 U	0.0068 U	0.0068 U	0.0069 U
Alpha Bhc (Alpha Hexachlorocyclohexane)	0.02	0.48	0.02	MG/KG	0.0021 U	0.002 U	0.002 U	0.0021 U	0.0021 U	0.002 U	0.002 U	0.0021 U
Alpha Endosulfan	2.4	24	102	MG/KG	0.0069 U	0.0068 U	0.0068 U	0.0071 U	0.0071 U	0.0068 U	0.0068 U	0.0069 U
Beta Bhc (Beta Hexachlorocyclohexane)	0.036	0.36	0.09	MG/KG	0.0021 U	0.002 U	0.002 U	0.0021 U	0.0021 U	0.002 U	0.002 U	0.0021 U
Beta Endosulfan	2.4	24	102	MG/KG	0.0069 U	0.0068 U	0.0068 U	0.0071 U	0.0071 U	0.0068 U	0.0068 U	0.0069 U
Chlordane (Technical)	--	--	--	MG/KG	0.069 U	0.068 U	0.068 U	0.071 U	0.071 U	0.068 U	0.068 U	0.069 U
Delta BHC (Delta Hexachlorocyclohexane)	0.04	100	0.25	MG/KG	0.0021 U	0.002 U	0.002 U	0.0021 U	0.0021 U	0.002 U	0.002 U	0.0021 U
Dieldrin	0.005	0.2	0.1	MG/KG	0.0021 U	0.002 U	0.002 U	0.0021 U	0.0021 U	0.002 U	0.002 U	0.0021 U
Endosulfan Sulfate	2.4	24	1000	MG/KG	0.0069 U	0.0068 U	0.0068 U	0.0071 U	0.0071 U	0.0068 U	0.0068 U	0.0069 U
Endrin	0.014	11	0.06	MG/KG	0.0069 U	0.0068 U	0.0068 U	0.0071 U	0.0071 U	0.0068 U	0.0068 U	0.0069 U
Endrin Aldehyde	--	--	--	MG/KG	0.0069 U	0.0068 U	0.0068 U	0.0071 U	0.0071 U	0.0068 U	0.0068 U	0.0069 U
Endrin Ketone	--	--	--	MG/KG	0.0069 U	0.0068 U	0.0068 U	0.0071 U	0.0071 U	0.0068 U	0.0068 U	0.0069 U
Gamma Bhc (Lindane)	0.1	1.3	0.1	MG/KG	0.0021 U	0.002 U	0.002 U	0.0021 U	0.0021 U	0.002 U	0.002 U	0.0021 U
Heptachlor	0.042	2.1	0.38	MG/KG	0.0069 U	0.0068 U	0.0068 U	0.0071 U	0.0071 U	0.0068 U	0.0068 U	0.0069 U
Heptachlor Epoxide	--	--	--	MG/KG	0.0069 U	0.0068 U	0.0068 U	0.0071 U	0.0071 U	0.0068 U	0.0068 U	0.0069 U
Methoxychlor	--	--	--	MG/KG	0.0069 U	0.0068 U	0.0068 U	0.0071 U	0.0071 U	0.0068 U	0.0068 U	0.0069 U
P,P'-DDD	0.0033	13	14	MG/KG	0.0069 U	0.0068 U	0.0068 U	0.0071 U	0.0071 U	0.0068 U	0.0068 U	0.0069 U
P,P'-DDE	**0.0033**	8.9	17	MG/KG	0.002 J	0.0068 U	0.0068 U	0.0071 U	**0.0043 J**	0.0068 U	0.0068 U	0.0069 U
P,P'-DDT	**0.0033**	7.9	136	MG/KG	**0.0097**	0.0068 U	0.0068 U	**0.0056 J**	**0.0063 J**	**0.0042 J+**	0.0024 J	**0.0038 J**
Toxaphene	--	--	--	MG/KG	0.069 U	0.068 U	0.068 U	0.071 U	0.071 U	0.068 U	0.068 U	0.069 U

Table 6. Summary of Metals in Groundwater, 1 Java Street, Brooklyn, New York

Parameter	NYSDEC Ambient Groundwater Standards and Guidance Values	Units	MW-1 05/30/2025 N Total	MW-1 05/30/2025 N Dissolved	MW-2 05/30/2025 N Total	MW-2 05/30/2025 N Dissolved	MW-3 05/30/2025 N Total	MW-3 05/30/2025 N Dissolved	MW-3 05/30/2025 FD Total	MW-3 05/30/2025 FD Dissolved
Aluminum	--	UG/L	1440	40 U	40 U	40 UJ	641	40 U	509	40 U
Antimony	**3**	UG/L	0.58 J	2 U	2 U	2 U	**3.6**	**3.7**	**4**	**4.2**
Arsenic	25	UG/L	1.3 J	2 U	9.3	2.3	3.9	2.7	4.4	2.8
Barium	1000	UG/L	113	110	117	94.6	251	238	253	241
Beryllium	3	UG/L	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U
Cadmium	5	UG/L	0.92 U	0.92 U	0.92 U	0.92 U	0.3 J	0.92 U	0.44 J	0.92 U
Calcium	--	UG/L	89700	87000	125000	114000	214000	203000	210000	207000
Chromium, Total	50	UG/L	7 J+	4 U	4 U	4 U	4.2 J+	4 U	3.1 J	4 U
Cobalt	--	UG/L	2.8	1.1 J	0.68 J	0.57 J	2.5	1.6 J	2.3	1.5 J
Copper	200	UG/L	8.7	4 U	4 U	4 U	37	24.6	34.3	26.9
Iron	**300**	UG/L	**3500**	120 U	**7190**	120 U	**1280**	37.2 J	**1000**	37.7 J
Lead	**25**	UG/L	5.4	1.2 U	1.2 U	1.2 U	**41.7**	6.9	**38.9**	7.3
Magnesium	**35000**	UG/L	28500	26400	**46800**	**45200**	**45400**	**42800**	**45400**	**43700**
Manganese	**300**	UG/L	**1190**	**1070**	**421**	**398**	**730**	**689**	**732**	**694**
Mercury	0.7	UG/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	100	UG/L	6	4 U	4 U	4 U	12.4	8.4	11.5	9
Potassium	--	UG/L	5210	4960	27900	28800	72800	69900	73000	72800
Selenium	10	UG/L	2.1 J	1.8 J	0.54 J	2.5 U	1.5 J	1.5 J	1.1 J	1.1 J
Silver	50	UG/L	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Sodium	**20000**	UG/L	**216000**	**212000**	**242000**	**238000**	**278000**	**275000**	**276000**	**274000**
Thallium	0.5	UG/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vanadium	--	UG/L	4.8	4 U	4 U	4 U	4.8	2.2 J	4.8	2.3 J
Zinc	2000	UG/L	12.2 J	16 U	16 U	16 U	27	10.1 J	25.1	8.9 J

Table 7. Summary of Volatile Organic Compounds in Soil Vapor, 1 Java Street, Brooklyn, New York

Sample Designation:		IA-1	IA-2	IA-3	IA-3	IA-3	IA-3	IA-4	IA-4	IA-4	IA-5	IA-7	IA-7	IA-8	IA-9	SVMP-1	SVMP-2
Sample Date:		07/25/2025	07/25/2025	07/25/2025	09/29/2025	11/19/2025	11/19/2025	07/25/2025	09/26/2025	11/19/2025	07/25/2025	07/25/2025	11/19/2025	11/19/2025	11/19/2025	07/25/2025	07/25/2025
Parameter	Units																
1,1,1-Trichloroethane (TCA)	UG/M3	1.1 U	1.1 U	1.1 U	1.09 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	5.5 U	2.2 U
1,1,2,2-Tetrachloroethane	UG/M3	1.4 U	1.4 U	1.4 U	1.37 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	6.9 U	2.7 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	UG/M3	**0.63 J**	**0.61 J**	**0.61 J**	1.53 U	**0.57 J**	**0.53 J**	**0.64 J**	1.5 U	**0.56 J**	**0.63 J**	**0.63 J**	**0.61 J**	**0.61 J**	**26**	7.7 U	3.1 U
1,1,2-Trichloroethane	UG/M3	1.1 U	1.1 U	1.1 U	1.09 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	5.5 U	2.2 U
1,1-Dichloroethane	UG/M3	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	4 U	1.6 U
1,1-Dichloroethene	UG/M3	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	1 U	0.4 U
1,2,4-Trichlorobenzene	UG/M3	3.7 U	3.7 U	3.7 U	3.71 U	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U	19 U	7.4 U
1,2,4-Trimethylbenzene	UG/M3	**0.91 J**	**1**	**4.6**	**18**	**1.5**	**1.6**	**5.7**	**13**	0.98 U	**1.1**	**0.53 J**	**1.2**	**7.8**	**1.2**	4.9 U	**2.8**
1,2-Dibromoethane (Ethylene Dibromide)	UG/M3	1.5 U	1.5 U	1.5 U	1.54 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	7.7 U	3.1 U
1,2-Dichlorobenzene	UG/M3	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	6 U	2.4 U
1,2-Dichloroethane	UG/M3	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	4 U	1.6 U
1,2-Dichloropropane	UG/M3	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	4.6 U	1.8 U
1,2-Dichlorotetrafluoroethane	UG/M3	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	**5.6**	7 U	2.8 U
1,3,5-Trimethylbenzene (Mesitylene)	UG/M3	0.98 U	0.98 U	**1.1**	**4.49**	0.98 U	0.98 U	**0.65 J**	**1.6**	0.98 U	0.98 U	0.98 U	0.98 U	**1.8**	0.98 U	4.9 U	2 U
1,3-Butadiene	UG/M3	0.44 U	**0.12 J**	**0.088 J**	0.44 U	0.44 U	0.44 U	**0.16 J**	0.44 U	0.44 U	**0.23 J**	0.44 U	0.44 U	0.44 U	0.44 U	2.2 U	**0.39 J**
1,3-Dichlorobenzene	UG/M3	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	6 U	2.4 U
1,4-Dichlorobenzene	UG/M3	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	6 U	2.4 U
1,4-Dioxane (P-Dioxane)	UG/M3	**0.7 J**	18 U	18 U	18 U	18 U	18 U	18 U	18 U	18 U	18 U	18 U	18 U	18 U	18 U	90 U	36 U
2,2,4-Trimethylpentane	UG/M3	**0.7 J**	**0.64 J**	**0.77 J**	**0.49 J**	**0.51 J**	**0.51 J**	**0.98**	**2.6**	0.93 U	**1.2**	**0.97**	**0.37 J**	**0.43 J**	**0.34 J**	**16**	1.9 U
2-Chlorotoluene	UG/M3	1 U	1 U	1 U	1.04 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5.2 U	2.1 U
2-Hexanone	UG/M3	2 U	2 U	2 U	2.05 U	2.1 U	2.1 U	2 U	**1.6 J**	2.1 U	2 U	2 U	2.1 U	2.1 U	2.1 U	10 U	4.1 U
4-Ethyltoluene	UG/M3	0.98 U	0.98 U	**0.81 J**	0.98 U	**0.93 J**	**0.94 J**	**0.49 J**	0.98 U	0.98 U	0.98 U	0.98 U	**0.86 J**	**4.8**	**0.84 J**	4.9 U	2 U
Acetone	UG/M3	**33**	**130 D**	**190 D**	**22.9**	**25**	**31**	**120 D**	**730 D**	**13**	**180 D**	**41**	**14**	**12**	**61 D**	**1500 D**	**370 D**
Allyl Chloride (3-Chloropropene)	UG/M3	1.6 U	1.6 U	1.6 U	1.57 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	7.8 U	3.1 U
Benzene	UG/M3	**0.7**	**0.77**	**0.93**	**0.46 J**	**0.51 J**	**0.51 J**	**0.96**	**2**	**0.37 J**	**1.6**	**0.59 J**	**0.47 J**	**0.48 J**	**0.51 J**	**3.6**	**0.64 J**
Benzyl Chloride	UG/M3	1 U	1 U	1 U	1.04 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5.2 U	2.1 U
Bromodichloromethane	UG/M3	1.3 U	1.3 U	1.3 U	1.34 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	6.7 U	2.7 U
Bromoform	UG/M3	2.1 U	2.1 U	2.1 U	2.07 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	10 U	4.1 U
Bromomethane	UG/M3	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	3.9 U	1.6 U
Butane	UG/M3	**4.2**	**2.1**	**130 D**	**2.97**	**4.2**	**4**	**30**	**31**	**3.4**	**42**	**5.3**	**3.2**	**3.2**	**6.9**	**6.9**	**6.9**
Carbon Disulfide	UG/M3	**0.61 J**	**21**	**1.9**	1.56 U	1.6 U	1.6 U	**7.6**	1.6 U	1.6 U	**17**	1.6 U	1.6 U	1.6 U	1.6 U	**6.9 J**	**4.4**
Carbon Tetrachloride	UG/M3	**0.54**	**0.51**	**0.53**	**0.48**	**0.44**	**0.45**	**0.53**	**0.54**	0.22 U	**0.54**	**0.53**	**0.49**	**0.52**	**3.7**	1.1 U	**0.5**
Chlorobenzene	UG/M3	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	**0.49 J**	4.6 U	1.8 U
Chlorodifluoromethane	UG/M3	**1.7 J**	**1.6 J**	**1.7 J**	**1.29 J**	1.8 U	1.8 U	**1.8**	1.8 U	1.8 U	**1.6 J**	**1.7 J**	1.8 U	1.8 U	1.8 U	8.8 U	**3 J**
Chloroethane	UG/M3	1.3 U	1.3 U	1.3 U	1.32 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	6.6 U	2.6 U
Chloroform	UG/M3	**0.35 J**	**0.29 J**	**0.46 J**	0.98 U	**0.43 J**	**0.43 J**	**1.1**	**2.2**	**0.85 J**	**0.31 J**	0.98 U	0.98 U	0.98 U	**1.1**	4.9 U	**9.3**
Chloromethane	UG/M3	**1.9**	**2.1**	**2.1**	**1.2**	**0.31 J**	1 U	**2.9**	**1.5**	1 U	**1.9**	**1.9**	1 U	1 U	1 U	**87**	**3.5**
Cis-1,2-Dichloroethylene	UG/M3	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**0.15 J**	0.2 U	0.2 U	0.2 U	**0.28**	**1.1**	0.4 U
Cis-1,3-Dichloropropene	UG/M3	0.91 U	0.91 U	0.91 U	0.91 U	0.91 U	0.91 U	0.91 U	0.91 U	0.91 U	0.91 U	0.91 U	0.91 U	0.91 U	0.91 U	4.5 U	1.8 U
Cyclohexane	UG/M3	**0.34 J**	**0.25 J**	**2.6**	**0.61 J**	**1.4**	**1.4**	**38**	**21**	**0.27 J**	**4.3**	**2.3**	**0.29 J**	**0.38 J**	**0.41 J**	**34**	**33**
Cymene	UG/M3	1.1 U	1.1 U	**0.5 J**	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	**0.61 J**	1.1 U	1.1 U	1.1 U	1.1 U	**2.7 J**	2.2 U
Dibromochloromethane	UG/M3	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	8.5 U	3.4 U
Dichlorodifluoromethane	UG/M3	**3**	**2.9**	**2.9**	**2.22 J**	**2.6**	**2.6**	**2.9**	**2.4 J**	**2.6**	**2.9**	**2.7**	**2.3 J**	**2.5**	**2.1 J**	12 U	**3.3 J**
Ethylbenzene	UG/M3	**0.4 J**	**0.38 J**	**1.7**	**1.45**	**1.1**	**1.1**	**1.3**	**7.4**	0.87 U	**2**	**1.1**	**0.69 J**	**1.4**	**1.7**	**12**	**2.4**
Hexachlorobutadiene	UG/M3	**1.7 J**	2.1 U	2.1 U	2.13 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	11 U	4.3 U
Isopropanol	UG/M3	**15**	12 U	**30**	12.3 U	12 U	12 U	**8.6 J**	**19**	12 U	**11 J**	12 U	12 U	12 U	**5 J**	**50 J**	25 U
Isopropylbenzene (Cumene)	UG/M3	0.98 U	0.98 U	0.98 U	**0.92 J**	0.98 U	0.98 U	**0.68 J**	**1.7**	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	4.9 U	**6**
m,p-Xylene	UG/M3	**1.1 J**	**1.2 J**	**6.8**	**6.2**	**5.2**	**5.2**	**4.2**	**30**	2.2 U	**8.1**	**6.1**	**3.3**	**5.9**	**5**	**16**	**5.4**
Methyl Ethyl Ketone (2-Butanone)	UG/M3	**4**	**3.9**	**7.9**	**1.46 J**	1.5 U	**2.8**	**7.7**	**28**	1.5 U	**4**	**4.2**	1.5 U	1.5 U	**7.5**	**15**	**2.5 J**
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	UG/M3	2 U	2 U	2 U	**0.53 J**	2.1 U	2.1 U	2 U	**8.7**	2.1 U	2 U	2 U	2.1 U	2.1 U	2.1 U	**5.6 J**	4.1 U
Methyl Methacrylate	UG/M3	2 U	**200 D**	**11**	2.05 U	**0.65 J**	**0.7 J**	**1.2 J**	**38**	2.1 U	**3.2**	**0.81 J**	**0.61 J**	2.1 U	**2.1**	**6 J**	**86**
Methylene Chloride	UG/M3	**0.76 J**	**3.1**	**0.77 J**	**0.81 J**	**0.66 J**	1.7 U	**0.96 J**	**0.74 J**	**0.64 J**	**0.74 J**	**0.68 J**	**0.9 J**	1.7 U	**0.68 J**	8.7 U	3.5 U

Table 7. Summary of Volatile Organic Compounds in Soil Vapor, 1 Java Street, Brooklyn, New York

Sample Designation:		IA-1	IA-2	IA-3	IA-3	IA-3	IA-3	IA-4	IA-4	IA-4	IA-5	IA-7	IA-7	IA-8	IA-9	SVMP-1	SVMP-2
Sample Date:		07/25/2025	07/25/2025	07/25/2025	09/29/2025	11/19/2025	11/19/2025	07/25/2025	09/26/2025	11/19/2025	07/25/2025	07/25/2025	11/19/2025	11/19/2025	11/19/2025	07/25/2025	07/25/2025
Parameter	Units																
Naphthalene	UG/M3	**0.79 J**	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	10 U	4 U
N-Butylbenzene	UG/M3	1.1 U	1.1 U	**0.47 J**	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	5.5 U	2.2 U
N-Heptane	UG/M3	**0.84**	**1.2**	**1.9**	0.82 U	0.82 U	0.82 U	**1.4**	**3.9**	0.82 U	**1.6**	**0.89**	0.82 U	0.82 U	0.82 U	**170**	**2.1**
N-Hexane	UG/M3	**0.95 J**	**1.9**	**40**	**0.47 J**	**0.51 J**	**0.64 J**	**6.6**	**5.1**	1.8 U	**11**	**1.7 J**	**0.48 J**	**0.46 J**	**0.69 J**	**7.7 J**	3.5 U
N-Propylbenzene	UG/M3	0.98 U	0.98 U	**0.72 J**	**1.62**	0.98 U	0.98 U	**0.34 J**	**0.66 J**	0.98 U	0.98 U	0.98 U	0.98 U	**0.89 J**	0.98 U	4.9 U	**2.7**
O-Xylene (1,2-Dimethylbenzene)	UG/M3	**0.42 J**	**0.46 J**	**3.2**	**2.17**	**1.6**	**1.6**	**1.8**	**8.3**	0.87 U	**2.3**	**1.3**	**0.88**	**1.5**	**1.1**	4.3 U	**2.5**
Sec-Butylbenzene	UG/M3	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	5.5 U	**1 J**
Styrene	UG/M3	**0.46 J**	0.85 U	**15**	**1.65**	**0.95**	**0.84 J**	**2.2**	**11**	0.85 U	**5.5**	**0.38 J**	0.85 U	0.85 U	**4**	4.3 U	**24**
T-Butylbenzene	UG/M3	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	5.5 U	2.2 U
Tert-Butyl Alcohol	UG/M3	15 U	15 U	15 U	15.2 U	15 U	15 U	15 U	**8.6 J**	15 U	15 U	15 U	15 U	15 U	15 U	**47 J**	**19 J**
Tert-Butyl Methyl Ether	UG/M3	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	3.6 U	1.4 U
Tetrachloroethylene (PCE)	UG/M3	**2**	1.4 U	1.4 U	1.36 U	**3.1**	1.4 U	**0.38 J**	1.4 U	**12**	1.4 U	**0.5 J**	**7.3**	**20**	**18**	**520**	**5**
Tetrahydrofuran	UG/M3	15 U	15 U	15 U	14.7 U	15 U	15 U	15 U	**6.4 J**	15 U	15 U	15 U	15 U	15 U	15 U	74 U	29 U
Toluene	UG/M3	**2.1**	**2.4**	**54**	**2.44**	**1.3**	**1.2**	**4.4**	**22**	**0.29 J**	**18**	**1.8**	**1.1**	**1**	**3**	**40**	**4.1**
Trans-1,2-Dichloroethene	UG/M3	0.79 U	0.79 U	0.79 U	0.79 U	0.79 U	0.79 U	0.79 U	0.79 U	0.79 U	0.79 U	0.79 U	0.79 U	0.79 U	0.79 U	4 U	**0.28 J**
Trans-1,3-Dichloropropene	UG/M3	0.91 U	0.91 U	0.91 U	0.91 U	0.91 U	0.91 U	0.91 U	0.91 U	0.91 U	0.91 U	0.91 U	0.91 U	0.91 U	0.91 U	4.5 U	1.8 U
Trichloroethylene (TCE)	UG/M3	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**8.1**	**0.82**
Trichlorofluoromethane	UG/M3	**1.7**	**1.6**	**1.7**	**1.21**	**1.3**	**1.3**	**1.7**	**1.2**	**1.3**	**1.7**	**1.7**	**1.4**	**1.2**	**15**	5.6 U	**12**
Vinyl Bromide	UG/M3	0.87 U	0.87 U	0.87 U	0.88 U	0.88 U	0.88 U	0.87 U	0.88 U	0.88 U	0.87 U	0.87 U	0.88 U	0.88 U	0.88 U	4.4 U	1.7 U
Vinyl Chloride	UG/M3	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**1.6**	0.4 U

Table 7. Summary of Volatile Organic Compounds in Soil Vapor, 1 Java Street, Brooklyn, New York

Sample Designation:		SVMP-3	SVMP-3	SVMP-3	SVMP-4	SVMP-4	SVMP-4	SVMP-5	SVMP-6	SVMP-7	SVMP-7	SVMP-8
Sample Date:		07/25/2025	09/29/2025	11/19/2025	07/25/2025	09/26/2025	11/19/2025	07/25/2025	07/25/2025	07/25/2025	11/19/2025	11/19/2025
Parameter	Units											
1,1,1-Trichloroethane (TCA)	UG/M3	2.2 U	1.09 U	4.4 U	1.1 UJ	1.1 U	1.1 U	22 U	1.1 U	11 U	1.1 U	1.1 U
1,1,2,2-Tetrachloroethane	UG/M3	2.7 U	1.37 U	5.5 U	1.4 UJ	1.4 U	1.4 U	27 U	1.4 U	14 U	1.4 U	1.4 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	UG/M3	3.1 U	1.53 U	**1.8 J**	1.5 UJ	1.5 U	**150**	31 U	1.5 U	15 U	**0.6 J**	**0.48 J**
1,1,2-Trichloroethane	UG/M3	2.2 U	1.09 U	4.4 U	1.1 UJ	1.1 U	1.1 U	22 U	1.1 U	11 U	1.1 U	1.1 U
1,1-Dichloroethane	UG/M3	1.6 U	0.81 U	3.2 U	0.81 UJ	0.81 U	0.81 U	16 U	0.81 U	8.1 U	0.81 U	0.81 U
1,1-Dichloroethene	UG/M3	0.4 U	0.2 U	0.8 U	0.2 UJ	0.2 U	0.2 U	4 U	0.2 U	2 U	0.2 U	0.2 U
1,2,4-Trichlorobenzene	UG/M3	7.4 U	3.71 U	15 U	3.7 UJ	3.7 U	3.7 U	74 U	3.7 U	37 U	3.7 U	3.7 U
1,2,4-Trimethylbenzene	UG/M3	**3.3**	**13.4**	3.9 U	**6.3 J-**	0.98 U	**2.3**	20 U	**5.4**	9.8 U	0.98 U	**8.2**
1,2-Dibromoethane (Ethylene Dibromide)	UG/M3	3.1 U	1.54 U	6.2 U	1.5 UJ	1.5 U	1.5 U	31 U	1.5 U	15 U	1.5 U	1.5 U
1,2-Dichlorobenzene	UG/M3	2.4 U	1.2 U	4.8 U	1.2 UJ	1.2 U	1.2 U	24 U	1.2 U	12 U	1.2 U	1.2 U
1,2-Dichloroethane	UG/M3	1.6 U	0.81 U	3.2 U	0.81 UJ	0.81 U	0.81 U	16 U	0.81 U	8.1 U	0.81 U	0.81 U
1,2-Dichloropropane	UG/M3	1.8 U	0.92 U	3.7 U	0.92 UJ	0.92 U	0.92 U	18 U	0.92 U	9.2 U	0.92 U	0.92 U
1,2-Dichlorotetrafluoroethane	UG/M3	2.8 U	1.4 U	5.6 U	1.4 UJ	1.4 U	**28**	28 U	1.4 U	14 U	1.4 U	1.4 U
1,3,5-Trimethylbenzene (Mesitylene)	UG/M3	2 U	**3.4**	3.9 U	0.98 UJ	0.98 U	0.98 U	20 U	**0.37 J**	9.8 U	0.98 U	**1.9**
1,3-Butadiene	UG/M3	0.88 U	0.44 U	1.8 U	0.44 UJ	0.44 U	0.44 U	8.8 U	**0.48**	**3.1 J**	0.44 U	0.44 U
1,3-Dichlorobenzene	UG/M3	2.4 U	1.2 U	4.8 U	1.2 UJ	1.2 U	1.2 U	24 U	1.2 U	12 U	1.2 U	1.2 U
1,4-Dichlorobenzene	UG/M3	2.4 U	1.2 U	4.8 U	1.2 UJ	1.2 U	1.2 U	24 U	1.2 U	12 U	1.2 U	1.2 U
1,4-Dioxane (P-Dioxane)	UG/M3	36 U	18 U	72 U	18 UJ	18 U	18 U	360 U	18 U	180 U	18 U	18 U
2,2,4-Trimethylpentane	UG/M3	1.9 U	**0.31 J**	3.7 U	**0.63 J-**	0.93 U	0.93 U	19 U	**0.57 J**	9.3 U	0.93 U	**0.4 J**
2-Chlorotoluene	UG/M3	2.1 U	1.04 U	4.2 U	1 UJ	1 U	1 U	21 U	1 U	10 U	1 U	1 U
2-Hexanone	UG/M3	4.1 U	**2.49**	8.2 U	2 UJ	**1.5 J**	2.1 U	41 U	**15**	20 U	2.1 U	2.1 U
4-Ethyltoluene	UG/M3	2 U	0.98 U	3.9 U	**0.39 J-**	0.98 U	**1.8**	20 U	**0.62 J**	9.8 U	0.98 U	**5**
Acetone	UG/M3	**36**	**221**	**75**	**42 J-**	**15**	**12**	**7000 D**	**110 D**	**2200 D**	**21**	**39**
Allyl Chloride (3-Chloropropene)	UG/M3	3.1 U	1.57 U	6.3 U	1.6 UJ	1.6 U	1.6 U	31 U	1.6 U	16 U	1.6 U	1.6 U
Benzene	UG/M3	1.3 U	**0.36 J**	2.6 U	**0.57 J-**	**0.29 J**	**0.5 J**	13 U	**0.99**	**6.9**	**0.49 J**	**0.54 J**
Benzyl Chloride	UG/M3	2.1 U	1.04 U	4.2 U	1 UJ	1 U	1 U	21 U	1 U	10 U	1 U	1 U
Bromodichloromethane	UG/M3	2.7 U	1.34 U	5.4 U	1.3 UJ	1.3 U	1.3 U	27 U	1.3 U	13 U	1.3 U	1.3 U
Bromoform	UG/M3	4.1 U	2.07 U	8.3 U	2.1 UJ	2.1 U	2.1 U	41 U	2.1 U	21 U	2.1 U	2.1 U
Bromomethane	UG/M3	1.6 U	**0.46 J**	3.1 U	0.78 UJ	0.78 U	0.78 U	16 U	0.78 U	7.8 U	0.78 U	0.78 U
Butane	UG/M3	**3.2**	**1.84**	4.8 U	**18 J-**	**1.8**	**1 J**	**150**	**5.3**	**12**	**3.8**	**2.7**
Carbon Disulfide	UG/M3	3.1 U	**0.61 J**	6.2 U	**1.6 J-**	**5.1 J+**	1.6 U	31 U	**9.9**	**23**	**0.45 J**	**0.42 J**
Carbon Tetrachloride	UG/M3	**0.44**	**0.43**	0.88 U	**0.38 J-**	**0.47**	**21**	4.4 U	**0.41**	2.2 U	**0.56**	**0.49**
Chlorobenzene	UG/M3	1.8 U	0.92 U	3.7 U	0.92 UJ	0.92 U	**4.3**	18 U	0.92 U	9.2 U	0.92 U	0.92 U
Chlorodifluoromethane	UG/M3	3.5 U	1.77 U	7.1 U	1.8 UJ	1.8 U	1.8 U	35 U	1.8 U	18 U	1.8 U	1.8 U
Chloroethane	UG/M3	2.6 U	1.32 U	5.3 U	1.3 UJ	1.3 U	1.3 U	26 U	**0.67 J**	13 U	1.3 U	1.3 U
Chloroform	UG/M3	**3.3**	**3.1**	**0.92 J**	**2.7 J-**	**8.7**	**7**	20 U	**24**	**5.8 J**	**0.28 J**	0.98 U
Chloromethane	UG/M3	**8**	**5.76**	**1.7 J**	**12 J-**	**1.4**	1 U	**74**	**7.3**	**9.2 J**	1 U	1 U
Cis-1,2-Dichloroethylene	UG/M3	0.4 U	0.2 U	0.8 U	0.2 UJ	0.2 U	**1.8**	4 U	0.2 U	2 U	0.2 U	0.2 U
Cis-1,3-Dichloropropene	UG/M3	1.8 U	0.91 U	3.6 U	0.91 UJ	0.91 U	0.91 U	18 U	0.91 U	9.1 U	0.91 U	0.91 U
Cyclohexane	UG/M3	**43**	**0.93**	**0.96 J**	**22 J-**	**1.7**	**0.68 J**	**2700 D**	**48**	**410**	**2.7**	**10**
Cymene	UG/M3	2.2 U	1.1 U	4.4 U	1.1 UJ	1.1 U	1.1 U	22 U	1.1 U	11 U	1.1 U	1.1 U
Dibromochloromethane	UG/M3	3.4 U	1.7 U	6.8 U	1.7 UJ	1.7 U	1.7 U	34 U	1.7 U	17 U	1.7 U	1.7 U
Dichlorodifluoromethane	UG/M3	**3.3 J**	**2.13 J**	9.9 U	**1.9 J-**	**2.5**	2.5 U	49 U	**2.8**	25 U	**2.6**	**2.5**
Ethylbenzene	UG/M3	**2.2**	**2.13**	3.5 U	**1.1 J-**	**0.55 J**	**0.93**	**5.7 J**	**2.1**	**4.8 J**	0.87 U	**1.3**
Hexachlorobutadiene	UG/M3	4.3 U	2.13 U	8.5 U	2.1 UJ	2.1 U	2.1 U	43 U	2.1 U	21 U	2.1 U	2.1 U
Isopropanol	UG/M3	25 U	12.3 U	49 U	12 UJ	12 U	12 U	**220 J**	**9.4 J**	120 U	12 U	**10 J**
Isopropylbenzene (Cumene)	UG/M3	**8**	0.98 U	3.9 U	**3.3 J-**	**1.4**	0.98 U	20 U	**5.6**	**6.8 J**	0.98 U	0.98 U
m,p-Xylene	UG/M3	**5.3**	**8.84**	8.7 U	**2.9 J-**	**2.3**	**3.7**	**8.2 J**	**5.6**	**7.8 J**	**1.5 J**	**5.5**
Methyl Ethyl Ketone (2-Butanone)	UG/M3	**3.5**	**2.54**	5.9 U	**10 J-**	1.5 U	**2.6**	**69**	**28**	**7 J**	**2.9**	**1.5**
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	UG/M3	4.1 U	2.05 U	8.2 U	2 UJ	2.1 U	2.1 U	41 U	**1.5 J**	20 U	2.1 U	2.1 U
Methyl Methacrylate	UG/M3	**1.5 J**	**0.99 J**	8.2 U	**1.6 J-**	2.1 U	2.1 U	41 U	**2.6**	20 U	2.1 U	2.1 U
Methylene Chloride	UG/M3	3.5 U	1.74 U	7 U	**0.85 J-**	1.7 U	**0.9 J**	35 U	**0.71 J**	17 U	1.7 U	1.7 U

Table 7. Summary of Volatile Organic Compounds in Soil Vapor, 1 Java Street, Brooklyn, New York

Sample Designation:		SVMP-3	SVMP-3	SVMP-3	SVMP-4	SVMP-4	SVMP-4	SVMP-5	SVMP-6	SVMP-7	SVMP-7	SVMP-8
Sample Date:		07/25/2025	09/29/2025	11/19/2025	07/25/2025	09/26/2025	11/19/2025	07/25/2025	07/25/2025	07/25/2025	11/19/2025	11/19/2025
Parameter	Units											
Naphthalene	UG/M3	4 U	2 U	8 U	**0.83 J-**	**22**	2 U	40 U	2 U	20 U	2 U	2 U
N-Butylbenzene	UG/M3	2.2 U	1.1 U	4.4 U	1.1 UJ	1.1 U	1.1 U	22 U	1.1 U	11 U	1.1 U	1.1 U
N-Heptane	UG/M3	**4.6**	0.82 U	3.3 U	**1.4 J-**	0.82 U	0.82 U	**390**	**3.6**	**17**	0.82 U	0.82 U
N-Hexane	UG/M3	3.5 U	1.76 U	7 U	**2.8 J-**	1.8 U	1.8 U	**43**	**2**	**8.3 J**	**0.5 J**	**0.46 J**
N-Propylbenzene	UG/M3	**3.4**	**1.61**	3.9 U	**1.4 J-**	0.98 U	0.98 U	20 U	**2.6**	**3 J**	0.98 U	**0.95 J**
O-Xylene (1,2-Dimethylbenzene)	UG/M3	1.7 U	**2.78**	3.5 U	**1.3 J-**	**0.76 J**	**0.85 J**	17 U	**2.3**	8.7 U	0.87 U	**1.5**
Sec-Butylbenzene	UG/M3	**1.4 J**	1.1 U	4.4 U	**0.53 J-**	1.1 U	1.1 U	22 U	**1.1**	11 U	1.1 U	1.1 U
Styrene	UG/M3	**30**	**2.64**	3.4 U	**12 J-**	**0.77 J**	0.85 U	17 U	**21**	**28**	0.85 U	0.85 U
T-Butylbenzene	UG/M3	2.2 U	1.1 U	4.4 U	1.1 UJ	1.1 U	1.1 U	22 U	1.1 U	11 U	1.1 U	1.1 U
Tert-Butyl Alcohol	UG/M3	**32**	15.2 U	61 U	**38 J-**	15 U	15 U	**820**	**56**	150 U	15 U	**7.2 J**
Tert-Butyl Methyl Ether	UG/M3	1.4 U	0.72 U	2.9 U	0.72 UJ	0.72 U	0.72 U	14 U	0.72 U	7.2 U	0.72 U	0.72 U
Tetrachloroethylene (PCE)	UG/M3	**12**	**3.68**	5.4 U	1.4 UJ	**6.1**	**140**	27 U	**4.9**	**2.9 J**	1.4 U	1.4 U
Tetrahydrofuran	UG/M3	29 U	14.7 U	59 U	15 UJ	15 U	**4 J**	290 U	15 U	150 U	**3.9 J**	15 U
Toluene	UG/M3	**5**	**2**	3 U	**3.1 J-**	**1.7**	**0.85**	**31**	**6.2**	**79**	**1.1**	**1.1**
Trans-1,2-Dichloroethene	UG/M3	1.6 U	0.79 U	3.2 U	0.79 UJ	0.79 U	0.79 U	16 U	0.79 U	7.9 U	0.79 U	0.79 U
Trans-1,3-Dichloropropene	UG/M3	1.8 U	0.91 U	3.6 U	0.91 UJ	0.91 U	0.91 U	18 U	0.91 U	9.1 U	0.91 U	0.91 U
Trichloroethylene (TCE)	UG/M3	**0.91**	0.2 U	0.8 U	**0.21 J-**	**0.61**	**1**	**6.5**	**0.39**	2 U	0.2 U	0.2 U
Trichlorofluoromethane	UG/M3	**30**	**21.3**	**9.9**	**13 J-**	**40**	**89**	22 U	**60**	**38**	**7.1**	**1.9**
Vinyl Bromide	UG/M3	1.7 U	0.88 U	3.5 U	0.87 UJ	0.88 U	0.88 U	17 U	0.87 U	8.7 U	0.88 U	0.88 U
Vinyl Chloride	UG/M3	0.4 U	0.2 U	0.8 U	0.2 UJ	0.2 U	0.2 U	4 U	0.2 U	2 U	0.2 U	0.2 U

FIGURES

1. Site Location Map
2. Site Layout Map
3. Remaining Soil Sample Exceedances
4. Remaining Groundwater Sample Exceedances
5. Remaining Soil Vapor Sample Detections
6A. Institutional and Engineering Control Boundaries
6B. As-Built Deviations from RAWP



QUADRANGLE LOCATION



SOURCE:
USGS; 2016, Brooklyn, NY
7.5 Minute Topographic Quadrangle

N

0 2000'

Title:

SITE LOCATION MAP

GREENPOINT FERRY SITE
BROOKLYN, NEW YORK

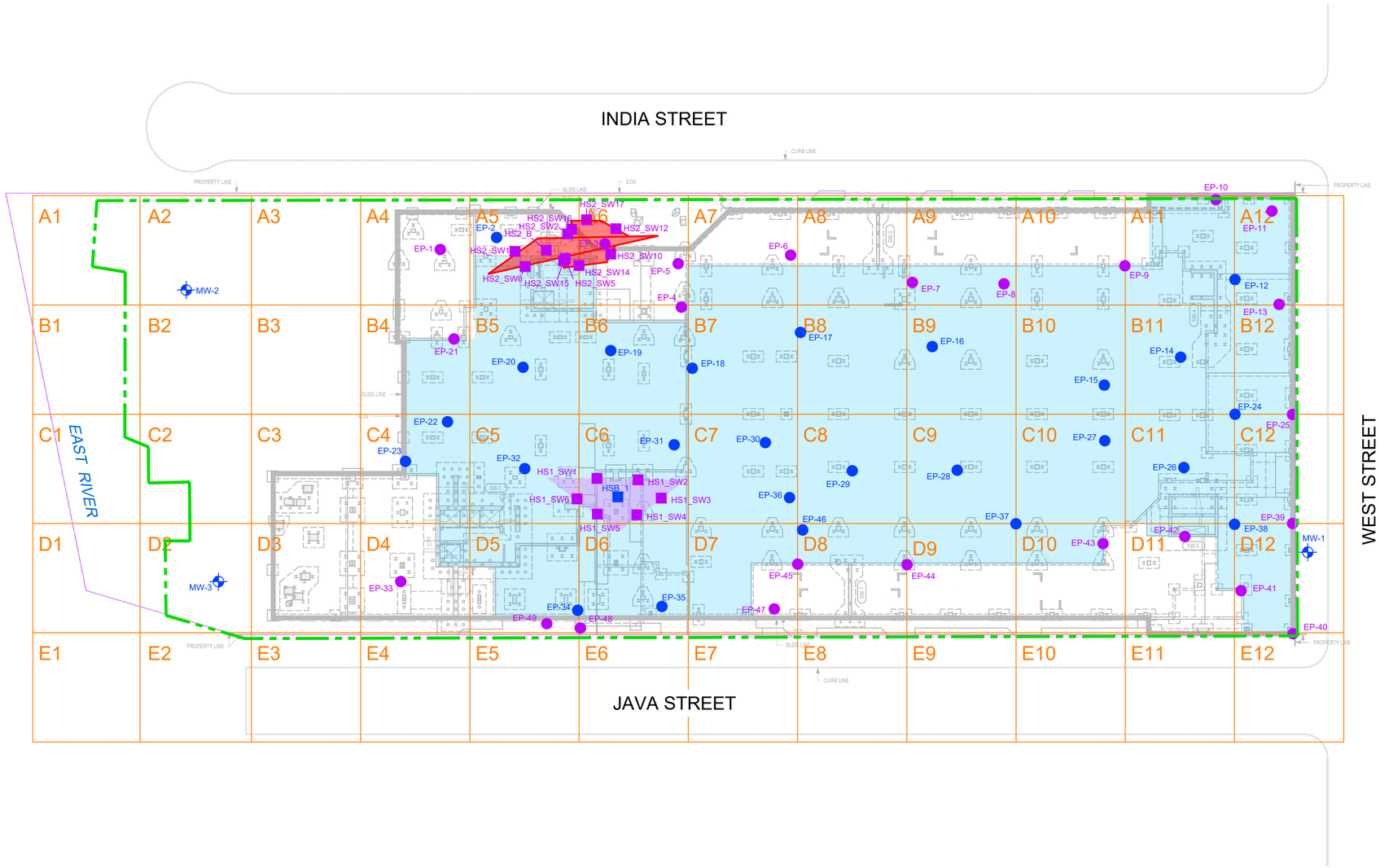
Prepared for:

1 JAVA OWNER LLC

ROUX

Compiled by: E.B.	Date: 19MAY21	FIGURE
Prepared by: B.H.C.	Scale: AS SHOWN	1
Project Mgr: J.W.	Project: 3583.0001Y000	
File: 3583.0001Y107.02.CDR		

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LEGEND

- BCP SITE BOUNDARY
- APPROXIMATE EXTENT OF BUILDING
- LOCATION OF DOCUMENTATION BOTTOM SAMPLE
- LOCATION OF DOCUMENTATION SIDEWALL SAMPLE
- LOCATION OF CONFIRMATORY BOTTOM SAMPLE
- LOCATION OF CONFIRMATORY SIDEWALL SAMPLE
- 50 FT ALPHANUMERIC GRID
- REMEDIAL EXCAVATION AND SITE COVER
- LIMITS OF LEAD HOTSPOT EXCAVATION: 5FT BLS (SEE RAWP APPENDIX I FOR DETAILS)
- LIMITS OF SECOND LEAD HOTSPOT EXCAVATION: 8FT BLS

NOTES

1. SEE APPENDIX C OF RAWP FOR COMPLETE WASTE CHARACTERIZATION REPORT.
2. SEE APPENDIX I OF RAWP FOR COMPLETE 2021 REUSE/WASTE CHARACTERIZATION REPORT
3. BCP – BROWNFIELD CLEANUP PROGRAM
4. RAWP – REMEDIAL ACTION WORK PLAN
5. BLS – BELOW LAND SURFACE
6. ENTIRE SITE AREA IS TRACK 4

N

40' 0 40'

Title:

SITE LAYOUT MAP

GREENPOINT FERRY SITE
BROOKLYN, NEW YORK

Prepared for:

1 JAVA OWNER LLC

ROUX

Compiled by: B.H.	Date: 26JUN25	FIGURE 2
Prepared by: G.M.	Scale: AS SHOWN	
Project Mgr: B.H.	Project: 3583.0001Y000	
File: 3583.0001Y166.01.DWG		

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EP-2	04/27/2023
Depth (ft bls)	3 - 3.5
Metals	
Copper	58.8
Lead	496
Mercury	0.55
Zinc	372
Pesticides/Herbicides	
P,P'-DDE	0.0084
P,P'-DDT	0.018 J

HS2_SW1	11/17/2022
Depth (ft bls)	8 - 8.5
Metals	
Lead	356

HS2_B	11/17/2022
Depth (ft bls)	8 - 8.5
Metals	
Lead	448

HS2_SW15	12/28/2022
Depth (ft bls)	8 - 8.5
Metals	
Lead	251

HS2_S5	11/17/2022
Depth (ft bls)	8 - 8.5
Metals	
Lead	513

HS2_SW2	11/17/2022
Depth (ft bls)	8 - 8.5
Metals	
Lead	338

HS2_SW16	12/28/2022
Depth (ft bls)	8 - 8.5
Metals	
Lead	378

HS2_SW17	12/28/2022
Depth (ft bls)	8 - 8.5
Metals	
Lead	449

HS2_SW14	12/28/2022
Depth (ft bls)	8 - 8.5
Metals	
Lead	371

HS2_SW12	12/12/2022
Depth (ft bls)	8 - 8.5
Metals	
Lead	2310

EP-3	04/25/2023
Depth (ft bls)	2.5 - 3
Metals	
Lead	148
Mercury	0.2
Pesticides/Herbicides	
P,P'-DDT	0.033

HS2_SW10	11/30/2022
Depth (ft bls)	8 - 8.5
Metals	
Lead	444

EP-5	04/27/2023
Depth (ft bls)	4.5 - 5
Metals	
Lead	190
Mercury	0.63
Zinc	118

EP-19	07/17/2023
Depth (ft bls)	10 - 10.5
Metals	
Lead	247
Mercury	0.69

EP-4	04/27/2023
Depth (ft bls)	4.5 - 5
Metals	
Lead	383
Mercury	0.37
Zinc	115

EP-18	06/23/2023
Depth (ft bls)	6 - 6.5
Metals	
Lead	95.9
Mercury	0.22

EP-10	04/25/2023	04/25/2023 DUP
Depth (ft bls)	3 - 3.5	3 - 3.5
SVOCs		
Benzo(A)Anthracene	1.1 J	3.8 J
Benzo(A)Pyrene	1.1 J	3.8 J
Benzo(B)Fluoranthene	1.3 J	4.2 J
Benzo(K)Fluoranthene	NE	1.5 J
Chrysene	1.1 J	3.2 J
Dibenz(A,H)Anthracene	NE	0.42 J
Indeno(1,2,3-C,D)Pyrene	0.59 J	2 J
Metals		
Lead	83.6	85.9
Mercury	1.4	1.1
Zinc	NE	123
Pesticides/Herbicides		
P,P'-DDT	0.0054 J	0.0051 J

WF-F	10/18/2024
Depth (ft bls)	4 - 4.5
Metals	
Lead	126
Mercury	1.2

EP-20	08/10/2023
Depth (ft bls)	10 - 10.5
Metals	
Lead	229
Mercury	0.4
Zinc	142
Pesticides/Herbicides	
P,P'-DDT	0.012

WF-E	10/18/2024
Depth (ft bls)	3 - 3.5
Metals	
Lead	125
Mercury	1.7
Zinc	290
Pesticides/Herbicides	
P,P'-DDT	0.0042 J+

EP-21	08/10/2023
Depth (ft bls)	3 - 3.5
Metals	
Copper	67.1
Lead	443
Mercury	0.49
Zinc	352
Pesticides/Herbicides	
P,P'-DDT	0.0095

WF-B	10/15/2024
Depth (ft bls)	1.5 - 2
Metals	
Chromium, Total	40.6 J

WF-C	10/15/2024
Depth (ft bls)	1 - 1.5
Metals	
Lead	105
Mercury	0.29
Pesticides/Herbicides	
P,P'-DDT	0.0056 J

EP-22	07/20/2023
Depth (ft bls)	9.5 - 10
Metals	
Chromium, Total	386
Lead	353
Mercury	0.29
Pesticides/Herbicides	
P,P'-DDE	0.0039 J
P,P'-DDT	0.0036 J

WF-D	10/15/2024
Depth (ft bls)	1 - 1.5
Metals	
Lead	163
Mercury	0.28
Zinc	118
Pesticides/Herbicides	
P,P'-DDE	0.0043 J
P,P'-DDT	0.0063 J

WF-A	10/15/2024
Depth (ft bls)	1.5 - 2
Metals	
Lead	150
Mercury	0.23
Pesticides/Herbicides	
P,P'-DDT	0.0097

EP-23	07/20/2023
Depth (ft bls)	9.5 - 10
Metals	
Lead	222
Mercury	0.38
Zinc	203

EP-32	08/10/2023
Depth (ft bls)	9 - 9.5
Metals	
Arsenic	13.8
Chromium, Total	33.6
Lead	137
Mercury	0.68
Zinc	112

WF-X	10/15/2024
Depth (ft bls)	0.5 - 1
Metals	
Lead	231
Mercury	0.37
Zinc	112
Pesticides/Herbicides	
P,P'-DDT	0.0038 J

HS1_SW1	09/07/2022
Depth (ft bls)	5 - 5.5
Metals	
Lead	163

HS1_SW6	09/07/2022
Depth (ft bls)	5 - 5.5
Metals	
Lead	124

EP-33	06/05/2023
Depth (ft bls)	4 - 4.5
Metals	
Lead	945
Mercury	1.3
Zinc	121

HS1_SW2	09/07/2022
Depth (ft bls)	5 - 5.5
Metals	
Lead	128

HS1_B	09/07/2022
Depth (ft bls)	5 - 5.5
Metals	
Lead	215

HS1_SW5	09/07/2022
Depth (ft bls)	5 - 5.5
Metals	
Lead	119

HS1_SW4	09/07/2022
Depth (ft bls)	5 - 5.5
Metals	
Lead	147

EP-49	09/15/2023
Depth (ft bls)	6 - 6.5
SVOCs	
Benzo(A)Anthracene	1.1
Benzo(B)Fluoranthene	1.2
Indeno(1,2,3-C,D)Pyrene	0.74
Metals	
Lead	166
Mercury	0.28
Zinc	110
Pesticides/Herbicides	
P,P'-DDT	0.0035 J

EP-34	09/15/2023
Depth (ft bls)	6.5 - 7
SVOCs	
Indeno(1,2,3-C,D)Pyrene	0.63
Metals	
Lead	219
Mercury	0.3
Zinc	138
Pesticides/Herbicides	
P,P'-DDT	0.0054 J

EP-48	09/21/2023
Depth (ft bls)	4.5 - 5
Metals	
Lead	90.6
Mercury	0.65

HS1_SW3	09/07/2022
Depth (ft bls)	5 - 5.5
Metals	
Lead	203

EP-35	09/15/2023
Depth (ft bls)	4.5 - 5
SVOCs	
Benzo(A)Anthracene	3.2
Benzo(A)Pyrene	3.2
Benzo(B)Fluoranthene	3.9
Benzo(K)Fluoranthene	1.3
Chrysene	3.1
Dibenz(A,H)Anthracene	0.54
Indeno(1,2,3-C,D)Pyrene	2.2
Metals	
Lead	170
Mercury	0.37
Zinc	119
Pesticides/Herbicides	
P,P'-DDE	0.0088
P,P'-DDT	0.024

EP-31	08/22/2023
Depth (ft bls)	9 - 9.5
SVOCs	
Benzo(A)Anthracene	1.9
Benzo(A)Pyrene	1.5
Benzo(B)Fluoranthene	1.6
Chrysene	1.7
Indeno(1,2,3-C,D)Pyrene	0.75
Metals	
Copper	57.7
Lead	82

EP-47	11/10/2023
Depth (ft bls)	5.5 - 6
SVOCs	
Benzo(A)Anthracene	1.4
Benzo(A)Pyrene	1.4
Benzo(B)Fluoranthene	1.7
Chrysene	1.3
Indeno(1,2,3-C,D)Pyrene	1.1
Metals	
Chromium, Total	58.1
Copper	53.7
Lead	133
Mercury	0.48
Nickel	31.9
Zinc	137
Pesticides/Herbicides	
P,P'-DDE	0.0063 J
P,P'-DDT	0.0066 J

EP-46	11/10/2023
Depth (ft bls)	5.5 - 6
SVOCs	
Benzo(A)Anthracene	4.4
Benzo(A)Pyrene	5.9
Benzo(B)Fluoranthene	6.5
Benzo(K)Fluoranthene	2
Chrysene	4.1
Dibenz(A,H)Anthracene	0.64
Indeno(1,2,3-C,D)Pyrene	3.8
Metals	
Lead	195
Mercury	5.7
Zinc	149

EP-29	12/07/2023
Depth (ft bls)	5.5 - 6
VOCs	
Acetone	0.09

EP-11	04/25/2023
Depth (ft bls)	0.5 - 1
Metals	
Lead	79.2
Mercury	0.22
Pesticides/Herbicides	
P,P'-DDT	0.0034 J+

EP-9	12/07/2023
Depth (ft bls)	1.5 - 2
Metals	
Lead	136
Mercury	0.24

EP-13	04/25/2023
Depth (ft bls)	3 - 3.5
PCBs	
Polychlorinated Biphenyl (PCBs)	0.15

EP-25	03/19/2024
Depth (ft bls)	3.5 - 4
Metals	
Lead	83.4
Mercury	0.3
Zinc	118

EP-24	01/03/2024	01/03/2024 DUP
Depth (ft bls)	7.5 - 8	7.5 - 8
Metals		
Chromium, Total	35.2 J	NE

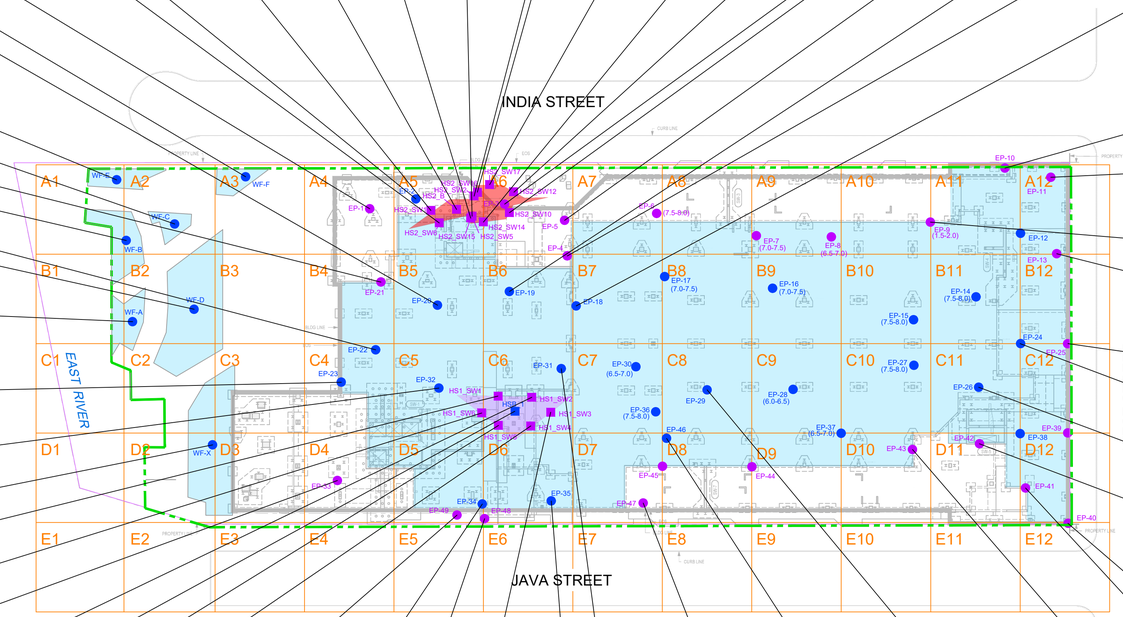
EP-26	01/03/2024
Depth (ft bls)	4.5 - 5
PCBs	
Polychlorinated Biphenyl (PCBs)	0.46

EP-42	05/09/2024
Depth (ft bls)	3.5 - 4
SVOCs	
Benzo(A)Anthracene	1.1
Benzo(A)Pyrene	1.1
Benzo(B)Fluoranthene	1.3
Chrysene	1.1
Indeno(1,2,3-C,D)Pyrene	0.61
Metals	
Arsenic	26.4
Copper	105
Lead	179
Mercury	0.3
Zinc	122

EP-40	05/09/2024
Depth (ft bls)	3.5 - 4
Metals	
Copper	68.1
Zinc	118

EP-41	05/09/2024
Depth (ft bls)	2 - 2.5
SVOCs	
Benzo(B)Fluoranthene	1.1
Indeno(1,2,3-C,D)Pyrene	0.54
Metals	
Arsenic	17.7
Lead	160
Mercury	0.25

EP-43	01/29/2024
Depth (ft bls)	8.5 - 9
SVOCs	
Benzo(A)Anthracene	1.9
Benzo(A)Pyrene	1.8
Benzo(B)Fluoranthene	2.1
Chrysene	1.8
Indeno(1,2,3-C,D)Pyrene	0.96



LEGEND

- BCP SITE BOUNDARY
- APPROXIMATE EXTENT OF BUILDING
- LOCATION OF DOCUMENTATION BOTTOM SAMPLE
- LOCATION OF DOCUMENTATION SIDEWALL SAMPLE
- LOCATION OF CONFIRMATORY BOTTOM SAMPLE
- LOCATION OF CONFIRMATORY SIDEWALL SAMPLE
- 50 FT ALPHANUMERIC GRID
- REMEDIAL EXCAVATION AREAS
- LIMITS OF LEAD HOTSPOT 1 EXCAVATION: 5FT BLS
- LIMITS OF LEAD HOTSPOT 2 EXCAVATION: 8FT BLS
- (7.0-7.5) DEPTH OF SAMPLE COLLECTION (FEET BELOW LAND SURFACE)

NOTES

1. SEE APPENDIX C OF RAWP FOR COMPLETE 2018 WASTE CHARACTERIZATION REPORT.
3. SEE APPENDIX I OF RAWP FOR COMPLETE 2021 REUSE/WASTE CHARACTERIZATION REPORT.
4. SEE APPENDIX L OF FER FOR 2022 WASTE CHARACTERIZATION DOCUMENTATION.
5. BCP – BROWNFIELD CLEANUP PROGRAM
6. RAWP – REMEDIAL ACTION WORK PLAN
7. BLS – BELOW LAND SURFACE
8. ENTIRE SITE AREA IS TRACK 4

Parameter	NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives	NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives	NYSDEC Part 375 Protection of Groundwater SCO	Units
VOCs				
Acetone	0.05	100	0.05	mg/kg
SVOCs				
Benzo(A)Anthracene	1	1	1	mg/kg
Benzo(A)Pyrene	1	1	22	mg/kg
Benzo(B)Fluoranthene	1	1	1.7	mg/kg
Benzo(K)Fluoranthene	0.8	3.9	1.7	mg/kg
Chrysene	1	3.9	1	mg/kg
Dibenz(A,H)Anthracene	0.33	0.33	1000	mg/kg
Indeno(1,2,3-C,D)Pyrene	0.5	0.5	8.2	mg/kg
Metals				
Arsenic	13	16	16	mg/kg
Chromium, Total	30	180	--	mg/kg
Copper	50	270	1720	mg/kg
Lead	63	400	450	mg/kg
Mercury	0.18	0.81	0.73	mg/kg
Nickel	30	310	130	mg/kg
Zinc	109	10000	2480	mg/kg
PCBs				
Polychlorinated Biphenyl (PCBs)	0.1	1	3.2	mg/kg
Pesticides/Herbicides				
P,P'-DDE	0.0033	8.9	17	mg/kg
P,P'-DDT	0.0033	7.9	136	mg/kg

mg/kg – MILLIGRAMS PER KILOGRAM

NYSDEC – NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

– – NO NYSDEC PART 375 SOIL CLEANUP OBJECTIVES AVAILABLE

J – ESTIMATED VALUE

J+ – ESTIMATED VALUE, HIGH BIAS

DUP – DUPLICATE SAMPLE

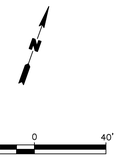
VOCs – VOLATILE ORGANIC COMPOUNDS

SVOCs – SEMIVOLATILE ORGANIC COMPOUNDS

PCBS – POLYCHLORINATED BIPHENYLS

NE – NO EXCEEDANCE

FT BLS – FEET BELOW LAND SURFACE



Title:

REMAINING SOIL SAMPLE EXCEEDANCES

GREENPOINT FERRY SITE
BROOKLYN, NEW YORK

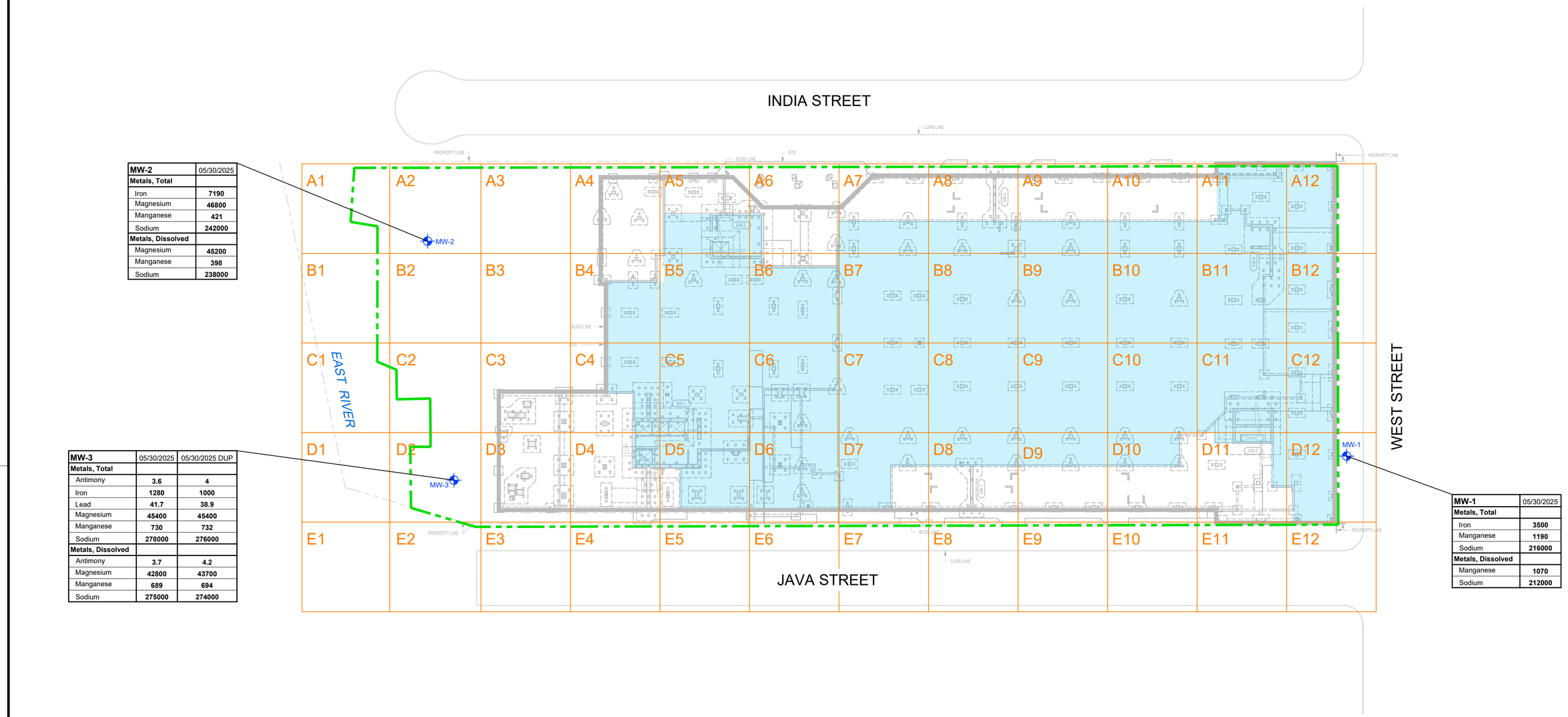
Prepared for:

1 JAVA OWNER LLC

ROUX

Compiled by: B.H.	Date: 12/12/2025	FIGURE 3
Prepared by: G.M.	Scale: AS SHOWN	
Project Mgr: B.H.	Project: 3583.0001Y000	
File: 3583.0001Y167.03.DWG		

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MW-2	05/30/2025
Metals, Total	
Iron	**7190**
Magnesium	**46800**
Manganese	**421**
Sodium	**242000**
Metals, Dissolved	
Magnesium	**45200**
Manganese	**398**
Sodium	**238000**

MW-3	05/30/2025	05/30/2025 DUP
Metals, Total		
Antimony	**3.6**	**4**
Iron	**1280**	**1000**
Lead	**41.7**	**38.9**
Magnesium	**45400**	**45400**
Manganese	**730**	**732**
Sodium	**278000**	**276000**
Metals, Dissolved		
Antimony	**3.7**	**4.2**
Magnesium	**42800**	**43700**
Manganese	**689**	**694**
Sodium	**275000**	**274000**

MW-1	05/30/2025
Metals, Total	
Iron	**3500**
Manganese	**1190**
Sodium	**216000**
Metals, Dissolved	
Manganese	**1070**
Sodium	**212000**

LEGEND

- BCP SITE BOUNDARY
- APPROXIMATE EXTENT OF BUILDING
- REMEDIAL EXCAVATION AND SITE COVER
- 50 FT ALPHANUMERIC GRID

Parameter	NYSDEC AWQSGV	Units
VOCs	NE	µg/L
SVOCs	ND	µg/L
Metals, Total		
Antimony	**3**	µg/L
Iron	**300**	µg/L
Lead	**25**	µg/L
Magnesium	**35000**	µg/L
Manganese	**300**	µg/L
Sodium	**20000**	µg/L
Metals, Dissolved		
Antimony	**3**	µg/L
Magnesium	**35000**	µg/L
Manganese	**300**	µg/L
Sodium	**20000**	µg/L
PCBs	ND	µg/L
Pesticides	ND	µg/L

CONCENTRATIONS IN µg/L

µg/L – MICROGRAMS PER LITER

NYSDEC – NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

AWQSGVS – AMBIENT WATER–QUALITY STANDARDS AND GUIDANCE VALUES

– – NO NYSDEC AWQSGV AVAILABLE

J – ESTIMATED VALUE

DUP – DUPLICATE SAMPLE

VOCs – VOLATILE ORGANIC COMPOUNDS

SVOCs – SEMIVOLATILE ORGANIC COMPOUNDS

PCBs – POLYCHLORINATED BIPHENYLS

NE – NO EXCEEDANCES

ND – NO DETECTION

N

40' 0 40'

Title:

REMAINING GROUNDWATER EXCEEDANCES

GREENPOINT FERRY SITE
BROOKLYN, NEW YORK

Prepared for:

1 JAVA OWNER LLC

ROUX

Compiled by: B.H.	Date: 01JUL25	FIGURE 4
Prepared by: G.M.	Scale: AS SHOWN	
Project Mgr: B.H.	Project: 3583.0001Y000	
File: 3583.0001Y166.01.DWG		

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SVMP-1	07/25/2025
VOCs	
2,2,4-Trimethylpentane	16
Acetone	1000 D
Benzene	3.6
Butane	6.9
Carbon Disulfide	0.31 J
Chloromethane	87
Cis-1,2-Dichloroethylene	1.1
Cyclohexane	34
Cymene	2.7 J
Ethylbenzene	12
Isopropanol	50 J
m,p-Xylene	16
Methyl Ethyl Ketone (2-Butanone)	15
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	5.6 J
Methyl Methacrylate	6 J
N-Heptane	170
N-Hexane	7.7 J
Tert-Butyl Alcohol	47 J
Tetrachloroethylene (PCE)	520
Toluene	40
Trichloroethylene (TCE)	0.1
Vinyl Chloride	1.6

IA-1	07/25/2025
VOCs	
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.63 J
1,2,4-Trimethylbenzene	0.91 J
1,4-Dioxane (P-Dioxane)	0.7 J
2,2,4-Trimethylpentane	0.7 J
Acetone	33
Benzene	0.7
Butane	4.2
Carbon Disulfide	0.61 J
Carbon Tetrachloride	0.54
Chlorodifluoromethane	1.7 J
Chloroform	0.35 J
Chloromethane	1.9
Cis-1,2-Dichloroethylene	0.34 J
Cyclohexane	34
Cymene	2.7 J
Ethylbenzene	12
Isopropanol	50 J
m,p-Xylene	1.1 J
Methyl Ethyl Ketone (2-Butanone)	4
Methylene Chloride	0.76 J
Naphthalene	0.79 J
N-Heptane	0.54
N-Hexane	0.95 J
O-Xylene (1,2-Dimethylbenzene)	0.42 J
Styrene	0.46 J
Tetrachloroethylene (PCE)	2
Toluene	2.1
Trichlorofluoromethane	1.7

SVMP-3	07/25/2025	09/29/2025	11/19/2025
VOCs			
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND	ND	1.8 J
1,2,4-Trimethylbenzene	3.3	13.4	ND
1,3,5-Trimethylbenzene (Mesitylene)	ND	3.4	ND
2,2,4-Trimethylpentane	ND	0.31 J	ND
2-Hexanone	ND	2.49	ND
Acetone	36	221	75
Benzene	ND	0.36 J	ND
Bromomethane	ND	0.46 J	ND
Butane	3.2	1.84	ND
Carbon Disulfide	ND	0.61 J	ND
Carbon Tetrachloride	0.44	0.43	ND
Chloroform	3.3	3.1	0.92 J
Chloromethane	8	5.76	1.7 J
Cyclohexane	43	0.93	0.96 J
Dichlorodifluoromethane	3.3 J	2.13 J	ND
Ethylbenzene	2.2	2.13	ND
Isopropylbenzene (Cumene)	8	ND	ND
m,p-Xylene	5.3	8.64	ND
Methyl Ethyl Ketone (2-Butanone)	3.5	2.54	ND
Methyl Methacrylate	1.5 J	0.99 J	ND
N-Heptane	4.6	ND	ND
N-Propylbenzene	3.4	1.61	ND
O-Xylene (1,2-Dimethylbenzene)	ND	2.78	ND
Sec-Butylbenzene	1.4 J	ND	ND
Styrene	30	2.64	ND
Tert-Butyl Alcohol	32	ND	ND
Tetrachloroethylene (PCE)	12	3.68	ND
Toluene	5	2	ND
Trichloroethylene (TCE)	0.91	ND	ND
Trichlorofluoromethane	30	21.3	9.9

IA-3	07/25/2025	09/29/2025	11/19/2025	11/19/2025 DUP
VOCs				
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.61 J	ND	0.57 J	0.53 J
1,2,4-Trimethylbenzene	4.6	18	1.5	1.6
1,3,5-Trimethylbenzene (Mesitylene)	1.1	4.49	ND	ND
1,3-Butadiene	0.088 J	ND	ND	ND
2,2,4-Trimethylpentane	0.77 J	0.49 J	0.51 J	0.51 J
4-Ethyltoluene	0.51 J	ND	0.93 J	0.94 J
Acetone	190 D	22.9	25	31
Benzene	0.93	0.46 J	0.51 J	0.51 J
Butane	130 D	2.97	4.2	4
Carbon Disulfide	1.9	ND	ND	ND
Carbon Tetrachloride	0.53	0.48	0.44	0.45
Chlorodifluoromethane	1.7 J	1.29 J	ND	ND
Chloroform	0.46 J	ND	0.43 J	0.43 J
Chloromethane	2.1	1.2	0.31 J	ND
Cyclohexane	2.6	0.61 J	1.4	1.4
Cymene	0.6 J	ND	ND	ND
Dichlorodifluoromethane	2.9	2.22 J	2.6	2.6
Ethylbenzene	1.7	1.45	1.1	1.1
Isopropanol	30	ND	ND	ND
Isopropylbenzene (Cumene)	ND	0.92 J	ND	ND
m,p-Xylene	6.8	6.2	5.2	5.2
Methyl Ethyl Ketone (2-Butanone)	7.9	1.46 J	ND	2.8
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	ND	0.53 J	ND	ND
Methyl Methacrylate	11	ND	0.65 J	0.7 J
Methylene Chloride	0.77 J	0.81 J	0.66 J	ND
N-Butylbenzene	0.47 J	ND	ND	ND
N-Heptane	1.9	ND	ND	ND
N-Hexane	40	0.47 J	0.51 J	0.64 J
N-Propylbenzene	0.72 J	1.62	ND	ND
O-Xylene (1,2-Dimethylbenzene)	3.2	2.17	1.6	1.6
Styrene	15	1.65	0.95	0.84 J
Tetrachloroethylene (PCE)	ND	ND	3.1	ND
Toluene	54	2.44	1.3	1.2
Trichlorofluoromethane	1.7	1.21	1.3	1.3

SVMP-8	11/19/2025
VOCs	
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.48 J
1,2,4-Trimethylbenzene	8.2
1,3,5-Trimethylbenzene (Mesitylene)	1.9
2,2,4-Trimethylpentane	0.4 J
4-Ethyltoluene	6
Acetone	39
Benzene	0.54 J
Butane	2.7
Carbon Disulfide	0.42 J
Carbon Tetrachloride	0.49
Cyclohexane	10
Dichlorodifluoromethane	2.5
Ethylbenzene	1.3
Isopropanol	10 J
m,p-Xylene	5.5
Methyl Ethyl Ketone (2-Butanone)	1.5
N-Hexane	0.46 J
N-Propylbenzene	0.95 J
O-Xylene (1,2-Dimethylbenzene)	1.5
Tert-Butyl Alcohol	7.2 J
Toluene	1.1
Trichlorofluoromethane	1.9

IA-8	11/19/2025
VOCs	
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.81 J
1,2,4-Trimethylbenzene	7.8
1,3,5-Trimethylbenzene (Mesitylene)	1.8
2,2,4-Trimethylpentane	0.43 J
4-Ethyltoluene	4.8
Acetone	12
Benzene	0.48 J
Butane	3.2
Carbon Tetrachloride	0.52
Cyclohexane	0.38 J
Dichlorodifluoromethane	2.5
Ethylbenzene	1.4
m,p-Xylene	5.9
N-Hexane	0.46 J
N-Propylbenzene	0.89 J
O-Xylene (1,2-Dimethylbenzene)	1.5
Tetrachloroethylene (PCE)	20
Toluene	1
Trichlorofluoromethane	1.2

SVMP-5	07/25/2025
VOCs	
Acetone	7000 D
Benzene	0.48 J
Butane	3.2
Carbon Tetrachloride	0.52
Cyclohexane	0.38 J
Dichlorodifluoromethane	2.5
Ethylbenzene	1.4
m,p-Xylene	5.9
N-Hexane	0.46 J
N-Propylbenzene	0.89 J
O-Xylene (1,2-Dimethylbenzene)	1.5
Tetrachloroethylene (PCE)	20
Toluene	1
Trichlorofluoromethane	1.2

IA-5	07/25/2025
VOCs	
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.63 J
1,2,4-Trimethylbenzene	1.1
1,3-Butadiene	0.23 J
2,2,4-Trimethylpentane	1.2
Acetone	100 D
Benzene	1.6
Butane	42
Carbon Disulfide	17
Carbon Tetrachloride	0.54
Chlorodifluoromethane	1.6 J
Chloroform	0.31 J
Chloromethane	1.9
Cis-1,2-Dichloroethylene	0.18 J
Cyclohexane	4.3
Cymene	0.61 J
Dichlorodifluoromethane	2.9
Ethylbenzene	2
Isopropanol	11 J
m,p-Xylene	8.1
Methyl Ethyl Ketone (2-Butanone)	4
Methyl Methacrylate	2.2
Methylene Chloride	0.74 J
N-Heptane	1.6
N-Hexane	11
O-Xylene (1,2-Dimethylbenzene)	2.3
Styrene	5.5
Toluene	18
Trichlorofluoromethane	1.7

SVMP-2	07/25/2025
VOCs	
1,2,4-Trimethylbenzene	2.8
1,3-Butadiene	0.39 J
Acetone	370 D
Benzene	0.64 J
Butane	6.9
Carbon Disulfide	4.4
Carbon Tetrachloride	0.5
Chlorodifluoromethane	3 J
Chloroform	9.3
Chloromethane	3.5
Cyclohexane	33
Dichlorodifluoromethane	3.3 J
Ethylbenzene	2.4
Isopropylbenzene (Cumene)	6
m,p-Xylene	5.4
Methyl Ethyl Ketone (2-Butanone)	2.5 J
Methyl Methacrylate	86
N-Heptane	2.1
N-Propylbenzene	2.7
O-Xylene (1,2-Dimethylbenzene)	2.5
Sec-Butylbenzene	1 J
Styrene	24
Tert-Butyl Alcohol	19 J
Tetrachloroethylene (PCE)	8
Toluene	4.1
Trans-1,2-Dichloroethene	0.28 J
Trichloroethylene (TCE)	0.82
Trichlorofluoromethane	12

IA-2	07/25/2025
VOCs	
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.61 J
1,2,4-Trimethylbenzene	1
1,3-Butadiene	0.12 J
2,2,4-Trimethylpentane	0.64 J
Acetone	130 D
Benzene	0.77
Butane	2.1
Carbon Disulfide	21
Carbon Tetrachloride	0.51
Chlorodifluoromethane	1.6 J
Chloroform	0.29 J
Chloromethane	2.1
Cyclohexane	0.35 J
Dichlorodifluoromethane	2.9
Ethylbenzene	0.58 J
m,p-Xylene	1.2 J
Methyl Ethyl Ketone (2-Butanone)	3.9
Methyl Methacrylate	200 D
Methylene Chloride	3.1
N-Heptane	1.2
N-Hexane	1.9
O-Xylene (1,2-Dimethylbenzene)	0.46 J
Toluene	2.4
Trichlorofluoromethane	1.6

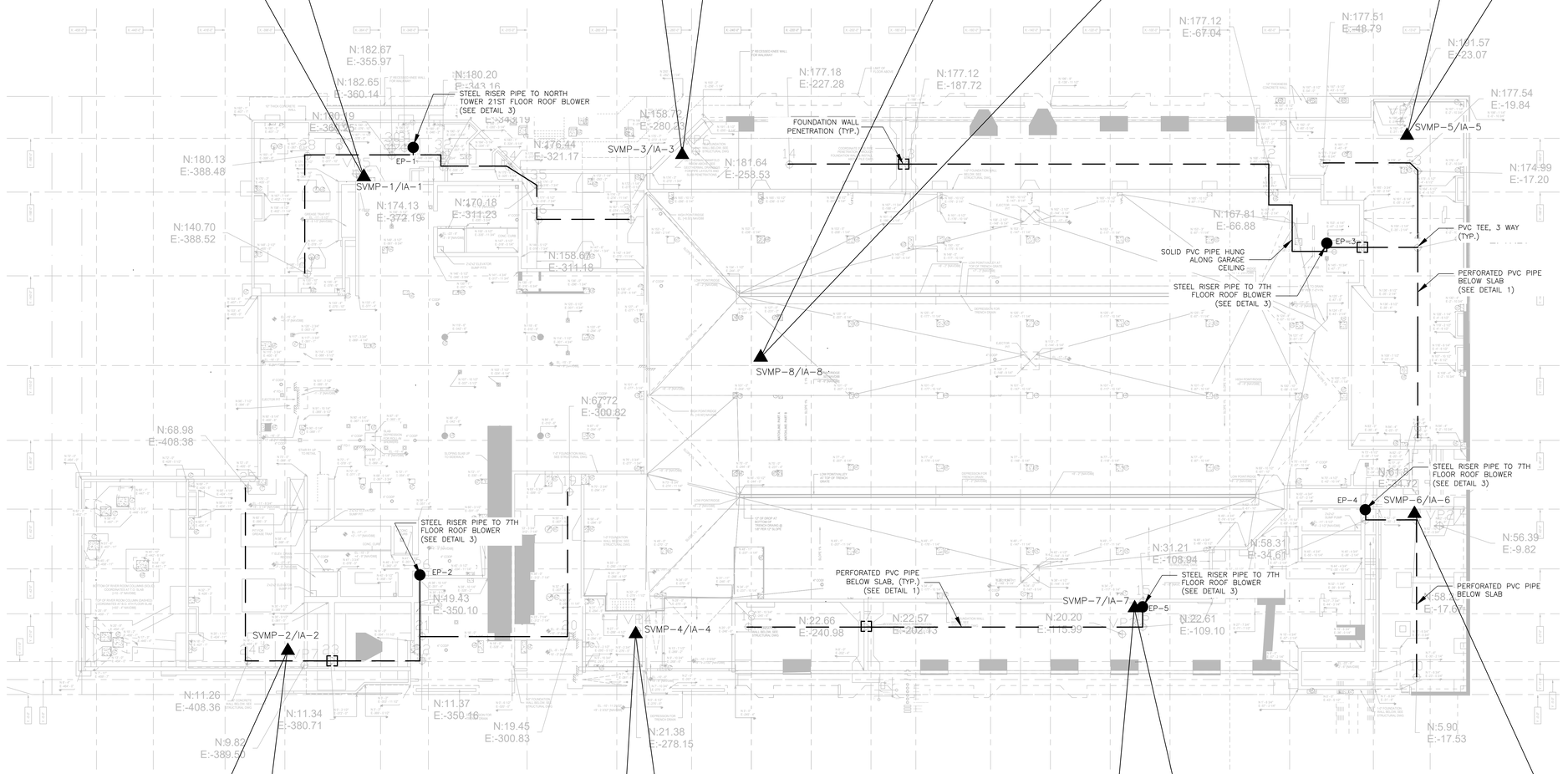
SVMP-4	07/25/2025	09/26/2025	11/19/2025
VOCs			
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND	ND	150
1,2,4-Trimethylbenzene	6.3 J-	ND	2.3
1,2-Dichlorotetrafluoroethane	ND	ND	28
2,2,4-Trimethylpentane	0.63 J-	ND	ND
2-Hexanone	ND	1.5 J	ND
Benzene	0.39 J-	ND	1.8
Butane	42 J-	15	12
Carbon Disulfide	0.57 J-	0.29 J	0.5 J
Carbon Tetrachloride	1.8 J-	1.8	1 J
Chlorodifluoromethane	1.6 J-	5.1 J+	ND
Chloroform	0.38 J-	0.47	21
Chloromethane	ND	ND	4.3
Cyclohexane	2.7 J-	8.7	7
Dichlorodifluoromethane	12 J-	1.4	ND
Ethylbenzene	ND	ND	1.8
m,p-Xylene	22 J-	1.7	0.68 J
Methyl Ethyl Ketone (2-Butanone)	1.9 J-	2.5	ND
Methyl Methacrylate	1.1 J-	0.55 J	0.93
Methylene Chloride	3.3 J-	1.4	ND
N-Heptane	2.9 J-	2.3	3.7
N-Hexane	10 J-	ND	2.6
N-Propylbenzene	1.6 J-	ND	ND
Sec-Butylbenzene	0.85 J-	ND	0.9 J
Styrene	0.83 J-	22	ND
Tert-Butyl Alcohol	1.4 J-	ND	ND
Tetrachloroethylene (PCE)	2.8 J-	ND	ND
Toluene	1.4 J-	ND	ND
Trichlorofluoromethane	1.3 J-	0.76 J	0.85 J
Sec-Butylbenzene	0.93 J-	ND	ND
Styrene	12 J-	0.77 J	ND
Tert-Butyl Alcohol	30 J-	ND	ND
Tetrachloroethylene (PCE)	ND	6.1	140
Tetrahydrofuran	ND	ND	4 J
Toluene	3.1 J-	1.7	0.85
Trichloroethylene (TCE)	0.21 J-	0.61	1
Trichlorofluoromethane	13 J-	40	89

IA-4	07/25/2025	09/26/2025	11/19/2025
VOCs			
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.64 J	ND	0.56 J
1,2,4-Trimethylbenzene	5.7	13	ND
1,3,5-Trimethylbenzene (Mesitylene)	0.65 J	1.6	ND
1,3-Butadiene	0.16 J	ND	ND
2,2,4-Trimethylpentane	0.98	2.6	ND
2-Hexanone	ND	1.6 J	ND
4-Ethyltoluene	0.49 J	ND	ND
Acetone	120 D	730 D	13
Benzene	0.96	2	0.37 J
Butane	30	31	3.4
Carbon Disulfide	7.6	ND	ND
Carbon Tetrachloride	0.53	0.54	ND
Chlorodifluoromethane	1.8	ND	ND
Chloroform	1.1	2.2	0.88 J
Chloromethane	2.9	1.5	ND
Cyclohexane	36	21	0.27 J
Dichlorodifluoromethane	2.9	2.4 J	2.6
Ethylbenzene	1.3	7.4	ND
Isopropanol	8.6 J	19	ND
Isopropylbenzene (Cumene)	0.68 J	1.7	ND
m,p-Xylene	4.2	30	ND
Methyl Ethyl Ketone (2-Butanone)	7.7	28	ND
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	ND	8.7	ND
Methyl Methacrylate	1.2 J	38	ND
Methylene Chloride	0.96 J	0.74 J	0.64 J
N-Heptane	1.4	3.9	ND
N-Hexane	6.6	5.1	ND
N-Propylbenzene	0.34 J	0.66 J	ND
O-Xylene (1,2-Dimethylbenzene)	1.8	8.3	ND
Styrene	2.2	11	ND
Tert-Butyl Alcohol	ND	8.6 J	ND
Tetrachloroethylene (PCE)	0.38 J	ND	12
Tetrahydrofuran	ND	6.4 J	ND
Toluene	4.4	22	0.29 J
Trichlorofluoromethane	1.7	1.2	1.3

SVMP-7	07/25/2025	11/19/2025
VOCs		
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND	0.6 J
1,3-Butadiene	3.1 J	ND
Acetone	2200 D	21
Benzene	6.9	0.49 J
Butane	12	3.8
Carbon Disulfide	23	0.45 J
Carbon Tetrachloride	ND	0.56
Chloroform	8.8 J	0.28 J
Chloromethane	9.2 J	ND
Cyclohexane	410	2.7
Dichlorodifluoromethane	ND	2.6
Ethylbenzene	4.8 J	ND
Isopropylbenzene (Cumene)	6.8 J	ND
m,p-Xylene	7.9 J	1.5 J
Methyl Ethyl Ketone (2-Butanone)	7 J	2.9
N-Heptane	17	ND
N-Hexane	8.3 J	0.5 J
N-Propylbenzene	3 J	ND
Styrene	28	ND
Tetrachloroethylene (PCE)	2.9 J	ND
Tetrahydrofuran	ND	3.9 J
Toluene	79	1.1
Trichlorofluoromethane	38	7.1

IA-7	07/25/2025	11/19/2025
VOCs		
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.63 J	0.61 J
1,2,4-Trimethylbenzene	0.53 J	1.2
1,3-Butadiene	0.97	0.37 J
2,2,4-Trimethylpentane	ND	0.56 J
2-Hexanone	41	14
4-Ethyltoluene	0.59 J	0.47 J
Acetone	5.3	3.2
Carbon Tetrachloride	0.53	0.49
Chlorodifluoromethane	1.7 J	ND
Chloromethane	1.9	ND
Cyclohexane	2.3	0.29 J
Dichlorodifluoromethane	2.7	2.3 J
Ethylbenzene	1.1	0.69 J
m,p-Xylene	6.1	3.5
Methyl Ethyl Ketone (2-Butanone)	4.2	ND
Methyl Methacrylate	0.81 J	0.61 J
Methylene Chloride	0.68 J	0.9 J
N-Heptane	0.88	ND
N-Hexane	1.7 J	0.48 J
O-Xylene (1,2-Dimethylbenzene)	1.3	0.88
Styrene	0.38 J	ND
Tetrachloroethylene (PCE)	0.5 J	7.3
Toluene	1.8	1.1
Trichlorofluoromethane	1.7	1.4

SVMP-6	07/25/2025
VOCs	
1,2,4-Trimethylbenzene	5.4
1,3,5-Trimethylbenzene (Mesitylene)	0.37 J
1,3-Butadiene	0.48
2,2,4-Trimethylpentane	0.57 J
2-Hexanone	13
4-Ethyltoluene	0.62 J
Acetone	110 D
Benzene	0.99
Butane	5.3
Carbon Disulfide	9.9
Carbon Tetrachloride	0.41
Chloroethane	0.67 J
Chloroform	24
Chloromethane	7.3
Cyclohexane	48
Dichlorodifluoromethane	2.8
Ethylbenzene	2.1
Isopropanol	9.4 J
Isopropylbenzene (Cumene)	5.6
m,p-Xylene	5.6
Methyl Ethyl Ketone (2-Butanone)	28
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	1.5 J
Methyl Methacrylate	2.6
Methylene Chloride	0.71 J
N-Heptane	3.6
N-Hexane	2
N-Propylbenzene	2.6
O-Xylene (1,2-Dimethylbenzene)	2.3
Sec-Butylbenzene	1.1
Styrene	21
Tert-Butyl Alcohol	56
Tetrachloroethylene (PCE)	4.9
Toluene	6.2
Trichloroethylene (TCE)	0.39
Trichlorofluoromethane	60



LEGEND

- PERFORATED PVC PIPE BELOW SLAB, SCHEDULE 40, 4" DIA.
- SOLID WALL PVC PIPE BELOW SLAB, SCHEDULE 40, 4" DIA.
- EP-1 — STEEL RISER PIPE EXTRACTION POINT, GALVANIZED, 4" DIA.
- [ ] — SUB-SLAB FOUNDATION WALL PENETRATION
- SVMP-1/IA-1 — VAPOR MONITORING POINT/INDOOR AIR POINT

SAMPLE LOCATION — SAMPLE DATE — ANALYTES — DETECTIONS

SVMP-5	07/25/2025
VOCs	
Acetone	7000 D
Butane	150
Chloromethane	74
Cyclohexane	2700 D
Ethylbenzene	5.7 J
Isopropanol	220 J
m,p-Xylene	8.2 J
Methyl Ethyl Ketone (2-Butanone)	69
N-Heptane	390
N-Hexane	43
Tert-Butyl Alcohol	820
Toluene	31
Trichloroethylene (TCE)	6.5

CONCENTRATIONS IN ug/m³

ug/m³ – MICROGRAMS PER CUBIC METER

VOCS – VOLATILE ORGANIC COMPOUNDS

ND – COMPOUND WAS ANALYZED FOR BUT NOT DETECTED

J – ESTIMATED VALUE

J– – ESTIMATED VALUE, LOW BIAS

D – A SECONDARY ANALYSIS AFTER DILUTION DUE TO EXCEEDANCE OF THE CALIBRATION RANGE IN THE ORIGINAL SAMPLE.

REFERENCES

1. BASE MAP FROM FOUNDATION PLAN, DRAWING NO. FD-100, PROGRESS SET DATED NOVEMBER 19, 2021.

GENERAL NOTES

1. SUB-SLAB DEPRESSURIZATION SYSTEM PIPING INSTALLED IMMEDIATELY BELOW LOWEST SLAB AS SHOWN ON DETAILS. SOME SOLID PVC PIPE SECTIONS HUNG ALONG GARAGE CEILING, AS NOTED.
2. RISERS FOR SUB-SLAB DEPRESSURIZATION SYSTEM TERMINATE ON ROOF AND CONFORM WITH SETBACK REQUIREMENTS SHOWN ON DETAILS.
3. SUB-SLAB PIPING AT UTILITY CROSSINGS CONSTRUCTED IN CONFORMANCE WITH DETAIL 6.

15' 0 15'

NO.	DATE	REVISION DESCRIPTION	INT.

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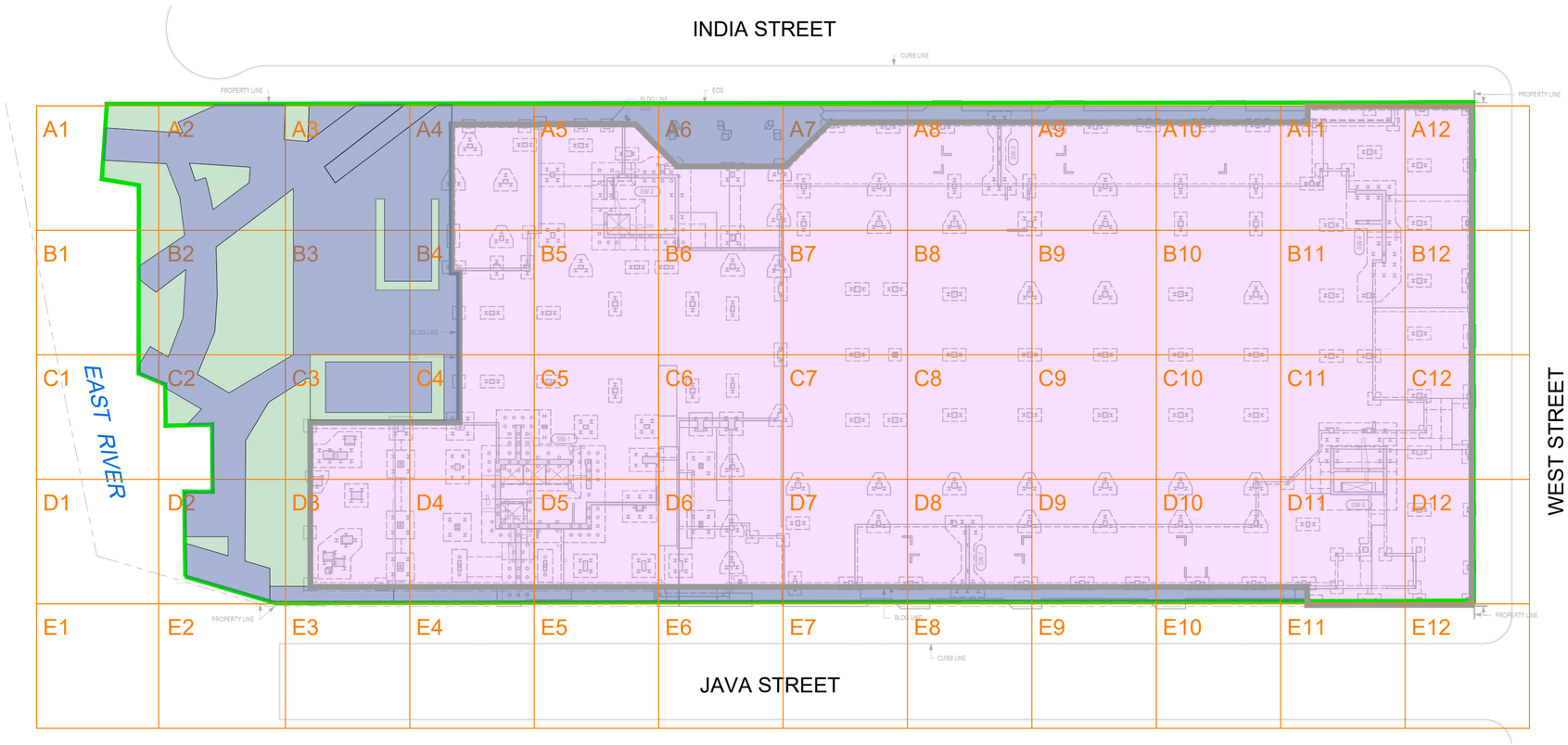
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Roux Environmental Engineering and Geology, D.P.C.
209 SHAFTER STREET ISLANDIA NEW YORK 11749
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PROJECT NAME:
GREENPOINT FERRY SITE
BROOKLYN, NEW YORK
PROJECT FOR:
1 JAVA OWNER, LLC

TITLE:
REMAINING SOIL VAPOR DETECTIONS

DRAWING NO.
5

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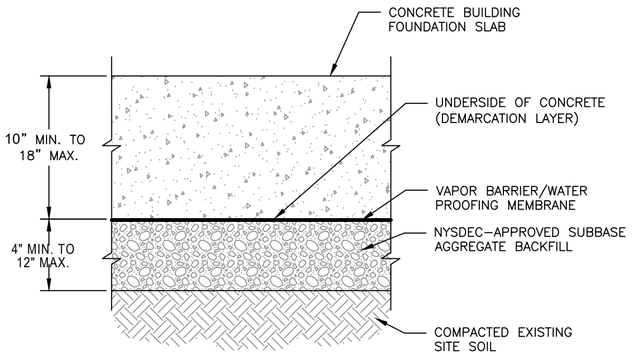


LEGEND

- BCP SITE BOUNDARY AND INSTITUTIONAL CONTROL BOUNDARY
- APPROXIMATE EXTENT OF BUILDING
- 50 FT ALPHANUMERIC GRID
- EXTERIOR LANDSCAPING WITH AT LEAST 2–FEET OF CLEAN FILL WITH UNDERLYING DEMARCATION (SEE DETAIL 3 AND NOTES 1 AND 2)
- EXTERIOR CONCRETE (SEE DETAIL 2 AND NOTE 2)
- CONCRETE BUILDING FOUNDATION WITH VAPOR BARRIER AND SSDS (SEE DETAIL 1 AND NOTE 2)

NOTE

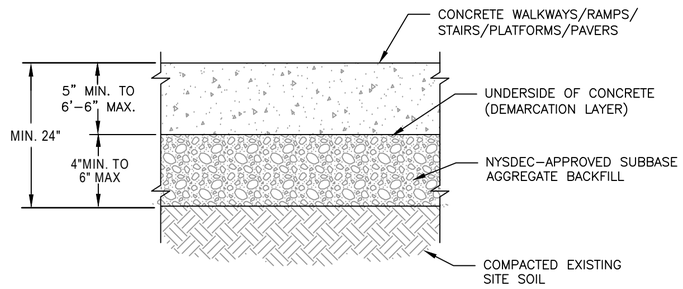
1. BACKFILL WAS APPROVED BY NYSDEC AND MEETS THE LOWER OF PART 375 RRSCOS OR PGWSCOS (WITH THE EXCEPTION OF VIRGIN GRANULAR FILL MATERIALS WITH LESS THAN 10 PERCENT PASSING THE NUMBER 80 SIEVE). FILL MATERIALS WITH LESS THAN 10 PERCENT PASSING THE NUMBER 80 SIEVE (I.E., STONE, GRAVEL, ET.) DID NOT REQUIRE SAMPLING.
2. SPECIFIC DETAILS FOR SITE COVER SYSTEM IN AREAS OF THE SITE ARE PROVIDED IN APPENDIX G.



1 SITE COVER SYSTEM: CONCRETE BUILDING FOUNDATION

SCALE: NOT TO SCALE

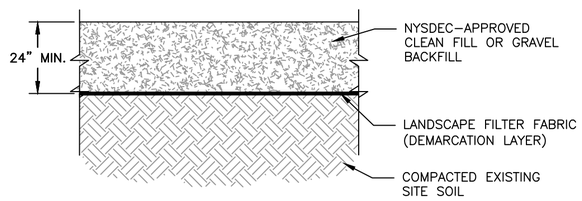
NOTE: FOR SITE COVER SYSTEM CONCRETE BUILDING FOUNDATION DETAILS SEE APPENDIX R, OWNER CONSTRUCTION DRAWINGS, 1 JAVA-FOUNDATION PLANS, DRAWINGS FO-100.01 THROUGH FO-106.00 FOR PLAN VIEW AND DRAWINGS FO-207.01, FO-208.00, FO-209.00, AND FO-300.01 THROUGH FO-305.00 FOR TYPICAL FOUNDATION SECTIONS.



2 SITE COVER SYSTEM: EXTERIOR CONCRETE

SCALE: NOT TO SCALE

NOTE: FOR SITE COVER SYSTEM EXTERIOR CONCRETE DETAILS SEE APPENDIX R, OWNER CONSTRUCTION DRAWINGS, 1 JAVA-WATERFRONT PLANS, DRAWINGS WSS-101.00 AND WSS-102.00 FOR PLAN VIEW AND DRAWINGS WSS-201.00 THROUGH WSS-203.00 AND WSS-501.00 THROUGH WSS-504.00 FOR SECTIONS AND TYPICAL DETAILS.



3 SITE COVER SYSTEM: EXTERIOR LANDSCAPING

SCALE: NOT TO SCALE

N

40' 0 40'

STATE OF NEW YORK
PAUL STEVEN MARTORANA
LICENSED PROFESSIONAL ENGINEER
88403

Title:

SITE WIDE COVER SYSTEM PLAN

GREENPOINT FERRY SITE
BROOKLYN, NEW YORK

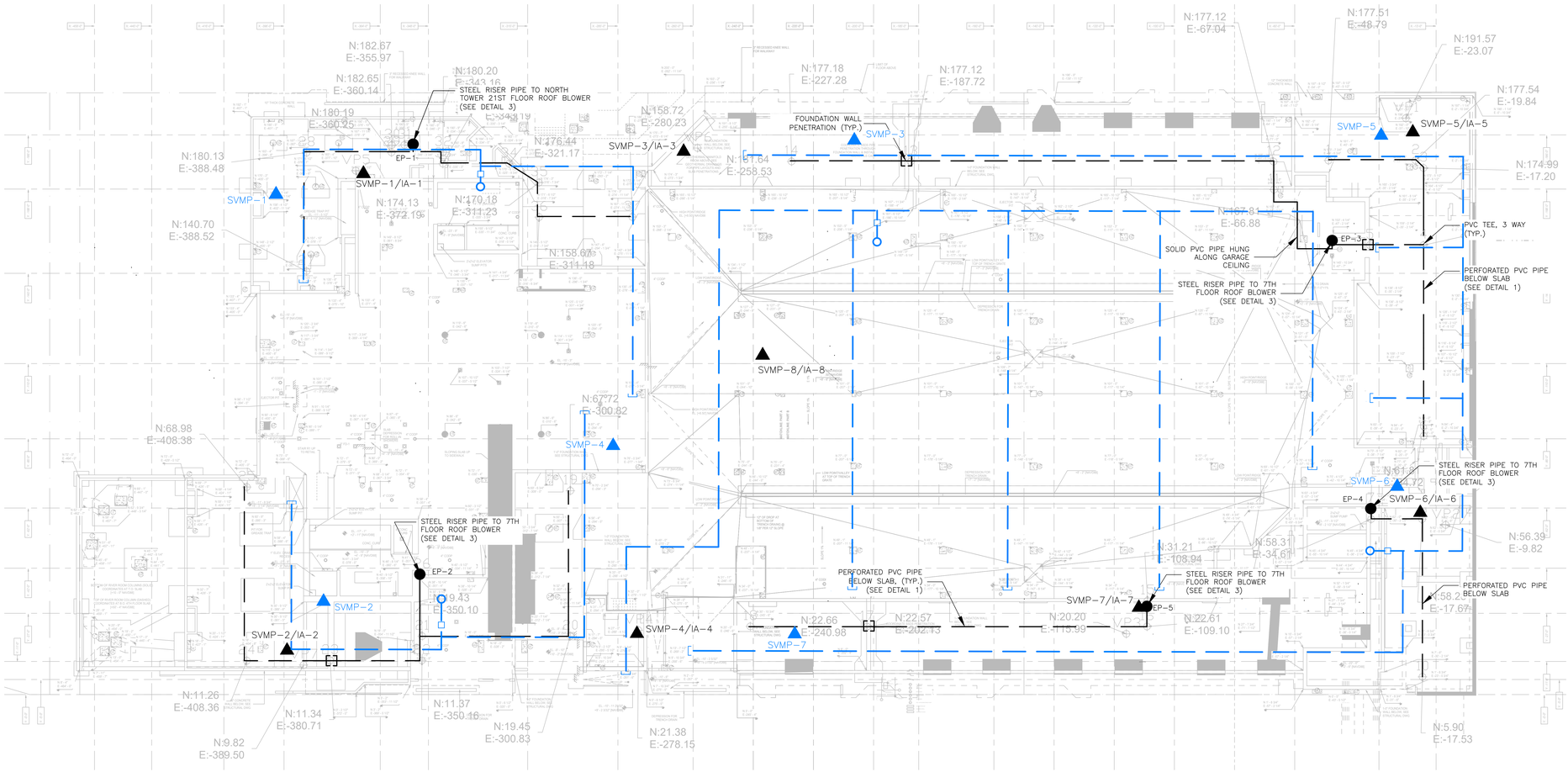
Prepared for:

1 JAVA OWNER LLC

ROUX

Compiled by: B.H.	Date: 29DEC25	FIGURE
Prepared by: G.M.	Scale: AS SHOWN	6A
Project Mgr: B.H.	Project: 3583.0001Y000	
File: 3583.0001Y167.04.DWG		

V:\CAD\PROJECTS\3583Y\0001Y\167\3583.0001Y167.04.DWG



LEGEND

- PERFORATED PVC PIPE BELOW SLAB, SCHEDULE 40, 4" DIA.
- SOLID WALL PVC PIPE BELOW SLAB, SCHEDULE 40, 4" DIA.
- EP-1 — STEEL RISER PIPE EXTRACTION POINT, GALVANIZED, 4" DIA.
- SUB-SLAB FOUNDATION WALL PENETRATION
- SVMP-1/IA-1 — VAPOR MONITORING POINT/INDOOR AIR POINT
- RAWP PIPE DESIGN
- RAWP RISER EXTRACTION POINT
- SVMP-2 — RAWP VAPOR MONITORING POINT

REFERENCES

1. BASE MAP FROM FOUNDATION PLAN, DRAWING NO. FO-100, PROGRESS SET DATED NOVEMBER 19, 2021.

GENERAL NOTES

1. SUB-SLAB DEPRESSURIZATION SYSTEM PIPING INSTALLED IMMEDIATELY BELOW LOWEST SLAB AS SHOWN ON DETAILS. SOME SOLID PVC PIPE SECTIONS HUNG ALONG GARAGE CEILING, AS NOTED.
2. RISERS FOR SUB-SLAB DEPRESSURIZATION SYSTEM TERMINATE ON ROOF AND CONFORM WITH SETBACK REQUIREMENTS SHOWN ON DETAILS.
3. SUB-SLAB PIPING AT UTILITY CROSSINGS CONSTRUCTED IN CONFORMANCE WITH DETAIL 6.

15' 0 15'

NO.	DATE	REVISION DESCRIPTION	INT.

STATE OF NEW YORK — PAUL STEVEN MARCHAND — 88403 — LICENSED PROFESSIONAL ENGINEER

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

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

PROJ. ENGINEER:	P.M.	DRAWN BY:	G.M.
DESIGNED BY:	P.M.	CHECKED BY:	P.M.
DRAWING SCALE:	AS SHOWN	PLOT SCALE:	1:1
DRAWING DATE:	15DEC25	PRINT TYPE:	B&W
OFFICE:	NY	PAPER SIZE:	ARCH E
PROJECT NO.:	3583.0001Y000		
DRAWING FILE:	3583.0001Y166.04.DWG		

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

PROJECT NAME:
GREENPOINT FERRY SITE
BROOKLYN, NEW YORK

PROJECT FOR:
1 JAVA OWNER, LLC

TITLE:
AS-BUILT DEVIATIONS FROM REMEDIAL ACTION WORK PLAN

DRAWING NO.
6B

V:\CAD\PROJECTS\3583\Y\0001Y\166\3583.0001Y166.04.DWG GM:TON

APPENDICES

A. Environmental Easement/Notice/Deed Restriction
B. List of Site Contacts
C. Monitoring Well Boring and Construction Logs
D. Excavation Work Plan
E. Health and Safety Plan/Community Air Monitoring Plan
F. Active SSDS Start-Up Certification Memorandum
G. As-Builts and Component Manual
H. Quality Assurance Project Plan/Field Sampling Plan
I. Site Management Forms
J. Remedial System Optimization Table of Contents

APPENDIX A

Environmental Easement

ENVIRONMENTAL EASEMENT GRANTED PURSUANT TO ARTICLE 71, TITLE 36 OF THE NEW YORK STATE ENVIRONMENTAL CONSERVATION LAW

THIS INDENTURE made this 26th day of August, 2025, between Owner, 1 Java Owner LLC, having an office at 300 Park Avenue, Suite 1402, New York, County and State of New York (the "Grantor"), and The People of the State of New York (the "Grantee"), acting through their Commissioner of the Department of Environmental Conservation (the "Commissioner", or "NYSDEC" or "Department" as the context requires) with its headquarters located at 625 Broadway, Albany, New York 12233,

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to encourage the remediation of abandoned and likely contaminated properties ("sites") that threaten the health and vitality of the communities they burden while at the same time ensuring the protection of public health and the environment; and

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to establish within the Department a statutory environmental remediation program that includes the use of Environmental Easements as an enforceable means of ensuring the performance of operation, maintenance, and/or monitoring requirements and the restriction of future uses of the land, when an environmental remediation project leaves residual contamination at levels that have been determined to be safe for a specific use, but not all uses, or which includes engineered structures that must be maintained or protected against damage to perform properly and be effective, or which requires groundwater use or soil management restrictions; and

WHEREAS, the Legislature of the State of New York has declared that Environmental Easement shall mean an interest in real property, created under and subject to the provisions of Article 71, Title 36 of the New York State Environmental Conservation Law ("ECL") which contains a use restriction and/or a prohibition on the use of land in a manner inconsistent with engineering controls which are intended to ensure the long term effectiveness of a site remedial program or eliminate potential exposure pathways to hazardous waste or petroleum; and

WHEREAS, Grantor, is the owner of real property located at the address of 127-141 West Street in the City of New York, County of Kings and State of New York, known and designated on the tax map of the New York City Department of Finance as tax map parcel number: Block 2538 Lot 1, being the same as that property conveyed to Grantor by deed dated October 7, 2020 and recorded in the City Register of the City of New York in City Register File No. 2020000284970. The property subject to this Environmental Easement (the "Controlled Property") comprises approximately 2.4205 +/- acres, and is hereinafter more fully described in the Land Title Survey dated October 22, 2024 prepared by Patrick Benedict Jones, which will be attached to the Site Management Plan. The Controlled Property description is set forth in and attached hereto as Schedule A; and

WHEREAS, the Department accepts this Environmental Easement in order to ensure the protection of public health and the environment and to achieve the requirements for remediation established for the Controlled Property until such time as this Environmental Easement is extinguished pursuant to ECL Article 71, Title 36; and

NOW THEREFORE, in consideration of the mutual covenants contained herein and the terms and conditions of Brownfield Cleanup Agreement Index Number: C224272-08-15, Grantor conveys to Grantee a permanent Environmental Easement pursuant to ECL Article 71, Title 36 in, on, over, under, and upon the Controlled Property as more fully described herein ("Environmental Easement").

1. Purposes. Grantor and Grantee acknowledge that the Purposes of this Environmental Easement are: to convey to Grantee real property rights and interests that will run with the land in perpetuity in order to provide an effective and enforceable means of encouraging the reuse and redevelopment of this Controlled Property at a level that has been determined to be safe for a specific use while ensuring the performance of operation, maintenance, and/or monitoring requirements; and to ensure the restriction of future uses of the land that are inconsistent with the above-stated purpose.

2. Institutional and Engineering Controls. The controls and requirements listed in the Department approved Site Management Plan ("SMP") including any and all Department approved amendments to the SMP are incorporated into and made part of this Environmental Easement. These controls and requirements apply to the use of the Controlled Property, run with the land, are binding on the Grantor and the Grantor's successors and assigns, and are enforceable in law or equity against any owner of the Controlled Property, any lessees and any person using the Controlled Property.

A. (1) The Controlled Property may be used for:

Restricted Residential as described in 6 NYCRR Part 375-1.8(g)(2)(ii), Commercial as described in 6 NYCRR Part 375-1.8(g)(2)(iii) and Industrial as described in 6 NYCRR Part 375-1.8(g)(2)(iv)

(2) All Engineering Controls must be operated and maintained as specified in the Site Management Plan (SMP);

(3) All Engineering Controls must be inspected at a frequency and in a manner defined in the SMP;

(4) The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the New York City Department of Health and Mental Hygiene to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;

(5) Groundwater and other environmental or public health monitoring must be performed as defined in the SMP;

(6) Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in the SMP;

(7) All future activities on the property that will disturb remaining

contaminated material must be conducted in accordance with the SMP;

(8) Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in the SMP;

(9) Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical components of the remedy shall be performed as defined in the SMP;

(10) Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by this Environmental Easement.

B. The Controlled Property shall not be used for Residential purposes as defined in 6NYCRR 375-1.8(g)(2)(i), and the above-stated engineering controls may not be discontinued without an amendment or extinguishment of this Environmental Easement.

C. The SMP describes obligations that the Grantor assumes on behalf of Grantor, its successors and assigns. The Grantor's assumption of the obligations contained in the SMP which may include sampling, monitoring, and/or operating a treatment system, and providing certified reports to the NYSDEC, is and remains a fundamental element of the Department's determination that the Controlled Property is safe for a specific use, but not all uses. The SMP may be modified in accordance with the Department's statutory and regulatory authority. The Grantor and all successors and assigns, assume the burden of complying with the SMP and obtaining an up-to-date version of the SMP from:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, New York 12233
Phone: (518) 402-9553

D. Grantor must provide all persons who acquire any interest in the Controlled Property a true and complete copy of the SMP that the Department approves for the Controlled Property and all Department-approved amendments to that SMP.

E. Grantor covenants and agrees that until such time as the Environmental Easement is extinguished in accordance with the requirements of ECL Article 71, Title 36 of the ECL, the property deed and all subsequent instruments of conveyance relating to the Controlled Property shall state in at least fifteen-point bold-faced type:

This property is subject to an Environmental Easement held by the New York State Department of Environmental Conservation pursuant to Title 36 of Article 71 of the Environmental Conservation

Law.

F. Grantor covenants and agrees that this Environmental Easement shall be incorporated in full or by reference in any leases, licenses, or other instruments granting a right to use the Controlled Property.

G. Grantor covenants and agrees that it shall, at such time as NYSDEC may require, submit to NYSDEC a written statement by an expert the NYSDEC may find acceptable certifying under penalty of perjury, in such form and manner as the Department may require, that:

(1) the inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under the direction of the individual set forth at 6 NYCRR Part 375-1.8(h)(3).

(2) the institutional controls and/or engineering controls employed at such site:

(i) are in-place;

(ii) are unchanged from the previous certification, or that any identified changes to the controls employed were approved by the NYSDEC and that all controls are in the Department-approved format; and

(iii) that nothing has occurred that would impair the ability of such control to protect the public health and environment;

(3) the owner will continue to allow access to such real property to evaluate the continued maintenance of such controls;

(4) nothing has occurred that would constitute a violation or failure to comply with any site management plan for such controls;

(5) the report and all attachments were prepared under the direction of, and reviewed by, the party making the certification;

(6) to the best of his/her knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program, and generally accepted engineering practices; and

(7) the information presented is accurate and complete.

3. Right to Enter and Inspect. Grantee, its agents, employees, or other representatives of the State may enter and inspect the Controlled Property in a reasonable manner and at reasonable times to assure compliance with the above-stated restrictions.

4. Reserved Grantor's Rights. Grantor reserves for itself, its assigns, representatives, and successors in interest with respect to the Property, all rights as fee owner of the Property, including:

A. Use of the Controlled Property for all purposes not inconsistent with, or limited by the terms of this Environmental Easement;

B. The right to give, sell, assign, or otherwise transfer part or all of the underlying fee interest to the Controlled Property, subject and subordinate to this Environmental Easement;

5. Enforcement

A. This Environmental Easement is enforceable in law or equity in perpetuity by Grantor, Grantee, or any affected local government, as defined in ECL Section 71-3603, against

the owner of the Property, any lessees, and any person using the land. Enforcement shall not be defeated because of any subsequent adverse possession, laches, estoppel, or waiver. It is not a defense in any action to enforce this Environmental Easement that: it is not appurtenant to an interest in real property; it is not of a character that has been recognized traditionally at common law; it imposes a negative burden; it imposes affirmative obligations upon the owner of any interest in the burdened property; the benefit does not touch or concern real property; there is no privity of estate or of contract; or it imposes an unreasonable restraint on alienation.

B. If any person violates this Environmental Easement, the Grantee may revoke the Certificate of Completion with respect to the Controlled Property.

C. Grantee shall notify Grantor of a breach or suspected breach of any of the terms of this Environmental Easement. Such notice shall set forth how Grantor can cure such breach or suspected breach and give Grantor a reasonable amount of time from the date of receipt of notice in which to cure. At the expiration of such period of time to cure, or any extensions granted by Grantee, the Grantee shall notify Grantor of any failure to adequately cure the breach or suspected breach, and Grantee may take any other appropriate action reasonably necessary to remedy any breach of this Environmental Easement, including the commencement of any proceedings in accordance with applicable law.

D. The failure of Grantee to enforce any of the terms contained herein shall not be deemed a waiver of any such term nor bar any enforcement rights.

6. Notice. Whenever notice to the Grantee (other than the annual certification) or approval from the Grantee is required, the Party providing such notice or seeking such approval shall identify the Controlled Property by referencing the following information:

County, NYSDEC Site Number, NYSDEC Brownfield Cleanup Agreement, State Assistance Contract or Order Number, and the County tax map number or the Liber and Page or computerized system identification number.

Parties shall address correspondence to:

Site Number: C224272
Office of General Counsel
NYSDEC
625 Broadway
Albany New York 12233-5500

With a copy to:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, NY 12233

All notices and correspondence shall be delivered by hand, by registered mail or by Certified mail and return receipt requested. The Parties may provide for other means of receiving and communicating notices and responses to requests for approval.

7. Recordation. Grantor shall record this instrument, within thirty (30) days of execution of this instrument by the Commissioner or her/his authorized representative in the office of the

recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

8. Amendment. Any amendment to this Environmental Easement may only be executed by the Commissioner of the New York State Department of Environmental Conservation or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

9. Extinguishment. This Environmental Easement may be extinguished only by a release by the Commissioner of the New York State Department of Environmental Conservation, or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

10. Joint Obligation. If there are two or more parties identified as Grantor herein, the obligations imposed by this instrument upon them shall be joint and several.

11. Consistency with the SMP. To the extent there is any conflict or inconsistency between the terms of this Environmental Easement and the SMP, regarding matters specifically addressed by the SMP, the terms of the SMP will control.

Remainder of Page Intentionally Left Blank

IN WITNESS WHEREOF, Grantor has caused this instrument to be signed in its name.

1 Java Owner LLC:

By: _____

Print Name: LAYTH MADI

Title: DIRECTOR OF DEVELOPMENT MANAGEMENT AND OPERATIONS Date: 8/13/2025

Grantor's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF NEW YORK)

On the 13th day of August, in the year 2025, before me, the undersigned, personally appeared Layth MADI, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

_____
Notary Public - State of New York

SOFIA FRROKAJ
NOTARY PUBLIC-STATE OF NEW YORK
No. 01FR0006301
Qualified in Westchester County
My Commission Expires 04-26-2027

THIS ENVIRONMENTAL EASEMENT IS HEREBY ACCEPTED BY THE PEOPLE OF THE STATE OF NEW YORK, Acting by and Through the Department of Environmental Conservation as Designee of the Commissioner,

By: _____
Andrew O. Guglielmi, Director
Division of Environmental Remediation

Grantee's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF ALBANY)

On the 26th day of August, in the year 2025 before me, the undersigned, personally appeared Andrew O. Guglielmi, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/ executed the same in his/her/ capacity as Designee of the Commissioner of the State of New York Department of Environmental Conservation, and that by his/her/ signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

_____
Notary Public - State of New York

Cheryl A. Salem
Notary Public State of New York
Registration No. 01SA0002177
Qualified in Albany County
My Commission Expires March 3, 2027

SCHEDULE "A" PROPERTY DESCRIPTION

Easement Description

BEGINNING AT THE INTERSECTION OF THE NORTHERLY LINE OF JAVA STREET (60 FEET WIDE) AND THE WESTERLY LINE OF WEST STREET (60 FEET WIDE), AND FROM SAID POINT AND PLACE OF BEGINNING

A. RUNNING THENCE; ALONG THE NORTHERLY LINE OF JAVA STREET, SOUTH 82 DEGREES 56 MINUTES 11 SECONDS WEST, A DISTANCE OF 480.58 FEET TO A POINT,
B. THENCE; NORTH 80 DEGREES 34 MINUTES 25 SECONDS WEST, A DISTANCE OF 37.42 FEET TO A POINT,
C. THENCE; NORTH 07 DEGREES 39 MINUTES 31 SECONDS WEST, A DISTANCE OF 34.06 FEET TO A POINT,
D. THENCE; NORTH 83 DEGREES 14 MINUTES 13 SECONDS EAST, A DISTANCE OF 11.32 FEET TO A POINT,
E. THENCE; NORTH 07 DEGREES 22 MINUTES 35 SECONDS WEST, A DISTANCE OF 26.90 FEET TO A POINT,
F. THENCE; NORTH 81 DEGREES 41 MINUTES 19 SECONDS WEST, A DISTANCE OF 18.65 FEET TO A POINT,
G. THENCE; NORTH 07 DEGREES 29 MINUTES 07 SECONDS WEST, A DISTANCE OF 16.45 FEET TO A POINT,
H. THENCE; NORTH 74 DEGREES 16 MINUTES 19 SECONDS WEST, A DISTANCE OF 11.62 FEET TO A POINT,
I. THENCE; NORTH 06 DEGREES 51 MINUTES 40 SECONDS WEST, A DISTANCE OF 75.38 FEET TO A POINT,
J. THENCE; SOUTH 87 DEGREES 32 MINUTES 34 SECONDS WEST, A DISTANCE OF 15.13 FEET TO A POINT,
K. THENCE; NORTH 03 DEGREES 06 MINUTES 10 SECONDS WEST, A DISTANCE OF 30.14 FEET TO A POINT,
L. THENCE; ALONG THE SOUTHERLY LINE OF INDIA STREET (60 FEET WIDE) NORTH 82 DEGREES 56 MINUTES 11 SECONDS EAST, A DISTANCE OF 547.71 FEET TO A POINT,
M. THENCE; ALONG THE WESTERLY SIDE OF AFOREMENTIONED WEST STREET SOUTH 07 DEGREES 03 MINUTES 49 SECONDS EAST, A DISTANCE OF 200.00 FEET TO THE POINT OR PLACE OF BEGINNING.

CONTAINING 105,440 SQUARE FEET OR 2.4205 ACRES

Deed Description (P/O Lot 1)

ALL THAT CERTAIN plot, piece or parcel of land, situate, lying and being in the Borough of Brooklyn, County of Kings, City and State of New York, bounded and described as follows:

BEGINNING at the corner formed by the intersection of the westerly side of West Street with the northerly side of Java Street;

RUNNING THENCE northerly along the westerly side of West Street, 200 feet to the southerly side of India Street;

THENCE westerly along the southerly side of India Street and a line in continuation thereof, 584.50 feet to the exterior line of the established bulkhead along the East River approved by The Secretary of War in 1917;

THENCE southerly along said exterior line of said bulkhead, 183.63 feet to a point in a line drawn parallel with the northerly side of Java Street and its prolongation westerly and distant 20 feet northerly therefrom;

THENCE easterly on a line forming an interior angles of 117 degrees 54 minutes 27 seconds with the last mentioned course, 70.47 feet to a point on the northerly side of Java Street distant 480.58 feet westerly from the northwest corner of said Java Street and West Street;

THENCE easterly along said northerly side of Java Street, 480.58 feet to the point or place of BEGINNING.

For Information Only: Premises known as 14-28 India Street a/k/a 1-45 Java Street a/k/a 127-141 West Street, Brooklyn, NY and designated as Block 2538 part of Lot 1 as shown on the Tax Map of the City of New York, County of Kings

TOGETHER WITH the benefits of that certain Pier Easement Agreement made between The People of the State of New York and 1 Java Owner LLC dated 11/10/2021 and to be recorded in the Office of the City Register of the County of Kings.

NEW YORK CITY DEPARTMENT OF FINANCE

NYC - RPT

Department of Finance

REAL PROPERTY TRANSFER TAX RETURN

(Pursuant to Title 11, Chapter 21, NYC Administrative Code)

▲ DO NOT WRITE IN THIS SPACE ▲
FOR OFFICE USE ONLY

GRANTOR

Name: 1 JAVA OWNER LLC

Grantor is a(n): (check one) ☐ individual ☐ partnership ☐ corporation ☑ single member LLC ☐ multiple member LLC (see instructions) ☐ other

Telephone Number: 212-592-6800

Permanent mailing address after transfer (number and street): 200 PARK AVENUE, 9TH FLOOR

City and State: NEW YORK, NY

Zip Code: 10166

Single member's name if grantor is a single member LLC: 1 JAVA VENTURE LLC

SOCIAL SECURITY NUMBER

OR

EMPLOYER IDENTIFICATION NUMBER: 85-2976917

SINGLE MEMBER EIN OR SSN: 85-2956896

GRANTEE

Name: PEOPLE OF NEW YORK BY DEPT. ENVIRONMENTAL CONSERVA

Grantee is a(n): (check one) ☐ individual ☐ partnership ☐ corporation ☐ single member LLC ☐ multiple member LLC (see instructions) ☑ other GOVERNMENTAL AGENCY

Telephone Number:

Permanent mailing address after transfer (number and street): 625 BROADWAY

City and State: ALBANY, NY

Zip Code: 12233

Single member's name if grantee is a single member LLC:

SOCIAL SECURITY NUMBER

OR

EMPLOYER IDENTIFICATION NUMBER: 14-6013200

SINGLE MEMBER EIN OR SSN

PROPERTY LOCATION

LIST EACH LOT SEPARATELY. ATTACH A RIDER IF ADDITIONAL SPACE IS REQUIRED

Address (number and street)	Apt. No.	Borough	Block	Lot	# of Floors	Square Feet	Assessed Value of Property
127-141 WEST STREET		BROOKLYN	2538	1	37	782,136	5,571,900.00

DATE OF TRANSFER TO GRANTEE: 4/3/2025

PERCENTAGE OF INTEREST TRANSFERRED: 0 %

CONDITION OF TRANSFER. See Instructions

Check (✓) all of the conditions that apply and fill out the appropriate schedules of this return. Additionally, Schedules1 and 2 **must** be completed for all transfers.

a. ☐ ..... Arms length transfer
b. ☐ ..... Transfer in exercise of option to purchase
c. ☐ ..... Transfer from cooperative sponsor to cooperative corporation
d. ☐ ..... Transfer by referee or receiver (complete Schedule A)
e. ☐ ..... Transfer pursuant to marital settlement agreement or divorce decree (complete Schedule I)
f. ☐ ..... Deed in lieu of foreclosure (complete Schedule C)
g. ☐ ..... Transfer pursuant to liquidation of an entity (complete Schedule D)
h. ☐ ..... Transfer from principal to agent, dummy, strawman or conduit or vice-versa (complete Schedule E)
i. ☐ ..... Transfer pursuant to trust agreement or will (attach a copy of trust agreement or will)
j. ☐ ..... Gift transfer not subject to indebtedness
k. ☐ ..... Gift transfer subject to indebtedness
l. ☐ ..... Transfer to a business entity in exchange for an interest in the business entity (complete Schedule F)
m. ☐ ..... Transfer to a governmental body
n. ☐ ..... Correction deed
o. ☐ ..... Transfer by or to a tax exempt organization (complete Schedule G)
p. ☐ ..... Transfer of property partly within and partly without NYC
q. ☐ ..... Transfer of successful bid pursuant to foreclosure
r. ☐ ..... Transfer by borrower solely as security for a debt or a transfer by lender solely to return such security
s. ☐ ..... Transfer wholly or partly exempt as a mere change of identity or form of ownership. Complete Schedule M)
t. ☐ ..... Transfer to a REIT or to a corporation or partnership controlled by a REIT. (Complete Schedule R)
u. ☐ ..... Other transfer in connection with financing (describe): _____
v. ☐ ..... A grant or assignment of a leasehold interest in a tax-free NY area
w. ☐ ..... Transfer to an HDFC or an entity controlled by an HDFC. (Complete Schedule L)
x. ..... Reserved
y. ..... Reserved
z. ☑ ..... Other (describe) ENVIRONMENTAL EASEMENT

2025040300557101O3

TYPE OF PROPERTY (✓)

- a. ☐ ..... 1-3 family house
- b. ☐ ..... Individual residential condominium unit
- c. ☐ ..... Individual cooperative apartment
- d. ☐ ..... Commercial condominium unit
- e. ☐ ..... Commercial cooperative
- f. ☐ ..... 4 family dwelling
- g. ☐ ..... Apartment building
- h. ☐ ..... Office building
- i. ☐ ..... Industrial building
- j. ☐ ..... Utility
- k. ☑ ..... OTHER (describe): OTHER

TYPE OF INTEREST (✓)

Check box at LEFT if you intend to record a document related to this transfer. Check box at RIGHT if you do not intend to record a document related to this transfer.

	REC.		NON REC.
a.	☐	Fee	☐
b.	☐	Leasehold Grant	☐
c.	☐	Leasehold Assignment or Surrender	☐
d.	☐	Easement	☑
e.	☐	Subterranean Rights	☐
f.	☐	Development Rights	☐
g.	☐	Stock	☐
h.	☐	Partnership Interest	☐
i.	☐	OTHER. (describe):	☐

SCHEDULE 1 - DETAILS OF CONSIDERATION

COMPLETE THIS SCHEDULE FOR ALL TRANSFERS AFTER COMPLETING THE APPROPRIATE SCHEDULES ON PAGES 5 THROUGH 12. ENTER "ZERO" ON LINE 11 IF THE TRANSFER REPORTED WAS WITHOUT CONSIDERATION.

1. Cash	1.	0 00
2. Purchase money mortgage	2.	0 00
3. Unpaid principal of pre-existing mortgage(s)	3.	0 00
4. Accrued interest on pre-existing mortgage(s)	4.	0 00
5. Accrued real estate taxes	5.	0 00
6. Amounts of other liens on property	6.	0 00
7. Value of shares of stock or of partnership interest received	7.	0 00
8. Value of real or personal property received in exchange	8.	0 00
9. Amount of Real Property Transfer Tax and/or other taxes or expenses of the grantor which are paid by the grantee	9.	0 00
10. Other (describe):	10.	0 00
11. **TOTAL CONSIDERATION** (add lines 1 through 10 - must equal amount entered on line 1 of Schedule 2) (see instructions)	11.	$ 0 00

See instructions for special rules relating to transfers of cooperative units, liquidations, marital settlements and transfers of property to a business entity in return for an interest in the entity.

SCHEDULE 2 - COMPUTATION OF TAX

A. **Payment**	Pay amount shown on line 15 - *See Instructions*	Payment Enclosed

1. Total Consideration (from line 11, above)	1.	0 00
2. Excludable liens (see instructions)	2.	0 00
3. Consideration (line 1 less line 2)	3.	0 00
4. Tax Rate (see instructions)	4.	0 %
5. HDFC Exemption (see Schedule L, line 15)	5.	0 00
6. Consideration less HDFC Exemption (line 3 less line 5)	6.	0 00
7. Percentage change in beneficial ownership (see instructions)	7.	100 %
8 Taxable consideration (multiply line 6 by line 7)	8.	0 00
9. Tax (multiply line 8 by line 4)	9.	0 00
10. Credit (see instructions)	10.	0 00
11. Transfer tax previously paid (see Schedule L, line 18)	11.	0 00
12. Tax due (line 9 less line 10 and 11) (if the result is negative, enter zero)	12.	0 00
13. Interest (see instructions)	13.	0 00
14. Penalty (see instructions)	14.	0 00
15. **Total Tax Due** (add lines 12, 13 and 14)	15.	$ 0 00

202504030055710103

GRANTOR'S ATTORNEY ▼

Name of Attorney: SIVE PAGET & RIESEL, P.C.			Telephone Number: (212) 421-2150
Address (number and street): 560 LEXINGTON AVE., 15TH FLOOR		City and State: NEW YORK, NY	Zip Code: 10022
EMPLOYER IDENTIFICATION NUMBER: 13-3061799	OR	SOCIAL SECURITY NUMBER:	

GRANTEE'S ATTORNEY ▼

Name of Attorney: NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION			Telephone Number: (518) 402-9518
Address (number and street): 625 BROADWAY		City and State: ALBANY, NY	Zip Code: 12233
EMPLOYER IDENTIFICATION NUMBER: 14-6013200	OR	SOCIAL SECURITY NUMBER:	

CERTIFICATION ▼

I swear or affirm that this return, including any accompanying schedules, affidavits and attachments, has been examined by me and is, to the best of my knowledge, a true and complete return made in good faith, pursuant to Title 11, Chapter 21 of the Administrative Code and the regulations issued thereunder.

GRANTOR

Sworn to and subscribed to before me on this 22nd day of April, 2025.

Signature of Notary: Sofia Frrokaj

Notary's stamp or seal:

SOFIA FRROKAJ
NOTARY PUBLIC-STATE OF NEW YORK
No. 01FR0006301
Qualified in Westchester County
My Commission Expires 04-26-2027

85-2976917
EMPLOYER IDENTIFICATION NUMBER OR SOCIAL SECURITY NUMBER

1 JAVA OWNER LLC
Name of Grantor

Signature of Grantor:

GRANTEE

Sworn to and subscribed to before me on this 26th day of AUGUST, 2025.

Signature of Notary: Cheryl A. Salem

Notary's stamp or seal:

Cheryl A. Salem
Notary Public State of New York
Registration No. 01SA0002177
Qualified in Albany County
My Commission Expires March 3, 2027

14-6013200
EMPLOYER IDENTIFICATION NUMBER OR SOCIAL SECURITY NUMBER

PEOPLE OF NEW YORK BY DEPT. ENVIRONMENTAL CONSERVA
Name of Grantee

Signature of Grantee:

2025040300557101

APPENDIX B

List of Site Contacts

APPENDIX B – LIST OF SITE CONTACTS

Name	Phone/Email Address
Site Owner: 1 Java Owner LLC	(314) 604-7977 Joshua.Argast@lendlease.com
Remedial Party: 1 Java Owner LLC	(314) 604-7977 Joshua.Argast@lendlease.com
Qualified Environmental Professional: Robert Kovacs, P.G.	(631) 232-2600 rkovacs@rouxinc.com
Remedial Engineer: Paul Martorano, P.E.	(631) 232-2600 pmartorano@rouxinc.com
NYSDEC DER Project Manager: Richard Mustico	(518) 402-9647 Richard.mustico1@dec.ny.gov
NYSDEC DER Project Manager's Supervisor: William Bennett	(518) 402-9659 william.bennett@dec.ny.gov
NYSDEC Site Control	(518) 402-9543 DERSiteControl@dec.ny.gov
NYSDOH Project Manager: Johnathan Robinson	(518) 402-7881 Johnathan.robinson@health.ny.gov
Remedial Party Attorney: Michael Bogin	(646) 378-7210 mbogin@sprlaw.com

APPENDIX C

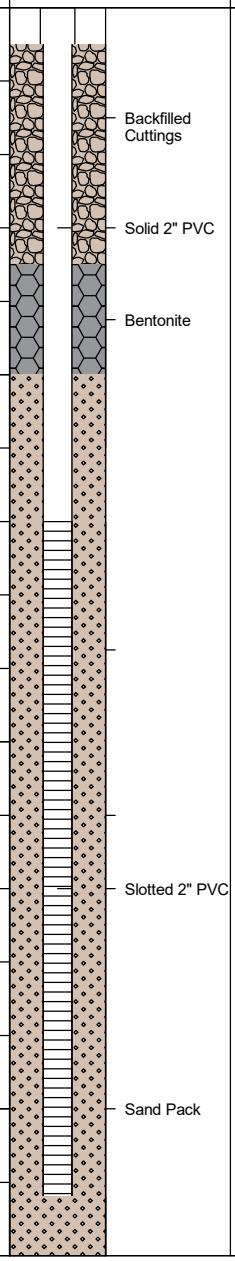
Monitoring Well Boring and Construction Logs

MW-1

Client: 1 Java Street Owner LLC	Site: 1 Java Street	Project Number: 3583.0001Y000
Address: 1 Java Street	City/State: Brooklyn, New York	Logged By: M. Villacres

Start to Finish Date: 5/8/2025 - 5/8/2025	Contractor: Aquifer Drilling & Testing	Drill Type: Geoprobe	Sampler Type/Method: 2" Macro-Core
Borehole Depth: 17 feet	Backfill: Cuttings	Borehole Diameter: 2-inches	DTW: 10 feet
Area: Exterior (At- Grade)	Elevation: 12.96	Latitude: 205723.28	Longitude: 885452.669

Well Depth: 17 feet	Well Dia./Materials: 2-inch PVC	Screen Interval: 7-17 feet	Screen Slot Size: 20-Slot	Sand/Filter Pack Size: Morie #2	Annular Seal: Bentonite

Depth (ft)	Well Diagram	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
								

ROUX STANDARD LOG_ - 5/22/25 15:36 - S:\GINT\PROJECTS\3583.0001Y000 WELL LOGS.GPJ

MW-2

Page 1 of 1

Client: 1 Java Street Owner LLC	Site: 1 Java Street	Project Number: 3583.0001Y000
Address: 1 Java Street	City/State: Brooklyn, New York	Logged By: M. Villacres

Start to Finish Date: 5/9/2025 - 5/9/2025	Contractor: Aquifer Drilling & Testing	Drill Type: Geoprobe	Sampler Type/Method: 2" Macro-Core
Borehole Depth: 15 feet	Backfill: Cuttings	Borehole Diameter: 2-inches	DTW: 5 feet
Area: Exterior (At- Grade)	Elevation: 8.44	Latitude: 205777.256	Longitude: 994928.824

Well Depth: 15 feet	Well Dia./Materials: 2-inch PVC	Screen Interval: 2-12 feet	Screen Slot Size: 20-Slot	Sand/Filter Pack Size: Morie #2	Annular Seal: Bentonite

Depth (ft)	Well Diagram	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
5	Backfilled Cuttings; Bentonite; Solid 2" PVC; Slotted 2" PVC; Sand Pack; Solid 2" PVC; Bottom Plug							
10								

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MW-3

Client: 1 Java Street Owner LLC	Site: 1 Java Street	Project Number: 3583.0001Y000
Address: 1 Java Street	City/State: Brooklyn, New York	Logged By: M. Villacres

Start to Finish Date: 5/8/2025 - 5/8/2025	Contractor: Aquifer Drilling & Testing	Drill Type: Geoprobe	Sampler Type/Method: 2" Macro-Core
Borehole Depth: 15 feet	Backfill: Cuttings	Borehole Diameter: 2-inches	DTW: 5 feet
Area: Exterior (At- Grade)	Elevation: 8.60	Latitude: 205646.752	Longitude: 994960.471

Well Depth: 15 feet	Well Dia./Materials: 2-inch PVC	Screen Interval: 2-12 feet	Screen Slot Size: 20-Slot	Sand/Filter Pack Size: Morie #2	Annular Seal: Bentonite

Depth (ft)	Well Diagram	USCS	USCS Graphic	Visual Description	Sample Interval	Recovery (ft)	PID	Notes
5	Backfilled Cuttings; Bentonite; Solid 2" PVC; Slotted 2" PVC; Sand Pack; Solid 2" PVC; Bottom Plug							
10								

ROUX STANDARD LOG_ - 5/22/25 15:36 - S:\GINT\PROJECTS\3583.0001Y000 WELL LOGS.GPJ

APPENDIX D

Excavation Work Plan

APPENDIX D – EXCAVATION WORK PLAN (EWP)

D-1 NOTIFICATION

At least 15 days prior to the start of any activity that is anticipated to encounter remaining contamination or breach or alter the site's cover system, the site owner or their representative will notify the NYSDEC contacts listed in the table below. Table D-1 includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of site-related contact information is provided in Appendix B of the SMP.

Table D-1: Notifications*

NYSDEC Project Manager: Richard Mustico	(518) 402-9647 Richard.mustico1@dec.ny.gov
NYSDEC Project Manager's Supervisor: William Bennett	(518) 402-9659 william.bennett@dec.ny.gov
NYSDEC Site Control	(518) 402-9543 DERSiteControl@dec.ny.gov

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

This notification will include:

- A detailed description of the work to be performed, including the location and areal extent of excavation, plans/drawings for site re-grading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of contaminated soil to be excavated, any modifications of truck routes, and any work that may impact an engineering control;
- A summary of environmental conditions anticipated to be encountered in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling;
- A schedule for the work, detailing the start and completion of all intrusive work, and submittals (e.g., reports) to the NYSDEC documenting the completed intrusive work;
- A summary of the applicable components of this EWP;
- A statement that the work will be performed in compliance with this EWP, 29 CFR 1910.120 and 29 CFR 1926 Subpart P;
- A copy of the contractor's health and safety plan (HASP), in electronic format, if it differs from the HASP provided in Appendix E of this SMP;
- Identification of disposal facilities for potential waste streams; and
- Identification of sources of any anticipated backfill, along with the required request to import form and all supporting documentation including, but not limited to, chemical testing results.

The NYSDEC project manager will review the notification and may impose additional requirements for the excavation that are not listed in this EWP. The alteration, restoration and modification of engineering

controls must conform with Article 145 Section 7209 of the Education Law regarding the application professional seals and alterations.

D-2 SOIL SCREENING METHODS

Visual, olfactory and instrument-based (e.g. photoionization detector) soil screening will be performed during all excavations into known or potentially contaminated material (remaining contamination) or a breach of the cover system. A qualified environmental professional as defined in 6 NYCRR Part 375, a PE who is licensed and registered in New York State, or a qualified person who directly reports to a PE who is licensed and registered in New York State will perform the screening. Soil screening will be performed when invasive work is done and will include all excavation and invasive work performed during development, such as excavations for foundations and utility work, after issuance of the COC.

Soils will be segregated based on previous environmental data and screening results into material that requires off-site disposal and material that requires testing to determine if the material can be reused on-site as soil beneath a cover or if the material can be used as cover soil. Further discussion of off-site disposal of materials and on-site reuse is provided in Section D-4 through D-7 of this Appendix.

D-3 SOIL STAGING METHODS

Soil stockpiles will be continuously encircled with a berm and/or silt fence. Hay bales will be used as needed near catch basins, surface waters and other discharge points.

Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected and damaged tarp covers will be promptly replaced.

Stockpiles will be inspected at a minimum once each week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by the NYSDEC.

D-4 MATERIALS EXCAVATION AND LOAD-OUT

A qualified environmental professional as defined in 6 NYCRR Part 375, a PE who is licensed and registered in New York State, or a qualified person who directly reports to a PE who is licensed and registered in New York State will oversee all invasive work and the excavation and load-out of all excavated material.

The owner of the property and remedial party (if applicable) and its contractors are responsible for safe execution of all invasive and other work performed under this Plan.

The presence of utilities and easements on the site will be investigated by the qualified environmental professional. It will be determined whether a risk or impediment to the planned work under

this SMP is posed by utilities or easements on the site. A site utility stakeout will be completed for all utilities prior to any ground intrusive activities at the site.

Loaded vehicles leaving the site will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and all other applicable transportation requirements). Trucks transporting contaminated soil must have either tight-fitting opaque covers that are secured on the sides and/or back, or opaque covers that are locked on all sides.

A truck wash will be operated on-site, as appropriate. The qualified environmental professional will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the site until the activities performed under this section are complete. Truck wash waters will be collected and disposed of off-site in an appropriate manner.

Locations where vehicles enter or exit the site shall be inspected daily for evidence of off-site soil tracking.

The qualified environmental professional will be responsible for ensuring that all egress points for truck and equipment transport from the site are clean of dirt and other materials derived from the site during intrusive excavation activities. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials. Material accumulated from the street cleaning and egress cleaning activities will be disposed off-site at a permitted landfill facility in accordance with all applicable local, State, and Federal regulations.

D-5 MATERIALS TRANSPORT OFF-SITE

All transport of materials will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded.

Material transported by trucks exiting the site will be secured with either tight-fitting opaque covers that are secured on the sides and/or back, or opaque covers that are locked on all sides. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used.

Truck transport routes are as follows and displayed on Figure 1: The inbound truck route to the Site is:

- From Interstate 278, take McGuiness Blvd north
- Take Greenpoint Avenue west (left turn)

- Turn north on Franklin Street (right turn)
- Turn west on Java Street (left turn)
- The Site is located on the right

The outbound truck route from the Site is:

- Leave the Site in India Street
- Take Franklin Street south (right turn)
- Take Greenpoint Avenue east (left turn)
- Take McGuiness Blvd south (right turn)
- Get on Interstate 278

All trucks loaded with site materials will exit the vicinity of the site using only these approved truck routes. This is the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off-site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport.

Trucks will be prohibited from stopping and idling in the neighborhood outside the project site.

Egress points for truck and equipment transport from the site will be kept clean of dirt and other materials during site remediation and development.

Queuing of trucks will be performed on-site in order to minimize off-site disturbance. Off-site queuing will be prohibited.

D-6 MATERIALS DISPOSAL OFF-SITE

All material excavated and removed from the site will be treated as contaminated and regulated material and will be transported and disposed off-site in a permitted facility in accordance with all local, State and Federal regulations. If disposal of material from this site is proposed for unregulated off-site disposal (i.e. clean soil removed for development purposes), a formal request with an associated plan will be made to the NYSDEC project manager. Unregulated off-site management of materials from this site will not occur without formal NYSDEC project manager approval.

Off-site disposal locations for excavated soils will be identified in the pre-excavation notification. This will include estimated quantities and a breakdown by class of disposal facility if appropriate, (e.g. hazardous waste disposal facility, solid waste landfill, petroleum treatment facility, C&D debris recovery

facility). Actual disposal quantities and associated documentation will be reported to the NYSDEC in the Periodic Review Report. This documentation will include, but will not be limited to: waste profiles, test results, facility acceptance letters, manifests, bills of lading and facility receipts.

Non-hazardous historic fill and contaminated soils taken off-site will be handled consistent with 6 NYCRR Parts 360, 361, 362, 363, 364 and 365. Material that does not meet Unrestricted SCOs is prohibited from being taken to a New York State C&D debris recovery facility (6 NYCRR Subpart 361-5 registered or permitted facility).

D-7 MATERIALS REUSE ON-SITE

The qualified environmental professional, as defined in 6 NYCRR Part 375, will ensure that procedures defined for materials reuse in this SMP are followed and that unacceptable material (i.e. contaminated) does not remain on-site. Contaminated on-site material, including historic fill and contaminated soil, that is acceptable for reuse on-site will be placed below the demarcation layer or impervious surface, and will not be reused within the cover system or within landscaping berms. Contaminated on-site material may only be used beneath the site cover as backfill for subsurface utility lines with prior approval from the DEC project manager.

Proposed materials for reuse on-site must be sampled for full suite analytical parameters including per- and polyfluoroalkyl substances (PFAS) and 1,4-dioxane. The sampling frequency will be in accordance with DER-10 Table 5.4(e)10 unless prior approval is obtained from the NYSDEC project manager for modification of the sampling frequency. The analytical results of soil/fill material testing must meet the site use criteria presented in NYSDEC DER-10 Appendix 5 – Allowable Constituent Levels for Imported Fill or Soil for all constituents listed, and the NYSDEC Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances April 2023 guidance values. Approvals for modifications to the analytical parameters must be obtained from the NYSDEC project manager prior to the sampling event.

Soil/fill material for reuse on-site will be segregated and staged as described in Sections D-2 and D-3 of this EWP. The anticipated size and location of stockpiles will be provided in the 15-day notification to the NYSDEC project manager. Stockpile locations will be based on the location of site excavation activities and proximity to nearby site features. Material reuse on-site will comply with requirements of NYSDEC DER-10 Section 5.4(e)4. Any modifications to the requirements of DER-10 Section 5.4(e)4 must be approved by the NYSDEC project manager.

Any demolition material proposed for reuse on-site will be sampled for asbestos and the results will be reported to the NYSDEC for acceptance. Concrete crushing or processing on-site will not be performed without prior NYSDEC approval. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the site may only be reused on-site with written approval from the NYSDEC project manager.

D-8 FLUIDS MANAGEMENT

All liquids to be removed from the site, including but not limited to, excavation dewatering, decontamination waters and groundwater monitoring well purge and development waters, will be handled, transported and disposed off-site at a permitted facility in accordance with applicable local, State, and Federal regulations. Dewatering, purge and development fluids will not be recharged back to the land surface or subsurface of the site, and will be managed off-site, unless prior approval is obtained from NYSDEC.

Discharge of water generated during large-scale construction activities to surface waters (i.e. a local pond, stream or river) will be performed under a SPDES permit.

D-9 COVER SYSTEM RESTORATION

After the completion of soil removal and any other invasive activities the cover system will be restored in a manner that complies with the decision document. This cover system is comprised of concrete-covered sidewalks, landscaped and gravel covered areas (with a minimum of 24 inches of clean fill over Site soils) and concrete building slabs. The demarcation layer, consisting of orange snow fencing material, white geotextile or equivalent material, etc. will be replaced to provide a visual reference to the top of the remaining contamination zone, the zone that requires adherence to special conditions for disturbance of remaining contaminated soils defined in this SMP. If the type of cover system changes from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt), as shown on Figure 5 on the SMP, this will constitute a modification of the cover element of the remedy and the upper surface of the remaining contamination. A figure showing the modified surface will be included in the subsequent Periodic Review Report and in an updated SMP. The alteration, restoration and modification of engineering controls must conform with Article 145 Section 7209 of the Education Law regarding the application professional seals and alterations.

D-10 BACKFILL FROM OFF-SITE SOURCES

All materials proposed for import onto the site will be approved by the qualified environmental professional, as defined in 6 NYCRR Part 375, and will be in compliance with provisions in this SMP prior to receipt at the site. A Request to Import/Reuse Fill or Soil form, which can be found at http://www.dec.ny.gov/regulations/67386.html, will be prepared and submitted to the NYSDEC project manager allowing a minimum of 5 business days for review. A copy of the form is presented in Appendix G of the RAWP.

Material from industrial sites, spill sites, other environmental remediation sites, or potentially contaminated sites will not be imported to the site.

All imported soils will meet the backfill and cover soil quality standards established in 6 NYCRR 375-6.7(d) and DER-10 Appendix 5 for restricted residential use. Based on an evaluation of the land use, protection of groundwater and protection of ecological resources criteria, the resulting soil quality standards are listed in Table 1. Soils that meet 'general' fill requirements under 6 NYCRR Part 360.13, but do not meet backfill or cover soil objectives for this site, will not be imported onto the site without prior approval by NYSDEC project manager. Soil material will be sampled for the full suite of analytical parameters, including PFAS and 1,4-dioxane. Solid waste will not be imported onto the site.

Trucks entering the site with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials and covered to prevent dust releases.

D-11 STORMWATER POLLUTION PREVENTION

Barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by the NYSDEC. All necessary repairs shall be made immediately.

Accumulated sediments will be removed as required to keep the barrier and hay bale check functional.

All undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials.

Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.

Erosion and sediment control measures identified in the SMP shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.

Silt fencing or hay bales will be installed around the entire perimeter of the construction area.

D-12 EXCAVATION CONTINGENCY PLAN

If underground tanks or other previously unidentified contaminant sources are found during post-remedial subsurface excavations or development related construction, excavation activities will be suspended until sufficient equipment is mobilized to address the condition. The NYSDEC project manager will be promptly notified of the discovery.

Sampling will be performed on product, sediment and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for a full list of analytes [TAL metals, TCL volatiles and semi-volatiles (including 1,4-dioxane), TCL pesticides and PCBs, and PFAS], unless the site history and previous sampling results provide sufficient justification to limit the list of analytes. In this case, a reduced list of analytes will be proposed to the NYSDEC project manager for approval prior to sampling. Any tanks will be closed as per NYSDEC regulations and guidance.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone within two hours to NYSDEC's Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. These findings will be also included in the Periodic Review Report.

D-13 COMMUNITY AIR MONITORING PLAN

Air monitoring around the Site perimeter and within the community is described in the Community Air Monitoring Plan (CAMP) included in the HASP located in Appendix E of the SMP. The location of air sampling stations will be based on generally prevailing wind conditions.

All CAMP reports will be submitted to NYSDEC and NYSDOH Project Managers on a daily basis. Exceedances of action levels listed in the CAMP will be reported to NYSDEC and NYSDOH Project Managers as soon as possible. All data is to be reported in the final report for the excavation activity.

D-13A: Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures

When work areas are within 20 feet of potentially exposed populations or occupied structures, the continuous monitoring locations for VOCs and particulates must reflect the nearest potentially exposed individuals and the location of ventilation system intakes for nearby structures. The use of engineering controls such as vapor/dust barriers, temporary negative-pressure enclosures, or special ventilation devices should be considered to prevent exposures related to the work activities and to control dust and odors. Consideration should be given to implementing the planned activities when potentially exposed populations are at a minimum, such as during weekends or evening hours in non-residential settings.

- If total VOC concentrations opposite the walls of occupied structures or next to intake vents exceed 1 part-per-million, monitoring should occur within the occupied structure(s). Depending upon the nature of contamination, chemical-specific colorimetric tubes of sufficient sensitivity may be necessary for comparing the exposure point concentrations with appropriate pre-determined response levels (response actions should also be pre-determined). Background readings in the occupied spaces must be taken prior to commencement of the planned work. Any unusual background readings should be discussed with NYSDOH prior to commencement of the work.
- If total particulate concentrations opposite the walls of occupied structures or next to intake vents exceed 150 micrograms per cubic meter, work activities should be suspended until controls are implemented and are successful in reducing the total particulate concentration to 150 micrograms per cubic meter or less at the monitoring point.

- Depending upon the nature of contamination and remedial activities, other parameters (e.g., explosivity, oxygen, hydrogen sulfide, carbon monoxide) may also need to be monitored. Response levels and actions should be pre-determined, as necessary, for each site.

D-13B: Special Requirements for Indoor Work with Co-Located Residences or Facilities

Unless a self-contained, negative-pressure enclosure with proper emission controls will encompass the work area, all individuals not directly involved with the planned work must be absent from the room in which the work will occur. Monitoring requirements shall be as stated above under "Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures" except that in this instance "nearby/occupied structures" would be adjacent occupied rooms. Additionally, the location of all exhaust vents in the room and their discharge points, as well as potential vapor pathways (openings, conduits, etc.) relative to adjoining rooms, should be understood and the monitoring locations established accordingly. In these situations, it is strongly recommended that exhaust fans or other engineering controls be used to create negative air pressure within the work area during remedial activities. Additionally, it is strongly recommended that the planned work be implemented during hours (e.g. weekends or evenings) when building occupancy is at a minimum.

D-14 ODOR CONTROL PLAN

This odor control plan is capable of controlling emissions of nuisance odors off-site and on-site. Specific odor control methods to be used on a routine basis will include limiting open excavation areas and covering excavated soil (i.e., with polyethylene sheeting or in covered roll off containers). If nuisance odors are identified at the site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the remedial party's Remediation Engineer, and any measures that are implemented will be discussed in the Periodic Review Report.

All necessary means will be employed to prevent on- and off-site nuisances. At a minimum, these measures will include: (a) limiting the area of open excavations and size of soil stockpiles; (b) shrouding open excavations with tarps and other covers; and (c) using foams to cover exposed odorous soils. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for off-site disposal; (e) use of chemical odorants in spray or misting systems; and, (f) use of staff to monitor odors in surrounding neighborhoods.

If nuisance odors develop during intrusive work that cannot be corrected, or where the control of nuisance odors cannot otherwise be achieved due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering the excavation and handling areas in a temporary containment structure equipped with appropriate air venting/filtering systems.

D-15 DUST CONTROL PLAN

Particulate monitoring must be conducted according to the Community Air Monitoring Plan (CAMP) provided in Section D-13. If particulate levels at the site exceed the thresholds listed in the CAMP or if airborne dust is observed on the site or leaving the site, the dust suppression techniques listed below will be employed. The remedial party will also take measures listed below to prevent dust production on the site.

A dust suppression plan that addresses dust management during invasive on-site work will include, at a minimum, the items listed below:

- Dust suppression will be achieved using a dedicated on-site water truck for road wetting. The truck will be equipped with a water cannon capable of spraying water directly onto off-road areas including excavations and stockpiles.
- Use of properly anchored tarps to cover stockpiles; and
- Exercising extra care during dry and high-wind periods.

D-16 OTHER NUISANCES

A plan for rodent control will be developed and utilized by the contractor prior to and during site clearing and site grubbing, and during all remedial work.

A plan will be developed and utilized by the contractor for all remedial work to ensure compliance with local noise control ordinances.

Table 1. Backfill Soil Cleanup Objectives, Greenpoint Ferry Site, Brooklyn, New York

Parameter	CAS Number	Units	Track 4 Backfill SCOs [1]
Volatile Organic Compounds			
1,1,1-Trichloroethane	71-55-6	mg/kg	0.68
1,1-Dichloroethane	75-34-3	mg/kg	0.27
1,1-Dichloroethene	75-35-4	mg/kg	0.33
1,2,4-Trimethylbenzene	95-63-6	mg/kg	3.6
1,2-Dichlorobenzene	95-50-1	mg/kg	1.1
1,2-Dichloroethane	107-06-2	mg/kg	0.02
1,3,5-Trimethylbenzene	108-67-8	mg/kg	8.4
1,3-Dichlorobenzene	541-73-1	mg/kg	2.4
1,4-Dichlorobenzene	106-46-7	mg/kg	1.8
1,4-Dioxane	123-91-1	mg/kg	0.1
Acetone	67-64-1	mg/kg	0.05
Benzene	71-43-2	mg/kg	0.06
Carbon tetrachloride	56-23-5	mg/kg	0.76
Chlorobenzene	108-90-7	mg/kg	1.1
Chloroform	67-66-3	mg/kg	0.37
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.25
Ethylbenzene	100-41-4	mg/kg	1
2-Butanone (MEK)	78-93-3	mg/kg	0.12
Methylene Chloride	75-09-2	mg/kg	0.05
MTBE	1634-04-4	mg/kg	0.93
n-Butylbenzene	104-51-8	mg/kg	12
n-Propylbenzene	103-65-1	mg/kg	3.9
sec-Butylbenzene	135-98-8	mg/kg	11
tert-Butylbenzene	98-06-6	mg/kg	5.9
Tetrachloroethene	127-18-4	mg/kg	1.3
Toluene	108-88-3	mg/kg	0.7
trans-1,2-Dichloroethene	156-60-5	mg/kg	0.19
Trichloroethene	79-01-6	mg/kg	0.47
Vinyl chloride	75-01-4	mg/kg	0.02
Xylenes (total)	1330-20-7	mg/kg	1.6
Semivolatile Organic Compounds			
Acenaphthene	83-32-9	mg/kg	98
Acenaphthylene	208-96-8	mg/kg	100
Anthracene	120-12-7	mg/kg	100
Benzo[a]anthracene	56-55-3	mg/kg	1
Benzo[a]pyrene	50-32-8	mg/kg	1
Benzo[b]fluoranthene	205-99-2	mg/kg	1
Benzo[g,h,i]perylene	191-24-2	mg/kg	100
Benzo[k]fluoranthene	207-08-9	mg/kg	1.7
Chrysene	218-01-9	mg/kg	1
Dibenzo[a,h]anthracene	53-70-3	mg/kg	0.33
Dibenzofuran	132-64-9	mg/kg	59
Fluoranthene	206-44-0	mg/kg	100
Fluorene	86-73-7	mg/kg	100
Hexachlorobenzene	118-74-1	mg/kg	1.2
Indeno[1,2,3-cd]pyrene	193-39-5	mg/kg	0.5
3-Methylphenol	108-39-4	mg/kg	0.33
Naphthalene	91-20-3	mg/kg	12
2-Methylphenol	95-48-7	mg/kg	0.33
4-Methylphenol	106-44-5	mg/kg	0.33
Pentachlorophenol	87-86-5	mg/kg	0.8
Phenanthrene	85-01-8	mg/kg	100
Phenol	108-95-2	mg/kg	0.33
Pyrene	129-00-0	mg/kg	100

Table 1. Backfill Soil Cleanup Objectives, Greenpoint Ferry Site, Brooklyn, New York

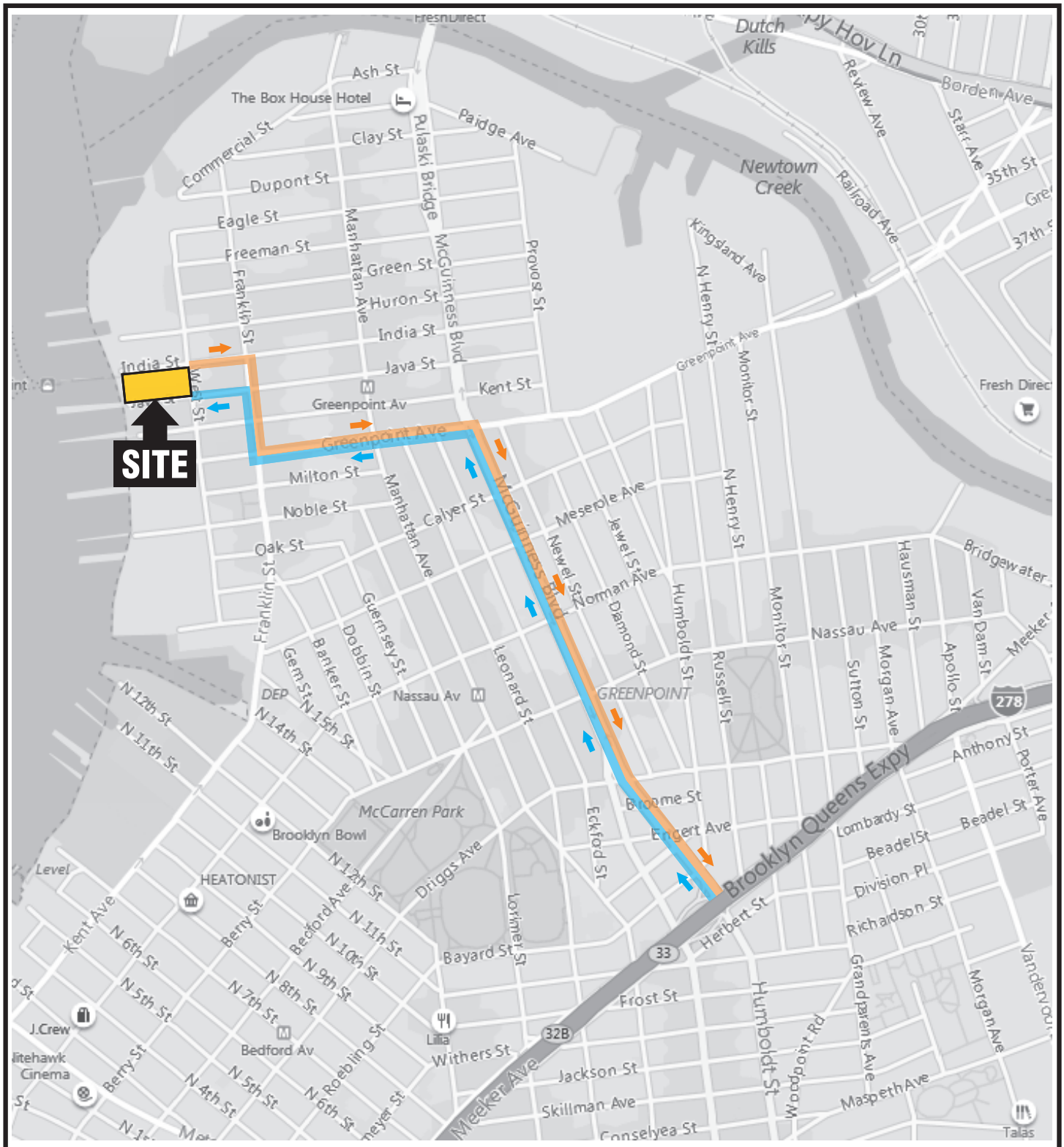
Parameter	CAS Number	Units	Track 4 Backfill SCOs [1]
Metals (Inorganics)			
Arsenic	7440-38-2	mg/kg	16
Barium	7440-39-3	mg/kg	400
Beryllium	7440-41-7	mg/kg	47
Cadmium	7440-43-9	mg/kg	4.3
Chromium, Hexavalent	18540-29-9	mg/kg	19
Chromium, Trivalent	16065-83-1	mg/kg	180
Chromium	7440-47-3	mg/kg	180
Copper	7440-50-8	mg/kg	270
Cyanide	57-12-5	mg/kg	27
Lead	7439-92-1	mg/kg	400
Manganese	7439-96-5	mg/kg	2000
Mercury	7439-97-6	mg/kg	0.73
Nickel	7440-02-0	mg/kg	130
Selenium	7782-49-2	mg/kg	4
Silver	7440-22-4	mg/kg	8.3
Zinc	7440-66-6	mg/kg	2480
Polychlorinated biphenyls (PCBs)			
Polychlorinated biphenyls (PCBs) - total	1336-36-3	mg/kg	1
Pesticides and Herbicides			
2,4,5-TP	93-72-1	mg/kg	3.8
4,4'-DDD	72-54-8	mg/kg	13
4,4'-DDE	72-55-9	mg/kg	8.9
4,4'-DDT	50-29-3	mg/kg	7.9
Aldrin	309-00-2	mg/kg	0.097
alpha-BHC	319-84-6	mg/kg	0.02
beta-BHC	319-85-7	mg/kg	0.09
delta-BHC	319-86-8	mg/kg	0.25
alpha-Chlordane	5103-71-9	mg/kg	2.9
Dieldrin	60-57-1	mg/kg	0.1
Endosulfan I	959-98-8	mg/kg	24
Endosulfan II	33213-65-9	mg/kg	24
Endosulfan sulfate	1031-07-8	mg/kg	24
Endrin	72-20-8	mg/kg	0.06
Heptachlor	76-44-8	mg/kg	0.38
gamma-BHC (Lindane)	58-89-9	mg/kg	0.1
Per- and Polyfluoroalkyl Substances (PFAS)			
Perfluorooctanoic Acid (PFOA)	335-67-1	µg/kg	0.8
Perfluorooctane Sulfonate (PFOS)	1763-23-1	µg/kg	1

Notes:

[1] Track 4 Backfill SCOs for the Track 4 areas are the lower of the NYSDEC Part 375 Protection of Groundwater or Restricted Residential Use SCOs.

[2] Track 4 SCOs for PFAS are based on the NYSDEC Sampling, Analysis and Assessment of PFAS Guidelines dated April 2023. If PFOA or PFOS is detected in any sample at or above the SCO then the soil will be tested by SPLP and the leachate analyzed for PFAS. The SCO for SPLP testing will be 10 ppt.

mg/kg - Milligrams per kilogram
µg/kg - micrograms per kilogram
NYSDEC - New York State Department of Environmental Conservation
SCOs - Soil Cleanup Objectives
SPLP - Synthetic Precipitation Leaching



IN-BOUND ROUTE

- From Interstate 278, take McGuiness Blvd north
- Take Greenpoint Avenue west (left turn)
- Turn north on Franklin Street (right turn)
- Turn west on Java Street (left turn)
- The Site is located on the right

OUT-BOUND ROUTE

- Leave the Site in India Street
- Take Franklin Street south (right turn)
- Take Greenpoint Avenue east (left turn)
- Take McGuiness Blvd south (right turn)
- Get on Interstate 278

N

1000' 0 1000'

Title:

TRUCK ROUTE MAP

GREENPOINT FERRY SITE
BROOKLYN, NEW YORK

Prepared for:

1 JAVA OWNER LLC

ROUX

Compiled by: E.B.	Date: 19APR21
Prepared by: B.H.C.	Scale: AS SHOWN
Project Mgr: J.W.	Project: 3583.0001Y000
File: 3583.0001Y107.04.CDR	

FIGURE 1

V:\CAD\PROJECTS\3583\Y0001Y\107\3583.0001Y107.04.CDR

APPENDIX E

Health and Safety Plan/Community Air Monitoring Plan

Site-Specific Health and Safety Plan

Greenpoint Ferry Site
1 Java Street
Brooklyn, New York 11222

July 29, 2025

Prepared for:

1 Java Owner LLC
200 Park Avenue, 9th Floor
New York, New York

Prepared by:

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

3583.0001Y180/CV

Environmental Consulting
& Management
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Site-Specific Emergency Information

Emergency Phone Numbers

Most emergency services can be obtained by calling 911. Where 911 service is not available, use the telephone numbers provided in the below table. The following is a master emergency phone list for use by the project management personnel. A more condensed version of the emergency numbers listed below will be posted throughout project work areas. Emergencies encountered on the site will be responded to by a combination of off-site emergency services and on-site personnel.

Emergency Contact Information			
Site Personnel			
Title	**Contact**		**Telephone**
Operations Manager (OM)	Jeffrey Wills		516-637-0213
Project Principal (PP)	Robert Kovacs		516-250-0359
Project Manager (PM)	Brooke Hildebrand		631-356-3719
Site Supervisor (SS)	TBD		
Site Health and Site Safety Officer (SHSO)	TBD		
Office Health and Safety Manager (OHSM)	Nevin Pahlad		347-885-6930
Corporate Health and Safety Director (CHSD)	Brian Hobbs, CIH, CSP		631-807-0193
WorkCare, Inc.	Occupational Health Care Management Provider		888-449-7787
Client Emergency Contact	Joshua Argast		314-604-7977
Outside Assistance			
Agency	**Contact**	**Telephone**	**Address/Location**
Ambulance/EMS	FDNY EMS Station 8	911	435 E 26th Street New York, NY 10016
Urgent Care	CityMD Greenpoint Urgent Care	(718) 489-3549	795 Manhattan Avenue Brooklyn, NY 11222
Police	NYCPD - 94th Precinct	(718) 383-3879	100 Meserole Avenue Brooklyn, NY 11222
Fire	FDNY Engine 238 & Ladder 106	(718) 999-2000	205 Greenpoint Avenue Brooklyn, NY 11222
Hospital	NYU Langone Health -Tisch Hospital	(646) 929-7870	550 1st Avenue New York, NY 10016
Site Address	1 Java St, Brooklyn, NY 11222		

Route to NYU Langone Health -Tisch Hospital, 550 1st Avenue, New York, NY (Figure 3):

Follow India Street to McGuinness Boulevard

Take Pulaski Bridge to Queens Midtown Tunnel

Take 2nd Avenue to 1st Avenue

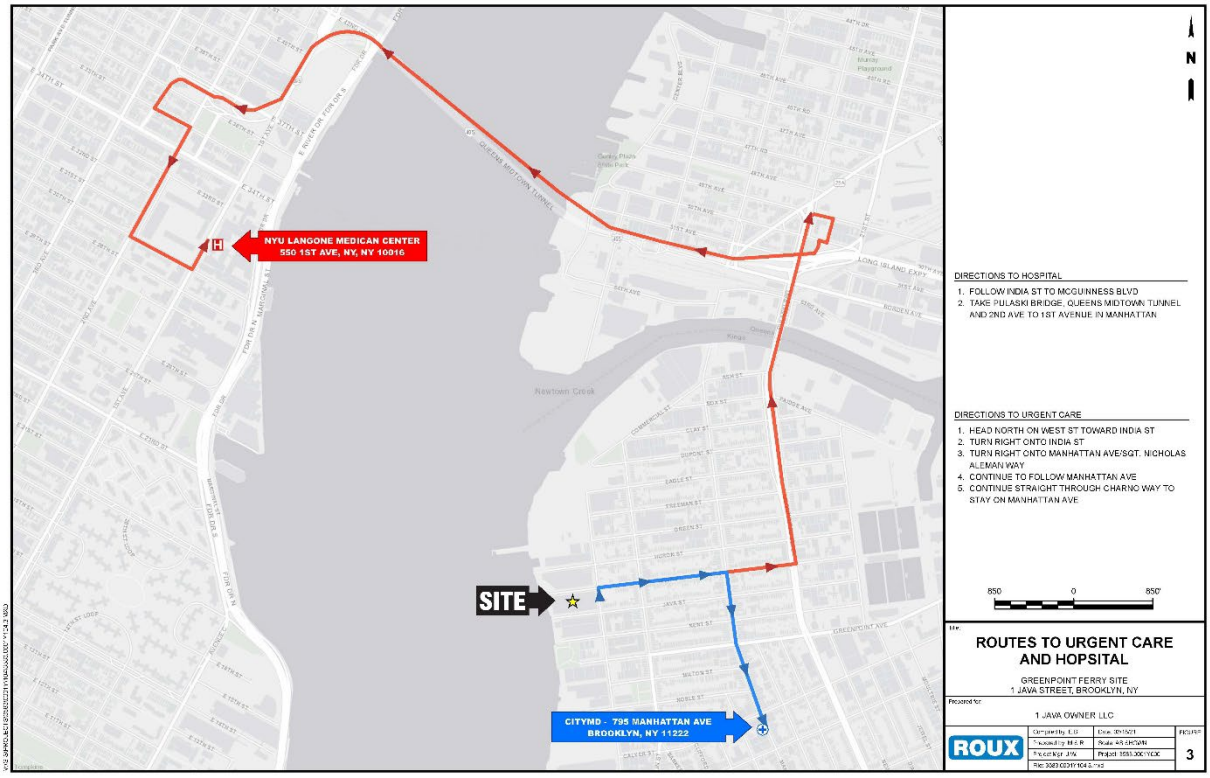
Route to City MD Greenpoint Urgent Care, 795 Manhattan Avenue, Brooklyn, NY (Figure 3):

Head north on West Street toward India Street

Turn right at the 1st cross street onto India Street

Turn right at the 2nd cross street onto Manhattan Avenue/Sgt. Nicholas Aleman Way, continue to follow Manhattan Avenue

Continue straight through Charno Way to Stay on Manhattan Avenue



1. Introduction

This Site-specific Health and Safety Plan (HASP) has been prepared by Roux Environmental Engineering and Geology, D.P.C. (Roux) for use during the Site management activities at the 1 Java Street Development, also known as Greenpoint Ferry Site, located at 1 Java Street, Brooklyn, New York (Site; **Figure 1**). This HASP was prepared in general accordance with the requirements of the Occupational Safety and Health Administration (OSHA) standards promulgated at 29 CFR 1910.120 and 29 CFR 1926.65, both commonly referred to as the Hazardous Waste Operations and Emergency Response (HAZWOPER) Standard. In accordance with the HAZWOPER Standard, this Site-specific HASP was prepared to address the safety and health hazards associated with the Site management activities which may include soil sampling, soil vapor sampling, groundwater sampling, and Site inspections activities being performed at the Site by Roux and to provide requirements and procedures for the protection of Roux employees, subcontractor personnel, government oversight personnel, Site personnel, and the general public. It also addresses client- and Site-specific requirements for health and safety. Additionally, subcontractors may be required to submit their own HASP as it relates to their specific work activities and will be kept onsite during such work.

Implementation of this HASP is the joint responsibility of the Project Manager (PM), the Site Health and Safety Officer (SHSO), and all field staff, with assistance from the Project Principal (PP), Office Health and Safety Manager (OHSM), and Corporate Health and Safety Director (CHSD). The PM for this project is Brooke Hildebrand. The Site Supervisor (SS) is TBD and Site Health and Safety Officer (SHSO) is TBD.

This HASP will be introduced to, reviewed, and signed off on by all Roux personnel through a formal training session prior to commencing work. A copy of the HASP will be kept at the Site at all times. The Roux SHSO or PM will be responsible for posting any changes, amendments, memos, etc. to the HASP. Any revisions to this HASP will be signed by appropriate personnel, which can include Roux's PP, CHSD, and SS. Any changes will be announced to all workers at the next safety meeting.

1.1 Roles and Responsibilities

Overall Roles and Responsibilities (R&Rs) of Roux personnel are provided in Roux's Policies and Procedures Manual. Only those R&Rs specific to HASP requirements are listed below.

Project Manager (PM)

The PM has responsibility and authority to direct all work operations. The PM coordinates safety and health functions with the Site Health and Safety Officer (SHSO), has the authority to oversee and monitor the performance of the SHSO, and bears ultimate responsibility for the proper implementation of this HASP. The specific duties of the PM are:

- Preparing and coordinating the Site work plan;
- Providing Site supervisor(s) with work assignments and overseeing their performance; Coordinating safety and health efforts with the SSHO;
- Ensuring effective emergency response through coordination with the Emergency Response Coordinator (ERC); and
- Serving as primary Site liaison with public agencies and officials and Site contractors.

Site Health and Safety Officer (SHSO)

The SHSO has the full responsibility and authority to develop and implement this HASP and to verify compliance. The SHSO reports to the Project Manager. The SHSO is on Site or readily accessible to the Site during all work operations and has the authority to halt Site work if unsafe conditions are detected. The specific responsibilities of the SHSO include:

- Managing the safety and health functions on this Site;
- Serving as the Site's point of contact for safety and health matters;
- Ensuring Site monitoring, worker training, and effective selection and use of PPE;
- Assessing Site conditions for unsafe acts and conditions and providing corrective action;
- Assisting the preparation and review of this HASP;
- Maintaining effective safety and health records as described in this HASP; and
- Coordinating with the SS and others as necessary for safety and health efforts.

Site Supervisor (SS)

The Site Supervisor (SS) is responsible for field operations and reports to the Project Manager (PM). The SS ensures the implementation of the HASP requirements and procedures in the field. The specific responsibilities of the Site Supervisor include:

- Executing the work plan and schedule as detailed by the PM;
- Coordination with the SHSO on safety and health; and
- Ensuring Site work compliance with the requirements of this HASP.

Employees

All Roux employees are responsible for reading and following all provisions of the Corporate Health and Safety Manual, including this HASP. Employees report to the SS at the project Site. Each employee is also responsible for the following:

- Wearing all appropriate PPE as outlined within this HASP;
- Attending all safety meetings;
- Inspecting tools and equipment prior to use, and taking any defective tools or equipment out of service;
- Appropriately documenting field events as they occur within a logbook or equivalent;
- Properly operating machinery and/or equipment only if trained to do so;
- Stopping work operations if unsafe conditions exist;
- Identifying and mitigating hazards when observed;
- Reporting all incidents and near misses to the Roux SHSO and SS immediately; and
- Knowing where emergency equipment is located (e.g., first aid kit, fire extinguisher).

Subcontractors and Visitors

Subcontractors and visitors are responsible for complying with the same health and safety requirements. It is the responsibility of all to make sure subcontractors and visitors comply and uphold the HASP. Subcontractors and visitors have the following additional responsibilities:

- Designating a qualified safety representative for the project that can make the necessary changes in work practices, as necessary;
- Attending all safety meetings while participating in Roux Site work activities;
- Reporting all incidents and near misses to Roux SHSO and SS immediately;
- Conducting initial and periodic equipment inspections in accordance with manufacturer and regulatory guidelines; and
- Providing copies of all Safety Data Sheets (SDS) to Roux SHSO for materials brought to the Site.

2. Background

Relevant background information is provided below, including a general description of the Site; a brief review of the Site's history with respect to hazardous material use, handling, and/or storage; and a review of known and potential releases of hazardous substances at the Site.

The Site was developed since at least 1887 as a planning mill, box factory and lumber storage. By circa 1942, the Site was improved with the current western Site building, and by 1953 the Site was improved with the current eastern Site building. Historical Site use includes lumber storage (including presence of a drying kiln); planing mill; a sash, door and blind factory; truck repair; gasoline tank and pumps for fueling; bottling plant warehouse; plastics manufacturer; cargo storage; and parking. The Site has undergone recent construction for use as mixed use residential and commercial building. Nearby properties include residential and commercial properties with the East River present to the west.

Multiple investigations have been conducted at the Site to date with the most recent being a Remedial Investigation (RI) conducted in 2020 by Roux. The following subsections summarize the soil quality based on laboratory analytical data that was generated during the RI.

Soil Results

Laboratory analytical data for soil samples are summarized in Tables 4 through 9 of the Remedial Investigation Report (RIR) and compared to NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives (SCOs), the Part 375 Protection of Groundwater SCOs and the Part 375 Restricted Residential SCOs. Analytical results are described below:

- Two VOCs (acetone and naphthalene) were detected above the Protection of Groundwater SCOs, and/or Restricted Residential SCOs;
- Nine SVOCs (3- and 4-methylphenol (total), benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene and Phenanthrene), predominantly polycyclic aromatic hydrocarbons (PAHs), were detected above the Protection of Groundwater SCOs and/or Restricted Residential SCOs;
- Five metals (arsenic, cadmium, copper, lead, and mercury) were detected above the Protection of Groundwater SCOs and/or the Restricted Residential SCOs; and
- There were minor detections of PCBs and pesticides, however, all detections were below all applicable SCOs.

In addition to the RI sampling, two *in situ* soil waste characterization sampling programs were completed by Roux in 2018 and 2021 to support the redevelopment of the Site. During the 2021 waste characterization sampling, a lead hotspot was identified within waste characterization grid SC-5 (located in the western portion of the Site), based on one composite soil sample exceeded the USEPA Resource Conservation and Recovery Act (RCRA) Characteristic Waste for Toxicity standard for lead. The remaining sampling results of the waste characterization sampling programs were generally consistent with the RI sampling.

Groundwater Results

Laboratory analytical data for groundwater samples are summarized in Tables 10 through 14 of the RIR and are compared to NYSDEC Ambient Water Quality Standards and Guidance Values (AWQSGVs) for Class GA groundwater. Analytical results are described below:

- There were no detections of VOCs exceeding the AWQSGVs;
- A total of four SVOCs, including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene and indeno(1,2,3-c,d)pyrene were found exceeding their AWQSGVs. These detections were relatively low and estimated by the laboratory since they were below reporting limits. These detections are related to the historic fill placed at the Site below the water table.
- Five metals including antimony, iron, magnesium, manganese and sodium were detected above the AWQSGVs. Note that these are all naturally occurring metals, commonly found in groundwater. Laboratory analysis for the field filtered and unfiltered samples yielded fairly consistent results.
- PCBs and pesticides were not detected in any of the groundwater samples collected during the RI.

Soil Vapor Results

Ten soil vapor samples were collected from locations beneath the existing warehouse buildings, as shown on Figure 2 of the RIR and submitted for analysis for VOCs. In total, 25 compounds were detected in the 10 soil vapor samples collected. Laboratory analytical results for soil vapor samples are summarized in Table 15 of the RIR.

There are currently no standards for soil vapor established by either NYSDEC or the NYSDOH. The NYSDOH has established guidance for evaluating soil vapor intrusion in which the results of soil vapor samples are compared to corresponding indoor air quality results. At the time of the RI, the guidance was presented in Matrix A, Matrix B, and Matrix C from the NYSDOH Center for Environmental Health (CEH) Bureau of Environmental Exposure Investigation (BEEI) Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006 (matrices were updated in May 2017). These matrices provide guidance relative to carbon tetrachloride, cis-1,2-dichloroethene, 1,1-dichloroethene, trichloroethene (TCE), tetrachloroethene (PCE), 1,1,1-trichloroethane, methylene chloride, and vinyl chloride. Analytical results indicated detections of all Matrix A, B and C compounds except for carbon tetrachloride in the soil vapor samples. Additionally, chloroform was detected in excess of the USEPA Target Sub-Slab Concentration of 4.1 ug/m3 in seven samples.

3. Scope of Work

The potential scope of work covered by this HASP includes the following activities:

- Limited ground-intrusive work by third-party contractor personnel if necessary, including, but not limited to, excavation, loadout, and off-Site disposal of Site soils at permitted facilities;
- Documentation soil sampling;
- Import of approved backfill where necessary to achieve at least two-feet of clean cover above native Site soils;
- Repair and maintenance of composite cover system comprised of concrete building foundations, exterior paved surfaces and exterior landscaped or gravel areas, if necessary;
- Periodic inspections of the SSDS and system components;
- Routine groundwater sampling, if required, and oversight of sampling-derived waste pickup for offsite transportation and disposal; and
- Routine soil vapor and indoor air sampling, if required.

If there are any changes with the scope a revision of the HASP will be required to address any new hazards.

4. Site Control

This Site control program is designed to reduce the spread of hazardous substances from contaminated areas to clean areas, to identify and isolate contaminated areas of the Site, to facilitate emergency evacuation and medical care, to prevent unauthorized entry to the Site, and to deter vandalism and theft.

4.1 Site Map

A map of this Site, showing Site boundaries, designated work zones, and points of entry and exit is provided in Figure 2.

4.2 Site Access

Access to the work areas at the Site is restricted to reduce the potential for exposure to its safety and health hazards. During hours of Site operation, Site entry and exit is authorized only at the points identified in Figure 2. Entry and exit at these points is controlled by the following: locked building doors. When the Site is not operating, access to the Site is controlled by the following: locked building doors.

4.3 Buddy System

While working in the Exclusion Zone, Site workers use the buddy system. The buddy system means that personnel work in pairs and stay in close visual contact to be able to observe one another and summon rapid assistance in case of an emergency. The responsibilities of workers using the buddy system include:

- Remaining in close visual contact with partner;
- Providing partner with assistance as needed or requested;
- Observing partner for signs of heat stress, chemical overexposure or other difficulties;
- Periodically checking the integrity of partner's PPE; and
- Notifying the SS or other Site personnel if emergency assistance is needed.

4.4 Site Communications

The following communication equipment is used to support on-site communication: cell phones and visual hand signals.

As applicable, hand signals will be used according to the following:

Hand Signals

SIGNAL	MEANING
Hand gripping throat	Out of air; I cannot breathe
Grip partner's wrist	Leave area immediately
Hands on top of head	Need assistance
Thumbs up	I am all right; okay
Thumbs down	No; negative

A current list of emergency contact numbers is included in the Site-Specific Emergency Information at the beginning of this HASP.

4.5 Site Work Zones

This Site is divided into three (3) major zones, described below. These zones are characterized by the likely presence or absence of biological, chemical, or physical hazards and the activities performed within them. Zone boundaries are clearly marked at all times and the flow of personnel among the zones is controlled. The Site is monitored for changing conditions that may warrant adjustment of zone boundaries. Zone boundaries are adjusted as necessary to protect personnel and clean areas. Whenever boundaries are adjusted, zone markings are also changed and workers are immediately notified of the change.

Exclusion Zone

The area where contamination exists is the Exclusion Zone (EZ). All areas where excavation and handling of contaminated materials take place are considered part of the EZ. This zone will be clearly delineated by chain link fencing, caution tape, cones or other effective barriers, as necessary. Safety tape may be used as a secondary delineation within the EZ. The zone delineation markings may be opened in areas for varying lengths of time to accommodate equipment operation or specific construction activities. The SHSO may establish more than one EZ where different levels of protection may be employed or where different hazards exist. Personnel are not allowed in the EZ without:

- A buddy (co-worker);
- Required minimum level PPE;
- Medical authorization;
- Training certification; and
- Requirement to be in the zone.

Contamination Reduction Zone

A Contamination Reduction Zone (CRZ) is established between the exclusion zone and the support zone. The CRZ contains the Contamination Reduction Corridor (CRC) and provides an area for decontamination of personnel and equipment. The CRZ will be used for general Site entry and egress in addition to access for heavy equipment and emergency support services. Personnel are not allowed in the CRZ without:

- A buddy (co-worker);
- Appropriate PPE;
- Medical authorization;
- Training certification; and
- Requirement to be in the zone.

Support Zone

The Support Zone (SZ) is an uncontaminated area that will be the field support area for the Site operations. The SZ will contain material and equipment required for the SOW. Appropriate sanitary facilities and safety equipment will be located in this zone. Potentially contaminated personnel or materials are not allowed in this zone. The only exception will be appropriately packaged/decontaminated and labeled samples.

5. Job Hazard Evaluation

Roux's work at the Site is expected to entail a variety of physical, chemical, and biological hazards, all of which must be sufficiently managed to allow the work to be performed safely. Some of the hazards are Site-specific (i.e., they are associated with the nature, physical characteristics, and/or routine operation of the Site itself), while others are activity-specific (i.e., they are associated with [or arise from] the particular activity being performed). The various hazards can be grouped into the following categories:

- **Caught/Crushed** – the potential to become caught in, under, between, or by an object or parts of an object, such as equipment with parts that open and close or move up and down ("pinch points") or equipment that rotates, and the accompanying potential to have body parts cut, mangled, or crushed thereby.
- **Contact** – the potential to be struck by or against moving or stationary objects that can cause physical injury, such as heavy machinery, overhead piping, moving vehicles, falling objects, and equipment (including tools and hand-held equipment) or infrastructure with the ability to cut or impale.
- **Energy Sources** – the potential for bodily harm associated with energy sources, most notably electricity, but also including latent energy sources such as compressed air and equipment under tension (which when released could cause injurious contact or a fall).
- **Ergonomics** – the potential for musculoskeletal injury associated with lifting/carrying, pushing/pulling, bending, reaching, and other physical activity attributable to poor body position/mechanics, repetitive motion, and/or vibration.
- **Exposure** – the potential for injury/illness due to physical, chemical, or biological exposures in the work environment, including, but not limited to, temperature extremes, solar radiation, and noise (physical), chemical splashes and hazardous atmospheres (chemical), and animal/insect bites and poisonous plants (biological).
- **Falls** – the potential to slip or trip and thus fall or drop a load, resulting in bodily injury to oneself or others.

The foregoing is intended to provide Roux employees with a general awareness of the hazards involved with Site work. A more detailed review of the potential hazards associated with each specific activity planned for the Site (or on-going activity, as the case may be) is provided in the activity-specific Job Safety Analysis (JSA) forms in **Appendix A**. As can be seen in the JSA forms, the hazards are identified by category per the above, and specific measures designed to mitigate/manage those hazards are also identified. In preparing the JSA forms, all categories of hazards were considered, and all anticipated potential hazards were identified to the extent possible based on the experience of the personnel preparing and reviewing the JSA forms. However, there is always the possibility for an unanticipated hazard to arise, potentially as condition change over the course of the workday. Roux personnel must maintain a continual awareness of potential hazards in the work zone, regardless of whether the hazard is identified in the JSA form. Particular attention should be paid to hazards associated with exposure to hazardous substances (see **Table 1** for a listing of the hazardous substances most likely to be encountered in environmental media at the Site) and to Site personnel being located "in the line of fire" with respect to moving equipment, pinch points, and latent energy (e.g., being located or having body parts located within the swing radius of an excavator, between two sections of pipe being connected, below a piece of suspended equipment, or adjacent to a compressed air line).

5.1 Hazard Communication and Overall Site Information Program

The information in the JSAs and SDSs is made available to all employees and subcontractors who could be affected by it prior to the time they begin their work activities.

Modifications to JSAs are communicated during routine pre-work briefings, and periodically updated as needed in the HASP. SDSs will be maintained by the SHSO/SS for new chemicals brought on-site as needed. Copies of SDSs can be found in **Appendix B**.

5.2 Noise

Noise is associated with the operation of heavy equipment, power tools, pumps, and generators. Noise is also a potential hazard when working near operating equipment such as excavators, drill rigs or pole drivers. High noise (i.e., < 85 dBA) operations may be evaluated by the SHSO utilizing a type 2 handheld sound level meter (SLM) operating on the "A"-weighted scale with slow response because this scale most closely resembles human response to noise and complies with OSHA 29 CFR 1910.95. Hearing protection is required in areas with noise exposure greater than 85 dBA. Double hearing protection (ear plugs and earmuffs) should be donned in areas where the noise exposure is more than 95 dBA. Noise exposure will be controlled by hearing protection as described above or by maintaining set-backs from high-noise equipment, as warranted. Personnel handling heavy equipment and using power tools that produce noise levels exceeding those described levels above are required by OSHA 29 CFR 1910.95 to wear the appropriate Noise Reduction Rating (NRR) level of hearing protection. Appropriate hearing protection will be evaluated by the SHSO as necessary in consultation with the OHSM and CHSD.

5.3 Slip, Trip, and Fall Hazards

Slip, trip, and fall hazards may include, but are not limited to, general slip and trip hazards associated with uneven ground, possible debris, wet grass, and equipment. Prior to work, walking paths will be assessed for solid footings, any ground penetrations that may cause a tripping hazard will be appropriately marked, and other areas will be noted and discussed with the field team.

Personnel shall be aware of their surroundings and footings at all time, and all accommodations should be made for proper housekeeping and organized equipment placement at the Site, where possible, to help prevent any slip, trip, and fall-related incidents. All tools and materials should be appropriately stored when not in use and placed in appropriate storage containers.

5.4 Biological Hazards

Biological hazards that may potentially be present at a Site, include poisonous plants, insects (ticks, spiders, bees), animals (snakes, dogs), etc. Information on biological hazards can be found within Roux's Biological Hazard Awareness Management Program located within Roux's Corporate Health and Safety Manual. There is also potential for transmission and/or exposure to SARS-CoV-2, the virus that causes COVID-19. Prior to beginning work, on-Site protocols shall be established by the project team, including subcontractors, in accordance with federal, state, county, city, and/or other guidance, as applicable.

6. Emergency Response Plan

This emergency response plan details actions to be taken in the event of Site emergencies. The PM and SHSO is responsible for the implementation of emergency response procedures onsite. The SHSO/PM provides specific direction for emergency action based upon information available regarding the incident and response capabilities and initiates emergency procedures and notification of appropriate authorities. In the event of an emergency, Site personnel are evacuated and do not participate in emergency response activities, response is facilitated through external emergency services.

6.1 Emergency Response

The SHSO, after investigating the incident and relevant information, shall determine the level of response required for containment, rescue and medical care. Limited on-site emergency response activities could occur therefore the SHSO is responsible for notifying external emergency response agencies. The SHSO provides relevant information to the responding organizations, including, but not limited to, the hazards associated with the emergency incident, potential containment problems, and missing Site personnel.

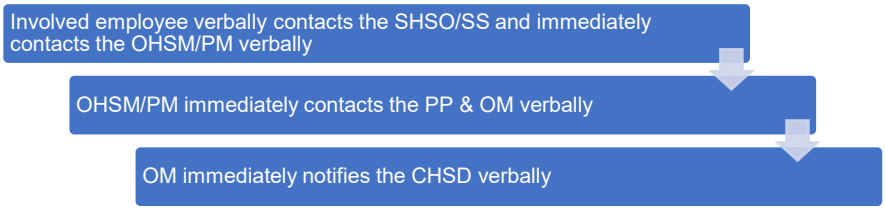
6.2 Emergency Alerting and Evacuation

If evacuation notice is given, Site workers leave the worksite, if possible, by way of the nearest exit. Appropriate primary and alternate evacuation routes and assembly areas have been identified and are shown on the Site Plan with Emergency Muster Area (**Figure 2**). The routes and assembly area will be determined by conditions at the time of the evacuation based on wind direction, the location of the hazard source, and other factors as determined by SHSO/PM.

Personnel exiting the Site gather at a designated assembly point. To determine that everyone has successfully exited the Site, personnel will be accounted for at the assembly point. If any worker cannot be accounted for, notification is given to the SHSO, PM, and any arriving response authorities so that appropriate action can be initiated. Subcontractors on this Site have coordinated their emergency response plans to ensure that these plans are compatible and potential emergencies are recognized, alarm systems are clearly understood, and evacuation routes are accessible to all personnel relying upon them.

6.3 Emergency Medical Treatment and First Aid

In the event of a work-related injury or illness, employees are required to follow the procedures outlined below. All work-place injury and illness situations require Roux's Project and Corporate Management Team to be notified when an injury/illness incident occurs, and communication with the contracted Occupational Health Care Management Provider, WorkCare, Inc., is initiated, as necessary. The Injury/Illness Notification Flowchart is provided below and within Roux's Incident Investigation and Reporting program included within Roux's Corporate Health and Safety Manual.



If on-Site personnel require any medical treatment, the following steps will be taken:

a. Notify Roux's Project and Corporate Management Team for any work-related injury and/or illness occurrence, and communicate with the contracted Occupational Health Care Management Provider, WorkCare, immediately following the notifications provided above.

b. Based on discussions with the Project Team, Corporate Management and the WorkCare evaluation, if medical attention beyond onsite first aid is warranted, transport the injured / ill person (IP) to the Urgent Care Center, or notify the Fire Department or Ambulance Emergency service and request an ambulance or transport the victim to the hospital, and continue communications with Corporate Management Team. An Urgent Care/Hospital Route map with location to City MD Greenpoint Urgent Care/ NYU Langone Health -Tisch Hospital is included as **Figure 3**.

c. Decontaminate to the extent possible prior to administration of first aid or movement to medical or emergency facilities.

d. First aid medical support will be provided by onsite personnel trained and certified in First Aid, Cardio Pulmonary Resuscitation (CPR), Automatic External Defibrillation (AED), and Blood-Borne Pathogens (BBP) Awareness, until relieved by emergency medical services (EMS).

e. The SHSO and PM will perform a Loss Investigation (LI) and the Project Team will complete the final Loss Report. If a Roux employee is involved in a vehicular incident, the employee must also complete the Acord Automobile Loss Notice.

7. Environmental Conditions and Response

7.1 Adverse Weather Conditions

In the event of adverse weather conditions, the SHSO or project principal will determine if work can continue without jeopardizing the health and safety of field workers. Some of the items related to adverse weather conditions to be considered prior to determining if work should continue include:

- Potential for heat stress and heat-related injuries;
- Potential for cold stress and cold-related injuries;
- Treacherous weather-related conditions. If wind speed is greater than 15 mph averaged over a 15-minute period or wind gusts over 25 mph, earthmoving operations will be ceased;
- Limited visibility; and
- Electrical storm potential.

Site activities will be limited to daylight hours and acceptable weather conditions. Inclement working conditions may include heavy rain, fog, high winds, and lightning. The SHSO and/or PM shall observe daily weather reports and evacuate, if necessary, in case of inclement weather conditions.

7.2 Electrical Storm Guidelines

In the event that lightning and/or thunder are observed while working onsite, all onsite activities shall stop and personnel shall seek proper shelter (e.g., substantial building, enclosed vehicle, etc.). Work shall not resume until the threat of lighting has subsided and no lightning or thunder has been observed for 30 minutes. If the possibility of lightning is forecast for the day, advise the onsite personnel on the risks and proper procedure at the pre-work safety briefing. Continuously monitor for changing weather conditions and allow enough time to properly stop work if lightning is forecast.

7.3 Environmental Stressors, Heat Stress, Heat Exhaustion, and Heat Stroke

It is the employer's responsibility to monitor weather forecasts and ambient air temperatures, both prior to the work shift and during the shift. The National Oceanic and Atmospheric Administration records average minimum/maximum temperatures of 47/61.6 degrees Fahrenheit during the year in Brooklyn, New York.

To prevent potential heat illness, the following strategies will be implemented:

- Adjusting personnel work/rest intervals;
- Monitoring for symptoms of heat illness;
- Providing shaded rest areas;
- Providing cool potable water so that each employee has access to at least one quart per hour for the entire shift, free of charge;
- Allowing for employees to acclimatize to the weather conditions and work demands;
- Observe workers during a heat wave (i.e., when the temperature is at least 80oF, and 10 degrees hotter than the average temperature of the five preceding days); and
- Implementing high heat procedures when the temperature reaches 95oF.

Roux's Heat Illness Prevention Plan is implemented when the when ambient temperatures exceed 80°F. Roux's Heat Illness Prevention Program can be found within **Appendix C**. Additional information regarding heat illnesses is provided below. This can include, but is not limited to, access to shade that is sufficient in size to fit all workers who are on break; a car with air conditioning is acceptable, too. Preventative cool-down breaks shall be allowed at any time, and anyone taking such a break will be monitored for heat illness symptoms and not required to return to work until all symptoms (if present) of heat illness have disappeared. If necessary, first aid will be offered, but if symptoms are severe, emergency response procedures will be implemented per Section 6.3. Anyone who has shown symptoms of severe heat illness will not be sent home without being offered first aid or medical treatment.

High heat procedures must be implemented when temperatures reach 95oF. These procedures include:

- Ensuring that effective communication by voice, observation, or electronic means is maintained so that employees at the work site can contact a supervisor when necessary. An electronic device, such as a cell phone or text messaging device, may be used for this purpose only if the reception in the area is reliable.
- Observing employees for alertness and signs or symptoms of heat illness. The employer shall ensure effective employee observation/monitoring by implementing one or more of the following:
    - Supervisor or designee observation of 20 or fewer employees;
    - Mandatory buddy system; and
    - Regular communication with sole employee such as by radio or cellular phone, or other effective means of observation.
- Designating one or more employees on each worksite as authorized to call for emergency medical services and allowing other employees to call for emergency services when no designated employee is available.
- Encouraging employees throughout the work shift to drink plenty of water.
- A review of the high heat procedures during the daily tailgate meeting and remind employees of their right to take a cool-down rest when necessary.

7.3.1 Heat Stress

Heat stress is the body's response to excessive heat and can be a significant potential hazard. The risk of heat stress can be increased with heavy physical activity and/or the use of personal protective equipment in hot, humid weather environments. There are also personal risk factors that can contribute to the risk of suffering from heat stress, such as obesity, water intake, alcohol and caffeine consumption, pregnancy, age, medication, etc. Heat illness includes heat cramps, heat exhaustion, heat syncope, and heat stroke.

7.3.2 Heat Cramps

Heat cramps may be brought on by prolonged exposure to heat. As an individual sweats, water and salts are lost by the body resulting in painful muscle cramps, typically in the legs.

First aid treatment includes, but is not limited to, shade, rest, and fluid replacement. Typically, the individual should recover within one-half hour while being monitored constantly. If the individual has not improved substantially within 30 minutes and the body temperature has not decreased, the individual should be transported to a hospital for medical attention.

Per Roux's Heat Illness Prevention Plan, employees shall have access to potable drinking water that is fresh, pure, suitably cool, free of charge and in sufficient quantities. Access to shade shall be present when temperatures exceed 80 degrees Fahrenheit and shall be available when temperatures do not exceed 80 degrees Fahrenheit.

7.3.3 Heat Exhaustion

Heat exhaustion may occur in an individual who has been exposed to excessive heat while working or exercising. The circulatory system of the individual fails as blood collects near the skin to rid the body of excess heat through transference. The signs and symptoms of heat exhaustion are as follows:

- Rapid and shallow breathing;
- Weak pulse;
- Cold and clammy skin with heavy perspiration;
- Skin appears pale;
- Fatigue and weakness;
- Dizziness; and
- Elevated body temperature.

First aid treatment includes, but is not limited to, cooling the victim, elevating the feet, and replacing fluids.

If the individual is not substantially improved within 30 minutes and the body temperature has not decreased, the individual should be transported to the hospital for medical attention.

7.3.4 Heat Stroke

Heat stroke occurs when an individual is exposed to excessive heat and stops sweating. This condition is classified as a MEDICAL EMERGENCY requiring immediate cooling of the victim and transport to a medical facility. The signs and symptoms of heat stroke are as follows:

- Dry, hot, red skin;
- Body temperature approaching or above 105oF;
- Confusion, altered mental state, slurred speech;
- Seizures;
- Large (dilated) pupils; and
- Loss of consciousness – the individual may go into a coma.

First aid treatment requires immediate cooling and transportation to a medical facility. Heat stress is a significant hazard if any type of protective equipment (semi-permeable or impermeable) that prevents evaporative cooling when worn in hot weather environments.

7.4 Cold Stress

Cold stress is a danger at low temperatures and when the wind-chill factor is low. Prevention of cold-related illnesses is a function of whole-body protection. Adequate insulating clothing must be used when the air temperature is below 60°F. A work/rest regimen will be initiated when ambient temperatures and protective

clothing cause a stressful situation. In addition, reduced work periods followed by rest in a warm area may be necessary in extreme conditions. The signs and symptoms of cold stress include the following:

- Severe shivering;
- Abnormal behavior;
- Slowing;
- Weakness;
- Stumbling or repeated falling;
- Inability to walk;
- Collapse; and/or
- Unconsciousness.

First aid requires removing the victim from the cold environment and seeking medical attention immediately. Also, prevent further body heat loss by covering the victim lightly with blankets. Do not cover the victim's face. If the victim is still conscious, administer hot drinks and encourage activity such as walking, wrapped in a blanket.

8. Safety Procedures

This section of the HASP presents the specific safety procedures to be implemented during Roux's activities at the Site in order to protect the health and safety of various on-site personnel. Minimum OSHA-mandated procedures are presented first, followed by client- and Site-specific procedures. Lastly, activity-specific procedures are discussed. These Site and activity-specific procedures supplement the general safety procedures included in Roux's Corporate Health and Safety Manual, which also must be followed in their entirely.

8.1 Training

At a minimum, Site personnel who will perform work in areas where there exists the potential for toxic exposure will be health and safety-trained prior to performing work onsite per OSHA 29 CFR 1910.120(e) and 29 CFR 1926.65(e). More specifically, all Roux, subcontractor, and other personnel engaged in sampling and remedial activities at the Site and who are exposed or potentially exposed to hazardous substances, health hazards, or safety hazards must have received at a minimum the 40 hour initial HAZWOPER training consistent with the requirements of 29CFR 1910.120(e)(3)(i) training and a minimum of 3 days' actual field experience under the direct supervision of a trained experienced supervisor, plus 8 hours of refresher training on an annual basis. Depending on tasks performed, less training may be permitted. Evidence of such training must be maintained at the Site at all times. Furthermore, all on-Site management and supervisory personnel directly responsible for or who supervise the employees engaged in Site remedial operations, must have received an additional 8 hours of specialized training at the time of job assignment on topics including, but not limited to, the employer's safety and health program and the associated employee training program, personal protective equipment program, spill containment program, and health hazard monitoring procedure and techniques, plus 8 hours of refresher training on an annual basis. Additionally, all workers who will be required to don a respirator will be properly trained on their employer's Respiratory Protection Program, which also includes being medically cleared to wear a respirator and passed a fit test, at least initially prior to use, and then annually thereafter in accordance with 29 CFR 1910.134, Respiratory Protection.

Roux personnel training records are maintained in a corporate database with records available upon request from either the OHSM/SHSO/CHSD or Human Resources Department.

8.2 Site-Specific Safety Briefings for Visitors

A site-specific briefing is provided to all site visitors who enter this site beyond the site entry point. For visitors, the site-specific briefing provides information about site hazards, the site lay-out including work zones and places of refuge, the emergency alarm system and emergency evacuation procedures, and other pertinent safety and health requirements as appropriate.

8.3 HASP Information and Site-Specific Briefings for Workers

Site personnel review this HASP and are provided a Site-specific tailgate briefing prior to the commencement of work to ensure employees are familiar with this HASP and the information and requirements it contains, as well as the relevant JSAs included in **Appendix A**. Additional briefings are provided as necessary to notify employees of any changes to this HASP as a result of information gathered during on-going Site characterization and analysis of changing conditions. Conditions for which we

schedule additional briefings include, but are not limited to: changes in site conditions, changes in the work schedule/plan, newly discovered hazards, and incidents occurring during Site work.

8.4 Medical Surveillance

The medical surveillance section of the Health and Safety Plan describes how worker health status is monitored at this site. Medical surveillance is used when there is the potential for worker exposure to hazardous substance at levels above OSHA Permissible Exposure Limits (PEL) or other published limits. The purpose of a medical surveillance program is to medically monitor worker health to ensure that personnel are not adversely affected by site hazards. The provisions for medical surveillance at this site are based on the site characterization and job hazard analysis found in Section 4 of this HASP and are consistent with OSHA requirements in 29 CFR 1910.120(f) as applicable.

8.4.1 Site Medical Surveillance Program

Medical surveillance requirements are based on a worker's potential for exposure as determined by the site characterization and job hazard analysis documented in Section 4 and JSAs within **Appendix A** of this HASP and in compliance with the requirements of 29 CFR 1910.120(f)(2). Based on site information and use of direct reading instruments, limited use of respirators (less than 30 days per year), and the absence of an employee-staffed HAZMAT team, a limited medical surveillance program is required and implemented at this site. The medical surveillance program provides that:

1. Workers assigned to tasks requiring the use of respirators receive medical examinations in accordance with 29 CFR 1910.134(e) to ensure they are physically capable to perform the work and use the equipment, and
2. If a worker is injured, becomes ill, or develops signs or symptoms of possible over-exposure to hazardous substance or health hazards, medical examinations are provided to that worker as soon as possible after the occurrence and as required by the attending physician.
3. These medical examinations and procedures are performed by or under the supervision of a licensed physician and are provided to workers free of cost, without loss of pay, and at a reasonable time and place. In addition, the need to implement a more comprehensive medical surveillance program will be re-evaluated after any apparent over-exposure.

8.4.2 Medical Recordkeeping Procedures

Medical recordkeeping procedures are consistent with the requirements of 29 CFR 1910.1020 and are described in the company's overall safety and health program. A copy of that program is available at our Islandia, New York office.

The following items are maintained in worker medical records:

- Respirator fit test and selection;
- Physician's medical opinion of fitness for duty (pre-placement, periodic, termination);
- Physician's medical opinion of fitness for respirator protection (pre-placement, periodic); and
- Exposure monitoring results.

8.4.3 Program Review

The medical program is reviewed to ensure its effectiveness. The Corporate Health and Safety Manager, in coordination with the Human Resources Director, is responsible for this review. At minimum, this review consists of:

- Review of accident and injury records and medical records to determine whether the causes of accidents and illness were promptly investigated and whether corrective measures were taken wherever possible;
- Evaluation of the appropriateness of required medical tests based on site exposures; and
- Review of emergency treatment procedures and emergency contacts list to ensure they were site specific, effective, and current.

8.5 Personnel Protection

Site safety and health hazards are eliminated or reduced to the greatest extent possible through engineering controls and work practices. Where hazards are still present, a combination of engineering controls, work practices and PPE are used to protect employees. Appropriate personal protective equipment (PPE) shall be worn by Site personnel when there is a potential exposure to chemical, biological or physical hazards (e.g., falling objects, flying particles, sharp edges, electricity, and noise), as determined by the SHSO. The level of personal protection, type and kind of equipment selected will depend on the hazardous conditions and in some cases cost, availability, compatibility with other equipment, and performance. An accurate assessment of all these factors will be made before work can be safely executed.

Roux maintains a comprehensive written PPE program that addresses proper PPE selection, use, maintenance, storage, fit and inspection. Roux's PPE program can be found within **Appendix D**. PPE to be used at the Site will meet the appropriate American National Standards Institute (ANSI) standards and the following OSHA (General/Construction Industry) standards for minimum PPE requirements.

The minimum level of PPE for entry onto the Site is Level D. The following equipment shall be worn:

- Work uniform (long pants, sleeved shirt);
- Hard hat;
- Steel or composite toe work boots (must comply with American Society for Testing and Materials [ASTM]) F 2412-05, Standard Test Methods for Foot Protection and ASTM F 2413-05, Standard Specification for Performance Requirements for Foot Protection);
- Safety Glasses (must comply with one of the following ANSI/ISEA Z87.1-2010, ANSI Z87.1-2003, ANSI Z87.1-2003);
- Boot Covers (as needed);
- Hearing protection (as needed);
- High visibility clothing (shirt/vest); and
- Hand protection (e.g., minimum cut resistance meeting ANSI 105-2000 Level 2).

Note that jewelry shall be removed or appropriately secured to prevent it from becoming caught in rotating equipment or unexpectedly snagged on a fixed object (e.g., wrist watches, bracelets, rings, chains and necklaces, open earrings). Do not wear loose clothing and all shoulder-length hair should be tied back.

Site specific PPE ensembles and materials are identified within task specific JSAs located within **Appendix A**, and any upgrades or downgrades of the level of protection (i.e., not specified in the JSA) must be approved by the PP and immediately communicated to all Roux personnel and subcontractors as applicable. PPE is used in accordance with manufacturer's recommendations.

8.5.1 Hearing Conservation

Hearing protection is made available when noise exposures equal or exceed an 8-hour time-weighted average sound level of 85 dBA. Hearing protection is required when the 8-hour time weighted average sound level > 85 dBA, or when noise levels exceed 140 dBA at any point or exceeds 115 dBA for at least 15 minutes. Where noise exposure meets or exceeds this level, noise is listed as a physical hazard in the JSA for the tasks/operation, and hearing protection is included as one of the control measures (PPE).

8.6 Monitoring

An air monitoring program is important to the safety of on- and off-Site personnel, and the surrounding area. A preliminary survey, to establish background conditions in the immediate sampling area, may be made prior to the initiation of Site work including, but not limited to, monitoring wind direction (e.g., wind socks) and approximate temperature during all invasive Site activities. This survey will be conducted with the appropriate pre-calibrated air monitoring instrument(s), as warranted by the field activity. Once this survey has been complete, any changes in the type of PPE will be determined and relayed to those working on Site.

Work zone air monitoring will be performed to verify that the proper level of PPE is used, and to determine if increased protection or work stoppage is required. The following equipment shall be used to monitor conditions:

- A Photoionization Detector (PID) with a lamp energy of 10.6 eV will be used to provide direct readings of organic vapor concentrations during intrusive activities to determine that personnel protection is adequate. Concentrations shall be recorded during intrusive activities with the potential to encounter contaminant vapors.
- A pre-calibrated multi-gas meter with combustible Lower Explosive Limit (LEL), oxygen (O2), carbon monoxide (CO), and hydrogen sulfide (H2S) sensors shall be used to monitor the potential for oxygen-deficient atmospheres, explosive concentrations of organic vapors, and toxic gases during intrusive operations. The calibration for this device will be performed using a known gas composition calibration mixture.

Personal exposure monitoring utilizing activated charcoal tubes may be considered based on whether or not the area sample results are at or above half of the PEL. The decision to perform the monitoring will be made by, and under the control of, the CHSD.

Below are monitoring action levels for Site-specific chemicals of concern. In the event PID readings above the thresholds identified below are sustained for 5 minutes in the breathing zone, worker protection will require upgrading following notification to the OHSM and applicable parties.

8.6.1 Action Levels for Air Monitoring

PPE can remain at Level D if breathing zone VOC concentrations are less than 5 ppm and benzene is non detect. Personnel are required to evacuate the Site when breathing zone VOC readings exceed 25 ppm.

The following tables include summaries of the air monitoring, work practices, and action levels for the expected contaminants. The action levels to initiate testing with colorimetric tubes for airborne volatiles is 1 ppm (PID reading) and is based on the Permissible Exposure Limit (PEL) for benzene (1 ppm). The colorimetric tubes are used to confirm the presence or absence of specific constituents, and they do not provide a measured concentration.

PPE can remain at Level D if breathing zone VOC concentrations are less than 5 ppm. Personnel are required to evacuate the Site when breathing zone VOC readings exceed 25 ppm.

The following tables include summaries of the air monitoring, work practices, and action levels for the expected contaminants.

Air Monitoring Summary and Action Levels Organic Vapors	
PID Reading in Breathing Zone (ppm)	**Action**
0-1 ppm above background	Continue monitoring
>1-5 ppm sustained 60 seconds	Continue monitoring
<5 ppm	Continue Monitoring, ventilate space
≥ 5 ppm - ≤ 25 ppm	Ventilate space until PID reads < 5 ppm. If < 5 ppm cannot be achieved, upgrade to Level C[1].
≥ 25 ppm	Ventilate space and evacuate area. Consult with CHSD.

Background concentrations should be established at the beginning of each work day. It may be necessary to re-establish background concentrations and ambient conditions vary through the day.

1 Measured air concentrations of known organic vapors will be reduced by the respirator to one half of the PEL or lower, and the individual and combined compound concentrations shall be within the service limit of the respirator cartridge.

Air Monitoring Summary and Action Levels Oxygen	
O_2 Reading in Breathing Zone (%)[1]	**Action**
20.9% O_2	Oxygen level normal
< 19.5% O_2	Oxygen deficient Interrupt task/Evacuate area
>23.5% O_2	Oxygen enriched Interrupt task/Evacuate area

1. Action levels based on USEPA Standard Operating Safety Guides; Table 5-1

Air Monitoring Summary and Action Levels Carbon Monoxide	
CO Reading in Breathing Zone (ppm)[1]	**Action**
<12.5 ppm	Inspect exhaust system for leaks or other sources of CO. Monitor initially and every 15 minutes during use of CO-generating equipment.

Air Monitoring Summary and Action Levels Carbon Monoxide	
12.5-25 ppm	Ventilate area. Monitor continuously and record measurements. Contact PM.
>25 ppm	Cease Field Operations. Ventilate area.

1. Based upon the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) of 25 ppm as an 8-hour time weighted average (TWA) and OSHA's Permissible Exposure Limit (PEL) of 50 ppm as an 8-hour TWA concentration.

Air Monitoring Summary and Action Levels Combustible Gases	
Lower Explosive Limit (LEL) Reading	**Action**
< 4% LEL	Site activities will continue with normal monitoring
4% – 20% LEL	Stop work until levels dissipate to <4% LEL
> 20% LEL	Potential explosion hazard. Halt all site activities, research source of release, aerate work area, suppress source.
Air Monitoring Summary and Action Levels Hydrogen Sulfide	
Hydrogen Sulfide (H_2S) Reading	**Action**
<10 ppm	Site activities will continue with normal monitoring
≥10 ppm	Stop work until levels dissipate to <10 ppm; use mechanical ventilation if possible. Consult with CHSD if unable to reduce concentrations below 10 ppm.

8.6.2 Explosive Hazard

Methane is a common gas constituent that is generated during the decomposition of organics. Methane, a non-toxic compound, does not have an OSHA PEL or other exposure limits based on toxicity; however, methane is explosive under certain conditions. The Lower Explosive Limit (LEL) for methane is 5% in air, or 50,000 parts per million by volume. At high concentrations, methane can also displace oxygen and cause asphyxiation. Since methane is lighter than air, it does not tend to accumulate in low-lying areas and will rapidly mix with atmospheric air if encountered during drilling activities. Methane concentrations will be continuously monitored using a pre-calibrated gas meter while excavation takes place.

8.6.3 Air Monitoring Equipment and Calibration

A PID calibrated to an appropriate calibration mixture will be used to detect organic vapors in and around the work areas. Monitoring will be conducted in and around all work areas and at the workers breathing zone before activities commence to establish a background level, then at 15-minute intervals throughout the day. All equipment will be calibrated according to the manufacturer's recommendation. A calibration log will be maintained and will include the name of the person who performed the calibration, the date and time calibrated, and the instrument reading at the time of calibration. A manual bellows pump or equivalent with colorimetric tubes for specific compounds will be utilized to determine the course of action related to upgrading or downgrading the level of respiratory protection, as applicable.

If air monitoring data indicate safe levels of potentially harmful constituents at consistent intervals (5-minute intervals), then monitoring can be conducted less frequently (every 30 minutes). This determination will be made by the onsite SHSO. Monitoring data, including background readings and calibration records, will be documented. Work to be performed on-Site will conform to Roux's Standard Operating Procedures (SOPs). Conformance with these guidelines as well as the guidelines described in this HASP will aid in mitigating the physical and chemical hazards mentioned throughout this HASP.

8.7 Tailgate Safety Meetings

A designated Site worker will provide daily safety briefings (e.g., tailgate meetings) including, but not limited to, the following scenarios:

- When new operations are to be conducted;
- Whenever changes in work practices must be implemented; and
- When new conditions are identified and/or information becomes available.

Daily safety briefings shall be recorded on the Roux Daily Tailgate Health and Safety Meeting Log/Daily Site Safety Checklist, and all completed forms will become a part of the project file.

8.8 Spill Containment

Spill containment equipment and procedures should, at a minimum, meet the requirements of the facility's Spill Prevention, Control and Countermeasure Plan, if applicable. Otherwise, spill containment equipment and procedures must be considered depending on the task, including, but not limited to, chemical/product transfer points and handling.

8.8.1 Initial Spill Notification and Response

Any worker who discovers a hazardous substance spill will immediately notify the SHSO. The worker will, to his/her best ability, report the hazardous substance involved, the location of the spill, the estimated quantity of material spilled, the direction/flow of the spill material, related fire/explosion incidents, and any associated injuries without compromising their own safety.

8.8.2 Spill Evaluation and Response

The SHSO is responsible for evaluating spills and determining the appropriate response. When this evaluation is being made, the spill area will be isolated and demarcated to the extent possible. If necessary to protect nearby community members, notification of the appropriate authorities is made by the PM as appropriate. On-Site response is limited to small spills (e.g., <10 gallons); large spills require external emergency responders who will be contacted by the SHSO.

8.9 Decontamination

The decontamination section of the HASP describes how personnel and equipment are decontaminated when they leave the Exclusion Zone. This section also describes how residual waste from decontamination processes is disposed. The site decontamination procedures are designed to achieve an orderly, controlled removal or neutralization of contaminants that may accumulate on personnel or equipment. These procedures minimize worker contact with contaminants and protect against the transfer of contaminants to clean areas of the site and off-site. They also extend the useful life of PPE by reducing the amount of time

that contaminants contact and can permeate PPE surfaces. Decontamination is facilitated within the CRZ at this site, if applicable.

8.9.1 Decontamination Procedures for Personnel and PPE

The following are general decontamination procedures established and implemented at this site.

1. Decontamination is required for all workers exiting a contaminated area. Personnel may re-enter the SZ only after undergoing the decontamination procedures described below in the next section.
2. Protective clothing is decontaminated, cleaned, laundered, maintained and/or replaced as needed to ensure its effectiveness.
3. PPE used at this site that requires maintenance or parts replacement is decontaminated prior to repairs, or
4. PPE used at this site is decontaminated or prepared for disposal on the premises. Personnel who handle contaminated equipment have been trained in the proper means to do so to avoid hazardous exposure.
5. This site uses an off-site laundry for decontamination of PPE. The site has informed that facility of the hazards associated with contaminated PPE from this site.
6. The site requires and trains workers that if their permeable clothing is splashed or becomes wetted with a hazardous substance, they will immediately exit the work zone, perform applicable decontamination procedures, shower, and change into uncontaminated clothing.
7. Procedures for disposal of decontamination waste meet applicable local, State, and Federal regulations.

8.9.2 Decontamination Procedures for Equipment

All tools, equipment, and machinery from the EZ or CRZ are decontaminated in the CRZ prior to removal to the SZ. Equipment decontamination procedures are designed to minimize the potential for hazardous skin or inhalation exposure and to avoid cross-contamination and chemical incompatibilities.

General Equipment Decontamination Procedures:

1. Decontamination is required for all equipment exiting a contaminated area. Equipment may re-enter the SZ only after undergoing the equipment decontamination procedures.
2. Vehicles that travel regularly between the contaminated and clean areas of the site are carefully decontaminated each time they exit the EZ and the effectiveness of that decontamination is monitored to reduce the likelihood that contamination will be spread to other parts of the site.
3. Particular attention is given to decontaminating tires, scoops, and other parts of heavy equipment that are directly exposed to contaminants and contaminated soil.
4. Procedures for disposal of decontamination waste shall meet applicable local, State, and Federal regulations.

The following items may be used to decontaminate equipment:

- Fresh water rinse;
- Non-phosphorus detergent wash;
- Acetone rinse;
- Distilled water rinse; and
- A steam cleaner or pressure washer (heavy equipment only).

8.9.3 Monitoring the Effectiveness of Decontamination Procedures

Visual examination and sampling are used to evaluate the effectiveness of decontamination procedures. Visual examination is used to ensure that procedures are implemented as described and that they appear to control the spread of contaminants under changing site conditions. Visual examination is also used to inspect for signs of residual contamination or for contaminant permeation of PPE.

Personnel who work in contaminated areas of the site, either the Contamination Reduction Zone (CRZ) or the Exclusion Zone, are trained in the principles and practices of decontamination described in this section of the HASP and in related SOPs. If site procedures are changed as a result of inspection and monitoring, all affected employees are notified of these changes.

8.10 Confined Space Entry

Confined space entry will not be performed; however, the following section discussed confined space entry.

The following is a list of the safety requirements for confined space entry at the Site:

- **ROUX PERSONNEL ARE NOT AUTHORIZED TO ENTER AN OSHA PERMIT REQUIRED CONFINED SPACE;**
- Currently the scope of work **DOES NOT** require personnel to enter permitted confined space for this project; and
- Any changes to the field activities that may necessitate confined space entry will be reported to the Project Principal and OHSM.

Confined space is defined as any space, depression, or enclosure that:

- Has limited opening for entry and egress;
- Is large enough for and employee to enter and perform assigned work; and
- Is not intended for continuous occupancy.

A permit required confined space is one that meets the definition of a confined space and has one or more of the following characteristics:

- May contain or produce life-threatening atmospheres due to oxygen deficiency the presence of toxic, flammable, or corrosive contaminants;
- Contains a material that has the potential for engulfment;
- Has an internal configuration that may cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section; and
- Contains any other serious safety or health hazards.

Although Roux personnel will not perform confined space entry, it is expected that subcontractors performing cleaning and mitigation and/or remedial measures activities may be required to enter structures that are considered to be a permit required confined space. Permitting of the confined space as well as hazard mitigation for entry will be completed by the subcontractor in accordance with 29 CFR 1910.146 or 1926.1201-1213 and/or applicable local/client requirements.

8.11 Client and Site-Specific

In addition to the OSHA-specific procedures discussed above, there may be client and site-specific safety procedures that must be adhered to during the performance of remedial activities at the Site.

8.12 Unusual or Significant Risks

Field activities that appear to have unusual or significant risks that cannot be adequately managed with existing risk tools such as LPS, HASPs, traffic safety plans, work permits, design and O&M practices, equipment HAZOPS or other safety tools must be referred to the CHSD to help with the assessment and management of the associated potential safety risks. Examples include the use of explosives for demolition, use of firearms to control wildlife, rappelling, demolition over water, diving, etc.

8.13 Activity-Specific Hazards

In addition to the general hazards discussed above, there are activity-specific hazards associated with each work activity planned for the Site. An activity-specific JSA has been completed for each of the activities planned for the Site. JSAs are provided in **Appendix A**. In the event that new work activities or tasks are planned, JSAs will be developed and implemented prior to performing the new activities. In the absence of a JSA, the personnel performing work must prepare a field JSA and receive clearance from a designated competent safety official prior to performing any task with significant risk. In emergency situations where time is critical, Last Minute Risk Assessments (LMRAs) will be utilized to identify the task, associated hazards and mitigative actions to take. For lower risk activities (as deemed by the discretion of a Competent Person) where a JSA is determined to not be needed, the individual(s) conducting the activities must perform LMRAs prior to and during the work.

8.13.1 Electrical and Other Utility Assessment and Accommodations

Roux shall perform a site walk to identify any potential overhead electrical or utility lines. All applicable guidelines will be followed in the vicinity of overhead power and utility lines (see Section 8.13.3 below).

Roux has also reviewed all available Site maps showing buried utility lines to identify potential hazards; the review revealed no underground hazards are known to exist in the vicinity of the areas of the Site pertinent to this HASP.

8.13.2 Subsurface Work

Subsurface work activities will require adherence to Roux's Corporate Subsurface Utility Clearance Management program found within Appendix E.

8.13.2.1 Excavations and Trenching

Trenching and excavation work activities carried out by Roux and their subcontractors shall comply with applicable OSHA standards (i.e., 29 CFR 1926.650-652). Regional Notification Centers (i.e., Underground Services Alert) shall be notified at least two working days prior to the start of any digging or excavation work per state requirements (i.e., 811-One Call). Personnel responsible for excavation activities will be trained in their job responsibilities. Additionally, for trenches 4 feet or deeper, where employees will enter, the trench needs to have a stairway, ladder or other safe means of egress, and located so that employees do not have to travel farther than 25 feet horizontally. Where employees will enter trenches greater than 5 feet deep, the trench must have some type of protective system or sloped sidewalls appropriately to prevent cave-ins.

The SHSO or other responsible Roux personnel will be present on-Site during all Roux contracted excavation and backfill operations and will supplement health and safety monitoring conducted by Subcontractor air quality screening to ensure that appropriate levels of protection and safety procedures are utilized. The proximity of chemical, water, sewer, and electrical lines will be identified by Roux and/or their subcontractor before any subsurface activity or sampling is attempted. Prior to any excavation activities, trees, shrubbery, and other objects that can potentially pose as a hazard during excavation should be supported or removed from the excavation area. The following safe work practices will be implemented during this task.

- The proximity of chemical, water, sewer, and electrical lines will be identified by a facility representative prior to beginning any subsurface activity.
- At the start of every day, a competent person will inspect excavations to evaluate if the area is stable and safe to enter. Inspections will be conducted as needed throughout the excavation operations. If deemed necessary, a competent person may also conduct inspections after rainfall or any other event that can potentially affect the integrity of the excavation. Employees will not enter excavations where water has accumulated until protective measures have been implemented.
- Prior to entering excavations greater than 4 feet in depth, air monitoring for oxygen and hazardous atmospheres must be conducted to assure atmospheric conditions are within normal levels described in Section 8.6. Continuous air monitoring with a standard multi-gas detector (O2, LEL%, CO, H2S) shall be used during the course of work within an excavation; if action limits are reached workers shall safely exit the excavation. Upgrades to worker protection should be evaluated with the SHSO and PP in consultation with the CHSD. Emergency rescue equipment, such as breathing apparatuses and safety harnesses connected to an extraction device, will be readily available in the event of hazardous atmospheric conditions.
- While earthmoving, stay out of the excavator's delineated heavy equipment exclusion zone and away from the excavation sides where there is potential for cave in (within excavations that are 6 feet or more in depth, a delineated perimeter 6 feet away from the excavated edge is required).
- During loading and unloading operations, stand away from haul trucks and other vehicles to avoid contact with any falling loads.
- Traffic cones, caution tape, or other barriers will be set up around the perimeter of the excavation when employees are working along the excavation edge and for any excavation that will be left open overnight or unattended for more than two days.

Maximum Allowable Slopes

Soil or Rock Type	Maximum Allowable Slopes (H:V)[1] for Excavations Less Than 20 Feet Deep[3]
Stable Rock	Vertical (90°)
Type A[2]	3/4 : 1 (53°)
Type B	1 : 1 (45°)
Type C	1 1/2 : 1 (34°)

29 CFR 1926 Subpart P Appendix B Sloping and Benching Table B-1

Notes:

[1] Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.

[2] A short-term maximum allowable slope of 1/2H : 1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 meters) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 meters) in depth shall be 3/4H : 1V (53°).

[3] Sloping or benching for excavations greater than 20 feet deep shall be designed and stamped by a registered professional engineer.

Proper stockpiling (i.e., 2 feet minimum distance from the excavation edge), containment, transport, storage, and disposal practices will be utilized and is dependent upon the potential type and amount of waste generated during operations. The location of safety equipment and evacuation procedures will be established prior to initiation of operations according to this HASP.

8.13.3 Heavy Equipment

Use of heavy equipment at the Site will require adherence to Roux's Corporate Heavy Equipment Exclusion Zone Management Program found within Appendix F. Additionally, operation of the drill rig/other heavy equipment will maintain clearances from overhead power lines in accordance with 29 CFR 1926.1408 Table A Minimum Clearance Distances provided below.

Minimum Required Clearances for Energized Overhead Power Lines

Nominal System Voltage of Power Line (K V)	Minimum Required Clearance (feet)
0-50	10
51-100	12
101-200	15
201-300	20
301-500	25
501-750	35
751-1000	45

1 kilovolt (KV) = 1,000 volts

8.14 Traffic Control

If Site operations encroach upon public streets or highways and a hazard exists to Site personnel because of traffic conditions, a traffic control plan will be implemented in accordance with the United States Department of Transportation's (DOT's) "Manual on Uniform Traffic Control Devices."

8.15 Sanitation

Sanitation facilities will be provided in accordance with the sanitation standards (29 CFR 1910.141, 29 CFR 1926.51 and 29 CFR 1928.110). Sanitation facilities will be maintained and kept in good conditions at all times.

9. Field Team Review

Each person performing work at or visiting this site shall sign this section after site-specific training is completed and before being permitted to access the CRZ or Exclusion Zone.

I have read and understand this Site-Specific Health and Safety Plan. I will comply with the provision contained therein.

Site/Project: Greenpoint Ferry Site/1 Java Street, Brooklyn, NY

Name & Company	Signature	Date

10. Approvals

By their signature, the undersigned certify that this HASP is approved and will be utilized at the 1 Java Development/Greenpoint Ferry Site.

TBD – Site Health and Safety Officer	Date
Nevin Pahlad – Office Health and Safety Manager	Date
Brooke Hildebrand – Project Manager	Date
Robert Kovacs – Project Principal	Date

TABLES

1. Toxicological Properties of Hazardous Substances Present at the Site

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site.

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
ORGANOCHLORINE PESTICIDES (OCP)									
DDT	50-29-3	TWA 1 mg/m3	TWA 0.5 mg/m3	TWA 1 mg/m3	500 mg/m3	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; vomiting; [potential occupational carcinogen]	Eyes, skin, central nervous system, kidneys, liver, peripheral nervous system	White, odorless and tasteless, very stable, water-insoluble, synthetic BP: 260°F Fl.Pt. = 162-171°F LEL: NA UEL: NA
Aldrin	309-00-2	TWA 0.1 mg/m3	TWA 0.25 mg/m3	TWA 0.25 mg/m3	25 mg/m3	Inhalation, ingestion, skin and/or eye contact	headache, dizziness; nausea, vomiting, malaise (vague feeling of discomfort); myoclonic jerks of limbs; clonic, tonic convulsions; coma; hematuria (blood in the urine), azotemia; [potential occupational carcinogen]	Developmemntal, Endocrine, Liver, Immune System, Nervous System,	Colorless to dark-brown crystalline solid with a mild chemical odor. BP: 293°F Fl.Pt. = 150°F LEL: NA UEL: NA
Lindane (gamma-BHC)	58-89-9	TWA 0.5 mg/m3	TWA 0.5 mg/m3	TWA 0.5 mg/m3	50 mg/m3	Inhalation, ingestion, skin and/or eye contact	irritation eyes, skin, nose, throat; headache; nausea; clonic convulsions; resp difficulty; cyanosis; aplastic anemia; muscle spasm; In Animals: liver, kidney damage	Eyes, skin, respiratory system, central nervous system, blood, liver, kidneys	White to yellow, crystalline powder with a slight, musty odor. BP: 614°F Fl.Pt. = 150°F LEL: NA UEL: NA
Dieldrin	860-57-1□	TWA 0.1 mg/m3	TWA 0.25 mg/m3	TWA 0.25 mg/m3	25 mg/m3	Inhalation, ingestion, skin and/or eye contact	headache, dizziness; nausea, vomiting, malaise (vague feeling of discomfort), sweating; myoclonic limb jerks; clonic, tonic convulsions; coma; ; In Animals: liver, kidney damage [potential occupational carcinogen]	Developmemntal, Endocrine, Liver, Immune System, Nervous System,	Colorless to light-tan crystals with a mild, chemical odor. BP: NA (Decomposes) Fl.Pt. = NA LEL: NA UEL: NA
VOLATILE ORGANIC COMPOUNDS (VOCs)									
1,1,1-Trichloroethane	71-55-6	TWA 350 ppm STEL 450 ppm	C 350 ppm (1900 mg/m^3) [15-minute]	TWA 350 ppm (1900 mg/m^3)	700 ppm	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin; headache, lassitude (weakness, exhaustion), central nervous system depression, poor equilibrium; dermatitis; cardiac arrhythmias; liver damage	Eyes, skin, central nervous system, cardiovascular system, liver	Colorless liquid with a mild, chloroform-like odor. BP: 165°F Fl.Pt. = NA LEL: 7.5% UEL: 12.5% Combustible Liquid, but burns with difficulty
1,1,2,2-Tetrachloroethane	79-34-5	TWA 1 ppm [skin]	Ca TWA 1 ppm (7 mg/m^3) [skin]	TWA 5 ppm (35 mg/m^3) [skin]	Ca [100 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Nausea, vomiting, abdominal pain; tremor fingers; jaundice, hepatitis, liver tenderness; dermatitis; leukocytosis (increased blood leukocytes); kidney damage; [potential occupational carcinogen]	Skin, liver, kidneys, central nervous system, gastrointestinal tract	Colorless to pale-yellow liquid with a pungent, chloroform-like odor BP: 296°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Liquid
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	TWA 1000 ppm STEL 1250 ppm	TWA 1000 ppm (7600 mg/m3) ST 1250 ppm (9500 mg/m3)	TWA 1000 ppm (7600 mg/m3)	2000 ppm	Inhalation, ingestion, skin and/or eye contact	Irritation skin, throat, drowsiness, dermatitis; central nervous system depression; In Animals: cardiac arrhythmias, narcosis	Skin, heart, central nervous system, cardiovascular system	Colorless to water-white liquid with an odor like carbon tetrachloride at high concentrations. [Note: A gas above 118°F.] BP: 118°F Fl.Pt. = NA LEL: NA UEL: NA
1,1,2-Trichloroethane	79-00-5	TWA 10 ppm [skin]	Ca TWA 10 ppm (45 mg/m3) [skin]	TWA 10 ppm (45 mg/m3) [skin]	Ca [100 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, nose; central nervous system depression; liver, kidney damage; dermatitis; [potential occupational carcinogen]	Eyes, respiratory system, central nervous system, liver, kidneys	Colorless liquid with a sweet, chloroform-like odor BP: 237°F Fl.Pt. = NA LEL: 6% UEL: 15.5% Combustible Liquid, forms dense soot
1,1-Dichloroethane	75-34-3	TWA 100 ppm	TWA 100 ppm (400 mg/m^3)	TWA 100 ppm (400 mg/m^3)	3,000 ppm	Inhalation, ingestion, skin and/or eye contact	Irritation skin; central nervous system depression; liver, kidney, lung damage	Skin, liver, kidneys, lungs, central nervous system	Colorless, oily liquid with a chloroform-like odor. BP: 135°F Fl.Pt. = 2°F LEL: 5.4% UEL: 11.4% Class IB Flammable Liquid Fl.P. below 73°F and BP at or above 100°F.

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site.

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
1,1-Dichloroethene	75-35-4	TWA 5 ppm	Ca	None	Ca	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, throat; dizziness, headache, nausea, dyspnea (breathing difficulty); liver, kidney disturbance; pneumonitis; [potential occupational carcinogen]	Eyes, skin, respiratory system, central nervous system, liver, kidneys	Colorless liquid or gas (above 89°F) with a mild, sweet, chloroform-like odor BP: 89°F Fl.Pt. = -2°F LEL: 6.5% UEL: 15.5% Class IA Flammable Liquid: Fl.P. below 73°F and BP below 100°F
1,2,3-Trichlorobenzene	87-61-6	Cameo Chemicals Source https://cameochemicals.noaa.gov/chemical/10051	NA	NA	NA	Inhalation, skin absorption, ingestion, skin and/or eye contact	Inhalation may cause irritation of respiratory tract. Irritating to the eyes. May redden skin on contact. Ingestion may cause liver damage.	Skin, eyes, respiratory tract, liver	A white solid with a sharp chlorobenzene odor. Insoluble in water and denser than water. Hence sinks in water Fl.Pt. = 234.9°F
1,2,4-Trichlorobenzene	120-82-1	C 5 ppm	C 5 ppm (40 mg/m3)	None	N.D.	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, skin, mucous membrane; In Animals: liver, kidney damage; possible teratogenic effects	Eyes, skin, respiratory system, liver, reproductive system	Colorless liquid or crystalline solid (below 63°F) with an aromatic odor BP: 416°F Fl.Pt. = 222°F LEL (302°F): 2.5% UEL (302°F): 6.6% Class IIIB Combustible Liquid: Fl.P. at or above 200°F. Combustible Solid
1,2-Dibromo-3-chloropropane	96-12-8	NA	Ca	TWA 0.001 ppm	Ca	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat; drowsiness; nausea, vomiting; pulmonary edema; liver, kidney injury; sterility; [potential occupational carcinogen]	Eyes, skin, respiratory system, central nervous system, liver, kidneys, spleen, reproductive system, digestive system	Dense yellow or amber liquid with a pungent odor at high concentrations. [pesticide] [Note: A solid below 43°F.] BP: 384°F Fl.Pt. = (oc) 170°F LEL: NA UEL: NA Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.
1,2-Dibromoethane	106-93-4	None listed Skin	Ca TWA 0.045 ppm C 0.13 ppm [15-minute]	TWA 20 ppm C 30 ppm 50 ppm [5-minute maximum peak]	Ca [100 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, respiratory system; dermatitis with vesiculation; liver, heart, spleen, kidney damage; reproductive effects; [potential occupational carcinogen]	Eyes, skin, respiratory system, liver, kidneys, reproductive system	Colorless liquid or solid (below 50°F) with a sweet odor. [fumigant] BP: 268°F Fl.Pt. = 50°F LEL: NA UEL: NA Noncombustible Liquid
1,2-Dichlorobenzene	95-50-1	TWA 25 ppm STEL 50 ppm	C 50 ppm (300 mg/m3)	C 50 ppm (300 mg/m3)	200 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, nose; liver, kidney damage; skin blisters	Eyes, skin, respiratory system, liver, kidneys	Colorless to pale-yellow liquid with a pleasant, aromatic odor. [herbicide] BP: 357°F Fl.Pt. = 1°F LEL: 2.2% UEL: 9.2% Class IIIA Combustible Liquid: Fl.P. at or above 140°F and below 200°F.
1,2-Dichloroethane	107-06-2	TWA 10 ppm	Ca TWA 1 ppm (4 mg/m3) ST 2 ppm (8 mg/m3)	TWA 50 ppm C 100 ppm 200 ppm [5-minute maximum peak in any 3 hours]	Ca [50 ppm]	Inhalation, ingestion, skin absorption, skin and/or eye contact	Irritation eyes, corneal opacity; central nervous system depression; nausea, vomiting; dermatitis; liver, kidney, cardiovascular system damage; [potential occupational carcinogen]	Eyes, skin, kidneys, liver, central nervous system, cardiovascular system	Colorless liquid with a pleasant, chloroform-like odor. [Note: Decomposes slowly, becomes acidic & darkens in color.] BP: 182°F Fl.Pt. = 56°F LEL: 6.2% UEL: 16% Class IB Flammable Liquid Fl.P. below 73°F and BP at or above 100°F.
1,2-Dichloropropane	78-87-5	TWA 10 ppm Dermal Sensitizer (DSEN)	Ca	TWA 75 ppm (350 mg/m3)	Ca [400 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, respiratory system; drowsiness, dizziness; liver, kidney damage; In Animals: central nervous system depression; [potential occupational carcinogen]	Eyes, skin, respiratory system, liver, kidneys, central nervous system	Colorless liquid with a chloroform-like odor. [pesticide] BP: 206°F Fl.Pt. = 60°F LEL: 3.4% UEL: 14.5% Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.
1,3-Dichlorobenzene	541-73-1	https://cameochemicals.noaa.gov/chemical/8514				Inhalation, skin absorption, ingestion, skin and/or eye contact	INHALATION: Causes headache, drousiness, unsteadiness. Irritating to mucous membranes. EYES: Severe irritation. SKIN: Severe irritation. INGESTION: Irritation of gastric mucosa, nausea, vomiting, diarrhea, abdominal cramps and cyanosis.		Colorless liquid. Sinks in water. BP: 343°F Fl.Pt. = 146°F LEL: 2.02% UEL: 9.2%
1,4-Dichlorobenzene	106-46-7	TWA 10 ppm	Ca	TWA 75 ppm (450 mg/m3)	Ca [150 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Eye irritation, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; In Animals: liver, kidney injury; [potential occupational carcinogen]	Liver, respiratory system, eyes, kidneys, skin	Colorless or white crystalline solid with a mothball-like odor. [insecticide] BP: 345°F Fl.Pt. = 150°F LEL: 2.5% UEL: NA Combustible Solid, but may take some effort to ignite.

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site.

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
1,4-Dioxane	123-91-1	TWA 20 ppm [skin]	Ca C 1 ppm (3.6 mg/m3) [30-minute]	TWA 100 ppm (360 mg/m3) [skin]	Ca [500 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, skin, nose, throat; drowsiness, headache; nausea, vomiting; liver damage; kidney failure; [potential occupational carcinogen]	Eyes, skin, respiratory system, liver, kidneys	Colorless liquid or solid (below 53°F) with a mild, ether-like odor. BP: 214°F Fl.Pt. = 55°F LEL: 2.0% UEL: 22% Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F
2-Butanone	78-93-3	TWA 200 ppm STEL 300 ppm	TWA 200 ppm (590 mg/m3) ST 300 ppm (885 mg/m3)	TWA 200 ppm (590 mg/m3)	3000 ppm	inhalation, ingestion, skin and/or eye contact	irritation eyes, skin, nose; headache; dizziness; vomiting; dermatitis	Eyes, skin, respiratory system, central nervous system	Colorless liquid with a moderately sharp, fragrant, mint- or acetone-like odor BP: 175°F Fl.Pt. = 16°F LEL (200°F): 1.4% UEL (200°F): 11.4% Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F
2-Hexanone	591-78-6	TWA 5 ppm STEL 10 ppm [skin]	TWA 1 ppm (4 mg/m3)	TWA 100 ppm (410 mg/m3)	1600 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, nose; peripheral neuropathy: lassitude (weakness, exhaustion), paresthesia; dermatitis; headache, drowsiness	Eyes, skin, respiratory system, central nervous system, peripheral nervous system	Colorless liquid with an acetone-like odor BP: 262°F Fl.Pt. = 77°F LEL: NA UEL: 8.0% Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F
4-Methyl-2-pentanone	108-10-1	TWA 20 ppm STEL 75 ppm	TWA 50 ppm (205 mg/m3) ST 75 ppm (300 mg/m3)	TWA 100 ppm (410 mg/m3)	500 ppm	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, mucous membrane; headache, narcosis, coma; dermatitis; In Animals: liver, kidney damage	Eyes, skin, respiratory system, central nervous system, liver, kidneys	Colorless liquid with a pleasant odor BP: 242°F Fl.Pt. = 64°F LEL (200°F): 1.2% UEL (200°F): 8.0% Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F
Acetone	67-64-1	TWA 250 ppm STEL 500 ppm	TWA 250 ppm (590 mg/m^3)	TWA 1000 ppm (2400 mg/m^3)	2500 ppm [10% LEL]	Inhalation, ingestion, skin and/or eye contact	irritation eyes, nose, throat; headache, dizziness, central nervous system depression; dermatitis	Eyes, skin, respiratory system, central nervous system	Colorless liquid with a fragrant, mint-like odor BP: 133°F Fl.Pt. = 0°F LEL: 12.8% UEL: 2.5% Class IB Flammable liquid: Fl.P. below 73°F and BP at or above 100°F.
Benzene	71-43-2	TWA 0.5 ppm STEL 2.5 ppm	Ca TWA 0.1 ppm ST 1 ppm	TWA 1 ppm ST 5 ppm	Ca [500 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen]	Eyes, skin, respiratory system, blood, central nervous system, bone marrow	Colorless to light yellow liquid with an aromatic odor [Note: Solid below 42 °F] BP: 176°F Fl.Pt. = 12°F LEL: 1.2% UEL: 7.8% Class IB Flammable liquid. Fl.P. below 73°F and BP at or above 100°F.
Bromochloromethane	74-97-5	TWA 200 ppm	TWA 200 ppm (1050 mg/m3)	TWA 200 ppm (1050 mg/m3)	2000 ppm	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, throat; confusion, dizziness, central nervous system depression; pulmonary edema	Eyes, skin, respiratory system, liver, kidneys, central nervous system	Colorless to pale-yellow liquid with a chloroform-like odor. [Note: May be used as a fire extinguishing agent.] BP: 155°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Liquid
Bromodichloromethane	75-27-4	https://cameochemicals.noaa.gov/chemical/16064				Inhalation, ingestion, skin and/or eye contact	Symptoms of exposure to this compound may include irritation of the skin, eyes, mucous membranes and respiratory tract. It may also cause narcosis. Other symptoms may include nausea, dizziness and headache.	Liver and kidney damage. Central nervous system effects may also occur.	Clear colorless liquid BP: 189°F Fl.Pt. = NA LEL: NA UEL: NA
Bromoform	75-25-2	TWA 0.5 ppm	TWA 0.5 ppm (5 mg/m3) [skin]	TWA 0.5 ppm (5 mg/m3) [skin]	850 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, respiratory system; central nervous system depression; liver, kidney damage	Eyes, skin, respiratory system, central nervous system, liver, kidneys	Colorless to yellow liquid with a chloroform-like odor. [Note: A solid below 47°F.] BP: 301°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Liquid
Bromomethane	74-83-9	TWA 1 ppm [skin]	Ca	C 20 ppm (80 mg/m3) [skin]	Ca [250 ppm]	Inhalation, skin absorption (liquid), skin and/or eye contact (liquid)	Irritation eyes, skin, respiratory system; muscle weak, incoordination, visual disturbance, dizziness; nausea, vomiting, headache; malaise (vague feeling of discomfort); hand tremor; convulsions; dyspnea (breathing difficulty); skin vesiculation; liquid: frostbite; [potential occupational carcinogen]	Eyes, skin, respiratory system, central nervous system	Colorless gas with a chloroform-like odor at high concentrations. [Note: A liquid below 38°F. Shipped as a liquefied compressed gas.] BP: 38°F Fl.Pt. = NA (Gas) LEL: 10% UEL: 16.0% Flammable Gas, but only in presence of a high energy ignition source.

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site.

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Carbon disulfide	75-15-0	TWA 1 ppm [skin]	TWA 1 ppm (3 mg/m3) ST 10 ppm (30 mg/m3) [skin]	TWA 20 ppm C 30 ppm 100 ppm (30-minute maximum peak)	500 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Dizziness, headache, poor sleep, lassitude (weakness, exhaustion), anxiety, anorexia, weight loss; psychosis; polyneuropathy; Parkinson-like syndrome; ocular changes; coronary heart disease; gastritis; kidney, liver injury; eye, skin burns; dermatitis; reproductive effects	Central nervous system, peripheral nervous system, cardiovascular system, eyes, kidneys, liver, skin, reproductive system	Colorless to faint-yellow liquid with a sweet ether-like odor. [Note: Reagent grades are foul smelling.] BP: 116°F Fl.Pt. = -22°F LEL: 1.3% UEL: 50.0% Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.
Carbon tetrachloride	56-23-5	TWA 5 ppm STEL 10 ppm [skin]	Ca ST 2 ppm (12.6 mg/m3) [60-minute]	TWA 10 ppm C 25 ppm 200 ppm (5-minute maximum peak in any 4 hours)	Ca [200 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; central nervous system depression; nausea, vomiting; liver, kidney injury; drowsiness, dizziness, incoordination; [potential occupational carcinogen]	Central nervous system, eyes, lungs, liver, kidneys, skin	Colorless liquid with a characteristic ether-like odor BP: 170°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Liquid
Chlorobenzene	108-90-7	TWA 10 ppm	NA	TWA 75 ppm (350 mg/m3)	1000 ppm	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose; drowsiness, incoordination; central nervous system depression; In Animals: liver, lung, kidney injury	Eyes, skin, respiratory system, central nervous system, liver	Colorless liquid with an almond-like odor BP: 270°F Fl.Pt. = 82°F LEL: 1.3% UEL: 9.6% Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.
Chloroethane	75-00-3	TWA 100 ppm [skin]	Handle with caution in the workplace	TWA 1000 ppm (2600 mg/m3)	3800 ppm [10%LEL]	Inhalation, skin absorption (liquid), ingestion (liquid), skin and/or eye contact	Incoordination, inebriation; abdominal cramps; cardiac arrhythmias, cardiac arrest; liver, kidney damage	Liver, kidneys, respiratory system, cardiovascular system, central nervous system	Colorless gas or liquid (below 54°F) with a pungent, ether-like odor. [Note: Shipped as a liquefied compressed gas.] BP: 54°F Fl.Pt. = NA (gas), -58°F (liquid) LEL: 3.8% UEL: 15.4% Flammable Gas
Chloroform	67-66-3	TWA 10 ppm	Ca ST 2 ppm (9.78 mg/m3) [60-minute]	C 50 ppm (240 mg/m3)	Ca [500 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; dizziness, mental dullness, nausea, confusion; headache, lassitude (weakness, exhaustion); anesthesia; enlarged liver; [potential occupational carcinogen]	Liver, kidneys, heart, eyes, skin, central nervous system	Colorless liquid with a pleasant odor BP: 143°F Fl.Pt. = -82°F LEL: NA UEL: NA Noncombustible Liquid
Chloromethane	74-87-3	TWA 50 ppm STEL 100 ppm	Ca	TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 3 hours)	Ca [2000 ppm]	Inhalation, skin and/or eye contact (liquid)	Dizziness, nausea, vomiting; visual disturbance, stagger, slurred speech, convulsions, coma; liver, kidney damage; liquid: frostbite; reproductive, teratogenic effects; [potential occupational carcinogen]	Central nervous system, liver, kidneys, reproductive system	Colorless gas with a faint, sweet odor which is not noticeable at dangerous concentrations. [Note: Shipped as a liquefied compressed gas.] BP: -12°F Fl.Pt. = NA (Gas) LEL: 8.1% UEL: 17.4% Flammable Gas
cis-1,2-Dichloroethene	156-59-2	TWA 200 ppm (All isomers)	TWA 200 ppm (790 mg/m3)	TWA 200 ppm (790 mg/m3)	1000 ppm	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, respiratory system; central nervous system depression	Eyes, respiratory system, central nervous system	Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor. BP: 118-140°F Fl.Pt. = 36-39°F LEL: 5.6% UEL: 12.8% Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F
cis-1,3-Dichloropropene	10061-01-5	https://cameochemicals.noaa.gov/chemical/20168				Inhalation, ingestion, skin and/or eye contact	Symptoms of exposure to this compound may include local irritation of the eyes skin and respiratory tract; dermatitis, gasping, coughing, substernal pain, extreme respiratory distress, lacrimation, central nervous system depression, skin irritation, acute gastrointestinal distress with pulmonary congestion and edema. It also may cause injury to the liver, kidneys and heart.	Skin, eyes, mucous membranes, liver, kidney, heart	Colorless to amber liquid with a sweetish odor. BP: 219.7°F Fl.Pt. = NA LEL: NA UEL: NA
Cyclohexane	110-82-7	TWA 100 ppm	TWA 300 ppm (1050 mg/m3)	TWA 300 ppm (1050 mg/m3)	1300 ppm [10%LEL]	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, respiratory system; drowsiness; dermatitis; narcosis, coma	Eyes, skin, respiratory system, central nervous system	Colorless liquid with a sweet, chloroform-like odor. [Note: A solid below 44°F.] BP: 177°F Fl.Pt. = 0°F LEL: 1.3% UEL: 8.0% Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.
Dibromochloromethane	124-48-1	https://cameochemicals.noaa.gov/chemical/16183				Inhalation, ingestion, skin and/or eye contact	Symptoms of exposure to this compound may include irritation of the skin, eyes, mucous membranes and upper respiratory tract. It may also cause fatigue. Other symptoms may include central nervous system effects, lung and cornea irritation and liver and kidney damage. Prolonged exposure can cause nausea, dizziness, headache and narcosis.	Skin, eyes, mucous membranes, upper respiratory tract	Clear colorless to yellow-orange liquid BP: 246-248°F Fl.Pt. = Greater than 200°F LEL: NA UEL: NA

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site.

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Dichlorodifluoromethane	75-71-8	TWA 1000 ppm	TWA 1000 ppm (4950 mg/m3)	TWA 1000 ppm (4950 mg/m3)	15,000 ppm	Inhalation, skin and/or eye contact (liquid)	Dizziness, tremor, asphyxia, unconsciousness, cardiac arrhythmias, cardiac arrest; liquid: frostbite	Cardiovascular system, peripheral nervous system	Colorless gas with an ether-like odor at extremely high concentrations. [Note: Shipped as a liquefied compressed gas.] BP: -22°F Fl.Pt. = NA LEL: NA UEL: NA Nonflammable Gas
Ethyl benzene	100-41-4	TWA 20 ppm	TWA 100 ppm (435 mg/m^3) ST 125 ppm (545 mg/m^3)	TWA 100 ppm (435 mg/m^3)	800 ppm [10%LEL]	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	Eyes, skin, respiratory system, central nervous system	Colorless liquid with an aromatic odor. BP: 277°F Fl.Pt. = 55°F LEL: 0.8% UEL: 6.7% Class IB Flammable Liquid below 73°F and BP at or above 100°F
Isopropyl benzene	98-82-8	TWA 5 ppm	TWA 50 ppm (245 mg/m3) [skin]	TWA 50 ppm (245 mg/m3) [skin]	900 ppm [10%LEL]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, mucous membrane; dermatitis; headache, narcosis, coma	Eyes, skin, respiratory system, central nervous system	Colorless liquid with a sharp, penetrating, aromatic odor BP: 306°F Fl.Pt. = 96°F LEL: 0.9% UEL: 6.5% Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F
Methyl Acetate	79-20-9	TWA 200 ppm STEL 250 ppm	TWA 200 ppm (610 mg/m3) ST 250 ppm (760 mg/m3)	TWA 200 ppm (610 mg/m3)	3100 ppm [10%LEL]	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat; headache, drowsiness; optic nerve atrophy; chest tightness; In Animals: narcosis	Eyes, skin, respiratory system, central nervous system	Colorless liquid with a fragrant, fruity odor BP: 135°F Fl.Pt. = 14°F LEL: 3.1% UEL: 16% Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.
Methylcyclohexane	108-87-2	TWA 400 ppm	TWA 400 ppm (1600 mg/m3)	TWA 500 ppm (2000 mg/m3)	1200 ppm [LEL]	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat; dizziness, drowsiness; In Animals: narcosis	Eyes, skin, respiratory system, central nervous system	Colorless liquid with a faint, benzene-like odor BP: 214°F Fl.Pt. = 25°F LEL: 1.2% UEL: 6.7% Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.
Methylene chloride	75-09-2	TWA 50 ppm [skin] STEL 100 ppm	Ca	[1910.1052] TWA 25 ppm ST 125 ppm	Ca [2300 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; lassitude (weakness, exhaustion), drowsiness, dizziness; numb, tingle limbs; nausea; [potential occupational carcinogen]	Eyes, skin, cardiovascular system, central nervous system	Colorless liquid with a chloroform-like odor. [Note: A gas above 104°F.] BP: 104°F Fl.Pt. = NA LEL: 13% UEL: 23% Combustible Liquid
Methyl-t-butyl ether	1634-04-4	TWA 50 ppm	NA	NA	NA	Inhalation, skin absorption, ingestion, skin and/or eye contact	May cause dizziness or suffocation. Contact may irritate or burn eyes or skin. May be harmful if swallowed.	Eyes, skin	A colorless liquid with a distinctive anesthetic-like odor. BP: 131°F Fl.Pt. = -14°F LEL: NA UEL: NA
o-Xylene	95-47-6	TWA 20 ppm (All isomers)	TWA 100 ppm (435 mg/m3) ST 150 ppm (655 mg/m3)	TWA 100 ppm (435 mg/m3)	900 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis	Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys	Colorless liquid with an aromatic odor BP: 292°F Fl.Pt. = 90°F LEL: 0.9% UEL: 6.7% Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F
Styrene	100-42-5	TWA 10 ppm STEL 20 ppm OTO (ototoxicant)	TWA 50 ppm (215 mg/m3) ST 100 ppm (425 mg/m3)	TWA 100 ppm C 200 ppm 600 ppm (5-minute maximum peak in any 3 hours)	700 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, nose, respiratory system; headache, lassitude (weakness, exhaustion), dizziness, confusion, malaise (vague feeling of discomfort), drowsiness, unsteady gait; narcosis; defatting dermatitis; possible liver injury; reproductive effects	Eyes, skin, respiratory system, central nervous system, liver, reproductive system	Colorless to yellow, oily liquid with a sweet, floral odor BP: 293°F Fl.Pt. = 88°F LEL: 0.9% UEL: 6.8% Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F
Tetrachloroethene	127-18-4	TWA 25 ppm STEL 100 ppm	Ca Minimize workplace exposure concentrations	TWA 100 ppm C 200 ppm (for 5 minutes in any 3-hour period), with a maximum peak of 300 ppm	Ca [150 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]	Eyes, skin, respiratory system, liver, kidneys, central nervous system	Colorless liquid with a mild, chloroform-like odor BP: 250°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Liquid, but decomposes in a fire to hydrogen chloride and phosgene

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site.

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Sodium Hydroxide	1310-73-2	Ceiling 2 mg/m^3	C 2 mg/m^3	TWA 2 mg/m^3	10 mg/m^3	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, mucous membrane; pneumonitis; eye, skin burns; temporary loss of hair	Eyes, skin, respiratory system	Colorless to white, odorless solid (flakes, beads, granular form). BP: 2534°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Solid, but when in contact with water may generate sufficient heat to ignite combustible materials.
Sulfuric Acid	7664-93-9	TWA 0.2 mg/m^3 (as thoracic particulate mass)	TWA 1 mg/m^3	TWA 1 mg/m^3	15 mg/m^3	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat; pulmonary edema, bronchitis; emphysema; conjunctivitis; stomatis; dental erosion; eye, skin burns; dermatitis	Eyes, skin, respiratory system, teeth	Colorless to dark-brown, oily, odorless liquid.[Note: Pure compound is a solid below 51°F. Often used in an aqueous solution.] BP = 554°F Fl.Pt. = NA LEL = NA UEL = NA Noncombustible Liquid, but capable of igniting finely divided combustible materials.
trans-1,2-Dichloroethene	156-60-5	200 ppm (All isomers)	TWA 200 ppm (790 mg/m3)	TWA 200 ppm (790 mg/m3)	1000 ppm	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, respiratory system; central nervous system depression	Eyes, respiratory system, central nervous system	Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor. BP: 118-140°F Fl.P: 36-39°F LEL: 5.6% UEL: 12.8% Class IB Flammable Liquid Fl.P. below 73°F and BP at or above 100°F.
trans-1,3-Dichloropropene	10061-02-6	https://cameochemicals.noaa.gov/chemical/18110				Inhalation, ingestion, skin and/or eye contact	Symptoms of exposure to this compound may include local irritation of the eyes skin and respiratory tract, dermatitis, gasping, coughing, substernal pain, extreme respiratory distress, lacrimation, central nervous system depression, acute gastrointestinal distress with pulmonary congestion and edema. It may also cause injury to the liver, kidneys and heart	Skin, eyes, mucous membranes, liver, kidney, heart	A clear colorless liquid with chloroform odor BP: 234°F Fl.P: NA LEL: NA UEL: NA
Toluene	108-88-3	TWA 20 ppm (ototoxicant)	TWA 100 ppm (375 mg/m^3) ST 150 ppm (560 mg/m^3)	TWA 200 ppm C 300 ppm 500 ppm (10-minute maximum peak)	500 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage	Eyes, skin, respiratory system, central nervous system, liver, kidneys	Colorless liquid with a sweet, pungent, benzene-like odor. BP: 232°F Fl.P: 40°F LEL: 1.1% UEL: 7.1% Class IB Flammable Liquid Fl.P. below 73°F and BP at or above 100°F.
Trichloroethene (TCE)	79-01-6	TWA 10 ppm STEL 25 ppm	Ca	TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 2 hours)	Ca [1000 ppm]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]	Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system	Colorless liquid (unless dyed blue) with a chloroform-like odor. BP: 189°F Fl.Pt. = NA LEL(77°F): 8.0% UEL(77°F): 10.5% Combustible Liquid, but burns with difficulty.
Trichlorofluoromethane	75-69-4	STEL C 1000 ppm	C 1000 ppm (5600 mg/m3)	TWA 1000 ppm (5600 mg/m3)	2000 ppm	Inhalation, ingestion, skin and/or eye contact	Incoordination, tremor; dermatitis; cardiac arrhythmias, cardiac arrest; asphyxia; liquid: frostbite	Skin, respiratory system, cardiovascular system	Colorless to water-white, nearly odorless liquid or gas (above 75°F) BP: 75°F Fl.P: NA LEL: NA UEL: NA Noncombustible Liquid Nonflammable Gas
Vinyl Chloride (chloroethylene)	75-01-4	TWA 1 ppm	Ca	TWA 1 ppm C 5 ppm [15-minute]	Ca (ND)	Inhalation, skin and/or eye contact (liquid)	Lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen]	Liver, central nervous system, blood, respiratory system, lymphatic system	Colorless gas or liquid (below 7°F) with a pleasant odor at high concentrations.[Note: Shipped as a liquefied compressed gas.] BP: 7°F Fl.Pt. = NA (Gas) LEL: 3.6% UEL: 33.0% Flammable Gas
Xylene (m, o & p isomers)	108-38-3, 95-47-6, 106-42-3	TWA 20 ppm	NA	NA	NA	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis	Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys	Colorless liquid with an aromatic odor BP: 282°F, 292°F, 281°F Fl. Pt. 82°F, 90°F, 81°F LEL: 1.1%, 0.9%, 1.1% UEL: 7.0%, 6.7%, 7.0% Class IC Flammable Liquid at or above 73°F and below 100°F.
Zinc Oxide (dust)	7440-66-6	TWA 2 mg/m3 (repsirable) STEL 10 mg/m^3 (respirable)	TWA 5 mg/m^3 C 15 mg/m^3	TWA 15 mg/m^3 (total dust) TWA 5 mg/m^3 (resp dust) TWA 5 mg/m^3 (fume)	500 mg/m^3	Inhalation	Metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough; lassitude (weakness, exhaustion); metallic taste; headache; blurred vision; low back pain; vomiting; malaise (vague feeling of discomfort); chest tightness; dyspnea (breathing difficulty), rales, decreased pulmonary function	Respiratory system	White, odorless solid. BP: NA Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Solid

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site.

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)									
2-Chloronaphthalene	91-58-7	https://cameochemicals.noaa.gov/chemical/16185				Inhalation, ingestion, skin and/or eye contact	Chloracne, cysts, headache, fatigue, vertigo, anorexia and jaundice		Monoclinic plates or off-white crystalline powder BP: NA Fl.Pt. = NA LEL: NA UEL: NA
2-Methylnaphthalene	91-57-6	TWA 0.5 ppm TLV-SL 3 mg/100 cm2 [skin]	https://cameochemicals.noaa.gov/chemical/20668			Inhalation, ingestion, skin and/or eye contact	Headaches, nausea, vomiting, diarrhea, anemia, jaundice, euphoria, dermatitis, visual disturbances, convulsions and comatose	Skin, eyes, mucous membranes and upper respiratory tract	White crystalline solid Combustible solid BP: 466-468 ° F Fl.Pt. = 208 ° F LEL: NA UEL: NA
Acenaphthene	83-32-9	https://cameochemicals.noaa.gov/chemical/10358				Inhalation, ingestion, skin and/or eye contact	Irritation of the skin, eyes, mucous membranes and upper respiratory tract, vomiting	Skin, eyes, mucous membranes and upper respiratory tract	White needles BP: 534 ° F Fl.Pt. = NA LEL: 0.6% UEL: NA
Acenaphthylene	208-96-8	https://cameochemicals.noaa.gov/chemical/16157				Inhalation, ingestion, skin and/or eye contact			Colorless crystalline solid BP: 509 to 527 ° F at 760 mm Hg Fl.Pt. = NA LEL: NA UEL: NA
Anthracene (as coal tar pitch volatiles)	120-12-7	TWA 0.2 mg/m3 (as Benzene solubles)	Ca TWA 0.1 mg/m3 (cyclohexane-extractable fraction)	TWA 0.2 mg/m3 (benzene-soluble fraction) [1910.1002]	Ca [80 mg/m3]	Inhalation, skin and/or eye contact	Dermatitis, bronchitis, [potential occupational carcinogen]	Respiratory system, skin, bladder, kidneys	Black or dark-brown amorphous residue BP: NA Fl.Pt. = NA LEL: NA UEL: NA Combustible Solids
Benzo[a]anthracene	56-55-3	https://cameochemicals.noaa.gov/chemical/16171				Inhalation, injestion, skin and/or eye contact			Colorless leaflets or plates or coarse gold powder with a greenish-yellow fluorescence. May reasonably be expected to be a carcinogen. BP: 815° F at 760 mm Hg Fl.Pt. = NA LEL: NA UEL: NA
Benzo[a]pyrene (as coal tar pitch volatiles)	50-32-8	TWA 0.2 mg/m3 (as Benzene solubles)	Ca TWA 0.1 mg/m3 (cyclohexane-extractable fraction)	TWA 0.2 mg/m3 (benzene-soluble fraction) [1910.1002]	Ca [80 mg/m3]	Inhalation, skin and/or eye contact	Dermatitis, bronchitis, [potential occupational carcinogen]	Respiratory system, skin, bladder, kidneys	Black or dark-brown amorphous residue BP: NA Fl.Pt. = NA LEL: NA UEL: NA Combustible Solids
Benzo[b]fluoranthene	205-99-2	None listed	https://cameochemicals.noaa.gov/chemical/16172			Inhalation, injestion, skin and/or eye contact			Needles or yellow fluffy powder BP: NA Fl.Pt. = NA LEL: NA UEL: NA
Benzo[g,h,i]perylene	191-24-2	https://cameochemicals.noaa.gov/chemical/16174				Inhalation, injestion, skin and/or eye contact	Inhalation of material may be harmful. Contact may cause burns to skin and eyes. Inhalation of Asbestos dust may have a damaging effect on the lungs. Fire may produce irritating, corrosive and/or toxic gases. Some liquids produce vapors that may cause dizziness or suffocation. Runoff from fire control may cause pollution.	Lungs, skin, eyes	Colorless to white crystalline solid. Water insoluble. BP: NA Fl.Pt. = NA LEL: NA UEL: NA
Benzo[k]fluoranthene	207-08-9	https://cameochemicals.noaa.gov/chemical/16173				Inhalation, injestion, skin and/or eye contact	When heated to decomposition this compound emits acrid smoke and irritating fumes.		Pale yellow needles or yellow crystalline solid BP: 896° F Fl.Pt. = NA LEL: NA UEL: NA
Chrysene (as coal tar pitch volatiles	218-01-9	TWA 0.2 mg/m3 (as Benzene solubles)	Ca TWA 0.1 mg/m3 (cyclohexane-extractable fraction)	TWA 0.2 mg/m3 (benzene-soluble fraction) [1910.1002]	Ca [80 mg/m3]	Inhalation, skin and/or eye contact	Dermatitis, bronchitis, [potential occupational carcinogen]	Respiratory system, skin, bladder, kidneys	Black or dark-brown amorphous residue BP: NA Fl.Pt. = NA LEL: NA UEL: NA Combustible Solids
Dibenzo(a,h)anthracene	53-70-3	https://cameochemicals.noaa.gov/chemical/16192				Inhalation, injestion, skin and/or eye contact	Symptoms of exposure to this compound may include irritation. This compound is harmful if swallowed or inhaled. It may cause irritation. When heated to decomposition it emits acrid smoke, irritating fumes and toxic fumes of carbon monoxide and carbon dioxide.	Lungs	White crystals or pale yellow solid. Sublimes BP: 975° F Fl.Pt. = NA LEL: NA UEL: NA

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site.

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Fluoranthene	206-44-0	https://cameochemicals.noaa.gov/chemical/16213				Inhalation, injestion, skin and/or eye contact	When heated to decomposition this compound emits acrid smoke and fumes.		Light yellow fine crystals BP: 482° F Fl.Pt. = NA LEL: NA UEL: NA
Fluorene	86-73-7	https://cameochemicals.noaa.gov/chemical/16214				Inhalation, injestion, skin and/or eye contact			White leaflets. Sublimes easily under a vacuum. Fluorescent when impure. BP: 563° F Fl.Pt. = NA LEL: NA UEL: NA
Indeno[1,2,3-cd]pyrene	193-39-5	https://cameochemicals.noaa.gov/chemical/16218				Inhalation, injestion, skin and/or eye contact			Yellow crystals BP: 997° F Fl.Pt. = NA LEL: NA UEL: NA
Naphthalene	91-20-3	TWA 10 ppm [skin]	TWA 10 ppm (50 mg/m3) ST 15 ppm (75 mg/m3)	TWA 10 ppm (50 mg/m3)	250 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage	Eyes, skin, blood, liver, kidneys, central nervous system	Colorless to brown solid with an odor of mothballs. [Note: Shipped as a molten solid.] BP: 424°F Fl.P: 174°F LEL: 0.9% UEL: 5.9% Combustible Solid, but will take some effort to ignite
Phenanthrene	85-01-8	https://cameochemicals.noaa.gov/chemical/16236				Inhalation, injestion, skin and/or eye contact	Symptoms following exposure to this compound may include skin sensitization, dermatitis, bronchitis, cough, dyspnea, respiratory neoplasm, kidney neoplasm, skin irritation, and respiratory irritation.	Skin, respiratory tract	Colorless monoclinic crystals with a faint aromatic odor. Solutions exhibit a blue fluorescence. BP: 642° F Fl.Pt. = 340° F LEL: NA UEL: NA
Pyrene (see coal tar pitch volatiles)	129-00-0	TWA 0.2 mg/m3 (as Benzene solubles)	Ca TWA 0.1 mg/m3 (cyclohexane-extractable fraction)	TWA 0.2 mg/m3 (benzene-soluble fraction) [1910.1002]	Ca [80 mg/m3]	Inhalation, skin and/or eye contact	Dermatitis, bronchitis, [potential occupational carcinogen]	Respiratory system, skin, bladder, kidneys	Black or dark-brown amorphous residue BP: NA Fl.Pt. = NA LEL: NA UEL: NA Combustible Solids
METALS									
Aluminum	7429-90-5	TWA 1 mg/m3	TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)	TWA 15 mg/m^3 (total) TWA 5 mg/m^3 (resp)	N.D.	Inhalation, skin and/or eye contact	Irritation eyes, skin, respiratory system	Eyes, skin, respiratory system	Silvery-white, malleable, ductile, odorless metal BP: 4221°F Fl.Pt. = NA LEL: NA UEL: NA Combustible Solid, finely divided dust is easily ignited; may cause explosions.
Antimony	7440-36-0	TWA 0.5 mg/m3 (as Sb)	TWA 0.5 mg/m3 [*Note: The REL also applies to other antimony compounds (as Sb).]	TWA 0.5 mg/m3 [*Note: The PEL also applies to other antimony compounds (as Sb).]	50 mg/m3 (as Sb)	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat, mouth; cough; dizziness; headache; nausea, vomiting, diarrhea; stomach cramps; insomnia; anorexia; unable to smell properly	Eyes, skin, respiratory system, cardiovascular system	Silver-white, lustrous, hard, brittle solid; scale-like crystals; or a dark-gray, lustrous powder BP: 2975°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Solid in bulk form, but a moderate explosion hazard in the form of dust when exposed to flame.
Arsenic	7440-38-2	TWA 0.01 mg/m3	Ca C 0.002 mg/m3 [15-minute]	[1910.1018] TWA 0.010 mg/m3	Ca [5 mg/m3 (as As)]	Inhalation, skin absorption, skin and/or eye contact, ingestion	Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, resp irritation, hyperpigmentation of skin, [potential occupational carcinogen]	Liver, kidneys, skin, lungs, lymphatic system	Metal: Silver-gray or tin-white, brittle, odorless solid BP: Sublimes Fl.Pt. = NA LEL: NA UEL: NA Metal: Noncombustible Solid in bulk form, but a slight explosion hazard in the form of dust when exposed to flame
Barium	7440-39-3	TWA 0.5 mg/m3	0.5 mg Ba/m3 TWA	0.5 mg Ba/m3 TWA	50 mg Ba/m3	Inhalation, ingestion, skin and/or eye contact	Inhalation or contact with vapors, substance or decomposition products may cause severe injury or death. Contact may cause burns to skin, eyes, and mucous membranes. May be toxic by ingestion, inhalation and skin absorption. Used to make other chemicals.	Lungs, skin, eyes, and mucous membrane	A silver to white metallic solid BP: 1337°F Fl.Pt. = NA LEL: NA UEL: NA
Beryllium	7440-41-7	TWA 0.00005 mg/m^3	Ca C 0.0005 mg/m^3	TWA 0.002 mg/m^3 C 0.005 mg/m^3 0.025 mg/m3 [30-minute maximum peak]	Ca [4 mg/m^3 (as Be)]	Inhalation, skin and/or eye contact	Berylliosis (chronic exposure): anorexia, weight loss, lassitude (weakness, exhaustion), chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation eyes; dermatitis; [potential occupational carcinogen]	Eyes, skin, respiratory system	Hard, brittle, gray-white solid BP: 4532°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Solid in bulk form, but a slight explosion hazard in the form of a powder or dust.

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site.

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Cadmium	7440-43-9	TWA 0.01 mg/m^3 total dust TWA 0.002 mg/m^3 (as Cd) respirable fraction	Ca	TWA 0.005 mg/m^3	Ca [9 mg/m3 (as Cd)]	Inhalation, ingestion	Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen]	Respiratory system, kidneys, prostate, blood	Silver-white/blue tinged lustrous, odorless solid. BP: 1409°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible - will burn in powder form
Calcium	7440-70-2	https://cameochemicals.noaa.gov/chemical/309				Inhalation, ingestion, skin and/or eye contact	Contact with eyes or skin produces caustic burns.	Eyes, skin	A silvery, soft metal that turns grayish white on exposure to air. BP: 2714°F Fl.Pt. = NA LEL: NA UEL: NA
Chromium	7440-47-3	TWA 0.5 mg/m^3 (metal) TWA 0.003 mg/m^3 (water-soluble Cr III compounds) TWA 0.0002 mg/m^3 (water-soluble Cr VI compounds) STEL 0.0005 mg/m3 (water-soluble Cr VI compounds)	TWA 0.5 mg/m^3	TWA 1 mg/m^3	250 mg/m^3 (as Cr)	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin; lung fibrosis (histologic)	Eyes, skin, respiratory system	Blue-white to steel-gray, lustrous, brittle, hard, odorless solid. BP: 4788°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible - will burn in dust form if heated in a flame
Cobalt	7440-48-4	TWA 0.02 mg/m3 [DSEN] [RSEN]	TWA 0.05 mg/m3	TWA 0.1 mg/m3	20 mg/m3 (as Co)	Inhalation, ingestion, skin and/or eye contact	Cough, dyspnea (breathing difficulty), wheezing, decreased pulmonary function; weight loss; dermatitis; diffuse nodular fibrosis; resp hypersensitivity, asthma	Skin, respiratory system	Odorless, silver-gray to black solid BP: 5612°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Solid in bulk form, but finely divided dust will burn at high temperatures.
Copper	7440-50-8	TWA 0.2 mg/m^3 (fume) TWA 1 mg/m3 (dusts and mists)	TWA 1 mg/m^3	TWA 1 mg/m^3	100 mg/m^3 (as Cu)	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, nose, pharynx; nasal septum perforation; metallic taste; dermatitis; In Animals: lung, liver, kidney damage; anemia	Eyes, skin, respiratory system, liver, kidneys (increased risk with Wilson's disease)	Reddish, lustrous, malleable, odorless solid. BP: 4703°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible - powdered form may ignite
Iron (as iron oxide)	7439-89-6	TWA 5 mg/m3 (respirable particulate mass)	TWA 1 mg/m^3	NA	NA	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, mucous membrane; abdominal pain, diarrhea, vomiting; possible liver damage	Eyes, skin, respiratory system, liver, gastrointestinal tract	Appearance and odor vary depending upon the specific soluble iron salt. BP: NA Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Solids
Lead	7439-92-1	TWA 0.05 mg/m3	TWA (8-hour) 0.050 mg/m3	[1910.1025] TWA 0.050 mg/m3	100 mg/m3 (as Pb)	Inhalation, ingestion, skin and/or eye contact	Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension	Eyes, gastrointestinal tract, central nervous system, kidneys, blood, gingival tissue	A heavy, ductile, soft, gray solid BP: 3164°F Fl.Pt. = NA LEL: NA UEL: NA Noncombustible Solid in bulk form
Magnesium	7439-95-4	https://cameochemicals.noaa.gov/chemical/6949				Eye and/or skin contact	Dust irritates eyes in same way as any foreign material. Penetration of skin by fragments of metal is likely to produce local irritation, blisters, and ulcers which may become infected.	Eyes	A light silvery metal BP: 1202°F Fl.Pt. = NA LEL: NA UEL: NA
Manganese	7439-96-5	TWA 0.02 mg/m3 [R] TWA 0.1 mg/m3 [I]	TWA 1 mg/m3 ST 3 mg/m3	C 5 mg/m3	500 mg/m3 (as Mn)	inhalation, ingestion	Manganism; asthenia, insomnia, mental confusion; metal fume fever: dry throat, cough, chest tightness, dyspnea (breathing difficulty), rales, flu-like fever; low-back pain; vomiting; malaise (vague feeling of discomfort); lassitude (weakness, exhaustion); kidney damage	respiratory system, central nervous system, blood, kidneys	A lustrous, brittle, silvery solid BP: 3564°F Fl.Pt. = NA LEL: NA UEL: NA Metal: Combustible Solid
Mercury	7439-97-6	TWA 0.1 mg/m3, as Hg Aryl compounds TWA 0.025 mg/m3 as Hg, inorganic forms including metallic mercury	Hg Vapor: TWA 0.05 mg/m3 [skin] Other: C 0.1 mg/m3 [skin]	TWA 0.1 mg/m3	10 mg/m3 (as Hg)	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria	Eyes, skin, respiratory system, central nervous system, kidneys	Metal: Silver-white, heavy, odorless liquid. [Note: "Other" Hg compounds include all inorganic & aryl Hg compounds except (organo) alkyls.] BP: 674°F Fl.Pt. = NA LEL: NA UEL: NA Metal: Noncombustible Liquid

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site.

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Nickel	7440-02-0	TWA 1.5 mg/m^3 [elemental] TWA 0.1 mg/m^3 [soluble inorganic compound] TWA 0.2 mg/m^3 [insoluble inorganic compound] TWA 0.1 mg/m^3 [Nickel subsulfide]	Ca TWA 0.015 mg/m^3	TWA 1 mg/m^3	Ca [10 mg/m3 (as Ni)]	Inhalation, ingestion, skin and/or eye contact	Sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]	Nasal cavities, lungs, skin	Lustrous, silvery, odorless solid. BP: 5139°F Fl.Pt. = NA LEL: NA UEL: NA Combustible Solid; nickel sponge catalyst may ignite spontaneously in air.
Potassium	9/7/7440	https://cameochemicals.noaa.gov/chemical/4289				Eye and/or skin contact	Will burn skin and eyes	Skin, eyes	Potassium is a soft silvery metal though normally grayish white due to oxidation BP: 1425°F Fl.Pt. = NA LEL: NA UEL: NA
Selenium	7782-49-2	TWA 0.2 mg/m3	TWA 0.2 mg/m3	TWA 0.2 mg/m3	1 mg/m3 (as Se)	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat; visual disturbance; headache; chills, fever; dyspnea (breathing difficulty), bronchitis; metallic taste, garlic breath, gastrointestinal disturbance; dermatitis; eye, skin burns; In Animals: anemia; liver necrosis, cirrhosis; kidney, spleen damage	Eyes, skin, respiratory system, liver, kidneys, blood, spleen	Amorphous or crystalline, red to gray solid. [Note: Occurs as an impurity in most sulfide ores.] BP: 1265°F Fl.Pt. = NA LEL: NA UEL: NA Combustible Solid
Silver	7440-22-4	TWA 0.1 mg/m3 [Metal, dust, and fume] TWA 0.01 mg/m3 [Soluble compounds, as Ag]	TWA 0.01 mg/m3	TWA 0.01 mg/m3	10 mg/m3 (as Ag)	Inhalation, ingestion, skin and/or eye contact	Blue-gray eyes, nasal septum, throat, skin; irritation, ulceration skin; gastrointestinal disturbance	Nasal septum, skin, eyes	Metal: White, lustrous solid BP: 3632°F Fl.Pt. = NA LEL: NA UEL: NA Metal: Noncombustible Solid, but flammable in form of dust or powder
Sodium	7440-23-5	https://cameochemicals.noaa.gov/chemical/7794				Skin contact	Severe burns caused by burning metal or by caustic soda formed by reaction with moisture on skin	Skin	A silvery soft metal that becomes grayish white upon exposure to air BP: 1621°F Fl.Pt. = NA LEL: NA UEL: NA
Thallium	7440-28-0	0.02 mg/m3 inhallable particulate matter	TWA 0.1 mg/m3 [skin]	TWA 0.1 mg/m3 [skin]	15 mg/m3 (as Tl)	Inhalation, skin absorption, ingestion, skin and/or eye contact	Nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peri neuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs	Eyes, respiratory system, central nervous system, liver, kidneys, gastrointestinal tract, body hair	Appearance and odor vary depending upon the specific soluble thallium compound BP: NA Fl.Pt. = NA LEL: NA UEL: NA
Vanadium	7440-62-2	https://cameochemicals.noaa.gov/chemical/16147				Inhalation, skin absorption, ingestion, skin and/or eye contact	Highly toxic, may be fatal if inhaled, swallowed or absorbed through skin. Avoid any skin contact. Effects of contact or inhalation may be delayed. Fire may produce irritating, corrosive and/or toxic gases. Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution	Skin	Silvery-whitish powder BP: NA Fl.Pt. = NA LEL: NA UEL: NA
Zinc	7440-66-6	https://cameochemicals.noaa.gov/chemical/4814				Inhalation, skin absorption, ingestion, skin and/or eye contact	Inhalation or contact with vapors, substance or decomposition products may cause severe injury or death. May produce corrosive solutions on contact with water. Fire will produce irritating, corrosive and/or toxic gases. Runoff from fire control may cause pollution	Lungs	A grayish powder BP: NA Fl.Pt. = NA LEL: NA UEL: NA
PCBs									
PCBs (total)	11097-69-1, 53469-21-9	TWA 0.5 mg/m3 [skin] TWA 1 mg/m3 [skin]	Ca TWA 0.001 mg/m3 Ca TWA 0.001 mg/m3	TWA 0.5 mg/m3 [skin] TWA 1 mg/m3 [skin]	Ca [5 mg/m3] Ca [5 mg/m3]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, chloracne; liver damage; reproductive effects; [potential occupational carcinogen]	Skin, eyes, liver, reproductive system	Colorless to pale-yellow, viscous liquid or solid (below 50°F) with a mild, hydrocarbon odor BP: 689-734°F, 617-691°F Fl.Pt. = NA, NA LEL: NA UEL: NA Nonflammable Liquid, but exposure in a fire results in the formation of a black soot containing PCBs, polychlorinated dibenzofurans, and chlorinated dibenzo-p-dioxins.
Petroleum Hydrocarbons									
Gasoline	86290-81-5	TWA 300 ppm STEL 500 ppm	Ca	None	Ca [N.D.]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, mucous membrane; dermatitis; headache, lassitude (weakness, exhaustion), blurred vision, dizziness, slurred speech, confusion, convulsions; chemical pneumonitis (aspiration liquid); possible liver, kidney damage; [potential occupational carcinogen]	Eyes, skin, respiratory system, central nervous system, liver, kidneys	Clear liquid with a characteristic odor BP: 102°F Fl.Pt. = -45°F LEL: 1.4% UEL: 7.6%

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site.

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties

References

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Abbreviations:

ACGIH – American Conference of Governmental Industrial Hygienists.
BP – boiling point at 1 atmosphere, °F
C – Ceiling, is a concentration that should not be exceeded during and part of the working exposure.
Ca – Carcinogenic.
CAS# - Chemical Abstracts Service registry number which is unique for each chemical.
DSEN - Dermal Sensitization
Ft Pt. – Flash point
IDLH - Immediately Dangerous to Life and Health concentrations represent the maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing or irreversible health effects.
LEL – Lower explosive (flammable) limit in air, % by volume (at room temperature)
mg/m^3 – Milligrams of substance per cubic meter of air
NIOSH - National Institute for Occupational Safety and Health.
OSHA – Occupational Safety and Health Administration
OTO - Ototoxicant
PEL - OSHA Permissible Exposure Limit (usually) a time weighted average concentration that must not be exceeded during any 8 hour work shift of a 40 hr work week.
ppm – parts per million
REL – NIOSH Recommended Limit indicated a time weighted average concentration that must not be exceeded during any 10 hour work shift of a 40 hr work week
RSEN - Respiratory Sensitization
SG - Specific Gravity
STEL – ACGIH Short-term exposure limit (ST)
TLV - ACGIH Threshold Limit Values (usually 8 hour time weighted average concentrations).
TWA – 8-hour, time-weighted average
UEL – Upper explosive (flammable) limit in air, % by volume (at room temperature)
VP - Vapor Pressure

FIGURES

1. Site Location Map
2. Site Plan with Emergency Muster Area
3. Routes to Urgent Care and Hospital



QUADRANGLE LOCATION



N

1,000 0 1,000'

Title:

SITE LOCATION MAP

GREENPOINT FERRY SITE
1 JAVA STREET, BROOKLYN, NY

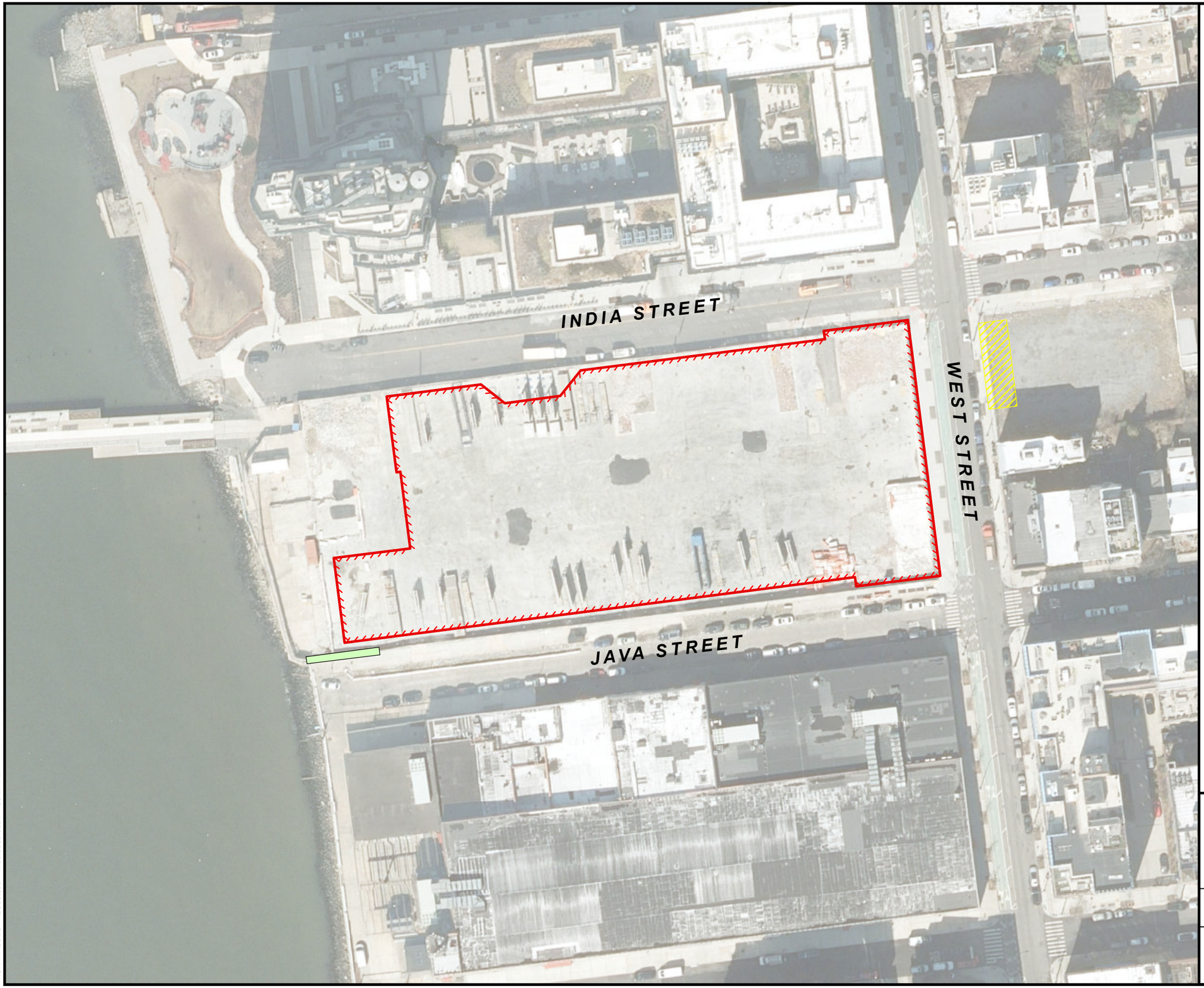
Prepared for:

1 JAVA OWNER LLC

ROUX

Compiled by: E.B.	Date: 03/18/21	FIGURE
Prepared by: M.S.R.	Scale: AS SHOWN	1
Project Mgr: J.W.	Project: 3583.0001Y000	
File: 3583.0001Y104.1.mxd		

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N

LEGEND

- EMERGENCY MEETING AREA
- SITE ENTRANCE AND EXIT
- APPROXIMATE EXTENT OF BUILDING

NOTES

1. AERIAL SOURCE: ESRI WAYBACK 01-2025

75 0 75'

Title:

SITE PLAN WITH EMERGENCY MUSTER AREA

GREENPOINT FERRY SITE
1 JAVA STREET, BROOKLYN, NY

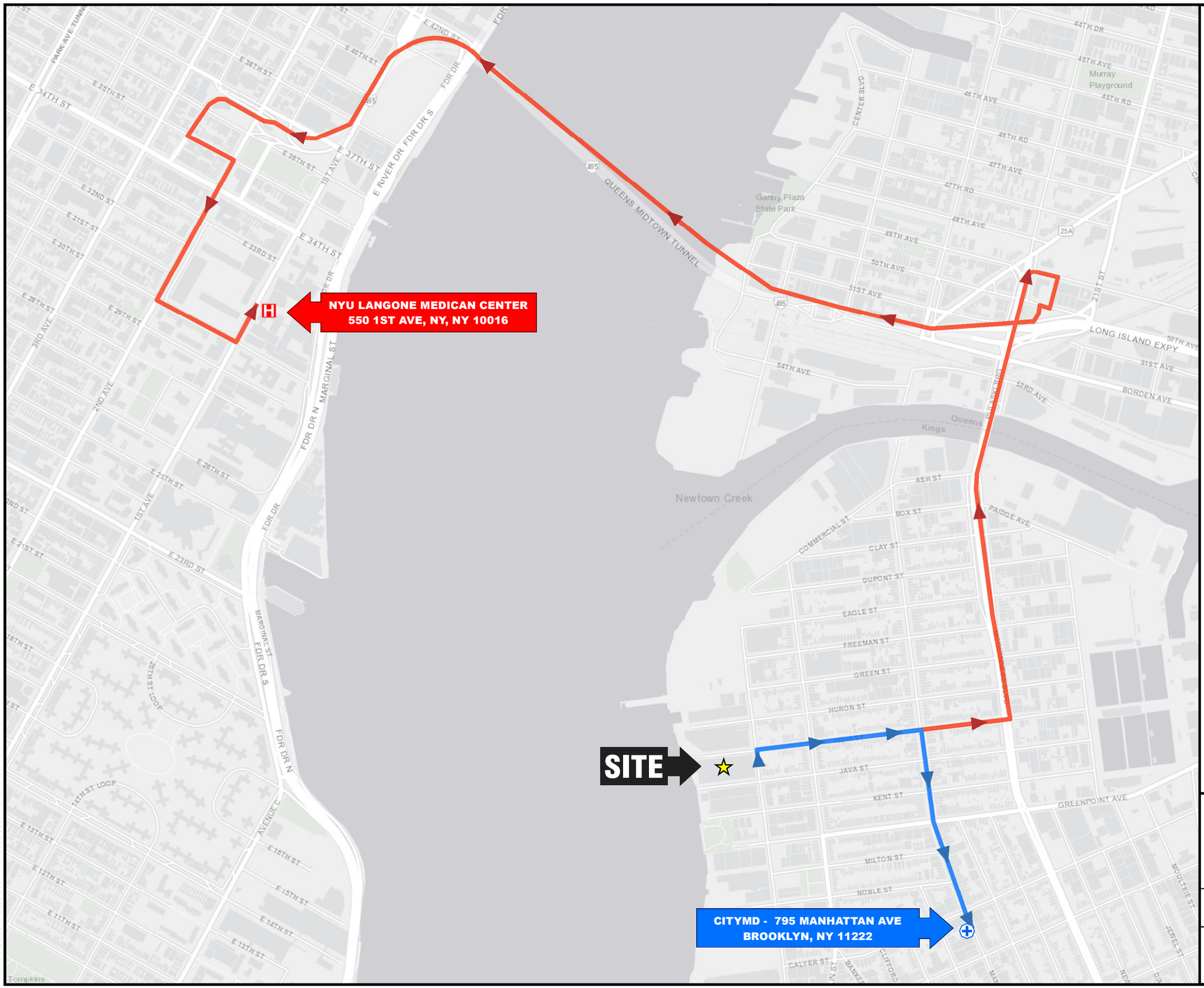
Prepared for:

1 JAVA OWNER LLC

ROUX

Compiled by: B.H.	Date: 07/25/25	FIGURE
Prepared by: M.S.R.	Scale: AS SHOWN	2
Project Mgr: J.W.	Project: 3583.0001Y000	
File: 3583.0001Y166.2.mxd		

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DIRECTIONS TO HOSPITAL

1. FOLLOW INDIA ST TO MCGUINNESS BLVD
2. TAKE PULASKI BRIDGE, QUEENS MIDTOWN TUNNEL AND 2ND AVE TO 1ST AVENUE IN MANHATTAN

DIRECTIONS TO URGENT CARE

1. HEAD NORTH ON WEST ST TOWARD INDIA ST
2. TURN RIGHT ONTO INDIA ST
3. TURN RIGHT ONTO MANHATTAN AVE/SGT. NICHOLAS ALEMAN WAY
4. CONTINUE TO FOLLOW MANHATTAN AVE
5. CONTINUE STRAIGHT THROUGH CHARNO WAY TO STAY ON MANHATTAN AVE

850 0 850'

Title:

ROUTES TO URGENT CARE AND HOPSITAL

GREENPOINT FERRY SITE
1 JAVA STREET, BROOKLYN, NY

Prepared for:

1 JAVA OWNER LLC

ROUX

Compiled by: E.B.	Date: 03/18/21	FIGURE
Prepared by: M.S.R.	Scale: AS SHOWN	3
Project Mgr: J.W.	Project: 3583.0001Y000	
File: 3583.0001Y104.3.mxd		

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APPENDICES

A. Job Safety Analysis (JSA) Forms
B. Safety Data Sheets (SDSs) for Chemicals Used
C. Heat Illness Prevention Program
D. Personal Protective Equipment (PPE) Management Program
E. Subsurface Utility Clearance Management Program
F. Heavy Equipment Exclusion Zone Policy
G. Community Air Monitoring Program

APPENDIX A

Job Safety Analysis (JSA) Forms

JOB SAFETY ANALYSIS	Ctrl. No. GEN-003	DATE 05/22/2025	☐ NEW ☒ REVISED	PAGE 1 of 2
JSA TYPE CATEGORY **GENERIC**	WORK TYPE **Construction - Excavation**	WORK ACTIVITY (Description) **Backfilling, Excavation & Compaction**		

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☒ GLOVES: cut-resistant level 2
☒ HARD HAT	☐ FACE SHIELD	☐ SUPPLIED RESPIRATOR	☐ OTHER _____
☐ LIFELINE / BODY HARNESS	☐ HEARING PROTECTION (as needed)	☒ PPE CLOTHING: ANSI-rated reflective vest	
☒ SAFETY GLASSES	☒ SAFETY TOE BOOTS		

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Payloader, Backhoe, Dump Trucks, Mechanical gas-powered tampers, Excavator with hydraulic tamper. APR when tamping if dust is present. Two-way radios.

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing LMRAs.

EXCLUSION ZONE (EZ): Maintain a Minimum Heavy Equipment Exclusion Zone (HEEZ) around equipment and loads while it is in motion. The HEEZ must be greater than the swing zone of any moving part of the equipment, the tip zone of the equipment, the fall zone of the equipment, and the contents

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Pre-construction meeting: Review proposed excavation locations	**1a. CONTACT:** Potential for contact with subsurface utilities and above-ground utilities	1a. Call 811 for mark-out service and a one-call ticket. 1a. Obtain private utility mark-out service, as necessary. 1a. Review and mark proposed excavations with white paint. 1a. Identify all "Critical" zones. A Critical zone is any area within 10 feet of any operating utility. 1a. Complete subsurface clearance checklist. 1a. Soft dig must be conducted within three lateral feet of any suspected underground utility. 1a. Protection of aboveground utilities identified within the work zone must be coordinated with the client and the utility owner.
2. Secure Work Area	**2a. CONTACT:** Potential for personnel to enter the work area. Potential for equipment to contact or crush personnel. **2b. EXERTION:** Potential for muscle strain or tear while installing traffic cones and barrels	2a. Ensure the work area is secure and inform others of work activity. Establish a HEEZ using traffic cones, barrels & snow fencing or telescoping poles. Use of flag persons to maintain clear traffic and to minimize motorist confusion during the set-up of the new traffic pattern. HEEZ is to include the tip/swing radius of the equipment. 2a. Dump Truck/Excavator/Payloader/Backhoe equipment to be set up by personnel who are familiar with the machinery. Spotters shall be in place for all equipment. and to control access to the HEEZ 2a. Truck wheels are chocked when the driver is not in the truck and the engine is shut off. 2a. Personnel shall stay out of the exclusion zone (10' minimum or greater than the equipment boom) while equipment is maneuvering. 2b. Keep back straight, keep load close to the body, and bend knees while lifting and working. If over 40 lbs., use 2 or more laborers for lifting or the use of equipment.

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.
[2] A hazard is a potential danger. Break hazards into six types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.
[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

3. Backfilling the excavation and compaction	**3a. CONTACT:** Traffic and live equipment.	3a. Equipment and trucks shall be isolated from other workers, subcontractors, and third-party traffic with traffic cones, barricades, snow fencing or telescoping poles, and/or Jersey barriers. Spotters shall direct the dump truck for the placement of fill near the excavation. Pay loader/ Excavator, as directed by a spotter, shall move fill into the trench where it shall be placed in layers and compacted by mechanical means.
		3a. Spotters will wear fluorescent vests at all times.
		3a. Spotters will remain out of the exclusion zone, line-of-fire from equipment and third-party vehicles.
		3a. Spotters and operators will have radios for communication when other visual and/or hand signals are insufficient.
		3a. Locate all overhead utilities. All personnel and machinery should maintain a minimum 10-foot distance from overhead electric lines. Refer to the OSHA chart for distances and voltage.
		3a. For excavations engineered (shored, sloped, benched), all personnel, equipment, and materials must remain a minimum of 2 feet from the edge of the excavation.
	3b. EXPOSURE: Fumes from a gas-powered tamper	3b. Fueling of all equipment will be done outside of the work area in a well-ventilated area. Refueling will be done only after a 5-minute cool-down. Pads and wipes will be available to contain any potential drips from refueling.
	3c. FALL: Slips, trips, and fall hazards.	3c. The work area will be clean and free of any debris to remove slip, trip, and fall hazards. All tools will be kept in designated areas. Ensure the work area is well illuminated.
		3c. Workers' walking paths shall be maintained, and workers will watch their footing while entering and exiting excavation areas for uneven surfaces, loose materials, and debris.
		3c. All persons working at elevations over 6’ shall maintain a 6-foot distance or use a guardrail system/ personal fall arrest system while within 6 feet of the edge of the excavation.
	3d. OVEREXERTION: Muscle strain or tear.	3d. Keep knees bent and back straight while transferring/ lifting/lowering the tamper from elevated areas. Utilize a co-worker to avoid straining muscles.
		3d. Keep knees bent and back straight while maneuvering the tamper. Utilize a co-worker to avoid straining muscles.
	3e. EXPOSURE: Noise from the tamper.	3e. Workers will wear hearing protection during compaction tamper activities.
	Dust inhalation.	3e. Wear a NIOSH-approved dust mask for personal comfort. If dust is visible for an extended time, limit by wetting down the area.
		3e. If dust continues, stop work and evaluate if an upgrade to APR is needed. Must have approval and medical clearance.

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

4. Secure/leave site.	**4a. FALL:** Slip, trip, fall	4a. Clear work area of all debris and store all equipment in designated areas/containers before opening to traffic. 4a. Replace fencing and barricades as needed to secure the path before opening the roadway or area up to traffic(vehicle, pedestrian, and/or bicycle).

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

JOB SAFETY ANALYSIS	Ctrl. No. GEN-009	DATE: 05/23/2025	☐ NEW ☒ REVISED	PAGE 1 of 1
JSA TYPE CATEGORY **Generic**	WORK TYPE **O&M**	WORK ACTIVITY (Description) **Movement of 55-Gallon Drums/Drum Handling with Mobile Carrier**		

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☒ GLOVES: Cut-resistant gloves level II
☒ HARD HAT	☐ FACE SHIELD	☐ SUPPLIED RESPIRATOR	☐ OTHER:
☐ LIFELINE / BODY HARNESS	☐ HEARING PROTECTION	☒ PPE CLOTHING: Fluorescent long-sleeve shirt or shirt and reflective safety vest.	
☒ SAFETY GLASSES	☒ SAFETY SHOES: Steel or composite toe		

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Mobile Drum Carrier, over-pack drum container, safety cones, and caution tape

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing LMRAs

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Preparing for an Inspection of the Drum	**1a. FALL:** Tripping/falling due to uneven surface. Loose debris/garbage in the work area.	1a. Clear the area of loose garbage and debris. Inspect 55-gal drums for proper condition, labeling, check drum ring and bolts for tightness, and inspect mobile drum carrier. 1a. Do a Test Lift to get a general sense of the weight of the drum. 1a. Inspect and use established pathways to avoid uneven terrain, weather-related hazards (i.e., debris, puddles, ice, etc.), and other obstructions. 1a. Secure a work area and coordinate and communicate the planned work activities with other personnel working in the area. 1a. Delineate work area with safety cones and caution tape
	1b. CONTACT/EXPOSURE: Drums could potentially be damaged or contain hazardous material. A mobile drum carrier could potentially be in poor working condition, causing malfunctioning during operation.	1b. Prior to inspecting drums, don cut-resistant gloves. If the drum is not properly labeled, do not open it and cease all drum transport activities. Immediately contact the project manager and inform him/her of the drum situation. 1b. Do not continue drum transport activities until the project manager determines further actions. 1b. If the drum is properly labeled, but leaking, improperly sealed, or in poor condition, place the drum in an overpack drum. 1b. Inspect the mobile drum carrier to ensure its overall integrity. Look for rust marks or potential weak points where the drum carrier could malfunction. Inspect the wheels to ensure that they easily turn and nothing is impeding their movement.
	1c. EXERTION/CAUGHT: Potential pinching/exertion hazards while securing the ring/ tightening bolts	1c. Keep back straight and knees slightly bent while securing the drum ring/tightening bolt. Wear cut-resistant gloves.
2. Position the drum clamp tightly in between the drum ribs, securing the drum clamp to the drum with the chain	**2a. CAUGHT:** Pinching fingers between the drum clamp and the handle/chain.	2a. Attach drum clamp with chain and tighten until snug. Do not place hands between the drum clamp and the drum as the chain is tightened; wear cut-resistant gloves. Keep face away from the drum when handling in case of escaping vapors.

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift." Avoid general statements such as, "be careful."

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Disengage safety latches on handle, pull handle down until drum is lifted off the ground, and safety latches are reengaged; slightly suspend drum off the ground	**3a. EXERTION/ CONTACT:** Potential muscle strain associated with lifting/engaging the drum/handle. The drum could shift/slip downward and crush toes.	3a. Ascertain whether the drum is overweight; if it is, then two people are needed to lower the handle while the drum is secured with the clamp so that safety latches can be engaged. Keep body out of the line-of-fire of the handle (do not position the head above the handle) as it is being pushed down. Do not allow feet/toes to be positioned under the drum as it is being lifted; wear steel/composite-toed boots.
	3b. CAUGHT: Fingers could be pinched while engaging/disengaging the safety latches on the handle	3b. Wear cut-resistant gloves while disengaging/reengaging safety latches. 3b. Avoid placing hands in pinch points.
4. Transport drums to the designated location and disengage the drum clamp (repeat Step 3 in reverse order)	**4a. FALL:** Tripping/ falling due to obstructions and uneven terrain. Potential for the drum to fall during transport.	4a. Ensure the transport path is free of potential obstructions that may cause the drum/carrier to become unstable. Position the drum clamp between the ribs on the drum to prevent possible slipping.

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift." Avoid general statements such as, "be careful."

JOB SAFETY ANALYSIS	Ctrl. No. GEN-011	DATE: 05/28/2025	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
Generic	**Construction - Excavation**	**Excavation / Trenching**

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☒ GLOVES: cut resistant level II
☒ HARD HAT	☐ FACE SHIELD	☐ SUPPLIED RESPIRATOR	☐ OTHER
☒ LONG SLEEVED SHIRT	HEARING PROTECTION (as needed)	☒ PPE CLOTHING: Fluorescent reflective vest or high visibility long sleeved clothing	
☐ LIFELINE / BODY HARNESS	☒ SAFETY SHOES: Steel-toe boots		
☒ SAFETY GLASSES			

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Jackhammer, Excavator, Backhoe, Hand Tools, Photoionization Detector, barrels, 42" traffic cones, snow fencing, telescoping poles, temporary chain link fence, ladders, shovels, digging bars, power tools (cut-off saw), Two-way radios, Sheeting, Trench box, Retractable lanyard, Harness

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing LMRAs

EXCLUSION ZONE (EZ): Maintain Minimum Heavy Equipment Exclusion Zone around equipment and loads while it is in motion. The HEEZ must be greater than the swing zone of any moving part of the equipment, tip zone of the equipment, fall zone of the equipment and contents, distance that debris may travel during demolition activities and/or footprint of a structure to be demolished.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Pre-Clearance Protocol.	**1a. CONTACT:** Damage to underground utility.	1a. Confirm that (if applicable) "Call Before You Dig" and local utility companies were contacted prior to trenching in order to confirm utility mark outs. Must have a case # before digging.
	1b. ENERGY SOURCE/CONTACT: Property damage; Pressurized water mains may cause lacerations or broken bones. Pressurized gas mains may explode, causing serious injury or death. Underground electric may cause severe burns, shock, or death.	**1b. Complete subsurface clearance checklist**. 1b. For excavations, all utilities need to be marked and then exposed by hand, following the protocols in this program. Pre-clearing for excavations may be performed by the "moat" technique (i.e., soft digging around the perimeter). In these cases, dig in small lifts (<12" for the first five feet) using a dedicated spotter.) For Tolerance Zone work, unless otherwise agreed upon with the Utility Operator, work within the tolerance zone requires verification by means of hand-dug test holes to expose the utility. Once structures have been verified, a minimum clearance of three feet must be maintained between the utility and any powered equipment.
	1c. FALL: Slip, Trip or Fall may cause muscle strains or tears, abrasions, lacerations, or broken bones.	1c. Be aware of the conditions when walking or loading equipment and working. Walk within an established pathway, avoiding uneven surfaces. Remove potential slip/trip/fall hazards.
2. Set up work zone.	**2a. CONTACT/CAUGHT:** Cuts/lacerations from equipment. Broken bones from contact by vehicle/equipment.	2a. Isolate work area from hazards with cones, barricades, snow fencing, telescoping poles, or a temporary chain link fence. Utilize a flag person when necessary (i.e., third-party traffic in the area). Install traffic signs in roadways and for detours. Spotters will maintain and enforce the exclusion zone.
	2b. FALL: Slip, Trip or Fall may cause muscle strains or tears, abrasions, lacerations, or broken bones.	2b. See 1c.

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Trenching Activity.	**3a. CONTACT:** Serious injury, including broken bones, muscle strains or tears, and possibly death, due to contact with the machine.	3a. Spotter(s) required for all heavy equipment operation. No worker shall be allowed inside the exclusion zone or along the trench/excavation area while any equipment is in operation. A minimum exclusion zone greater than the length of the equipment boom must be established. Workers are only allowed in the exclusion zone if the operator is in "Hands Off "mode. The operator will not operate the equipment until the worker is out of the exclusion zone. Spotters and operators will have radios for communication when either loses sight of one another, and/or in case of emergency.
	3b. FALL: Slip, Trip or Fall may cause muscle strains or tears, abrasions, lacerations, or broken bones	3b. Any trench/excavation deeper than 3' must have a ladder within 25' of any worker in the excavation. At least 3'(rungs) of the ladder shall be above the top of the excavation. All equipment, tools, material, and spoil piles shall be maintained 2' minimum from the edge of the excavation. 3b. Any trench/excavation deeper than 6' must have fall protection, a retractable lanyard for ladder use, and a 42" high guardrail system along the edge of the trench/excavation.
	3c. EXPOSURE: Noise, Dust, concrete-asphalt, and petroleum hydrocarbon vapors may cause damage to the ears and lungs	3c. Air monitoring using a calibrated photoionization detector (PID) will be used to monitor the breathing zone of the work area. If a reading of >5ppm is recorded, the oversight personnel must temporarily cease work and instruct all Site personnel to step away from the area of elevated readings.
4. Setting Trench protections if necessary.	**4a. CAUGHT:** Injury due to contact with a failed trench may include muscle strains or tears, abrasions or lacerations, broken bones, and possibly death.	4a. To prevent cave-ins and avoid being caught/between, excavations over 5' in depth, unless working in stable rock, shall have engineer-approved shoring, sheeting, or trench box. The top of protection shall be at least 18" above the top of the excavation.
	4b. CONTACT/CAUGHT: Injury due to rigging activities and entering the exclusion zone during lifting and/or transport of shoring/trench box/material may include muscle strains or tears, abrasions or lacerations, broken bones, and possibly death. Pinch/ Amputation points.	4b. Use only inspected rigging with 2, 3, or 4 lift points; wear cut-resistant gloves. Rigging to be hooked up to factory-installed hookup points on equipment. Control load with non-conductive tag lines with workers out of the exclusion zone. Do not stand underneath a suspended load; wear steel-toed boots and a hard hat. Keep hands and extremities out of pinch/amputation points/ line of fire areas.
	4c. FALL: Possible injuries due to a fall into an excavation may include muscle strains or tears, abrasions or lacerations, or broken bones. Impact/ impalement hazard	4c. Shoring to be set and sides will be backfilled to avoid fall hazards before workers are allowed to enter area. The operator will be in "HANDS OFF" mode before workers enter the work area to unhook the rigging. An inspected ladder extending 3' above the top of the shoring will be used to enter and exit the excavation. Workers will use three points of contact when using the ladder. Cover/ cap vertical impalement hazards.
5. Secure/Leave Site. If backfilling, see excavation backfilling and compaction JSA for potential hazards and critical actions.	**5a. FALL:** Potential Slip, Trip or Fall - may cause muscle strains, tears, abrasions or lacerations, or broken bones.	5a. See 1c. 5a. All open excavations must be backfilled or secured prior to departure with steel plates, orange construction fence, or temporary chain link fencing.

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JOB SAFETY ANALYSIS Ctrl. No. GEN-013	DATE 05/28/2025	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY	WORK TYPE:	WORK ACTIVITY (Description):
Generic	**Gauging and Sampling**	**Gauging and Sampling**

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☒ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☒ SAFETY SHOES: Composite-toed or steel-toed boots	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	☒ GLOVES: , Nitrile and cut-resistant level II ☒ OTHER: Knee pads, Insect Repellant, sunscreen (as needed)

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Traffic Safety Cones, Caution Tape, Interface Probe with Ground Clamp, and/or Water Level Meter, 20-lb. type ABC Fire Extinguisher, Buckets. Tools as needed: Socket Wrench, Screw Driver, Crow Bar, Mallet, and Wire Brush.

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing LMRAs

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Mobilization to monitoring well(s).	**1a. FALL:** Personal injury from slip/trip/fall due to uneven terrain and/or obstructions.	1a. Inspect the pathway and plan for the most suitable designated pathway prior to mobilization. 1a. Use established pathways, walk and/or drive on stable, secure ground, and avoid steep hills or uneven terrain. 1a. If working near open water with an unguarded edge, wear a personal flotation device (PFD).
	1b. CONTACT: With traffic/third parties.	1b. Identify potential traffic sources and delineate the work area with traffic safety cones. Position the vehicle to protect against oncoming traffic. Use caution tape to provide a more visible delineation of the work area if necessary. 1b. Wear appropriate PPE, including high visibility clothing and reflective vest, when exposed to traffic 1b. Face traffic, maintain eye contact with oncoming vehicles, and establish a safe exit route.
	1c. EXERTION: Muscle strain from lifting equipment	1c. Use proper lifting techniques when handling/moving equipment; bend knees and keep back straight. 1c. Use mechanical assistance or team lifting techniques when equipment is 40 lbs. or heavier. 1c. Make multiple trips to carry equipment.
	1d. EXPOSURE: To biological hazards.	1d. Inspect work area for bees and insects. 1d. Use insect/tick repellent, as necessary. 1d. Treat clothing with permethrin prior to mobilization. 1d. Don Tyvek/mosquito nets, as applicable.
2. Open/close well.	**2a. EXERTION:** Muscle strain.	2a. Use proper lifting techniques; keep back straight, lift with legs, and bend knees when reaching to open/close the well.
	2b. CAUGHT: Pinch/crush points associated with removing/replacing manholes and working with hand tools.	2b. Wear cut-resistant level II gloves when working with well cover and hand tools. 2b. Use proper tools (ratchet and pry bar or magnet for well cover) and inspect before use. 2b. Do not put fingers under the well cover.
	2c. CAUGHT: Pinch points associated with placing the J-plug back onto the PVC pipe.	2c. See 2b. 2c. Keep fingers out of line-of-fire when securing cap.
	2d. EXPOSURE: To potential hazardous vapors.	2d. No open flames/heat sources. 2d. To minimize exposure to vapors, allow the well to vent after opening it and before sampling activities begin. 2d. Stand upwind if possible, to avoid inhaling vapors. 2d. Monitor atmosphere with multi-gas meter/PID.
3. Gauge well.	**3a. CONTACT:** With contamination (e.g., contaminated groundwater).	3a. Wear chemical-resistant disposable gloves (over cut-resistant gloves) and safety glasses when gauging well. 3a. Insert and remove the probe slowly to avoid splashing. 3a. Use an absorbent pad to clean probe.
	3b. CONTACT: With traffic.	3b. See 1b.
	3c. Exposure: To static electricity, fire, or explosion.	3c. Ground interface probe to a designated grounding point/rod, well casing, or electrically conductive surface to dissipate static electricity.

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
4. Purge and sample well	**4a. EXPOSURE/CONTACT:** To contamination (e.g., SPH, contaminated groundwater, vapors) and/or sample preservatives.	4a. Open and fill sample jars slowly to avoid splashing and contact with preservatives. 4a. Wear cut-resistant gloves and chemical-resistant disposable gloves when sampling. 4a. Fill sample containers over the purge container to avoid spilling water onto the ground. 4a. Use an absorbent pad to clean spills. 4a. When using a bailer to purge a well, pull the bailer slowly from the well to avoid splash hazards. 4a. When sampling or purging the water using a bailer, pour water slowly to reduce the potential for splash hazards with groundwater. 4a. When using a tubing valve, always remove the valve slowly after sample collection to release any pressure and avoid pressurized splash hazards. 4a. When collecting a groundwater sample, always point the sampling apparatus (tubing, bailer, etc.) away from the face and body.
	4b. CONTACT: Personal injury from cuts, abrasions, or punctures by glassware or sharp objects.	4b. To avoid spills or breakage, place sampleware on an even surface. 4b. Do not over-tighten caps on glass sampleware. 4b. Wear chemical-resistant nitrile disposable gloves over cut-resistant (i.e., Kevlar) gloves when sampling and handling glassware (i.e., VOA vials) or when using approved cutting tools.
	4c. EXERTION: Muscle strain while carrying equipment.	4c. Use proper lifting techniques when handling/moving equipment, bend knees, and keep back straight. 4c. Use mechanical assistance or team lifting techniques when equipment is 40 lbs. or heavier. 4c. Make multiple trips to carry equipment.
	4d. CONTACT: With traffic.	4d. See 1b.
	4e. CONTACT: Pinch points with groundwater pump components (i.e., wheel, line, clamps).	4e. Wear cut-resistant gloves when working with groundwater pumps. 4e. Never place hands on or near pinch points such as the wheel, clamps, or other moving parts during pump operations. 4e. Use the correct mechanisms, such as a pump reel, to lower the pump into the well. 4e. Never attempt to manually stop any moving part of equipment, including hose reels and/or tubing.
	4f. EXERTION: Muscle strain from repetitive motion of bailing and sampling a well.	4f. See 4c. 4f. Include a stretch break when repetitive motions are part of the task.
5. Management of purge water.	**5a. EXPOSURE/CONTACT:** To contamination (e.g., SPH, contaminated groundwater, vapors).	5a. Do not overfill the container, and pour liquids slowly so that they do not splash. 5a. Properly dispose of used materials/PPE in an appropriate container in the designated storage area.
	5b. EXERTION: Muscle strain from lifting/carrying, and moving containers.	5b. Use proper lifting techniques when lifting/carrying or moving container(s) (see 4c.). 5b. Do not overfill container(s).
6. Decontaminate equipment.	**6a. EXPOSURE/CONTACT:** To contamination (e.g., SPH, contaminated groundwater, vapors).	6a. Work on the upwind side, where possible, of the decon area. 6a. Wear chemical-resistant disposable gloves and safety glasses. 6a. Use an absorbent pad to clean spills.
	6b. CAUGHT: Pinch points associated with handling hand tools	6b. See 2b. 6b. Inspect hand tools for sharp edges before decontaminating.

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JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
GENERIC	**Site Recon**	**Mobilization/Demobilization**

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☒ HEARING PROTECTION (as needed) ☒ SAFETY SHOES: Steel Toe or composite toe	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest of high-visibility clothing; long-sleeved shirt; long pants	☒ GLOVES: Cut-resistant Level II, nitrile ☐ OTHER

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Required Equipment: Varies

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing LRAs

EXCLUSION ZONE (EZ): Maintain a Minimum Heavy Equipment Exclusion Zone around equipment and loads while in motion. The HEEZ must be greater than the swing zone of any moving part of the equipment, the tip zone of the equipment, the fall zone of the equipment, and the contents.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Mobilize/demobilize and establish a work area	**1a. FALL:** Slip/trips/falls from obstructions, uneven terrain, weather conditions, heavy loads, and/or poor housekeeping.	1a. Use 3 points-of-contact/ensure secure footing when entering and exiting the vehicle. 1a. Inspect walking path for uneven terrain, steep hills, obstructions, and/or weather-related hazards (i.e., ice, snow, and puddles) prior to mobilizing equipment. Use established pathways. Walk on stable/secure ground. 1a. Do not climb over stored materials/equipment; walk around. Practice good housekeeping; organize and store equipment neatly in one area at its lowest potential energy. 1a. Wear boots with adequate treads. 1a. Delineate unsafe areas with traffic safety cones, caution tape, and/or flagging.
	1b. CONTACT: Personal injury and/or property damage caused by being struck by Site traffic or equipment used in Site activities.	1b. Observe and maintain the posted speed limits. 1b. When first arriving onsite, park vehicles in designated parking spaces and/or out of the way locations. Use parking brake on all vehicles and tire chocks on work trucks and trailers. 1b. Check in with Site Manager/Supervisor to ensure coordination with other Site activities and to discuss any special hazards. Ensure that short-service employees (SSE) are identified. 1b. Identify potential traffic sources. 1b. Wear PPE, including high visibility clothing or reflective vest, when around vehicles or operating equipment 1b. Use a spotter while moving work vehicles; plan to avoid backing whenever possible. 1b. Maintain a minimum exclusion zone when vehicles are in motion (i.e., greater than the swing/tip radius of the equipment). When backing up the truck rig with an attached trailer, use a second spotter if there is tight clearance simultaneously on multiple sides of the equipment or if turning angles limit driver-to-spotter visibility. 1b. Delineate work area with traffic cones, flags, caution tape, and/or other barriers. 1b. Position “Work Area” signs at Site entrances, if possible, or at either side of the work area. 1b. Position the largest vehicle to protect against oncoming traffic. 1b. Face traffic, maintain eye contact with oncoming vehicles, use a spotter, and establish a safe exit route.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
		1b. Observe potential overhead and ground surface features that may interfere with moving equipment. Clear the path of physical hazards prior to initiating mobilization.
	1c. CAUGHT: Personal injury from pinch points and being in the line of fire of the vehicle and/or equipment.	1c. Make sure the driver has engaged the parking brake and placed wheel chocks in a position to prevent movement. Be sure that the vehicle is parked in front/down gradient (positioned to block oncoming traffic) of the work area. 1c. Wear cut-resistant gloves (Kevlar or similar) when handling objects/tools or equipment, 1c. Keep body parts away from line-of-fire of equipment. 1c. Always carry tools by the handles and/or designated carrier. Ensure sharp-edged tools are sheathed/secure. 1c. Remove any loose jewelry. Avoid wearing loose clothing and/or ensure loose clothing is secure. 1c. Secure all items on the equipment, tighten up any items or features that have the potential to shift or break during mobilization.
	1d. OVEREXERTION: Muscle strains while lifting/carrying equipment.	1d. Use body positioning and lifting techniques that avoid muscle strain; keep back straight, lift with legs, turn with whole body, keep load close to body, and never reach with a load. 1d. Ensure that loads are balanced. Use assistance (mechanical or additional person) to carry equipment that is either unwieldy or over 50 lbs.
	1e. EXPOSURE: Personal injury from exposure to biological and environmental hazards.	1e. Inspect the area to avoid contact with biological hazards (i.e., poisonous plants, stinging insects, ticks, etc.). 1e. Wear long-sleeved clothes that can be treated with Permethrin, apply insect repellent (may contain DEET) to exposed skin, and inspect clothes and skin for ticks during and after work. 1e. Apply sunscreen (SPF 15+) if exposure to the sun for 30 minutes or more is expected.
	1f. EXPOSURE: Weather-related injuries.	1f. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, nausea, rapid and shallow breathing). Take breaks in cool places and hydrate as needed. 1f. Watch for cold stress symptoms (severe shivering, slowing body movement, weakness, stumbling or inability to walk, collapse). Take breaks in warm areas as needed. 1f. Wear clothing appropriate for weather and temperature conditions (e.g., rain jackets, snow pants, multiple layers). 1f. If lightning is observed, wait 30 minutes in a sheltered location (car is acceptable) before resuming work.
	1g. EXPOSURE: Personal injury from noise hazards.	1g. Wear hearing protection if sound levels exceed 85 dBA (if you must raise your voice for normal conversation).

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JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
GENERIC	**Site Reconnaissance**	**Site Walk and Inspection**

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☒ HEARING PROTECTION: earplugs/muffs as necessary ☒ SAFETY SHOES: Steel or composite toed	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: High-visibility vest or high-vis outerwear	☒ GLOVES: /cut-resistant (level II)/chemical resistant ☒ OTHER: Tyvek and rubber boots as necessary, dust mask as necessary

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Required Equipment: Site map, emergency contact list, documentation of urgent care/hospital routes, and/or guide familiar with Site, operating cell phone or walkie-talkie if Site allows, and bug spray.

Commitment to Safety – All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing LMRAs

EXCLUSION ZONE (EZ): Maintain a Minimum Heavy Equipment Exclusion Zone around equipment and loads while in motion. The HEEZ must be greater than the swing zone of any moving part of the equipment, the tip zone of the equipment, the fall zone of the equipment, and the contents.

SITE SECURITY: Before site inspection, verify the appropriate method to address Site Security concerns related to potential criminal activity, homeless population, and/or isolation concerns. Work with the Project Principal and/or Project Manager to address appropriately.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Check in with the Site contact.	**1a. CONTACT/EXPOSURE/FALL:** Personal injury caused by a lack of awareness of site-specific hazards.	1a. Inquire about hazards and other activities taking place at the Site. 1a. Inform Site contact of work scope, timeline, and location(s). 1a. Discuss emergency evacuation procedures and muster points with the Site contact.
2. Traversing the Site	**2a. CONTACT:** Property damage and personal injury caused by obstructions/vehicles or unauthorized personnel at remote Sites.	2a. All equipment must be stowed and secured prior to moving. 2a. Maintain speed limit as posted on-site. 2a. When possible, drive on established roadways. 2a. Yield to all pedestrians. 2a. Use pull-through spots or back into parking spots. 2a. Don high-visibility clothing/safety vest. If working at a remote Site, add orange accessories during hunting season.
	2b. FALL: Uneven terrain and weather conditions. Overgrown shrubs and vines. Equipment in the work zone.	2b. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment. 2b. Use established pathways and walk on stable, secure ground when possible. 2b. Communicate traversing hazards with others.
	2c. OVEREXERTION: Muscle strain while carrying equipment.	2c. When carrying equipment to/from the work area, use proper lifting techniques; keep back straight, lift with legs, keep the load close to the body, never reach with a load. Ensure that loads are balanced to reduce the potential for muscle strain. Use the buddy system or mechanical means to maneuver items heavier than 40 lbs. If necessary, make multiple trips to carry equipment.
	2d. EXPOSURE: Biological hazards – ticks, bees/wasps, poison ivy, insects; (Ticks are most active whenever the temperature is above freezing, typically from March to November.)	2d. Inspect the area to avoid contact with biological hazards. 2d. Ticks: • Treat outer clothing, including pants, shirts, socks, boots, and hats, the evening before with Permethrin (allowing at least two hours before use). • Apply DEET or equivalent to exposed skin before travelling to the Site and reapply after two hours. • Wear light colored clothing and visually check for ticks during and after work. 2d. Bees: • Use bee spray as appropriate to deter/eliminate bees. • Protect exposed skin with insect repellent. 2d. Poison Ivy: • Identify areas of poison ivy and spray with weed killer. Don

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
		• Identify areas of poison ivy and spray with weed killer. Don Tyvek and rubber boots while traversing poison ivy areas. • If skin comes into contact with poison ivy, wash the skin thoroughly with soap and water.
	2e. EXPOSURE: Heat Stress & Cold Stress. Personal injury from working in inclement weather conditions.	2e. Wear sunscreen with SPF 15 or greater on exposed skin whenever 30 minutes or more of sun exposure is expected. 2e. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, rapid and shallow breathing). Take breaks as needed. 2e. Watch for cold stress symptoms (severe shivering, slowing body movement, weakness, stumbling or inability to walk, collapse). Take breaks as needed. 2e. Wear appropriate rain gear as needed. 2e. Take frequent breaks if tired, wet, or cold/hot. Drink water. 2e. If lightning is observed, wait 30 minutes after the last thunder boom/lightning bolt in a sheltered location (car acceptable) before starting work again.
3. Walking near heavy equipment and machinery.	**3a. CONTACT:** Personal injury from Site and roadway traffic. Personal injury from flying debris	3a. See 2a. 3a. Maintain an exclusion zone of at least 10 feet from all engaged equipment. Increase distance to include swing tip radius. 3a. Keep body parts out of the line-of-fire of pinch points. 3a. Wear appropriate PPE always.
	3b. OVEREXERTION: Personal injury from lifting/moving/rotating equipment.	3b. See 2c.
	3c. EXPOSURE: Hearing damage from noise-generating equipment/processes. Inhalation/exposure to hazardous vapors and or dust.	3c. Wear hearing protection if >85 dBA. (i.e., noise levels which require you to raise your voice to communicate) 3c. Always wear cut-resistant gloves when handling any tools or equipment. 3c. Always wear appropriate PPE based on the chemicals present.
	3d. EXPOSURE: Working in a remote area.	3d. Use the "buddy system" whenever possible. If working alone, contact PM upon arrival/departure and during work activities prior to commencing work if applicable. 3d. Always carry a communication device (i.e., cell phone, walkie-talkie) or directional (i.e., map, compass, etc.) when traversing remote areas. 3d. If available, follow Lone Worker Protocol/Procedure.
4. Working in adverse weather conditions.	**4a. EXPOSURE:** Heat Stress & Cold Stress. Personal injury from working in inclement weather conditions.	4a. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, rapid and shallow breathing). Take breaks as needed. 4a. Watch for cold stress symptoms (severe shivering, slowing body movement, weakness, stumbling or inability to walk, collapse). Take breaks as needed. 4a. Wear appropriate rain gear as needed. 4a. Take frequent breaks if tired, wet, or cold/hot. Drink water. 4a. If lightning is observed, wait 30 minutes after the last thunder boom/lightning bolt in a sheltered location (car acceptable) before starting work again.
5. Departing Site.	**5a. EXPOSURE:** Exposure to unnecessary hazards should prompt personnel to believe Roux is on-site during an emergency and conduct a search.	5a. Sign out or notify the Site contact and Roux Project Manager of your departure.

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JSA TYPE CATEGORY:	WORK TYPE:	WORK ACTIVITY (Description):
GENERIC	**Gauging & Sampling**	**Soil Sampling**

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES ☒ FLAME RESISTANT CLOTHING (as needed)	☐ GOGGLES ☐ FACE SHIELD: ☒ HEARING PROTECTION: (as needed) ☒ SAFETY SHOES: Composite-toe or steel-toe boots	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	☒ GLOVES: , Nitrile and cut resistant level II ☒ OTHER: Insect repellent, sunscreen (as needed)

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Recommended Equipment: traffic safety cones, caution tape, trowel

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing LMRAs.

EXCLUSION ZONE (EZ): Maintain a Minimum Heavy Equipment Exclusion Zone around equipment and loads while it is in motion. The HEEZ must be greater than the swing zone of any moving part of the equipment, the tip zone of the equipment, the fall zone of the equipment, and the contents.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Secure location	**1a. CONTACT:** Personnel and vehicular traffic may enter the work area.	1a. If in an area with foot or vehicle traffic, delineate the work area with traffic cones and/or caution tape to prevent exposure to traffic and inform others of work activity. 1a. Wear a reflective vest and/or high visibility clothing. 1a. Face the direction of any vehicular traffic. Position the vehicle to protect the worker from traffic. 1a. Communicate work activity with adjacent work areas.
	1b. FALL: Tripping/falling due to uneven terrain or entry/exit from excavations.	1b. Inspect pathways and work area for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions. 1b. Use established pathways and walk on stable, secure ground. 1b. Stage equipment and tools in a convenient, stable, and orderly manner. Store equipment at the lowest potential energy. 1b. Roux employees should stay 6 feet from in-progress excavations and trenches. Should entry to an excavation be required (when stabilization is complete), ladders must be employed for steep embankments, excavations, pits, and trenches.
	1c. EXPOSURE: Exposure to sun and excessive heat, possibly causing sunburn, heat exhaustion, or heat stroke. Exposure to cold temperatures may cause cold stress. Skin burn as a result of fire, if applicable. Exposure to explosive vapors due to tank farm operations. Exposure to airborne dust due to high wind speeds. Biological hazards - ticks, bees/wasps, poison ivy, thorns, insects, etc.	1c. Wear sunscreen with an SPF 15 or greater whenever 30 minutes or more of exposure is expected. 1c. Use a tent to shade the work area from direct sunlight, particularly when warm temperatures are expected. 1c. Be aware of the location of all Site personnel. 1c. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, rapid and shallow breathing). 1c. Watch for cold stress symptoms (severe shivering, slowing of body movement, weakness, stumbling or inability to walk, collapse). 1c. Take breaks for rest and water as necessary. Move to an area that is well shaded or a climate-controlled area (i.e., car, site trailer, etc.). 1c. No open flames/heat sources. 1c. Conduct air monitoring and ensure that harmful vapor concentrations are within the levels detailed in the Site Specific HASP. Follow the procedures detailed in HASP for exceedances. 1c. Flame retardant clothing must be worn when specified by Site policy. 1c. Cell phones should be disabled when specified by Site policy. 1c. Pre-treat field clothing with Permethrin prior to site visit to kill ticks and insects. 1c. Wear long-sleeved shirts and tuck in (or tape) pant legs into socks or boots to prevent ticks from reaching skin. 1c. Spray insect repellent containing DEET or equivalent on exposed skin when working in overgrown areas of the Site. 1c. Inspect the area to avoid contact with biological hazards. 1c. Wear cut-resistant gloves when handling material, equipment, or branches, shrubs, etc. that may lie within the walking path. 1c. Wear spoggles if the average wind speeds are above 15 mph. 1c. Personnel shall examine themselves and their co-workers' outer clothing for ticks periodically when on-site. 1c. If skin comes in contact with poison ivy, wash skin thoroughly with soap and water. If rash persists after washing, immediately notify your supervisor, the OM, and OHSM for possible consultation with a physician at an approved Occupational Health Clinic.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
2. Collect Soil Sample	**2a. CONTACT:** Personal injury from pinch points, cuts, and abrasions from sampling equipment, tools, and material within the soil sample. Personal injury from contact with moving equipment while sampling. Personal injury from contact with glass sample jars.	2a. Wear cut-resistant (i.e., Kevlar) gloves under chemical-resistant (nitrile) disposable gloves when handling soil samples and sampling jars. 2a. Where possible, use a trowel or equivalent tool to avoid contact with soil. 2a. If sampling from a bucket of heavy equipment, ensure all equipment is off and the operator utilizes the "show me your hands" policy. 2a. See 1a.
	2b. EXPOSURE: Exposure to contamination (impacted soil) and/or lab preservatives.	2b. Wear chemical-resistant (nitrile) disposable gloves over cut-resistant gloves to protect hands when handling samples; use containment material or plastic sheeting to protect surrounding areas. 2b. Wear safety glasses to protect eyes from dust or air-borne contaminants that may result from disturbing the soil. 2b. Where possible, remain upgradient from the sample location if collecting soil samples from stockpile, drill rig, etc., to avoid breathing contaminant vapors, if they are present. 2b. When collecting a soil sample from a hand auger, put a large zip lock bag over the entire auger to prevent soil from spilling onto the ground. 2b. Open sample jars slowly and fill carefully to avoid contact with preservatives.
	2c. EXERTION: Exertion due to repetitive motion and ergonomics.	2c. Utilize a table or raised surface for soil sampling if multiple soil samples are going to be taken to minimize repetitive bending motion.
3. Decontaminate equipment	**3a. EXPOSURE/CONTACT:** Contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated vapors, and/or soil). **3b. EXPOSURE:** Chemicals in the cleaning solution include ammonia.	3a. Wear chemical-resistant (nitrile) disposable gloves and safety glasses. 3a. Use an absorbent pad to clean spills. 3a. Properly dispose of used materials/PPE in the provided drums in the designated drum storage area. 3a. Remain upwind of the sample and avoid breathing contaminant vapors, if they are present. 3b. Wear chemical-resistant (nitrile) disposable gloves and safety glasses. 3b. Work on the upwind side of the decontamination area. 3b. Use an absorbent pad to clean spills. 3b. Properly dispose of used materials/PPE in the provided drums in the designated drum storage area. Ensure that all drums are properly labeled and secured.

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JSA TYPE CATEGORY:	WORK TYPE	WORK ACTIVITY (Description)
GENERIC	**Gauging and Sampling**	**Soil Vapor Sampling (Permanent Monitoring Points)**

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☒ GLOVES: Cut-resistant level ii & Nitriles
☒ HARD HAT	☐ FACE SHIELD	☐ SUPPLIED RESPIRATOR	
☐ LIFELINE / BODY HARNESS	☐ HEARING PROTECTION	☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	☒ OTHER: Bug Spray, Sun Screen, Knee Pads, or kneeling pad
☒ SAFETY GLASSES	☒ SAFETY SHOES: Steel-toe composite safety boots		

REQUIRED AND / OR RECOMMENDED EQUIPMENT

9/16" Socket and Wrench, Non-Toxic Clay, Teflon-Lined Tubing, Masterflex Tubing, Air Pump with Low Flow, Dry Cal, Enclosure (Bucket with 2 holes), Helium Gas Canister, Summa Canisters and Flow Controllers, MultiRAE Photo Ionization Detector (PID), Helium Detector, Tubing Cutter, Traffic/Safety Cones, Caution Tape or Retractable Cone Bars

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing LMRAs.

Work Zone (WZ): A 5-foot exclusion zone will be maintained for non-essential personnel.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Define and secure a work area.	**1a. FALL:** Potential tripping hazards.	1a. Ensure work area is secure and inform others (third party) of work activity. 1a. Remove tripping hazards and inspect the walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment.
	1b. CONTACT: Potential contact with moving vehicles or pedestrians.	1b. If working alongside roads, look both ways before entering roadways, face traffic, and utilize the work vehicle to protect employees. 1b. Delineate work area (including vehicles) with traffic safety cones and caution tape or retractable cone bars. 1b. Maintain a 5-foot exclusion zone. 1b. Wear high visibility clothing or a reflective safety vest.
	1c. EXERTION: Muscle strain while lifting and carrying equipment.	1c. When carrying equipment to/from the work area, keep back straight, lift with legs, keep the load close to the body, never reach with a load. Ensure that loads are balanced. Use the buddy system or mechanical means to maneuver loads heavier than 40 lbs. If necessary, make multiple trips to carry equipment.
2. Remove well cover / close well cover.	**2a. CONTACT/CAUGHT:** Pinch points and scrapes associated with hand tools and well covers.	2a. Keep hands away from pinch points. 2a. Use hand tools with extensions or a magnet to remove and replace well covers. 2a. Wear cut-resistant gloves. 2a. Use knee pads or a kneeling pad when repetitive kneeling on rough ground is anticipated.
	2b. FALL: Potential tripping hazards associated with installing bolts.	2b. Place security bolts in a secure location so as not to create tripping hazards. Replace security bolts so that they fit flush with monitoring well covers.
	2c. EXERTION: Physical exertion is required to remove bolts that were over-torqued or stripped.	2c. Replace any security bolts that show signs of stripping. Do not over-tighten. 2c. Use body positioning and bending techniques that minimize muscle strain; keep back straight, bend at the knees. 2c. See 2a.

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.
[2] A hazard is a potential danger. Break hazards into six types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – Electricity, pressure, tension/compression, torque.
[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Screen vapor point with PID.	**3a. FALL:** Potential tripping hazards associated with equipment.	3a. Place the equipment in one area close to the sampling location. 3a. Identify an area where the equipment is to be stored within the work area (away from the main walking path). 3a. Do not leave equipment on the ground. Return equipment to the storage area between uses.
	3b. EXPOSURE: Inhalation of soil vapor	3b. Replace brass caps immediately upon completion to avoid soil vapors migrating to the surface through sample tubing. 3b. Stand upwind of the sample point during screening activities.
4. Remove/replace brass caps at the end of the sample tubing.	**4a. CONTACT:** Pinch points are associated with hand tools and brass caps.	4a. Use a wrench to remove and replace brass caps. 4a. Wear cut-resistant gloves to protect against pinch points and scrapes.
	4b. EXPOSURE: Potential pathway for vapors to migrate to the land surface.	4b. See 3b. 4b. Stand upwind of the sample point location.
5. Set up soil vapor sampling equipment and calibration of meters.	**5a. FALL:** Potential tripping hazards associated with equipment and tubing.	5a. See 3a. 5a. Keep tubing slack to a minimum and locate the summa canister as close to the sampling location as possible. 5a. Avoid stepping over equipment and tubing.
	5b. CONTACT: Pinch points associated with handling equipment.	5b. Do not place fingers/hands under sampling equipment. 5b. Make multiple trips when unloading equipment in the work area. 5b. Wear cut-resistant gloves to protect against pinch points while handling sampling equipment.
	5c. EXPOSURE: Inhalation of calibration gas and helium.	5c. Review the SDS for each type of calibration gas used before calibrating. 5c. Calibrate meters in a well-ventilated area and keep the air flow regulator away from your face. 5c. Close valve on canisters after use to avoid inhalation of excess helium or calibration gas. 5c. Stand upwind of the bucket during the helium tracer gas test.
6. Cleaning Work Area.	**6a. FALL:** Potential tripping hazards are associated with equipment and tubing.	6a. See 3a. 6a. See 3b.
	6b. CONTACT: Storing and transport of equipment in car.	6b. Ensure that the equipment is placed securely in the vehicle. Do not stack equipment on top of each other. Secure the equipment so that it will not slide while being transported. 6b. Wear cut-resistant gloves while handling/loading equipment.

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.
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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

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JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
Generic	**General**	**Trucking**

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☒ GLOVES: Cut resistant level II
☒ HARD HAT	☐ FACE SHIELD	☐ SUPPLIED RESPIRATOR	☐ OTHER
☐ LIFELINE / BODY HARNESS	☐ HEARING PROTECTION	☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	
☒ SAFETY GLASSES	☒ SAFETY SHOES: Steel/composite-toe boots		

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Heavy equipment to load/unload and transportation(i.e., trucks)

COMMITMENT TO SAFETY- All personnel onsite will actively participate in Hazard recognition and mitigation throughout the day by verbalizing LMRAs.

EXCLUSION ZONE (EZ): Maintain a Minimum Heavy Equipment Exclusion Zone around equipment and loads while it is in motion. The HEEZ must be greater than the swing zone of any moving part of the equipment, tip zone of the equipment, fall zone of the equipment and contents, distance that debris may travel during demolition activities, and/or footprint of a structure to be demolished.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Set up the work zone.	**1a. CONTACT:** Personal injury/property damage caused by obstruction/vehicle.	1a. Establish a work zone for manifesting/paperwork by communicating with workers before the task begins. Maintain a minimum **Exclusion Zone (EZ)** around all heavy equipment.
2. Loading of the truck.	**2a. CONTACT:** A rolling Vehicle could cause bodily harm.	2a. All commercial vehicles without an operator must have their engines off and wheels chocked. The truck and loading area should be on level and stable ground.
	2b. CONTACT: A machine or load may crush personnel, property, or machinery.	2b. All machines (Excavator, Lull, Backhoe) must have a spotter. Spotter must communicate contact hazards such as other personnel in the work area, objects in the machine's blind spot, and overhead lines to the operator. Spotter and operator should have verbal / 2-way radios or established hand signals to communicate when needed. 2b. Loads must not be swung over other vehicles or personnel. 2b. Maintain **EZ** around all equipment.
	2c. CONTACT: Load shifting during travel.	2c. Secure all loads prior to moving the truck with chains, straps, or cribbing. 2c. Any loose soil or debris should be cleaned off the truck sides prior to truck mobilization. 2c. All truck beds must be secured prior to traveling.
3. Dumping loads.	**3a. CONTACT:** A truck may flip sideways or backwards.	3a. All workers must stay behind and away from the side of trucks that are dumping to avoid contact with flying debris and the truck potentially tipping sideways or backwards. **EZ** must be maintained equal to the height of the bed while lifted.
4. Exchanging paperwork with the truck driver.	**4a. CONTACT/CAUGHT:** Broken bones from contact with a vehicle.	4a. The truck driver should exit the truck with proper PPE, using the three points of contact, and enter the established work zone to complete paperwork. If Site-specific safety prohibits drivers from exiting the truck, wait until the truck is finished loading, with the engine turned off, before approaching the truck. 4a. Always establish eye contact with the driver prior to approaching the truck. 4a. Confirm sides of truck have been cleaned/brushed off prior to approaching the truck.
	4b. FALL: Slip, Trip or Fall may cause muscle strains or tears, abrasions or lacerations, or broken bones.	4b. Survey walking route to identify slip/trip/fall hazards. Avoid icy/wet surfaces. Remove slip/trip/fall hazards if present. 4b. Communicate with driver and spotter prior to approaching truck. Maintain **EZ** around all heavy equipment.

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.
[2] A hazard is a potential danger. Break hazards into six types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards, energy source; Energy Source – electricity, pressure, compression/tension.
[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

APPENDIX B

Safety Data Sheets (SDSs) for Chemicals Used

Safety Data Sheet (SDS)

OSHA HazCom Standard 29 CFR 1910.1200(g) revised in 2012 and GHS Rev 03.

Issue date 03/28/2021 Reviewed on 03/28/2021

1 Identification

· **Product Identifier**

· **Trade Name: Precision Calibration Gas Mixture**
· **Product Number:** G-1315
· **Relevant identified uses of the substance or mixture and uses advised against:**
Used for calibration of gas measuring devices. Not suitable for human consumption.
· **Product Description:**
Calibration gas mixture consisting of Carbon Monoxide, Hydrogen Sulfide, Methane, Oxygen and Nitrogen.
· **Application of the substance / the mixture:** Pressurized gas, requires appropriate regulator to dispense.

· **Details of the Supplier of the Safety Data Sheet:**
· **Manufacturer/Supplier:**
Gasco Affiliates, LLC
320 Scarlett Blvd.
Oldsmar, Fl 34677

TELEPHONE NUMBER: (800) 910-0051
FAX NUMBER: (866) 755-8920
E-MAIL: info@gascogas.com
· **Emergency telephone number:**
Inside the US: 1-833-723-3267 (CHEMTREC, 24 hours)
Outside the US: 1-703-527-3887 (CHEMTREC, 24 hours)

2 Hazard(s) Identification

· **Classification of the substance or mixture:**


Gas cylinder

Press. Gas H280 Contains gas under pressure; may explode if heated.



Acute Tox. 4 H332 Harmful if inhaled.

Simple Asphyxiant May displace oxygen and cause rapid suffocation.

· **Label elements:**
· **Hazard pictograms:**



· **Signal word:** Warning

· **Hazard-determining components of labeling:**
Carbon Monoxide
· **Hazard statements:**
H280 Contains gas under pressure; may explode if heated.
H332 Harmful if inhaled.
May displace oxygen and cause rapid suffocation.
· **Precautionary statements:**
P261 Avoid breathing dust/fume/gas/mist/vapors/spray.
P271 Use only outdoors or in a well-ventilated area.

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Trade Name: Precision Calibration Gas Mixture

P304+P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P312 Call a poison center/doctor if you feel unwell.
P410+P403 Protect from sunlight. Store in a well-ventilated place.

· ***Unknown acute toxicity:***
99.5 % of the mixture consists of component(s) of unknown toxicity.
· ***Classification system:***
· ***NFPA ratings (scale 0 - 4)***



Health = 0
Fire = 1
Reactivity = 0

· ***HMIS-ratings (scale 0 - 4)***



Health = 0
Fire = 1
Physical Hazard = 0

· ***Hazard(s) not otherwise classified (HNOC):*** None known

3 Composition/Information on Ingredients

· ***Chemical characterization: Substance***
· ***Description:*** Mixture of substances listed below with non-hazardous additions.

· ***Dangerous Components:***		
CAS: 7727-37-9 RTECS: QW 9700000	Nitrogen Press. Gas, H280; Simple Asphyxiant	75.3901 - 91.799%
CAS: 7782-44-7	Oxygen Oxid. Gas 1, H270; Press. Gas, H280	8 - 21%
CAS: 74-82-8 RTECS: PA 1490000	Methane Flam. Gas 1, H220; Press. Gas, H280; Simple Asphyxiant	0.1 - 3.0%
CAS: 630-08-0 RTECS: FG 3500000	Carbon Monoxide Flam. Gas 1, H220; Press. Gas, H280; Acute Tox. 3, H331; Repr. 1A, H360; STOT RE 1, H372	0.0005-0.15%
CAS: 7783-06-4	Hydrogen Sulfide Flam. Gas 1, H220; Press. Gas, H280; Acute Tox. 2, H330; Aquatic Acute 1, H400	0.0005 - 0.01%

*

4 First-Aid Measures

· ***Description of first aid measures***
· ***After inhalation:***
Supply fresh air. If required, provide artificial respiration. Consult doctor if symptoms persist.
In case of unconsciousness place patient stably in the side position for transportation.
· ***After skin contact:*** Generally, the product does not irritate the skin.
· ***After eye contact:*** Not anticipated under normal use.
· ***After swallowing:*** Not a normal route of entry.
· ***Information for doctor***
· ***Most important symptoms and effects, both acute and delayed:*** No further relevant information available.
· ***Indication of any immediate medical attention and special treatment needed:***
No further relevant information available.

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5 Fire-Fighting Measures

· ***Extinguishing media***
· ***Suitable extinguishing agents:*** Use fire fighting measures that suit the environment.
· ***For safety reasons unsuitable extinguishing agents:*** No further relevant information.
· ***Special hazards arising from the substance or mixture:***
If incinerated, product will release the following toxic fumes: Oxides of Carbon, Nitrogen (NOx) and Sulfur.
· ***Advice for firefighters***
This gas mixture is not flammable; however, containers, when involved in fire, may rupture or burst in the heat of the fire. Firefighters should be aware of the presence of Hydrogen Sulfide in this gas mixture, which can cause significant health effects.
· ***Special protective equipment for firefighters:***
As in any fire, wear self-contained breathing apparatus pressure-demand (NIOSH approved or equivalent) and full protective gear to prevent contact with skin and eyes.

6 Accidental Release Measures

· ***Personal precautions, protective equipment and emergency procedures:***
Ensure adequate ventilation.
Keep people at a distance and stay upwind.
· ***Environmental precautions:*** Inform authorities in case of gas release.
· ***Methods and material for containment and cleaning up:***
Dispose of contaminated material as waste according to section 13.
Ensure adequate ventilation.
Dispose of the collected material according to regulations.
· ***Reference to other sections:***
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

* 7 Handling and Storage

· ***Handling***
· ***Precautions for safe handling:***
Ensure good ventilation/exhaustion at the workplace.
Open and handle receptacle with care.
Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of this gas mixture could occur without any significant warning symptoms due to the potential for oxygen deficiency (simple asphyxiation). Do not attempt to adjust, repain or in any other way modify the cylinders containing this gas mixture. If there is a malfunction or another type of operational problem, contact nearest distributor immediately.
· ***Information about protection against explosions and fires:***
Pressurized container: protect from sunlight and do not expose to temperatures exceeding 50°C, i.e. electric lights. Do not pierce or burn, even after use.
Keep protective respiratory device available.
Do not spray on a naked flame or any incandescent material.

· ***Conditions for safe storage, including any incompatibilities***
Store away from strong oxidizing agents, strong bases, phosphorous, organic materials and powdered metals.
· ***Storage***
· ***Requirements to be met by storerooms and receptacles:***
Store in a cool location.
CylinDers should be firmly secured to prevent falling or being knocked over. Cylinders must be protected from the environment, and preferably kept at room temperature. Cylinders should be stored in dry, well-ventilated areas, away from sources of heat, ignition, and direct sunlight. Protect cylinders against physical damage. Full and empty cylinders should be segregated. Use a "first-in, first-out" inventory system to prevent full containers

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Trade Name: Precision Calibration Gas Mixture

freom being stored for long periods of time.
· ***Information about storage in one common storage facility:*** Not required.
· ***Further information about storage conditions:*** Store in cool, dry conditions in well sealed receptacles.
· ***Specific end use(s):*** No further relevant information available.

*
8 Exposure Controls/Personal Protection

· ***Additional information about design of technical systems:*** No further data; see section 7.

· ***Control parameters:***
All ventilation should be designed in accordance with OSHA standard (29 CFR 1910.94). Use local exhaust at filling zones and where leakage and dust formation is probable. Use mechanical (general) ventilation for storage areas. Use appropriate ventilation as required to keep Exposure Limits in Air below TLV & PEL limits.
· ***Components with occupational exposure limits:***
The following constituents are the only constituents of the product which have a PEL, TLV or other recommended exposure limit.
At this time, the remaining constituents have no known exposure limits.

7727-37-9 Nitrogen	
TLV	withdrawn TLV, see App. F; simple asphyxiant
74-82-8 Methane	
TLV	refer to Appendix F, 1000ppm
630-08-0 Carbon Monoxide	
PEL	Long-term value: 55 mg/m³, 50 ppm
REL	Long-term value: 40 mg/m³, 35 ppm Ceiling limit value: 229 mg/m³, 200 ppm
TLV	Long-term value: 29 mg/m³, 25 ppm BEI
7783-06-4 Hydrogen Sulfide	
PEL	Ceiling limit value: 20; 50* ppm *10-min peak; once per 8-hr shift
REL	Ceiling limit value: 15* mg/m³, 10* ppm *10-min
TLV	Short-term value: 7 mg/m³, 5 ppm Long-term value: 1.4 mg/m³, 1 ppm

· ***Ingredients with biological limit values:***	
630-08-0 Carbon Monoxide	
BEI	3.5 % of hemoglobin blood end of shift Carboxyhemoglobin (background, nonspecific) 20 ppm end-exhaled air end of shift Carbon monoxide (background, nonspecific)

· ***Additional information:*** The lists that were valid during the creation of this SDS were used as basis.

· ***Exposure controls:***
· ***Personal protective equipment***
· ***General protective and hygienic measures:***
Keep away from foodstuffs, beverages and feed.

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Trade Name: Precision Calibration Gas Mixture

Immediately remove all soiled and contaminated clothing and wash before reuse.
Wash hands before breaks and at the end of work.
Store protective clothing separately.

· **Breathing equipment:**



Suitable respiratory protective device recommended.

· **Protection of hands:** Not required.
· **Material of gloves:** Not applicable.
· **Penetration time of glove material:** Not applicable.

*

9 Physical and Chemical Properties

· **Information on basic physical and chemical properties**
· **General Information**
· **Appearance:**

Form:	Gaseous
Color:	Clear, colorless
· **Odor:**	Rotten
· **Odor threshold:**	Not determined.
· **pH-value:**	Not available
· **Change in condition**	
Melting point/Melting range:	Not determined.
· **Flash point:**	None
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Auto igniting:**	Product is not self-igniting.
· **Danger of explosion:**	Not determined.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not determined.
· **Density:**	
Relative density:	Not determined.
Vapor density:	Not determined.
Evaporation rate:	Not applicable.
· **Solubility in / Miscibility with:**	
Water:	Not miscible or difficult to mix.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not determined.
Kinematic:	Not determined.
· **Solvent content:**	
Organic solvents:	0.0 %

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Trade Name: Precision Calibration Gas Mixture

· **Other information:** No further relevant information available.

10 Stability and Reactivity

· **Reactivity:** No further relevant information available.
· **Chemical stability:** Stable under normal conditions.
· **Thermal decomposition / conditions to be avoided:** No decomposition if used according to specifications.
· **Possibility of hazardous reactions:** No dangerous reactions known.
· **Conditions to avoid:** No further relevant information available.
· **Incompatible materials:**
Strong oxidizing agents, strong bases, phosphorous, organic materials and powdered metals.
· **Hazardous decomposition products:** Oxides of Carbon, Nitrogen (NOx) and Sulfur.

11 Toxicological Information

· **Information on toxicological effects:**
· **Acute toxicity:**

· **LD/LC50 values that are relevant for classification:**		
630-08-0 Carbon Monoxide		
Inhalative	LC50/4 h	7520 mg/l (Rat)
7783-06-4 Hydrogen Sulfide		
Inhalative	LC50/4 h	634 mg/l (Mouse)
		444 mg/l (Rat)
	LC50/96 hours	0.016 mg/l (Pimephales)
74-82-8 Methane		
Inhalative	LC50/4 h	217 mg/l (Mouse)

· **Primary irritant effect:**
· **On the skin:** No irritating effect.
· **On the eye:** No irritating effect.
· **Additional toxicological information:**
The product shows the following dangers according to internally approved calculation methods for preparations:

· **Carcinogenic categories:**
· **IARC (International Agency for Research on Cancer):**
Group 1 - Carcinogenic to humans
Group 2A - Probably carcinogenic to humans
Group 2B - Possibly carcinogenic to humans
Group 3 - Not classifiable as to its carcinogenicity to humans
Group 4 - Probably not carcinogenic to humans

None of the ingredients are listed.

· **NTP (National Toxicology Program):**
None of the ingredients are listed.

· **OSHA-Ca (Occupational Safety & Health Administration):**
None of the ingredients are listed.

12 Ecological Information

· **Toxicity:**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability:** No further relevant information available.

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Trade Name: Precision Calibration Gas Mixture

· ***Behavior in environmental systems:***
· ***Bioaccumulative potential:*** No further relevant information available.
· ***Mobility in soil:*** No further relevant information available.
· ***Additional ecological information:***
· ***General notes:*** Generally not hazardous for water.
· ***Results of PBT and vPvB assessment:***
· ***PBT:*** Not applicable.
· ***vPvB:*** Not applicable.
· ***Other adverse effects:*** No further relevant information available.

13 Disposal Considerations

· ***Waste treatment methods***
· ***Recommendation:***
Release all residual gas pressure in a well ventilated area. Verify the cylinder is completely empty (0 PSIG). Remove or cover any hazard labels. Return empty supplier for recycling.
NOTE: Check with the local waste authority before placing any gas cylinder into a waste container for pickup. GASCO encourages the consumer to return all cylinders.
· ***Waste disposal key:*** The U.S. EPA has not published waste numbers for this product's components.

· ***Uncleaned packaging***
· ***Recommendation:*** Return cylinder and unused product to supplier.

* 14 Transport Information

· ***UN-Number:***
· ***DOT, ADR/ADN, IMDG, IATA*** UN1956
· ***UN proper shipping name:***
· ***DOT*** Compressed gas, n.o.s.
· ***ADR/ADN*** UN1956 Compressed gas, n.o.s.
· ***IMDG, IATA*** UN1956 COMPRESSED GAS, N.O.S.
· ***Transport hazard class(es):***

· ***DOT***



· ***Class:*** 2.2
· ***Label:*** 2.2

· ***ADR/ADN***



· ***Class:*** 2.2 1A
· ***Label:*** 2.2

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Trade Name: Precision Calibration Gas Mixture

· **IMDG, IATA**



· **Class:**	2.2
· **Label:**	2.2
· **Packing group:**	-
· **Environmental hazards:**	Not applicable.
· **Special precautions for user:**	Not applicable.
· **Hazard identification number (Kemler code):**	20
· **EMS Number:**	F-C,S-V
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code:**	Not applicable.

· **Transport/Additional information:**

· **DOT**

· **Quantity limitations:**	On passenger aircraft/rail: 75 kg On cargo aircraft only: 150 kg

· **ADR/ADN**

· **Excepted quantities (EQ):**	Code: E1 Maximum net quantity per inner packaging: 30 ml Maximum net quantity per outer packaging: 1000 ml
· **UN "Model Regulation":**	UN1956, Compressed gas, n.o.s., 2.2

15 Regulatory Information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture:**
No further relevant information available.

· **SARA (Superfund Amendments and Reauthorization):**

· **Section 355 (extremely hazardous substances):**

7783-06-4	Hydrogen Sulfide

· **Section 313 (Specific toxic chemical listings):**

7783-06-4	Hydrogen Sulfide

· **TSCA (Toxic Substances Control Act):**

7727-37-9	Nitrogen
7782-44-7	Oxygen
74-82-8	Methane
630-08-0	Carbon Monoxide
7783-06-4	Hydrogen Sulfide

· **California Proposition 65:**

· **Chemicals known to cause cancer:**
None of the ingredients are listed.

· **Chemicals known to cause reproductive toxicity for females:**
None of the ingredients are listed.

· **Chemicals known to cause reproductive toxicity for males:**
None of the ingredients are listed.

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Trade Name: Precision Calibration Gas Mixture

· **Chemicals known to cause developmental toxicity:**

630-08-0	Carbon Monoxide

· **New Jersey Right-to-Know List:**

All ingredients are listed.

· **New Jersey Special Hazardous Substance List:**

74-82-8	Methane	F4
630-08-0	Carbon Monoxide	TE, F4
7783-06-4	Hydrogen Sulfide	F4

· **Pennsylvania Right-to-Know List:**

All ingredients are listed.

· **Pennsylvania Special Hazardous Substance List:**

630-08-0	Carbon Monoxide	E
7783-06-4	Hydrogen Sulfide	E

· **Carcinogenic categories:**

· **EPA (Environmental Protection Agency):**

7783-06-4	Hydrogen Sulfide	I

· **TLV (Threshold Limit Value established by ACGIH):**

None of the ingredients are listed.

· **NIOSH-Ca (National Institute for Occupational Safety and Health):**

None of the ingredients are listed.

· **GHS label elements**

The product is classified and labeled according to the Globally Harmonized System (GHS).

· **Hazard pictograms:**



· **Signal word:** Warning

· **Hazard-determining components of labeling:**

Carbon Monoxide

· **Hazard statements:**

H280 Contains gas under pressure; may explode if heated.
H332 Harmful if inhaled.
May displace oxygen and cause rapid suffocation.

· **Precautionary statements:**

P261 Avoid breathing dust/fume/gas/mist/vapors/spray.
P271 Use only outdoors or in a well-ventilated area.
P304+P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P312 Call a poison center/doctor if you feel unwell.
P410+P403 Protect from sunlight. Store in a well-ventilated place.

· **National regulations:**

None of the ingredients are listed.

· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

(Contd. on page 10)

Safety Data Sheet (SDS)

OSHA HazCom Standard 29 CFR 1910.1200(g) revised in 2012 and GHS Rev 03.

Issue date 03/28/2021 *Reviewed on 03/28/2021*

Trade Name: Precision Calibration Gas Mixture

16 Other Information

· ***Relevant phrases:***
Gasco Affiliates, LLC, makes no express or implied warranties, guarantees or representations regarding the product or the information herein, including but not limited to any implied warranty or merchantability or fitness for use. Gasco Affiliates, LLC shall not be liable for any personal injury, property or other damages of any nature, whether compensatory, consequential, exemplary, or otherwise, resulting from any publication, use or reliance upon the information herein.
· ***Contact:***
· ***Date of last revision/ revision number:*** 03/28/2021 / -
· ***Abbreviations and acronyms:***
ADR: The European Agreement concerning the International Carriage of Dangerous Goods by Road
ADN: The European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
ELINCS: European List of Notified Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety and Health
OSHA: Occupational Safety & Health Administration
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
BEI: Biological Exposure Limit
Flam. Gas 1: Flammable gases – Category 1
Oxid. Gas 1: Oxidizing gases – Category 1
Press. Gas: Gases under pressure – Compressed gas
Press. Gas: Gases under pressure – Dissolved gas
Acute Tox. 2: Acute toxicity – Category 2
Acute Tox. 3: Acute toxicity – Category 3
Acute Tox. 4: Acute toxicity – Category 4
Repr. 1A: Reproductive toxicity – Category 1A
STOT RE 1: Specific target organ toxicity (repeated exposure) – Category 1
Aquatic Acute 1: Hazardous to the aquatic environment - acute aquatic hazard – Category 1
· **** Data compared to the previous version altered.***
SDS created by MSDS Authoring Services www.msdsauthoring.com +1-877-204-9106

Safety Data Sheet

Effective date: 11 May 2023 **Revision**: 11 May 2023

Trade Name: Alconox® Powdered Precision Cleaner

1 Identification of the substance/mixture and of the supplier

1.1 GHS Product identifier

Trade Name: Alconox® Powdered Precision Cleaner

Product number: 1101, 1103, 1104, 1104-1, 1112, 1112-1, 1125, 1150

1.2 Application of the substance / the mixture: Cleaning material/Detergent

1.2.1 Recommended dilution ratio: 1 – 2% in water

1.3 Details of the supplier of the Safety Data Sheet

Manufacturer:
Alconox Inc.
30 Glenn St
White Plains, NY 10603
(914) 948-4040

Supplier:
Not Applicable

Emergency telephone number:
ChemTel Inc
North America: 1-888-255-3924
International: +1 813-248-0573

2 Hazards identification

2.1 Classification of the substance or mixture:

In compliance with EC regulation No. 1272, 29CFR1910/1200 and GHS requirements.

Hazard-determining components of labeling:
Tetrasodium Pyrophosphate
Sodium tripolyphosphate
Sodium Alkylbenzene Sulfonate

2.2 Label elements:

Eye damage, category 1.

Skin irritation, category 2.

Product at recommended dilution:

Eye irritation, category 2B

Hazard pictograms:



Signal word: Danger

Hazard statements:
H315 Causes skin irritation.
H318 Causes serious eye damage.

Precautionary statements:
P264 Wash skin thoroughly after handling.

Effective date: 11 May 2023 **Revision**: 11 May 2023
Trade Name: Alconox® Powdered Precision Cleaner

P280 Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P321 Specific treatment (see supplemental first aid instructions on this label).
P332+P313 If skin irritation occurs: Get medical advice/attention.
P362 Take off contaminated clothing and wash before reuse.
P501 Dispose of contents and container as instructed in Section 13.

Hazardous Elements at Use Dilution:

Hazard Pictograms:



Signal Word: Warning
Hazard Statements:
H320 Causes eye irritation

Precautionary statements:
P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P501 Dispose of contents and container as instructed in Section 13

Additional information: None.

Hazard description
Hazards Not Otherwise Classified (HNOC): May cause surfaces to become slippery if wet. Use caution in areas of foot traffic if on floors.

Information concerning particular hazards for humans and environment:
The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

Classification system:
The classification is according to EC regulation No. 1272, 29CFR1910/1200 and GHS Requirements, and extended by company and literature data. The classification is in accordance with the latest editions of international substances lists and is supplemented by information from technical literature and by information provided by the company.

3 Composition/information on ingredients

3.1 Chemical characterization: Not determined or not available.

3.2 Description: None

3.3 Hazardous components (percentages by weight)

Identification	Chemical Name	Classification	Wt. %
CAS number: 7758-29-4	Sodium tripolyphosphate	Skin Irrit. 2; H315 Eye Irrit. 2; H319	12-28
CAS number: 68081-81-2 or 68411-30-3	Sodium Alkylbenzene Sulfonate	Acute Tox. 4; H303 Skin Irrit. 2; H315 Eye Dam. 1; H318	8-22
CAS number: 7722-88-5	Tetrasodium Pyrophosphate	Skin Irrit. 2; H315 Eye Irrit. 2; H319	2-16

Hazardous components at use dilution (percentages by weight):

Identification	Chemical Name	Classification	Wt. %
CAS number: 7758-29-4	Sodium tripolyphosphate	Eye Irrit. 2; H319	0.12 - 0.28
CAS number: 68081-81-2 or 68411-30-3	Sodium Alkylbenzene Sulfonate	Eye Irrit. 2; H319	0.08 – 0.22
CAS number: 7722-88-5	Tetrasodium Pyrophosphate	Eye Irrit. 2; H319	0.02 – 0.16

3.4 Additional Information: None.

4 First aid measures

4.1 Description of first aid measures

General information: None.

After inhalation:
Maintain an unobstructed airway.
Loosen clothing as necessary and position individual in a comfortable position.

After skin contact:
Wash affected area with soap and water.
Seek medical attention if symptoms develop or persist.

After eye contact:
Rinse/flush exposed eye(s) gently using water for 15-20 minutes.
Remove contact lens(es) if able to do so during rinsing.
Seek medical attention if irritation persists or if concerned.

After swallowing:
Rinse mouth thoroughly.
Seek medical attention if irritation, discomfort, or vomiting persists.

4.2 Most important symptoms and effects, both acute and delayed

None

4.3 Indication of any immediate medical attention and special treatment needed:

No additional information.

First aid measure at recommended dilution:

General information: None.

After inhalation:
Maintain an unobstructed airway.
Loosen clothing as necessary and position individual in a comfortable position.

After skin contact:
Wash affected area with soap and water.

After eye contact:
Rinse/flush exposed eye(s) gently using water for 15-20 minutes.
Remove contact lens(es) if able to do so during rinsing.

After swallowing:
Rinse mouth thoroughly. Seek medical attention if irritation, discomfort, or vomiting develops.

5 Firefighting measures

Effective date: 11 May 2023 **Revision**: 11 May 2023
Trade Name: Alconox® Powdered Precision Cleaner

5.1 Extinguishing media

Suitable extinguishing agents:
Use appropriate fire suppression agents for adjacent combustible materials or sources of ignition.

For safety reasons unsuitable extinguishing agents: None

5.2 Special hazards arising from the substance or mixture:
Thermal decomposition can lead to release of irritating gases and vapors.

5.3 Advice for firefighters

Protective equipment:
Wear protective eye wear, gloves and clothing.
Refer to Section 8.

5.4 Additional information:
Avoid inhaling gases, fumes, dust, mist, vapor and aerosols.
Avoid contact with skin, eyes and clothing.

6 Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures:
Ensure adequate ventilation.
Ensure air handling systems are operational.

6.2 Environmental precautions:
Should not be released into the environment.
Prevent from reaching drains, sewer or waterway.

6.3 Methods and material for containment and cleaning up:
Wear protective eye wear, gloves and clothing.

6.4 Reference to other sections: None

7 Handling and storage

7.1 Precautions for safe handling:
No expected hazards under normal use condition.
Avoid breathing mist or vapor if aerosolized.
Do not eat, drink, smoke or use personal products when handling chemical substances.

7.2 Conditions for safe storage, including any incompatibilities:
Store in a cool, well-ventilated area.

7.3 Specific end use(s):

No additional information.

Safety Data Sheet

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Trade Name: Alconox® Powdered Precision Cleaner

8 Exposure controls/personal protection





8.1 Control parameters:

a) 7722-88-5, Tetrasodium Pyrophosphate, ACGIH TWA 10 mg/m3
b) 7758-29-4, Sodium Tripolyphosphate, ACGIH TWA 10 mg/m3
c) Dusts, non-specific OEL, Irish Code of Practice
   (i) Total inhalable 10 mg/m3 (8hr)
   (ii) Respirable 4 mg/m3 (8hr)
   (iii) Tetrasodium Pyrophosphate, OSHA TWA 5 mg/m3, (8hr)

8.2 Exposure controls

Appropriate engineering controls:
Emergency eye wash fountains and safety showers should be available in the immediate vicinity of use or handling.

Respiratory protection:
Not needed under normal use conditions.

Protection of skin:
Select glove material impermeable and resistant to the substance.

Eye protection:
Safety goggles or glasses, or appropriate eye protection. Recommended to comply with ANSI Z87.1 and/or EN 166.

General hygienic measures:
Wash hands before breaks and at the end of work.
Avoid contact with skin, eyes and clothing.

Exposure Control and Personal Protective Equipment at recommended dilution:

Under normal use and operational conditions, no special personal protective equipment or engineering controls will be necessary. Handle with care.

9 Physical and chemical properties

Appearance (physical state, color):	White and cream colored flakes - powder	**Explosion limit lower:** **Explosion limit upper:**	Not determined or notavailable. Not determined or notavailable.
Odor:	Not determined or not available.	**Vapor pressure at 20°C:**	Not determined or notavailable.
Odor threshold:	Not determined or not available.	**Vapor density:**	Not determined or notavailable.
pH-value:	9.5 (1% aqueous solution)	**Relative density:**	Not determined or notavailable.

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Melting/Freezing point:	Not determined or not available.	**Solubilities**:	Not determined or notavailable.
Boiling point/Boiling range:	Not determined or not available.	**Partition coefficient (n-octanol/water)**:	Not determined or notavailable.
Flash point (closed cup):	Not determined or not available.	**Auto/Self-ignition temperature**:	Not determined or notavailable.
Evaporation rate:	Not determined or not available.	**Decomposition temperature**:	Not determined or notavailable.

Flammability (solid, gaseous):	Not determined or not available.	**Viscosity**:	a. Kinematic: Not determined or not available. b. Dynamic: Not determined or not available.
Density at 20°C:	Not determined or not available.		

10 Stability and reactivity

10.1 Reactivity: Not determined or not available.
10.2 Chemical stability: Not determined or not available.
10.3 Possibility hazardous reactions: Not determined or not available.
10.4 Conditions to avoid: Not determined or not available.
10.5 Incompatible materials: Not determined or not available.
10.6 Hazardous decomposition products: Not determined or not available.

11 Toxicological information

11.1 Information on toxicological effects:

Acute Toxicity:

Oral:

: LD50 > 5000 mg/kg oral rat - Product.

Chronic Toxicity: No additional information.

Skin corrosion/irritation:

Sodium Alkylbenzene Sulfonate: Causes skin irritation.

Serious eye damage/irritation:

Sodium Alkylbenzene Sulfonate: Causes serious eye damage.

Tetrasodium Pyrophosphate: Risk of serious damage to eyes.

Product information at recommended dilution:

Eye irritation may occur upon direct contact with eyes. No specific hazards for skin contact, inhalation, or chronic exposure are expected within normal use parameters.

Respiratory or skin sensitization: No additional information.

Carcinogenicity: No additional information.

IARC (International Agency for Research on Cancer): None of the ingredients are listed.

NTP (National Toxicology Program): None of the ingredients are listed.

Germ cell mutagenicity: No additional information.

Reproductive toxicity: No additional information.

STOT-single and repeated exposure: No additional information.

Additional toxicological information: No additional information.

12 Ecological information

12.1 Toxicity:

Sodium Alkylbenzene Sulfonate: Fish, LC50 1.67 mg/l, 96 hours.
Sodium Alkylbenzene Sulfonate: Aquatic invertebrates, EC50 Daphnia 2.9 mg/l, 48 hours.
Sodium Alkylbenzene Sulfonate: Aquatic Plants, EC50 Algae 29 mg/l, 96 hours.
Tetrasodium Pyrophosphate: Fish, LC50 - other fish - 1,380 mg/l - 96 h.
Tetrasodium Pyrophosphate: Aquatic invertebrates, EC50 - Daphnia magna (Water flea) - 391 mg/l - 48 h.

12.2 Persistence and degradability: No additional information.

12.3 Bioaccumulative potential: No additional information.

12.4 Mobility in soil: No additional information.

General notes: No additional information.

12.5 Results of PBT and vPvB assessment:

PBT: No additional information.

vPvB: No additional information.

12.6 Other adverse effects: No additional information.

13 Disposal considerations

13.1 Waste treatment methods (consult local, regional and national authorities for proper disposal)

Relevant Information:

It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory entities. (US 40CFR262.11).

14 Transport information

14.1 UN Number: ADR, ADN, DOT, IMDG, IATA	None
14.2 UN Proper shipping name: ADR, ADN, DOT, IMDG, IATA	None
14.3 Transport hazard classes: ADR, ADN, DOT, IMDG, IATA	**Class:** None **Label:** None **LTD. QTY:** None

US DOT
Limited Quantity Exception: None

Bulk:
RQ (if applicable): None
Proper shipping Name: None
Hazard Class: None
Packing Group: None
Marine Pollutant (if applicable): No additional information.

Non Bulk:
RQ (if applicable): None
Proper shipping Name: None
Hazard Class: None
Packing Group: None
Marine Pollutant (if applicable): No additional information.

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Comments: None	**Comments:** None
14.4 Packing group: ADR, ADN, DOT, IMDG, IATA	None
14.5 Environmental hazards:	None
14.6 Special precautions for user:	None
Danger code (Kemler):	None
EMS number:	None
Segregation groups:	None
14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code: Not applicable.	
14.8 Transport/Additional information:	
Transport category:	None
Tunnel restriction code:	None
UN "Model Regulation":	None

15 Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture.

North American

SARA

Section 313 (specific toxic chemical listings): None of the ingredients are listed.
Section 302 (extremely hazardous substances): None of the ingredients are listed.

CERCLA (Comprehensive Environmental Response, Clean up and Liability Act) Reportable

Spill Quantity: None of the ingredients are listed.

TSCA (Toxic Substances Control Act):

Inventory: All ingredients are listed as active.
Rules and Orders: Not applicable.

Proposition 65 (California):

Chemicals known to cause cancer: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for females: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for males: None of the ingredients are listed.

Chemicals known to cause developmental toxicity: None of the ingredients are listed.

Canadian

Canadian Domestic Substances List (DSL):
All ingredients are listed.

EU

REACH Article 57 (SVHC): None of the ingredients are listed.

Germany MAK: Not classified.
EC 648/2004 – This is an industrial detergent. Contains >30% phosphate, 15-30% anionic surfactant, <5% EDTA salts
EC 551/2009 – This is not a laundry or dishwasher detergent
EC 907/2006 – Contains no enzymes, optical brighteners, perfumes, allergenic fragrances, or preservative agents

Asia Pacific

Australia

Australian Inventory of Chemical Substances (AICS): All ingredients are listed.

China

Inventory of Existing Chemical Substances in China (IECSC): All ingredients are listed.

Japan

Inventory of Existing and New Chemical Substances (ENCS): All ingredients are listed.

Korea

Existing Chemicals List (ECL): All ingredients are listed.

New Zealand

New Zealand Inventory of Chemicals (NZOIC): All ingredients are listed.

Philippines

Philippine Inventory of Chemicals and Chemical Substances (PICCS): All ingredients are listed.

Taiwan

Taiwan Chemical Substance Inventory (TSCI): All ingredients are listed.

16 Other information

Abbreviations and Acronyms: None

Summary of Phrases

Hazard statements:
H315 Causes skin irritation.
H318 Causes serious eye damage.

NFPA: 1-0-0
HMIS: 1-0-0

At recommended dilution:
NFPA: 1-0-0
HMIS: 1-0-0

Precautionary statements:
P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P321 Specific treatment (see supplemental first aid instructions on this label).
P332+P313 If skin irritation occurs: Get medical advice/attention.
P362 Take off contaminated clothing and wash before reuse.
P501 Dispose of contents and container as instructed in Section 13.

Manufacturer Statement:

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Hydrochloric Acid,ACS

SECTION 1: Identification of the substance/mixture and of the supplier

Product name: **Hydrochloric Acid,ACS**

Manufacturer/Supplier Trade name:

Manufacturer/Supplier Article number: **S25358**

Recommended uses of the product and restrictions on use:

Manufacturer Details:

AquaPhoenix Scientific, Inc
9 Barnhart Drive, Hanover, PA 17331
(717) 632-1291

Supplier Details:

Fisher Science Education
6771 Silver Crest Road, Nazareth, PA 18064
(724)517-1954

Emergency telephone number:

Fisher Science Education
Emergency Telephone No.: 800-535-5053

SECTION 2: Hazards identification

Classification of the substance or mixture:



Corrosive
Serious eye damage, category 1
Corrosive to metals, category 1
Skin corrosion, category 1B



Irritant
Specific target organ toxicity following single exposure, category 3

Corr. Metals 1.
Corr. Skin 1B.
Eye Damage 1.
STOT. SE 3.

Signal word: Danger

Hazard statements:

May be corrosive to metals.
Causes severe skin burns and eye damage.
May cause respiratory irritation.

Precautionary statements:

If medical advice is needed, have product container or label at hand.
Keep out of reach of children.
Read label before use.
Use only outdoors or in a well-ventilated area.
Wear protective gloves/protective clothing/eye protection/face protection.
Keep only in original container.
Do not get in eyes, on skin, or on clothing.
Wash skin thoroughly after handling.

IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
Immediately call a POISON CENTER or doctor/physician.
Specific treatment (see supplemental first aid instructions on this label).
Wash contaminated clothing before reuse.
Absorb spillage to prevent material damage.
Store in a well ventilated place. Keep container tightly closed.
Store locked up.
Store in corrosive resistant stainless steel container with a resistant inner liner.
Dispose of contents and container to an approved waste disposal plant.

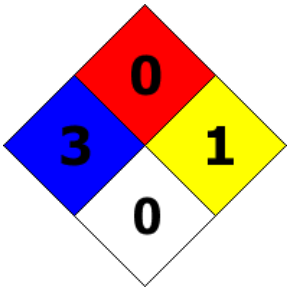
Other Non-GHS Classification:

WHMIS

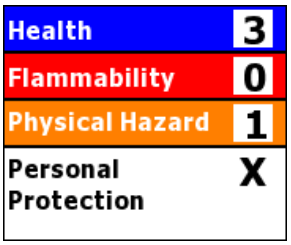
D1A 

E 

NFPA/HMIS



NFPA SCALE (0-4)



HMIS RATINGS (0-4)

SECTION 3: Composition/information on ingredients

Ingredients:		
CAS 7647-01-0	Hydrochloric Acid, ACS	30-50 %
CAS 7732-18-5	Water	50-70 %
		Percentages are by weight

SECTION 4: First aid measures

Description of first aid measures

After inhalation:

Move exposed individual to fresh air. Loosen clothing as necessary and position individual in a comfortable position. Seek medical attention if irritation or coughing persists.

After skin contact:

Wash affected area with soap and water. Immediately remove contaminated clothing and shoes. Rinse

thoroughly with plenty of water for at least 15 minutes. Immediately seek medical attention.

After eye contact:

Protect unexposed eye. Flush thoroughly with plenty of water for at least 15 minutes. Remove contact lenses while rinsing. Continue rinsing eyes during transport to hospital.

After swallowing:

Rinse mouth thoroughly. Do not induce vomiting. Have exposed individual drink sips of water. Immediately seek medical attention.

Most important symptoms and effects, both acute and delayed:

Inhalation may cause irritation to nose and upper respiratory tract, ulceration, coughing, chest tightness and shortness of breath. Higher concentrations cause tachypnoea, pulmonary oedema and suffocation. Ingestion may cause corrosion of lips, mouth, oesophagus and stomach, dysphagia and vomiting. Pain, eye ulceration, conjunctival irritation, cataracts and glaucoma may occur following eye exposure. Erythema and skin irritation, as well as chemical burns to skin and mucous membranes may arise following skin exposure. Potential sequelae following ingestion of hydrochloric acid include perforation, scarring of the oesophagus or stomach and stricture formation causing dysphagia or gastric outlet obstruction. In some cases, RADS may develop. Respiratory symptoms may take up to 36 hours to develop. Symptoms of burning sensation, cough, wheezing, laryngitis, shortness of breath, spasm, inflammation, edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema. Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin.

Indication of any immediate medical attention and special treatment needed:

Provide SDS to Physician. Physician should treat symptomatically.

SECTION 5: Firefighting measures

Extinguishing media

Suitable extinguishing agents:

Use water, dry chemical, chemical foam, carbon dioxide, or alcohol-resistant foam.

Unsuitable extinguishing agents: None

Special hazards arising from the substance or mixture:

Combustion products may include carbon oxides or other toxic vapors. If in contact with metals toxic fumes may be released.

Advice for firefighters:

Protective equipment:

Wear protective eyeware, gloves, and clothing. Refer to Section 8. Wear respiratory protection.

Additional information (precautions):

Thermal decomposition can produce poisoning chlorine. Hydrochloric acid reacts also with many organic materials with liberation of heat. Avoid inhaling gases, fumes, dust, mist, vapor, and aerosols. Avoid contact with skin, eyes, and clothing.

SECTION 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures:

Ensure adequate ventilation. Ensure that air-handling systems are operational.

Environmental precautions:

Should not be released into environment. Prevent from reaching drains, sewer, or waterway.

Methods and material for containment and cleaning up:

Always obey local regulations. If necessary use trained response staff or contractor. Evacuate personnel to safe areas. Containerize for disposal. Refer to Section 13. Keep in suitable closed containers for disposal. Soak up

with inert absorbent material and dispose of as hazardous waste. Cover spill with soda ash or calcium carbonate. Mix and add water to form slurry. Wear protective eyeware, gloves, and clothing. Refer to Section 8.

Reference to other sections: None

SECTION 7: Handling and storage

Precautions for safe handling:

Prevent formation of aerosols. Never use hot water and never add water to the acid. Do not allow contact between hydrochloric acid, metal, and organics. Follow good hygiene procedures when handling chemical materials. Refer to Section 8. Prevent contact with skin, eyes, and clothing. Follow proper disposal methods. Refer to Section 13. Do not eat, drink, smoke, or use personal products when handling chemical substances. Use only in well ventilated areas. Avoid splashes or spray in enclosed areas.

Conditions for safe storage, including any incompatibilities:

Store in a cool location. Keep away from food and beverages. Protect from freezing and physical damage. Store away from incompatible materials. Provide ventilation for containers. Keep container tightly sealed. Containers for hydrochloric acid must be made from corrosion resistant materials: glass, polyethylene, polypropylene, polyvinyl chloride, carbon steel lined with rubber or ebonite.

SECTION 8: Exposure controls/personal protection






Control Parameters: 7647-01-0, Hydrochloric Acid, ACGIH: 2 ppm Ceiling.
7647-01-0, Hydrochloric Acid, NIOSH: 5 ppm Ceiling; 7 mg/m3 Ceiling.

Appropriate Engineering controls: Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and mists below the applicable workplace exposure limits (Occupational Exposure Limits-OELs) indicated above. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of handling.

Respiratory protection: Not required under normal conditions of use. Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. When necessary use NIOSH approved breathing equipment.

Protection of skin: Select glove material impermeable and resistant to the substance. Select glove material based on rates of diffusion and degradation. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Use proper glove removal technique without touching outer surface. Avoid skin contact with used gloves. Wear protective clothing.

Eye protection: Faceshield (8-inch minimum). Tightly fitting safety goggles.

General hygienic measures: Perform routine housekeeping. Wash hands before breaks and immediately after handling the product. Avoid contact with skin, eyes, and clothing. Before rewearing wash contaminated clothing.

SECTION 9: Physical and chemical properties

Appearance (physical state, color):	Clear, colorless liquid.	**Explosion limit lower**: **Explosion limit upper**:	Non Explosive Non Explosive
Odor:	Pungent odor	**Vapor pressure at 20°C**:	5.7mmHg @ 0C

Hydrochloric Acid,ACS

Odor threshold:	0.3 – 14.9 mg/m3	**Vapor density**:	1.27 (Air=1)
pH-value:	< 1	**Relative density**:	1.0 - 1.2
Melting/Freezing point:	- 74 C	**Solubilities**:	Miscible.
Boiling point/Boiling range:	81.5 - 110 C	**Partition coefficient (n-octanol/water)**:	Not Determined
Flash point (closed cup):	Not Applicable	**Auto/Self-ignition temperature**:	Not Determined
Evaporation rate:	>1.00	**Decomposition temperature**:	Not Determined
Flammability (solid, gaseous):	non combustible	**Viscosity**:	a. Kinematic: Not Determined b. Dynamic: Not Determined
Density at 20°C:	Not Determined **Hydrochloric Acid:**MW is36.46		

SECTION 10: Stability and reactivity

Reactivity:

Reacts violently with bases and is corrosive.

Chemical stability:

No decomposition if used and stored according to specifications.

Possible hazardous reactions:

Attacks many metals in the presence of water forming flammable explosive gas (hydrogen). Reacts violently with oxidants forming toxic gas (chlorine).

Conditions to avoid:

Incompatible materials.

Incompatible materials:

Bases, Amines, Alkali metals, Metals, permanganates (potassium permanganate), Fluorine, Metal acetylides, Hexalithium disilicide.

Hazardous decomposition products:

Hydrogen chloride gas. Carbon oxides.

SECTION 11: Toxicological information

Acute Toxicity:

Oral:

7647-01-0 LD50 Rat 238 - 277 mg/kg

Dermal:

7647-01-0 LD50 Rabbit >5010 mg/kg

Inhalation:

7647-01-0 LD50 Rat 3124 ppm/hour

Chronic Toxicity: No additional information.

Corrosion Irritation:

Dermal:

7647-01-0 Skin - rabbit Result: Causes burns.

Ocular:

7647-01-0 Eyes - rabbit Result: Corrosive to eyes

Sensitization: No additional information.
Numerical Measures: No additional information.
Carcinogenicity: No additional information.
Mutagenicity: No additional information.
Reproductive Toxicity: No additional information.

SECTION 12: Ecological information

Ecotoxicity:

7647-01-0: Toxicity to fish LC50 - Gambusia affinis (Mosquito fish) - 282 mg/l - 96 h (Hydrochloric acid)

Persistence and degradability: No additional information.
Bioaccumulative potential: No additional information.
Mobility in soil: No additional information.
Other adverse effects: No additional information.

SECTION 13: Disposal considerations

Waste disposal recommendations:

Do not allow product to reach sewage system or open water. It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory entities (US 40CFR262.11). Contact a licensed professional waste disposal service to dispose of this material. Dispose of empty containers as unused product. Product or containers must not be disposed together with household garbage. Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations. Ensure complete and accurate classification.

SECTION 14: Transport information

US DOT

UN Number:
ADR, ADN, DOT, IMDG, IATA 1789

Limited Quantity Exception: None

Bulk:
RQ (if applicable): None
Proper shipping Name: HYDROCHLORIC ACID.
Hazard Class: 8
Packing Group: II.
Marine Pollutant (if applicable): No additional information.
Comments: None

Non Bulk:
RQ (if applicable): None
Proper shipping Name: HYDROCHLORIC ACID.
Hazard Class: 8
Packing Group: II.
Marine Pollutant (if applicable): No additional information.
Comments: None




SECTION 15: Regulatory information

United States (USA)

SARA Section 311/312 (Specific toxic chemical listings):

Acute

SARA Section 313 (Specific toxic chemical listings):

7647-01-0 Hydrochloric Acid.

RCRA (hazardous waste code):

None of the ingredients are listed.

TSCA (Toxic Substances Control Act):

All ingredients are listed.

CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act):

7647-01-0 Hydrochloric Acid 5000 lbs.

Proposition 65 (California):

Chemicals known to cause cancer:

None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for females:

None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for males:

None of the ingredients are listed.

Chemicals known to cause developmental toxicity:

None of the ingredients are listed.

Canada

Canadian Domestic Substances List (DSL):

All ingredients are listed.

Canadian NPRI Ingredient Disclosure list (limit 0.1%):

None of the ingredients are listed.

Canadian NPRI Ingredient Disclosure list (limit 1%):

7647-01-0 Hydrochloric Acid.

SECTION 16: Other information

This product has been classified in accordance with hazard criteria of the Controlled Products Regulations and the SDS contains all the information required by the Controlled Products Regulations. Note. The responsibility to provide a safe workplace remains with the user. The user should consider the health hazards and safety information contained herein as a guide and should take those precautions required in an individual operation to instruct employees and develop work practice procedures for a safe work environment. The information contained herein is, to the best of our knowledge and belief, accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by the use of this material. It is the responsibility of the user to comply with all applicable laws and regulations applicable to this material.

GHS Full Text Phrases: None

Abbreviations and Acronyms:

IMDG International Maritime Code for Dangerous Goods.
PNEC Predicted No-Effect Concentration (REACH).
CFR Code of Federal Regulations (USA).
SARA Superfund Amendments and Reauthorization Act (USA).
RCRA Resource Conservation and Recovery Act (USA).
TSCA Toxic Substances Control Act (USA).
NPRI National Pollutant Release Inventory (Canada).
DOT US Department of Transportation.
IATA International Air Transport Association.
GHS Globally Harmonized System of Classification and Labelling of Chemicals.
ACGIH American Conference of Governmental Industrial Hygienists.
CAS Chemical Abstracts Service (division of the American Chemical Society).
NFPA National Fire Protection Association (USA).
HMIS Hazardous Materials Identification System (USA).
WHMIS Workplace Hazardous Materials Information System (Canada).
DNEL Derived No-Effect Level (REACH).

Effective date: 01.08.2015
Last updated: 05.28.2015

SAFETY DATA SHEET

Nonflammable Gas Mixture: Helium 99.9-99.9999% / Water 1-1000ppm

Section 1. Identification

GHS product identifier : Nonflammable Gas Mixture: Helium 99.9-99.9999% / Water 1-1000ppm

Other means of identification : Not available.

Product type : Gas.

Product use : Synthetic/Analytical chemistry.

SDS # : 011710

Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

24-hour telephone : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : GASES UNDER PRESSURE - Compressed gas

GHS label elements

Hazard pictograms :



Signal word : Warning

Hazard statements : Contains gas under pressure; may explode if heated.
May displace oxygen and cause rapid suffocation.

Precautionary statements

General : Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction.

Prevention : Not applicable.

Response : Not applicable.

Storage : Protect from sunlight. Store in a well-ventilated place.

Disposal : Not applicable.

Hazards not otherwise classified : In addition to any other important health or physical hazards, this product may displace oxygen and cause rapid suffocation.

Section 3. Composition/information on ingredients

Substance/mixture : Mixture

Other means of identification : Not available.

Product code : 011710

Section 3. Composition/information on ingredients

Ingredient name	%	CAS number
Helium	99.9 - 99.9999	7440-59-7
WATER	0.0001 - 0.1	7732-18-5

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : As this product is a gas, refer to the inhalation section.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Contact with rapidly expanding gas may cause burns or frostbite.

Inhalation : No known significant effects or critical hazards.

Skin contact : Contact with rapidly expanding gas may cause burns or frostbite.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Ingestion : As this product is a gas, refer to the inhalation section.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : Contains gas under pressure. In a fire or if heated, a pressure increase will occur and the container may burst or explode.

Hazardous thermal decomposition products : No specific data.

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Immediately contact emergency personnel. Stop leak if without risk.

Large spill : Immediately contact emergency personnel. Stop leak if without risk. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Avoid breathing gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

Avoid contact with eyes, skin and clothing. Empty containers retain product residue and can be hazardous.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Section 7. Handling and storage

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F). Keep container tightly closed and sealed until ready for use. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Helium	**ACGIH TLV (United States, 3/2017). Oxygen Depletion [Asphyxiant].**
WATER	None.

Appropriate engineering controls : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Gas.

Color : Not available.

Odor : Not available.

Odor threshold : Not available.

pH : Not available.

Melting point : -272.2°C (-458°F) This is based on data for the following ingredient: helium.

Boiling point : Not available.

Critical temperature : Lowest known value: -267.9°C (-450.2°F) (helium).

Flash point : Not available.

Evaporation rate : Not available.

Flammability (solid, gas) : Not available.

Lower and upper explosive (flammable) limits : Not available.

Vapor pressure : Not available.

Vapor density : Highest known value: 0.14 (Air = 1) (helium).

Gas Density (lb/ft ^{3}) : Only known value: 0.0104 (helium).

Relative density : Not applicable.

Solubility : Not available.

Solubility in water : Not available.

Partition coefficient: n-octanol/water : Not available.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

Viscosity : Not applicable.

Flow time (ISO 2431) : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : No specific data.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Not available.

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Contact with rapidly expanding gas may cause burns or frostbite.

Inhalation : No known significant effects or critical hazards.

Skin contact : Contact with rapidly expanding gas may cause burns or frostbite.

Ingestion : As this product is a gas, refer to the inhalation section.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Section 11. Toxicological information

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Helium	0.28	-	low
WATER	-1.38	-	low

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1956	UN1956	UN1956	UN1956	UN1956
UN proper shipping name	COMPRESSED GAS, N.O.S. (helium, water)	COMPRESSED GAS, N.O.S. (helium, water)	COMPRESSED GAS, N.O.S. (helium, water)	COMPRESSED GAS, N.O.S. (helium, water)	COMPRESSED GAS, N.O.S. (helium, water)
Transport hazard class(es)	2.2 	2.2 	2.2 	2.2 	2.2 
Packing group	-	-	-	-	-
Environmental hazards	No.	No.	No.	No.	No.

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Additional information

TDG Classification : Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.13-2.17 (Class 2).
Explosive Limit and Limited Quantity Index 0.125
Passenger Carrying Road or Rail Index 75

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Refer to Section 2: Hazards Identification of this SDS for classification of substance.

Section 15. Regulatory information

State regulations

Massachusetts : The following components are listed: HELIUM

New York : None of the components are listed.

New Jersey : The following components are listed: HELIUM

Pennsylvania : The following components are listed: HELIUM

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol (Annexes A, B, C, E)

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Inventory list

Australia : All components are listed or exempted.

Canada : All components are listed or exempted.

China : All components are listed or exempted.

Europe : All components are listed or exempted.

Japan : **Japan inventory (ENCS)**: Not determined.
Japan inventory (ISHL): Not determined.

Malaysia : Not determined.

New Zealand : All components are listed or exempted.

Philippines : All components are listed or exempted.

Republic of Korea : All components are listed or exempted.

Taiwan : All components are listed or exempted.

Thailand : Not determined.

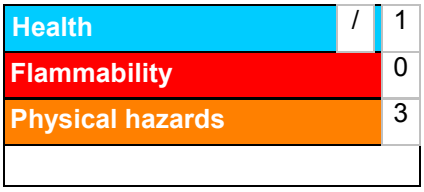
Turkey : Not determined.

United States : All components are listed or exempted.

Viet Nam : Not determined.

Section 16. Other information

Hazardous Material Information System (U.S.A.)

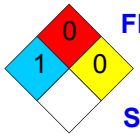


Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings and the associated label are not required on SDSs or products leaving a facility under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered trademark and service mark of the American Coatings Association, Inc.

The customer is responsible for determining the PPE code for this material. For more information on HMIS® Personal Protective Equipment (PPE) codes, consult the HMIS® Implementation Manual.

National Fire Protection Association (U.S.A.)

Section 16. Other information



Flammability

Health

Instability/Reactivity

Special

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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

Procedure used to derive the classification

Classification	Justification
GASES UNDER PRESSURE - Compressed gas	On basis of test data

History

Date of printing : 8/5/2018

Date of issue/Date of revision : 8/5/2018

Date of previous issue : 9/29/2016

Version : 2

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

References : Not available.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

SAFETY DATA SHEET

Isobutylene

Section 1. Identification

GHS product identifier : Isobutylene

Chemical name : 2-methylpropene

Other means of identification : 1-Propene, 2-methyl-; Isobutene; Isobutylene; 1-Propene, 2-methyl- (isobutene); 1, 1-Dimethylethylene; Isopropylidenemethylene; iso-Butene; i-Butene; 2-Methylpropylene; 2-Methyl-2-propene; 2-Methyl-1-propene

Product type : Gas.

Product use : Synthetic/Analytical chemistry.

Synonym : 1-Propene, 2-methyl-; Isobutene; Isobutylene; 1-Propene, 2-methyl- (isobutene); 1, 1-Dimethylethylene; Isopropylidenemethylene; iso-Butene; i-Butene; 2-Methylpropylene; 2-Methyl-2-propene; 2-Methyl-1-propene

SDS # : 001031

Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

24-hour telephone : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : FLAMMABLE GASES - Category 1
GASES UNDER PRESSURE - Liquefied gas

GHS label elements

Hazard pictograms :



Signal word : Danger

Hazard statements : Extremely flammable gas.
May form explosive mixtures with air.
Contains gas under pressure; may explode if heated.
May displace oxygen and cause rapid suffocation.

Precautionary statements

General : Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction. Always keep container in upright position. Approach suspected leak area with caution.

Prevention : Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

Response : Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so.

Storage : Protect from sunlight. Store in a well-ventilated place.

Disposal : Not applicable.

Hazards not otherwise classified : In addition to any other important health or physical hazards, this product may displace oxygen and cause rapid suffocation.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : 2-methylpropene

Other means of identification : 1-Propene, 2-methyl-; Isobutene; Isobutylene; 1-Propene, 2-methyl- (isobutene); 1, 1-Dimethylethylene; Isopropylidenemethylene; iso-Butene; i-Butene; 2-Methylpropylene; 2-Methyl-2-propene; 2-Methyl-1-propene

Product code : 001031

CAS number/other identifiers

CAS number : 115-11-7

Ingredient name	%	CAS number
Isobutylene	100	115-11-7

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : As this product is a gas, refer to the inhalation section.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Ingestion : As this product is a gas, refer to the inhalation section.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Section 4. First aid measures

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : Contains gas under pressure. Extremely flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool. If involved in fire, shut off flow immediately if it can be done without risk. If this is impossible, withdraw from area and allow fire to burn. Fight fire from protected location or maximum possible distance. Eliminate all ignition sources if safe to do so.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : Accidental releases pose a serious fire or explosion hazard. No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment.

Large spill : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Avoid breathing gas. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

Use only non-sparking tools. Avoid contact with eyes, skin and clothing. Empty containers retain product residue and can be hazardous. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F). Keep container tightly closed and sealed until ready for use. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Isobutylene	**ACGIH TLV (United States, 3/2017).** TWA: 250 ppm 8 hours.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Section 8. Exposure controls/personal protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Gas. [Compressed gas.]

Color : Colorless.

Odor : Characteristic.

Odor threshold : Not available.

pH : Not available.

Melting point : -140.7°C (-221.3°F)

Boiling point : -6.9°C (19.6°F)

Critical temperature : 144.75°C (292.6°F)

Flash point : Closed cup: -76.1°C (-105°F)

Evaporation rate : Not available.

Flammability (solid, gas) : Extremely flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and oxidizing materials.

Lower and upper explosive (flammable) limits : Lower: 1.8%
Upper: 9.6%

Vapor pressure : 24.3 (psig)

Vapor density : 1.94 (Air = 1)

Specific Volume (ft ^{3}/lb) : 6.6845

Gas Density (lb/ft ^{3}) : 0.1496 (25°C / 77 to °F)

Relative density : Not applicable.

Solubility : Not available.

Solubility in water : 0.26 g/l

Partition coefficient: n-octanol/water : 2.34

Auto-ignition temperature : 465°C (869°F)

Decomposition temperature : Not available.

Viscosity : Not applicable.

Flow time (ISO 2431) : Not available.

Molecular weight : 56.12 g/mole

Aerosol product

Heat of combustion : -45029034 J/kg

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

Incompatible materials : Oxidizers

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Isobutylene	LC50 Inhalation Vapor	Rat	550000 mg/m³	4 hours

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Section 11. Toxicological information

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : As this product is a gas, refer to the inhalation section.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Isobutylene	2.34	-	low

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Section 12. Ecological information

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1055	UN1055	UN1055	UN1055	UN1055
UN proper shipping name	ISOBUTYLENE	ISOBUTYLENE	ISOBUTYLENE	ISOBUTYLENE	ISOBUTYLENE
Transport hazard class(es)	2.1 	2.1 	2.1 	2.1 	2.1 
Packing group	-	-	-	-	-
Environmental hazards	No.	No.	No.	No.	No.

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Additional information

DOT Classification : **Limited quantity** Yes.
Quantity limitation Passenger aircraft/rail: Forbidden. Cargo aircraft: 150 kg.
Special provisions 19, T50

TDG Classification : Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.13-2.17 (Class 2).
Explosive Limit and Limited Quantity Index 0.125
ERAP Index 3000
Passenger Carrying Ship Index Forbidden
Passenger Carrying Road or Rail Index Forbidden
Special provisions 29

IATA : **Quantity limitation** Passenger and Cargo Aircraft: Forbidden. Cargo Aircraft Only: 150 kg.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined

Clean Air Act (CAA) 112 regulated flammable substances: Isobutylene

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Refer to Section 2: Hazards Identification of this SDS for classification of substance.

State regulations

Massachusetts : This material is listed.

New York : This material is not listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol (Annexes A, B, C, E)

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Inventory list

Australia : This material is listed or exempted.

Canada : This material is listed or exempted.

China : This material is listed or exempted.

Europe : This material is listed or exempted.

Japan : **Japan inventory (ENCS)**: This material is listed or exempted.
Japan inventory (ISHL): Not determined.

Malaysia : Not determined.

New Zealand : This material is listed or exempted.

Philippines : This material is listed or exempted.

Republic of Korea : This material is listed or exempted.

Section 15. Regulatory information

Taiwan : This material is listed or exempted.

Thailand : Not determined.

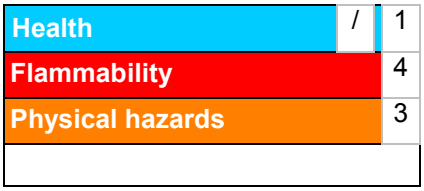
Turkey : Not determined.

United States : This material is listed or exempted.

Viet Nam : Not determined.

Section 16. Other information

Hazardous Material Information System (U.S.A.)



Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings and the associated label are not required on SDSs or products leaving a facility under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered trademark and service mark of the American Coatings Association, Inc.

The customer is responsible for determining the PPE code for this material. For more information on HMIS® Personal Protective Equipment (PPE) codes, consult the HMIS® Implementation Manual.

National Fire Protection Association (U.S.A.)



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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

Procedure used to derive the classification

Classification	Justification
FLAMMABLE GASES - Category 1 GASES UNDER PRESSURE - Liquefied gas	Expert judgment Expert judgment

History

Date of printing : 5/10/2018

Date of issue/Date of revision : 5/10/2018

Date of previous issue : 7/11/2016

Version : 0.02

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973

Section 16. Other information

as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

References : Not available.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

APPENDIX C

Heat Illness Prevention Program

HEAT ILLNESS
PREVENTION PROGRAM

CORPORATE HEALTH AND SAFETY DIRECTOR	:	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	:	**10/2019**
REVISION DATE	:	**03/2025**
REVISION NUMBER	:	**4**

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1. PURPOSE

Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C, and Remedial Engineering (collectively, "Roux"), have established this heat illness prevention program to assist in preventing workplace accidents, injuries, and illnesses associated with temperature extremes. Roux is committed to taking every precaution to protect employees who might be exposed to heat stress, including establishing safe work practices, heat illness prevention controls, and emergency preparedness, which will be detailed in this plan.

2. SCOPE AND APPLICABILITY

Roux's Heat Illness Prevention Program applies to all employees and subcontractors who may be exposed to heat stress in the field.

3. ROLES AND RESPONSIBILITIES

The Heat Illness Prevention Program Administrator for Roux is the Corporate Health and Safety Director (CHSD), Brian Hobbs, CIH, CSP. The daily administration of the program is delegated to the Operations Manager (OM) , Office Health and Safety Manager (OHSM), and Site Health and Safety Officer (SHSO). The CHSD has the authority, responsibility, and overall accountability for the comprehensive implementation of this program.

All managers and supervisors shall implement and maintain the heat illness prevention program in work areas where there is a potential for heat stress.

Management Responsibilities

Management (i.e., Project Managers, Project Principals, OM) must provide the following to promote compliance and foster a good safety culture:

- Comply with applicable standards.
- Inform employees of the provisions of the heat illness prevention program and ensure understanding.
- Provide sufficient water, shade, rest areas, and other heat illness controls for employees.
- Assist with establishing work practices to minimize heat stress risks, such as acclimatization, required rest periods, employee monitoring, and strategic scheduling.
- Encourage employees to report hazardous conditions or heat illness symptoms.
- Provide training to any employee who could possibly be exposed to the risk of heat illness.

Employee Responsibilities

Employees are expected to actively participate in the organization's heat illness prevention program, which includes the following responsibilities:

- Receive appropriate training with regard to heat stress.
- Understand core concepts of heat illness prevention and follow guidelines to mitigate risks.
- Recognize the signs and symptoms of heat illness and immediately report them.
- Cooperate with workplace inspections and incident investigations.

Effective Communication

All Roux employees shall be accountable for ensuring there is effective communication with both the field team and their subcontractors. Communication between Roux employees, project leads (e.g., Project Principal, Project

Managers), and subcontractors (if applicable) will be established and maintained so that employees can quickly contact should there be a change in condition or someone at the Site exhibits signs/symptoms of heat stress. These types of incidents would follow Roux's Incident Investigation and Reporting Management Program 2.12 and Roux's Injury Illness Prevention Program 2.22.

4. HAZARD IDENTIFICATION AND ASSESSMENT

Prior to scheduled fieldwork, the project team shall ensure a hazard assessment is conducted as it relates to heat stress. This will include a determination of how much heat and exertion employees are likely to be exposed to based on the work activity.

Factors that can increase heat stress include the following:

- Temperatures at the work site;
- Humidity;
- A lack of air movement or exchange;
- The amount of time employees spend working in the heat;
- The time of day work takes place;
- Sources of radiant heat (e.g., sunlight, fire, or hot furnace);
- Work activities that produce heat (e.g., welding);
- Physical contact with warm or hot objects or liquids;
- The clothing and PPE employees are required to wear; and/or
- Physically strenuous work.

Results of the hazard analysis should be used to determine appropriate controls for mitigating heat stress, whenever possible, for planning acclimatization, and for developing work schedules that rotate workers to limit employee exposure. Typically, the Site Supervisor (SS) or Site Health and Safety Officer (SHSO) shall conduct worksite observations to ensure all employees follow heat illness prevention procedures and that hazards are sufficiently controlled. However, all employees should be continuously evaluating work site conditions and be able to recognize heat stressors in order to prevent heat illnesses.

5. TRAINING

All Roux employees shall be trained on the topics listed below prior to beginning work, which may potentially expose workers to heat stress.

Training Topics

- The environmental, behavioral, and personal risk factors for heat illness, such as radiant heat sources, exertion, clothing and PPE, and use of alcohol or drugs.
- Types of heat illnesses, common symptoms, and appropriate emergency response for each.
- The knowledge that mild symptoms may quickly become more severe or life-threatening.
- The importance of immediately reporting any signs or symptoms of heat illness to the supervisor.
- The employer's responsibility to provide shade, water, access to first aid, and cool-down rests during work and the employee's freedom to exercise their rights under this standard without fear of retaliation.

- The employer's heat stress plan and its procedures:
  - Procedures for employees who are newly assigned to work in high-heat areas.
  - The organization's acclimatization methods, as applicable.
  - Heatwave procedures.
  - Heat illness and emergency response, including contact information.
- The importance of frequent consumption of water and the taking of rest breaks.
- How heat illness prevention applies to employees' specific tasks.

Increasing Training Effectiveness:

- The SS/SHSO will hold daily tailgates with the field team to go over daily work tasks and basic safety information, including Job Safety Analysis (JSA) review, as well as incorporate elements such as current weather and effects on the work activities for the day.
- If a heat wave or high heat is anticipated, OHSMs and/or OMs will provide communications to Roux employees prior to their shifts and remind them of any special high heat procedures.

6. DRINKING WATER

Employees shall be given access to potable drinking water. Access to water will be provided as near as possible to where employees are working, and there shall be enough locations so employees will have sufficient water. Water should be fresh and pure, free of taste or smell that would discourage employees from drinking, comfortably cool, and obtained from an approved source.

The recommendation is that during warm or hot weather, employees drink four 8-ounce glasses of water, or a total of one quart per hour, throughout the entire work shift. Easy access to sufficient potable drinking water throughout the work shift encourages employees to drink.

During a heat wave, water shall be replenished more often to keep it available and cool. Water containers (and all spouts and levers) must be kept clean. If able, provide single-use drinking cups with appropriate waste receptacles. Accessible sanitation facilities shall also be maintained at work Sites as appropriate.

SS/SHSO is responsible for the following:

- Drink sufficient water before, during, and after work shifts to maintain hydration.
- Encourage frequent drinking of small amounts of water throughout the shift. In high-heat environments, remind field staff and subcontractors that drinking extra water may be necessary.
- Discourage the choice of drinks with caffeine or sugar that may possibly dehydrate employees instead of water. Also, discourage the drinking of alcohol.
- Monitor the water supply.
- If employees become dehydrated and are unable to alleviate symptoms with the steps below, get them immediate medical attention.

Field Staff/Subcontractors are responsible for the following:

- Drink sufficient water before, during, and after work shifts to maintain hydration. Drink up to 4 cups of water per hour, especially during hot weather.
- Be aware that in high-heat situations, you may need to drink more water.

- Monitor yourself and others for signs of dehydration. If you feel dehydrated:
  - Follow Roux's Incident Notification Flowchart;
  - Rest in the shaded resting area; and
  - Drink water in small amounts, but frequently.

7. ACCESS TO SHADE

Access to shaded areas will be provided to Roux staff, as needed. Employees are encouraged to use these areas when they feel overheated. Roux's SS/SHSO shall oversee the proper implementation of shaded areas and will communicate these locations on a daily basis with the Field Team.

Depending on the Site, shaded areas can include the following:

- Pop-up Tents
- Canopies
- Umbrellas
- Structures mechanically ventilated or open to air movement
  - Garage
- Conex-mounted RV canopies
- Full and thick tree canopies that block direct sunlight
- Buildings
- Enclosed areas only if they provide cooling comparable to shade in open-air
  - Vehicles with air conditioning

Shaded Area Requirements

The shade shall be strong enough to cool employees down and other shadows should not be visible in the shade. The shade will be provided by Roux when the air temperature exceeds 80°F. If the temperature is less than 80°F, shade will be available and provided upon request. The SS/SHSO will monitor conditions to determine when the air will exceed (and is exceeding) 80°F. For most Sites, air will be monitored hourly and shade will be set up immediately if 80°F is exceeded.

Shade shall be located as close as practical to areas where employees are working and is easily accessible. These areas will be considered safe and free from other hazards. Shaded areas should be large enough to accommodate all employees who are on a break, resting, or recovering without crowding. Should natural vegetation be used for shade, the SS/SHSO will evaluate shade for effectiveness.

Field Staff Responsibilities

Field Staff should take ordinary rest breaks in the shaded areas and monitor themselves for signs of heat stress, and go to the shaded area when they need to cool down. Any issues or problems with shaded areas should be reported to the SS/SHSO for the Site.

If shaded areas are used for a preventative cool-down, the SS/SHSO will ensure the affected employees will remain in the shade until they begin to feel better. The SS/SHSO will continue to monitor the employees and ask them if

they are experiencing symptoms of a heat illness. Employees shall not be sent back to work before symptoms have ended and at a minimum at least 10 minutes of rest.

8. MONITORING AND SCHEDULING

Monitoring

The SS/SHSO and Field Team will continue to monitor themselves and others for signs of heat illness. The SS/SHSO will monitor when the air temperature exceeds 80°F. Throughout the summer, weather and temperature will be monitored at least two weeks ahead, and the work schedule will be planned to accommodate the expected weather.

Scheduling

Scheduling accommodations may include:

- Working during cooler hours of the day
- Working at night
- Stopping work early
- Rescheduling work activities
- Increasing frequency of breaks

In general, strenuous work activities shall be rescheduled to the coolest parts of the day.

Special precautions are required for temperatures above 80°F, 95°F, and heat waves. These precautions are provided in the sections below.

9. ACCLIMATIZATION AND NEW EMPLOYEE PROCEDURES

Roux requires employees to be acclimatized in order for them to better tolerate heat in the workplace. Acclimatization is the physical process of adapting to a different thermal environment, allowing a better toleration of heat. Acclimatization procedures require gradual exposure that gives the employee time to adjust to each level of exposure. Acclimatization is essential for new employees but is necessary for all employees when the temperature significantly changes. Heat stress is much more likely if these procedures are not followed.

The SS/SHSO is responsible for observing new employees during their first 14 days of employment in high-heat areas.

Re-acclimatization is necessary if employees are absent from high-heat environments for a week or more or the temperature increases significantly.

10. HEATWAVE AND EXTREME HEAT PROCEDURES

Heat Wave Procedures

A heat wave is defined as consistent temperatures over 80°F or if the temperature is 10° higher than the average daily temperatures in the preceding 5 days.

SS/SHSO and Project Management (e.g., PP, PM) shall closely observe and monitor employees during a heat wave. The Field Teams should institute a ratio of one SS to 20 or fewer employees, a mandatory buddy system, or

a consistent practice for supervisors to check on employees. Pre-shift meetings to review high-heat procedures with employees will be carried out to emphasize work-rest schedules, drinking water, shade, etc.

Extreme Heat Procedures

When work-site temperatures equal or exceed 95°F, the employer will enact extreme heat procedures:

- Employees will be closely observed by the SS/SHSO for signs of heat illness. New employees will be supervised for acclimatization.
- Effective communication and monitoring will be ensured through the use of periodic check-ins via phone with the SS/SHSO. Communications between employees and Project Management (e.g., PP/PM) will be established and maintained. Mandatory 10-minute break periods are required for every two hours worked. SS/SHSO must enforce this rule.
- Pre-shift safety tailgate meetings will occur to review procedures and to remind employees to drink water and take cool-down rests if needed. SS/SHSO shall remind employees to rest and drink water. Employees should drink more water than usual.

11. EMERGENCY RESPONSE PROCEDURES

Roux is dedicated to providing prompt appropriate care for all employees who report or show symptoms of heat illness. If an employee shows signs of heat illness, they will be monitored and shall not be left alone or sent home without being offered first aid or emergency medical services. If on-site personnel require any medical treatment, the following steps will be taken:

1. Notify Roux's Project and Corporate Management Team for any work-related injury and/or illness occurrence, and communicate with the contracted Occupational Health Care Management Provider, AllOne Health (AOH), immediately following the notifications provided above.
2. Based on discussions with the Project Team, Corporate Management, and the AOH evaluation, if medical attention beyond onsite First Aid is warranted, transport the injured/ill person (IP) to the Urgent Care Center, or notify the Fire Department or Ambulance Emergency service and request an ambulance or transport the victim to the hospital, and continue communications with Corporate Management Team. An Urgent Care/Hospital Route map with locations and directions is provided within Site Specific Health and Safety Plans.
3. First aid medical support will be provided by onsite personnel trained and certified in First Aid, Cardio Pulmonary Resuscitation (CPR), Automatic External Defibrillation (AED), and Blood-Borne Pathogens (BBP) Awareness, until relieved by emergency medical services (EMS).
4. The SHSO and Project Manager will perform a Loss Investigation (LI), and the Project Team will complete the final Loss Report.

12. HEAT-RELATED ILLNESSES

Heat Stress

Heat stress is a significant potential hazard and can be associated with heavy physical activity and/or the use of personal protective equipment (PPE) in hot-weather environments. For these reasons, the company will provide potable drinking water and access to shade or other areas of relief (i.e., air-conditioned vehicles and work trailers). Supervisors, prior to supervising personnel in the field as well as all personnel involved with the fieldwork of a project, are trained in this HASP that includes preventing heat-related illnesses and the below procedures in response to heat-related symptoms and illness. Since much of our work is dependent upon environmental factors beyond our control, we must closely monitor air temperature and humidity and be aware of avoiding radiant heat sources and providing as much air circulation as possible wherever we work. Physical factors that need to be evaluated as part of our Job Safety Analysis (JSA) reviews include the level of physical activity and duration of work

and the type (i.e., color, weight breathability) of the clothing we select. In addition, personal factors such as age, weight, fitness, drug/alcohol use, and prior history of heat-related illness need to be considered.

Heat cramps are brought on by prolonged exposure to heat. As an individual sweats, water and salts are lost by the body, resulting in painful muscle cramps. The signs and symptoms of heat stress are as follows:

- Severe muscle cramps, usually in the legs and abdomen;
- Exhaustion, often to the point of collapse; and
- Dizziness or periods of faintness.

First aid treatment includes, but is not limited to, shade, rest, and fluid replacement. Typically, the individual should recover within one-half hour while being monitored constantly. If the individual has not improved substantially within 30 minutes and the body temperature has not decreased, the individual should be transported to a hospital for medical attention.

Heat Exhaustion

Heat exhaustion may occur in a healthy individual who has been exposed to excessive heat while working or exercising. The circulatory system of the individual fails as blood collects near the skin to rid the body of excess heat through transference. The signs and symptoms of heat exhaustion are as follows:

- Rapid and shallow breathing;
- Weak pulse;
- Cold and clammy skin with heavy perspiration;
- Skin appears pale;
- Fatigue and weakness;
- Dizziness; and
- Elevated body temperature.

First aid treatment includes, but is not limited to, cooling the victim, elevating the feet, and replacing fluids. If the individual is not substantially improved within 30 minutes and the body temperature has not decreased, the individual should be transported to the hospital for medical attention.

Heat Stroke

Heat stroke occurs when an individual is exposed to excessive heat and stops sweating. This condition is classified as a MEDICAL EMERGENCY requiring immediate cooling of the victim and transport to a medical facility. The signs and symptoms of heat stroke are as follows:

- Dry, hot red skin;
- Body temperature approaching or above 105 degrees F;
- Confusion, altered mental state, slurred speech;
- Seizures;
- Large (dilated) pupils; and
- Loss of consciousness – the individual may go into a coma.

First aid treatment requires immediate cooling and transportation to a medical facility. Heat stress is a significant hazard if any type of protective equipment (semi-permeable or impermeable) that prevents evaporative cooling is worn in hot-weather environments.

13. OTHER HEAT CONTROLS

Clothing and PPE

Employees should choose clothing that is reflective, light-colored, lightweight, loose-fitting, and breathable. Clothing should cover the exposed parts of the body. In direct sun, hard hats with a brim or bill may be helpful. Should specialized cooling garments be applicable, please consult with your OM/OHSM/CHSD.

Managing Employee Risk Factors

It is recommended that employees are aware of how their health can affect their risk of heat stress. The following increases personnel's risk for a heat-related illness:

- A poor level of physical fitness
- Obesity
- Chronic or acute illnesses
- Conditions such as diabetes, heart disease, or high blood pressure
- Certain medications, such as diuretics
- Age (60+)

Employees should:

- Maintain their health outside of work
- Be aware of the effects of medications
- Drink adequate amounts of water
- Eat light, cool meals during work shifts and save heavy meals until after the shift is over
- Do not skip meals: food helps replace electrolytes when sweating
- Take breaks as needed
- Do not consume alcohol prior to working in a hot environment

APPENDIX D

Personal Protective Equipment (PPE) Management Program

PERSONAL PROTECTIVE EQUIPMENT
MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY DIRECTOR	:	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	:	**01/2019**
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1. PURPOSE

Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C., and Remedial Engineering (collectively, “Roux”), have instituted the following program to establish guidelines for the selection of personal protective equipment (PPE) for use by Roux personnel performing field activities in hazardous environments. PPE is not meant to be a substitute for engineering, work practice, and/or administrative controls, but PPE should be used in conjunction with these controls to protect employees in the workplace. Clothing, body coverings, and other accessories designed to prevent worker exposure to workplace hazards are all types of PPE. To ensure adequate PPE,, employee-owned PPE is assessed on a case-by-case basis to ensure its adequacy, maintenance, and sanitation.

2. SCOPE AND APPLICABILITY

These guidelines apply to all PPE selection decisions to implement the Roux program. The foundations for this program are the numerous Occupational Health and Safety Administration (OSHA) standards related to PPE cited in 29 CFR 1910 Subpart I, 29 CFR 1926 Subpart E, and the hazardous environment work employee protection requirements under the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standard at 29 CFR 1910.120 and 1926.65 as well as California OSHA (Cal/OSHA) Title 8 5192 HAZWOPER. To ensure hazard assessments are documented, the levels of protection, types of protection, and tasks requiring protection are covered in site-specific Health and Safety Plans (HASPs) and Job Safety Analyses (JSAs).

3. PROCEDURES

Due to the varied nature of site activities and the different potential hazards associated with different sites, several aspects must be considered when selecting PPE. The following text describes PPE selection logic and provides guidelines and requirements for the appropriate selection and use of PPE.

3.1 Introduction

To harm the body, chemicals must first gain entrance. The intact skin and respiratory tract are usually the first body tissues that are exposed to chemical contaminants. These tissues provide barriers to some chemicals but, in many cases, are damaged themselves or are highly permeable by certain chemical compounds. PPE, therefore, is used to minimize or eliminate chemical compounds from coming into contact with these first barrier tissues.

Proper PPE selection is essential in preventing exposure. The Project Manager (PM) or health and safety personnel making the selection will have to consider several factors. The level of protection, type, and kind of equipment selected depends on the hazardous conditions. In some cases, additional selection factors include cost, availability, compatibility with other equipment, and performance. All these factors must be accurately assessed before work can be safely carried out.

3.1.1 Training

Training shall be provided to all field-based employees on how to properly use and care for PPE. Training shall include, but not be limited to, the initial 40-hour HAZWOPER training, annual 8-hour HAZWOPER refresher training, and site-specific PPE training. The training program includes when PPE is necessary, what types of PPE are required; how to don, doff, adjust, and wear PPE; the limitations of PPE; the proper care, maintenance, useful life, signs of PPE failure and emergency procedures to follow in the event of PPE failure and disposal of PPE. In addition, retraining shall be conducted when workplace changes require a change in PPE when an employee demonstrates a lack of knowledge or improper use of PPE is identified.

3.2 Types of PPE

The type and selection of PPE must meet certain general criteria and requirements as required under OSHA 29 CFR 1910.132 (General Industry) and 1926.95 (Construction). In addition to these general requirements, specific requirements and specifications exist for some types of PPE that form the basis of the protective clothing scheme. All manufacturer's recommendations for PPE care and use shall be followed. All PPE shall be maintained in a sanitary and reliable condition. Additionally, proper fit and size shall be evaluated to ensure adequate employee protection. Should PPE become defective, it shall be immediately removed from service and discarded.

The following is a list of the common types of specific PPE and the specific requirements for the PPE type, where applicable:

1. Hard Hats - Regulated by 29 CFR 1910.135 and 1926.100; and specified in ANSI Z89.1.
2. Face Shields and Safety Glasses - Regulated by 29 CFR 1910.133 and 1926.102; and specified in ANSI Z87.1.
3. Respiratory Protection - Regulated by 29 CFR 1910.134 and 1926.103.
4. Hand Protection - Regulated by 29 CFR 1910.138
5. Foot Protection - Regulated by 29 CFR 1910.136 and 1926.96; and specified in ANSI Z41.1.
6. Protective Clothing (e.g., fully encapsulated suits, aprons) - Specified in NFPA 1991/1992/1994.

3.2.1 PPE Inspection, Cleaning Maintenance, and Storage

The Office Health and Safety Manager (OHSM) or their designee is responsible for procuring PPE, in accordance with this management program. Single-use/disposable PPE should be purchased and used whenever practicable.

3.2.1.1 PPE Inspection

Roux employees must inspect PPE regularly, before and after each use, to check for defects and damage. Garments and other PPE in central storage must be inspected at least annually or as recommended by the manufacturer by the OHSM, Equipment Manager, and/or their designee. Defective or damaged equipment must be tagged as out-of-service, immediately removed from the work site, and discarded.

3.2.1.2 PPE Cleaning and Maintenance

All Roux employees are responsible for routine cleaning of their assigned PPE. Decontamination of PPE is addressed within Roux's Site Control and Decontamination Program as specified within site-specific health and safety plans. As appropriate, Roux employees should be issued single-use PPE when practicable to minimize the requirement for decontamination. When performing routine cleaning of reusable PPE:

- Always follow the manufacturer's recommendations to avoid damaging the PPE. For example, some cleaning solutions compromise the integrity of protective helmets shell.
- Clean and maintain PPE according to the manufacturer's recommendations. Before being re-issued, PPE should be thoroughly sanitized.
- Disassemble, wash and sanitize reusable respirators after each use. For more information, refer to Roux's Respiratory Protection Management Program.

Employees are not authorized to repair PPE without prior approval from the Health and Safety Department. Reusable PPE may require maintenance by the manufacturer to maintain integrity and certification. Many

manufacturers specify which repairs, if performed by the end-user, will void the product warranty. Therefore, Roux employees are not authorized to perform such maintenance or repairs.

3.2.1.3 PPE Storage

Certain equipment failures can be directly attributed to improper storage. The OHSM or Equipment Manager (or another designated person) is responsible for implementing procedures for appropriate PPE storage, for equipment that is centrally stored. Both central storage and dedicated PPE provided to employees should be stored using the following:

- Store goggles and safety glasses in protective cases.
- Store PPE (such as helmets, boots, etc.) in clean, dust-proof containers or bags out of direct sunlight.
- PPE should ideally be stored under climate-controlled conditions. PPE, stocked gear bags, and/or go-kits should not be stored in hot, cold, or other extreme environmental conditions, and they should not be stored in vehicles (government-owned or rentals) for even short periods of time. Do not store helmets on the rear window shelf of a vehicle.
- Store different kinds of clothing and gloves separately to prevent errors in selection.
- Hang or fold protective clothing in accordance with manufacturers' recommendations.
- Never store contaminated PPE near new protective clothing or street clothing. Potentially contaminated, reusable clothing must be stored (usually bagged) away from new PPE in a well-ventilated area with good airflow around each item until the garment is decontaminated or disposed.
- See Roux's Respiratory Protection Management Program for detailed respirator storage procedures.

3.3 Fitting, Donning, and Doffing PPE

Roux shall provide appropriately sized PPE for Roux employees. Improper fitting such as tight-fitting garments, can tear, especially at the knees, crotch, shoulders, back, and elbows due to movement. Protective clothing that is too large can easily snag and/or limit a user's dexterity. The Roux PM shall ensure site/project-specific PPE is kept in a sufficient stock of appropriately sized PPE (e.g., Level C ensembles). The OHSM, Equipment Manager, and/or their designee shall maintain a sufficient stock of appropriately sized PPE in central storage locations.

The Site Supervisor (SS)/Site Health and Safety Officer (SHSO) is responsible for ensuring that site-specific procedures for donning and doffing PPE are incorporated into site-specific HASPs. Donning and doffing procedures may differ depending on the type of PPE and clothing (e.g., Level D, Modified Level D, Level C) utilized. Figures 1-4, provide examples of procedures that can be used to don and doff Levels A through D and are provided as a reference. Site-specific conditions may warrant adjustments to such procedures. Consult the CHSD for additional information.

Site-specific donning and doffing procedures should include using an assistant where necessary. Donning and doffing certain types of PPE without assistance could risk failure or damage. Care must be taken to prevent the spread of contaminants on the PPE. Decontamination procedures should limit the potential for cross-contamination and may include gross decontamination of outer boots, gloves, and suits as necessary to prevent contaminants from tracking into the contamination reduction zone (CRZ) and clean zone(s).

3.4 Controlling Hazards Associated with PPE Use

PPE use can pose potential health and safety hazards, which range from minor discomfort to life-threatening height stroke. The magnitude of the potential hazard can vary and will depend on various factors, including an individual's fitness level, the type of PPE worn, the work demands, individual work practices, duration of work, and environmental conditions. The use of PPE can also lead to reduced efficiency and work performance.

Among hazards associated with PPE use, heat stress emerges as a prevalent and significant hazard. Particularly, the use of substantial and/or impermeable attire, such as heavy coveralls, Tyvek suits, splash suits, or Level A or B suits, alongside strenuous work, amplifies the risk of heat stress. Regular monitoring for indications of heat stress is imperative for workers operating in such conditions. Roux's Heat Illness Prevention Program lays out requirements for signs and symptoms as well as preventative measures to mitigate the potential for heat illness. In addition, cold environments can pose adverse risk, such examples include use of non-insulated steel-toe safety shoes in frigid conditions which has the potential to increase the risk of frostbite, while safety gloves worn for chemical protection may inadequately insulate hands from the cold.

It is the responsibility of Project Teams to integrate site-specific protocols to manage PPE hazards into such site-specific HASPs. These protocols can encompass considerations like work/rest ratios, crew rotations, and other accommodations for exceptionally demanding conditions.

The following measures are recommended for controlling hazards posed by PPE use:

- Prioritize through the hierarchy of controls with a focus on elimination, substitution, engineering, work practice and administrative control implementation rather than sole reliance on PPE. PPE shall be considered the last line of worker protection.
- Workers should maintain physical fitness to be able to withstand the potential physical strain of PPE use. A physically fit individual will endure less physiological strain, manifesting in a lower heart rate, reduced body temperature (indicating diminished retained body heat), more effective sweating, slightly lower oxygen consumption, and carbon dioxide production. Furthermore, acclimatization to extreme environmental conditions, such as high temperatures, can influence work performance and physical capacity.
- Understand the symptoms of PPE failure. Workers encountering any of these symptoms while donning PPE should promptly notify their onsite SHSO and/or SS:
    - Perception of odors when wearing a respirator
    - Skin irritation
    - Acute discomfort
    - Difficulty breathing
    - Unusual fatigue
    - Dizziness
    - Inability to see, hear, or speak clearly
    - Uncomfortable restriction of movement
    - Rapid pulse, nausea, or chest pain
- Implement a buddy system. Especially in situations where there is a need for increased level of protection (e.g., Level A-C) workers should work in pairs or teams, and are instructed to monitor the integrity of their team/partners gear and remain alert for symptoms of PPE failure.

3.5 PPE Selection

For site-specific work, the Project Manager, in consultation with the Health and Safety Department, has overall responsibility for coordinating the selection and distribution of PPE to field staff and for ensuring that the selected PPE is appropriate for the site-specific hazards. Generally speaking, Roux employees are not engaged in emergency response or perform work at uncontrolled hazardous waste sites; if this is the case, the CHSD shall be made aware of the work and consult with the Project Team on appropriate PPE selection. Most work falls under environmental sampling of low-concentration contaminants in water/soil/perimeter air. Therefore work is carried out in Level D PPE. Upgrades would be based on more information as it becomes available. The United States Environmental Protection Agency (EPA) has created Guidelines for PPE Ensemble Selection to assist workers in selecting PPE ensembles for specific activities and tasks and determining which ensembles and air monitoring equipment should be used to address specific chemicals. Guidelines to Ensembles for Specific Activities/Tasks Where Chemical Exposure is Possible is provided as a reference in Appendix A.

3.6 Protective Clothing Selection Criteria

3.6.1 Chemicals Present

The most important factor in selecting PPE is the determination of what chemicals the employee may be exposed to. The number of chemicals on field investigations may range from a few to several hundred. The exact chemicals or group of chemicals present at the site (certain groups tend to require similar protection) can be determined by collecting and analyzing air, soil, water, or other site media samples. When data are lacking, research into the hazardous materials used or stored at the site can be used to infer potential chemical exposures on the site.

The most appropriate clothing shall be selected once the known or suspected chemicals have been identified and considered based on the type of work to be performed.

Protective garments are made of several different substances for protection against specific chemicals. There is no universal protective material. All will decompose, permeate, or otherwise fail to protect under given circumstances. Fortunately, most manufacturers make guides to using their products (i.e., Dupont's Tyvek™ Permeation Guide). These guides are usually for gloves and coveralls and typically provide information regarding chemical degradation rates (failure of the material to maintain structural integrity when in contact with the chemical) and may provide information on the permeation rate (whether or not the material allows the chemical to pass through). When permeation tables are available, they shall be used with degradation tables to determine the most appropriate protective material for the specific chemical hazard(s).

During most site work, chemicals are usually in mixed combinations, and the protective materials are not in continuous contact with pure chemicals for long periods; therefore, the selected material may be adequate for the particular chemical of most concern and the type of work being performed, yet not the "best" protecting material for all site chemicals and activities. Selection shall depend upon the most hazardous chemicals based on their hazards and concentrations. Sometimes, layering (i.e., using several layers of protective materials) affords the best protection.

3.6.2 Concentration of the Chemical(s)

One of the major criteria for selecting protective material is the concentration of the chemical(s) in air, liquid, and solid state. Airborne and liquid chemical concentrations should be compared to the OSHA standards, American Conference of Governmental Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH) guidelines to determine the level of skin or other absorptive

surface (e.g., eyes) protection needed. While these standards are not designed specifically for skin exposed directly to the liquid, they may provide skin designations indicative of chemicals known to have significant skin or dermal absorption effects. For example, airborne levels of PCBs on-site may be low because they are not very volatile, so the inhalation hazard may be minimal; however, PCB-containing liquid coming in direct contact with the skin may cause overexposure. Thus, PCBs have been assigned a skin designation in the OSHA and ACGIH exposure limit tables.

3.6.3 Physical State

The characteristics of a chemical may range from nontoxic to highly toxic, depending on its physical state. Inorganic lead in soil would not be considered toxic to site personnel unless it became airborne since it is generally not absorbed through the intact skin. However, organic lead in a liquid could be readily absorbed through the skin. Soil is frequently contaminated with hazardous materials. Concentrations will vary from a few parts per million to nearly one hundred percent by volume. The degree of hazard depends on the type of soil and concentration of the chemical. Generally speaking, “dry” soils that have not become airborne do not pose a hazard to site personnel if they take minimal precautions, such as wearing lightweight gloves.

3.6.4 Length of Exposure

The length of time a material is exposed to a chemical increases the probability of a breakthrough. Determinations of actual breakthrough times for short-term exposures indicate that several materials that would be considered inadequate under long-term exposures can be used. Different materials that would be considered inadequate under long-term exposures can be used. It should be kept in mind that during the manufacturer’s permeation testing, a pure (100% composition) liquid is usually placed in direct contact with the material, producing a worst-case situation.

3.6.5 Abrasion

When selecting protective clothing, the job the employee is engaged in must be taken into consideration. Persons moving drums or performing other manual tasks may require added protection for their hands, lower chest, and thighs. Using leather gloves and a heavy apron over other normal protective clothing will help prevent damage to the normal PPE and thus reduce worker exposures.

3.6.6 Dexterity

Although protection from skin and inhalation hazards is the primary concern when selecting PPE, the ability to perform the assigned task must be maintained. For example, personnel cannot be expected to perform work that requires fine dexterity if they must wear thick gloves. Therefore, the PPE selection process must consider the task being performed and provide PPE alternatives or techniques that maintain dexterity while still protecting the worker (e.g., wearing tight latex gloves over more bulky hand protection to increase dexterity).

3.6.7 Ability to Decontaminate

If disposable clothing cannot be used, the ability to decontaminate the materials selected must be taken into consideration. Once a chemical makes contact with the material, the PPE must be cleaned before reusing it. If the chemical has completely permeated the material, the clothing cannot be adequately decontaminated, and the material should be discarded.

3.6.8 Climactic Conditions

The human body works best with few restraints from clothing. Protective clothing adds a body burden by increasing weight, restricting movement, and preventing the body's natural cooling process. In severe situations, a modified work program must be used.

Some materials act differently when they are very hot and very cold. For example, PVC becomes almost brittle in frigid temperatures. If there are any questions about the stability of the protective materials under different conditions, the manufacturer should be contacted before using PPE in the field.

3.6.9 Work Load

Like climactic conditions, the type of work activity may affect work duration and personnel's ability to perform certain tasks. Similarly, the amount of protective materials a person wears will affect their ability to perform certain tasks. For example, a person in a total encapsulating suit, even at 72˚F, cannot work for more than a short period of time without requiring a break.

The work schedule should be adjusted to maintain the health of the employees. Modified work practices may include allowing more time for individual job tasks and implementing work/rest cycles per NIOSH and ACGIH thermal stress recommendations. Special consideration should be given to the selection of clothing that protects the worker and adds the least burden when personnel are required to perform strenuous tasks. Excessive bodily stress frequently represents the most significant hazard encountered during fieldwork.

3.6.10 Types of Protective Materials

1. Cellulose or Paper: suitable for nuisance dust and coarse fibers.
2. Natural and Synthetic Fibers
    a. Tyvek™: suitable small-sized hazardous particles, including lead, asbestos, and mold.
    b. Tychem™: is suitable for a variety of hazards, from light liquid splashes to heavy exposures to industrial chemicals and agents.
    c. Nomex™: is suitable for flame-resistance, radiation resistance, acids, alkalis, fluorocarbon refrigerants (CFCs), and non-polar solvents.
3. Elastomers
    a. Polyethylene: suitable for polar substances and solvents.
    b. Saran™ : suitable for flame-resistance, acids, alkalis, oils, and organic solvents.
    c. Polyvinyl Chloride (PVC): suitable for alcohols, oils, inorganic acids, alkalis, and salts.
    d. Neoprene: suitable for polar/non-polar substances, petroleum mixtures, and ≤ 200 F heat resistance.
    e. Butyl Rubber: suitable for polar substances and solvents.
    f. Viton: suitable for non-polar substances, petroleum mixtures, and ≤ 200 F heat resistance.
    g. Nitrile: suitable for polar/non-polar substances and petroleum mixtures.

3.7 Protection Levels

3.7.1 Level A Protection

Level A protection (a fully encapsulated suit) is used when skin hazards exist or when no known data positively rule out skin and other absorption hazards. Per the Roux Respiratory Protection Management Program, Roux employees are not authorized to enter an IDLH atmosphere; therefore, the program does

not allow supplied air respirators (SARs) or self-contained breathing apparatus (SCBA). At no time will Level A work be performed without the consent of the CHSD and OM.

The following conditions warrant the use of Level A protection:

- Hazardous substances have been identified and require the highest level of protection for skin, eyes, and the respiratory system;
- The atmosphere contains less than 19.5% oxygen or an atmosphere immediately dangerous to life and health (IDLH) that have not been ruled out;
- Site operations involve a high potential for splash, skin immersion, or exposure to suspected skin hazards;
- Direct-reading instruments indicate high levels of unidentified but potentially hazardous vapors or gases in the air (e.g., Total atmospheric readings on the Photoionization Detector (PID), Flame Ionization Detector (FID), and similar instruments indicate 500 to 1,000 ppm of unidentified substances); and
- Direct-reading instruments are not available to test the air and suspected highly toxic substances may be present.

It may be necessary to base the decision to use Level A protection on indirect evidence. Other conditions that may indicate the need for Level A protection include:

- Confined spaces;
- Sites containing known skin hazards;
- Sites with no established history to rule out skin and other absorption hazards;
- Site exhibiting signs of acute mammalian toxicity (e.g., dead animals, illnesses associated with past entry into the site by humans);
- Sites at which sealed drums of unknown materials must be opened;
- Visible indicators such as leaking containers or smoking chemical fires; and
- Extremely hazardous substances (e.g., cyanide compounds, concentrated pesticides, Department of Transportation Poison "A" materials, suspected carcinogens, and infectious substances) are known or suspected to be present, and skin contact is possible.

Table 1: Recommended Level A Ensemble Components

Component	Type	Manufacturer / Recommended Material	Notes
Respirator	Positive-pressure full-facepiece SCBA or positive-pressure supplied-air respirator with escape SCBA[1]	NIOSH approved respirator	See Roux's Respiratory Protection Program. Roux employees are not approved to utilize Supplied Air (SAR) and/or Self-contained breathing apparatus (SCBA).
Suit	Totally encapsulated chemical- and vapor-protective suit	DuPont® Tychem™ or Responder CSM™	Other material types may be substituted based on known contaminants.
Inner Gloves	Lightweight	Nitrile, Neoprene, PVC, or Viton®	Other material types may be substituted based on known contaminants.
Outer Gloves	An integral part of the suit	See Appendix A for additional information	Confirm chemical performance rating for suspected contaminants. Glove material may have different performance ratings than suit material. All fully-encapsulating suit materials must be compatible with substances involved.
Inner Boot	Integral Part of Suit	-	-
Outer Boot	HazMat boot[2]	–	Confirm chemical performance rating of outer boot for suspected contaminants. Provides slip/abrasion resistance.
Hard Hat	Standard[3]	-	-

[1] Must be NIOSH approved.
[2] Must meet NFPA 1991/NFPA 1994 requirements depending on the site hazard assessment.
[3] Must comply with the applicable ANSI standard.

3.7.2 Level B Protection

Level B protection is utilized when the highest level of respiratory protection is needed, but hazardous material exposure to the few unprotected areas of the body is unlikely. At no time will Level B work be performed by Roux personnel without the consent of the CHSD and OM.

The following conditions suggest a need for Level B protection:

- The type and atmospheric concentration of toxic substances have been identified, and they require the highest level of respiratory protection;

- IDLH atmospheres where the substance or concentration in the air does not present a severe skin hazard;
- The type and concentrations of toxic substances do not meet the selection criteria permitting the use of air-purifying respirators and
- It is highly unlikely that the work being done will generate high concentrations of vapors, gases, particulates, or splashes of materials that will affect personnel's skin.

Table 2: Recommended Level B Ensemble Components

Component	Type	Manufacturer / Recommended Material	Notes
Respirator	Positive-pressure full- facepiece SCBA or positive-pressure supplied-air respirator with escape SCBA[1]	NIOSH approved respirator	See Roux's Respiratory Protection Program. Roux employees are not approved to utilize Supplied Air (SAR) and/or Self-contained breathing apparatus (SCBA).
Suit	Chemical-resistant clothing (liquid-splash protective suit with integral boot and hood)[2]	DuPont® Tychem® CPF 3	Other material types may be substituted based on known contaminants.
Inner Gloves	Light/medium weight	Nitrile, Neoprene, PVC, Viton®, or PE/EVAL	Other material types may be substituted based on known contaminants.
Outer Gloves	Medium/heavy weight	Butyl MIL-G12223, Nitrile, Neoprene, PVC, Viton®, PE/EVAL, or heavy weight Nitrile or Neoprene	Confirm chemical performance rating. Other material types may be substituted based on known contaminants.
Inner Boot	Safety work boot	–	Other boot types may be substituted based on known contaminants and physical hazards. Puncture resistant shanks may be required.
Outer Boot	Heavy weight Latex booties or outer boots[2]	Latex booties are used to protect suit for light duty applications. NFPA-rated outer boots may be required based on anticipated site conditions and tasks.	Other outer boot coverings may be substituted based on known contaminants/anticipated tasks.
Hard Hat	Standard[3]	-	-

[1] Must be NIOSH approved.
[2] Must meet NFPA 1991/NFPA 1994 requirements depending on the site hazard assessment.
[3] Must comply with the applicable ANSI standard.

3.7.3 Level C Protection

Level C protection is utilized when skin and respiratory hazards are well defined, and the criteria for using negative pressure respirators have been fulfilled (i.e., known contaminants and contaminant concentrations, acceptable oxygen levels, approved filter/cartridge available, known cartridge service

life, etc.). Level C protection may require an emergency escape respirator during specific initial entry and site reconnaissance situations or when applicable after that.

Table 3: Recommended Level C Ensemble Components

Component	Type	Manufacturer / Recommended Material	Notes
Respirator	Full-face air-purifying respirator with appropriate cartridge[1]	NIOSH approved respirator	See Roux's Respiratory Protection Program for information about the brand, model, acceptable configurations, and specific care instructions for the standard issue respirator. Half-faced respirators may be donned if hazard assessment warrants.
Suit	Puncture/tear resistant suit material with boot and hood[2]	DuPont® Tychem® CPF 2/CPF 3 or Saranex	Other material types may be substituted based on known contaminants, if considered more appropriate.
Inner Gloves	Light weight	Nitrile, Neoprene	Other material types like Neoprene, PVC, Viton®, or PE/EVAL may be substituted based on known contaminants, if considered more appropriate.
Outer Gloves	Medium/heavy weight	Butyl, Nitrile, or other work glove	Confirm chemical performance rating. Other material types may be substituted based on known contaminants, if considered more appropriate.
Inner Boot	Safety work boot	–	Other boot types may be substituted based on known contaminants and physical hazards. Puncture resistant shanks may be required.
Outer Boot	Heavy weight Latex booties or outer boots[2]	Latex booties are used to protect suit for light duty applications. NFPA rated outer boots may be required based on anticipated site conditions and tasks.	Other outer boot coverings may be substituted based on known contaminants.
Hard Hat	Standard[3]	-	-
Eye Protection	Safety glasses/goggles[3,4]	-	-

1 Must be NIOSH approved.
2 Must meet NFPA 1991/NFPA 1994 requirements depending on the site hazard assessment.
3 Must comply with the applicable ANSI standard.
4 In the case a ½ face respirator is worn eye protection is required.

3.7.4 Level D Protection

Level D is the basic work uniform. Level D is worn when the atmosphere contains no known hazard. Work functions preclude splashes, immersion, potential for inhalation, or direct contact with hazard chemicals. For most Roux field jobs Level D is the standard minimum level of protection worn.

Table 4: Recommended Level D Ensemble Components

Component	Type	Manufacturer / Recommended Material	Notes
Respirator	None	-	-
Suit	Coveralls, street clothes, or disposable Tyvek suit	–	Other types may be substituted as appropriate.
Inner Gloves	N/A		
Outer Gloves	As appropriate for physical hazards and for comfort	–	-
Boot	Safety work boot	–	Roux's standard safety boot is 6", steel/composite safety toe, and electrical hazard (EH) rated.
Outer Boot Covering	As appropriate	–	–
Hard Hat	Standard[3]	-	-
Eye Protection	Safety glasses/goggles[3]	-	-
High Visibility Clothing	High Visibility Vest /Jacket[3]	-	ANSI Class 2 Safety Vests/Jackets are the standard. Class 3 Safety vests/jackets shall be worn in worksites with 50+ MPH traffic.
Hearing Protection	Ear muffs/plugs	-	Workers exposed to excessive noise shall don hearing protection. Refer to Roux's Hearing Conservation Program for more information.

[1] Must be NIOSH approved.
[2] Must meet NFPA 1991/NFPA 1994 requirements depending on the site hazard assessment.
[3] Must comply with the applicable ANSI standard.

3.7.5 Level E Protection

Level E protection is used when radioactivity above 10 millirems per hour (mrems/hr) is detected at the site. Personal protective equipment for Level E includes:

- Coveralls;
- Air purifying respirator (i.e., P100 or equivalent);
- Time limits on exposure;
- Appropriate dermal protection for the type of radiation present, and

- Radiation dosimetry and ambient monitoring.

3.7.6 Additional Considerations

Fieldwork will contain a variety of situations due to chemicals in various concentrations and combinations. These situations may be partially ameliorated by following the work practices listed below:

1. Foot protection is needed on every site. If the ground to be worked on is contaminated with liquid, and it is necessary to walk in the chemicals, some sort of protective shoe coverings or "booties" can be worn over the boots. Shoe coverings should be designed with soles to help prevent slips. Using disposable shoe coverings when contacting liquid contamination can on and reduce overall decontamination requirements. If non-liquids are to be encountered, a Tyvek™ bootie could be used. The advantage of booties is questionable if the ground contains any sharp objects. Boots should be worn with either cotton or wool socks to help absorb perspiration.
2. If the site requires hard hats, chin straps should be used if a person is stooping over where his/her hat may fall off. Respirator straps should not be placed over the hard hats, as this will affect the respirator's fit.

   Some types of protective materials conduct heat and cold readily. In cold conditions, natural material clothing should be worn under protective clothing. Protective clothing should be removed before allowing a person "to get warm." Applying heat, such as with a space heater, to the outside of the protective clothing may drive contaminant permeation. In hot weather, under clothing will absorb sweat. It is recommended that workers use all cotton undergarments.
3. Body protection should be worn and taped to prevent anything from running into the top of the boot. Gloves should be worn and taped to prevent substances from entering the top of the glove. Duct tape is preferred, but masking tape can be used. When aprons are used, they should be taped across the back for added protection. However, this should be done so that the person has mobility.
4. Atmospheric conditions such as precipitation, temperature, wind direction, humidity, wind velocity, and pressure determine the behavior of contaminants in air or the potential for volatile materials to become airborne. These parameters should be considered in determining the need for and the level of protection.
5. A program must be established for periodic air monitoring during site operations. Without an air monitoring program, any changes to air quality would go undetected and might jeopardize on-site personnel. Monitoring can be done with various types of air pumps and filtering devices, followed by laboratory analysis of the filtration media, personnel dosimeters, and periodic walk-throughs by personnel carrying real-time direct-reading survey instruments.
6. For operations in the exclusion zone, different levels of protection may be selected, and various types of chemical-resistant clothing may be worn. This selection should be based on the job function, reason for being in the area, and the potential for skin contact with, or inhalation of, the chemicals present.
7. Escape masks must be readily available when levels of respiratory protection do not include an SCBA and the possibility of an IDLH atmosphere exists. The use and placement of escape masks should be made on a case-by-case basis. Escape masks should be strategically located at the site in areas with a higher potential for vapors, gases, or particulates.

3.8 Decontamination of PPE

Roux prefers the use of single-use PPE to minimize the requirement for significant decontamination. The following procedures shall be considered should a field project require the need for decontamination of PPE. Roux has also developed a Site Control and Decontamination Management Program.

3.8.1 Site-Specific Decontamination Plans

The Project Manager (or another authorized individual) is responsible for formulating the site-specific PPE decontamination plan as an integral part of the Health and Safety Plan (HASP). The SHSO/SS' responsibilities include ensuring the plan's implementation and adapting it as site conditions evolve. Refer to Roux's Site Control and Decontamination Management program for additional requirements.

The decontamination plan, often created in conjunction with PPE selection, must be established prior to workers entering potentially contaminated areas. The plan should address the following key aspects:

- Decontamination Hazard Evaluation and Risk Assessment: Assessing risks associated with decontamination processes.
- PPE for Decontamination Line Assistants: Specifying appropriate PPE for personnel involved in decontamination.
- Roles and Responsibilities During Decontamination: Defining tasks and duties during the decontamination process.
- Layout and Quantity of Decontamination Stations: Determining the number and arrangement of decontamination stations, along with the designated PPE decontamination procedures at each station.
- Decontamination Equipment: Identifying the necessary equipment for effective decontamination.
- Decontamination Methods: Describing the methods and protocols for decontaminating personnel and equipment.
- Preventing Contamination of Clean Areas: Outlining procedures to prevent contamination of uncontaminated zones.
- Minimizing Contact with Contaminants During CPC Removal: Providing guidelines to reduce wearer exposure during the removal of Chemical Protective Clothing (CPC).
- Disposal Procedures for Inadequately Decontaminated Clothing and Equipment: Ensuring proper disposal practices for items that have not been adequately decontaminated.

The initial decontamination plan, which is developed in conjunction with the initial site hazard assessment, should be based on worst-case assumptions about the extent and type of contamination.

3.8.2 Emergency Decontamination of PPE

The designated SHSO/SS (or another authorized individual) assumes responsibility for addressing emergency decontamination within the site-specific Health and Safety Plan (HASP). Emergency decontamination may become necessary due to events such as fires, explosions, sudden violent storms, or medical emergencies. The emergency decontamination plan must clearly delineate emergency egress routes, as well as procedures for both decontamination and egress.

Some key points to consider regarding emergency decontamination.

- Immediate Notification: The SHSO/SS (or their designated counterpart) must be promptly informed of any circumstances requiring emergency decontamination. Additionally, they are accountable for tracking all personnel during the process.
- Urgent Medical Treatment: If urgent medical attention is necessary, decontamination of PPE may be delayed until the victim's condition stabilizes.
- Balancing Priorities: When feasible, decontamination should occur without hindering essential first aid. However, if a worker is exposed to an extremely toxic or corrosive substance, immediate decontamination is crucial to prevent severe injury or fatality.

- Heat-Related Illness: In cases of heat-related illness, protective clothing must be promptly removed (refer to Roux's Heat Illness Prevention Program).

Emergency Facilities:

- For workers potentially exposed to corrosive materials, quick drenching or flushing facilities must be provided in accordance with 29 CFR 1910.151(c) and 1926.50(g).
- Similarly, if workers face other hazards (such as splash or dust) that could harm the eyes or body, readily accessible wash stations are essential. These stations should be properly located and maintained, including regular water changes, as per the manufacturer's instructions.

3.8.3 Protection of Decontamination Line Assistants

Should work require a decontamination corridor the following shall be used as guidance. The SHSO/SS (or other designated person) must for ensuring that decontamination line assistants receive appropriate PPE and addressing their protection within the site-specific HASP. Key zones—namely, the Exclusion Zone (EZ), Contamination Reduction Zone (CRZ), and Clean Support Zone—must be clearly marked both in the field and within the site-specific HASP. The following should be considered when preparing for protection of decontamination line assistants.

1. Task Hazard Analysis: A thorough analysis must be conducted for line assistants to determine the optimal PPE level required. Factors influencing this decision include:
    - Expected or Visible Contamination on Responders
    - Type of Contaminant and associated respiratory and skin hazards
    - Total Vapor/Gas Concentrations in the CRZ
    - Presence of Particulates and specific inorganic or organic vapors in the CRZ
    - Results of Wipe Tests (refer to Section 5.4)
    - Slope and Configuration of the CRZ
2. PPE Levels: Depending on the situation:
    - Line assistants may need to wear the same PPE level as workers in the EZ.
    - Alternatively, line assistants may be adequately protected by using PPE one level lower (e.g., wearing Level C protection while decontaminating workers who are wearing Level B)."

3.8.4 Procedures to Minimize PPE Contamination

Proper work practices and procedures should be implemented at sites to minimize the potential for contact with chemicals of concern while onsite. The following guidance should be considered when developing site-specific procedures:

- Opt for single-use Personal Protective Equipment (PPE) when feasible to minimize decontamination needs.
- Ensure complete sealing of PPE closures and interfaces, including pockets, zippers, and other potential openings.
- Position gloves and boots underneath the sleeves and pant legs of outerwear to reduce exposure.
- Place hoods outside the collar if they are not already attached.
- Utilize disposable outerwear and equipment when suitable to facilitate easy disposal and reduce decontamination efforts.
- Secure all junctions with tape to block contaminants from entering gloves, boots, jackets, and suits.

- Adopt work practices that limit contact with hazardous substances, such as avoiding unnecessary exposure.
- Employ remote techniques for sampling, handling, and opening containers, like using drum grapples and pneumatic impact wrenches.
- Store monitoring and sampling devices in bags designed with openings for sample ports and sensors.
- Cover contaminant sources with plastic sheeting or overpacks to shield PPE from contamination.

3.8.5 PPE Disposal

The PM, in coordination with the field team, shall ensure the safe disposal of all wastes generated from PPE use. PPE must be placed in appropriate containers, labeled, and prepared for disposal separately from other forms of waste. Refer to Roux's General Waste Corporate Management Program for further guidance.

APPENDIX A
EPA's Emergency Responder Health and Safety Manual

APPENDIX E

Subsurface Utility Clearance Management Program

SUBSURFACE UTILITY CLEARANCE MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY DIRECTOR	**:**	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	**:**	**01/2019**
REVIEW DATE	**:**	**03/2025**
REVISION NUMBER	**:**	**5**

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APPENDICES

Appendix A – Roux Subsurface Utility Clearance Checklist/ Utility Verification/Site Walkthrough Record

Appendix B – Private Utility Technology Applications and Considerations

1. PURPOSE

Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C., and Remedial Engineering (collectively, "Roux"), have instituted the following program for completing proper utility mark-outs and for conducting subsurface clearance activities. This establishes a method to ensure, to the greatest extent possible, that utilities have been identified and contact and/or damage to underground utilities and other subsurface structures will be avoided. For the purpose of this program, a structure is defined as any underground feature that may present a potential source(s) of energy, such as, but not limited to, utility vaults, bunkers, piping, electrical boxes, wires, conduits, culverts, utility lines, underground tanks, and ducts.

2. SCOPE AND APPLICABILITY

The Subsurface Utility Clearance Management Program applies to all Roux employees, as well as their contractors and subcontractors. Employees are expected to follow this program for all intrusive work involving Roux or other personnel (e.g., contractors, subcontractors) working for Roux, unless the client's requirements are more stringent. Intrusive work activities can include, but are not limited to, digging or scraping the ground surface, including, but not limited to, excavation; test pitting or trenching; soil vapor sampling or the installation of soil borings, soil vapor monitoring points and wells, or monitoring wells; and drilling within concrete slabs on grade.

Deviation from the program, regardless of the specific work activity or location, must be pre-approved based on the client's site knowledge, experience, site conditions, and additional documentation on the site. Any exceptions shall be documented through the Roux Subsurface Utility Clearance Variance Form, located within the Roux Health & Safety Online Application or via OKTA. Approval is required from the Project Principal (PP) and the Operations Manager (OM), in consultation with the Office Health and Safety Manager (OHSM) or Corporate Health and Safety Director (CHSD), prior to mobilization. Depending on the work location, more stringent federal, state, local, or client requirements may apply. It is the responsibility of the Project Team to identify such requirements prior to mobilization.

3. PROCEDURES

3.1 Before Intrusive Activities/Job Planning Process

Prior to intrusive work at a site, the Project Manager (PM) shall ensure that the notification of the State One Call or equivalent service (Nationwide-811) is completed a minimum of 48-72 hours (One-Call State Law Directory) before intrusive work activities (this timeline excludes Saturdays, Sundays, Legal Holidays and 811 observed holidays). This notification is required by law for all states. State-specific or local laws related to utility location may vary. The project team is responsible for understanding requirements that may affect their work site.

Obtain, review, and field verify relevant historical site data that may include: as-builts/site plans; easement/right-of-way information; historical aerial photos/development plans; local/state permitting records; previous site investigation/boring logs; and/or interviews with site representative/client. Interviews with site or client personnel should ask the following:

- Employee(s) Name and Relationship with the site;
- Types of utilities, including structure and location of utilities on-site;
- Depth of known utilities; and
- Any other relevant information as it pertains to the site.

Prior to intrusive work activities, information pertaining to the site should be included in Roux's Subsurface Utility Clearance Checklist and Utility Verification/Site Walkthrough forms. This form is located within the Roux Health & Safety Online Application or through OKTA.

If there is the potential for unexploded ordnances or munitions, consultation with your OM and CHSD is required prior to site operations.

3.1.1 Project Kick-Off Meeting

During the project kick-off meeting for intrusive activities, the PM will review the Roux Subsurface Utility Clearance Checklist, Utility Verification / Site Walkthrough Record (Appendix A) and the below bullet points with the project field team:

- Confirm that the State One Call or equivalent is received and that the ticket number is confirmed, reviewed, and valid for the time of work. If intrusive work activities are not conducted during this valid time period, the One Call ticket must be renewed, and the site must be remarked;
- Review the work scope to be performed with the site owner/tenant to determine if it may impact any utilities;
- Determine the need for utility owner companies to be contacted or to have their representatives on site;
- Where mark-outs terminate at the property boundary, consider the use of private utility locating / (e.g., Radio Frequency Detection, Electromagnetic Induction), Ground Penetrating Radar (GPR) , and other applicable geophysical inspection services. The use of private utility locating firms, however, does not eliminate the legal requirement for the subcontractor (e.g., driller, excavation firm) to submit a request for Public Utility Mark-outs. Also, the information provided by the service may be inaccurate and unable to locate subsurface utilities and structures in urban areas, landfills, urban fill areas, below-reinforced slabs, etc. They should not be relied upon as the only means of performing utility clearance;
    - A mark-out is defined as the process of contracting with a competent and qualified company to confirm the presence or absence of underground utilities and structures. This process will clearly mark out and delineate identified utilities so that intrusive work activities can be performed without causing disturbance or damage to the subsurface utilities and structures. After utility mark-outs are completed, soft Digging must completed prior to intrusive work. Section 3.4 Preferred Methods of Clearing the Subsurface (Pre-Clearing) outlines requirements for pre-clearing techniques in order of preference.
- Documented description of the dig site, which is included in the project's Health and Safety Plan (HASP), and one call report will be maintained in the field and distributed amongst Roux personnel, its contractors, and subcontractors; and
- Documentation of the actual placement of mark outs in the field shall be collected using dated pictures, videos, and/or sketches with distance from markings to fixed objects. All documentation shall be maintained within the project file.

3.2 Utility Mark Out

- Ensure the Mark-out / Stake-out Request Information Sheet (or one-call report) is complete and accurate for the site, including address and cross streets, and review for missing utilities. Ensure ticket life is still valid for work.
    - Note: Utility mark-out organizations do not have contracts with all utilities, and it is often necessary to contact certain utilities separately, such as the local water and sewer authorities, local transportation departments, and railroad operators. In the event the Project Teams

anticipate subsurface work will impact public utilities, railroad operations, or public roadways, coordination with the utility owners/operators is required.

- Have written confirmation prior to mobilizing to the site that the Project Team or Roux personnel performing the intrusive activity has correctly completed the mark-out notification process, including requesting mark-outs, waiting for mark-outs to be applied to ground surfaces at the site, and receiving written confirmation of findings (via fax or email) from utility operators for all known or suspected utilities in the proposed area of intrusive activity, and provided utility owner written confirmation to Roux personnel for review and project files documentation.
- Do not begin any intrusive activity until all utility mark-outs have been completed (i.e., Did all utilities mark-out the site?) and any unresolved mark-out issues are finalized. Perform a site walk to review the existing utilities and determine if the utility locators have located said utilities.

  (Note: The Tolerance Zone is defined as three feet from the outside edge of any subsurface structure.)
- For non-subscribing utility owners or if public one-call service is not available, perform due diligence and request further information regarding utility type, construction details, location, and burial depth directly from public service providers/utility owners. Request utility mark-out by each public service provider/utility owner as applicable. Confirm contact and response by each public utility owner on the Subsurface Utility Clearance Checklist.
- If utilizing a Private Mark out, ensure the contractor has a plan regarding what types of technology will be used based on Table 1 in Appendix B: Private Utility Technology Applications and Considerations. If possible, it is recommended that multiple technologies be used to sweep each location/work area. Use a tracer wire to locate the utility (when tracer wires are present). Record the results of the private utility mark-out on the Utility Verification/Site Walkthrough Record form.

3.3 Site Visit/Utility Walkthrough

Before mobilization with the subcontractor or during the pre-work safety tailgate with the subcontractor, perform a site walkthrough after utility mark-outs have been completed to determine whether additional potential hazards are present and look for visible signs of utilities that may be present. Outlined below are considerations regarding a site walk before intrusive activities. Before initiating any intrusive work, verify that the utilities marked on-site align with the information provided in the One Call response notification/ticket and with site plans and documents. If any discrepancies arise, address them promptly to ensure accuracy and do not start intrusive work until they are rectified.

- Identify overhead utilities that may impede equipment mobilization or work zones to ensure adequate Occupational Safety and Health Administration (OSHA) clearance distance(s), as specified within the site-specific Health and Safety Plan (HASP) and 29 CFR 1926.1408 Table A.

The presence of any of the following may indicate potential subsurface structures:

- Locations of buildings, equipment, and features like area lights, signs, sprinkler systems, phones, drains, natural gas meters, manholes, etc.;
- Warning tape, which is often a sign of underground services;
- Material like pea gravel, sand, or other non-native materials can indicate the presence of tanks or lines or any deviations from the established native soil or backfill conditions;
- Red concrete that is often used for electrical duct banks;
- Evidence of damaged utilities, such as piping materials, insulation, or odors present in the work area; and

- Other utilities, including fire hydrants, electrical transformers, pipeline markers, valve covers, steam lines, valve box covers, clean-outs, etc.

By observing the path between the main service line and the connection point (e.g., a utility meter at the exterior of the site building), it may be possible to determine the likely routing of on-site utilities. However, this method should not be relied upon solely, and proper risk mitigation strategies should be in place before proceeding with any ground disturbance activities. Look outside your work zone for other potential utilities that may cross through it.

For sites with potential underground storage tanks present (UST), the following guidance applies:

- Identify if the product piping is either rigid or flexible.
- Conduct a visual examination of the tank field, observation wells, dispensers, vent stacks, and UST fill points to determine their location.
- Locate and become familiar with the emergency shutoff button/switch, if present.
- Determine the orientation, arrangement, and location of the tanks, as well as their size and capacity, through the examination of visible features at grade, such as fill ports and extractor covers, and by consulting any available as-built drawings.

Before commencing any subsurface intrusive work, field staff should thoroughly address any discrepancies in utility company mark-outs or the absence of mark-outs.

3.3.1 Project Management - Field Personnel

Whenever possible, it is advisable to assign the same project personnel to both utility location and clearance tasks as well as intrusive activities. This continuity ensures that site knowledge and utility information gathered during the clearance phase remain up-to-date. Having this historical perspective helps minimize the risk potential of utility strikes.

In cases where maintaining the same personnel throughout the project is not feasible, a thorough knowledge transfer regarding site utilities, locations, clearance results, and proposed intrusive activities becomes essential. The PM must ensure that there is a successful handoff of information when there is a change in field personnel.

3.3.2 Utility Markings

The utility marking color code includes various uniform colors. The following APWA uniform color code (ANSI Z535.1) is provided below. While certain government agencies or large industrial facilities may use additional colors, Roux's policy is to consider any unlisted paint marking or pin flag color as a subsurface utility marking unless proven otherwise.

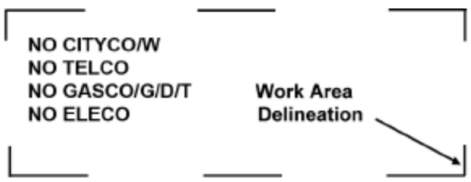
If utilities or subsurface anomalies are identified but their type or classification remains uncertain, it is advised to employ pink paint or pin flag (Temporary Survey Marking) for marking. Once the utility type is definitively established, the pink marks should be updated to represent the correct type of utility accurately.

White	Proposed Excavation
Pink	Temporary Survey Markings
Red	Electric Power Lines, Cables, Conduit, and Lighting Cables
Yellow	Gas, Oil, Steam, Petroleum, or Gaseous Materials
Orange	Communication, Alarm or Signal Lines, Cables, or Conduit
Blue	Potable Water
Purple	Reclaimed Water, Irrigation, and Slurry Lines
Green	Sewers and Drain Lines

Understanding the markings left by locators during the 811 process is crucial for avoiding utility-related issues. Typically, these markings are done when Roux staff members are not physically present on-site. To enhance understanding/accuracy, it is advisable for staff to be present during the 811 process or engage in conversations with locators, both public and private, while on-site. Additionally, utility marks must adhere to the proper standards outlined in the Uniform Color Code.

Common Abbreviations *(Source: Common Ground Alliance)*

Facility Identifier		Underground Construction Descriptions		Infrastructure Materials	
CH	Chemical	C	Conduit	ABS	Acrylonitrile - Butadiene - Styrene
E	Electric	CDR	Corridor	ACP	Asbestos Cement Pipe
FO	Fiber Optic	D	Distribution Facility	CL	Cast Iron
G	Gas	DB	Direct Buried	CMC	Cement Mortar Coated
LPG	Liquefied Petroleum	DE	Dead End	CML	Cement Mortar Lined
PP	Petroleum Products	JT	Joint Trench	CPP	Corrugated Plastic Pipe
RR	Railroad Signal	HP	High Pressure	CMP	Corrugated Metal Pipe
S	Sewer	HH	Hand Hole	CU	Copper
SD	Storm Drain	MH	Manhole	CWD	Creosote Wood Duct
SS	Storm Sewer	PB	Pull Box	HDPE	High Density Polyethylene
SL	Street Lighting	R	Radius	MTD	Multiple Tile Duct
STM	Steam	STR	Structure (vaults, junction inlets, lift station)	PLA	Plastic (conduit or pipe)
SP	Slurry System	T	Transmission Facility	RCB	Reinforced Concrete Box
TEL	Telephone			RCP	Reinforced Concrete Pipe
TS	Traffic Signal			RF	Reinforced Fiberglass
TV	Television			SCCP	Steel Cylinder Concrete Pipe
W	Water			STL	Steel
W	Reclaimed Water "Purple"			VCP	Vitrified Clay Pipe



3.4 Preferred Methods of Clearing the Subsurface (Pre-Clearing)

At least one of the methods listed below shall be carried out during pre-clearing activities. The Project Team is responsible for evaluating risks associated with the Scope of Work to determine which method is selected.

If none of the following pre-clearing activities are performed, a Subsurface Utility Clearance Variance must be submitted to the OM. This Subsurface Utility Clearance Variance must provide clear lines of evidence that there are no utilities present within the intrusive work zone. Examples include demolition permits of the site, utility closure documents indicating no live utilities on-site, as-builts, site history, etc.

The following approaches shall be considered and implemented based on the Scope of Work.

- ***Soft Digging***
  - This is the preferred method of utility clearance when clearing higher-risk utilities. Soil should be cleared through the use of a vacuum truck/equivalent, an accompanying air knife (preferred), or a water lance to break up and loosen the soil for removal with the vacuum.
- ***Hand Digging***
  - Soil should be broken up and removed using a shovel or other appropriate hand tools without excessive force. Limit the use of dig bars or other tools that, if used incorrectly, can significantly damage utilities.
- ***Hand Augering***
  - The hand auger must be turned slowly using even hand pressure without excessive force. Rounded-edge augers are preferred. Hand augers should not be used in pea stone/pea gravel where utilities may be present and could potentially be damaged by the hand auger. The abrupt absence of soil recovery in a hand auger could indicate utilities as pea gravel or sand may have spilled out of the auger (exception: native soil conditions that typically result in poor hand auger recoveries). If any resistance is encountered while operating the hand auger for pre-clearance, the equipment will be removed, and the exploratory test hole will be visually inspected by onsite personnel for any obstructions or indications of subsurface structures.

3.4.1 Guidance for Tools and Equipment

Personnel performing pre-clearance activities shall keep tools and equipment in safe working order and be properly inspected before use. If tools or equipment are broken, they will be tagged and removed from service. The following specify additional guidelines regarding tools and equipment:

- Hand-digging tools must have a non-conductive handle, such as fiberglass, wood, or composite, or fully insulated handles and potential contact surfaces.
- Blades on shovels and post-hole diggers should have rounded or blunt edges.
- Pick axes or pointed spades should not be used for physical clearance.
- Crowbars, pinch-bars, or pry bars should not be used to break hardened soil or backfill except when authorized by the Site Supervisor (SS). This should only be used to loosen materials like bricks or larger stones.
- Electric-powered equipment must have ground-fault protection.
- Should there be refusal or difficulty with advancing hand tools, the contractor shall stop work and notify the Roux SS or Site Health and Safety Officer (SHSO) immediately.

3.5 During Intrusive Activities

3.5.1 Concrete/Paving Surface Removal

Remove any surface coverings (i.e., pavement, brush, debris, etc.) to ensure workers have clear visibility of the work area and subsurface conditions. Avoid mechanical jackhammering over known lines unless they are de-energized, locked-out/tagged-out, and potential repairs are planned or if the utility has been completely disconnected prior. When cutting or coring, go only as far as needed to penetrate the surface cover. When removing a large surface area, begin at the perimeter of the removal zone. This initial step helps identify any utilities passing through the work zone. For extensive areas, using a concrete saw might not be practical. Instead, heavy equipment is often employed. During this process, a designated spotter should guide the heavy equipment. Their role is to watch for warning signs of utilities. It is crucial that the heavy equipment does not have “teeth” that could potentially pass through the surface and damage utilities.

3.5.2 Pre-Clearance Procedures

Install pre-clearance exploratory test holes using one of the techniques, as outlined in Section 3.4, for the first 5-ft below land surface (BLS) at each location before conducting intrusive mechanized activities. Should utilities be located at a greater depth than 5-ft BLS consult with the OM, OHSM and CHSD regarding adjustments to the pre-clearance requirements to go greater than 5-ft BLS. Some Clients may require greater than 5-ft BLS for pre-clearance test holes; Project teams should be aware of such Client requirements prior to work.

Pre-clearance exploratory test holes should be defined in the SOW/proposal provided to the client to prevent project delays and to allow adequate time for the PM and PP to evaluate alternative approaches for the project. Alternative approaches will need to be pre-approved by the OM through a Subsurface Utility Clearance Variance.

Both single-point and three-point clearance are acceptable as long as the following criteria are met below. For single-point clearance, the exploratory test hole is advanced at the exact location of the proposed borehole. If three-point clearance is performed, it must be done in a triangular pattern around the proposed borehole and in a configuration that would not allow utilities to enter the borehole.

- The size of the pre-clearance exploratory test hole should be, at a minimum, twice the diameter of any downhole tool or boring device.
- For direct push applications (CPT, Geoprobe®, etc.), the borehole clearance diameter shall be at least 125% of the diameter of the largest tool being pushed through the subsurface (e.g., tip, rod, sampler, etc.), to the minimum required depth.
- For excavations, all utilities need to be marked and then exposed by soft-digging or by hand, following the protocols in this program. Pre-clearing for excavations may be performed by the “moat” technique (i.e., soft Digging around the perimeter). In these cases, dig in small lifts (<12” for first 5 feet using a dedicated spotter.
- For Tolerance Zone work, unless otherwise agreed upon with the Utility Operator, work within the tolerance zone requires verification by means of pre-clearance test holes specified in Section 3.4 to expose the utility. Once structures have been verified, a minimum clearance of three feet must be maintained between the utility and any powered equipment. If considered a high-risk utility, additional requirements may be necessary and required by the Operator of the utility. Consultation with the OM and CHSD may be appropriate.

The PM, field team lead, or personnel performing oversight is to:

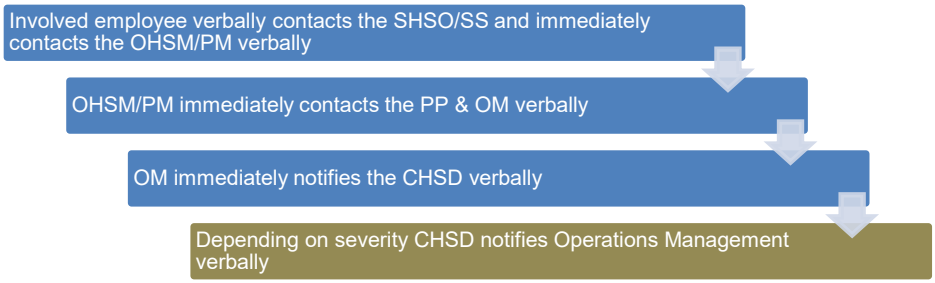
- Ensure the mark-out remains valid. (In certain states, there are limits regarding the duration of time after the mark-out was applied to the ground surface work can be started or interrupted.) Additionally, the mark-outs must be maintained, documented, and in many cases, refreshed periodically to be considered valid. This will be accomplished through calls to the one call center.
- Ensure intrusive activities are only performed within the safe boundaries of the mark-out as detailed in the One-Call Report.
- Halt all work if intrusive activities have resulted in the discovery of an unmarked utility. Roux personnel shall notify the facility owner/operator and the one call center. All incidents such as this will be reported as per Roux Incident Investigation and Reporting Management Program.
- Halt all work if intrusive activities must take place outside of the safe boundaries of a mark-out and only proceed after new mark-outs and subsurface utility clearance are performed.
- Halt the intrusive activities and immediately consult with the PP if an unmarked utility is encountered.
- Complete any loss reports associated with subsurface utility strikes, as necessary.
- If a utility cannot be found as marked, Roux personnel shall notify the facility owner/operator directly or through the one-call center. If the facility operator is not responsive, then the one-call center must be notified. Following notification, the excavation/mechanical intrusive work may continue unless otherwise specified in state law.
- Contractors/subcontractors must contact the one-call center to refresh the ticket when the excavation continues past the life of the ticket. State law dictates ticket life. Project teams must be aware of their state-specific requirements.

3.6 Stop Work Authority

Each Roux employee has Stop Work Authority that he or she will execute upon determination of any imminent safety hazard, emergency situation, or other potentially dangerous situation, such as hazardous weather conditions. This Stop Work Authority includes subsurface clearance issues such as the adequacy of a mark-out or identification during intrusive operations of an unexpected underground utility. Authorization to proceed with work will be issued by the PM/PP in consultation with the OHSM after such action is reviewed and resolved. The PM will initiate and execute all management notifications and contact emergency facilities and personnel when this action is appropriate.

3.7 Reporting Utility Incidents

Roux field personnel engaged in any utility strike (e.g., subsurface/aboveground) must promptly stop work, shutdown any equipment and get to a safe location at the Site. Then notify the PM to discuss the incident. In case of injuries, field personnel must call 911 or the local emergency services number and then inform the PM. Additional notifications shall follow Roux's Incident Notification Process. Depending on the utility strike additional notifications shall be made to utility operators and/or clients/site contacts.



Appendix A
Roux Subsurface Utility Clearance Checklist

Appendix A

Roux Subsurface Utility Clearance Checklist/Utility Verification/Site Walkthrough Record

Roux Subsurface Utility Clearance Checklist ***Date of Revision: 3/2024***

Work site set-up and work execution

ACTIVITY	Yes	No	N/A	COMMENTS INCLUDING JUSTIFICATION IF RESPONSE IS NO OR NOT APPLICABLE
Daily site safety meeting conducted, SPSAs performed, JSAs reviewed, appropriate work permits obtained (if applicable).				
HASP is available and reviewed by site workers / visitors.				
Subsurface Utility Clearance Procedure has been reviewed with all site workers.				
Mechanical intrusive work activities may not be performed at any location without authorization from the Roux Site Supervisor (SS). Clearance activities may not be performed at any location unless the SS is physically present.				
Work area secured; traffic control established as needed. Emergency shut-off switch located. Fire extinguishers / other safety equipment available as needed.				
Utility mark-outs (public / private) clear and visible. Provide Excavator's Stake-Out Reference Number / Request Date / Time.				
Tolerance zone work identified. Intrusive work activities cannot be performed in areas that are in direct conflict with any markings made by public or private locators.				
Unless the PP & OM authorizes it, all boreholes and test pit locations must be physically cleared before using mechanized equipment. Required minimum physical clearance depths and diameters are as follows: • Physically clear to a depth of 5 feet bls. • The size of the pre-clearance exploratory test hole must be, at a minimum, twice the diameter of any downhole tool or boring device. • For direct push applications (CPT, Geoprobe®, etc.) the borehole clearance diameter shall be at least 125% to the diameter of the largest tool being pushed through the subsurface (e.g., tip, rod, sampler, etc.).				
Work execution plan reviewed and adhered to (ground disturbance methods, clearance depths, any special utility protection requirements, or any other execution requirements; especially for Tolerance Zone work).				

Mechanical intrusive work is prohibited within 3-feet distance in all directions from subsurface structures that will be intentionally exposed during pre-clearance. Any removal of material within 3-feet of the subsurface structure may only proceed by hand using non-conductive tools/compressed air if authorized by state law and the owner/operator of the utility.				
All equipment onsite must maintain the appropriate horizontal distance from any point on the equipment to the nearest overhead electrical power line. Refer to site-specific HASP and local/utility company requirements.				
Verbal endorsement received from Roux PM and OM for any required field deviations to work execution plan.				

Key Reminders for Execution

The Subsurface Utility Clearance Protocol should be referenced to determine all requirements while executing subsurface work. The bullet points below are intended as general reminders only and should not be relied upon solely.

- The size of the pre-clearance exploratory test hole must be at a minimum twice the diameter of any downhole tool or boring device to minimum required depth of 5 feet bls.
- For direct push applications (CPT, Geoprobe®, etc.) the borehole clearance diameter shall be at least 125% of the diameter of the largest tool being pushed through the subsurface (e.g., tip, rod, sampler, etc.), to the minimum required depth of 5 feet bls.
- The tolerance zone is defined as three feet plus half of the diameter or half of the greatest dimension (for elliptical sewers, duct banks, and other non-cylindrical utilities) of a utility and three feet from the outside of any subsurface structure.
- For excavations, all utilities need to be marked and then exposed by hand, following the protocols in this program. Pre-clearing for excavations may be performed by the “moat” technique (i.e., soft digging around the perimeter). In these cases, dig in small lifts (<12” for first five feet) using a dedicated spotter.) For Tolerance Zone work, unless otherwise agreed upon with the Utility Operator, work within the tolerance zone requires verification by means of hand-dug test holes to expose the utility. Once structures have been verified, a minimum clearance of three feet must be maintained between the utility and any powered equipment.

Utility Verification/Site Walkthrough Record

Employee Name:_____

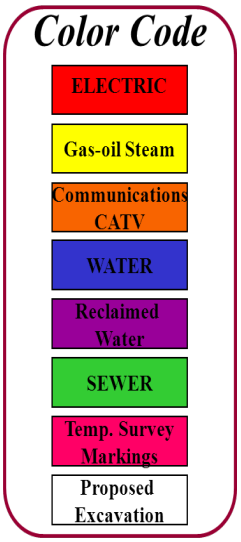
Date: _____

Instructions: For each utility suspected at the job site, indicate the location on the job site, approximate burial depth, and means of detecting the utility. Leave blank if that utility is not believed to be present.

Utility	Description of Utility Location Identified Onsite	Approx. Depth (bls)	Method / Instrumentation used to determine Utility Location	Utility Owner Response (Date/Time)	Mark Out Indicates (Clear / Conflict)
Electrical Lines					
Gas Lines					
Pipelines					
Steam Lines					
Water Lines					
Sanitary and Stormwater Sewer lines					
Pressured Air-Lines					
Tank Vent Lines					
Fiber Optic Lines					
Underground Storage Tanks					
Phone Lines/ Other					

* bls - below land surface

Site Sketch Showing Utilities:



Other Comments / Findings:

Completed by: _____

Signature: _____ Date: _____

Appendix B
Private Utility Technology Applications and Considerations

Appendix B – Private Utility Technology Applications and Considerations

Technology ⇒ Utility/Object ⇓	Radio Frequency Electro-Magnetic Detector (connection to utility, or induction without connection)	Radio Frequency Electro-Magnetic Detector (passive sweep)	Ground Penetrating Radar (GPR)⊙	Acoustic Plastic Pipe Locator	Beacon, Sonde or Conductive Rodder Insertion	EM-61 (time domain electromagnetics) Ξ	
Power/Instrument Line (Energized/Signaled) □	❋ G	G	G	R	R	G	
Power Line (Non-energized) □	❋ G	R	G	R	R	G	
Sewer/Water Line (Metallic) □	❋ G	Y	G	Y	G	G	
Sewer/Water Line (Non-metallic)	R	R	G	G	❋ G	R	
Instrument / Telecomm Lines (Non-energized)	❋ G	R	G	R	R	Y Only if metallic	
Hydrocarbon Transmission Line (Pipeline)◆ □	❋ G	R	G	R	R	G	
Metallic/Non-Metallic Line (with Tracer Wire)	❋ G	Y	G	Y	Y	G metallic	Y non-metallic
Metallic/Non-Metallic Line (without Tracer Wire)	G metallic	R non-metallic	R	❋ G	Y	Y	G metallic	R non-metallic
Metal or Fiberglass UST	R	R	❋ G	R	R	G metallic	R non-metallic

Additional Considerations

Technology ⇒ Variable ⇓	Radio Frequency Electro-Magnetic Detector	Ground Penetrating Radar (GPR)⊙	Acoustic Pipe Locator	Beacon, Sonde, or Conductive Rodder Insertion	EM-61 Ξ
Moist Soil	G	Y	G	G	G
Dry Soil	Y	G	Y	G	G
Clay	Y	R	G	G	G
Concrete w/Rebar	R	Y	G	G	R
Long Horizontal Profile	G	G	G	G	G
Short Horizontal but Deep Vertical Profile	Y	G	R	R	G
Access to Line✚	G	N/A	G	G	G
No Access to Line✚	G (induction or passive)	G	R	R	G
	R (direct connect)				G
Ferrous Metal	G	G	G	G	G
Non-ferrous Metal	Y	G	G	G	G
Adjacent or crossing conductive utility(ies)	Y	N/A	N/A	N/A	Y

Each site will be unique. Do not use this table as the sole criteria for technology selection. Use it as a starting point to assess available, applicable technology(s).

❋ Indicates best technology for given object. Site structures, rebar in concrete, shallow groundwater tables, perched storm water, etc. can significantly affect performance and reliability of any electro/magnetic method. Other utilities which cross or are adjacent to the target line can cause the EM signal to bleed or jump to the other utility line.

□ Metallic lines that have power running through them or can be connected to a tracer signal generator.

◆ Natural gas pipeline locating technicians must be trained/certified (in the U.S. requires DOT and Office of Pipeline Safety standards, other regions may have similar certification or requirements).

⊙ Most sensitive to interpretation. The skill, training and experience of operator are critical.

Ξ Emerging technology with limited availability.

✚ Access: induce unique electronic signature, apply acoustical impulse or insert conductive rodder/beacon/sonde.

Green Generally, an applicable technology **Yellow** May or may not be applicable **Red** Not generally applicable

APPENDIX F

Heavy Equipment Exclusion Zone Policy

HEAVY EQUIPMENT EXCLUSION ZONE MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY DIRECTOR	:	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	:	**01/2019**
REVIEWED DATE	:	**03/2025**
REVISION NUMBER	:	**4**

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1. PURPOSE

The Exclusion Zone Management Program aims to establish the minimum clearance distance that must be maintained between workers and heavy equipment while the equipment is in operation (i.e., engaged or in motion). The intent is to have no personnel or equipment entering the Exclusion Zone while the equipment is in operation or moving to ensure that Roux and Subcontractor employees are unnecessarily exposed to the hazards of the equipment.

2. SCOPE AND APPLICABILITY

This Management Program applies to all Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C., and Remedial Engineering (collectively, "Roux") employees and their subcontractors performing fieldwork and are potentially exposed to heavy equipment. Heavy equipment includes, but is not necessarily limited to, excavation equipment, drill rigs, vacuum trucks, forklifts, lull telehandlers, man lifts, bobcats, delivery trucks, etc.

3. PROCEDURES

As specified in the following sections of this program, Exclusion Zones must be established and maintained during activities involving the movement/operation of heavy equipment. The Exclusion Zone requirements apply to all personnel on the site but are primarily focused on personnel required to work near the equipment. The exclusion zone is in effect when heavy equipment is moving or engaged (e.g., movement of an arm or bucket of an excavator, rotation of an auger, lifting of a load with a forklift, raising/lowering of a man lift, etc.).

1. The Exclusion Zone must meet the following minimum requirements:
   - A minimum distance of 10 feet from all heavy equipment and loads being moved by the equipment;
   - Greater than the swing/reach radius of any moving part on the heavy equipment (i.e., for large equipment, this may mean an exclusion zone distance larger than 20 feet);
   - Greater than the fall zone of equipment and their contents; and
   - Greater than the tip-over distance of the heavy equipment.

   The size of the Exclusion Zone will need to be determined on a task-specific basis considering the size of the heavy equipment in use and the task being performed. Prior to all heavy equipment operations, the Exclusion Zone(s) distance must be specifically identified in the Job Planning Process and incorporated in the pre-job tailgate meeting with the subcontractor(s), including any updates to our Job Safety Analysis (JSA).
2. The spotter (or another authorized individual) is responsible for enforcing the Exclusion Zone and not conducting any other task. The spotter should be positioned immediately outside of the Exclusion Zone within a clear line of sight of the equipment operator. The spotter must signal the operator to stop work if anyone or anything has the potential to enter or compromise the Exclusion Zone. The operator should stop work if the spotter is not within their line of sight. If a spotter must be within the Exclusion Zone, they must be in a designated area outside the swing/tip radius, fall zone, line of fire of lifted loads, etc. If multiple pieces of equipment are being used, one spotter may be adequate so long as there is a clear line of sight and the spotter can control the zone(s). Radios would be required since hand signals would not be adequate if two pieces of equipment are in operation at the same time in the Exclusion Zone.

3. If an individual must enter the Exclusion Zone, the designated Spotter must signal the Equipment Operator to stop the equipment. Once the equipment is no longer moving (e.g., movement of an arm of an excavator is STOPPED, lifting of a load with a forklift STOPPED, raising/lowering of a man lift is STOPPED, etc.), the operator must bring the boom/arm to the ground ensuring a “Zero Energy State” and DISENGAGE THE CONTROLS and STOP and SIGNAL BY “SHOWING HIS HANDS.” This signal will indicate that it is safe for the person to enter the limits of the Exclusion Zone to perform the required activity. The equipment must remain completely stopped/disengaged until all personnel exited the Exclusion Zone's boundaries and the designated Spotter has signaled by “SHOWING HIS HANDS” to the Equipment Operator that it is safe to resume operations.
4. When entering the limits of the Exclusion Zone, personnel must, at a minimum:
    - Establish eye contact with the operator and approach the heavy equipment in a manner that is in direct line of sight to the Equipment Operator;
    - Never walk under any suspended loads or raised booms/arms of the heavy equipment; and
    - Identify a travel path free of Slip/Trip/Fall hazards.
5. The Exclusion Zone should be delineated using cones with orange snow fences or solid poles between the cones, barrels, tape, or other measures. For work in rights-of-way, rigid barriers, such as Jersey barriers or temporary chain link fences, should be used. For certain types of widespread or moving/mobile equipment operations, such delineation may not be practicable around equipment or individual work areas. In such instances, it is expected that the entire operation will be within a larger secure work area or that additional means will be utilized to ensure the security of the work zone.

All subcontractors who provide heavy equipment operations to field projects must implement a program that meets or exceeds the expectations described above, as well as any additional requirements that may be required on a client or site-specific basis. Logistics involving heavy equipment should be understood and discussed prior to the field event during the job planning phase.

3.1 Exceptions

It is recognized that certain heavy equipment activities may require personnel to work within the limits of the Exclusion Zone as specified in this program. Such activities may include certain excavation clearance tasks, drill crew activities, or construction tasks. However, any such activity must be pre-planned, emphasizing limiting the amount and potential exposure of any activity required within the zone. The critical safety steps to mitigate the hazards associated with working within the Exclusion Zone must be defined in the JSA and potentially other project-specific plans (i.e., critical lift plans, etc.), and approved by the Roux Project Principal (PP), Office Health and Safety Manager (OHSM) and client representative, if required, prior to implementation.

4. TRAINING

Many Roux projects have different requirements that are client-specific or site-specific in nature. However, all Roux employees are provided initial training, as well as annually thereafter, on our Heavy Equipment Exclusion Zone policy.

5. STOP WORK AUTHORITY

All Roux employees and their subcontractors have stop-work authority. Upon initial hire, all Roux employees are provided initial safety orientation, including stop work authority. All Roux employees and subcontractors are encouraged to stop work whenever any task or operation presents an unreasonable risk or employees

are unsure how to carry out work safely. This includes upon observing any questionable safety-related behavior or condition, they are to stop work immediately and discuss the behavior or condition with the individual(s) involved. Upon stopping work, the following actions will be taken:

- Notify the affected parties to include the Project Manager (PM) and Site Health and Safety Officer (SHSO);
- Work to correct the situation or not proceed until the situation is corrected by the PM or SHSO;
- Resume work only when told to proceed by either the PM or SHSO;
- The SHSO will document the Stop-Work intervention in the field logbook;
- Stop-Work interventions will be reported to the PP for review to ensure the interventions are closed; and
- The PP will share learnings from the interventions, as appropriate, throughout the firm, to demonstrate the importance of the Stop-Work interventions.

Please note: Any form of retribution or intimidation directed at any individual or company for exercising their right to issue a stop work authority will not be tolerated.

APPENDIX G

Community Air Monitoring Program

Community
Air Monitoring Plan

Greenpoint Ferry Site
1 Java Street
Brooklyn, New York 11222

NYSDEC BCP Site No. C224272

July 29, 2025

Prepared for:

1 Java Street Owner LLC
200 Park Avenue, 9th Floor
New York, New York

Prepared by:

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Islandia, New York 11749

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Table

1. Action Limit Summary for VOCs and Particulates

Appendices

A. Action Limit Report

B. Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures

1. Introduction

Roux Environmental Engineering and Geology, D.P.C. (Roux), on behalf of 1 Java Owner LLC (Volunteer), has developed a project specific Community Air Monitoring Plan (CAMP) to implement real time monitoring if ground intrusive activities occur during Site management activities at 1 Java Street, Brooklyn, New York (Site). The Site occupies the upland portion of Block 2538, Lot 1. CAMP will be implemented if ground intrusive activities occur.

The monitoring program will be implemented at all times during which earth disturbance activities are occurring. The CAMP is designed to provide a measure of protection for the downwind community and on-Site workers not directly involved with the subject work activities from potential airborne contaminant releases as a direct result of remedial and construction activities. This plan is consistent with the New York State Department of Health's (NYSDOH) Generic Community Air Monitoring Plan guidance document.

The specifics of the CAMP are presented in the following four (4) sections:

- 1.1 VOC Monitoring Approach
- 1.2 Particulate Monitoring Approach
- 1.3 Special Requirement for Work Within 20 Feet of Potentially Exposed Individuals or Structures
- 1.4 Meteorological Monitoring Approach
- 1.5 Available Suppression Techniques

As described below, the general approach to this CAMP will include deploying one (1) upwind, and one (1) downwind monitoring station for VOCs and particulates near the active work area, as well as one (1) fixed monitoring station for VOCs and particulates near the ferry terminal entrance. Should the active work area expand in size, and/or earth disturbance work extend to multiple active work areas, in consultation with NYSDEC and NYSDOH, an additional downwind monitoring station for VOCs and particulates will be deployed.

1.1 VOC Monitoring Approach

Total VOC concentrations in air will be monitored continuously at a location downwind of the excavation activities during all ground intrusive activities. An upwind monitoring station will be set up adjacent to where the excavation is occurring. Further, one additional fixed monitoring station will be placed at the perimeter of the Site near the access to the active ferry terminal. The VOC monitoring equipment will be located at temporary monitoring stations established daily based on Site logistics and weather conditions. The monitoring work will be conducted using MiniRAE 3000 (or equivalent) portable VOC monitors, or similar type monitors, for all VOC monitoring. The equipment will be calibrated at least once daily using isobutylene as the calibration gas. One (1) upwind, one (1) downwind, and one (1) fixed monitor (near the ferry terminal access) will be deployed each day. Each monitoring unit is equipped with an audible alarm to indicate exceedance of the action levels (as defined below and summarized in Table 1).

The equipment is capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total VOCs at the downwind perimeter of the Site exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily

halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

- If the ambient air concentration of total VOCs at the downwind perimeter of the Site persists at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of VOCs identified, suppression techniques employed to abate emissions, and monitoring continued. After these steps, work activities can resume if the total organic vapor level at the Site perimeter is below 5 ppm over the background concentration for the 15-minute average. If levels are in excess of 25 ppm above background, identified contributing ground-intrusive activities will be halted and vapor suppression techniques will be evaluated and modified until monitoring indicates VOC levels at the Site perimeter are below 5 ppm over background. Once VOC levels are below 5 ppm at the Site perimeter, work will resume with continued monitoring.
- All 15-minute readings will be recorded and available for State Regulator (NYSDEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes will be recorded. If an exceedance of the action level occurs, an Action Limit Report (ALR) will be completed, identifying the monitoring device location, the measured VOC level, the activity causing the exceedance, meteorological conditions, and the corrective actions taken, as provided in Appendix A. Additionally, the NYSDEC and NYSDOH will be notified within 24 hours of the VOC ALR generation. Daily monitoring equipment locations and meteorological conditions will also be documented on the daily CAMP Monitoring Location Plan. All documentation will be kept on file at the Site.

1.2 Particulate Monitoring, Response Levels and Actions

Particulate concentrations will be monitored continuously at temporary particulate monitoring stations set up at the sidewalk at upwind and downwind locations. One additional fixed monitoring station will be placed at the perimeter of the Site near the access to the active ferry terminal. The particulate monitoring will 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 levels (as defined below and summarized in Table 1). Monitoring equipment will be MIE Data Ram monitors or equivalent. A minimum of one (1) upwind and one (1) downwind monitor will be deployed each day, equipped with an omni-directional sampling inlet and a PM-10 sample head. The data logging averaging period will be set to 15-minutes with time and date stamp recording. Alarm averaging will be set at 90 micrograms per cubic meter ($\mu g/m^3$) per 15-minute period. This setting will allow proactive evaluation of Site conditions prior to reaching Action Levels of 100 $\mu g/m^3$ above background. The equipment will be outfitted with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration will be visually assessed during all work activities. The monitoring will be used to compare values to the following:

- If the downwind PM-10 particulate level is 100 $\mu g/m^3$ greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the Site, 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 $\mu g/m^3$ above the upwind level and provided that no visible dust is migrating from the Site.
- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 $\mu g/m^3$ above the upwind level, work must be stopped, a re-evaluation of activities initiated, and dust suppression techniques modified. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 $\mu g/m^3$ of the upwind level and in preventing visible dust migration.

All 15-minute readings will be recorded and available for State Regulator (NYSDEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes will be recorded. If an exceedance of the action level occurs, an ALR will be completed, identifying the monitoring device location, the measured

particulate concentration, the activity causing the exceedance, meteorological conditions, and the corrective actions taken, as provided in Appendix A. Daily monitoring equipment locations will also be documented on the daily CAMP Monitoring Location Plan. All documentation will be kept on file at the Site.

1.3 Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures

Although not anticipated or expected to occur as part of this project, this CAMP includes additoinal measures to be implemented in the event earth disturbance work areas are located within 20 feet of potentially exposed populations or occupied structures. In the unexpected event that this situation occurs, the requirements outlined in Appendix B of this CAMP will be followed.

1.4 Meteorological Monitoring

Wind speed (estimated) and wind direction will be approximated based on field observations of on-Site personnel. Meteorological data consisting of temperature, barometric pressure, and relative humidity will be recorded in the field book based upon publically available information from local weather stations.

1.5 Available Suppression Techniques

Odor Control

Due to the nature of the project, with potetnial excavation occurring, the potential for generation of nuisance odors and the need for odor control may be necessary. If nuisance odors are identified, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of all other complaints about the project within 24 hours through either the submission of Dail Reports or via email.

All necessary means will be employed to prevent on- and off-Site nuisances. At a minimum, procedures will include: (a) limiting the area of open excavations; (b) shrouding open excavations with tarps and other covers; and (c) using foams to cover exposed odorous soils. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) use of chemical odorants in spray or misting systems; and (e) use of staff to monitor odors in surrounding neighborhoods.

Dust Control

Due to the nature of the project, the potential for generation of nuisance dust and the need for dust control may be necessary. Dust suppression will be achieved through the use of water for wetting excavation areas, if required. Water will be available on-site at suitable supply and pressure for use in dust control.

1.6 Reporting

All recorded monitoring data will be downloaded, and field logged periodically, including action limit reports (ALRs) (if any) and daily CAMP monitoring location plans. All records will be maintained onsite and available for NYSDEC/NYSDOH review. CAMP readings, including any exceedances and ALRs, will be provided to NYSDEC in the Daily Reports. The reason for exceedance, what was done to correct it, and whether it was effective will also be included in these reports. A summary of any ALRs will also be provided in the Monthly Reports. All CAMP monitoring records will be included in the overall Final Engineering Report that will be submitted to the NYSDEC and NYSDOH and will include all of the CAMP data collected, daily monitoring station location maps, and copies of the ALRs (if any). If an ALR is generated due to a VOC or particulate exceedances, the NYSDEC and NYSDOH will be notified within 24 hours of the exceedance.

TABLE

1. Action Limit Summary for VOCs and Particulates

Table 1. Action Limit Summary for VOCs and Particulates, 1 Java Street Development, Greenpoint, NY

Contaminant	Downwind Action Levels*	Action/Response
Volatile Organic Compounds (VOCs) (Monitoring Via Photoionization Detector and Odor Observation)	< 5 ppm	1. Resume work with continuing monitoring.
	5 ppm < level < 25 ppm	1. Work activities must be temporarily halted, source vapors must be identified, suppression techniques employed to abate emissions and monitoring continued. 2. After these steps, if VOC levels (200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or structure, whichever is less) is below 5 ppm over background, resume work.
	> 25 ppm	1. Identified contributing ground intrusive activities must be halted and vapor suppression techniques must be evaluated and modified until monitoring indicates VOC levels below the action level. 2. After these steps, if VOC levels (half the distance to the nearest potential receptor or structure) are below 5 ppm over background, resume work.
Particulates (Monitoring Via Particulate Meter and Observation)	< 100 ug/m^3	1. If dust is observed leaving the work area, then dust control techniques must be implemented or additional controls used.
	100 ug/m3 < level < 150 ug/m^3	1. Employ dust suppression techniques. 2. Work may continue with dust suppression techniques provided that downwind PM-10 particulate concentration do not exceed 150 ug/m^3 above the upwind level and provided that no visible dust is migrating from the work area.
	> 150 ug/m^3	1. STOP work 2. Re-evaluate activities, modify dust suppression techniques. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 ug/m^3 of the upwind level and in preventing visible dust migration.

* Instantaneous readings above background. Particulate readings are based on the respirable (PM-10) fraction. Background readings are taken at upwind locations relative to Work Areas or Exclusion Zones.

APPENDIX A

Action Limit Report

ACTION LIMIT REPORT

Project Location: 1 Java Street Development, Greenpoint, New York
Upland Portion of Tax Block 2538, Lot 1

Date: _____ Time: _____

Name: _____

Contaminant: PM-10: _____ VOC: _____

Wind Speed: _____ Wind Direction: _____

Temperature: _____ Barometric Pressure: _____

DOWNWIND DATA

Monitor ID #: _____ Location: _____ Level Reported: _____

Monitor ID#: _____ Location: _____ Level Reported: _____

UPWIND DATA

Monitor ID #: _____ Location: _____ Level Reported: _____

Monitor ID#: _____ Location: _____ Level Reported: _____

BACKGROUND CORRECTED LEVELS

Monitor ID #: _____ Location: _____ Level Reported: _____

Monitor ID#: _____ Location: _____ Level Reported: _____

ACTIVITY DESCRIPTION

CORRECTIVE ACTION TAKEN

APPENDIX B

Special Requirements for Work Within 20 Feet of
Potentially Exposed Individuals or Structures

Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures

When work areas are within 20 feet of potentially exposed populations or occupied structures, the continuous monitoring locations for VOCs and particulates must reflect the nearest potentially exposed individuals and the location of ventilation system intakes for nearby structures. The use of engineering controls such as vapor/dust barriers, temporary negative - pressure enclosures, or special ventilation devices should be considered to prevent exposures related to the work activities and to control dust and odors. Consideration should be given to implementing the planned activities when potentially exposed populations are at a minimum, such as during weekends or evening hours in non-residential settings.

- If total VOC concentrations opposite the walls of occupied structures or next to intake vents exceed 1 ppm, monitoring should occur within the occupied structure(s). Depending upon the nature of contamination, chemical-specific colorimetric tubes of sufficient sensitivity may be necessary for comparing the exposure point concentrations with appropriate pre-determined response levels (response actions should also be pre-determined). Background readings in the occupied spaces must be taken prior to commencement of the planned work. Any unusual background readings should be discussed with NYSDOH prior to commencement of the work.

- If total particulate concentrations opposite the walls of occupied structures or next to intake vents exceed 150 mcg/m_3, work activities should be suspended until controls are implemented and are successful in reducing the total particulate concentration to 150 mcg/m_3 or less at the monitoring point.

- Depending upon the nature of contamination and remedial activities, other parameters (e.g., explosivity, oxygen, hydrogen sulfide, carbon monoxide) may also need to be monitored. Response levels and actions should be pre-determined, as necessary, for each site.

Special Requirements for Indoor Work with Co-Located Residences or Facilities
Unless a self -contained, negative-pressure enclosure with proper emission controls will encompass the work area, all individuals not directly involved with the planned work must be absent from the room in which the work will occur. Monitoring requirements shall be as stated above under “Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures” except that in this instance “nearby/occupied structures” would be adjacent occupied rooms. Additionally, the location of all exhaust vents in the room and their discharge points, as well as potential vapor pathways (openings, conduits, etc.) relative to adjoining rooms, should be understood and the monitoring locations established accordingly. In these situations, it is strongly recommended that exhaust fans or other engineering controls be used to create negative air pressure within the work area during remedial activities. Additionally, it is strongly recommended that the planned work be implemented during hours (e.g. weekends or evenings) when building occupancy is at a minimum.

APPENDIX F

Active SSDS Start-Up Certification Memorandum

MEMORANDUM

Date: December 10, 2025

To: Richard P. Mustico, P.E., Professional Engineer 1, New York State Department of Environmental Conservation, Division of Environmental Remediation

From: Paul Martorano, Technical Director, Roux Environmental Engineering and Geology, D.P.C.

Subject: Greenpoint Ferry Site
Brooklyn, New York
BBL: 3025380001
BCP Site No. C224272

---

1. I am currently a registered professional engineer licensed by the State of New York.
2. I had primary direct responsibility for the implementation of the remedial program activities conducted at the-above referenced (the "Site") under the New York State Brownfield Cleanup Program ("BCP").
3. I certify that the attached Site Plan for the Site sub-slab depressurization system (SSDS) reflects the as-built conditions for the system and that the SSDS blowers have been installed and are fully functional.
4. I certify that the attached Summary of Active SSDS Vacuum Monitoring reflects the post start-up readings for the noted Extraction Points (EPs) and sub-slab Soil Vapor Monitoring Points (SVMPs), collected on December 10, 2025, which collectively document that the Site has achieved successful depressurization (> -0.004 iwc) within the sub-slab.

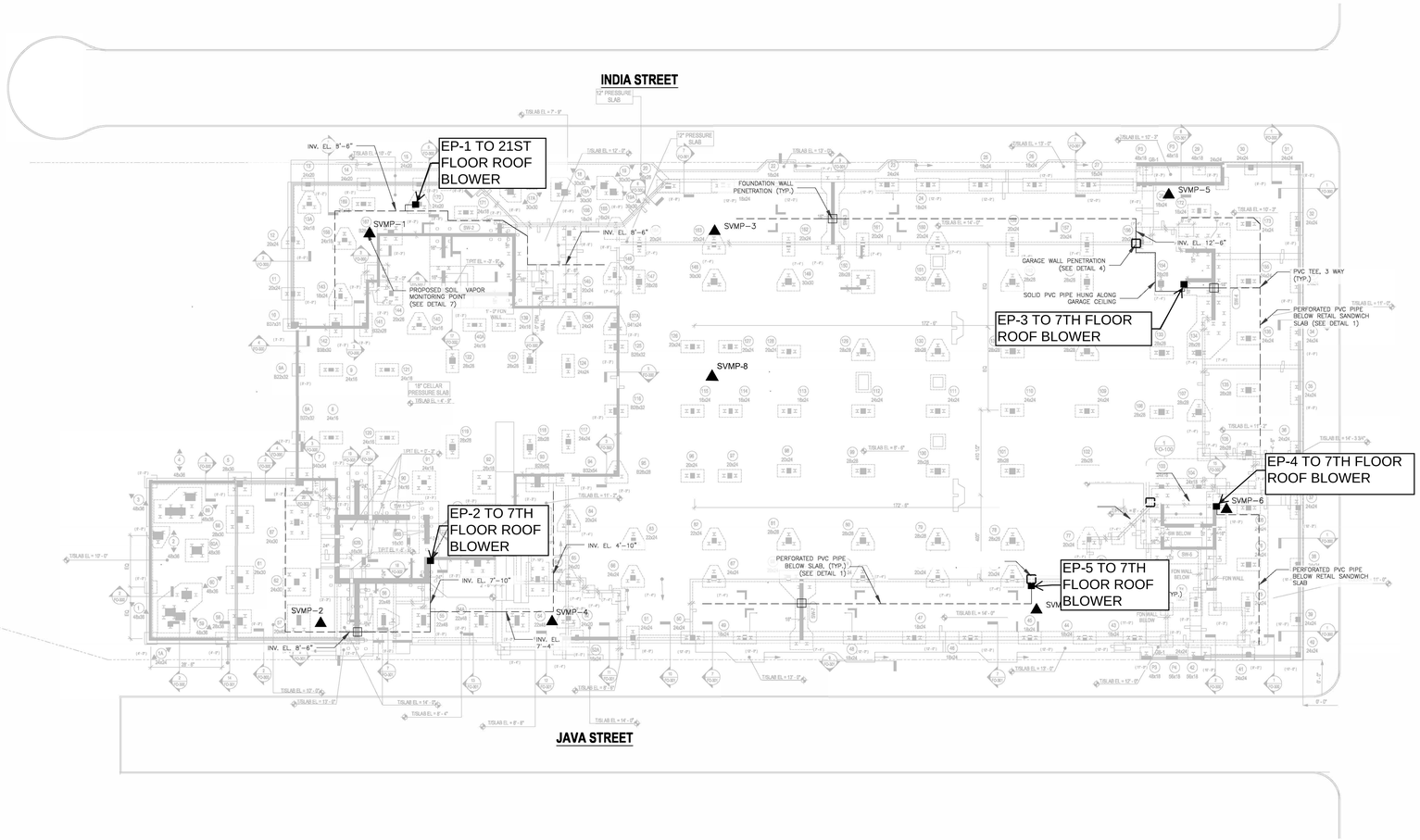
Paul Martorano
Name

088403
PE License Number

Signature

December 10, 2025
Date





SITE PLAN

20' 0 20'

LEGEND

- PERFORATED PVC PIPE BELOW SLAB, SCHEDULE 40, 4" DIA.
- SOLID WALL PVC PIPE, SCHEDULE 40, 4" DIA.
- EXTRACTION POINT STEEL RISER PIPE, GALVANIZED, 4" DIA.
- SUB-SLAB FOUNDATION WALL PENETRATION

REFERENCES

1. BASE MAP FROM FOUNDATION PLAN, DRAWING NO. FD-100, PROGRESS SET DATED NOVEMBER 19, 2021.

GENERAL NOTES

1. ALL INVERT ELEVATIONS ARE APPROXIMATE [NAVD88] AND PROVIDED FOR REFERENCE ONLY TO INDICATE CORRESPONDING SLAB ELEVATION CHANGES.
2. SUB-SLAB DEPRESSURIZATION SYSTEM PIPING INSTALLED IMMEDIATELY BELOW LOWEST SLAB AS SHOWN ON DITAILS.
3. RISERS FOR SUB-SLAB DEPRESSURIZATION SYSTEM TERMINATE ON ROOF AND CONFORM WITH SETBACK REQUIREMENTS SHOWN ON DETAILS.
4. SUB-SLAB PIPING AT UTILITY CROSSINGS CONSTRUCTED IN CONFORMANCE WITH DETAIL 6.
5. DEPICTED LOCATIONS OF SOIL VAPOR MONITORING POINTS ARE APPROXIMATE.

NO.	DATE	REVISION DESCRIPTION	INT.

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PROJECT NO.: 3583.0001Y000			
DRAWING FILE: 3583.0001Y123.01_SOCD (2).DWG			

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

PROJECT NAME:
GREENPOINT FERRY SITE
BROOKLYN, NEW YORK

PROJECT FOR:
1 JAVA OWNER, LLC

TITLE:
ACTIVE SUB-SLAB DEPRESSURIZATION SYSTEM SITE PLAN

FIGURE NO.
6

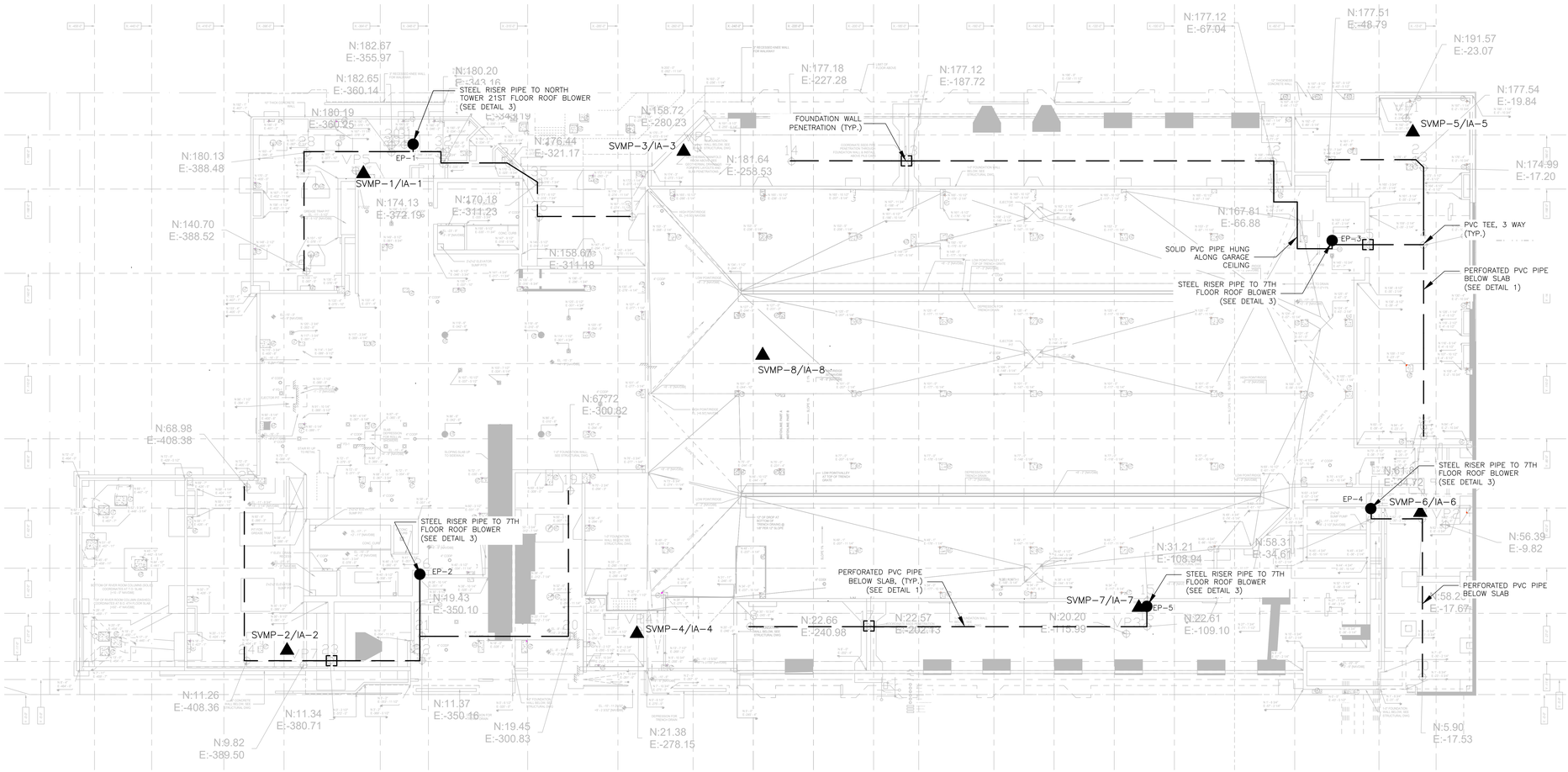
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Summary of Active SSDS Vacuum Monitoring
Greenpoint Ferry Site, Brooklyn, New York

Monitoring Point	12/10/2025 Vacuum (iwc)	Fan Setpoint (0-100%)
EP-01	-0.687	75%
EP-02	-1.227	50%
EP-03	-0.305	50%
EP-04	-0.807	50%
EP-05	-0.964	50%
SVMP-01	-0.089	--
SVMP-02	-0.368	--
SVMP-03	-0.127	--
SVMP-04	-0.130	--
SVMP-05	-0.222	--
SVMP-06	-0.184	--
SVMP-07	-0.597	--
SVMP-08	-0.254	--

APPENDIX G

As-Builts and Component Manual



LEGEND

- PERFORATED PVC PIPE BELOW SLAB, SCHEDULE 40, 4" DIA.
- SOLID WALL PVC PIPE BELOW SLAB, SCHEDULE 40, 4" DIA.
- EP-1 — STEEL RISER PIPE EXTRACTION POINT, GALVANIZED, 4" DIA.
- [ ] — SUB-SLAB FOUNDATION WALL PENETRATION
- SVMP-1/IA-1 — VAPOR MONITORING POINT/INDOOR AIR POINT (SEE DETAIL 6)

REFERENCES

1. BASE MAP FROM FOUNDATION PLAN, DRAWING NO. FD-100, GMP SET DATED SEPTEMBER 28, 2023.

GENERAL NOTES

1. SUB-SLAB DEPRESSURIZATION SYSTEM PIPING INSTALLED IMMEDIATELY BELOW LOWEST SLAB AS SHOWN ON DETAILS. SOME SOLID PVC PIPE SECTIONS HUNG ALONG GARAGE CEILING, AS NOTED.
2. RISERS FOR SUB-SLAB DEPRESSURIZATION SYSTEM TERMINATE ON ROOF AND CONFORM WITH SETBACK REQUIREMENTS SHOWN ON DETAILS.
3. SUB-SLAB PIPING AT UTILITY CROSSINGS CONSTRUCTED IN CONFORMANCE WITH DETAIL 6.

15' 0 15'

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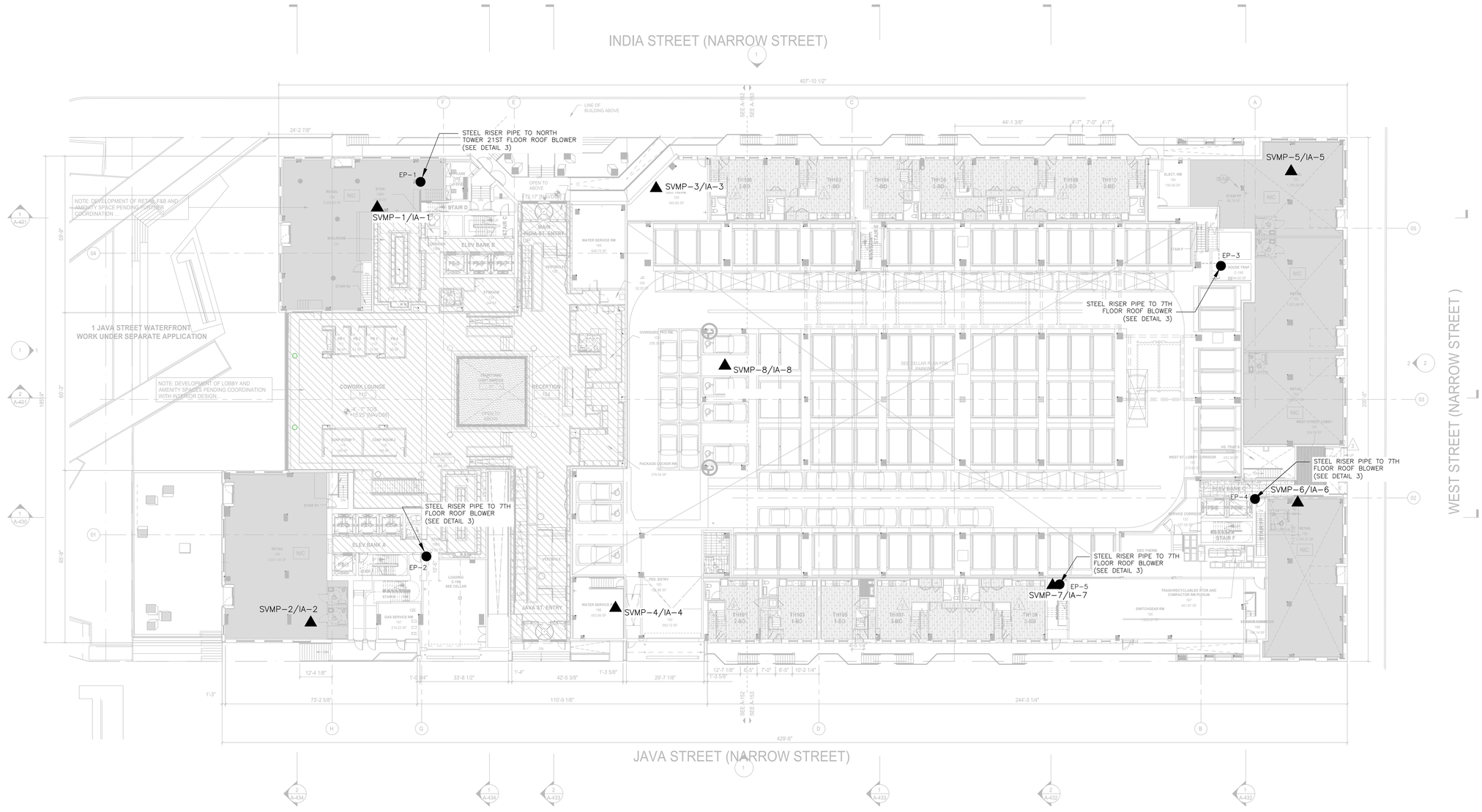
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GREENPOINT FERRY SITE
BROOKLYN, NEW YORK

PROJECT FOR:
1 JAVA OWNER, LLC

TITLE:
ACTIVE SUB-SLAB DEPRESSURIZATION SYSTEM SUBGRADE FOUNDATION PLAN

DRAWING NO.
1
DRAWING 1 OF 5

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LEGEND

EP-1 ●	STEEL RISER PIPE EXTRACTION POINT, GALVANIZED, 4" DIA.
SVMP-1/IA-1 ▲	VAPOR MONITORING POINT/INDOOR AIR POINT (SEE DETAIL 6)

REFERENCES

1. BASE MAP FROM OVERALL PLANS – FLOOR 01, DRAWING NO. A-101, GMP SET DATED SEPTEMBER 28, 2023.

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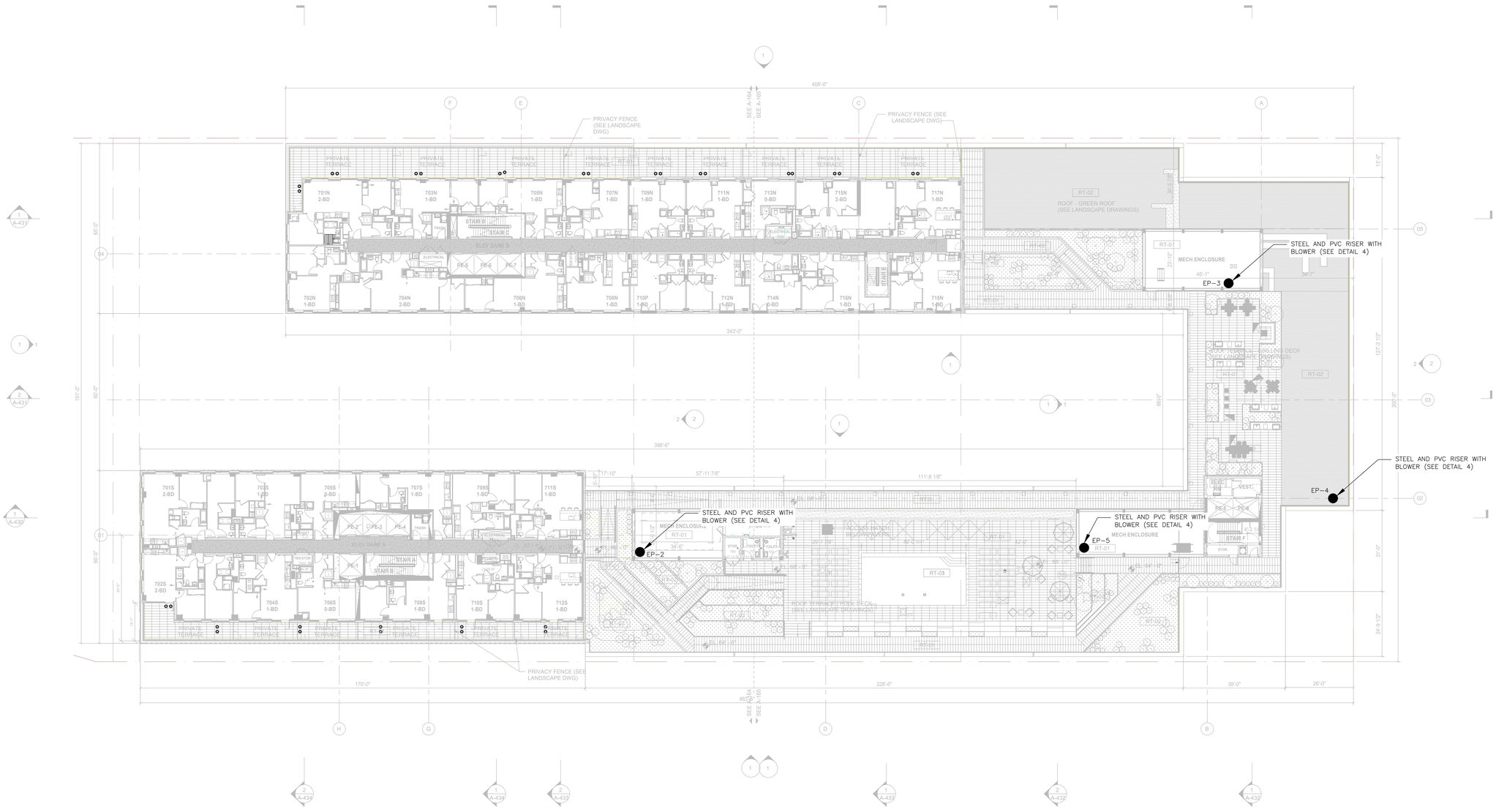
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BROOKLYN, NEW YORK

PROJECT FOR:
1 JAVA OWNER, LLC

TITLE:
ACTIVE SUB-SLAB DEPRESSURIZATION SYSTEM
FIRST FLOOR PLAN

DRAWING NO.
2
DRAWING 2 OF 5

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LEGEND

EP-2 ● STEEL AND PVC RISER WITH BLOWER

REFERENCES

1. BASE MAP FROM OVERALL PLANS – FLOOR 07, DRAWING NO. A-107, GMP SET DATED SEPTEMBER 28, 2023.

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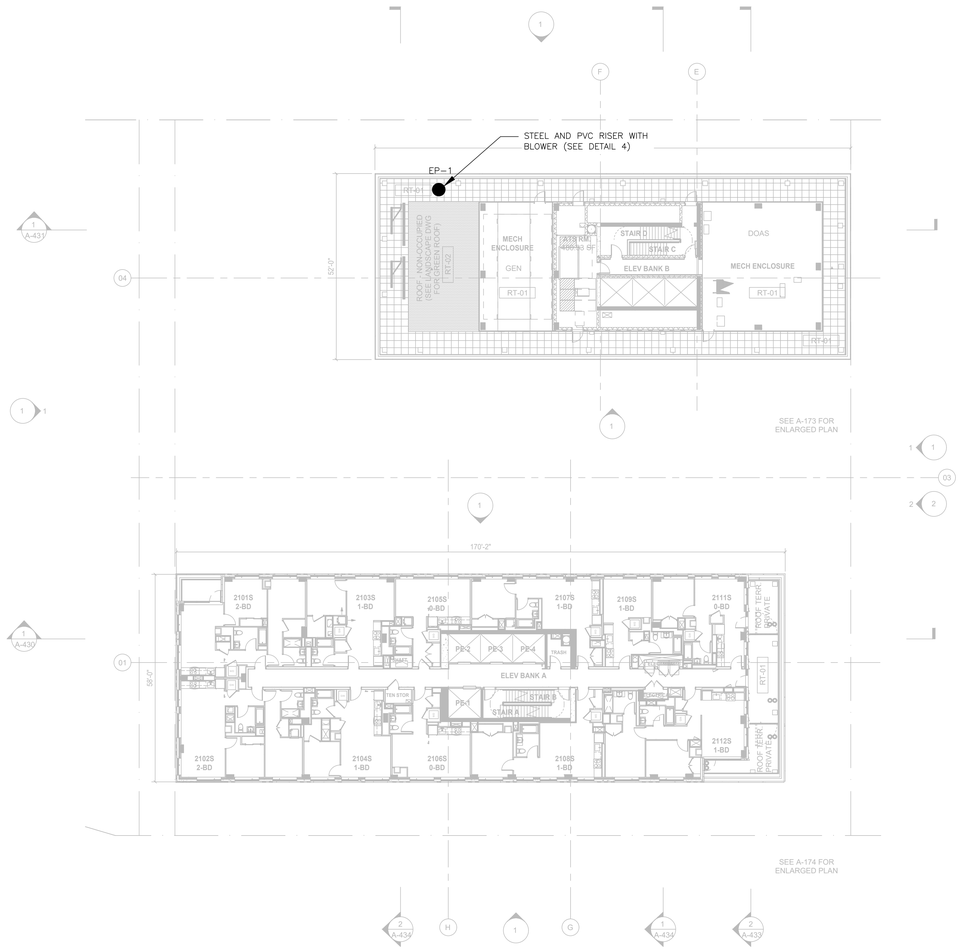
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PROJECT FOR:
1 JAVA OWNER, LLC

TITLE:
ACTIVE SUB-SLAB DEPRESSURIZATION SYSTEM SEVENTH FLOOR PLAN

DRAWING NO.
3
DRAWING 3 OF 5

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LEGEND

EP-1 ● STEEL AND PVC RISER WITH BLOWER

REFERENCES

1. BASE MAP FROM OVERALL PLANS – FLOORS 21, 22–35, N. TWR ROOFS (BLKHD 1 & 2), DRAWING NO. A–121, GMP SET DATED SEPTEMBER 28, 2023.

15' 0 15'

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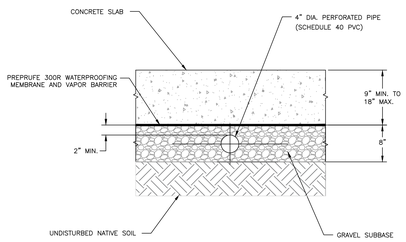
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BROOKLYN, NEW YORK

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1 JAVA OWNER, LLC

TITLE:
ACTIVE SUB-SLAB DEPRESSURIZATION SYSTEM
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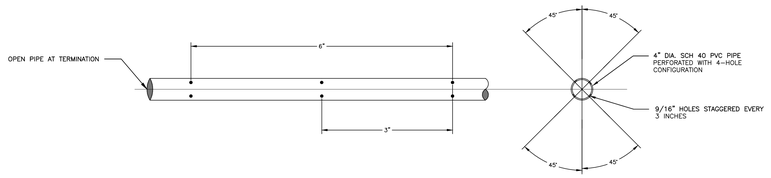
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DRAWING 4 OF 5

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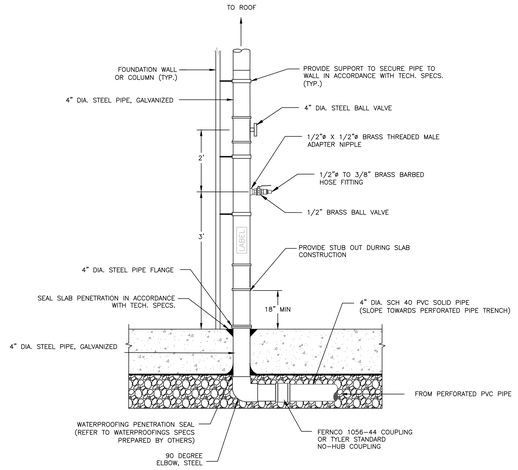
1 SUB-SLAB DEPRESSURIZATION SYSTEM PIPE DETAIL

SCALE: NOT TO SCALE



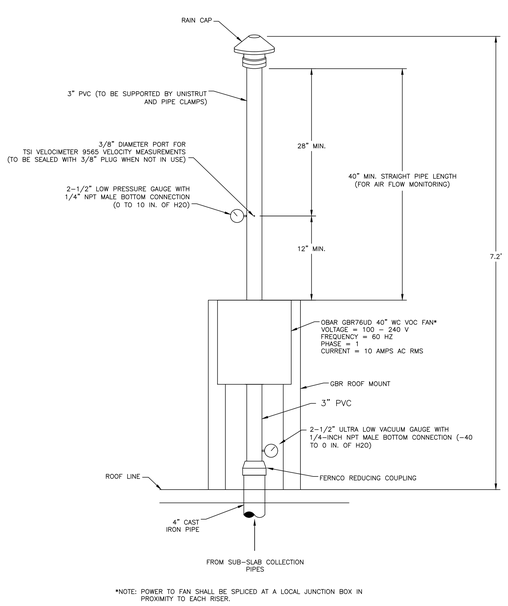
2 PERFORATED PVC PIPE DETAIL

SCALE: NOT TO SCALE



3 VERTICAL RISER DISCHARGE STACK TO SLAB PENETRATION (TYP)

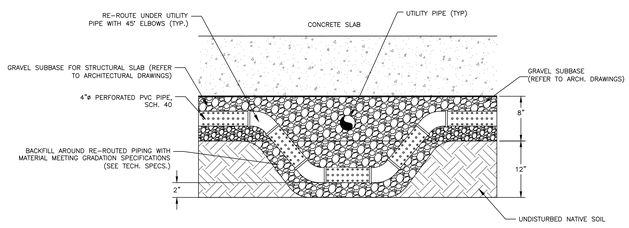
NOT TO SCALE



*NOTE: POWER TO FAN SHALL BE SPLICED AT A LOCAL JUNCTION BOX IN PROXIMITY TO EACH RISER.

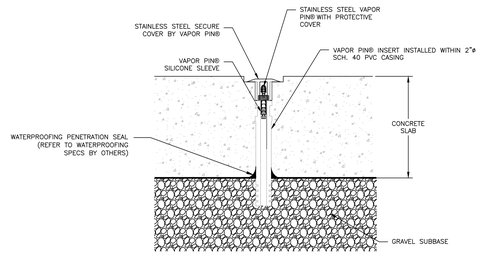
4 VAPOR EXTRACTION RISER WITH ROOF-MOUNT

SCALE: NOT TO SCALE



5 TYPICAL UTILITY PIPE CROSSING

SCALE: NOT TO SCALE



6 SOIL VAPOR MONITORING POINT DETAIL

SCALE: NOT TO SCALE

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(631) 232-2600

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BROOKLYN, NEW YORK

PROJECT FOR:
1 JAVA OWNER, LLC

TITLE:
ACTIVE SUB-SLAB DEPRESSURIZATION SYSTEM DETAILS

DRAWING NO.
5
DRAWING 5 OF 5

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1 JAVA

1 JAVA STREET
BROOKLYN, NY 11222

FO - Structural Sheet List

Sheet Number	Sheet Name	50% CD	100% CD
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FO-010	SITE PLAN	•	•
FO-100	FOUNDATION PLAN	•	•
FO-101	FOUNDATION REINF PART A - SOUTH TOWER	•	•
FO-102	FOUNDATION REINF PART B - NORTH TOWER	•	•
FO-103	FOUNDATION REINF PART C - NORTH TOWER	•	•
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FO-209	CAISSON DETAILS	•	•
FO-210	REINF DEVELOPMENT LENGTH/LAP SPLICE SCHEDULE	•	•
FO-300	FOUNDATION SECTIONS	•	•
FO-301	FOUNDATION SECTIONS	•	•
FO-302	FOUNDATION SECTIONS	•	•
FO-303	FOUNDATION SECTIONS	•	•
FO-304	FOUNDATION SECTIONS	•	•
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FO-400	FOUNDATION GENERAL ARRANGEMENT PLAN - WEST	•	•
FO-401	FOUNDATION GENERAL ARRANGEMENT PLAN - EAST	•	•
FO-402	FOUNDATION GENERAL ARRANGEMENT PART PLAN	•	•



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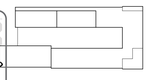
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REV	DATE	DESCRIPTION
1	06/01/2021	ISSUE FOR FOUNDATION
2	06/11/2021	50% SCHEMATIC SUBMISSION
3	08/06/2021	ISSUED FOR 100% SD
4	12/10/2021	50% DESIGN DEVELOPMENT
5	02/25/2022	ISSUED FOR 100% DD
	10/05/2022	DOB PAA #1 - CD
7	07/18/2022	REVISED AS NOTED
8	08/05/2022	100% CD
	10/05/2022	DOB PAA #1

2021054.00
1 JAVA

18 INDIA STREET
BROOKLYN, NY 11222

KEY PLAN



NYC Buildings
APPROVED
Date: 11/16/2022

FO COVER SHEET

SCALE:

STATE OF NEW YORK · JENNIFER E. SELVA · 092779 · LICENSED PROFESSIONAL ENGINEER

DRAWING #:
FO-000.01
___ of ___

DOB JOB:
B00539478-P2

10/4/2022 6:06:57 PM © MARVEL ARCHITECTS, PLLC 2018

GENERAL NOTES:

1. All work shall conform to the requirements of the 2014 New York City Building Code.
2. The Contractor shall verify all dimensions and conditions in the field prior to commencing work. Where dimensions and elevations of existing construction could affect the new construction, it is the Contractor's responsibility to make field measurements in time for their incorporation in the Shop Drawings. The Architect and Engineer shall be notified of any discrepancies that may exist.
3. See architectural drawings for floor elevations, slopes, locations of depressed floor areas, and floor openings. The Contractor shall compare the structural drawings with the architectural drawings and report any discrepancy to the Architect and Engineer prior to construction.
4. Principal openings through the framing are shown on these drawings. The General Contractor shall examine the structural, architectural and mechanical drawings for the required openings and shall verify size and location of all openings with the Mechanical Contractor. Providing all openings required by the Mechanical, Electrical, or Plumbing trades shall be a part of the General Contract, whether or not shown in the structural drawings. Any deviation from the openings shown on the structural drawings shall be brought to the Engineer's attention for review.
5. Furnish and place all supports, temporary and permanent, whether shoring, bracing, needling, underpinning, or sheet piling, necessary to brace existing walls or framing to remain, so that no horizontal or vertical settlement occurs to the existing structures. Temporary supports shall be maintained in place until permanent supports are installed. Design of these supports shall be by a registered Structural Engineer in the state of NY in the employ of the Contractor.
6. Alternate connection details may be approved if such details are submitted to the Engineer for review and acceptance is granted. However, the Engineer shall be the sole judge of acceptability and the Contractor's bid shall anticipate the use of those specific details shown on the drawings. The Contractor shall retain a registered Structural Engineer to be responsible for the design of any alternate details which he proposes.
7. Work not indicated on a part of the drawings but reasonably implied to be similar to that shown at corresponding places, shall be included in the Contractor's work.
8. The Contractor shall be completely responsible for the safety of adjacent structures, property, his workmen, and the public, as affected by the construction of this project.
9. All Contractors are required to examine the drawings and specifications carefully, visit the site and fully inform themselves as to all existing conditions and limitations, prior to agreeing to perform the work. Failure to visit the site and familiarize themselves with the existing conditions and limitations will in no way relieve the Contractor from furnishing any materials or performing any work in accordance with drawings and specifications without additional cost to the Owner.
10. Structural drawings may represent construction with a reference scale. Due to the inherent process of drawing development and presentation not all work may be shown "exact" in that scale. Do not "scale" drawings to obtain any missing information or to interpret any information not specifically dimensioned for "exact" detailing or construction purposes.
11. The Contract Documents represent final conditions. Stability of the structure during construction and means and methods that impose temporary loading conditions on the incomplete structure is the sole responsibility of the General Contractor. This responsibility includes, but is not limited to, the design and furnish of any temporary supports, shoring, and/or bracing required for the safety and stability of the structure during construction.

DESIGN LOADS		
Design Code: ASCE 7 - 05/10 as per NYCBC		
Occupancy category: II		
Snow Loads	Ground snow load, pg	25 psf
	Flat roof snow load, p=0.7(Ce)(Ct)(Is)(pg)	18 psf
	Snow exposure factore, Ce	1.0
	Thermal factor, Ct	1.0
	Snow load importance factor, I	1.0
	Snow drift conditions in accordance with Section 1608.0	
Wind Loads	Basic Wind Speed (3-Second gust)	98 mph
	Wind Importance factor, Iw	1.0
	Wind Exposure =	C
	Design wind pressures for main wind force resisting system in accordance with ASCE 7-05 Section 6.5.12.2	
	Design wind pressures on components and cladding in accordance with ASCE 7-05 Section 6.5.12.4	
	Wind Tunnel Loads as per BLWTL interim report dated November 15, 2021	
	Wind Base Shear	1,953k (N-S direction)
		774k (E-W direction)
Earthquake Loads	Seismic importance factor, I	1.0
	Spectral response acceleration, Ss	0.281
	Spectral response acceleration, S1	0.073
	Long-Period Transitional Period, T	6 sec
	Site class	D
	Design spectral response coefficient, Sds	0.2951
	Design spectral response coefficient, Sd	0.1168
	Seismic design category	B
	Basic Seismic force resisting system	Ordinary reinforced concrete shearwalls (N-S direction)
		Ordinary reinforced concrete shearwalls (E-W direction)
	Seismic Base Shear	2,130k (N-S direction)
		2,300k (E-W direction)
	Seismic response coefficient, Cs	0.013 (N-S direction)
		0.013 (E-W direction)
	Response Modification Coefficient, R	5 (N-S direction)
		5 (E-W direction)
	Analysis procedure: Response Spectrum Analysis	

LOADING SCHEDULE				
Occupancy	Superimposed Dead Load (psf)	Live Load (psf)	Live Load Reduction	Concentrated Load (lbs)
Residential	15	40	Yes	
Corridors above 1st Floor	30	100	No	2000
Private Terraces	30	60	No	
Lobbies	40	100	No	
Public Areas	30	100	No	
Retail	30	100	No	1000
Stairs	5	100	No	
Mechanical Areas	30	150	No	
Elevator Machine Rooms	5	75+Equip but not less than 150	No	300 (Grating , on area of 4in^2
Roof	40	30	No	[Concrete roof 2000, on 30in²] [All other roofs 300, on 6in²]

FOUNDATIONS:

1. The foundation design is based on recommendations contained in the Geotechnical Report by LANGAN dated May 24, 2021. This report is available to bidding Contractors for their information, however their attention is directed to the limitations of the report described therein.
2. Individual pile plan locations to submit to the Structural Engineer for review prior to fabrication of reinforcing for pile caps. Pile caps with piles driven out of plan tolerance will require adjustment to cap size and reinforcing. Adjustments may also be required at adjacent tie beams and grade beams. Plan dimensions shown for pile caps on structural drawings represent minimum requirements.
3. No foundations shall be placed in water or on frozen ground.
4. All finished foundation excavations shall be inspected and approved by the Geotechnical Engineer or his designate before any concrete is placed.
5. Unless otherwise noted, all foundations and buttresses shall be centered under supported members.
6. Carefully follow the requirements of the specifications for back fill under or adjacent to any portion of the building.
7. Where foundation elements are to have fill on both sides, each side shall be filled simultaneously, maintaining a common elevation.
8. Coordinate under floor drain requirements with architectural and mechanical drawings and the requirements of the Geotechnical Engineer.
9. Contractor shall provide continuous control of surface and underground water as required during construction such that the work is done in the dry. However, the Contractor shall insure that ground water levels under adjacent structures are not lowered by his construction techniques. Additionally, if so directed by notes in the plans, the Contractor will continue to maintain a condition of no hydrostatic pressure until sufficient building weight is in place to prevent flotation of any part of the structure.
10. Building walls retaining earth rely on the completed floor slabs for lateral support. If required by the construction sequence, the Contractor shall temporarily brace all building walls against which back fill is to be placed until all floor slabs supporting the walls are in place and have attained at least 75% of their specified design strength. Design of temporary braces shall be by a registered Structural Engineer in the state of NY in the employ of the Contractor.

CAISSON/PILE CAPACITY SCHEDULE				
Type	Compression (Tons)	Tension (Tons)	Lateral (Tons)	Comments
◌ 13 3/8" CAISSON	550	274	3.0	--
I HP 14x89, 13.625" OD, t=0.625", 14" OD t=0.80"	250	40	3.0	Grade 50 ksi

REINFORCED MASONRY:

1. All masonry work shall conform to the ``Building Code Requirements of Masonry Structures" (ACI 530-02/ASCE 5-02) and (ACI 530.1-02/ASCE 6-02).
2. The compressive strength of the masonry, f'm, shall be at least 1500 psi. Unless otherwise approved by the Structural Engineer on the basis of prism testing the components of the masonry shall have compressive strengths as given below: 2000psi.
3. All concrete masonry units (CMU) shall conform to ASTM C90, grade N-1, with an individual compressive strength of 2400 psi
4. Mortar for block wall construction shall be Type M or S conforming to ASTM C270.
5. Grout for piers and block walls shall conform to ASTM C476 with a minimum compressive strength of 2000 psi determined in accordance with the provisions of ASTM C1019.
6. Reinforcing bars shall conform to ASTM A615, Grade 60, except bars to be welded shall conform to ASTM A706.
7. Wire for joint reinforcing shall conform to ASTM A82, yield point = 70 ksi (min.).
8. Unless noted otherwise provide minimum reinforcing per the typical details.
9. Provide bond beams with (2)-#5 continuous, at the top of parapets, at each floor level, and where shown on the drawings.
10. Unless noted otherwise on plans, provide the following additional vertical reinforcement in the cell immediately adjacent to each side of a masonry opening and in the cell of discontinuous walls. These bars are to extend full height of the wall or in the case of masonry openings at multi-story walls, from story to level above to story level below the opening. For 6" and 8" CMU Walls provide (2)-#5. For 10" and 12" CMU Walls provide (2)-#6.
11. Extend additional reinforcement a minimum of 36 bar diameters beyond the opening.
12. The minimum length of lap for reinforcing bars embedded in grout is 48 bar diameters, unless shown otherwise on the drawings.
13. Place reinforcing bars before grouting. Place grout in lifts not exceeding 5 feet. Consolidate each lift by mechanical vibration. The next lift of the pour may be made after the initial water loss and reconsolidation of the prior lift, while it is still plastic.
14. Properly secure reinforcing bars to maintain the positions indicated on the drawings. Bars to be located in center of cells unless otherwise noted.
15. All CMU shall be braced during construction for the governing code lateral design loads until permanent restraints have been installed.
16. The following steps are to be followed when laying masonry in the temperatures stated below:

COLD WEATHER MASONRY CONSTRUCTION	
Mean daily air temperature	Instructions
40° - 32° F	Heat mixing water or aggregate to 70° F. Protect masonry from rain or snow for 24 hours.
32° - 20° F	Heat mixing water and aggregate to 70° F. Provide wind breaks for wind velocity in excess of 15 m.p.h. Cover masonry with insulating blankets for 24 hours and provide heat sources on both sides of masonry construction.
Below 20° F	Heat mixing water and aggregate to 70° F. Provide enclosures and heat to maintain 40° minimum temperature. Temperature of masonry units must be 40° F minimum when laid. Maintain masonry above 40° F for 24 hours by enclosures and supplemental heat.

CONCRETE:

1. All concrete work shall conform to the 2011 edition of the ACI Building Code Requirements for Reinforced Concrete (ACI 318) and the 2014 New York City Building Code. In case of conflict, the City Building Code shall govern.
2. All concrete shall be controlled concrete, mixed and placed under the supervision of an approved concrete testing agency.
3. Concrete shall be normal weight concrete unless otherwise noted with sand and gravel aggregate, Type I or Type II Portland Cement and minimum compressive strength (f'c) in 28 days as specified in the Concrete Strength Table.
4. All concrete exposed to the weather or possible freeze/thaw action shall contain an air entrainment admixture. Air content to be 6% ± 1 1/2%.
5. All concrete shall be proportioned for a maximum allowable unit shrinkage of 0.03% measured at 28 days after curing in lime water as determined by ASTM C 157 (using air storage)
6. All concrete shall be placed without horizontal construction joints, except where specifically noted. Vertical construction joints and stops in shored concrete work shall be made at midspan. Horizontal reinforcement shall be continuous through vertical construction joints.
7. Construction joint locations other than shown on the drawings are permitted subject to prior approval of the Engineer. Expansion joint and control joint locations are mandatory as shown. Contractor shall submit drawings showing intended placing sequences and locations of construction joints to the Engineer for approval.
8. Unless otherwise shown on drawings, slabs on grade shall be cast in alternating strips, one (1) column bay wide. Adjacent sections shall be placed no sooner than three days apart. Alternatively, slab on grade areas may be poured in as large an area as can be handled provided that saw cut joints are cut as soon as the concrete will support a man's weight without permanent deformation and the joint process does not dislodge aggregates. Saw cut locations shall be submitted to engineer for review prior to construction.
9. Grout under column base plates and under other bearing plates shall be non-shrink, nonmetallic grout with a minimum compressive strength of 5000 psi at 3 days.
10. Pipes or conduits placed in slabs on grade shall not be placed closer than 3 diameters on centers and shall have an outside diameter less than 1/3 of the slab thickness and be positioned so that they do not interfere with slab reinforcement. Aluminum conduits shall not be placed in concrete. No conduits or pipes shall be placed in composite slabs on metal deck.
11. All keys shall be 2" x 4" (nominal) unless otherwise shown on the drawings.
12. Concrete cast on sloped surfaces shall begin at the lowest elevation and continue monolithically toward the higher elevations until the intended pour is completed.
13. No concrete shall be cast before review and approval of the reinforcing and embedded items have been obtained from the Special Inspector.
14. All exposed edges of concrete members shall be chamfered 3/4" unless shown otherwise on architectural drawings.
15. Concrete must reach the following percentages of its 28-day compressive strength (f'c) before forms or shores may be removed: Pile caps....20%, Walls and beam sides....20%, Columns....40% (1500psi min), Beam bottoms (if shored)....70%, Floor systems....85%
16. See architectural drawings for concrete finishes. Where finish is not specified, conform to requirements of ACI 301 - "Specifications for Structural Concrete for Buildings."
17. See architectural drawings for door and window openings, drips, washes, reglets, concrete finishes, masonry anchors, and for miscellaneous embedded plates, bolts, anchors, angles, etc.
18. The placement of sleeves, outlet boxes, box-outs, anchors, etc., for the mechanical, electrical and plumbing trades is the responsibility of the trade involved.
19. At sawcutting of existing concrete, including slabs on grade, no overcut at corners is allowed. All corners shall have a core hole of sufficient diameter made prior to cutting at adjacent sides to prevent cut beyond the required dimension.

CONCRETE STRENGTH TABLE		
Intended Use	28 Day Strength, f`c (psi)	Other Requirements & Admixtures
Pile caps	6000 UNO	
Foundation Walls	5000	
Fill concrete	4000	
Mud mats	2500	
Grade Beams	6000	
Exposed parking floors, slabs, driveways, ramps, sidewalks	7200	a) 1.5Lbs/YD³ Fiber Mesh b) Silica Fume (10% Max) c) DCI or equal or all top bars to be epoxy coated* on non-metallic chairs d) Max water - cement ratio 0.4

REINFORCING:

1. Detailing of concrete reinforcement and accessories shall be in accordance with ACI 315 - "Manual of Standard Practice for Detailing Reinforced Concrete Structures," latest edition.
2. Reinforcement shall be continuous through all construction joints unless otherwise noted on drawings.
3. Provide and schedule with the shop drawings, all necessary accessories to hold reinforcing securely in position. Minimum requirements shall be: High chairs....4'-0" OC, Slab bolsters....4'-0" OC. Support bars for high chairs shall be #5 min.
4. All continuous reinforcement shall have a minimum lap as required for a Class B splice (ACI 318) unless noted otherwise.
5. WWF shall be provided in flat sheets. All laps in WWF shall be one mesh plus two inches at splices.
6. Concrete protection for reinforcement including WWF shall be provided as follows unless otherwise shown on the drawings:
7. All hooks shown on drawings shall be standard hooks unless noted otherwise.
8. Where continuous bars are called for, they shall run continuously around corners and be lapped at necessary splices, or hooked at discontinuous ends. Lap lengths shall be as given in the splice and development table. Lap beam top bars at mid-span and beam bottom bars at supports, unless otherwise noted.

REINFORCING MATERIAL TABLE			
Reinforcing element	ASTM	Grade, Fy (ksi)	Comments
Reinforcing bars equal to and less than #11	A615	60	#11 Gr. 75 for Shear Walls and Link beams
Reinforcing bars greater than #11	A615	75	
Welded reinforcing	A 706	60	Reinforcing bars may not be welded without prior approval of the Structural Engineer.
Slab on grade (6x6 - W2.9 x W2.9)	A185	65	
Slab on metal deck (6x6 - W2.1 x W2.1)	A185	65	
Around structural members encased in concrete (4x4 - W1.4 x W1.4), plus (1)-#5 spacer bar each corner	A185	65	
In middle of concrete fill for stairs (2x2 - W1.4 x W1.4)	A185	65	Fibermesh at 1 1/2#/cu. yd. may be substituted for WWF in stairs.

CONCRETE COVER TABLE (UNO)		
Condition		Cover
Surfaces cast against earth		3 inches
Formed surfaces exposed to earth or weather:	#6 bars and larger	2 inches
	#5 bars and smaller	1 1/2 inches
Formed surfaces not exposed to earth or weather. Slabs, walls, joists:	#11 bars and smaller	3/4 inches
	#14 - #18	1 1/2 inches
Formed surfaces not exposed to earth or weather. Beams and columns:		1 1/2 inches
Pressure Slab		3/4 inches

DRILLED-IN CONCRETE ANCHORS:

1. Mechanical Anchors: Wedge type with current ICBO approval and published in ICC ESR Code Report and conforming to ICC ES AC193. Complete with required nuts, washers, and manufacturer's installation instructions. Size and manufacturer as indicated on drawings. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by Architect, provide one of the following listed in the Post Installed Anchor Table for cracked and un-cracked concrete (unless otherwise noted)
2. Chemical Anchors: Threaded carbon steel or stainless steel rod complete with required nuts, washers, adhesive system and manufacturer's installation instructions. Current ICBO approval and published ICC ESR Code Report required and conforming to ICC ES AC308. Size and manufacturer as indicated on drawings. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Architect, provide one of the following listed in the Post Installed Anchor Table for cracked and un-cracked concrete (unless otherwise noted)
3. At locations where post installed anchors are being used in concrete, a survey shall be preformed to locate existing rebar. using ground penetrating radar. Survey results are to be coordinated with shop drawings. Alternatively, anchor rods are to be installed after which a template is to be created for use by the fabricator in the shop drawings. Notify Engineer of record (E.O.R.) if as-installed location varies more than 1/2" from theoretical.

POST INSTALLED ANCHOR MATERIAL TABLE			
Manufacture	Anchor Type	Name	Comments
Hilti	Mechanical	HAD ICC	--
Hilti	Mechanical	HSL-3	--
Hilti	Mechanical	Kwik Bolt TZ	--
Hilti	Mechanical	Kwik Bolt 3	un-cracked concrete only
Power Fasteners	Mechanical	Power-Stud + SD11 Category 1	1/4"Ø - uncracked concrete only, all others acceptable for both cracked and un-cracked concrete
Power Fasteners	Mechanical	Power-Stud + SD2 Category 1	--
Power Fasteners	Mechanical	Wedge-Bolt+ Category1	1/4"Ø - uncracked concrete only, all others acceptable for both cracked and un-cracked concrete
Power Fasteners	Mechanical	Snake+ Category 1	--
Power Fasteners	Mechanical	Vertigo + Category 1	--
Simpson Strong-Tie	Mechanical	Strong-Bolt	--
Simpson Strong-Tie	Mechanical	Titen HD	--
Simpson Strong-Tie	Mechanical	Titen HD Rod Hanger	3/8", 1/2"Ø only for both cracked and un-cracked concrete
ITW Red Head	Mechanical	Trubolt +	3/8", 1/2", 5/8"Ø only
ITW Red Head	Mechanical	Trubolt	1/4", 3/8", 1/2"Ø - uncracked concrete only, all others acceptable for both cracked and un-cracked concrete
Hilti	Chemical	HIT-RE 500 SD	--
Hilti	Chemical	HIT-HY 200 SAFE SET	1 1/4"Ø max. for both cracked and un-cracked concrete. Note: for embedment greater than 15" use HIT-RE 500 SD due to the quick setting time of the 200 SAFE SET.
Power Fasteners	Chemical	AC100+ Gold-Dry, Wet, Water-Filled	un-cracked concrete only
Power Fasteners	Chemical	PE1000+ -Dry, Wet, Water-Filled	3/8", 1", 1 1/4"Ø - acceptable for un-cracked concrete only, all others acceptable for both cracked and un-cracked concrete
Power Fasteners	Chemical	T308+	3/8" - 7/8"Ø - un-cracked concrete only, none acceptable for cracked concrete
Simpson Strong-Tie	Chemical	SET-XP	--
ITW Red Head	Chemical	EPCON G5	un-cracked concrete only

SPECIAL INSPECTIONS:

1. All special inspections shall be made by a NYC DOB approved special inspection agency selected and paid by the owner. Contractor shall furnish testing agency access to work, facilities and incidental labor required for testing and inspection. Retention by the Owner of an independent testing agency shall in no way relieve the Contractor of responsibility for performing all work in accordance with the contract requirements.
2. Special inspections required are as follows:

SPECIAL INSPECTIONS NYCBC 2014	
Concrete - Cast-In-Place	BC 1704.4
Subsurface Conditions- Fill placement & In-Place Density	(TR 4) BC 1704.7.4
Subsurface Conditions- Borings/Test Pits	(TR 4) BC 1704.7.4
Deep Foundation Elements	(TR-5) BC 1704.8
Post-installed Anchors (BB#2014-018, 2014-019)	BC 1704.32
Concrete Design Mix	(TR-3) BC 1905.3, BC 1913.5
Concrete Sampling and Testing	(TR-2) BC 1905.6, BC 1913.10

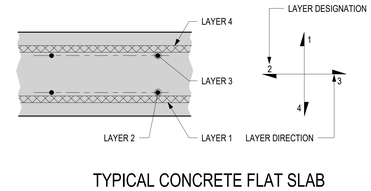
ABBREVIATIONS LIST	
(E)or EXIST	Existing
(S)	Salvaged
/	Per
@	At
AB	Anchor Bolt
ADD'L	Additional
AESS	Architectural Exposed Structural Steel
ALT	Alternate
ALUM	Aluminum
ANCH	Anchor
APPROX	Approximate
ARCH	Architectural
BF	Braced Frame
BL	Brick Ledge
BLDG	Building
BM	Beam
BO	Bottom of
BOS	Bottom of Steel
BOT or B	Bottom
BRDG	Bridging
BRG	Bearing
BTWN	Between
C	Channel
CANT	Cantilever
CF	Cold Formed
CFSF	Cold Formed Steel Fabricator
CIP	Cast-In-Place
CJ	Control Joint
CJP	Complete Joint Penetration
CL	Centerline
CLG	Ceiling
CLR	Clear
CMU	Concrete Masonry Unit
COL	Column
CONC	Concrete
CONN(S)	Connection(s)
CONST	Construction
CONT	Continue or Continuous
COORD	Coordinate
CSJ	Construction Joint
CTR(D)	Center(ed)
DB	Bar Diameter
DBA	Deformed Bar Anchor
DBL	Double
DIA or Ø	Diameter
DIAG	Diagonal
DIM	Dimension
DL	Dead Load
DN	Down
DO	Ditto
DTL(S)	Detail(s)
DWG(S)	Drawing(s)
DWL(S)	Dowel(s)
E-W	East-West
EA	Each
EC	Epoxy Coated
EE	Each End

ABBREVIATIONS LIST	
EF	Each Face
EJ	Expansion Joint
EL	Elevation
ELEV	Elevator
EMBED	Embedded
ENGR	Engineer
EOR	Engineer-of-Record
EOS	Edge of Slab
EQ	Equal
EQ SP	Equally Spaced
EQUIP	Equipment
EQUIV	Equivalent
ES	Each Side
EW	Each Way
EXP	Expansion
EXP ANC	Expansion Anchor
EXT	Exterior
FA	Face
FAB	Fabricate
FD	Floor Drain
FDN	Foundation
FF	Finished Floor
FIN	Finish(ed)
FLG	Flange
FLR	Floor
FO	Face Of
FP	Full Penetration Or Fire Proofing Or Fire Proofing
FS	Far Side
FT	Foot or Feet
FTG	Footing
GA	Gage or Gauge
GALV	Galvanized
GB	Grade Beam
GEN	General
GR	Grade or Grind
HAS or HDAS	Headed Anchor Stud
HC	Hollow Core (Precast Plank)
HDAR	Headed Anchor Rod
HDG	Hot Dipped Galvanized
HGR	Hanger
HK	Hook
HORZ	Horizontal
HP	High Point
HSS	Hollow Structural Shape
HT	Height
HVAC	Heating-Ventilating and A/C
ID	Inside Diameter
IF	Inside Face
IN	Inch
INT	Interior
JT	Joint
K	Kip
KSF	Kip Per Square Foot
KSI	Kip Per Square Inch
L or LG	Length
LB	Link Beam (or Coupling Beam)

ABBREVIATIONS LIST	
LB(S)	Pound(s)
LCE	Compression Embedment
LCS	Compression Lap Splice
LDH	Hook Development Length
LL	Live Load
LLBB	Long Leg Back to Back
LLH	Long Leg Horizontal
LLV	Long Leg Vertical
LOC(S)	Location(s) or Locate
LONG	Longitudinal
LP	Low Point
LT	Light
LTE	Tension Embedment
LTS	Tension Lap Splice Length
LWC	Light Weight Concrete
MAS	Masonry
MATL	Material
MAX	Maximum
MC	Moment Connection
MECH	Mechanical
MEP	Mech/Elect/Plumb
MEZZ	Mezzanine
MF	Moment Frame
MFR	Manufacturer
MIN	Minimum
MISC	Miscellaneous
MLS	Masonry Lap Splice
MTL	Metal
N	North
N-S	North-South
NFP	Fireproofing Not Required
NIC	Not in Contract
NO or #	Number
NOM	Nominal
NS	Non-Shrink or Near Side
NTS	Not To Scale
NWC	Normal Weight Concrete
OC	On Center
OD	Outside Diameter
OF	Outside Face
OH	Opposite Hand
OPNG(S)	Opening(s)
OPP	Opposite
OVS	Oversized
OWS	One Way Slab
PAF	Power Actuated Fastener
PC	Precast
PEN	Penetration
PERP	Perpendicular
PL	Plate (Steel)
PLF	Pounds Per Lineal Foot
PREFAB	Prefabricated
PRELIM	Preliminary
PS	Prestressed
PSF	Pounds Per Square Foot
PSI	Pounds Per Square Inch
PT	Point or Post-Tension or Pretensioned

ABBREVIATIONS LIST	
QTY	Quantity
RAD or R	Radius
RD	Roof Drain
RE: of REF	Refer to (Reference)
REINF	Reinforce(ing)(d)(ment)
REQD	Required
REQT(S)	Requirement(s)
RET	Return
REV	Revision
RTC	Roof Top Unit
S	South
SB	Strap Beam
SC	Slip Critical
SCHED	Schedule
SECT	Section
SHT	Sheet
SIM	Similar
SLBB	Short Leg Back to Back
SLH	Short Leg Horizontal
SLV	Short Leg Vertical
SOG	Slab on Grade
SP	Space(s)
SP @	Space at
SPECS	Specifications
SPRT	Support
SQ	Square
SS	Stainless Steel
STD	Standard
STIFF	Stiffener
STIR	Stirrup
STL	Steel
STR	Structural
SW	Shearwall
SYM	Symmetrical
T	Top
T&B	Top & Bottom
THK	Thick or Thickness
TL	Total Load
TO	Top of
TOC	Top of Concrete
TOS	Top of Steel
TOW	Top of Wall
TRANS	Transverse
TWS	Two Way Slab
TYP	Typical
ULT	Ultimate
UNO	Unless Noted Otherwise
VERT	Vertical
VIF	Verify in Field
W	With
W/O	Without
WF	Wide Flange
WP	Working Point or Waterproofing
WT	Wide Flange Tee Section
WWR	Welded Wire Reinforcement
WxH	Width x Height

Symbol Legend	
PC-x (X'-X")	INDICATES PILE CAP GROUP WHERE: X = MARK (X'-X") = ABSOLUTE TOP OF CAP ELEVATION
XFxx.x (X'-X")	INDICATES SPREAD COLUMN FOOTING MARK. SEE FOOTING SCHEDULE ON Sxxx. (X'-X") = ABSOLUTE TOP OF FOOTING ELEVATION
GB-x	INDICATES GRADE BEAM. SEE GRADE BEAM SCHEDULE ON Sxxx.
SB-x	INDICATES STRAP BEAM. SEE TIE BEAM SCHEDULE ON Sxxx.
<X'-X">	INDICATES TOP OF FOUNDATION WALL
[X'-X"]	INDICATES BOTTOM OF FOUNDATION WALL
(X'-X")	INDICATES TOP OF FOOTING / PILE CAP ELEVATION
(X)	INDICATES COLUMN NUMBER
(X) (X)	INDICATES COLUMN UP AND COLUMN DOWN RESPECTIVELY
(X)#X	INDICATES ADDITIONAL TOP REINFORCING, SEE TYPICAL CONCRETE DETAILS FOR LENGTHS
(X)#X (X)#X	INDICATES ADDITIONAL BOTTOM REINFORCING, SEE TYPICAL CONCRETE DETAILS FOR LENGTHS
(X)#X**	INDICATES EPOXY COATED REINFORCEMENT
(X)#X	INDICATES ADDITIONAL MID-DEPTH REINFORCING WITH TERMINATOR
(X)#X	DOUBLE ARROW INDICATES REINFORCEMENT SIZE AND SPACING IS CONTINUOUS UNTIL A NEW SIZE AND SPACING OF REBAR IS SHOWN

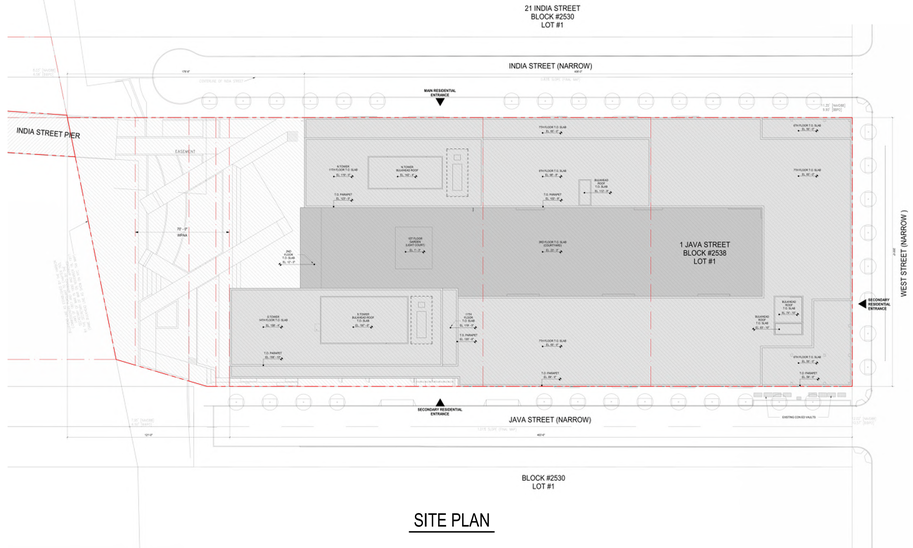


TYPICAL CONCRETE FLAT SLAB REINFORCEMENT ORIENTATION

Scope of Work: Foundation work as per plans filed, Filed in conjunction with NB # B00539478-I1

The following applications being filed in conjunction with NB filing:
- **Fence: B00637246-I1**
- **BPP - : 340818958**

DESIGN LOADS COMPLY AS PER BC 107.7 & BC 1604



SITE PLAN

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145 HUDSON STREET, FLR.3 NEW YORK, NY 10013
212.616.0420

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200 PARK AVE, 9TH FLOOR NY, NY 10166

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45 W 45TH ST, 10TH FLOOR NY, NY 10036

BUILDING SYSTEMS ENGINEER
ARUP
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ACCESSIBILITY SERVICES
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166 AMES ST, HACKENSACK, NJ 07601

REV	DATE	DESCRIPTION
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2	06/11/2021	50% SCHEMATIC SUBMISSION
3	08/06/2021	ISSUED FOR 100% SD
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7	07/18/2022	REVISED AS NOTED
8	08/05/2022	100% CD
	10/05/2022	DOB PAA #1

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1 JAVA
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KEY PLAN

APPROVED
Date: 11/16/2022

GENERAL NOTES

SCALE: As indicated

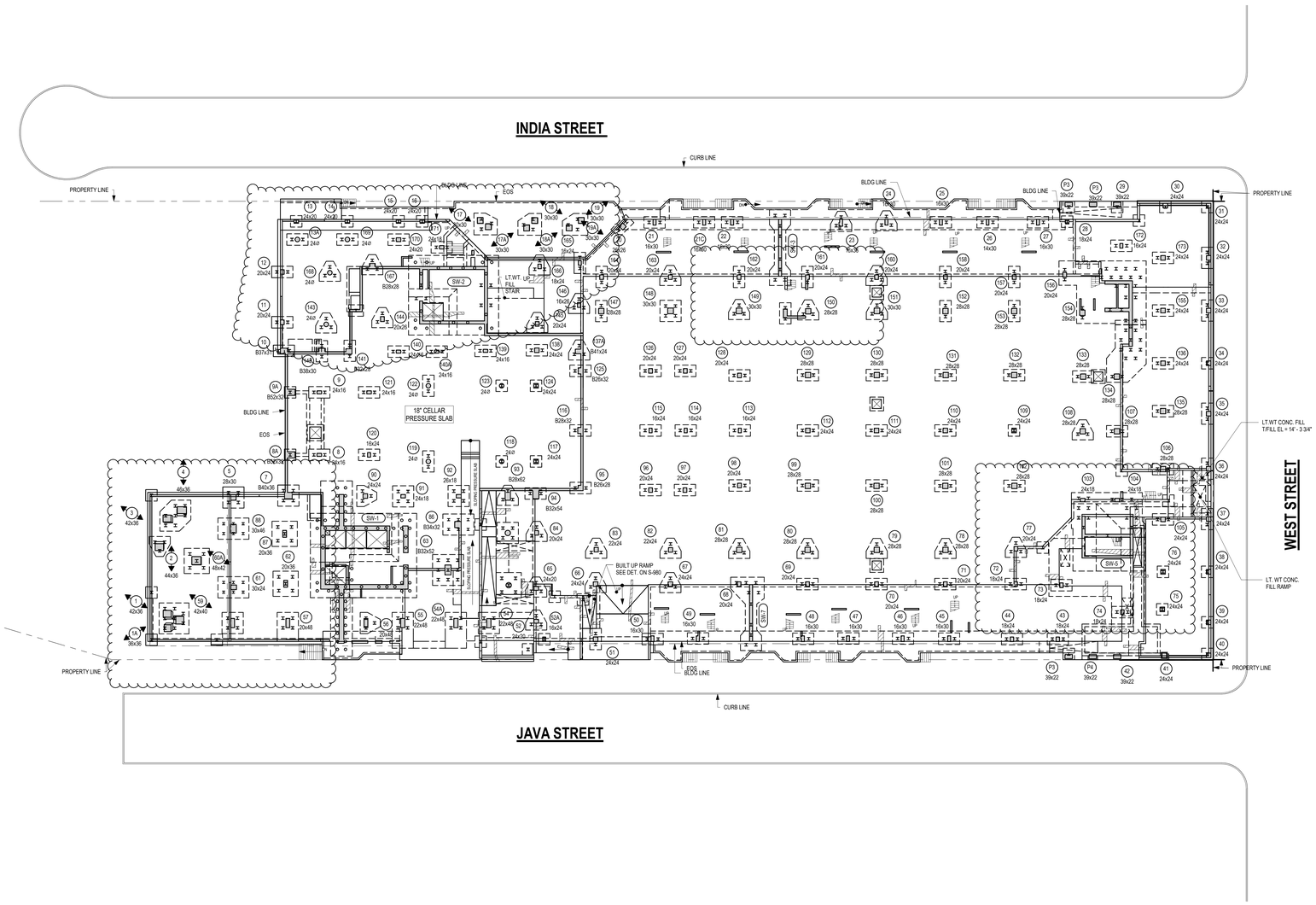
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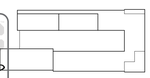
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1 JAVA

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KEY PLAN



NYC Buildings
APPROVED
Date: 11/16/2022

SITE PLAN

SCALE: 1" = 20'-0"

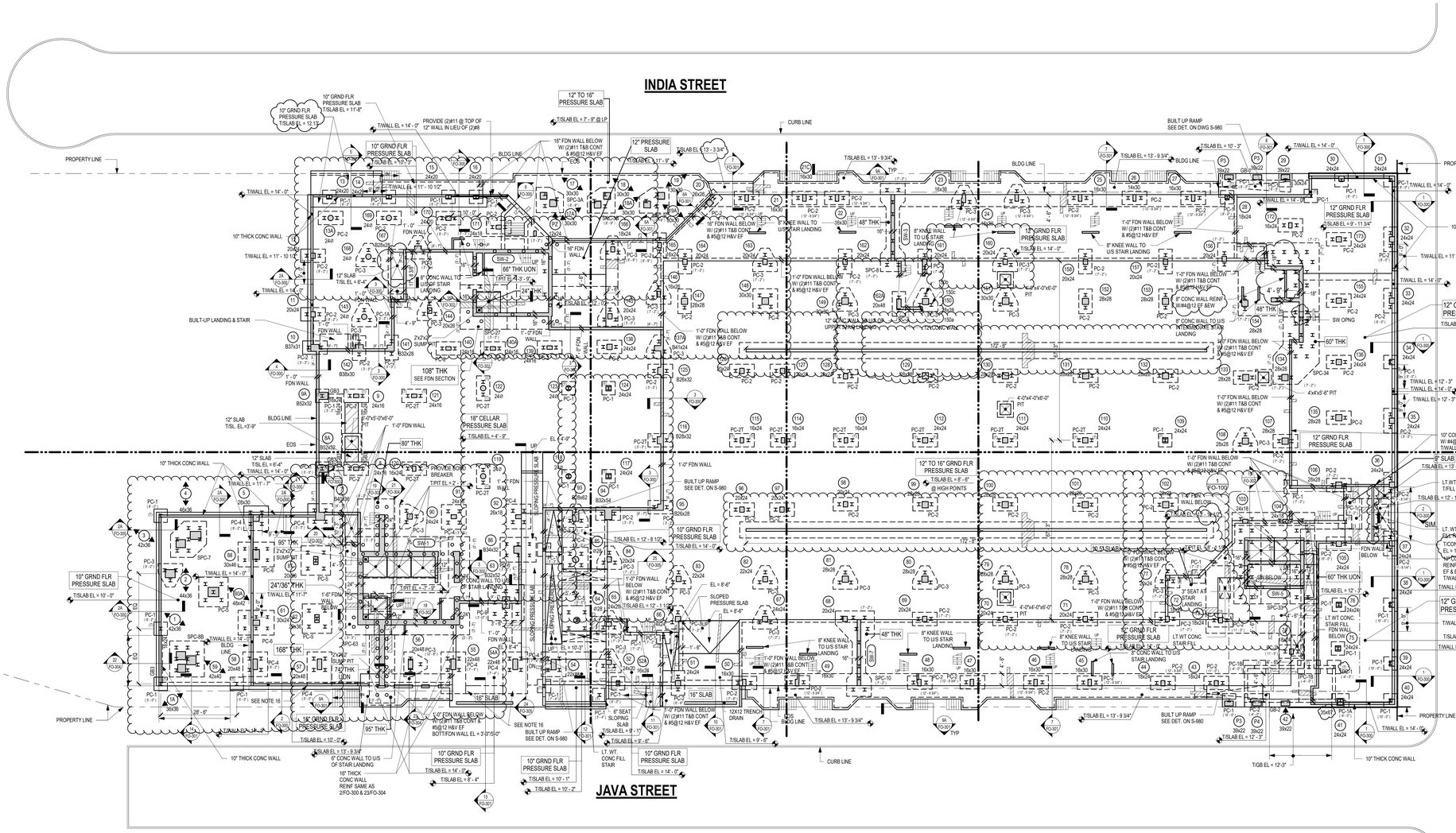
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INDIA STREET
JAVA STREET
WEST STREET
PROPERTY LINE
BLDG LINE
CURB LINE
10" GRND FLR PRESSURE SLAB T/SLAB EL = 11'-8"
10" GRND FLR PRESSURE SLAB T/SLAB EL = 12'-1"
12" TO 16" PRESSURE SLAB T/SLAB EL = 7'-9" @ LP
12" PRESSURE SLAB T/SLAB EL = 11'-6"
T/SLAB EL 13' - 3 3/4"
T/SLAB EL = 13' - 9 3/4"
T/SLAB EL = 10' - 3"
T/SLAB EL = 14' - 0"
T/SLAB EL = 11' - 10 1/2"
T/SLAB EL = 11' - 7"
T/SLAB EL = 9' - 11 3/4"
T/SLAB EL = 10' - 8 1/4"
T/SLAB EL = 12' - 3"
T/SLAB EL = 12' - 10"
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T/SLAB EL = 3' - 9"
T/SLAB EL = 3' - 6"
T/SLAB EL = 13' - 9 3/4"
T/GB EL = 12'-3"
10" THICK CONC WALL
T/WALL EL = 14' - 0"
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T/WALL EL = 11' - 10"
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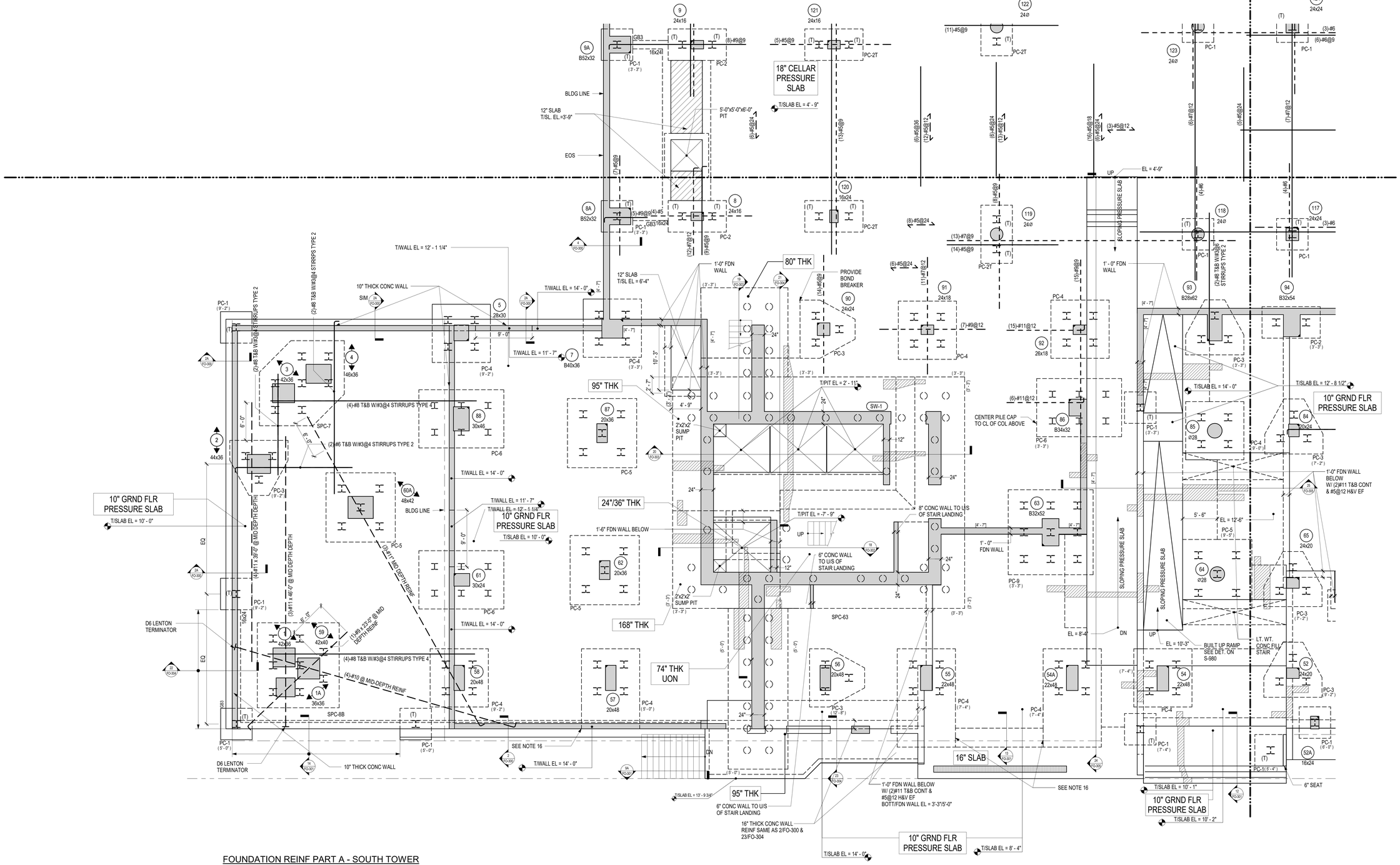
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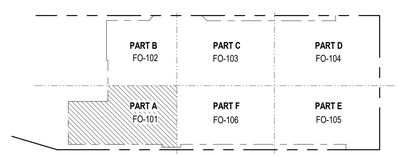
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REV	DATE	DESCRIPTION
4	12/10/2021	50% DESIGN DEVELOPMENT
5	02/25/2022	ISSUED FOR 100% DD
6	05/20/2022	ISSUED FOR 50% CD
7	07/18/2022	REVISED AS NOTED
8	08/05/2022	100% CD
	10/05/2022	DOB PAA #1



FOUNDATION REINF PART A - SOUTH TOWER
SCALE: 3/16" = 1'-0"



KEY PLAN

2021054.00
1 JAVA
18 INDIA STREET
BROOKLYN, NY 11222

KEY PLAN

APPROVED
Date: 11/16/2022

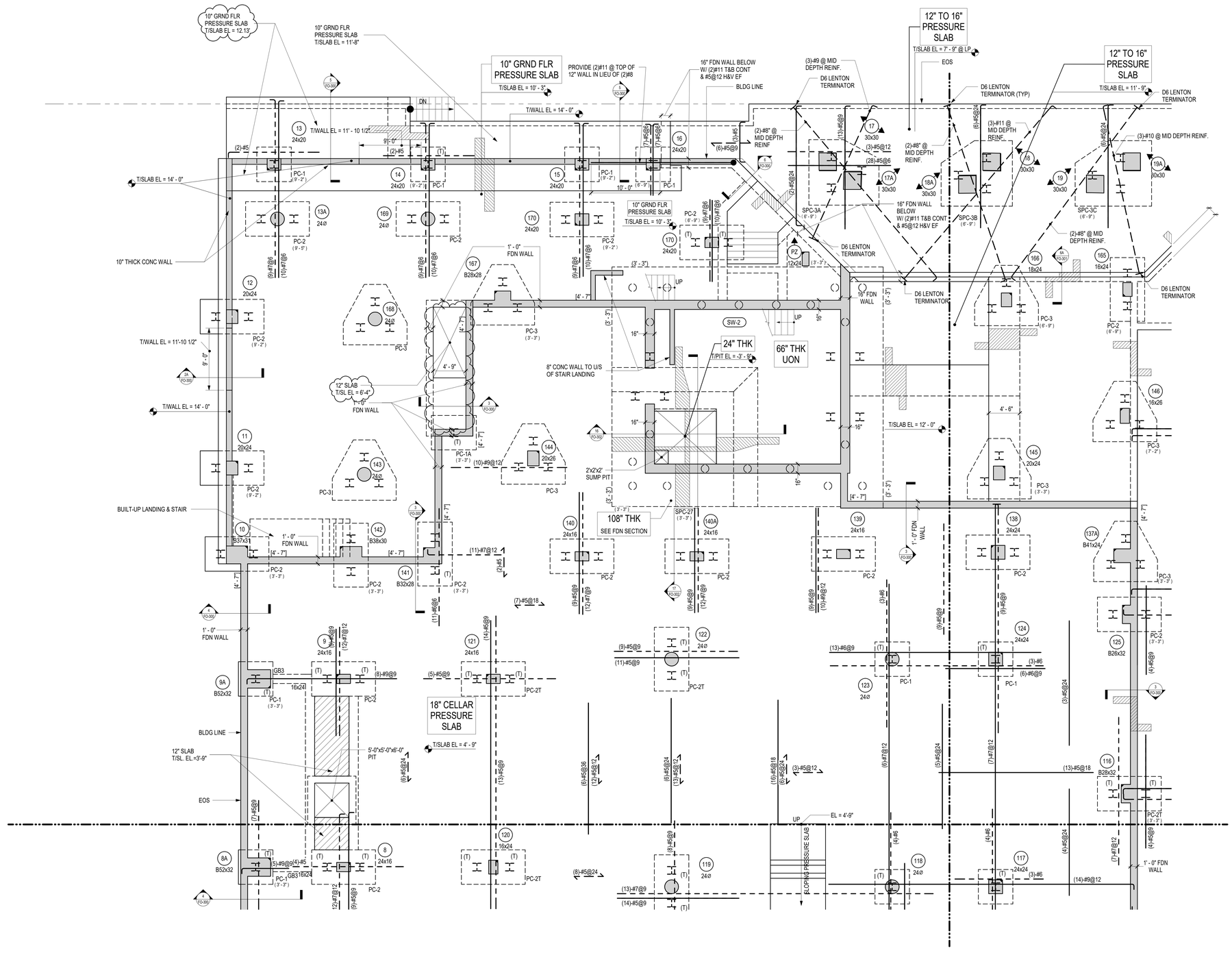
FOUNDATION REINF PART A - SOUTH TOWER

SCALE: As indicated

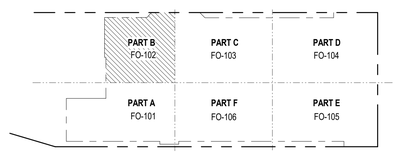
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FOUNDATION REINF PART B - NORTH TOWER
SCALE: 3/16" = 1'-0"



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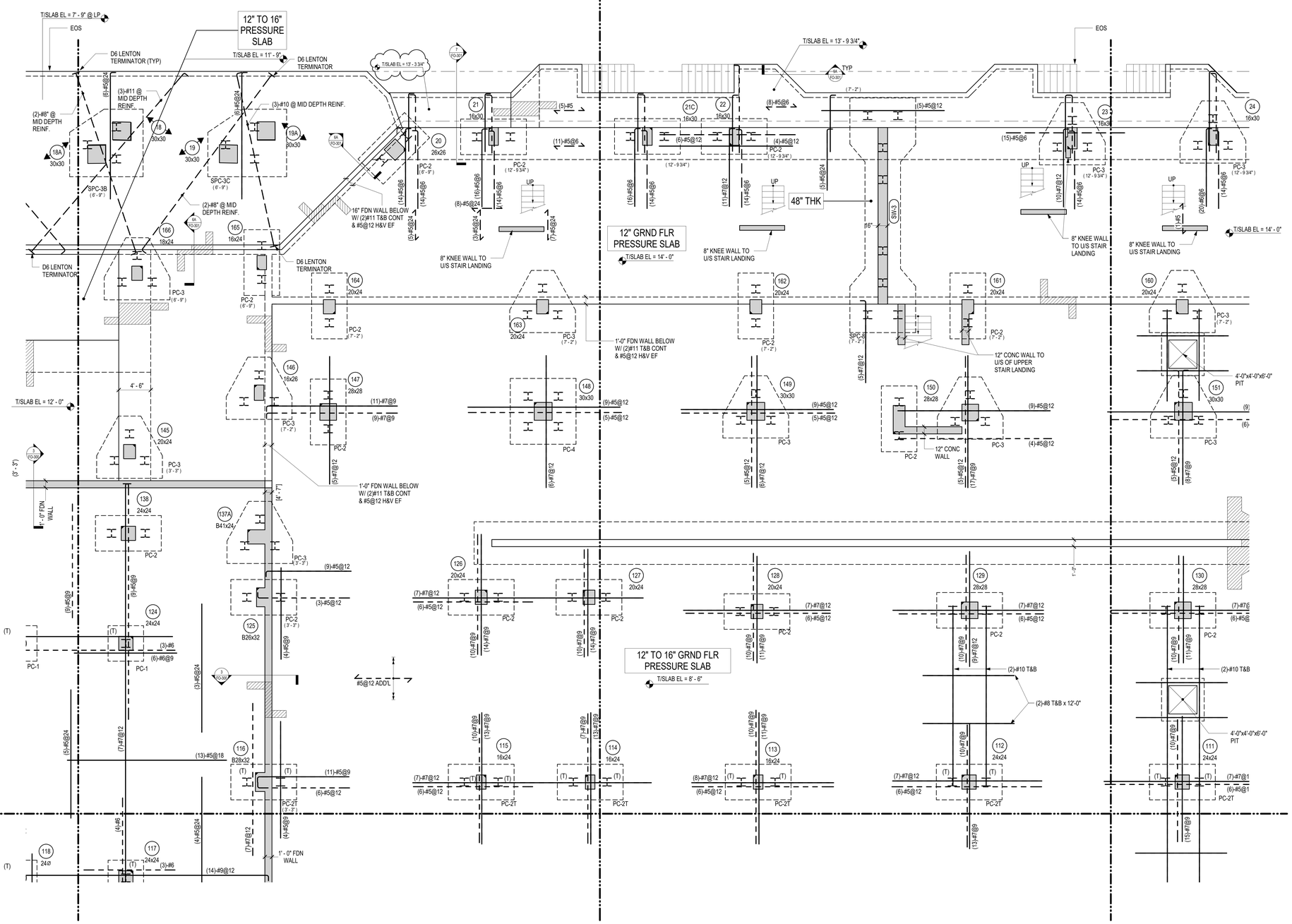
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FOUNDATION REINF PART C - NORTH TOWER
SCALE: 3/16" = 1'-0"



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MARINE ENGINEER
MCLAREN ENGINEERING GROUP
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MARVEL
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JAMES CORNER FIELD OPERATIONS
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LIGHTING DESIGNER
ONELUX
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ACCESSIBILITY SERVICES
120-34 QUEENS BLVD, SUITE 320
KEW GARDENS, NY 11415

ACOUSTICS
LONGMAN-LINDSAY
200 W 41ST, SUITE 1100, NY, NY 10036

EXPEDITOR
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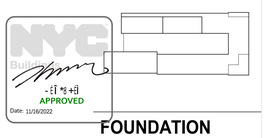
POOL CONSULTANT
AQUATECTONIC/LOTHROP ASSOCIATES, LLP
333 WESTCHESTER AVE,
WHITE PLAINS, NY 10604

FACADE MAINTENANCE
ENTEK ENGINEERING
166 AMES ST, HACKENSACK, NJ 07601

REV	DATE	DESCRIPTION
4	12/10/2021	50% DESIGN DEVELOPMENT
5	02/25/2022	ISSUED FOR 100% DD
6	05/20/2022	ISSUED FOR 50% CD
7	07/18/2022	REVISED AS NOTED
8	08/05/2022	100% CD
	10/05/2022	DOB PAA #1

2021054.00
1 JAVA
18 INDIA STREET
BROOKLYN, NY 11222

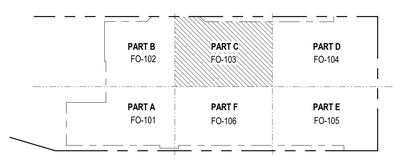
KEY PLAN



NYC Buildings
APPROVED
Date: 11/3/2022

FOUNDATION REINF PART C - NORTH TOWER

SCALE: As indicated



KEY PLAN

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212.616.0420

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STRUCTURAL ENGINEER
MCNAMARA SALVIA
45 W 45TH ST, 10TH FLOOR NY, NY 10036

BUILDING SYSTEMS ENGINEER
ARUP
77 WATER ST, 5TH FLOOR NY,NY 10005

VERTICAL TRANSPORTATION
LERCH BATES
1430 BROADWAY, SUITE 908 NY, NY 10018

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WALKER CONSULTANTS
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STEVEN WINTER ASSOCIATES, INC
307 7TH AVE, SUITE 1701 NY, NY 1001

ENVELOPE CONSULTANT
SOCOTEC, INC
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MCLAREN ENGINEERING GROUP
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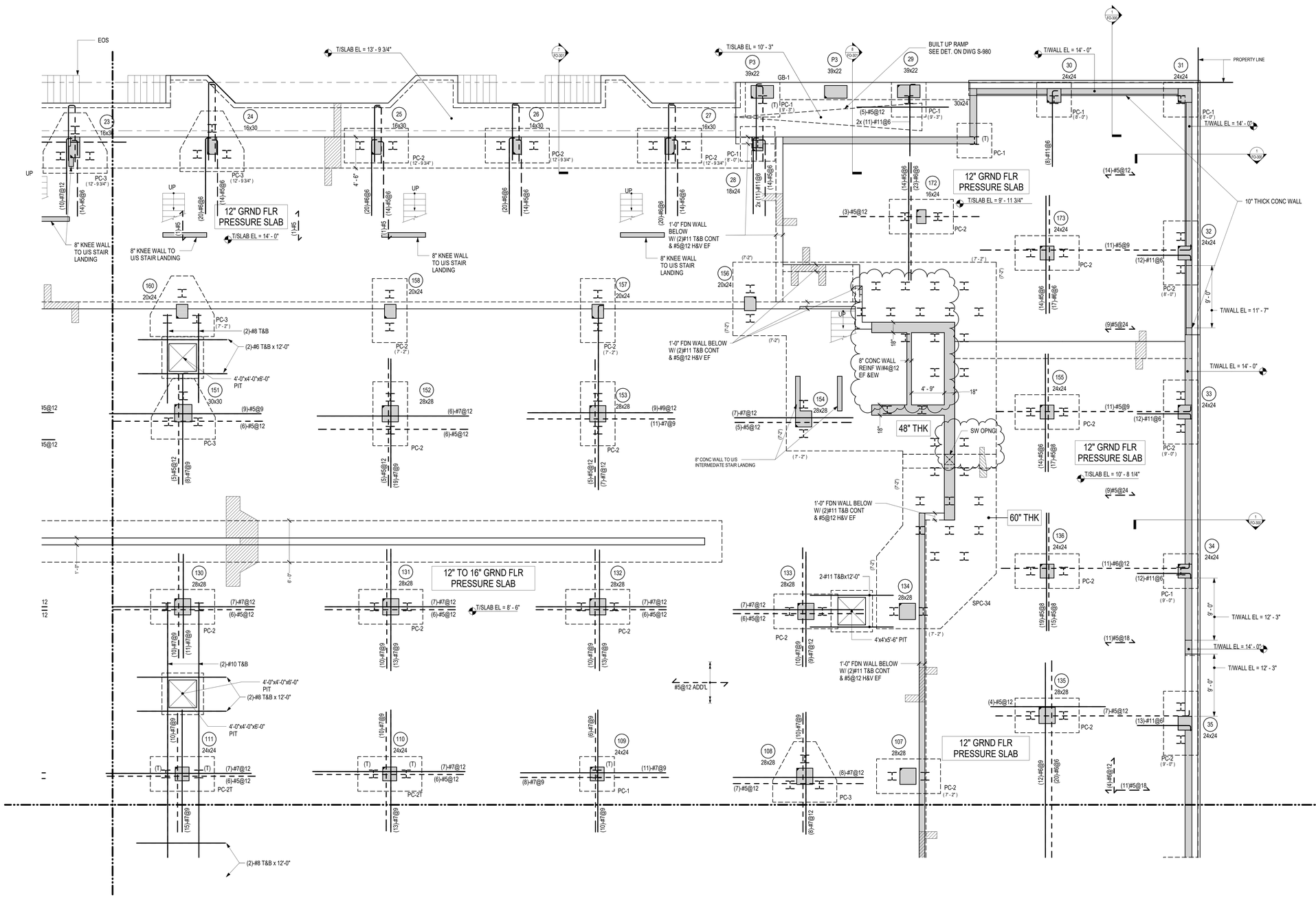
EXPEDITOR
JAM CONSULTANTS INC.
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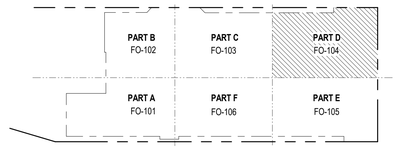
POOL CONSULTANT
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WHITE PLAINS, NY 10604

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FOUNDATION REINF PART D - NORTH TOWER
SCALE: 3/16" = 1'-0"



KEY PLAN

2021054.00
1 JAVA
18 INDIA STREET
BROOKLYN, NY 11222

KEY PLAN

APPROVED
Date: 11/16/2022

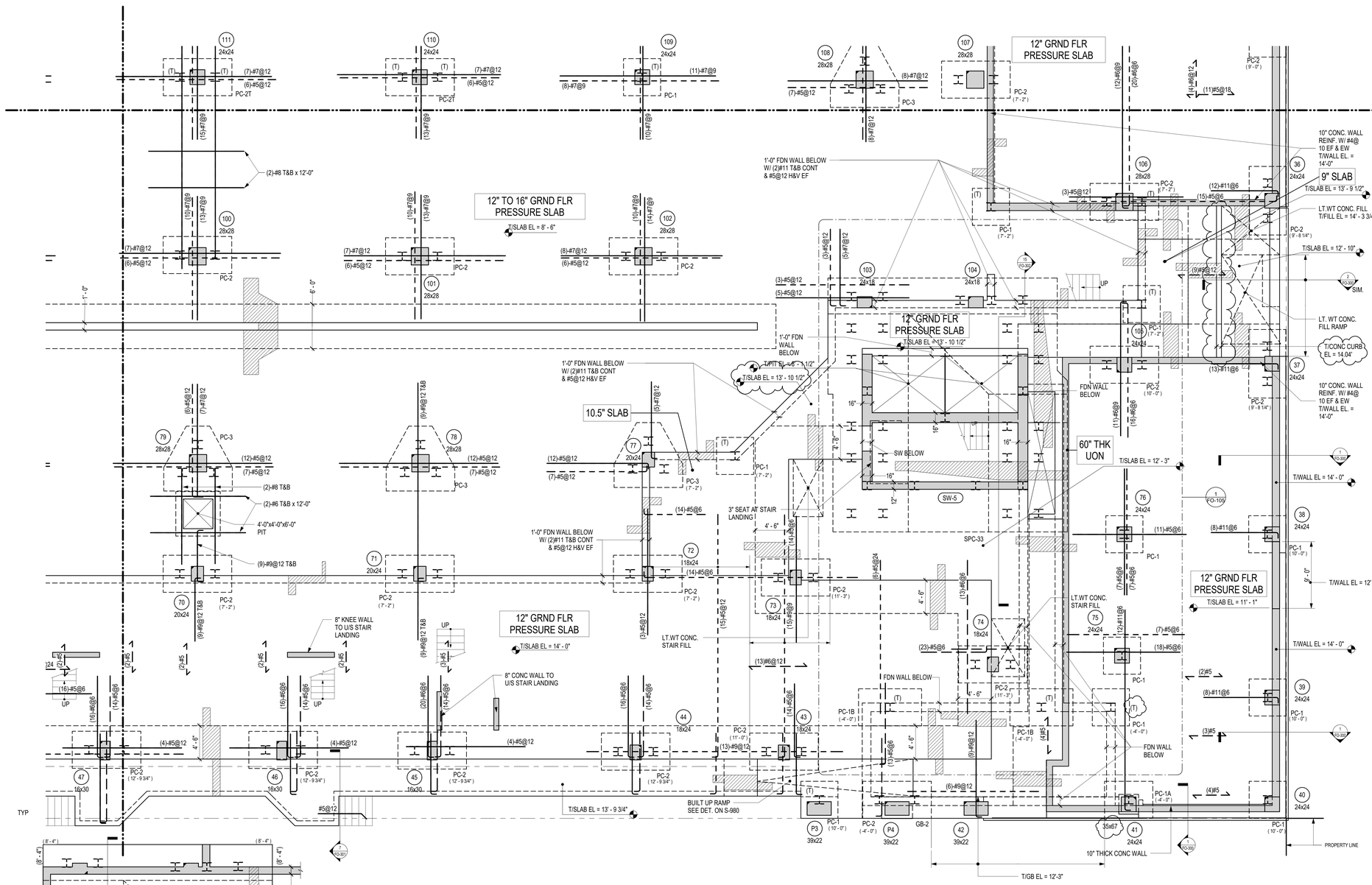
FOUNDATION REINF PART D - NORTH TOWER

SCALE: As indicated

DRAWING #:
FO-104.00
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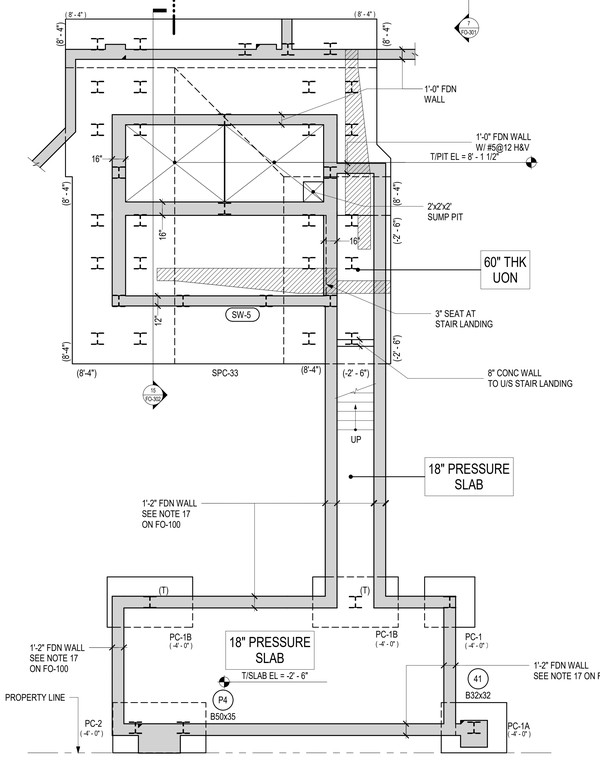
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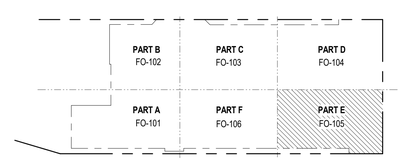


FOUNDATION REINF PART E - SOUTH TOWER

SCALE: 3/16" = 1'-0"



1 FO-105 FOUNDATION REINF PART PLAN
SCALE: 3/16" = 1'-0"



KEY PLAN



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212.616.0420

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	10/05/2022	DOB PAA #1

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1 JAVA
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BROOKLYN, NY 11222

KEY PLAN

NYC Buildings
APPROVED
Date: 11/16/2022

FOUNDATION REINF PART E - SOUTH TOWER

SCALE: As indicated

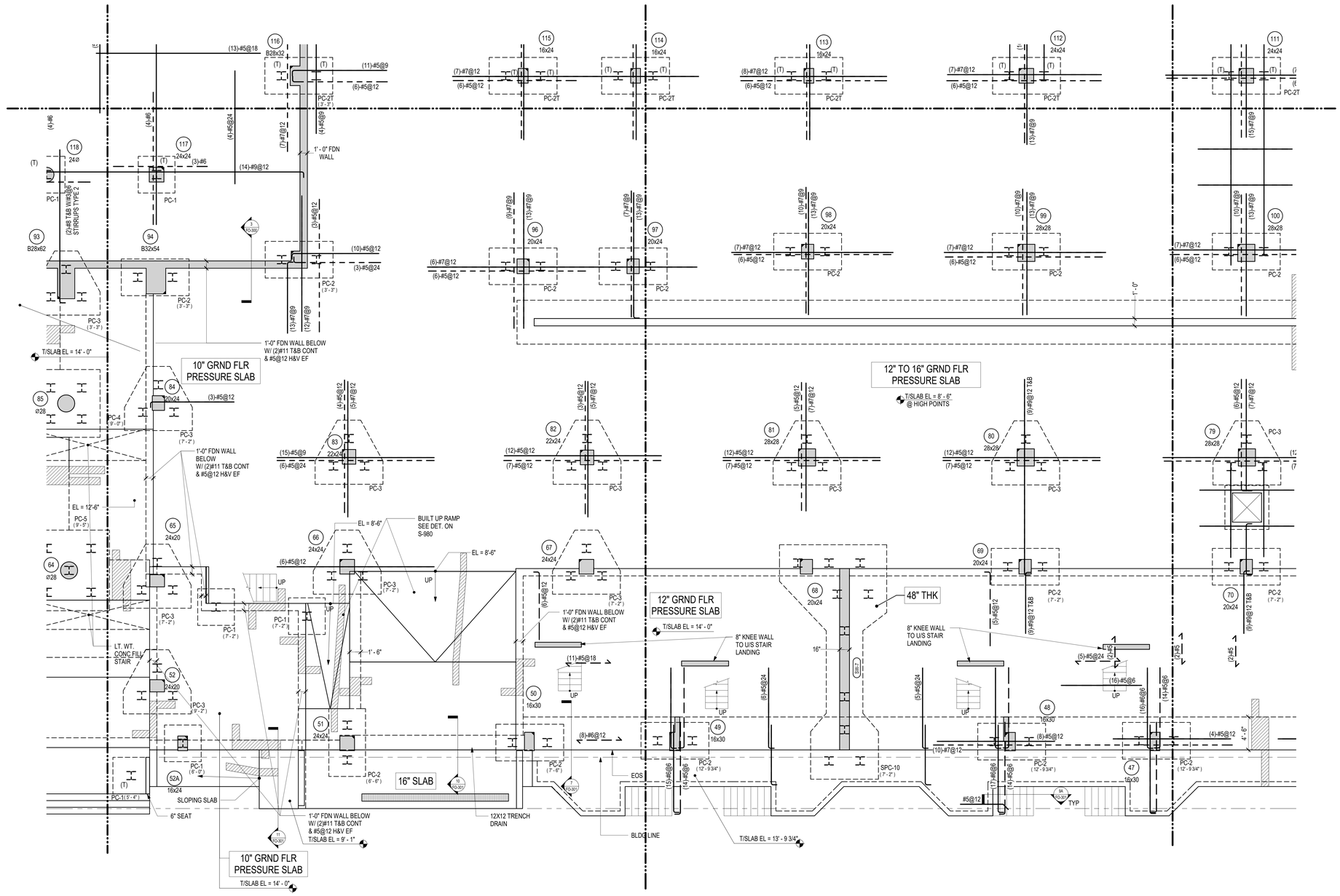
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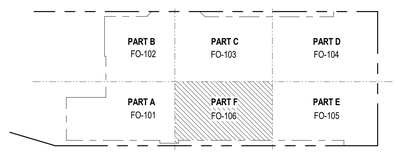
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FOUNDATION REINF PART F - SOUTH TOWER

SCALE: 3/16" = 1'-0"



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ARUP
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ONELUX
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ACCESSIBILITY
ACCESSIBILITY SERVICES
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KEW GARDENS, NY 11415

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EXPEDITOR
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BROOKLYN, NY 11222

KEY PLAN

APPROVED
Date: 11/16/2022

FOUNDATION REINF PART F - SOUTH TOWER

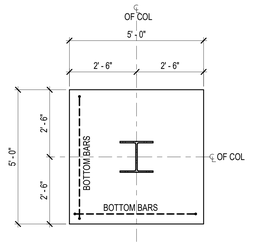
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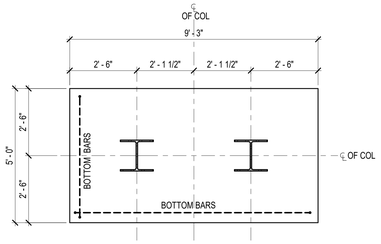
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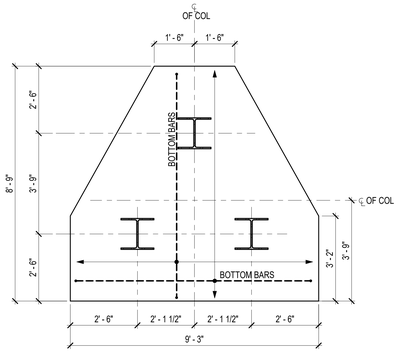
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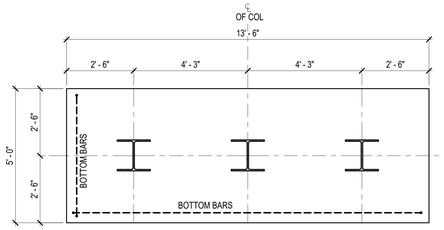
MARK	PILE CAPACITY	DEPTH	REINFORCING BARS
			EACH WAY
PC-1	250 TONS	36"	(4)#9 ☐



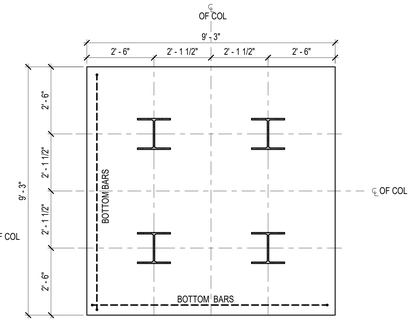
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			LONG	SHORT
PC-2	250 TONS	48"	(6)#11(BOT) ☐ (6)#9(TOP) ☐	(10)#9(BOT) ☐ (10)#9(TOP) ☐
PC-2T	250 TONS	48"		



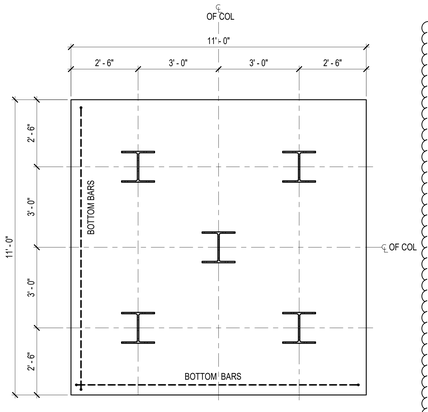
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			EACH WAY
PC-3	250 TONS	50"	(13)#11 ☐



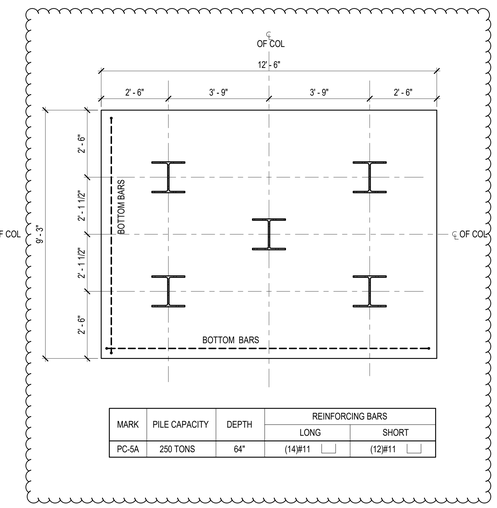
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PC-3A	250 TONS	70"	(9)#11 ☐	(14)#11 ☐



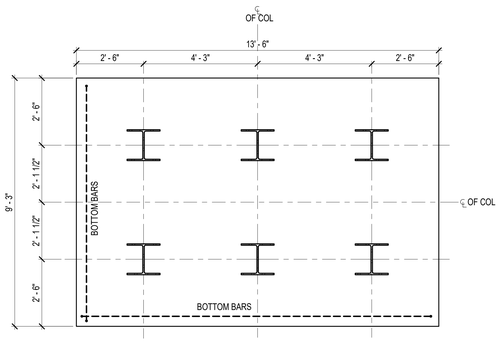
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			EACH WAY
PC-4	250 TONS	54"	(11)#11 ☐



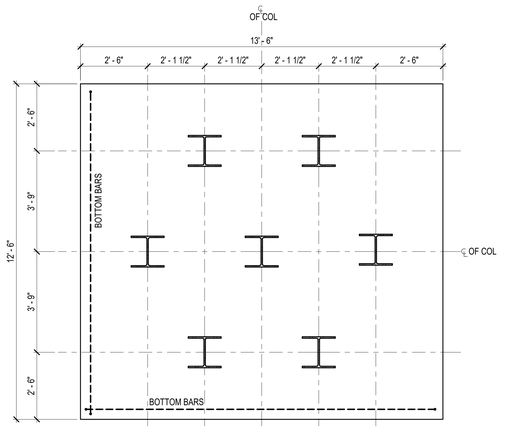
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			EACH WAY
PC-5	250 TONS	58"	(14)#11 ☐



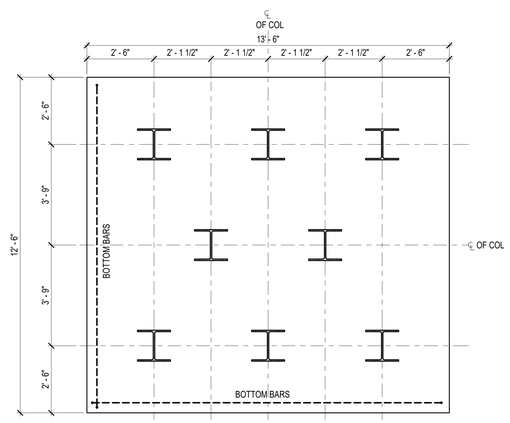
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			LONG	SHORT
PC-5A	250 TONS	64"	(14)#11 ☐	(12)#11 ☐



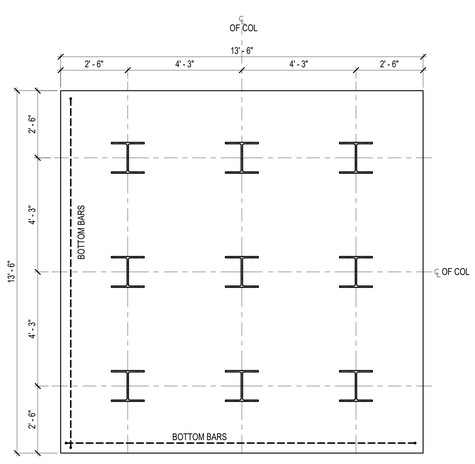
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			LONG	SHORT
PC-6	250 TONS	70"	(14)#11 ☐	(14)#11 ☐



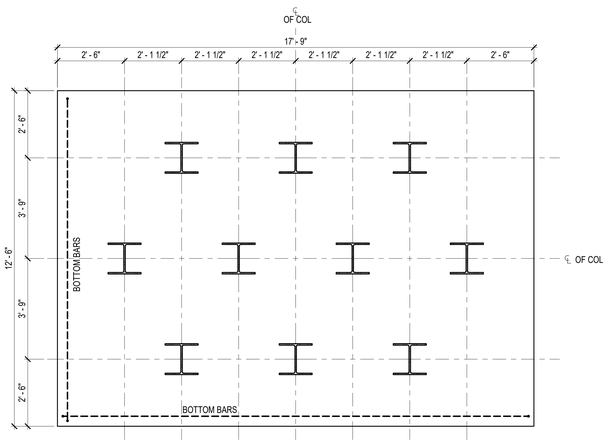
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			LONG	SHORT
PC-7	250 TONS	70"	(17)#11 ☐	(16)#11 ☐



MARK	PILE CAPACITY	DEPTH	REINFORCING BARS
			EACH WAY
PC-8	250 TONS	70"	(19)#11 ☐ (21)#11 ☐

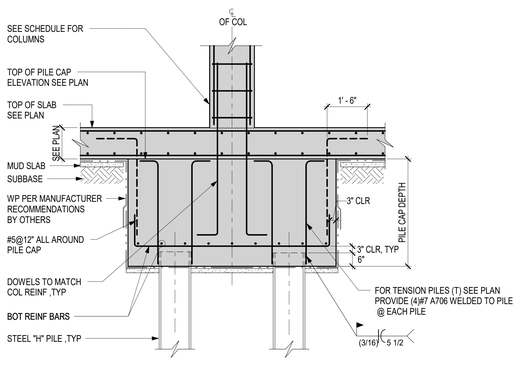


MARK	PILE CAPACITY	DEPTH	REINFORCING BARS
			EACH WAY
PC-9	250 TONS	74"	(22)#11 ☐

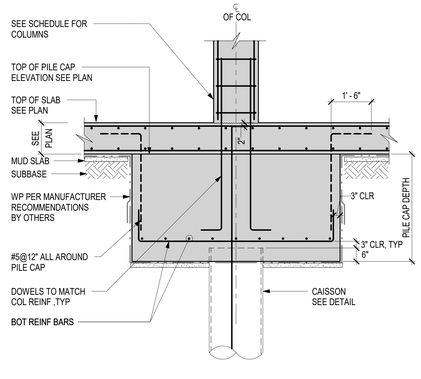


MARK	PILE CAPACITY	DEPTH	REINFORCING BARS	
			LONG	SHORT
PC-10	250 TONS	74"	(24)#11 ☐	(24)#11 ☐

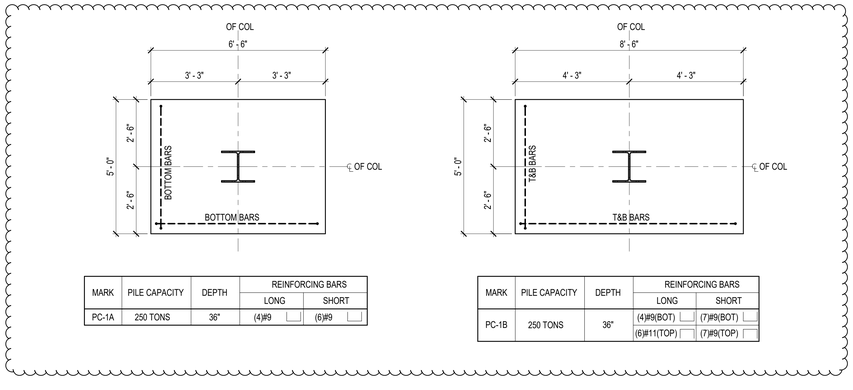
1 TYPICAL 250 TON H-PILE CAP DETAILS



2 TYPICAL "H" PILE CAP SECTION



3 TYPICAL CAISSON CAP SECTION



MARK	PILE CAPACITY	DEPTH	REINFORCING BARS	
			LONG	SHORT
PC-1A	250 TONS	36"	(4)#9 ☐	(6)#9 ☐

MARK	PILE CAPACITY	DEPTH	REINFORCING BARS	
			LONG	SHORT
PC-1B	250 TONS	36"	(4)#9(BOT) ☐ (6)#11(TOP) ☐	(7)#9(BOT) ☐ (7)#9(TOP) ☐



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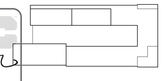
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KEY PLAN



NYC Buildings
APPROVED
Date: 11/16/2022

250 TON CONCRETE PILE CAP DETAILS

SCALE: 1/2" = 1'-0"

STATE OF NEW YORK · VLADIMIR E. SERAFIN · 092770 · LICENSED PROFESSIONAL ENGINEER

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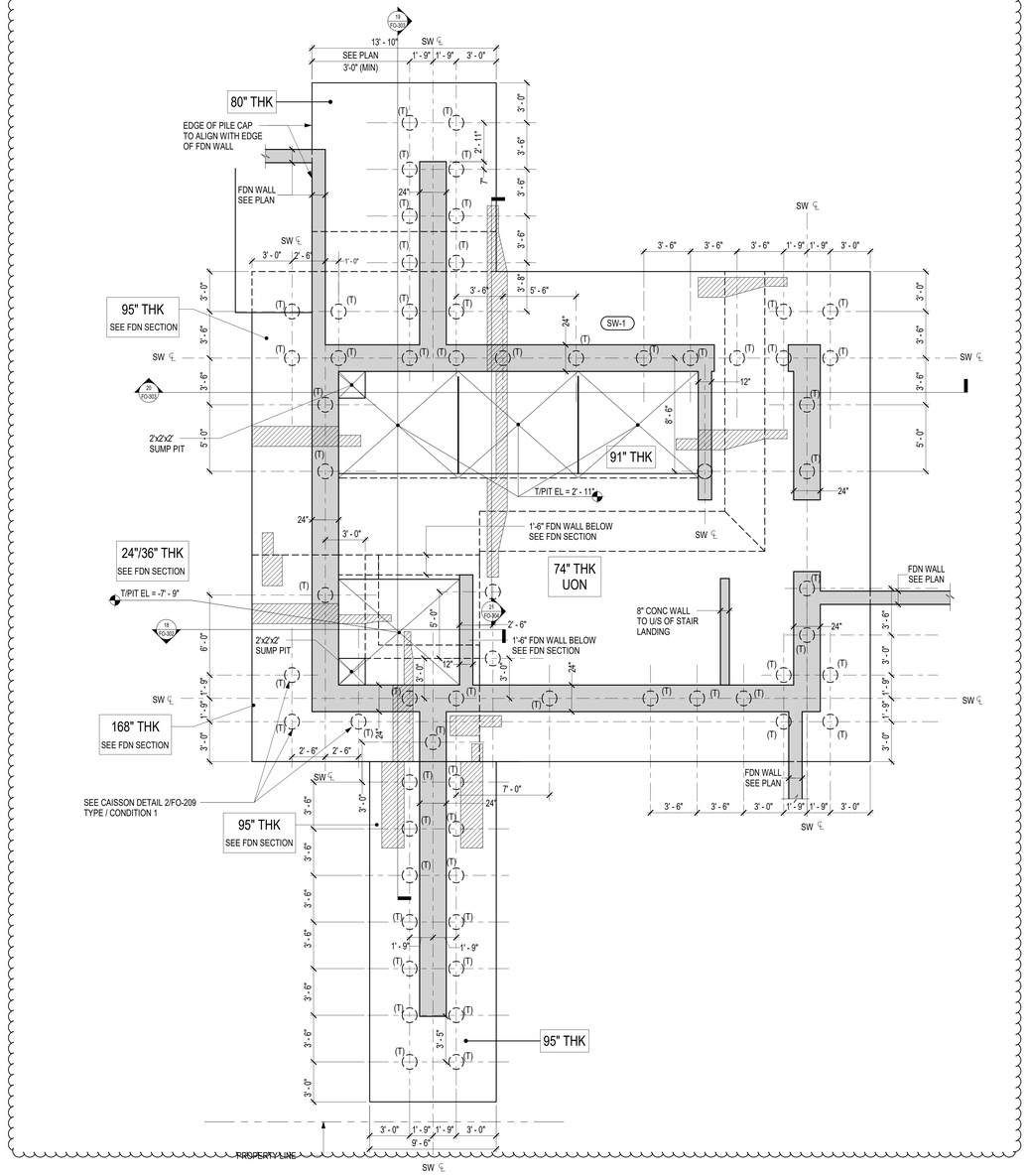
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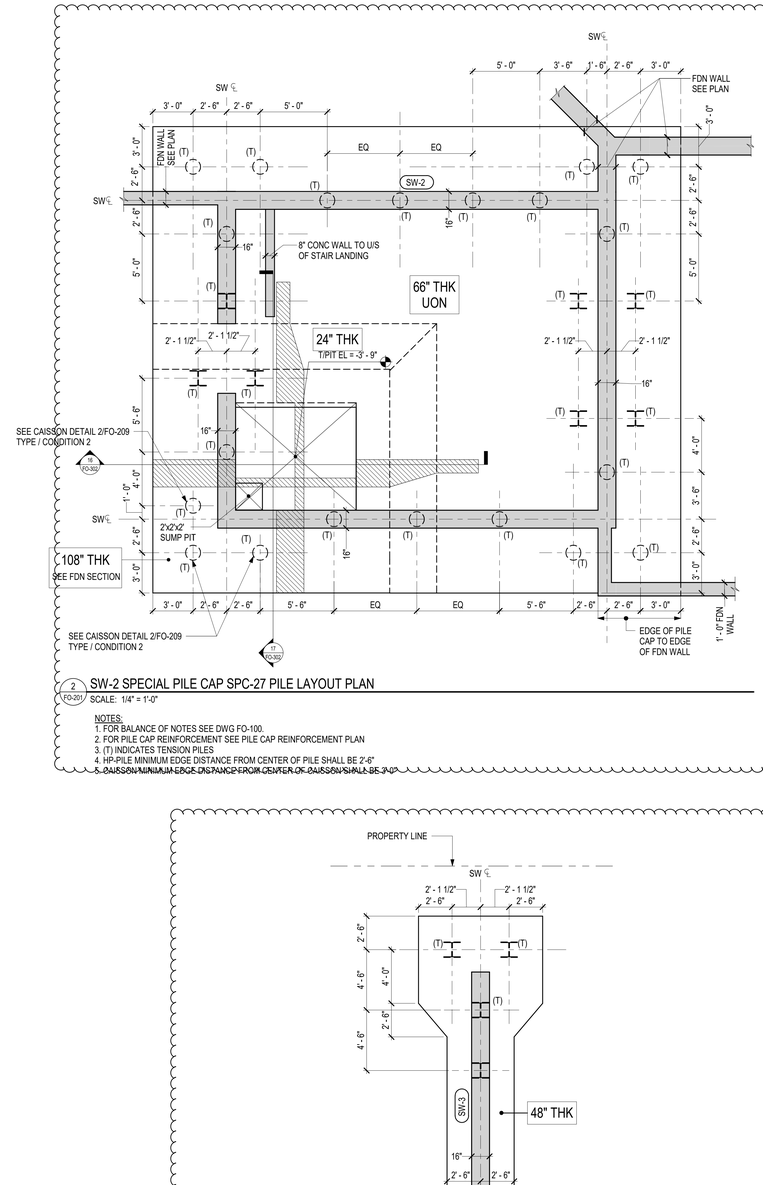
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1 FO-201 SW-1 SPECIAL PILE CAP SPC-63 PILE LAYOUT PLAN

SCALE: 1/4" = 1'-0"

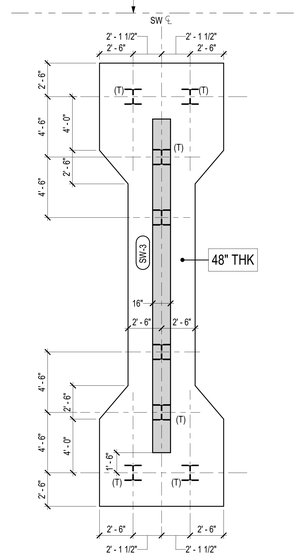
NOTES:
1. FOR BALANCE OF NOTES SEE DWG FO-100.
2. FOR PILE CAP REINFORCEMENT SEE PILE CAP REINFORCEMENT PLAN
3. (T) INDICATES TENSION PILES
4. HP-PILE MINIMUM EDGE DISTANCE FROM CENTER OF PILE SHALL BE 2'-6"
5. CAISSON MINIMUM EDGE DISTANCE FROM CENTER OF CAISSON SHALL BE 3'-0"



2 FO-201 SW-2 SPECIAL PILE CAP SPC-27 PILE LAYOUT PLAN

SCALE: 1/4" = 1'-0"

NOTES:
1. FOR BALANCE OF NOTES SEE DWG FO-100.
2. FOR PILE CAP REINFORCEMENT SEE PILE CAP REINFORCEMENT PLAN
3. (T) INDICATES TENSION PILES
4. HP-PILE MINIMUM EDGE DISTANCE FROM CENTER OF PILE SHALL BE 2'-6"
5. CAISSON MINIMUM EDGE DISTANCE FROM CENTER OF CAISSON SHALL BE 3'-0"



3 FO-201 SW-3 SPECIAL PILE CAP SPC-8 PILE LAYOUT PLAN

SCALE: 1/4" = 1'-0"

NOTES:
1. FOR BALANCE OF NOTES SEE DWG FO-100.
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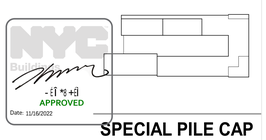
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KEY PLAN



NYC Buildings
APPROVED
Date: 11/16/2022

SPECIAL PILE CAP DETAILS

SCALE: 1/4" = 1'-0"

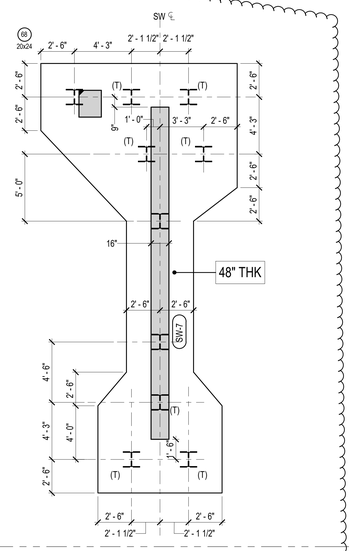


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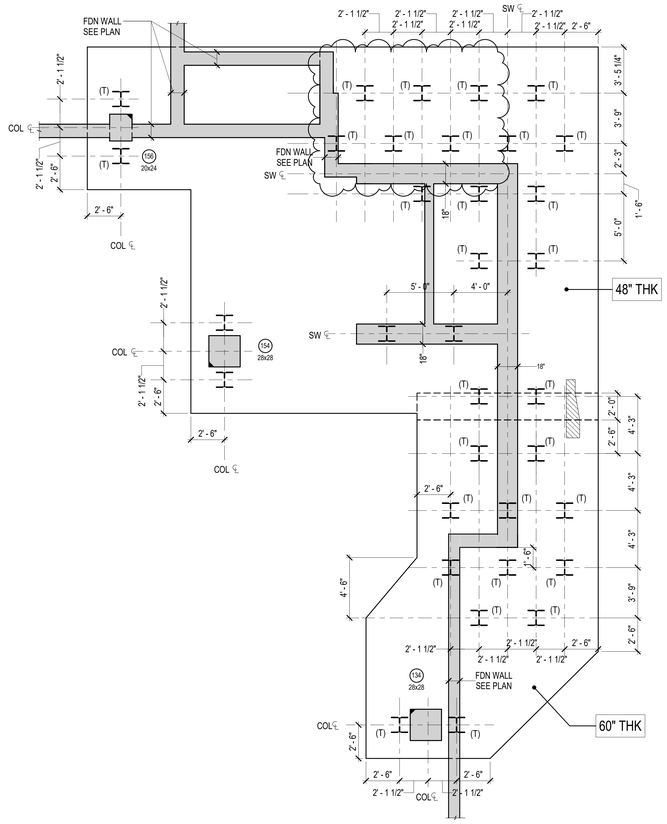
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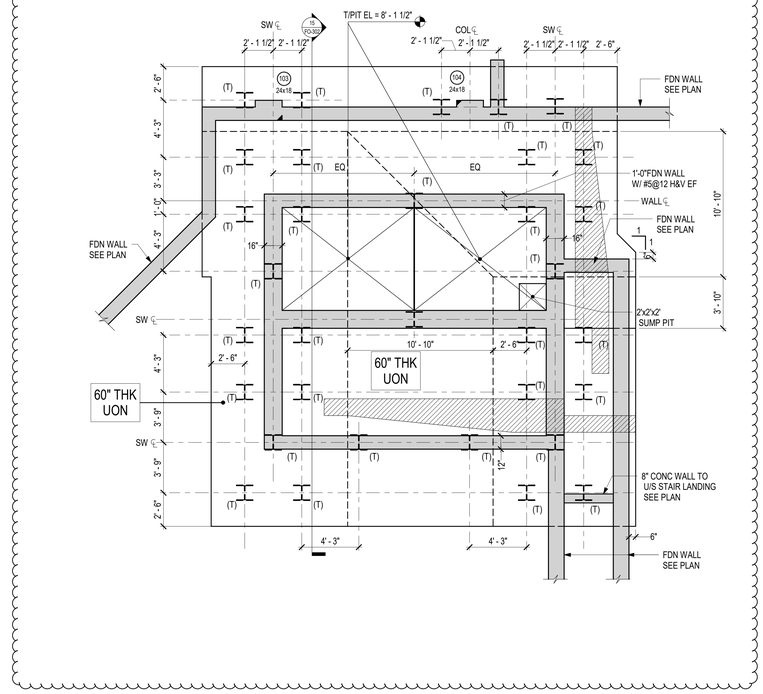
1 FO-202 SW-7 SPECIAL PILE CAP SPC-10 PILE LAYOUT PLAN
SCALE: 1/4" = 1'-0"

NOTES:
1. FOR BALANCE OF NOTES SEE DWG FO-100.
2. FOR PILE CAP REINFORCEMENT SEE PILE CAP REINFORCEMENT PLAN
3. (T) INDICATES TENSION PILES
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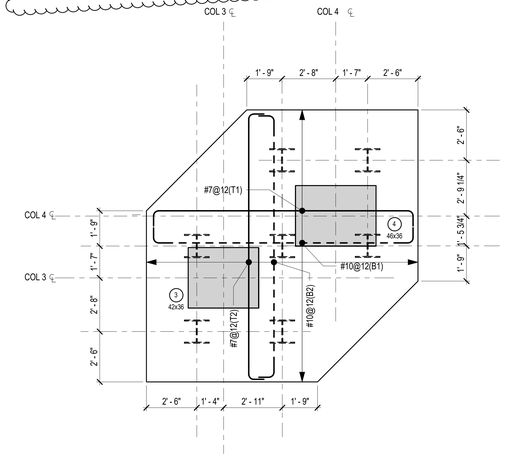
2 FO-202 SW-4 SPECIAL PILE CAP SPC-34 PILE LAYOUT PLAN
SCALE: 1/4" = 1'-0"

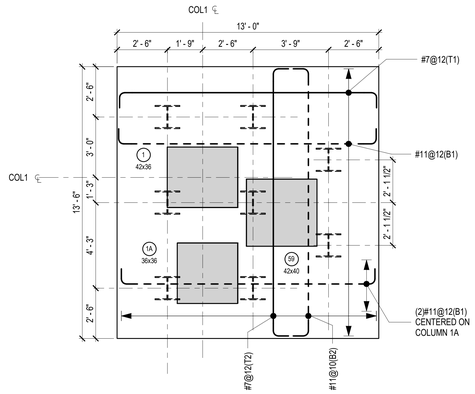
NOTES:
1. FOR BALANCE OF NOTES SEE DWG FO-100.
2. FOR PILE CAP REINFORCEMENT SEE PILE CAP REINFORCEMENT PLAN
3. (T) INDICATES TENSION PILES
4. HP-PILE MINIMUM EDGE DISTANCE FROM CENTER OF PILE SHALL BE 2'-6"
5. CAISSON MINIMUM EDGE DISTANCE FROM CENTER OF CAISSON SHALL BE 3'-0"



3 FO-202 SW-5 SPECIAL PILE CAP SPC-33 PILE LAYOUT PLAN
SCALE: 1/4" = 1'-0"

NOTES:
1. FOR BALANCE OF NOTES SEE DWG FO-100.
2. FOR PILE CAP REINFORCEMENT SEE PILE CAP REINFORCEMENT PLAN
3. (T) INDICATES TENSION PILES
4. HP-PILE MINIMUM EDGE DISTANCE FROM CENTER OF PILE SHALL BE 2'-6"
5. CAISSON MINIMUM EDGE DISTANCE FROM CENTER OF CAISSON SHALL BE 3'-0"





4 FO-202 SPECIAL PILE CAP SPC-7 PILE LAYOUT AND REINFORCEMENT PLAN
SCALE: 3/8" = 1'-0"

NOTES:
1. FOR BALANCE OF NOTES, SEE SPECIAL PILE CAPS REINFORCEMENT GENERAL NOTES FO-203.

SPECIAL PILE CAP REINFORCEMENT				
MARK	PILE CAPACITY	DEPTH	REINFORCING BARS	
			LONG	SHORT
SPC-7	250 TONS	42"	SEE PLAN	SEE PLAN

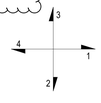


INDICATE SEQUENCE OF PLACING BARS

6 FO-202 SPC-8B SPECIAL PILE CAP PLAN AND REINFORCEMENT PLAN
SCALE: 3/8" = 1'-0"

NOTES:
1. FOR BALANCE OF NOTES, SEE SPECIAL PILE CAPS REINFORCEMENT GENERAL NOTES FO-203.

SPECIAL PILE CAP REINFORCEMENT				
MARK	PILE CAPACITY	DEPTH	REINFORCING BARS	
			LONG	SHORT
SPC-8B	250 TONS	48"	SEE PLAN	SEE PLAN



INDICATE SEQUENCE OF PLACING BARS



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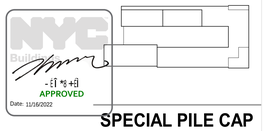
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SPECIAL PILE CAP DETAILS

SCALE: As indicated

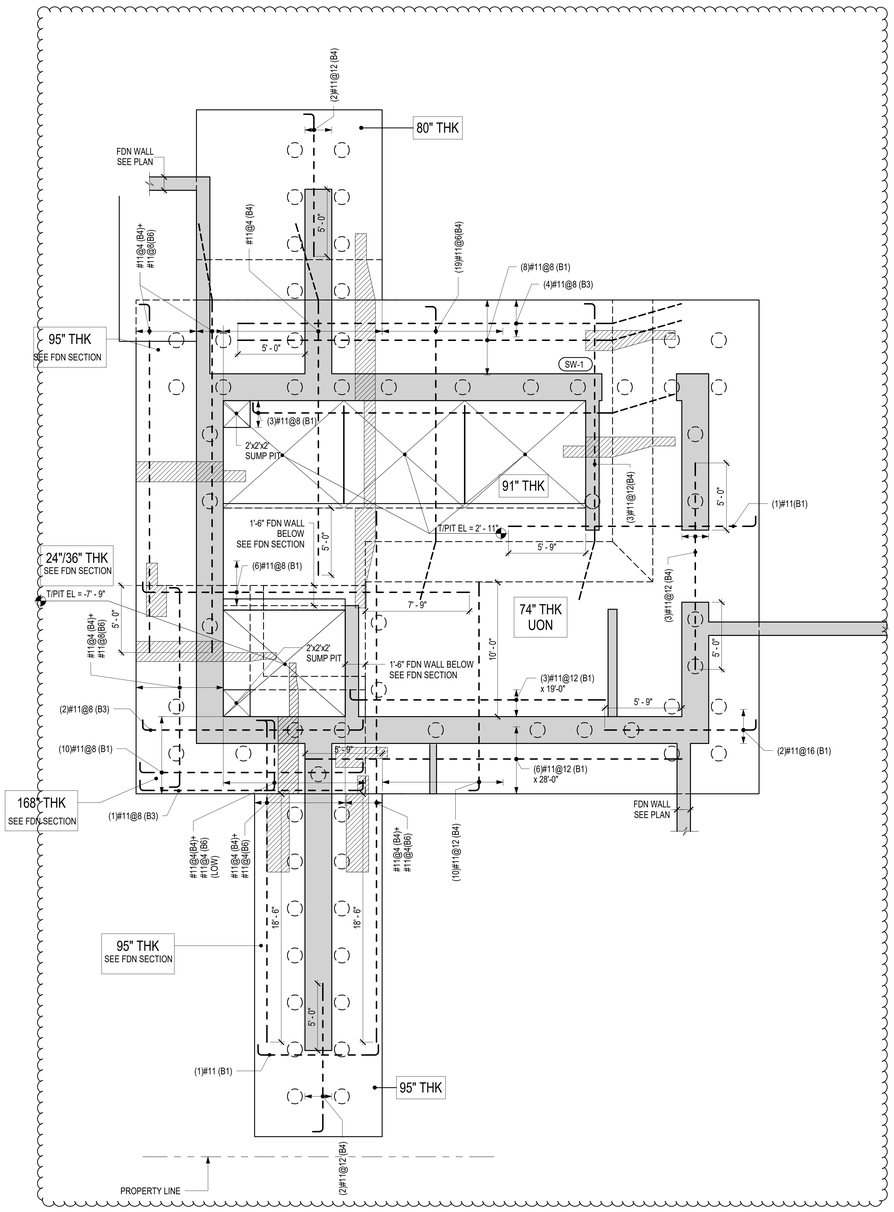


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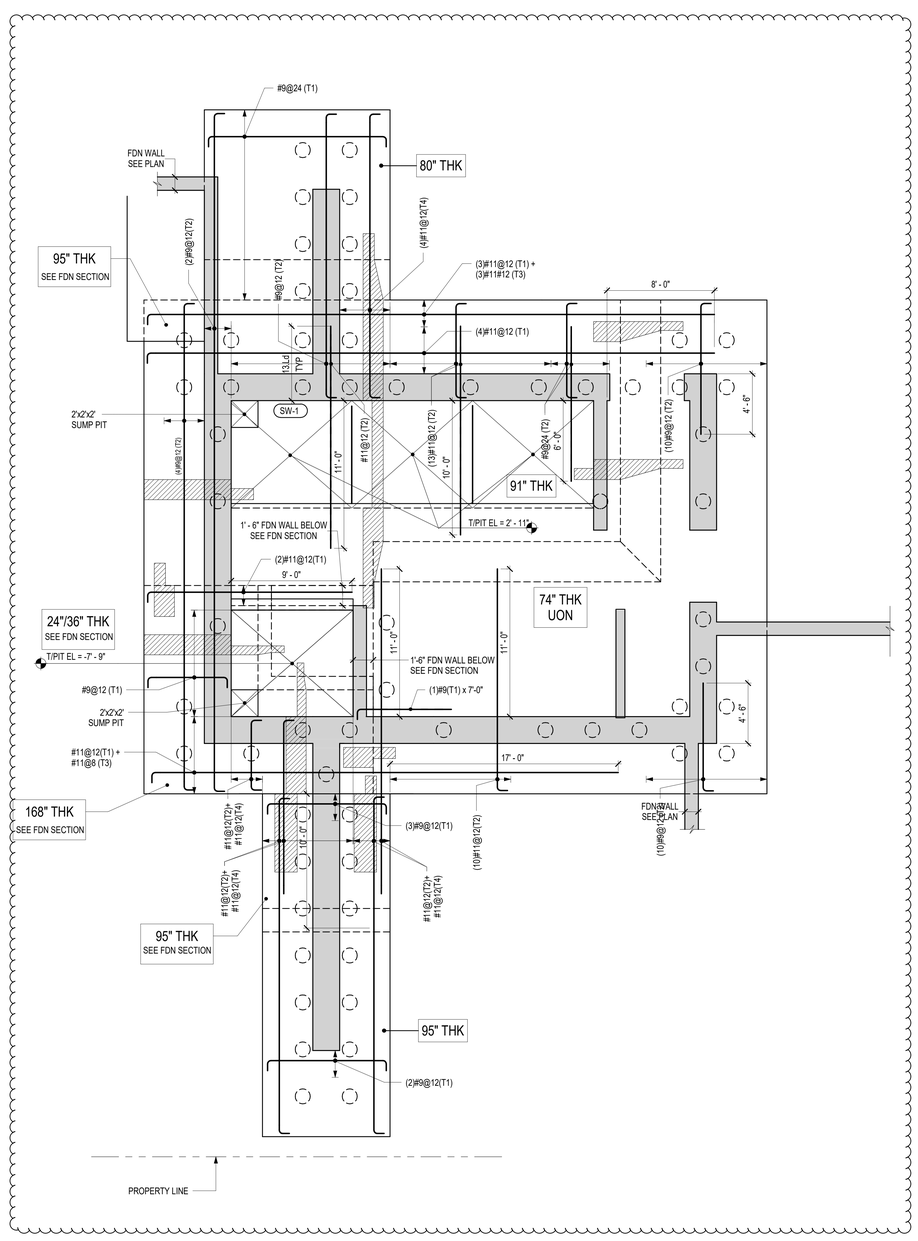
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1 FO-203 SW-1 SPECIAL PILE CAP SPC-63 REINFORCEMENT PLAN (ADDITIONAL BOTTOM BARS)
SCALE: 1/4" = 1'-0"



2 FO-203 SW-1 SPECIAL PILE CAP SPC-63 REINFORCEMENT PLAN (ADDITIONAL TOP BARS)
SCALE: 1/4" = 1'-0"

NOTES:
1. ALL REINFORCEMENT SHOWN ON PLAN ARE IN ADDITION TO THE TYPICAL MAT REINFORCEMENT TABLE BELOW
2. FOR BALANCE OF NOTES, SEE SPECIAL PILE CAPS REINFORCEMENT GENERAL NOTES FO-203
3. BOTTOM REINFORCEMENT TO FOLLOW THE SHAPE AS SHOWN ON FOUNDATION SECTION

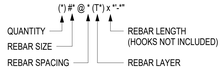
TYPICAL MAT REINFORCEMENT						
THICKNESS	CONCRETE STRENGTH	B1	B2	T1	T2	REMARKS
24"/36"	f'c = 6000 psi	#6@10	#6@10	#6@10	#6@10	
74" & 80"		#11@8	#11@4	#9@12	#9@12	
91", 95"		#11@8	#11@4	#9@12	#9@12	
168"		#11@8	#11@4	#9@12	#9@12	



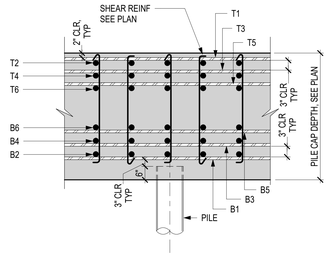
INDICATE SEQUENCE OF PLACING BARS

SPECIAL PILE CAPS REINFORCEMENT GENERAL NOTES:

1. FOR BALANCE OF NOTES SEE DWG FO-100.
2. ALL ADDITIONAL REINF SHALL BE CENTERED ON WALL OR COLUMNS UON.
3. FOR PARALLEL REINF CALLED OUT WITH SAME REBAR LAYER, PLACE REINF ALTERNATELY.
4. CONCRETE STRENGTH f'c = 6,000 psi UON
5. REINFORCEMENT fy = 60ksi UON



REBAR LAYOUT



TYP PILE CAP REINF LAYOUT



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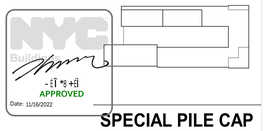
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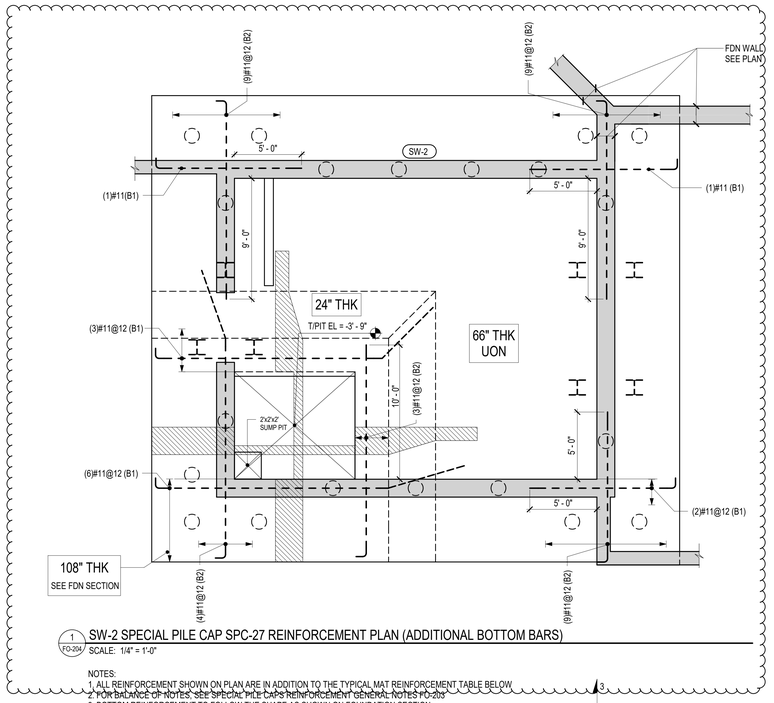
SPECIAL PILE CAP DETAILS

SCALE: As indicated



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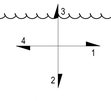


1 FO-204 SW-2 SPECIAL PILE CAP SPC-27 REINFORCEMENT PLAN (ADDITIONAL BOTTOM BARS)
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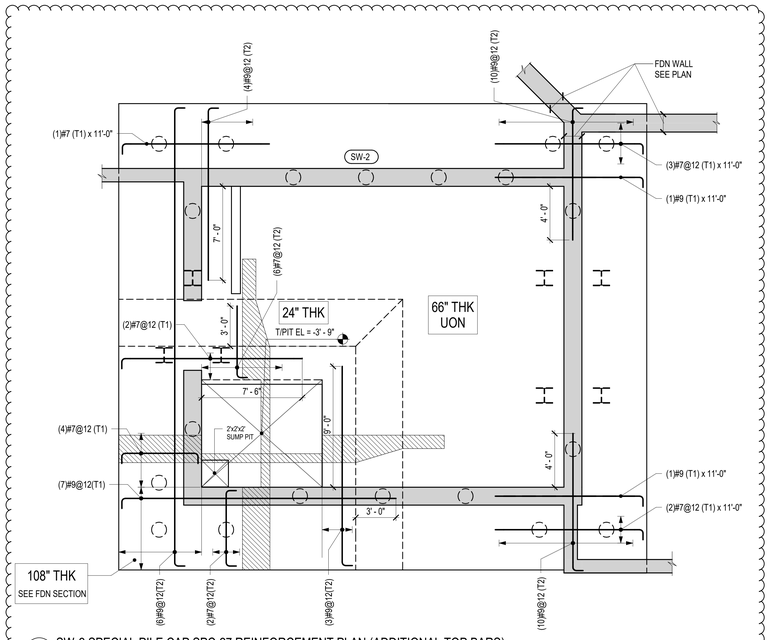
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2. FOR BALANCE OF NOTES, SEE SPECIAL PILE CAPS REINFORCEMENT GENERAL NOTES FO-203
3. BOTTOM REINFORCEMENT TO FOLLOW THE SHAPE AS SHOWN ON FOUNDATION SECTION

TYPICAL MAT REINFORCEMENT

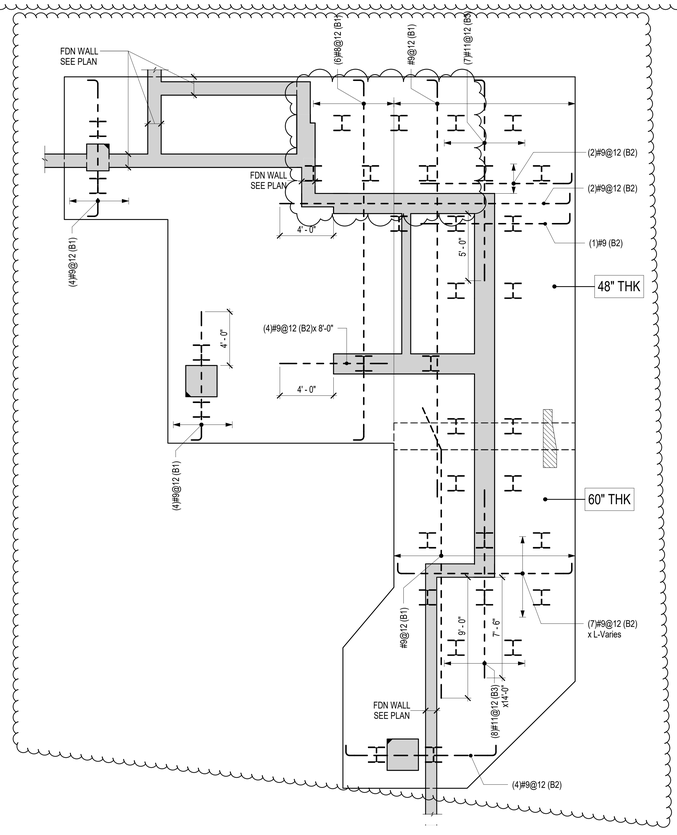
THICKNESS	CONCRETE STRENGTH	B1	B2	T1	T2	REMARKS
24"	f'c = 6000 psi	#11@12	#11@12	#6@12	#6@12	
66"		#11@12	#11@12	#7@12	#7@12	
108"		#11@12	#11@12	#7@12	#7@12	

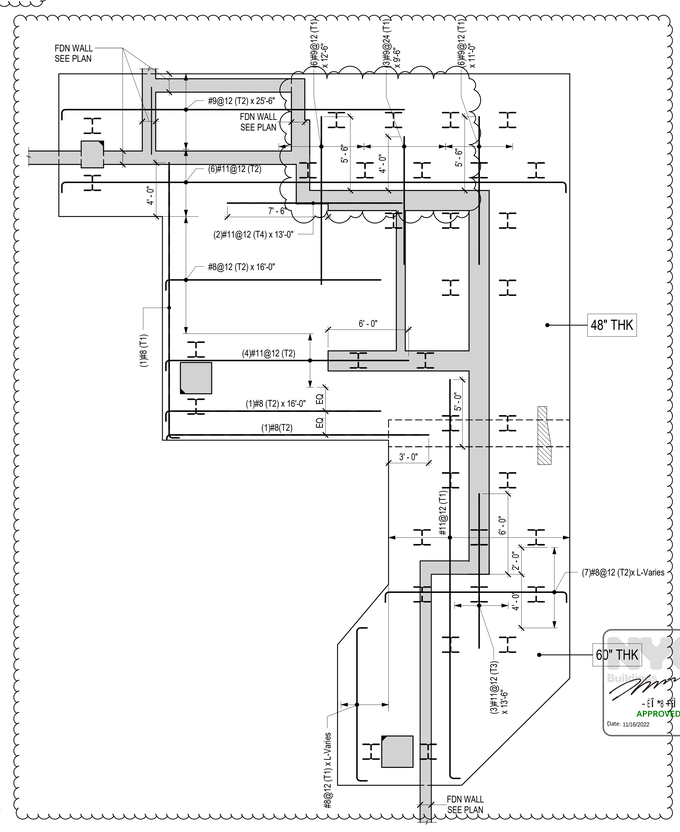


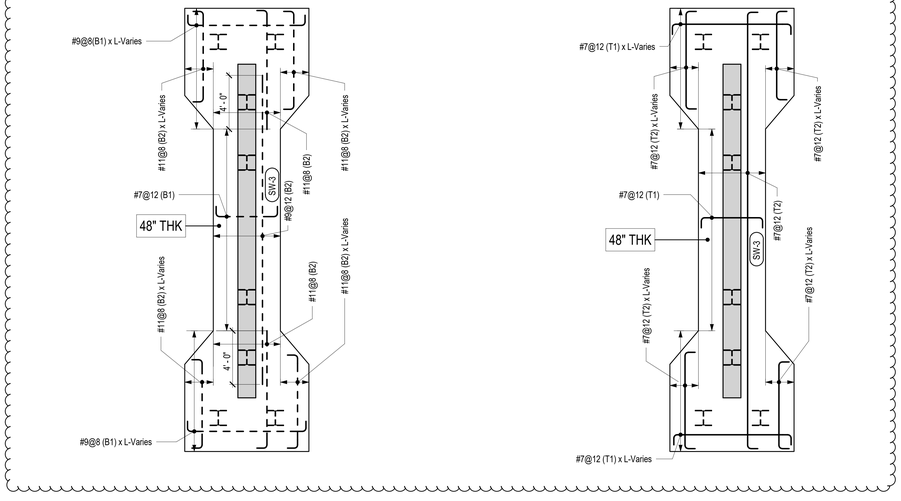
INDICATE SEQUENCE OF PLACING BARS



2 FO-204 SW-2 SPECIAL PILE CAP SPC-27 REINFORCEMENT PLAN (ADDITIONAL TOP BARS)
SCALE: 1/4" = 1'-0"

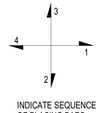






3 FO-204 SW-3 SPECIAL PILE CAP SPC-8 REINFORCEMENT PLAN - BOTTOM BARS
SCALE: 1/4" = 1'-0"

NOTES:
1. FOR BALANCE OF NOTES, SEE SPECIAL PILE CAPS REINFORCEMENT GENERAL NOTES FO-203



INDICATE SEQUENCE OF PLACING BARS

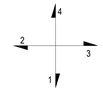
4 FO-204 SW-3 SPECIAL PILE CAP SPC-8 REINFORCEMENT PLAN - TOP BARS
SCALE: 1/4" = 1'-0"

5 FO-204 SW-4 SPECIAL PILE CAP SPC-34 REINFORCEMENT PLAN (ADDITIONAL BOTTOM BARS)
SCALE: 1/4" = 1'-0"

NOTES:
1. ALL REINFORCEMENT SHOWN ON PLAN ARE IN ADDITION TO THE TYPICAL MAT REINFORCEMENT TABLE BELOW
2. FOR BALANCE OF NOTES, SEE SPECIAL PILE CAPS REINFORCEMENT GENERAL NOTES FO-203

TYPICAL MAT REINFORCEMENT

THICKNESS	CONCRETE STRENGTH	B1	B2	T1	T2	REMARKS
48"	f'c = 6000 psi	#9@12	#9@12	#8@12	#8@12	
60"		#9@12	#9@12	#8@12	#8@12	



INDICATE SEQUENCE OF PLACING BARS

6 FO-204 SW-4 SPECIAL PILE CAP SPC-34 REINFORCEMENT PLAN (ADDITIONAL TOP BARS)
SCALE: 1/4" = 1'-0"



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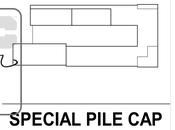
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333 WESTCHESTER AVE,
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ENTEK ENGINEERING
166 AMES ST, HACKENSACK, NJ 07601

REV	DATE	DESCRIPTION
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2	06/11/2021	50% SCHEMATIC SUBMISSION
3	08/06/2021	ISSUED FOR 100% SD
4	12/10/2021	50% DESIGN DEVELOPMENT
5	02/25/2022	ISSUED FOR 100% DD
6	05/20/2022	ISSUED FOR 50% CD
7	07/18/2022	REVISED AS NOTED
8	08/05/2022	100% CD
	10/05/2022	DOB PAA #1

2021054.00
1 JAVA
18 INDIA STREET
BROOKLYN, NY 11222

KEY PLAN



APPROVED
Date: 11/16/2022

SPECIAL PILE CAP DETAILS

SCALE: As indicated

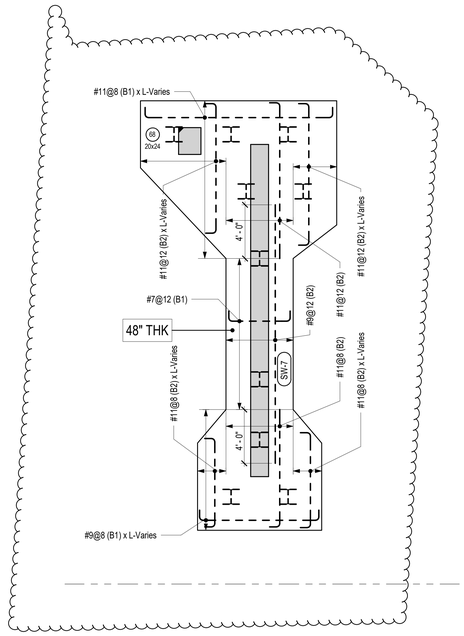


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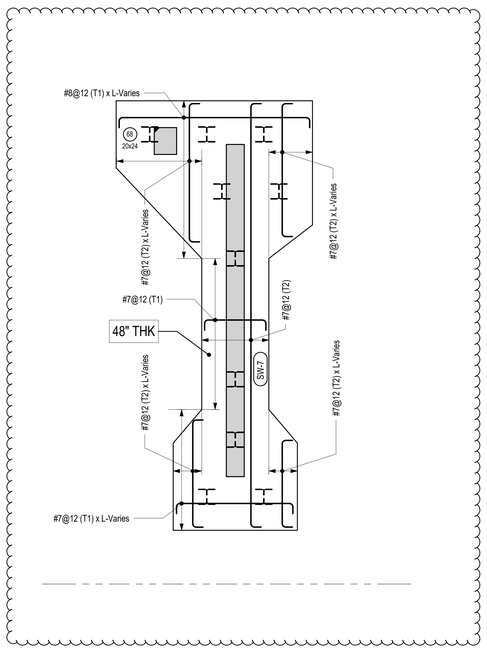
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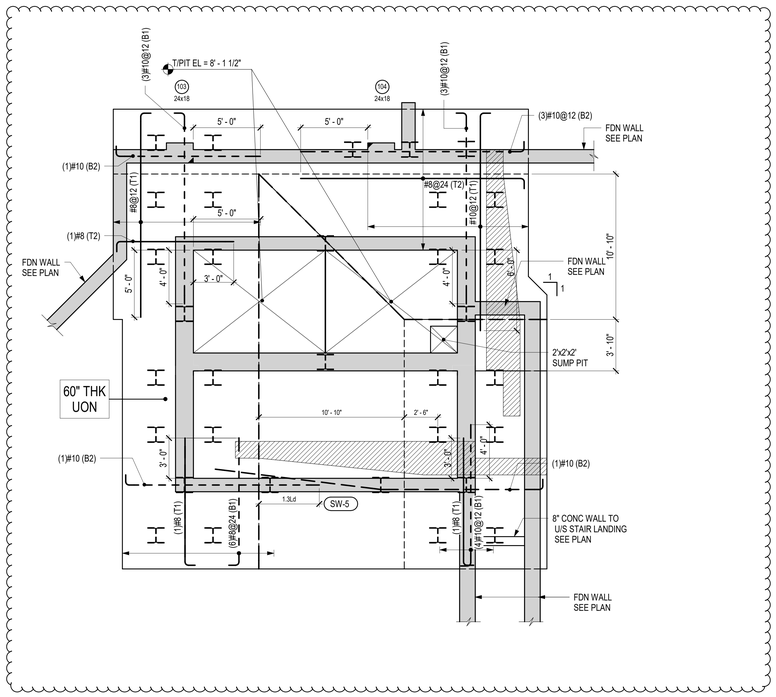
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1 FO-205 SW-7 SPECIAL PILE CAP SPC-10 REINFORCEMENT PLAN - BOTTOM BARS
SCALE: 1/4" = 1'-0"



2 FO-205 SW-7 SPECIAL PILE CAP SPC-10 REINFORCEMENT PLAN - TOP BARS
SCALE: 1/4" = 1'-0"



3 FO-205 SW-5 SPECIAL PILE CAP SPC-33 REINFORCEMENT PLAN (ADDITIONAL TOP & BOTTOM BARS)
SCALE: 1/4" = 1'-0"

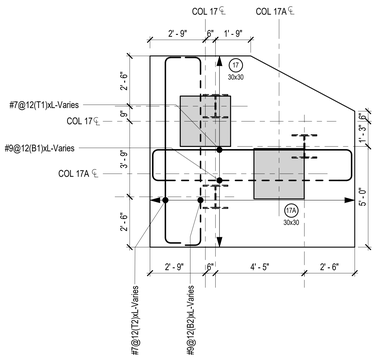
NOTES:
1. FOR BALANCE OF NOTES, SEE SPECIAL PILE CAPS REINFORCEMENT GENERAL NOTES FO-203

INDICATE SEQUENCE OF PLACING BARS

NOTES:
1. ALL REINFORCEMENT SHOWN ON PLAN ARE IN ADDITION TO THE TYPICAL MAT REINFORCEMENT TABLE BELOW
2. FOR BALANCE OF NOTES, SEE SPECIAL PILE CAPS REINFORCEMENT GENERAL NOTES FO-203
3. BOTTOM REINFORCEMENT TO FOLLOW THE SHAPE AS SHOWN ON FOUNDATION SECTION

TYPICAL MAT REINFORCEMENT						
THICKNESS	CONCRETE STRENGTH	B1	B2	T1	T2	REMARKS
60"	f'c = 6000 psi	#10@12	#10@12	#8@12	#8@12	

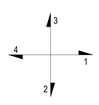
INDICATE SEQUENCE OF PLACING BARS



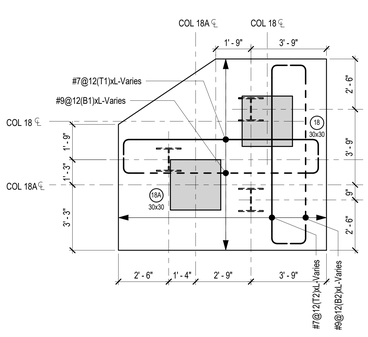
4 FO-205 SPECIAL PILE CAP SPC-3A PILE LAYOUT AND REINFORCEMENT PLAN
SCALE: 3/8" = 1'-0"

NOTES:
1. FOR BALANCE OF NOTES, SEE SPECIAL PILE CAPS REINFORCEMENT GENERAL NOTES FO-203.

SPECIAL PILE CAP REINFORCEMENT				
MARK	PILE CAPACITY	DEPTH	REINFORCING BARS	
			LONG	SHORT
SPC-3A	250 TONS	48"	SEE PLAN	SEE PLAN



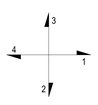
INDICATE SEQUENCE OF PLACING BARS



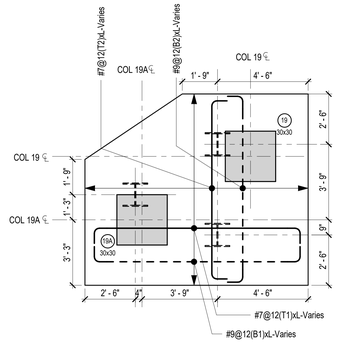
5 FO-205 SPECIAL PILE CAP SPC-3B PILE LAYOUT AND REINFORCEMENT PLAN
SCALE: 3/8" = 1'-0"

NOTES:
1. FOR BALANCE OF NOTES, SEE SPECIAL PILE CAPS REINFORCEMENT GENERAL NOTES FO-203.

SPECIAL PILE CAP REINFORCEMENT				
MARK	PILE CAPACITY	DEPTH	REINFORCING BARS	
			LONG	SHORT
SPC-3B	250 TONS	48"	SEE PLAN	SEE PLAN



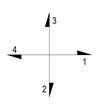
INDICATE SEQUENCE OF PLACING BARS



6 FO-205 SPECIAL PILE CAP SPC-3C PILE LAYOUT AND REINFORCEMENT PLAN
SCALE: 3/8" = 1'-0"

NOTES:
1. FOR BALANCE OF NOTES, SEE SPECIAL PILE CAPS REINFORCEMENT GENERAL NOTES FO-203.

SPECIAL PILE CAP REINFORCEMENT				
MARK	PILE CAPACITY	DEPTH	REINFORCING BARS	
			LONG	SHORT
SPC-3C	250 TONS	48"	SEE PLAN	SEE PLAN



INDICATE SEQUENCE OF PLACING BARS



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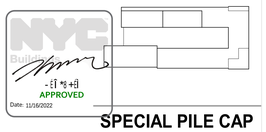
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10/05/2022		DOB PAA #1

2021054.00
1 JAVA

18 INDIA STREET
BROOKLYN, NY 11222

KEY PLAN



SPECIAL PILE CAP DETAILS

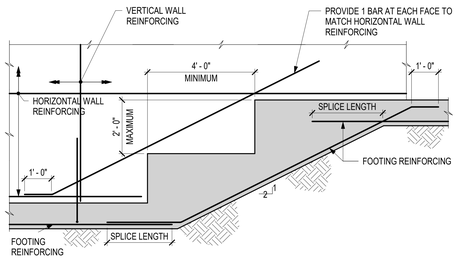
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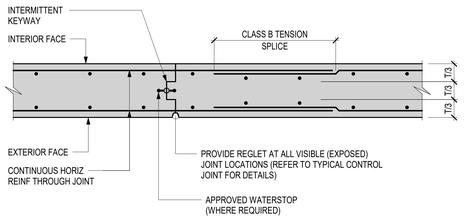
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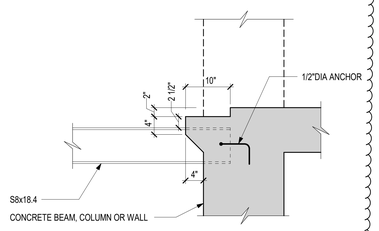
1 TYPICAL ELEVATION OF CONTINUOUS STEPPED WALL FOOTING



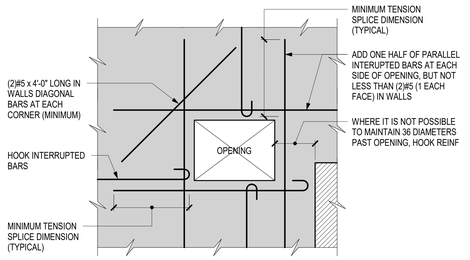
NOTES:

1. SPACE CONTROL JOINS AT 30 x THICKNESS OF THE WALL, 3 x HEIGHT OF THE WALL, OR 30FT. MAXIMUM, WHICHEVER IS LESS. COORDINATE SPACING WITH ARCHITECTURAL DRAWINGS.
2. DOUBLE-SIDED CONTROL JOINTS ARE PREFERRED AT WALLS WHERE BOTH SIDES OF WALL ARE EXPOSED TO VIEW. COORDINATE LOCATIONS WITH ARCHITECTURAL DRAWINGS.
3. COORDINATE REGLET GEOMETRY WITH ARCHITECTURAL DRAWINGS. DEPTH AND REGLET BOTTOM WIDTH IN DETAILS ARE REQUIRED; CHAMFER(S) ARE OPTIONAL BASED ON ARCHITECTURAL REQUIREMENTS. CHAMFERS ARE RECOMMENDED WHEN REGLET FORMS ARE TO BE REMOVED.
4. CONTROL JOINTS MAY ALSO SERVE AS CONSTRUCTION JOINTS. COORDINATE WITH ARCHITECTURAL DRAWINGS.
5. WATERSTOP IS OPTIONAL. COORDINATE WITH GEOTECHNICAL ENGINEER.
6. ALL CONTROL AND CONSTRUCTION JOINTS ARE TO BE CLEARLY SHOWN ON SHOP DRAWINGS FOR REVIEW AND APPROVAL BY BOTH THE ARCHITECT AND ENGINEER OF RECORD.

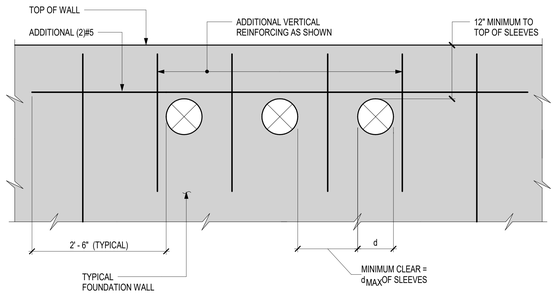
2 TYPICAL CONSTRUCTION JOINT DETAIL AT VERTICAL WALL



3 TYPICAL ELEVATOR SEPERATOR BM CONN



4 TYPICAL REINFORCING AT OPENINGS IN CONCRETE WALLS

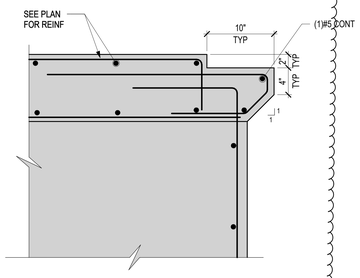


USE FOR 3 OR MORE SLEEVES

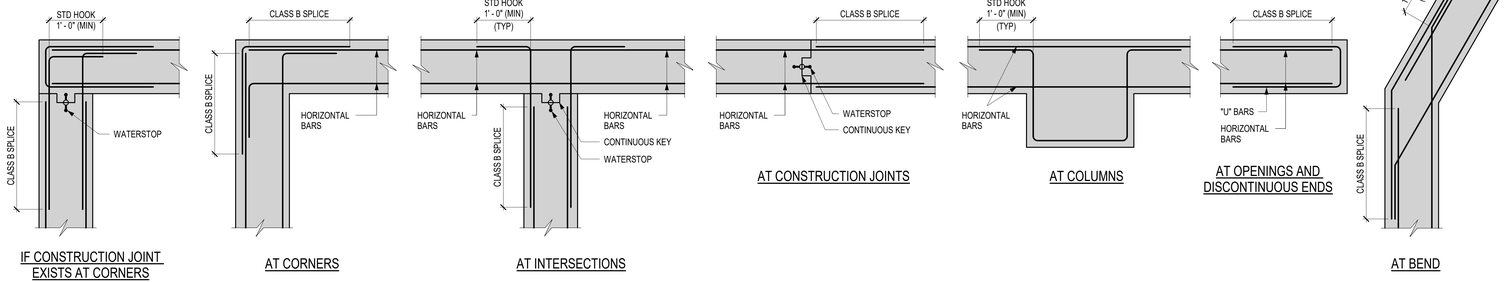
NOTE:

1.- ALL SLEEVES SHALL BE CLEARLY SHOWN ON SHOP DRAWINGS FOR APPROVAL.

5 TYPICAL MULTI-SLEEVE DETAIL AT FOUNDATION WALL



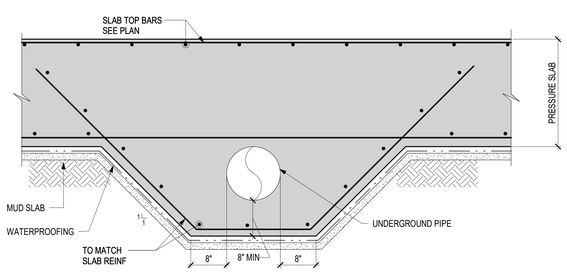
6 TYPICAL ELEVATOR SILL DETAIL @ PIT



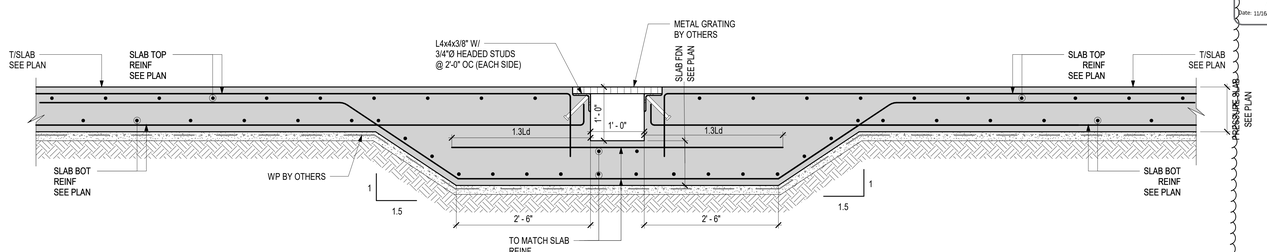
NOTE:

1.- VERTICAL REINF BARS ARE NOT SHOWN FOR CLARITY (TYP)

7 TYPICAL PLAN DETAIL OF HORIZONTAL WALL REINFORCING



8 TYPICAL UNDERGROUND UTILITY HAUNCH DETAIL



9 TYPICAL SECTION AT TRENCH



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166 AMES ST, HACKENSACK, NJ 07601

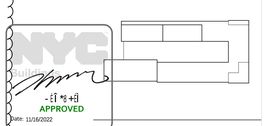
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1	06/01/2021	ISSUE FOR FOUNDATION
2	06/11/2021	50% SCHEMATIC SUBMISSION
3	08/06/2021	ISSUED FOR 100% SD
4	12/10/2021	50% DESIGN DEVELOPMENT
5	02/25/2022	ISSUED FOR 100% DD
6	05/20/2022	ISSUED FOR 50% CD
7	07/18/2022	REVISED AS NOTED
8	08/05/2022	100% CD
	10/05/2022	DOB PAA #1

2021054.00

1 JAVA

18 INDIA STREET
BROOKLYN, NY 11222

KEY PLAN



APPROVED
Date: 11/16/2022

TYPICAL FOUNDATION DETAILS

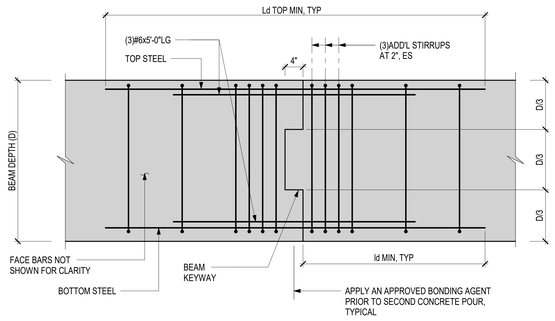
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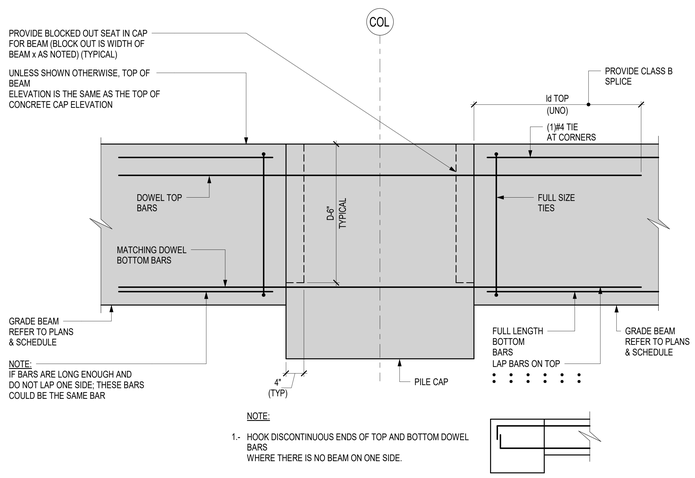
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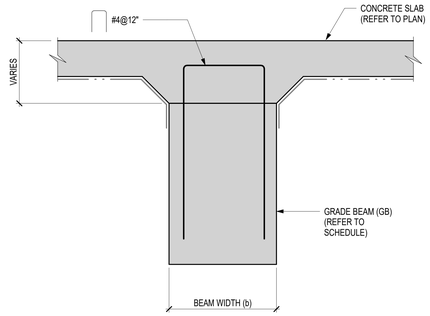
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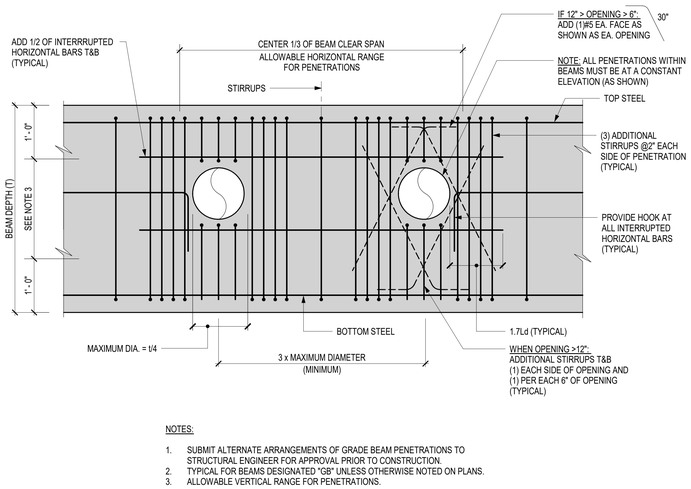
1 TYPICAL CONSTRUCTION JOINT DETAIL AT CONCRETE GRADE BEAMS



2 TYPICAL GRADE BEAM DETAIL AT PILE CAP



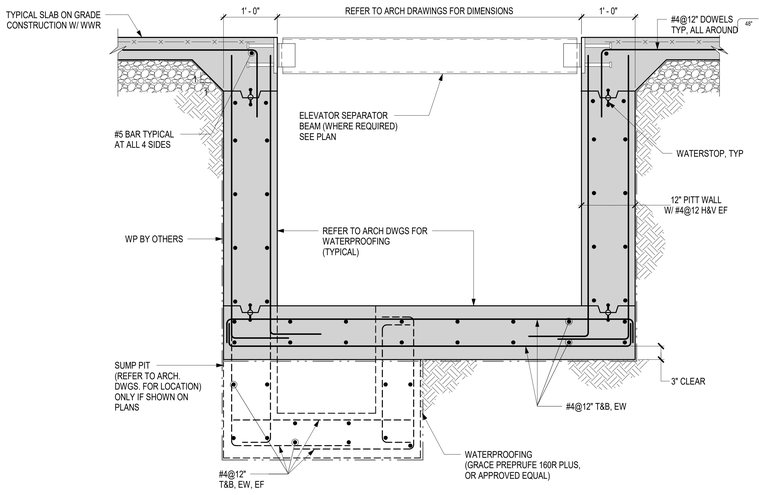
3 TYPICAL SLAB CONNECTION TO GRADE BEAM



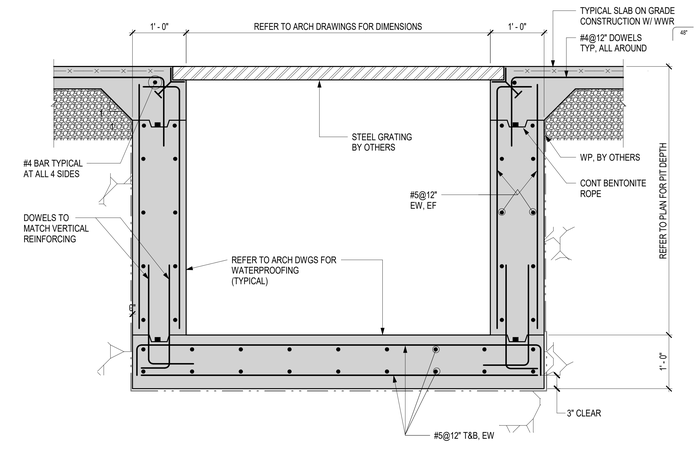
NOTES:

1. SUBMIT ALTERNATE ARRANGEMENTS OF GRADE BEAM PENETRATIONS TO STRUCTURAL ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION.
2. TYPICAL FOR BEAMS DESIGNATED "GB" UNLESS OTHERWISE NOTED ON PLANS.
3. ALLOWABLE VERTICAL RANGE FOR PENETRATIONS.

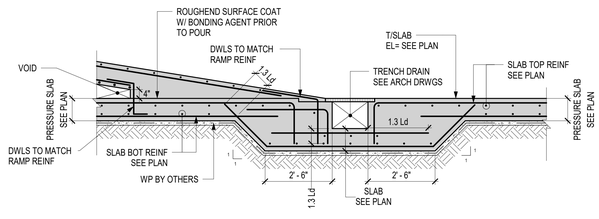
4 TYPICAL DETAIL AT GRADE BEAM PENETRATIONS



5 TYPICAL SECTION AT ELEVATOR PIT



6 TYPICAL SECTION AT SINGLE EJECTOR PIT



7 SECTION

MARVEL
145 HUDSON STREET, FLR.3 NEW YORK, NY 10013
212.616.0420

OWNER
1 JAVA OWNER, LLC
200 PARK AVE, 9TH FLOOR NY, NY 10166

STRUCTURAL ENGINEER
MCNAMARA SALVIA
45 W 45TH ST, 10TH FLOOR NY, NY 10036

BUILDING SYSTEMS ENGINEER
ARUP
77 WATER ST, 5TH FLOOR NY,NY 10005

VERTICAL TRANSPORTATION
LERCH BATES
1430 BROADWAY, SUITE 908 NY, NY 10018

PARKING CONSULTANT
WALKER CONSULTANTS
49 W 38TH ST, 9TH FLOOR NY, NY 10018

SUSTAINABILITY CONSULTANT
STEVEN WINTER ASSOCIATES, INC
307 7TH AVE, SUITE 1701 NY, NY 1001

ENVELOPE CONSULTANT
SOCOTEC, INC
151 W 42ND ST, NY, NY 10036

GEOTECHNICAL/CIVIL ENGINEER
LANGAN
360 W 31ST ST, 8TH FLOOR NY, NY 10001

MARINE ENGINEER
MCLAREN ENGINEERING GROUP
131 W 35TH ST, 4TH FLOOR NY, NY 10001

LANDSCAPE DESIGNER
MARVEL
145 HUDSON ST, 3RD FLOOR NY, NY 10013

LANDSCAPE ARCHITECT (WATERFRONT)
JAMES CORNER FIELD OPERATIONS
475 10TH AVE, 9TH FLOOR NY, NY 10018

LIGHTING DESIGNER
ONELUX
158 W 29TH ST, 10TH FLOOR NY, NY 10001

ACCESSIBILITY
ACCESSIBILITY SERVICES
120-34 QUEENS BLVD, SUITE 320
KEW GARDENS, NY 11415

ACOUSTICS
LONGMAN-LINDSAY
200 W 41ST, SUITE 1100, NY, NY 10036

EXPEDITOR
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333 WESTCHESTER AVE,
WHITE PLAINS, NY 10604

FACADE MAINTENANCE
ENTEK ENGINEERING
166 AMES ST, HACKENSACK, NJ 07601

REV	DATE	DESCRIPTION
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2021054.00
1 JAVA

18 INDIA STREET
BROOKLYN, NY 11222

KEY PLAN

NYC Buildings
APPROVED
Date: 11/16/2022

TYPICAL FOUNDATION DETAILS

SCALE: As indicated

STATE OF NEW YORK · YASMIN E. SEVA · LICENSED PROFESSIONAL ENGINEER · 027170

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MATERIAL PROPERTIES:

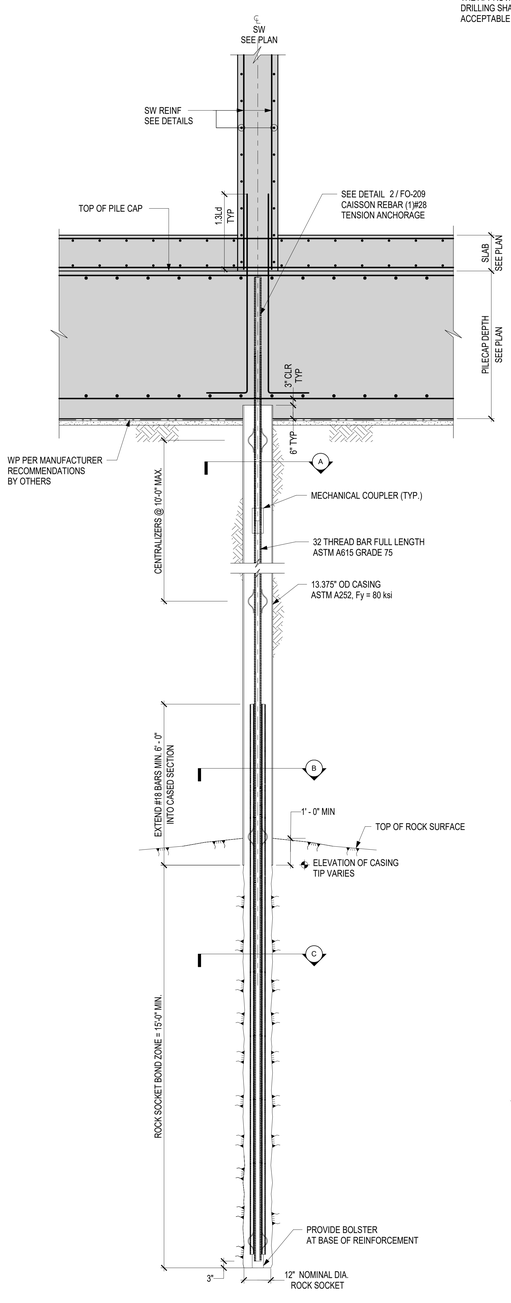
1. ALL STEEL CASING SHALL CONFORM WITH ASTM A252, EXCEPT THAT Fy = 80 KSI.
2. ALL THREADED BAR OR DEFORMED BAR REINFORCING SHALL CONFORM WITH ASTM A615, GR75, Fy = 75 KSI.
3. MINI-CAISSON GROUT SHALL BE A MIXTURE OF NEAT PORTLAND CEMENT (TYPE I, II, OR III) AND WATER WITH WATER TO CEMENT RATIO NOT EXCEEDING 0.45, AND SHALL HAVE A MINIMUM UNCONFINED COMPRESSIVE STRENGTH AT 28 DAYS OF Fc = 11 KSI.

MINI-CAISSON DESIGN NOTES:

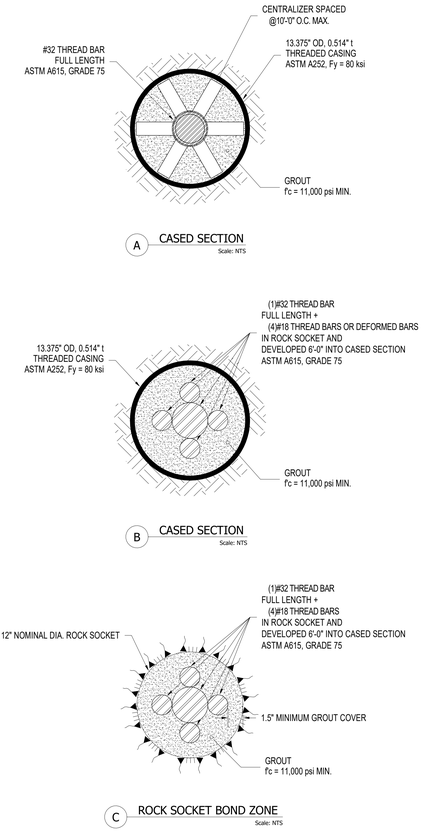
- COMPRESSION CAPACITY = 1,100 KIPS
- TENSION CAPACITY = 547 KIPS
- LATERAL CAPACITY = 6 KIPS
- ROCK SOCKET BOND ZONE LENGTH = 15'-0"

GENERAL NOTES:

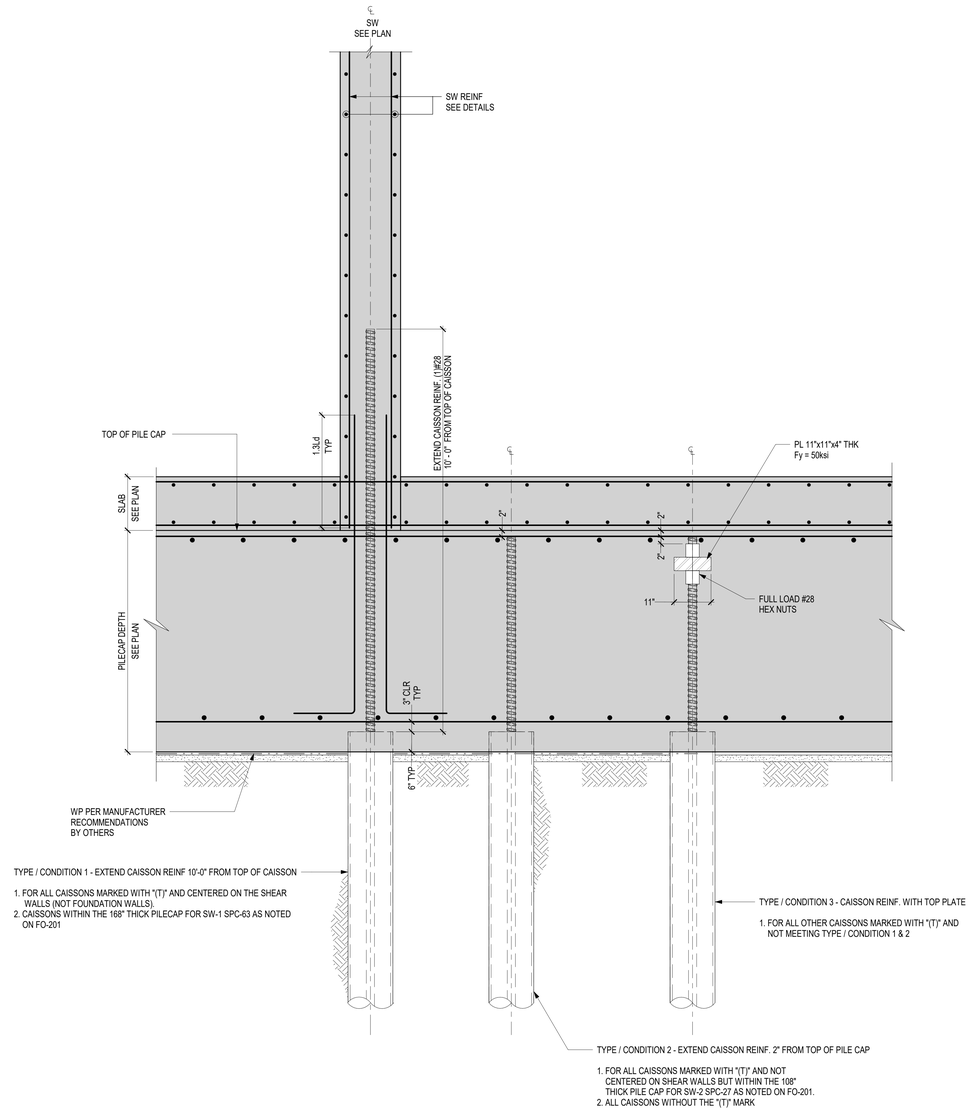
1. REFER TO SECTION 316326 OF THE PROJECT SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS PERTAINING TO MINI-CAISSONS.
2. MINI-CAISSON INSTALLATION METHODS ARE SUBJECT TO APPROVAL BY THE OWNER'S ENGINEER. THE CONTRACTOR SHALL FIELD VERIFY THE LOCATION OF ALL EXISTING STRUCTURES AND UTILITIES PRIOR TO DRILLING.
3. MONITOR PERFORMANCE OF ADJACENT STRUCTURES DURING MINI-CAISSON INSTALLATION AS REQUIRED BY THE MONITORING PLAN AND SPECIFICATION 310901. NO WORK SHALL BE PERFORMED UNTIL MONITORING IS IN PLACE AND BASELINE READINGS ARE APPROVED BY THE OWNER'S ENGINEER.
4. ALL LOADS REFERENCED HEREIN ARE SERVICE LOADS IN KIPS.
5. MECHANICAL COUPLERS SHALL DEVELOP 125% OF THE ULTIMATE TENSILE STRENGTH OF THE BAR BEING SPLICED.
6. REINFORCING STEEL SHALL HAVE A MINIMUM COVER OF 2-INCHES WITHIN THE UNCASED PORTION OF THE ROCK SOCKET.
7. CARE MUST BE TAKEN NOT TO DAMAGE THE THREADED BARS AND ACCESSORIES. DO NOT WELD IN THE VICINITY OF THE HIGH-STRENGTH THREADED BARS. DO NOT USE THREADED BARS AS A GROUND FOR WELDING.
8. CENTRALIZERS SHALL BE PROVIDED AT A MAXIMUM SPACING OF 10 FEET CENTER TO CENTER.
9. REBAR SHALL BE ELEVATED 3 INCHES FROM THE BASE OF THE ROCK SOCKET USING APPROVED BOLSTERS.
10. ROCK SOCKET BOND ZONES HAVE BEEN PROPORTIONED ASSUMING AN ALLOWABLE SIDE SHEAR OF 200 PSI FOR COMPRESSION AND 100 PSI FOR TENSION.
11. ALL ROCK CONDITIONS SHALL BE VERIFIED BY DOWN-HOLE VIDEO INSPECTION, UNLESS OTHERWISE APPROVED BY THE OWNER'S ENGINEER. ROCK SHALL MEET THE MINIMUM REQUIREMENTS OF NYC BUILDING CODE CLASS 1C FOR SIDEWALLS.
12. METHODS FOR EXCAVATION OR DRILLING TO CLEAR OBSTRUCTIONS SHALL BE SUBJECT TO THE APPROVAL OF THE OWNER'S ENGINEER. ALL SOILS DISTURBED BY EXCAVATION OR DRILLING SHALL BE PROPERLY COMPACTED, OR IMPROVED BY GROUTING OR OTHER MEANS ACCEPTABLE TO THE OWNER'S ENGINEER TO PREVENT REDUCTION OF LATERAL RESISTANCE.



MINI-CAISSON ELEVATION



1 CAISSON DETAILS



2 TYPICAL CAISSON TENSION DETAIL



MARVEL
145 HUDSON STREET, FLR.3 NEW YORK, NY 10013
212.616.0420

OWNER
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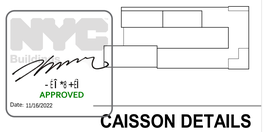
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1 JAVA
18 INDIA STREET
BROOKLYN, NY 11222

KEY PLAN



NYC Buildings
APPROVED
Date: 11/16/2022

CAISSON DETAILS

SCALE: As indicated

STATE OF NEW YORK · JASMIN E. SELLA · 092779 · LICENSED PROFESSIONAL ENGINEER

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COMPRESSION DEVELOPMENT LENGTH AND COMPRESSION LAP SPLICE LENGTH (inches)

(UNLESS NOTED OTHERWISE)

f'c = 4000 PSI, NORMAL WEIGHT CONCRETE

BAR SIZE	LENGTH TYPE	REINFORCING GRADE (Fy)	
		Fy=60 ksi	Fy=75 ksi
#3	COMPRESSION DEVELOPMENT	12	12
	COMPRESSION LAP SPLICE	12	17
#4	COMPRESSION DEVELOPMENT	12	12
	COMPRESSION LAP SPLICE	15	22
#5	COMPRESSION DEVELOPMENT	12	15
	COMPRESSION LAP SPLICE	19	28
#6	COMPRESSION DEVELOPMENT	14	18
	COMPRESSION LAP SPLICE	23	33
#7	COMPRESSION DEVELOPMENT	17	21
	COMPRESSION LAP SPLICE	27	39
#8	COMPRESSION DEVELOPMENT	19	24
	COMPRESSION LAP SPLICE	30	44
#9	COMPRESSION DEVELOPMENT	21	27
	COMPRESSION LAP SPLICE	34	50
#10	COMPRESSION DEVELOPMENT	24	30
	COMPRESSION LAP SPLICE	38	56
#11	COMPRESSION DEVELOPMENT	27	33
	COMPRESSION LAP SPLICE	42	62

TENSION DEVELOPMENT LENGTH (Ld) AND TENSION LAP SPLICE LENGTH (Lap Class B OR 1.3Ld) FOR GRADE 60 DEFORMED REINFORCING BARS (inches)

(UNLESS NOTED OTHERWISE)

f'c = 4000 PSI, NORMAL WEIGHT CONCRETE

BAR SIZE	LENGTH TYPE	CONCRETE COVER ≥ 0.75 in				CONCRETE COVER ≥ 1.0 in				CONCRETE COVER ≥ 1.25 in				CONCRETE COVER ≥ 1.50 in				CONCRETE COVER ≥ 2.00 in				CONCRETE COVER ≥ 3.00 in			
		CLEAR BAR SPACING ² ≥ 1.50 in				CLEAR BAR SPACING ² ≥ 2.0 in				CLEAR BAR SPACING ² ≥ 2.50 in				CLEAR BAR SPACING ² ≥ 3.0 in				CLEAR BAR SPACING ² ≥ 4.0 in				CLEAR BAR SPACING ² ≥ 6.0 in			
		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED	
		TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER
#3	Ld	12	12	15	13	12	12	15	13	12	12	14	12	12	12	14	12	12	12	14	12	12	12	14	12
	B	15	12	19	17	15	12	19	17	15	12	18	14	15	12	18	14	15	12	18	14	15	12	18	14
#4	Ld	19	15	25	22	15	12	20	18	15	12	20	18	15	12	18	14	15	12	18	14	15	12	18	14
	B	25	19	32	28	20	15	26	23	20	15	26	23	20	15	24	18	20	15	24	18	20	15	24	18
#5	Ld	28	21	36	32	23	17	29	26	19	15	25	22	19	15	25	22	19	15	23	18	19	15	23	18
	B	36	28	47	41	29	23	38	34	25	19	32	28	25	19	32	28	25	19	29	23	25	19	29	23
#6	Ld	37	29	49	43	31	24	40	35	26	20	34	30	23	18	30	26	23	18	30	26	23	18	27	21
	B	49	37	63	56	40	31	52	46	34	26	44	39	29	23	38	34	29	23	38	34	29	23	35	27
#7	Ld	60	46	78	69	50	38	65	57	42	33	55	49	37	29	48	43	33	25	43	38	33	25	39	30
	B	78	60	102	90	65	50	84	74	55	42	72	63	48	37	63	55	43	33	56	49	43	33	51	39
#8	Ld	74	57	97	86	62	48	81	72	53	41	70	61	47	36	61	54	37	29	49	43	37	29	45	35
	B	97	74	126	111	81	62	105	93	69	53	90	80	61	47	79	70	49	37	63	56	49	37	58	45
#9	Ld	90	69	118	104	76	58	99	87	65	50	85	75	58	44	75	66	46	36	61	53	42	33	55	49
	B	117	90	153	135	98	76	128	113	85	65	111	98	75	58	97	86	60	46	79	69	55	42	71	63
#10	Ld	108	83	141	125	92	71	120	106	80	61	104	92	70	54	92	81	57	44	75	66	47	37	62	55
	B	141	108	184	162	119	92	156	137	103	80	135	119	91	70	119	105	74	57	97	85	62	47	80	71
#11	Ld	127	98	166	146	108	83	142	125	95	73	124	109	84	65	110	97	68	53	89	79	53	41	69	61
	B	165	127	215	190	141	108	184	162	123	95	160	142	109	84	142	126	89	68	116	102	68	53	89	79

TENSION DEVELOPMENT LENGTH (Ld) AND TENSION LAP SPLICE LENGTH (Lap Class B OR 1.3Ld) FOR GRADE 60 DEFORMED REINFORCING BARS (inches)

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		CLEAR BAR SPACING ² ≥ 1.50 in				CLEAR BAR SPACING ² ≥ 2.0 in				CLEAR BAR SPACING ² ≥ 2.50 in				CLEAR BAR SPACING ² ≥ 3.0 in				CLEAR BAR SPACING ² ≥ 4.0 in				CLEAR BAR SPACING ² ≥ 6.0 in			
		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED	
		TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER
#3	Ld	12	12	13	12	12	12	13	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	B	13	12	17	15	13	12	17	15	13	12	16	12	13	12	16	12	13	12	16	12	13	12	16	12
#4	Ld	17	13	22	20	14	12	18	16	14	12	18	16	14	12	16	13	14	12	16	13	14	12	16	13
	B	22	17	29	25	18	14	23	20	18	14	23	20	18	14	21	16	18	14	21	16	18	14	21	16
#5	Ld	25	19	32	29	20	16	26	23	17	13	22	20	17	13	22	20	17	13	20	16	17	13	20	16
	B	32	25	42	37	26	20	34	30	22	17	29	25	22	17	29	25	22	17	26	20	22	17	26	20
#6	Ld	34	26	44	39	28	21	36	32	23	18	30	27	20	16	26	23	20	16	26	23	20	16	24	19
	B	44	34	57	50	36	28	47	41	30	23	39	35	26	20	34	30	26	20	34	30	26	20	31	24
#7	Ld	54	42	70	62	45	34	58	51	38	29	50	44	33	26	43	38	29	23	38	34	29	23	35	27
	B	70	54	91	81	58	45	75	67	49	38	64	57	43	33	56	50	38	29	50	44	38	29	46	35
#8	Ld	67	51	87	77	56	43	73	64	48	37	62	55	42	32	55	48	34	26	44	39	34	26	40	31
	B	87	67	113	100	72	56	94	83	62	48	81	71	54	42	71	63	44	34	57	50	44	34	52	40
#9	Ld	81	62	105	93	68	52	89	78	59	45	76	67	52	40	67	59	42	32	54	48	38	29	49	44
	B	105	81	137	121	88	68	115	101	76	59	99	88	67	52	87	77	54	42	70	62	49	38	64	56
#10	Ld	97	75	126	112	82	63	107	95	71	55	93	82	63	49	82	73	51	39	67	59	43	33	55	49
	B	126	97	164	145	107	82	139	123	93	71	121	107	82	63	107	94	66	51	87	76	55	43	72	64
#11	Ld	114	87	148	131	97	75	127	112	85	65	111	98	75	58	98	87	61	47	80	71	47	36	62	54
	B	147	114	193	170	126	97	164	145	110	85	144	127	97	75	127	112	80	61	104	92	61	47	80	70

TENSION DEVELOPMENT LENGTH (Ld) AND TENSION LAP SPLICE LENGTH (Lap Class B OR 1.3Ld) FOR GRADE 60 DEFORMED REINFORCING BARS (inches)

(UNLESS NOTED OTHERWISE)

f'c = 6000 PSI, NORMAL WEIGHT CONCRETE

BAR SIZE	LENGTH TYPE	CONCRETE COVER ≥ 0.75 in				CONCRETE COVER ≥ 1.0 in				CONCRETE COVER ≥ 1.25 in				CONCRETE COVER ≥ 1.50 in				CONCRETE COVER ≥ 2.00 in				CONCRETE COVER ≥ 3.00 in			
		CLEAR BAR SPACING ² ≥ 1.50 in				CLEAR BAR SPACING ² ≥ 2.0 in				CLEAR BAR SPACING ² ≥ 2.50 in				CLEAR BAR SPACING ² ≥ 3.0 in				CLEAR BAR SPACING ² ≥ 4.0 in				CLEAR BAR SPACING ² ≥ 6.0 in			
		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED	
		TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER
#3	Ld	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	B	12	12	16	14	12	12	16	14	12	12	15	12	12	12	15	12	12	12	15	12	12	12	15	12
#4	Ld	16	12	20	18	13	12	16	14	13	12	16	14	13	12	15	12	13	12	15	12	13	12	15	12
	B	20	16	26	23	16	13	21	19	16	13	21	19	16	13	19	15	16	13	19	15	16	13	19	15
#5	Ld	23	18	30	26	18	14	24	21	16	12	20	18	16	12	20	18	16	12	19	14	16	12	19	14
	B	29	23	38	34	24	18	31	27	20	16	26	23	20	16	26	23	20	16	24	19	20	16	24	19
#6	Ld	31	24	40	35	25	20	33	29	21	17	28	25	19	14	24	21	19	14	24	21	19	14	22	17
	B	40	31	52	46	33	25	43	38	28	21	36	32	24	19	31	28	24	19	31	28	24	19	29	22
#7	Ld	49	38	64	57	41	31	53	47	35	27	45	40	30	23	40	35	27	21	35	31	27	21	32	25
	B	64	49	83	74	53	41	69	61	45	35	59	52	39	30	51	45	35	27	45	40	35	27	42	32
#8	Ld	61	47	80	70	51	39	66	59	44	34	57	50	38	30	50	44	31	24	40	35	31	24	37	28
	B	79	61	103	91	66	51	86	76	57	44	74	65	50	38	65	57	40	31	52	46	40	31	48	37
#9	Ld	74	57	96	85	62	48	81	71	53	41	70	62	47	36	61	54	38	29	50	44	35	27	45	40
	B	96	74	125	110	80	62	105	93	69	53	91	80	61	47	80	70	49	38	64	57	45	35	58	52
#10	Ld	88	68	116	102	75	58	98	86	65	50	85	75	58	44	75	66	47	36	61	54	39	30	51	45
	B	115	88	150	132	97	75	127	112	85	65	110	97	75	58	97	86	61	47	79	70	50	39	66	58
#11	Ld	104	80	135	120	89	68	116	102	77	60	101	89	69	53	90	79	56	43	73	65	43	33	56	50
	B	135	104	176	155	115	89	150	133	100	77	131	116	89	69	116	103	73	56	95	84	56	43	73	64

TENSION DEVELOPMENT LENGTH (Ld) AND TENSION LAP SPLICE LENGTH (Lap Class B OR 1.3Ld) FOR GRADE 60 DEFORMED REINFORCING BARS (inches)

(UNLESS NOTED OTHERWISE)

f'c = 7000 PSI, NORMAL WEIGHT CONCRETE

BAR SIZE	LENGTH TYPE	CONCRETE COVER ≥ 0.75 in				CONCRETE COVER ≥ 1.0 in				CONCRETE COVER ≥ 1.25 in				CONCRETE COVER ≥ 1.50 in				CONCRETE COVER ≥ 2.00 in				CONCRETE COVER ≥ 3.00 in			
		CLEAR BAR SPACING ² ≥ 1.50 in				CLEAR BAR SPACING ² ≥ 2.0 in				CLEAR BAR SPACING ² ≥ 2.50 in				CLEAR BAR SPACING ² ≥ 3.0 in				CLEAR BAR SPACING ² ≥ 4.0 in				CLEAR BAR SPACING ² ≥ 6.0 in			
		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED	
		TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER
#3	Ld	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	B	12	12	14	12	12	12	14	12	12	12	13	12	12	12	13	12	12	12	13	12	12	12	13	12
#4	Ld	14	12	18	16	12	12	14	13	12	12	14	13	12	12	14	13	12	12	13	12	12	12	13	12
	B	18	14	23	20	14	12	18	16	14	12	18	16	14	12	18	16	14	12	18	16	14	12	17	13
#5	Ld	20	15	26	23	16	12	21	18	14	12	18	16	14	12	18	16	14	12	18	16	14	12	16	13
	B	26	20	33	29	21	16	27	24	18	14	23	20	18	14	23	20	18	14	23	20	18	14	21	16
#6	Ld	27	21	35	31	22	17	28	25	19	14	24	21	16	13	21	19	16	13	21	19	16	13	19	15
	B	35	27	45	40	28	22	37	33	24	19	31	28	21	16	27	24	21	16	27	24	21	16	25	19
#7	Ld	43	33	56	49	35	27	46	41	30	23	39	35	26	20	34	30	26	20	34	30	26	20	31	24
	B	55	43	72	64	46	35	60	53	39	30	51	45	34	26	44	39	30	23	39	35	30	23	36	28
#8	Ld	53	41	69	61	44	34	58	51	38	29	49	44	33	26	43	38	29	23	35	31	27	21	32	25
	B	69	53	89	79	57	44	75	66	49	38	64	57	43	33	56	50	35	27	45	40	35	27	41	32
#9	Ld	64	49	83	74	54	41	70	62	46	36	60	53	41	31	53	47	33	25	42	37	33	25	39	30
	B	84	64	108	96	70	54	91	80	60	46	78	69	53	41	69	61	43	33	56	49	39	30	51	45
#10	Ld	77	59	100	88	65	50	85	75	56	44	74	65	50	39	65	58	41	31	53	47	34	26	44	39
	B	100	77	130	115	84	65	110	97	73	56	96	84	65	50	84	75	53	41	69	61	44	34	57	50
#11	Ld	90	69	117	104	77	59	100	88	67	52	87	77	59	46	78	69	49	37	63	56	37	29	49	43
	B	117	90	152	135	100	77	130	115	87	67	127	114	87	65	114	100	77	59	101	89	63	49	82	73

TENSION DEVELOPMENT LENGTH (Ld) AND TENSION LAP SPLICE LENGTH (Lap Class B OR 1.3Ld) FOR GRADE 60 DEFORMED REINFORCING BARS (inches)

(UNLESS NOTED OTHERWISE)

f'c = 8000 PSI, NORMAL WEIGHT CONCRETE

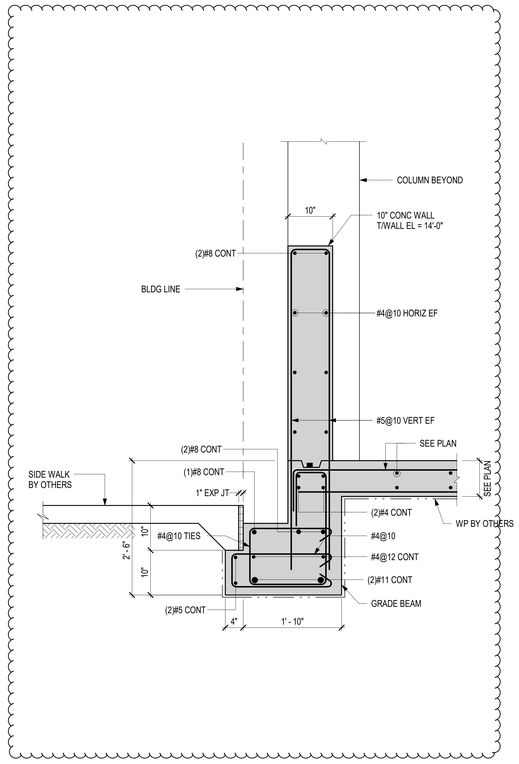
BAR SIZE	LENGTH TYPE	CONCRETE COVER ≥ 0.75 in				CONCRETE COVER ≥ 1.0 in				CONCRETE COVER ≥ 1.25 in				CONCRETE COVER ≥ 1.50 in				CONCRETE COVER ≥ 2.00 in				CONCRETE COVER ≥ 3.00 in			
		CLEAR BAR SPACING ² ≥ 1.50 in				CLEAR BAR SPACING ² ≥ 2.0 in				CLEAR BAR SPACING ² ≥ 2.50 in				CLEAR BAR SPACING ² ≥ 3.0 in				CLEAR BAR SPACING ² ≥ 4.0 in				CLEAR BAR SPACING ² ≥ 6.0 in			
		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED	
		TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER
#3	Ld	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	B	12	12	14	12	12	12	14	12	12	12	13	12	12	12	13	12	12	12	13	12	12	12	13	12
#4	Ld	14	12	18	16	12	12	14	13	12	12	14	13	12	12	14	13	12	12	13	12	12	12	13	12
	B	18	14	23	20	14	12	18	16	14	12	18	16	14	12	18	16	14	12	18	16	14	12	17	13
#5	Ld	20	15	26	23	16	12	21	18	14	12	18	16	14	12	18	16	14	12	18	16	14	12	16	13
	B	26	20	33	29	21	16	27	24	18	14	23	20	18	14	23	20	18	14	23	20	18	14	21	16
#6	Ld	27	21	35	31	22	17	28	25	19	14	24	21	16	13	21	19	16	13	21	19	16	13	19	15
	B	35	27	45	40	28	22	37	33	24	19	31	28	21	16	27	24	21	16	27	24	21	16	25	19
#7	Ld	43	33	56	49	35	27	46	41	30	23	39	35	26	20	34	30	26	20	34	30	26	20	31	24
	B	55	43	72	64	46	35	60	53	39	30	51	45	34	26	44	39	30	23	39	35	30	23	36	28
#8	Ld	53	41	69	61	44	34	58	51	38	29	49	44	33	26	43	38	29	23	35	31	27	21	32	25
	B	69	53	89	79	57	44	75	66	49	38	64	57	43	33	56	50	35	27	45	40	35	27	41	32
#9	Ld	64	49	83	74	54	41	70	62	46	36	60	53	41	31	53	47	33	25	42	37	33	25	39	30
	B	84	64	108	96	70	54	91	80	60	46	78	69	53	41	69	61	43	33	56	49	39	30	51	45
#10	Ld	77	59	100	88	65	50	85	75	56	44	74	65	50	39	65	58	41	31	53	47	34	26	44	39
	B	100	77	130	115	84	65	110	97	73	56	96	84	65	50	84	75	53	41	69	61	44	34	57	50
#11	Ld	90	69	117	104	77	59	100	88	67	52	87	77	59	46	78	69	49	37	63	56	37	29	49	43
	B	117	90	152	135	100	77	130	115	87	67	127	114	87	65	114	100	77	59	101	89	63	49	82	73

TENSION DEVELOPMENT LENGTH (Ld) AND TENSION LAP SPLICE LENGTH (Lap Class B OR 1.3Ld) FOR GRADE 60 DEFORMED REINFORCING BARS (inches)

(UNLESS NOTED OTHERWISE)

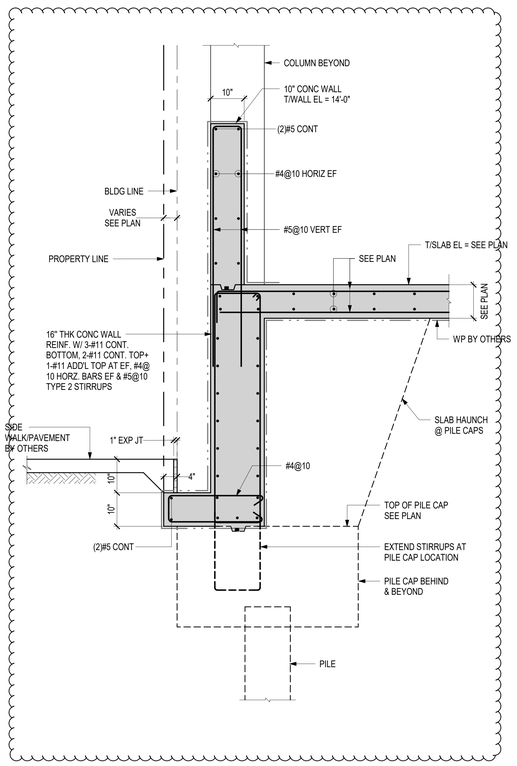
f'c = 9,000 PSI, NORMAL WEIGHT CONCRETE

BAR SIZE	LENGTH TYPE	CONCRETE COVER ≥ 0.75 in				CONCRETE COVER ≥ 1.0 in				CONCRETE COVER ≥ 1.25 in				CONCRETE COVER ≥ 1.50 in				CONCRETE COVER ≥ 2.00 in				CONCRETE COVER ≥ 3.00 in			
		CLEAR BAR SPACING ² ≥ 1.50 in				CLEAR BAR SPACING ² ≥ 2.0 in				CLEAR BAR SPACING ² ≥ 2.50 in				CLEAR BAR SPACING ² ≥ 3.0 in				CLEAR BAR SPACING ² ≥ 4.0 in				CLEAR BAR SPACING ² ≥ 6.0 in			
		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED		UNCOATED		EPOXY-COATED	
		TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER	TOP ¹	OTHER
#3	Ld	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	B	12	12	13	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
#4	Ld	13	12	17	15	12	12	13	12	12	12	13	12	12	12	13	12	12	12	12	12	12	12	12	12
	B	17	13	21	19	13	12	17	15	13	12	17	15	13	12	17	15	13	12	16	12	13	12	16	12
#5	Ld	19	14	24	21	15	12	20	17	13	12	17	15	13	12	17	15	13	12	17	15	13	12	15	12
	B	24	19	31	28	20	15	25	23	17	13	21	19	17	13	21	19	17	13	21	19	17	12	20	15
#6	Ld	25	19	33	29	21	16	27	24	18	14	23	20	18	14	23	20	15	12	20	18	15	12	20	16
	B	33	25	42	37	27	21	35	31	23	18	30	26	20	15	26	23	20	15	26	23	20	15	26	23
#7	Ld	40	31	52	46	33	26	43	38	28	22	37	33	25	19	32	29	22	17	29	25	22	17	26	20
	B	52	40	68	60	43	33	56	50	37	28	48	42	32	25	42	37	29	22	37	33	29	22	34	26
#8	Ld	50	38	65	57	42	32	54	48	36	28	47	41	31	24	41	36	25	19	33	29	25	19	30	23
	B	65	50	84	74	54	42	70	62	46	36	60



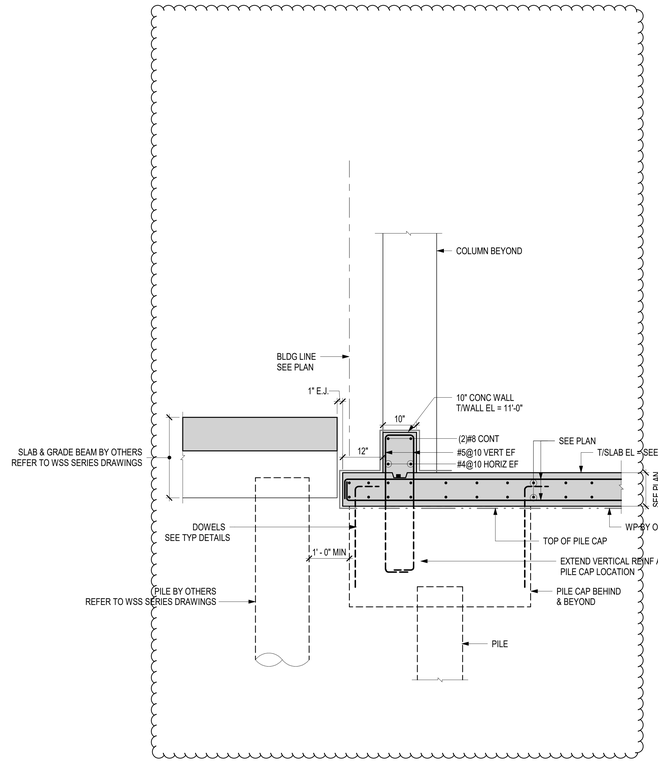
1 SECTION

SCALE: 1" = 1'-0"



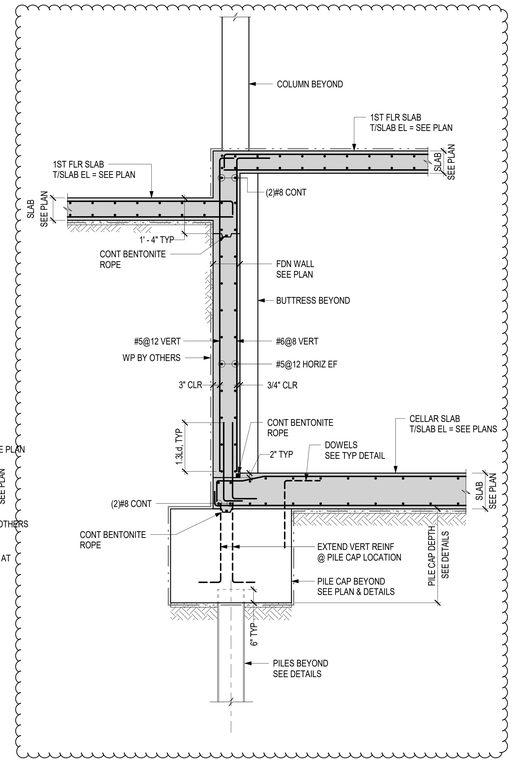
2 SECTION

SCALE: 3/4" = 1'-0"



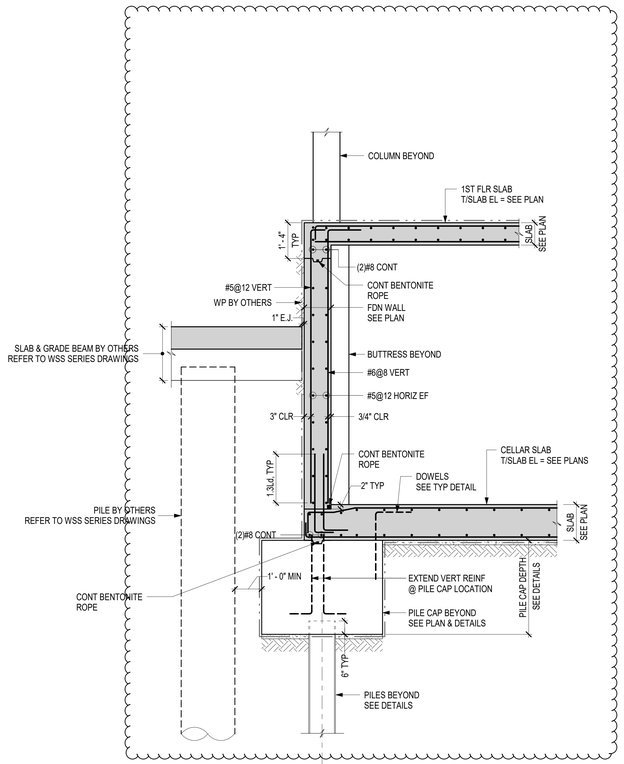
2A SECTION

SCALE: 3/4" = 1'-0"



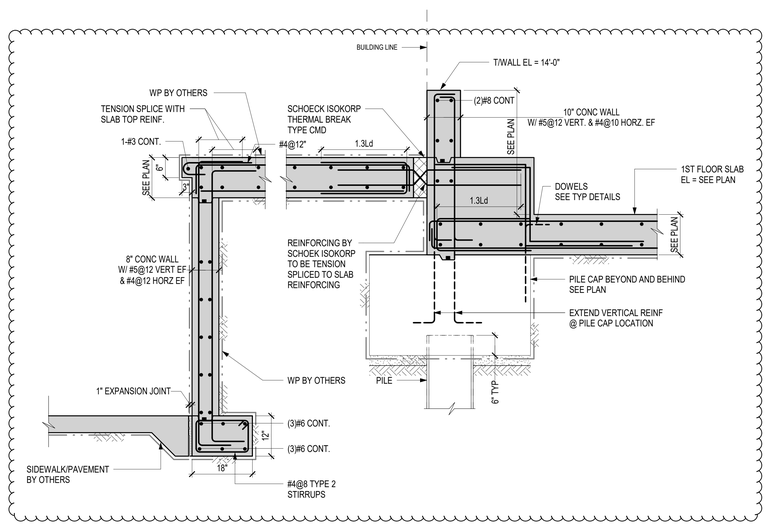
3 SECTION

SCALE: 1/2" = 1'-0"



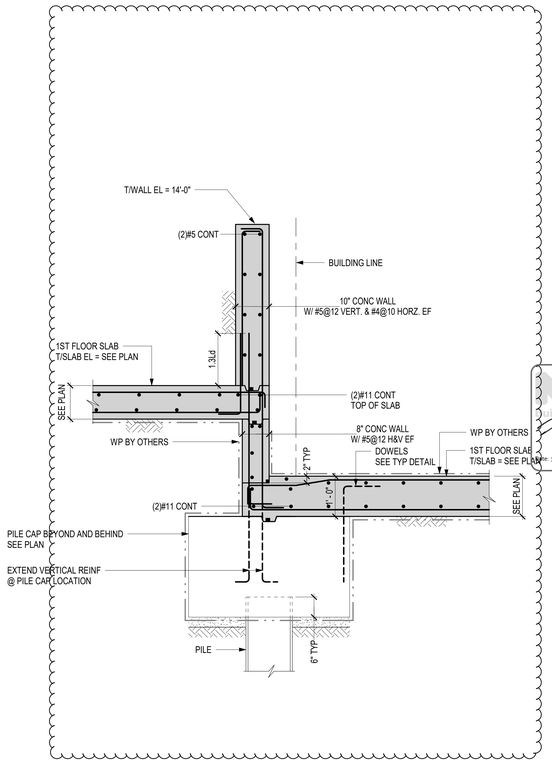
4 SECTION

SCALE: 1/2" = 1'-0"



5 SECTION

SCALE: 3/4" = 1'-0"



6 SECTION

SCALE: 3/4" = 1'-0"



MARVEL

145 HUDSON STREET, FLR.3 NEW YORK, NY 10013
212.616.0420

OWNER
1 JAVA OWNER, LLC
200 PARK AVE, 9TH FLOOR NY, NY 10166

STRUCTURAL ENGINEER
MCNAMARA SALVIA
45 W 45TH ST, 10TH FLOOR NY, NY 10036

BUILDING SYSTEMS ENGINEER
ARUP
77 WATER ST, 5TH FLOOR NY,NY 10005

VERTICAL TRANSPORTATION
LERCH BATES
1430 BROADWAY, SUITE 908 NY, NY 10018

PARKING CONSULTANT
WALKER CONSULTANTS
49 W 38TH ST, 9TH FLOOR NY, NY 10018

SUSTAINABILITY CONSULTANT
STEVEN WINTER ASSOCIATES, INC
307 7TH AVE, SUITE 1701 NY, NY 1001

ENVELOPE CONSULTANT
SOCOTEC, INC
151 W 42ND ST, NY, NY 10036

GEOTECHNICAL/CIVIL ENGINEER
LANGAN
360 W 31ST ST, 8TH FLOOR NY, NY 10001

MARINE ENGINEER
MCLAREN ENGINEERING GROUP
131 W 35TH ST, 4TH FLOOR NY, NY 10001

LANDSCAPE DESIGNER
MARVEL
145 HUDSON ST, 3RD FLOOR NY, NY 10013

LANDSCAPE ARCHITECT (WATERFRONT)
JAMES CORNER FIELD OPERATIONS
475 10TH AVE, 9TH FLOOR NY, NY 10018

LIGHTING DESIGNER
ONELUX
158 W 29TH ST, 10TH FLOOR NY, NY 10001

ACCESSIBILITY
ACCESSIBILITY SERVICES
120-34 QUEENS BLVD, SUITE 320
KEW GARDENS, NY 11415

ACOUSTICS
LONGMAN-LINDSAY
200 W 41ST, SUITE 1100, NY, NY 10036

EXPEDITOR
JAM CONSULTANTS INC.
104 W 29TH ST, 9TH FLOOR NY, NY 10001

INTERIORS
INC ARCHITECTURE & DESIGN
150 VARICK ST, 5T FLOOR, NY, NY 10013

POOL CONSULTANT
AQUATECTONIC/LOTHROP ASSOCIATES, LLP
333 WESTCHESTER AVE,
WHITE PLAINS, NY 10604

FACADE MAINTENANCE
ENTEK ENGINEERING
166 AMES ST, HACKENSACK, NJ 07601

REV	DATE	DESCRIPTION
1	06/01/2021	ISSUE FOR FOUNDATION
2	06/11/2021	50% SCHEMATIC SUBMISSION
3	08/06/2021	ISSUED FOR 100% SD
4	12/10/2021	50% DESIGN DEVELOPMENT
5	02/25/2022	ISSUED FOR 100% DD
6	05/20/2022	ISSUED FOR 50% CD
7	07/18/2022	REVISED AS NOTED
8	08/05/2022	100% CD
	10/05/2022	DOB PAA #1

2021054.00

1 JAVA

18 INDIA STREET
BROOKLYN, NY 11222

KEY PLAN

APPROVED
DOB: 11/16/2022

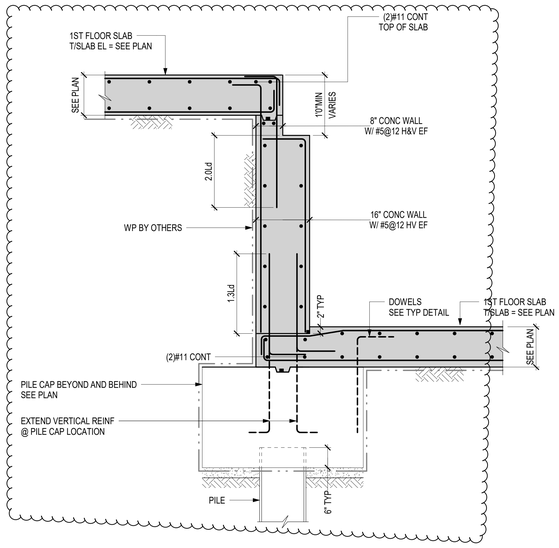
FOUNDATION SECTIONS

SCALE: As indicated

DRAWING #:
FO-300.01
___ of ___

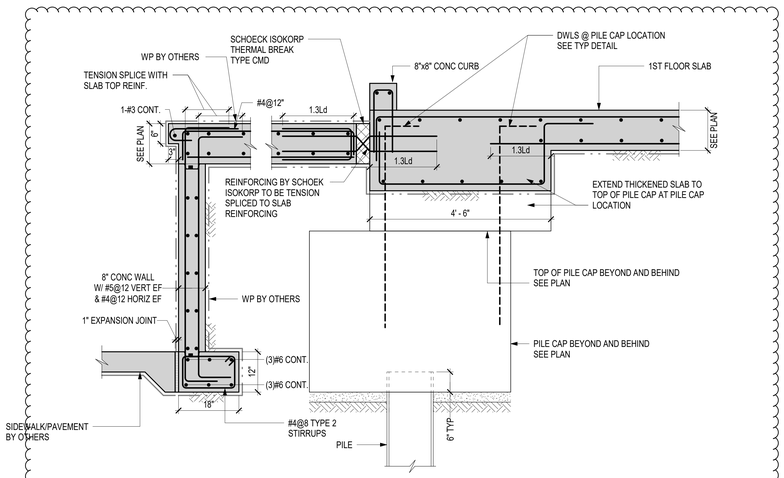
DOB JOB:
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10/4/2022 6:09:21 PM © MARVEL ARCHITECTS, PLLC 2016



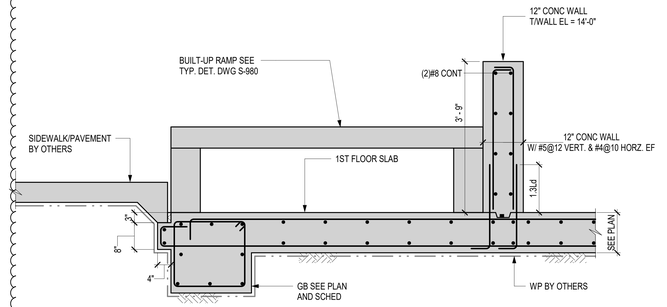
6A SECTION

SCALE: 3/4" = 1'-0"



7 SECTION

SCALE: 3/4" = 1'-0"



8 SECTION

SCALE: 3/4" = 1'-0"



MARVEL

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212.616.0420

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SOCOTEC, INC
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360 W 31ST ST, 8TH FLOOR NY, NY 10001

MARINE ENGINEER
MCLAREN ENGINEERING GROUP
131 W 35TH ST, 4TH FLOOR NY, NY 10001

LANDSCAPE DESIGNER
MARVEL
145 HUDSON ST, 3RD FLOOR NY, NY 10013

LANDSCAPE ARCHITECT (WATERFRONT)
JAMES CORNER FIELD OPERATIONS
475 10TH AVE, 9TH FLOOR NY, NY 10018

LIGHTING DESIGNER
ONELUX
158 W 29TH ST, 10TH FLOOR NY, NY 10001

ACCESSIBILITY
ACCESSIBILITY SERVICES
120-34 QUEENS BLVD, SUITE 320
KEW GARDENS, NY 11415

ACOUSTICS
LONGMAN-LINDSAY
200 W 41ST, SUITE 1100, NY, NY 10036

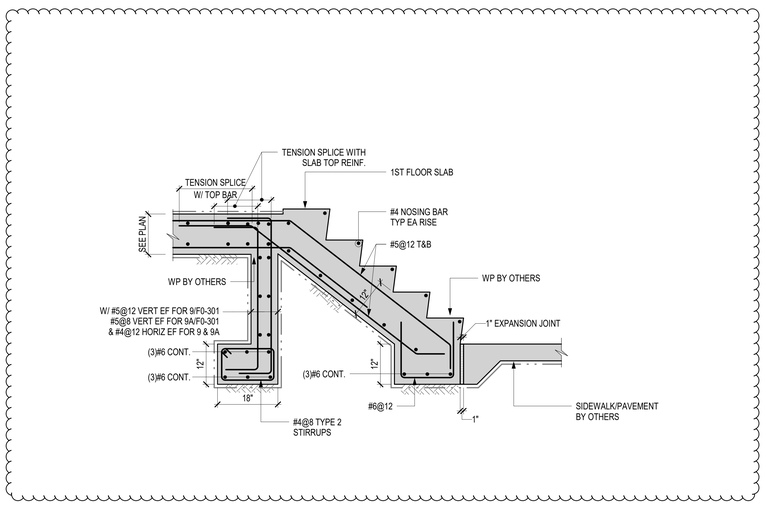
EXPEDITOR
JAM CONSULTANTS INC.
104 W 29TH ST, 9TH FLOOR NY, NY 10001

INTERIORS
INC ARCHITECTURE & DESIGN
150 VARICK ST, 5T FLOOR, NY, NY 10013

POOL CONSULTANT
AQUATECTONIC/LOTHROP ASSOCIATES, LLP
333 WESTCHESTER AVE,
WHITE PLAINS, NY 10604

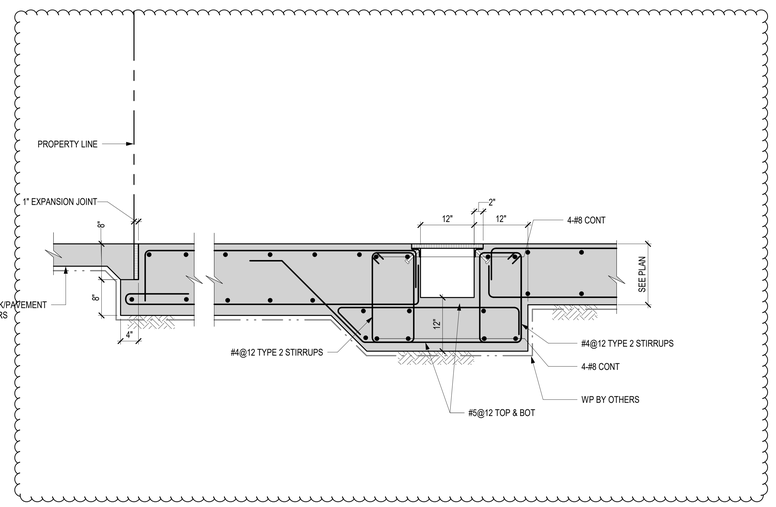
FACADE MAINTENANCE
ENTEK ENGINEERING
166 AMES ST, HACKENSACK, NJ 07601

REV	DATE	DESCRIPTION
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5	02/25/2022	ISSUED FOR 100% DD
6	05/20/2022	ISSUED FOR 50% CD
7	07/18/2022	REVISED AS NOTED
8	08/05/2022	100% CD
	10/05/2022	DOB PAA #1



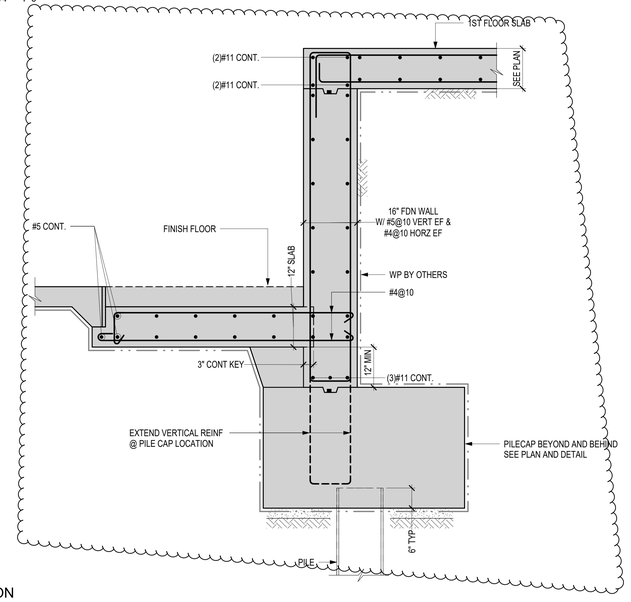
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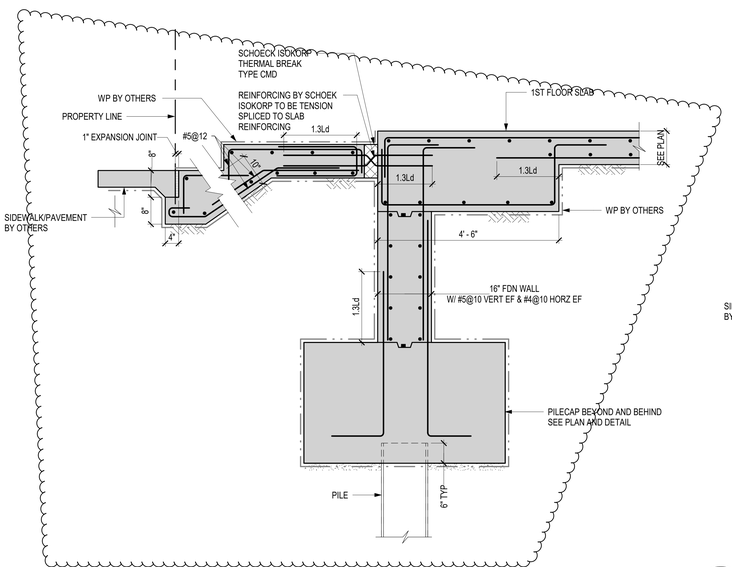
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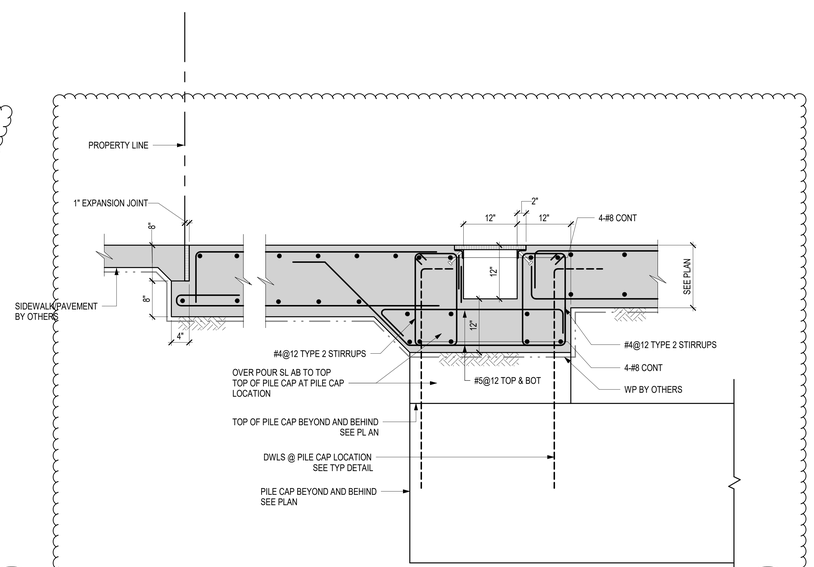
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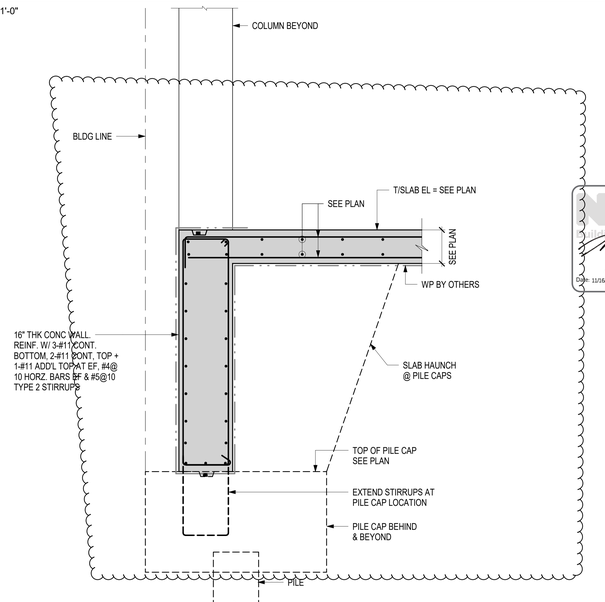
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SCALE: 3/4" = 1'-0"



13 SECTION

SCALE: 1" = 1'-0"



14 SECTION

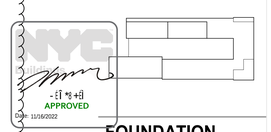
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2021054.00

1 JAVA

18 INDIA STREET
BROOKLYN, NY 11222

KEY PLAN



FOUNDATION SECTIONS

SCALE: As indicated



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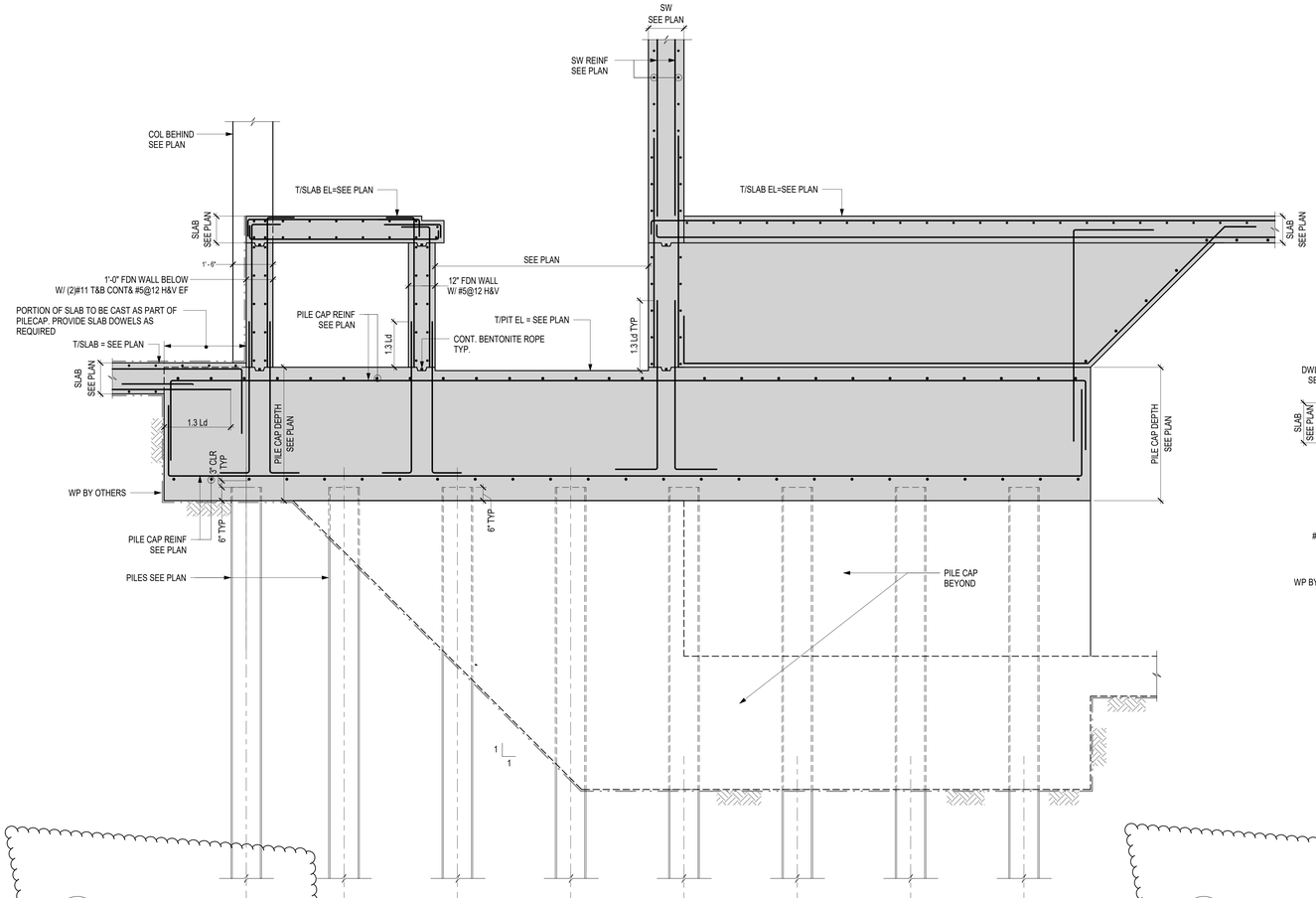
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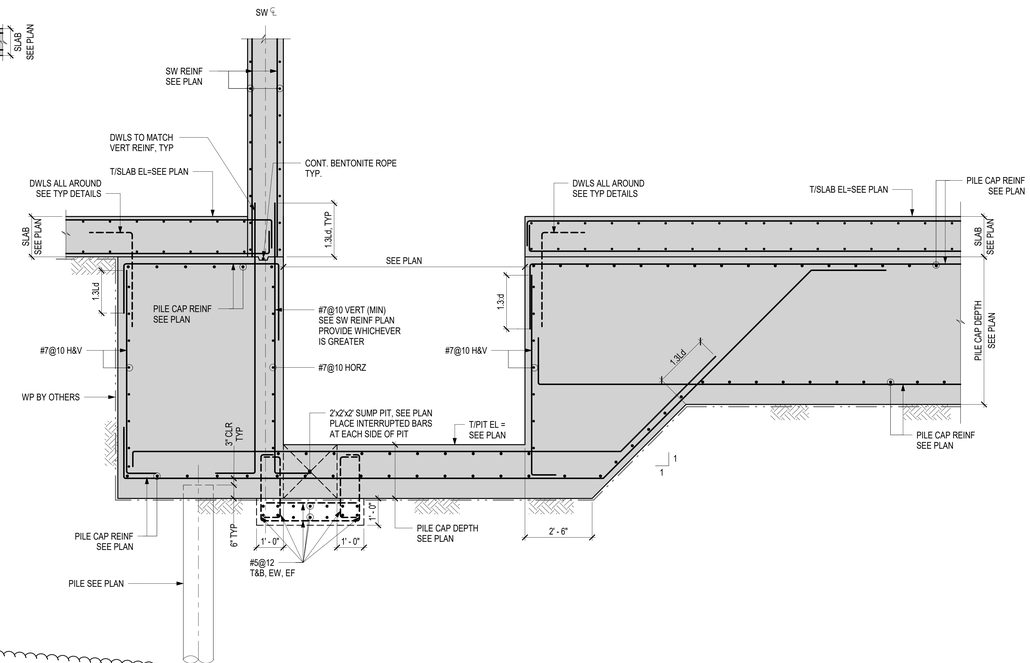
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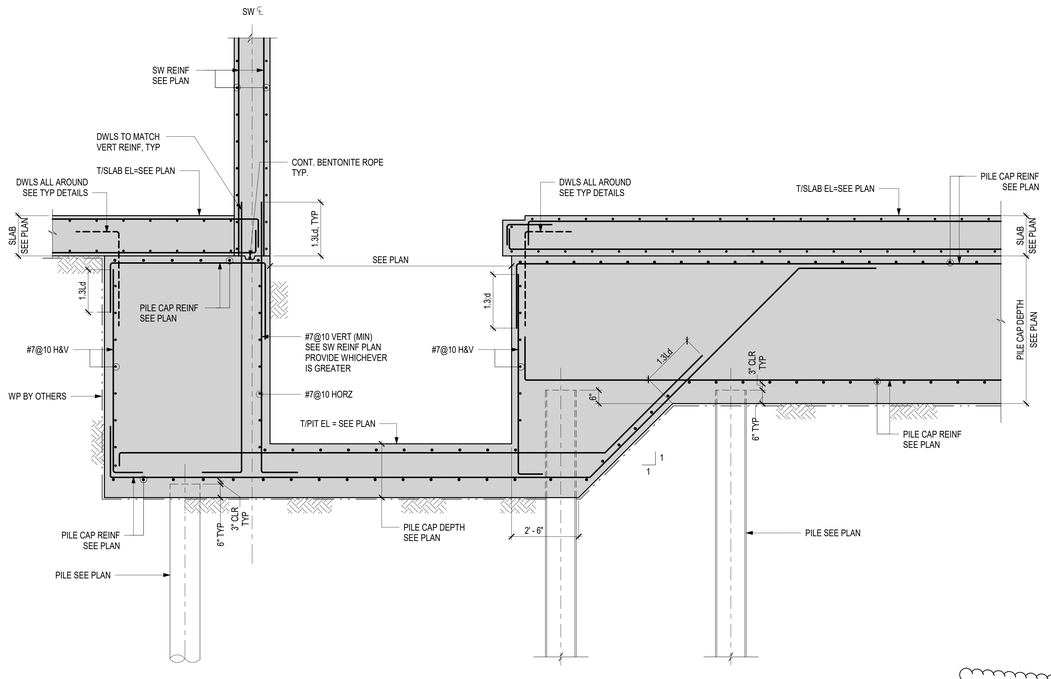
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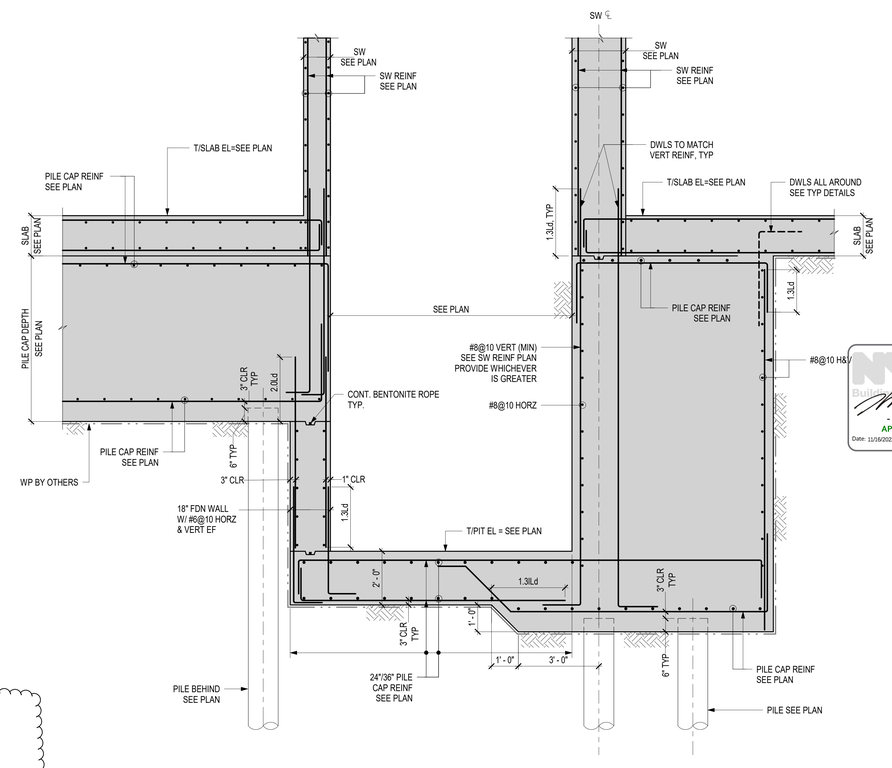
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SCALE: 1/2" = 1'-0"



16 SECTION
SCALE: 1/2" = 1'-0"



17 SECTION
SCALE: 1/2" = 1'-0"



18 SECTION
SCALE: 1/2" = 1'-0"



MARVEL

145 HUDSON STREET, FLR.3 NEW YORK, NY 10013
212.616.0420

OWNER
1 JAVA OWNER, LLC
200 PARK AVE, 9TH FLOOR NY, NY 10166

STRUCTURAL ENGINEER
MCNAMARA SALVIA
45 W 45TH ST, 10TH FLOOR NY, NY 10036

BUILDING SYSTEMS ENGINEER
ARUP
77 WATER ST, 5TH FLOOR NY,NY 10005

VERTICAL TRANSPORTATION
LERCH BATES
1430 BROADWAY, SUITE 908 NY, NY 10018

PARKING CONSULTANT
WALKER CONSULTANTS
49 W 38TH ST, 9TH FLOOR NY, NY 10018

SUSTAINABILITY CONSULTANT
STEVEN WINTER ASSOCIATES, INC
307 7TH AVE, SUITE 1701 NY, NY 1001

ENVELOPE CONSULTANT
SOCOTEC, INC
151 W 42ND ST, NY, NY 10036

GEOTECHNICAL/CIVIL ENGINEER
LANGAN
360 W 31ST ST, 8TH FLOOR NY, NY 10001

MARINE ENGINEER
MCLAREN ENGINEERING GROUP
131 W 35TH ST, 4TH FLOOR NY, NY 10001

LANDSCAPE DESIGNER
MARVEL
145 HUDSON ST, 3RD FLOOR NY, NY 10013

LANDSCAPE ARCHITECT (WATERFRONT)
JAMES CORNER FIELD OPERATIONS
475 10TH AVE, 9TH FLOOR NY, NY 10018

LIGHTING DESIGNER
ONELUX
158 W 29TH ST, 10TH FLOOR NY, NY 10001

ACCESSIBILITY
ACCESSIBILITY SERVICES
120-34 QUEENS BLVD, SUITE 320
KEW GARDENS, NY 11415

ACOUSTICS
LONGMAN-LINDSAY
200 W 41ST, SUITE 1100, NY, NY 10036

EXPEDITOR
JAM CONSULTANTS INC.
104 W 29TH ST, 9TH FLOOR NY, NY 10001

INTERIORS
INC ARCHITECTURE & DESIGN
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333 WESTCHESTER AVE,
WHITE PLAINS, NY 10604

FACADE MAINTENANCE
ENTEK ENGINEERING
166 AMES ST, HACKENSACK, NJ 07601

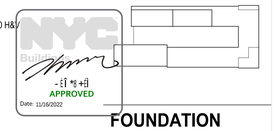
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3	08/06/2021	ISSUED FOR 100% SD
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6	05/20/2022	ISSUED FOR 50% CD
7	07/18/2022	REVISED AS NOTED
8	08/05/2022	100% CD
	10/05/2022	DOB PAA #1

2021054.00

1 JAVA

18 INDIA STREET
BROOKLYN, NY 11222

KEY PLAN



FOUNDATION SECTIONS

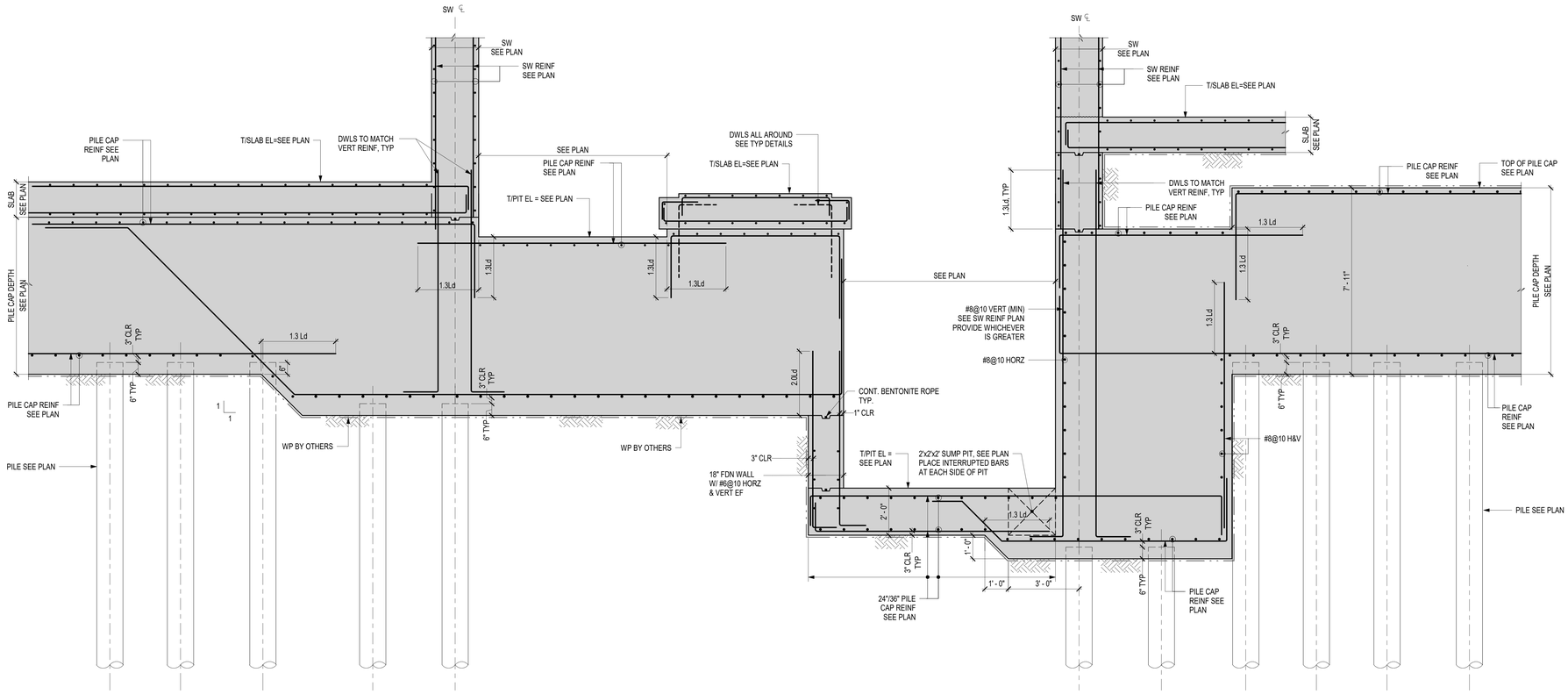
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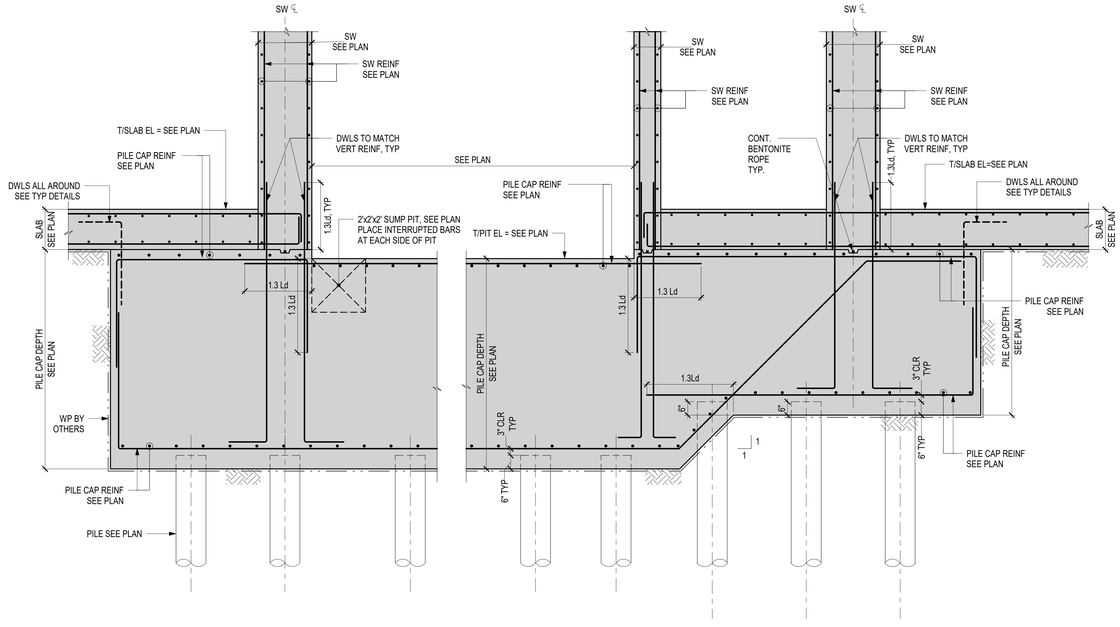
DOB JOB:
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19 SECTION

SCALE: 1/2" = 1'-0"



20 SECTION

SCALE: 1/2" = 1'-0"



MARVEL

145 HUDSON STREET, FLR.3 NEW YORK, NY 10013
212.616.0420

OWNER
1 JAVA OWNER, LLC
200 PARK AVE, 9TH FLOOR NY, NY 10166

STRUCTURAL ENGINEER
MCNAMARA SALVIA
45 W 45TH ST, 10TH FLOOR NY, NY 10036

BUILDING SYSTEMS ENGINEER
ARUP
77 WATER ST, 5TH FLOOR NY,NY 10005

VERTICAL TRANSPORTATION
LERCH BATES
1430 BROADWAY, SUITE 908 NY, NY 10018

PARKING CONSULTANT
WALKER CONSULTANTS
49 W 38TH ST, 9TH FLOOR NY, NY 10018

SUSTAINABILITY CONSULTANT
STEVEN WINTER ASSOCIATES, INC
307 7TH AVE, SUITE 1701 NY, NY 1001

ENVELOPE CONSULTANT
SOCOTEC, INC
151 W 42ND ST, NY, NY 10036

GEOTECHNICAL/CIVIL ENGINEER
LANGAN
360 W 31ST ST, 8TH FLOOR NY, NY 10001

MARINE ENGINEER
MCLAREN ENGINEERING GROUP
131 W 35TH ST, 4TH FLOOR NY, NY 10001

LANDSCAPE DESIGNER
MARVEL
145 HUDSON ST, 3RD FLOOR NY, NY 10013

LANDSCAPE ARCHITECT (WATERFRONT)
JAMES CORNER FIELD OPERATIONS
475 10TH AVE, 9TH FLOOR NY, NY 10018

LIGHTING DESIGNER
ONELUX
158 W 29TH ST, 10TH FLOOR NY, NY 10001

ACCESSIBILITY
ACCESSIBILITY SERVICES
120-34 QUEENS BLVD, SUITE 320
KEW GARDENS, NY 11415

ACOUSTICS
LONGMAN-LINDSAY
200 W 41ST, SUITE 1100, NY, NY 10036

EXPEDITOR
JAM CONSULTANTS INC.
104 W 29TH ST, 9TH FLOOR NY, NY 10001

INTERIORS
INC ARCHITECTURE & DESIGN
150 VARICK ST, 5T FLOOR, NY, NY 10013

POOL CONSULTANT
AQUATECTONIC/LOTHROP ASSOCIATES, LLP
333 WESTCHESTER AVE,
WHITE PLAINS, NY 10604

FACADE MAINTENANCE
ENTEK ENGINEERING
166 AMES ST, HACKENSACK, NJ 07601

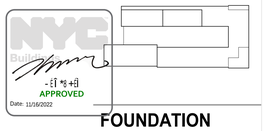
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6	05/20/2022	ISSUED FOR 50% CD
7	07/18/2022	REVISED AS NOTED
8	08/05/2022	100% CD
	10/05/2022	DOB PAA #1

2021054.00

1 JAVA

18 INDIA STREET
BROOKLYN, NY 11222

KEY PLAN



APPROVED
Date: 11/16/2022

FOUNDATION SECTIONS

SCALE: 1/2" = 1'-0"



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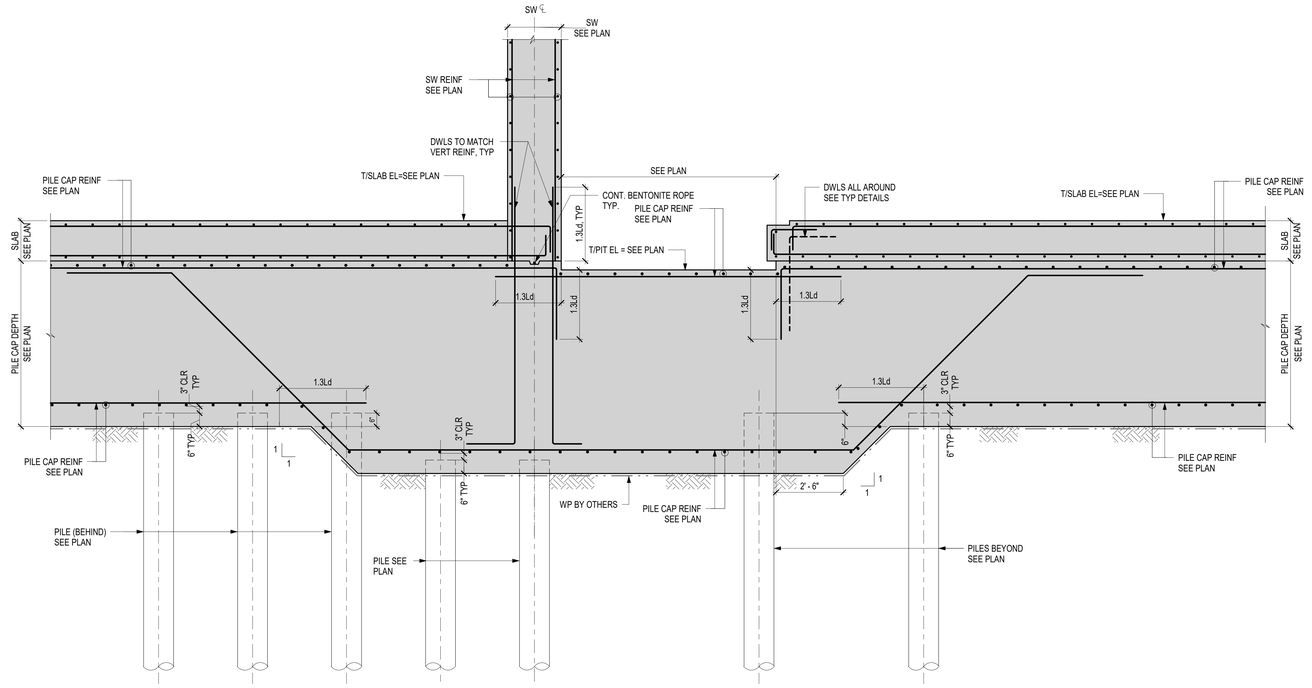
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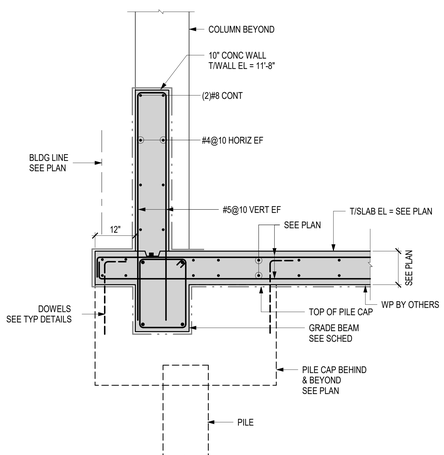
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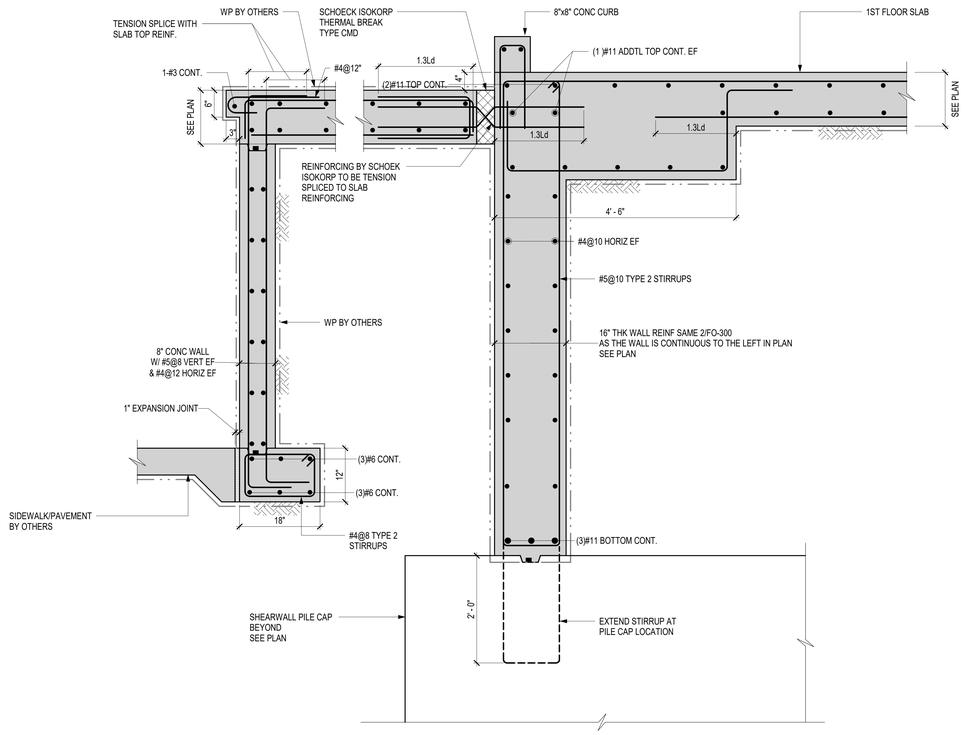
21 SECTION

SCALE: 1/2" = 1'-0"



22 SECTION

SCALE: 3/4" = 1'-0"



23 SECTION

SCALE: 1" = 1'-0"



MARVEL
145 HUDSON STREET, FLR.3 NEW YORK, NY 10013
212.616.0420

OWNER
1 JAVA OWNER, LLC
200 PARK AVE, 9TH FLOOR NY, NY 10166

STRUCTURAL ENGINEER
MCNAMARA SALVIA
45 W 45TH ST, 10TH FLOOR NY, NY 10036

BUILDING SYSTEMS ENGINEER
ARUP
77 WATER ST, 5TH FLOOR NY,NY 10005

VERTICAL TRANSPORTATION
LERCH BATES
1430 BROADWAY, SUITE 908 NY, NY 10018

PARKING CONSULTANT
WALKER CONSULTANTS
49 W 38TH ST, 9TH FLOOR NY, NY 10018

SUSTAINABILITY CONSULTANT
STEVEN WINTER ASSOCIATES, INC
307 7TH AVE, SUITE 1701 NY, NY 1001

ENVELOPE CONSULTANT
SOCOTEC, INC
151 W 42ND ST, NY, NY 10036

GEOTECHNICAL/CIVIL ENGINEER
LANGAN
360 W 31ST ST, 8TH FLOOR NY, NY 10001

MARINE ENGINEER
MCLAREN ENGINEERING GROUP
131 W 35TH ST, 4TH FLOOR NY, NY 10001

LANDSCAPE DESIGNER
MARVEL
145 HUDSON ST, 3RD FLOOR NY, NY 10013

LANDSCAPE ARCHITECT (WATERFRONT)
JAMES CORNER FIELD OPERATIONS
475 10TH AVE, 9TH FLOOR NY, NY 10018

LIGHTING DESIGNER
ONELUX
158 W 29TH ST, 10TH FLOOR NY, NY 10001

ACCESSIBILITY
ACCESSIBILITY SERVICES
120-34 QUEENS BLVD, SUITE 320
KEW GARDENS, NY 11415

ACOUSTICS
LONGMAN-LINDSAY
200 W 41ST, SUITE 1100, NY, NY 10036

EXPEDITOR
JAM CONSULTANTS INC.
104 W 29TH ST, 9TH FLOOR NY, NY 10001

INTERIORS
INC ARCHITECTURE & DESIGN
150 VARICK ST, 5T FLOOR, NY, NY 10013

POOL CONSULTANT
AQUATECTONIC/LOTHROP ASSOCIATES, LLP
333 WESTCHESTER AVE,
WHITE PLAINS, NY 10604

FACADE MAINTENANCE
ENTEK ENGINEERING
166 AMES ST, HACKENSACK, NJ 07601

REV	DATE	DESCRIPTION
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	10/05/2022	DOB PAA #1

2021054.00

1 JAVA

18 INDIA STREET
BROOKLYN, NY 11222

KEY PLAN

NYC Buildings
APPROVED
Date: 11/16/2022

FOUNDATION SECTIONS

SCALE: As indicated

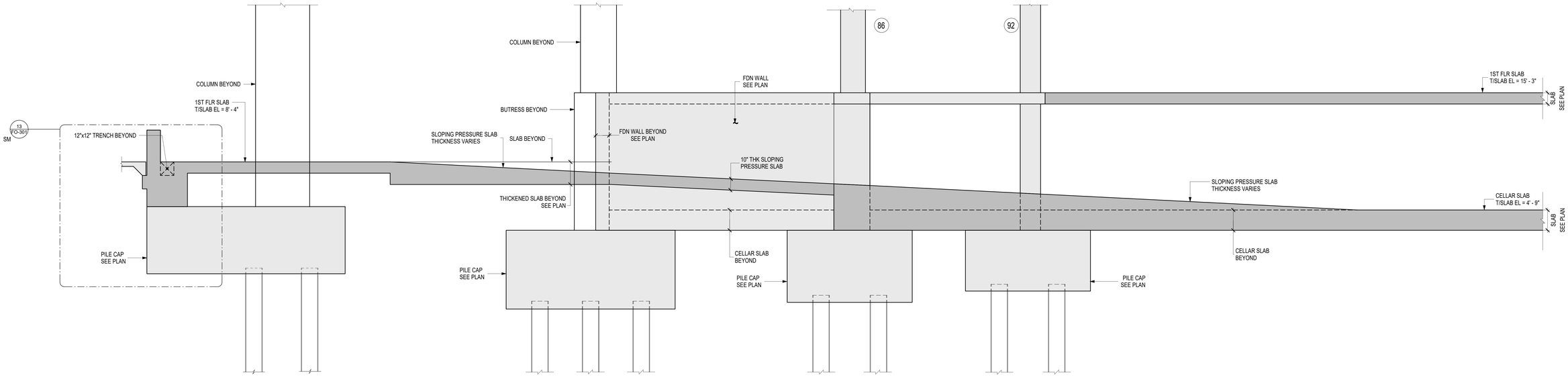
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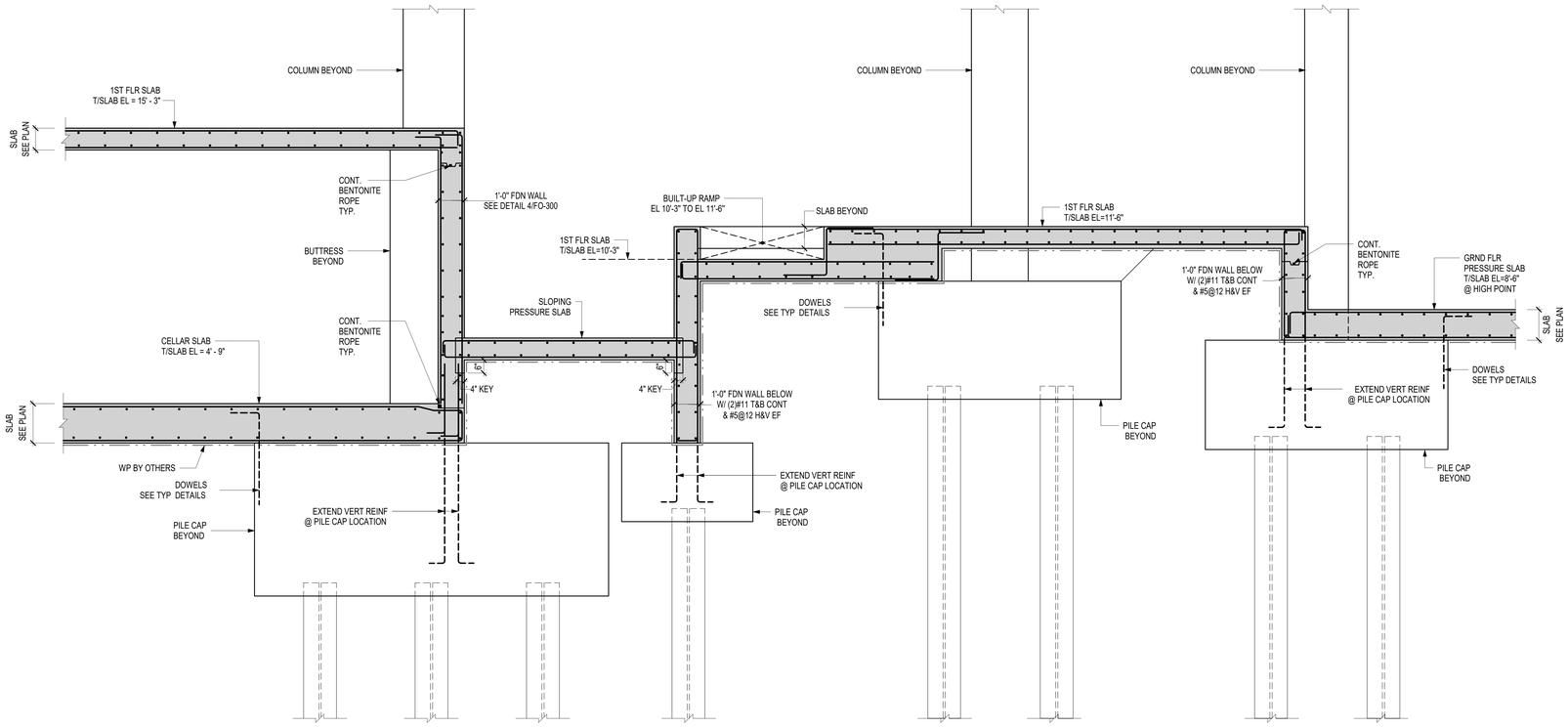
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24 SECTION

SCALE: 3/8" = 1'-0"



25 SECTION

SCALE: 1/2" = 1'-0"



MARVEL

145 HUDSON STREET, FLR.3 NEW YORK, NY 10013
212.616.0420

OWNER
1 JAVA OWNER, LLC
200 PARK AVE, 9TH FLOOR NY, NY 10166

STRUCTURAL ENGINEER
MCNAMARA SALVIA
45 W 45TH ST, 10TH FLOOR NY, NY 10036

BUILDING SYSTEMS ENGINEER
ARUP
77 WATER ST, 5TH FLOOR NY,NY 10005

VERTICAL TRANSPORTATION
LERCH BATES
1430 BROADWAY, SUITE 908 NY, NY 10018

PARKING CONSULTANT
WALKER CONSULTANTS
49 W 38TH ST, 9TH FLOOR NY, NY 10018

SUSTAINABILITY CONSULTANT
STEVEN WINTER ASSOCIATES, INC
307 7TH AVE, SUITE 1701 NY, NY 1001

ENVELOPE CONSULTANT
SOCOTEC, INC
151 W 42ND ST, NY, NY 10036

GEOTECHNICAL/CIVIL ENGINEER
LANGAN
360 W 31ST ST, 8TH FLOOR NY, NY 10001

MARINE ENGINEER
MCLAREN ENGINEERING GROUP
131 W 35TH ST, 4TH FLOOR NY, NY 10001

LANDSCAPE DESIGNER
MARVEL
145 HUDSON ST, 3RD FLOOR NY, NY 10013

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LIGHTING DESIGNER
ONELUX
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ACCESSIBILITY SERVICES
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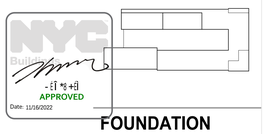
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	10/05/2022	DOB PAA #1

2021054.00

1 JAVA

18 INDIA STREET
BROOKLYN, NY 11222

KEY PLAN



FOUNDATION SECTIONS

SCALE: As indicated



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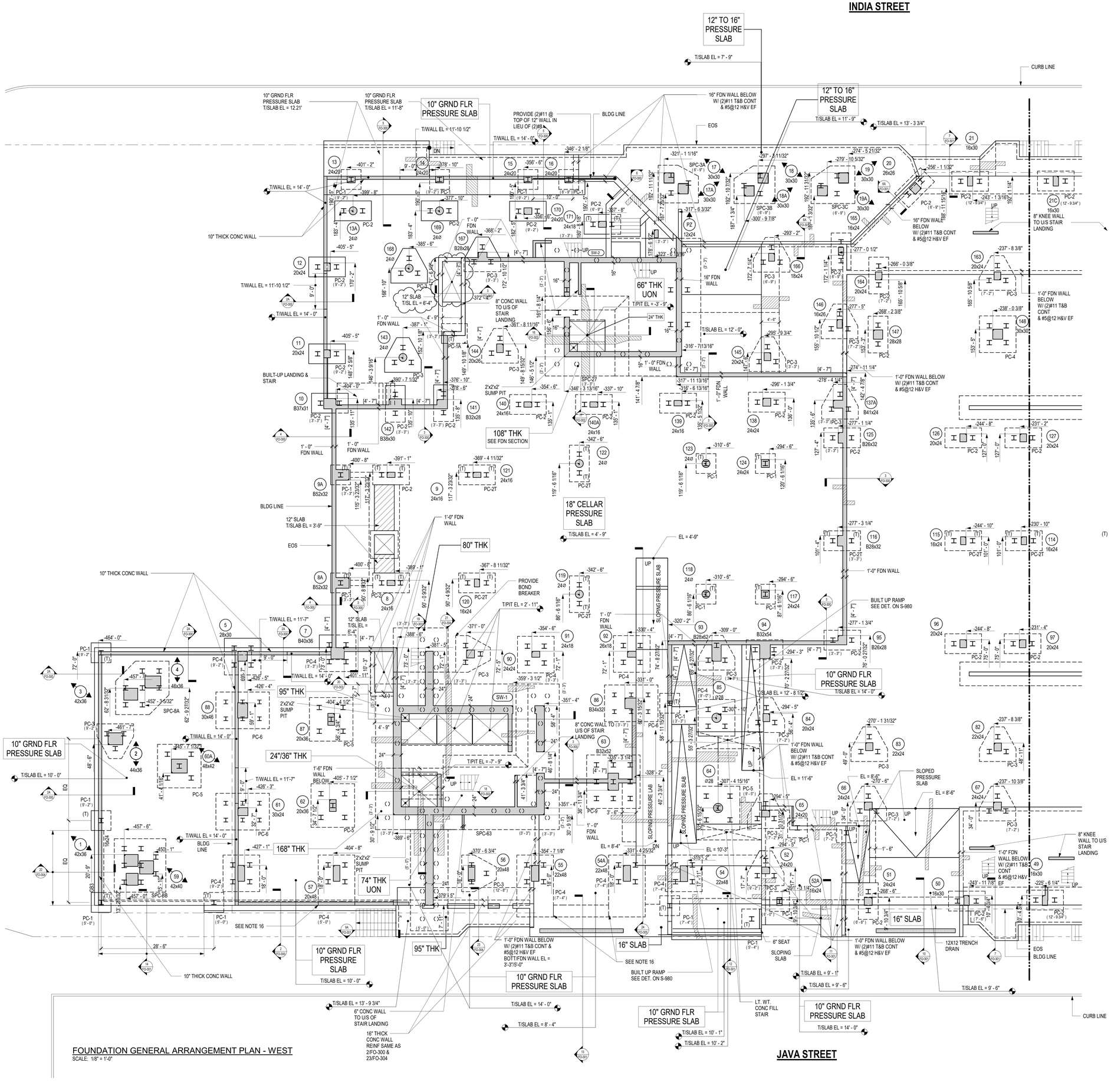
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FOUNDATION GENERAL ARRANGEMENT PLAN - WEST

SCALE: 1/8" = 1'-0"

MARVEL

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212.616.0420

OWNER
1 JAVA OWNER, LLC
200 PARK AVE, 9TH FLOOR NY, NY 10166

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MCNAMARA SALVIA
45 W 45TH ST, 10TH FLOOR NY, NY 10036

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ARUP
77 WATER ST, 5TH FLOOR NY,NY 10005

VERTICAL TRANSPORTATION
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WALKER CONSULTANTS
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SOCOTEC, INC
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ACCESSIBILITY SERVICES
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KEW GARDENS, NY 11415

ACOUSTICS
LONGMAN-LINDSAY
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REV	DATE	DESCRIPTION
6	05/20/2022	ISSUED FOR 50% CD
7	07/18/2022	REVISED AS NOTED
8	08/05/2022	100% CD
	10/05/2022	DOB PAA #1

2021054.00

1 JAVA

18 INDIA STREET
BROOKLYN, NY 11222

KEY PLAN

APPROVED
Date: 11/16/2022

FOUNDATION GENERAL ARRANGEMENT PLAN - WEST

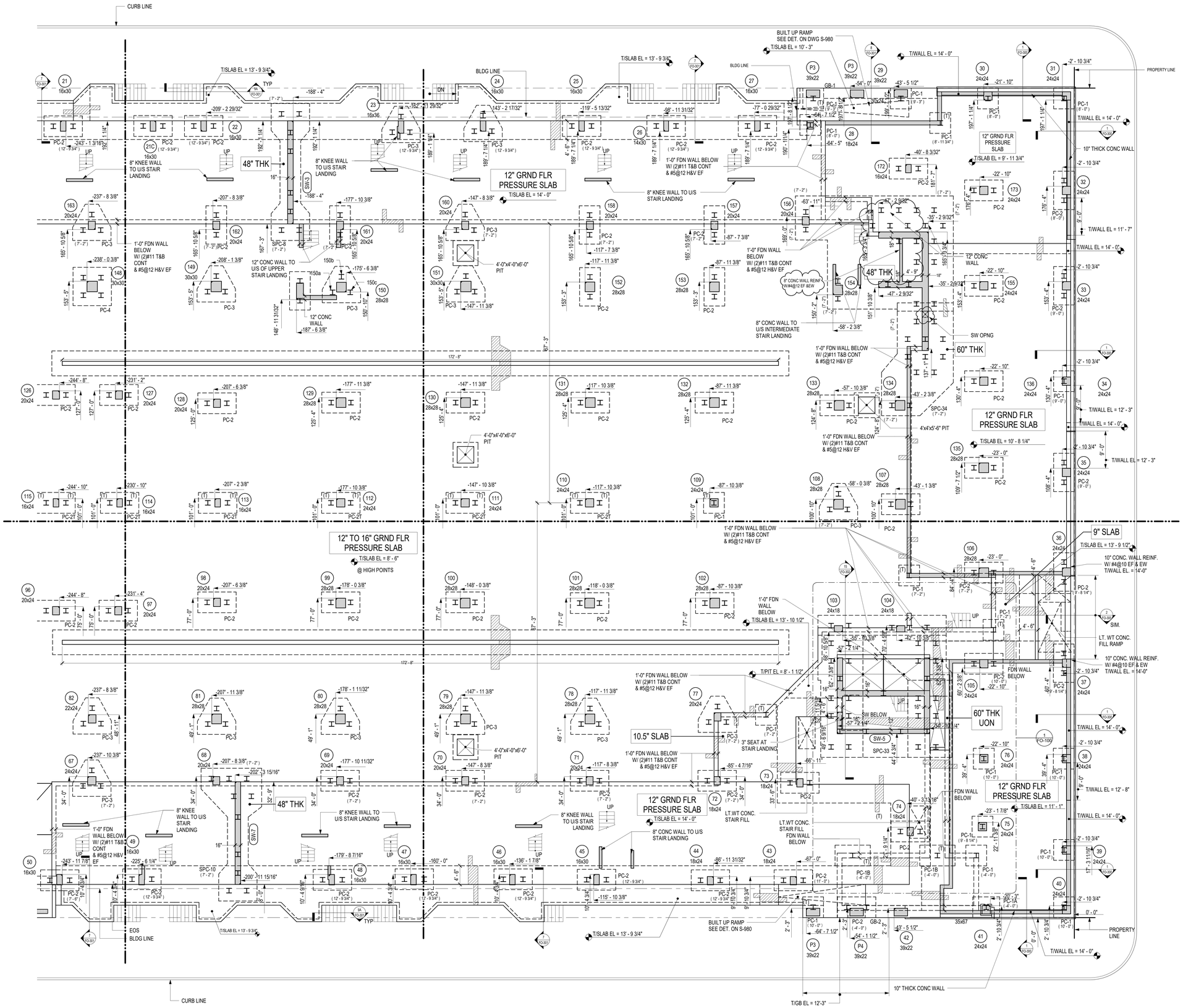
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FOUNDATION GENERAL ARRANGEMENT PLAN - EAST
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MARVEL
145 HUDSON STREET, FLR.3 NEW YORK, NY 10013
212.616.0420

OWNER
1 JAVA OWNER, LLC
200 PARK AVE, 9TH FLOOR NY, NY 10166

STRUCTURAL ENGINEER
MCNAMARA SALVIA
45 W 45TH ST, 10TH FLOOR NY, NY 10036

BUILDING SYSTEMS ENGINEER
ARUP
77 WATER ST, 5TH FLOOR NY,NY 10005

VERTICAL TRANSPORTATION
LERCH BATES
1430 BROADWAY, SUITE 908 NY, NY 10018

PARKING CONSULTANT
WALKER CONSULTANTS
49 W 38TH ST, 9TH FLOOR NY, NY 10018

SUSTAINABILITY CONSULTANT
STEVEN WINTER ASSOCIATES, INC
307 7TH AVE, SUITE 1701 NY, NY 1001

ENVELOPE CONSULTANT
SOCOTEC, INC
151 W 42ND ST, NY, NY 10036

GEOTECHNICAL/CIVIL ENGINEER
LANGAN
360 W 31ST ST, 8TH FLOOR NY, NY 10001

MARINE ENGINEER
MCLAREN ENGINEERING GROUP
131 W 35TH ST, 4TH FLOOR NY, NY 10001

LANDSCAPE DESIGNER
MARVEL
145 HUDSON ST, 3RD FLOOR NY, NY 10013

LANDSCAPE ARCHITECT (WATERFRONT)
JAMES CORNER FIELD OPERATIONS
475 10TH AVE, 9TH FLOOR NY, NY 10018

LIGHTING DESIGNER
ONELUX
158 W 29TH ST, 10TH FLOOR NY, NY 10001

ACCESSIBILITY
ACCESSIBILITY SERVICES
120-34 QUEENS BLVD, SUITE 320
KEW GARDENS, NY 11415

ACOUSTICS
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BROOKLYN, NY 11222

KEY PLAN

APPROVED
Date: 11/16/2022

FOUNDATION GENERAL ARRANGEMENT PLAN - EAST

SCALE: 1/8" = 1'-0"

STATE OF NEW YORK · JASWINN E. SELLU · 092779 · LICENSED PROFESSIONAL ENGINEER

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MARVEL

145 HUDSON STREET, FLR.3 NEW YORK, NY 10013
212.616.0420

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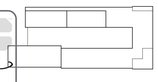
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FOUNDATION GENERAL ARRANGEMENT PART PLAN
SCALE: 1/8" = 1'-0"

2021054.00
1 JAVA

18 INDIA STREET
BROOKLYN, NY 11222

KEY PLAN



NYC Buildings
APPROVED
Date: 11/16/2022

FOUNDATION GENERAL ARRANGEMENT PART PLAN

SCALE: 1/8" = 1'-0"

STATE OF NEW YORK
JASWINR E. SELUJA
LICENSED PROFESSIONAL ENGINEER
092779

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FO-402.00
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DESIGN CRITERIA:

1. DESIGN INTENT:
THE OBJECTIVE OF THIS DESIGN IS TO COMPLETE THE CONSTRUCTION OF THE PROPOSED WATER FRONT STRUCTURE WITH A DESIGN IN ACCORDANCE WITH THE STANDARDS OUTLINED BELOW.

2. BUILDING CODE:
THESE PLANS HAVE BEEN PREPARED IN ACCORDANCE WITH THE 2014 NEW YORK CITY BUILDING CODE. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THIS CODE AND LOCAL REQUIREMENTS.

3. SERVICE CONDITION DENOTES THE MAXIMUM ALLOWABLE ENVIRONMENTAL CONDITIONS WITHIN WHICH THE STRUCTURE IS DESIGNED TO OPERATE. FACTOR OF SAFETY IS IN ACCORDANCE WITH CODE.

4. DESIGN LOADS
   A. LIVE LOAD:
      PEDESTRIAN LIVE LOAD = 100 PSF
   B. SUPERIMPOSED DEAD LOAD: 50 PSF
   C. WIND LOAD: (ASCE 7-10)
      WIND SPEED = 110 MPH
      IMPORTANCE FACTOR = I
      GUST EFFECT FACTOR = 0.85
   D. WAVE ANALYSIS (100 YEAR STORM):
      EXTREME DESIGN WAVE HEIGHT = 5.63'
      SERVICE DESIGN WAVE HEIGHT = 4.42'
      WAVE PRESSURE ANALYSIS ASSUMES A STANDING WAVE PRESSURE DIAGRAM AND SAINFLOU DISTRIBUTION.
   E. SNOW LOAD: (ASCE 7-10)
      GROUND SNOW LOAD (PG) = 25 PSF
      SNOW EXPOSURE FACTOR (CE) = 0.9
      SNOW IMPORTANCE FACTOR (IS) = 1.1
      THERMAL FACTOR (CT) = 1.2

5. NEW YORK CITY FLOOD RESISTANT CONSTRUCTION:
   A. THE PROPOSED WORK DOES NOT ENCROACH ON THE FLOODWAY. ALTER THE WATERCOURSE OR MODIFY A SAND DUNE IN A V-ZONE AND THEREFORE DOES NOT REQUIRE TECHNICAL CERTIFICATION ACCORDING TO SECTION G103 OF THE CODE.
   B. THE PROPOSED WORK IS NOT LOCATED IN A REGULATORY FLOODWAY.
   C. THE PROPOSED WORK DOES NOT INCLUDE ANY ENCLOSED STRUCTURES AND IS NOT SUBJECT TO THE CERTIFICATION REQUIREMENTS OF CODE SECTIONS G104.5.
   D. FLOOD ZONE COMPLIANCE INSPECTION REQUIREMENT IS INDICATED UNDER THE INSPECTIONS SECTION OF THESE NOTES. ELEVATION AND FLOOD SHIELD INSPECTIONS ARE NOT APPLICABLE.
   E. RETAINING WALLS AND FILL HAS BEEN DESIGNED AND SPECIFIED IN ACCORDANCE WITH SECTION G303.7 AND DOES NOT DIRECT WATER OR WAVES TOWARD ANY BUILDING.
   F. THE PROPOSED WORK IS AN UNOCCUPIED ACCESSORY STRUCTURE, IS NOT REQUIRED FOR ANY BUILDING EGRESS AND IS NOT REQUIRED FOR SUPPORT OR FLOOD PROTECTION OF ANY BUILDING. THE REQUIREMENTS OF CODE SECTION G304 ARE NOT APPLICABLE. THE STRUCTURE HAS BEEN DESIGNED TO PREVENT FLOTATION, COLLAPSE AND LATERAL MOVEMENT RESULTING FROM HYDROSTATIC LOADS, INCLUDING THE EFFECTS OF BUOYANCY, DURING CONDITIONS OF FLOODING TO THE DESIGN FLOOD ELEVATION.
   G. THE PROPOSED WORK HAS BEEN DESIGNED IN ACCORDANCE WITH ASCE 24-05 REQUIREMENTS FOR EROSION CONTROL STRUCTURES AND IS NOT ATTACHED TO THE FOUNDATION OR SUPERSTRUCTURE OF ANY STRUCTURE, WILL NOT FOCUS OR INCREASE THE FLOOD FORCES OR EROSION IMPACTS ON ANY ADJACENT STRUCTURE.

6. CONTRACTOR SHALL VERIFY ALL MEASUREMENTS AND EXISTING SITE CONDITIONS PRIOR TO CONSTRUCTION.

GENERAL NOTES:

1. ALL WORK SHALL CONFORM WITH ALL FEDERAL, STATE, COUNTY, OR LOCAL CODES HAVING JURISDICTION OVER SUCH WORK. ANY DISCREPANCY SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER BEFORE PROCEEDING WITH THAT PORTION OF THE WORK.

2. CONTRACTOR IS SOLELY RESPONSIBLE FOR MEANS, METHODS, AND SAFETY OF WORK.

3. DIMENSIONS SHOWN ON THESE CONTRACT PLANS HAVE BEEN OBTAINED FROM LIMITED FIELD SURVEY AND MAY NOT ACCURATELY REFLECT PRESENT FIELD CONDITIONS. ACCORDINGLY, THE CONTRACTOR WILL BE RESPONSIBLE FOR MAKING FIELD MEASUREMENTS OF ALL EXISTING STRUCTURES IMPACTED BY THE PROJECT TO ASSURE CONSISTENCY WITH THE PROPOSED CONSTRUCTION PLANS; THAT IS, THE CONTRACTOR SHALL FIELD VERIFY ACTUAL CONDITIONS, DIMENSIONS, CLEARANCES, ELEVATIONS, AND OTHER INFORMATION INDICATED IN THE DOCUMENTS PRIOR TO ORDERING ANY MATERIALS, COMMENCING ANY FABRICATIONS, OR PERFORMING ANY WORK. THE CONTRACTOR SHALL NOTIFY THE OWNER'S REPRESENTATIVE OF ANY FIELD CONDITIONS WHICH MAY DIFFER FROM THAT REPRESENTED PRIOR TO COMMENCING WORK.

4. PRIOR TO COMMENCING WORK, THE CONTRACTOR SHALL VISIT THE SITE AND SHALL NOTIFY THE OWNER'S REPRESENTATIVE OF ANY ADDITIONAL UTILITIES, STRUCTURES, OR ANY OTHER ELEMENTS WHICH MAY IMPEDE WORK. UTILITY AND/OR STRUCTURE RELOCATIONS, IF NECESSARY, SHALL BE COORDINATED THROUGH THE OWNER'S REPRESENTATIVE AT NO ADDITIONAL COST.

5. PRIOR TO COMMENCING ANY WORK, THE CONTRACTOR SHALL SCHEDULE AND COORDINATE ALL WORK THROUGH THE OWNER'S REPRESENTATIVE AND ANY OTHER OCCUPYING TENANT WHO WILL BE AFFECTED BY CONSTRUCTION OPERATIONS. THE CONTRACTOR SHALL COORDINATE THE WORK SO AS TO MINIMIZE INTERRUPTIONS IN FACILITY OPERATIONS (ACCESS AND EGRESS).

6. THE CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE OSHA REGULATIONS AND SAFETY PROCEDURES TO ENSURE PERSONNEL HEALTH AND SAFETY. THE CONTRACTOR MUST MAINTAIN A SAFE AND CLEAN WORKING ENVIRONMENT AND SHALL ASSURE PROPER PERSONAL PROTECTIVE EQUIPMENT AT ALL TIMES. IN AREAS WHERE PEDESTRIAN AND/OR VEHICULAR TRAFFIC MAY BE AFFECTED BY THE WORK, THE CONTRACTOR SHALL CORDON OFF THE WORK AREA.

7. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR COMPLIANCE WITH THE TERMS AND CONDITIONS OF ALL PERMITS ISSUED BY ANY REGULATING AGENCY HAVING JURISDICTION OVER THE WORK OF THIS PROJECT.

8. THE CONTRACTOR SHALL EXERCISE EXTREME CARE TO PREVENT DAMAGE TO EXISTING STRUCTURES BY OR AS A RESULT OF HIS OPERATIONS. ANY DAMAGE RESULTING FROM THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED AS DIRECTED BY THE OWNER'S REPRESENTATIVE AT NO ADDITIONAL COST.

9. ALL DEBRIS AS A RESULT OF OR IN THE IMMEDIATE VICINITY OF THE WORK SHALL BE RECOVERED AND PROPERLY DISPOSED OF BY THE CONTRACTOR AT NO ADDITIONAL COST.

10. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PREVENT ALL CONSTRUCTION DEBRIS OR WASTE FROM FALLING INTO THE WATER. ANY DEBRIS FALLING INTO THE WATER SHALL BE RECOVERED AND PROPERLY DISPOSED.

DELIVERY, STORAGE & HANDLING:

1. DELIVER MATERIALS TO THE CONSTRUCTION SITE AT APPROPRIATE INTERVALS SO AS TO ENSURE UNINTERRUPTED PROGRESS OF WORK.

2. MATERIAL SHALL BE STORED OFFSITE IN AN AREA DESIGNATED OR APPROVED BY THE OWNER. STRUCTURAL STEEL SHALL BE DRAINED PROPERLY. ADEQUATE SHORING AND PROTECTION SHALL BE PROVIDED TO PREVENT DISTORTION AND OTHER DAMAGE. STRUCTURAL STEEL SHALL BE STORED ON TIMBER AND NOT ON MUD OR CINDERS, AND OTHERWISE HANDLED SO AS NOT TO DAMAGE SHOP PAINT. ALL SECTIONS WHICH ARE TO BE PLACED IN GROUND STORAGE SHALL BE READILY ACCESSIBLE FOR INSPECTION.

3. MATERIALS WHICH FAIL TO COMPLY WITH SPECIFIED REQUIREMENTS, EITHER AT THE SHOP OR CONSTRUCTION SITE, SHALL BE PROMPTLY REMOVED FROM THE SITE AND REPLACED WITH ACCEPTABLE MATERIAL, WITHOUT ADDITIONAL COST TO THE OWNER, AND WITHOUT CAUSING DELAY IN WORK.

SUBMITTALS:

THE CONTRACTOR SHALL SUPPLY ALL SUBMITTALS STATED BELOW AND LISTED IN THE PROJECT SPECIFICATIONS:

1. DEMOLITION PLAN SHOWING ALL PROPOSED REMOVALS AND EXCAVATIONS. PLAN SHALL INCLUDE TEMPORARY SHORING AS NEEDED, ENVIRONMENTAL CONTROLS AND POST DEMOLITION SURVEY.

2. MEANS AND METHODS AND SEQUENCE OF CONSTRUCTION.

3. SHOP DRAWINGS/ERECTION DRAWINGS:
   - CONCRETE REINFORCEMENT
   - PILE PLAN W/ IDENTIFICATION OF INDICATOR PILES
   - CONCRETE SLAB & GRADE BEAM DRAWINGS
   - AS-BUILT PILE SURVEY

4. PRODUCT DATA:
   - GEOTEXTILE FILTER FABRIC
   - COATING SYSTEMS
   - CONCRETE MIX DESIGNS
   - CEMENTITIOUS GROUT

5. TESTING RESULTS:
   - STONE GRADATION
   - STONE MATERIAL
   - PRELIMINARY DESIGN MIX TEST REPORTS (ACI-301) OR VERIFICATION OF MIX DESIGNS BASED ON STANDARD DEVIATION ANALYSIS. THE MIX DESIGN SUBMITTAL MUST BE SIGNED AND SEALED BY AN ENGINEER REGISTERED IN THE STATE OF NEW YORK.
   - AIR ENTRAINMENT TESTING (ASTM C173) FOR NORMAL AND LIGHTWEIGHT CONCRETE AND ASTM C231 FOR NORMAL WEIGHT CONCRETE.
   - LABORATORY TEST RESULTS FOR BEDDING STONE

6. CERTIFICATES
   - LABORATORY SPECIFICATION
   - STEEL PIPE PILE MILL CERTIFICATES
   - WELDERS AWS CERTIFICATES
   - BEDDING STONE AND ARMOR STONE GRADATION

7. PERFORMANCE DATA & CALCULATIONS
   - WELDING PROCEDURE SPECIFICATIONS (WPS)
   - PROCEDURE QUALIFICATION RECORDS (PQR)

8. CONTRACTOR SHALL PROVIDE MOCKUPS/SAMPLES OF CONCRETE SURFACES WITH ARCHITECTURAL FINISH FOR REVIEW AND APPROVAL.

9. ALL SUBMITTALS MADE BY CONTRACTOR'S P.E. SHALL BE FOR ACCEPTANCE ONLY. ENGINEER AND OWNER DO NOT TAKE RESPONSIBILITY FOR ANY ERRORS OR OMISSIONS.

SHOP DRAWINGS:

1. THE SHOP DRAWINGS SHALL CONTAIN ALL DIMENSIONAL AND GEOMETRIC INFORMATION. MATERIALS SHALL NOT BE ORDERED, FABRICATED, OR DELIVERED TO THE PROJECT SITE BEFORE THE SHOP DRAWINGS HAVE BEEN APPROVED.

2. PRIOR TO REVIEW OF THE SHOP DRAWINGS BY THE ENGINEER, SUCH SHOP DRAWINGS SHALL HAVE BEEN REVIEWED AND APPROVED BY THE CONTRACTOR AND SHALL BE STAMPED TO INDICATE THIS BY THE CONTRACTOR. SUCH APPROVAL BY THE CONTRACTOR SHALL CONSTITUTE THE CONTRACTOR'S REPRESENTATION THAT THE CONTRACTOR HAS VERIFIED ALL QUANTITIES, DIMENSIONS, SPECIFIED PERFORMANCE CRITERIA, INSTALLATION REQUIREMENTS, MATERIALS, CATALOG NUMBERS AND SIMILAR DATA WITH RESPECT THERETO AND HAS REVIEWED OR COORDINATED EACH SHOP DRAWING WITH OTHER SHOP DRAWINGS AND SAMPLES AND WITH THE REQUIREMENTS OF THE WORK AND THE CONTRACT DRAWINGS AND SPECIFICATIONS.

3. SHOP DRAWINGS SHALL INCLUDE LAYOUTS AND DETAILS SHOWING THE TYPE OF MATERIAL FOR EACH MEMBER, SIZES OF MEMBERS, CONNECTIONS, CUTS, CAMBER, COPE REINFORCING, BOLTS, WELDS AND OTHER PERTINENT DATA.

4. UNLESS NOTED OTHERWISE, ALL STEEL CONSTRUCTION SHALL BE OF WELDED DESIGN. ALL WELDS SHALL BE INDICATED BY STANDARD WELDING SYMBOLS AS DEFINED BY AWS AND ENGINEERING STRESS CALCULATIONS THAT ARE APPROVED BY THE AWS. SHOP DRAWINGS SHALL SHOW THE SIZE, LENGTH, AND TYPE OF EACH WELD.

5. SHOP DRAWINGS SHALL BE SUBMITTED IN COMPLETE PACKAGES SO THAT INDIVIDUAL PARTS AND THE ASSEMBLED UNIT MAY BE REVIEWED TOGETHER.

6. THE REVIEW OF SHOP DRAWINGS BY THE ENGINEER SHALL NOT IN ANY WAY RELIEVE THE CONTRACTOR FROM THE RESPONSIBILITY FOR THE ADEQUACY OF THE DESIGN OF THE CONNECTIONS AND ALL REQUIRED DETAILING, THE RESPONSIBILITY FOR THE PROPER FITTING OF THE WORK IN STRICT CONFORMANCE WITH THE CONTRACT REQUIREMENTS AND FROM THE NECESSITY OF FURNISHING MATERIAL AND WORKMANSHIP REQUIRED BY CONTRACT DRAWINGS AND SPECIFICATIONS IN ADDITION TO THAT INDICATED ON THE SHOP DRAWINGS.

7. THE CONTRACTOR SHALL KEEP A COMPLETE SET OF SHOP DRAWINGS BEARING THE ENGINEER'S ACCEPTANCE STAMP ON THE JOB SITE AT ALL TIMES SUBSEQUENT TO SUCH ACCEPTANCE.

QUALITY ASSURANCE:

1. THE CONTRACTOR SHALL QUALIFY WELDING PROCESSES AND WELDING OPERATORS IN ACCORDANCE WITH THE APPLICABLE AWS WELDING CODE AND SHALL PROVIDE CERTIFICATION THAT WELDERS TO BE EMPLOYED IN THE WORK HAVE SATISFACTORILY PASSED AWS QUALIFICATION TESTS. WRITTEN WELDING PROCEDURES DEMONSTRATING COMPLIANCE WITH THE AWS REQUIREMENTS SHALL BE SUBMITTED TO THE ENGINEER.

2. THE CONTRACTOR SHALL EMPLOY NON-DESTRUCTIVE TESTING (NDT) PERSONNEL THAT MEET AWS REQUIREMENTS AND ASNT SNT-TC-1A LEVEL II QUALIFICATIONS. ALL WELDING SHALL BE SUBJECT TO NDT INSPECTION BY THE ENGINEER.

3. ALL FULL PENETRATION WELDS SHALL BE NON-DESTRUCTIVELY TESTED BY RADIOGRAPHIC OR ULTRASONIC METHODS, AS APPROVED BY THE ENGINEER. FILLET WELDS SHALL BE NON-DESTRUCTIVELY TESTED BY MAGNETIC PARTICLE OR DYE PENETRANT METHODS, AS APPROVED BY THE ENGINEER. THE FIRST 15 WELDS OF EACH TYPE PRODUCED BY THE WELDER SHALL BE TESTED. IF TEST RESULTS FOR THE WELDER ARE DEEMED ACCEPTABLE BY THE ENGINEER THEN ONLY 30% OF ALL SUBSEQUENT WELDS PRODUCED BY THAT WELDER NEED BE TESTED THEREAFTER. IF IN THE OPINION OF THE ENGINEER, THE TEST RESULTS FOR A WELDER DISCLOSE TWO OR MORE UNACCEPTABLE WELDS, THEN THE PERCENTAGE OF WELDS REQUIRED TO BE TESTED MAY BE INCREASED, AS DEEMED NECESSARY BY THE ENGINEER, UP TO 100%, WITHOUT ADDITIONAL COMPENSATION THEREFORE.

4. UNLESS OTHERWISE INDICATED, ALL FILLET WELDS SHALL BE CONTINUOUS AND DOUBLE SIDED. ALL BUTT WELDS SHALL BE FULL PENETRATION WELDS. ANY DEFECTS FOUND SHALL BE CORRECTED IN ACCORDANCE WITH AWS RULES.

5. THE CONTRACTOR SHALL HAVE SOLE RESPONSIBILITY FOR COORDINATING THE WORK TO ASSURE THAT ALL TESTING AND INSPECTION PROCEDURES REQUIRED BY THE ENGINEER ARE PROPERLY PROVIDED.

6. THE OWNER MAY PERFORM QUALITY ASSURANCE AUDITS TO ENSURE QUALITY WORKMANSHIP. THESE AUDITS MAY INCLUDE BUT NOT BE LIMITED TO VISUAL INSPECTIONS, ULTRASONIC, RADIOGRAPH, MAGNETIC PARTICLE OR DYE PENETRANT TESTING OF THE WELDING AND CUTTING PERFORMED IN THE FABRICATION SHOP AND IN THE FIELD. THE CONTRACTOR SHALL NOTIFY THE ENGINEER 15 DAYS PRIOR TO THE START OF FABRICATION.

7. MATERIALS WILL NOT BE ACCEPTED WHICH CANNOT BE IDENTIFIED WITH APPROPRIATE CERTIFICATES OF CONFORMANCE AND CERTIFIED TEST REPORTS. TEST REPORTS FOR MATERIAL TESTS AND ANALYSES SHALL BE IDENTIFIED WITH SPECIFIC LOTS AND ITEMS PRIOR TO INSTALLATION.

DEMOLITION:

1. THE CONTRACTOR SHALL SUBMIT TO THE OWNERS REPRESENTATIVE, A REMOVAL SCHEDULE, AND A TEMPORARY SHORING PLAN AS MAY BE REQUIRED FOR DEMOLITION AND REMOVALS. THE TEMPORARY SHORING PLAN SHALL BE DESIGNED AND SIGNED AND SEALED BY A PROFESSIONAL ENGINEER, LICENSED IN THE STATE OF NEW YORK. THE CONTRACTOR SHALL NOT COMMENCE WORK WITHOUT APPROVAL FROM THE OWNER'S REPRESENTATIVE OF THE DEMOLITION AND REMOVAL SCHEDULE AND THE TEMPORARY SHORING PLAN.

2. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING, IDENTIFYING AND MARKOUT OF ALL UTILITIES PRIOR TO START OF DEMOLITION WORK.

3. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING AND STAGING DEMOLITION WORK WITH OTHER CONSTRUCTION ACTIVITIES AT THE SITE.

4. THE CONTRACTOR SHALL PERFORM ALL WORK WITH CARE SO THAT ANY MATERIALS WHICH ARE TO REMAIN IN PLACE, OR WHICH ARE TO REMAIN THE PROPERTY OF THE OWNER OR TENANT, WILL NOT BE DAMAGED. IF CONTRACTOR DAMAGES ANY MATERIALS WHICH ARE TO REMAIN IN PLACE, OR WHICH ARE TO REMAIN THE PROPERTY OF THE OWNER OR TENANT, DAMAGED MATERIALS SHALL BE REPAIRED OR REPLACED IN A MANNER SATISFACTORY TO OWNER'S REPRESENTATIVE AT THE EXPENSE OF THE CONTRACTOR.

5. WHENEVER ITEMS IN THE CONTRACT REQUIRE MATERIALS TO BE REMOVED AND DISPOSED, THE COST OF SUPPLYING A DISPOSAL AREA AND TRANSPORTATION TO THAT AREA SHALL BE INCLUDED IN THE PRICE BID FOR THOSE ITEMS.

6. ALL DEBRIS AS A RESULT OF, OR IN THE IMMEDIATE VICINITY OF THE WORK SHALL BE RECOVERED AND PROPERLY DISPOSED OF BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.

7. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PREVENT ALL CONSTRUCTION DEBRIS OR WASTE FROM FALLING INTO THE WATER. ANY DEBRIS FALLING INTO THE WATER SHALL BE RECOVERED AND LEGALLY DISPOSED OF AT NO ADDITIONAL COST TO THE OWNER.

EXCAVATION AND BACKFILL:

1. THE CONTRACTOR SHALL SUBMIT TO THE OWNERS REPRESENTATIVE, A REMOVAL SCHEDULE, AND A TEMPORARY SHORING PLAN AS MAY BE REQUIRED FOR DEMOLITIONS AND REMOVALS. THE TEMPORARY SHORING PLAN SHALL BE DESIGNED AND PREPARED BY A LICENSED PROFESSIONAL ENGINEER. THE CONTRACTOR SHALL NOT COMMENCE WORK WITHOUT APPROVAL FROM THE OWNERS REPRESENTATIVE OF THE DEMOLITION AND REMOVAL SCHEDULE AND THE TEMPORARY SHORING PLAN.

2. WHENEVER ITEMS IN THE CONTRACT REQUIRE MATERIALS TO BE REMOVED AND DISPOSED, THE COST OF SUPPLYING A DISPOSAL AREA AND TRANSPORTATION TO THAT AREA SHALL BE INCLUDED IN THE LUMP SUM PRICE BID FOR THOSE ITEMS.

3. EXCAVATION SHALL INCLUDE REMOVAL OF PAVEMENTS, FOUNDATIONS, AND ALL OTHER MATERIALS INCLUDING ROCK, IF ENCOUNTERED.

4. EXCAVATIONS SHALL BE TO ELEVATIONS REQUIRED FOR INSTALLATION OF PERMANENT CONSTRUCTION WITHOUT DISTURBANCE TO SUBGRADE BELOW SUCH ELEVATIONS.

5. BACKFILLING SHALL INCLUDE FILLING OF EXCAVATIONS MADE FOR CONSTRUCTION PURPOSES, EXTENDING TO EXISTING OR DESIGN GRADE.

6. ALL TRUCKS USED TO TRANSPORT EXCAVATED MATERIALS SHALL BE TARPED PURSUANT TO THE APPLICABLE NYSDOT AND NYCDOT REQUIREMENTS OR APPLICABLE REGULATORY AGENCY REQUIREMENTS.

7. BACKFILL SHALL BE PLACED IN EIGHT INCH MAXIMUM LOOSE LIFTS AND COMPACTED TO PROVIDE 95% OF MAXIMUM DRY DENSITY PER ASTM D-1556. MOISTURE CONTENT SHALL BE MAINTAINED WITHIN A RANGE OF PLUS OR MINUS 2% OF OPTIMUM.

8. ALL BACKFILL MATERIAL WILL BE AS SHOWN ON PLANS AND MEET THE REQUIREMENTS STATED IN THE CORRESPONDING SPECIFICATION.

9. CONTRACTOR IS RESPONSIBLE FOR UTILITY MARK-OUT AND IDENTIFICATION PRIOR TO CONSTRUCTION ACTIVITIES.

10. CONTRACTOR IS RESPONSIBLE FOR TESTING AND DISPOSAL OF NON-HAZARDOUS, HISTORIC FILL THAT MAY BE ENCOUNTERED ON SITE AT NO ADDITIONAL COST TO THE OWNER.

STRUCTURAL STEEL:

1. STEEL CONSTRUCTION SHALL CONFORM TO AISC "STEEL CONSTRUCTION MANUAL", FOURTEENTH EDITION, AND SHALL BE FABRICATED AND INSTALLED IN ACCORDANCE WITH AISC "CODE OF STANDARD PRACTICE FOR STEEL BUILDINGS AND BRIDGES" AS ADOPTED MARCH 18, 2005.

2. MATERIALS FOR STRUCTURAL STEEL SHALL CONFORM TO THE FOLLOWING ASTM SPECIFICATIONS:
   ANGLES, PLATES, AND MISCELLANEOUS SHAPES ASTM A36

3. GALVANIZING: WHERE STEEL PRODUCTS ARE SPECIFIED TO BE GALVANIZED, THEY SHALL BE HOT-DIP GALVANIZED AFTER FABRICATION, IN ACCORDANCE WITH THE REQUIREMENTS OF THE APPLICABLE SPECIFICATIONS AND OTHER REQUIREMENTS LISTED BELOW:
   A. SPECIFICATIONS FOR ZINC (HOT-GALVANIZED) COATINGS ON PRODUCTS FABRICATED FROM ROLLED, DRESSED AND FORGED STEEL SHAPES, PLATES AND STRIP - ASTM A123, GR 100.
   B. SPECIFICATION FOR ZINC COATING (HOT-DIP) ON IRON AND STEEL HARDWARE - ASTM A153.
   C. SPECIFICATION FOR ZINC COATING (HOT-DIP) ON ASSEMBLED STEEL PRODUCTS - ASTM A386.
   D. THE ZINC COATING SHALL WEIGH NOT LESS THAN 2 OUNCES PER SQUARE FOOT.
   E. ZINC DUST-ZINC OXIDE PRIMER CONFORMING TO MILITARY SPECIFICATION MIL-P-21035 SHALL BE APPLIED IN 2 COATS FOR REPAIRS TO DAMAGED SURFACES AFTER REMOVAL OF LOOSE OR CRACKED ZINC COATING.
   F. PRIOR TO GALVANIZING, ALL WELDED CONNECTIONS SHALL BE SEALED ALL AROUND WITH A SEAL WELD. BOLTED CONNECTIONS SHALL NOT BE MADE PRIOR TO GALVANIZING.

4. ALL BOLTED CONNECTIONS SHALL BE INSTALLED IN ACCORDANCE WITH "SPECIFICATIONS FOR STRUCTURAL JOINTS USING ASTM A325 OR 490 BOLTS" UNLESS OTHERWISE DETAILED.

5. STRUCTURAL STEEL SHALL BE SHOP PAINTED WITH TWO (2) COATS OF TNEMEC HI-BUILD TNEME TAR SERIES 46H-413 POLYAMIDE EPOXY-COAL TAR OR APPROVED EQUAL. STEEL SURFACE SHALL BE PREPARED IN ACCORDANCE WITH SSPC10 NEAR WHITE BLAST CLEANING. TOUCH-UP ABRADED AND DAMAGED AREAS IN THE FIELD IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATION. MINIMUM DRY FILM THICKNESS PER COAT = 8.0 MILS. MINIMUM DRY FILM THICKNESS TOTAL = 16.0 MILS.

6. ALL HOLES IN STRUCTURAL STEEL SHALL BE DRILLED, NOT BURNED.

7. ALL BOLTED CONNECTIONS SHALL BE PROVIDED WITH ASTM F3125 GRADE A325 HEAVY HEX BOLTS WITH NUTS AND WASHERS UNLESS OTHERWISE NOTED.

8. ALL SHOP DRAWINGS SHALL CLEARLY INDICATE SEPARATION OF DISSIMILAR METALS, WHERE RELIABLE SEPARATION IS NOT POSSIBLE. THE SMALLER ELEMENT SHALL BE THE NOBLER METAL.

STEEL PIPE PILES:

1. STEEL PIPE PILES SHALL CONFORM TO THE FOLLOWING REQUIREMENTS:
   A. STEEL PIPE PILES SHALL CONFORM TO ASTM A252 GR. 3 (MIN Fy=45 ksi).
   B. LOAD TESTS ARE TO BE IN ACCORDANCE WITH 2014 NYC BUILDING CODE SECTION 1808.4.1.1.
   C. ALL PILES SHALL BE DRIVEN OPEN-ENDED UNLESS OTHERWISE NOTED.

2. FILL ALL PILES WHERE SPECIFIED WITH CONCRETE AFTER THEY HAVE BEEN INSTALLED TO REQUIRED CAPACITY. PROVIDE MINIMUM CONCRETE STRENGTH (f'c) AS SHOWN ON PLANS. CONTRACTOR TO VERIFY ALL PILES ARE FREE OF ANY FILL OR DEBRIS PRIOR TO PLACING CONCRETE.

3. STEEL PIPE PILES SHALL BE SHOP PAINTED WITH TWO (2) COATS OF TNEMEC HI-BUILD TNEME TAR SERIES 46H-413 POLYMIDE EPOXY-COAL TAR OR APPROVED EQUAL PRIOR TO DRIVING. STEEL SURFACE SHALL BE PREPARED IN ACCORDANCE WITH SSPC SP10 NEAR WHITE BLAST CLEANING. TOUCH UP ABRADED AND DAMAGED AREAS IN THE FIELD IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATION. MINIMUM DRY FILM THICKNESS PER COAT = 8.0 MILS. PIPE PILES SHALL BE COATED FROM APPROXIMATELY 15 FT BELOW MUDLINE/GRADE TO TOP OF PILE.

4. THE CONNECTION OF PILE SECTIONS SHALL DEVELOP THE FULL BENDING CAPACITY OF THE PILE. PILE SPLICES SHALL BE COMPLETED WITH PREQUALIFIED COMPLETE JOINT PENETRATION GROOVE WELDS. CONTRACTOR TO PROVIDE AND SUBMIT CONNECTION DETAILS AND CALCULATIONS SIGNED AND SEALED BY A LICENSED PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF NEW YORK FOR APPROVAL.

PILE DRIVING:

1. PILES SHALL BE DRIVEN IN THE PRESENCE OF A PROFESSIONAL ENGINEER, REGISTERED IN THE STATE OF NEW YORK. BLOWS PER FOOT, PILE ENERGY AND DEPTH OF PILE SHALL BE RECORDED AND SUBMITTED TO THE OWNER AND ENGINEER OF RECORD BY THE SUPERVISING PROFESSIONAL ENGINEER.

2. MAXIMUM ALLOWABLE DEVIATION FOR PILES SHALL BE THREE (3) INCHES IN EACH DIRECTION. CONTRACTOR SHALL PROVIDE SURVEY OF "AS-BUILT" PILE LOCATIONS INDICATING NORTH-SOUTH AND EAST-WEST OUT OF TOLERANCE DIMENSIONS FROM THE THEORETICAL PILE CENTERLINE. PILES WHICH ARE OUT OF TOLERANCE OR DO NOT ACHIEVE THE REQUIRED STRENGTH WILL BE SUBJECT TO REDESIGN. THE ENGINEERING COSTS OF THE REDESIGN, ADDITIONAL PILES AND ADDITIONAL PILE CAP COST SHALL BE BORNE BY THE CONTRACTOR.

3. STEEL PIPE PILES SHALL HAVE MAXIMUM SWEEP OF 1½" OVER THE LENGTH AS DELIVERED ON SITE.

4. IF REFUSAL OR ANY OBSTRUCTIONS ARE ENCOUNTERED PRIOR TO REACHING THE REQUIRED MINIMUM ALLOWABLE CAPACITY AND EMBEDMENT, NOTIFY ENGINEER IMMEDIATELY.

6. STEAM, PNEUMATIC, DIESEL, OR VIBRATORY HAMMER MAY BE USED TO DRIVE ALL PILING. ANY MATERIAL WHICH STOPS THE DRIVING INCLUDING EXISTING PILE STUBS SHALL BE REMOVED BY THE CONTRACTOR.

7. STEEL PILES SHALL BE PROTECTED FROM CORROSION, DEFORMATION, AND OTHER TYPES OF DAMAGE.

8. THE CONTRACTOR SHALL PERFORM PDA AND CAPWAP ANALYSIS TO DEMONSTRATE THE REQUIRED PILE CAPACITY CRITERIA. ANALYSIS RESULT SHALL BE SUBMITTED TO ENGINEER OF RECORD FOR REVIEW.

9. A MINIMUM OF FIVE (5) PILES ARE REQUIRED TO BE TESTED WITH PDA'S. PILES CAN BE PRODUCTIONS PILES IF THE REQUIRED CAPACITIES ARE MET. A PILE DRIVING ANALYZER SHALL BE ATTACHED TO THE PILE IN ACCORDANCE WITH ASTM D4945.

10. CONTRACTOR SHALL PERFORM WAVE EQUATION ANALYSIS OF PILE DRIVING (WEAP) TO DEMONSTRATE THE REQUIRED PILE CAPACITY AND/OR EMBEDMENT SHALL BE ACHIEVED WITH THE SELECTED PILE DRIVING HAMMER. THE FINAL DRIVING CRITERIA AND WEAP ANALYSIS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW.

11. CONTRACTOR SHALL SUBMIT PROPOSED PILE DRIGING EQUIPMENT, WEAP ANALYSIS AND PILE FALSEWORK AS NECESSARY TO THE ENGINEER FOR REVIEW AND APPROVAL.

12. STEEL PIPE PILES SHALL BE DRIVEN TO THE TIP ELEVATIONS SHOWN IN THE CONTRACT DRAWINGS AND TO AN ALLOWABLE AXIAL CAPACITY OF 60 TONS (120 TONS ULTIMATE).

WELDING:

1. ALL WELDING AND FABRICATION SHALL CONFORM WITH THE AMERICAN WELDING SOCIETY (AWS) REQUIREMENTS AND GUIDELINES.

2. ALL WELDERS SHALL BE CERTIFIED BY AWS GUIDELINES.

3. UNLESS OTHERWISE INDICATED, ALL FILLET WELDS SHALL BE CONTINUOUS AND DOUBLE SIDED. ALL BUTT WELDS SHALL BE COMPLETE PENETRATIONS WELDS.

4. ALL WELDS SHALL BE SUBJECT TO NON DESTRUCTIVE TESTING AT THE DISCRETION OF THE ENGINEER OF RECORD AND AT THE CONTRACTOR'S COST.

5. ALL ELECTRODES USED SHALL COMPLY WITH ABS OR AWS SPECIFICATION AND SHALL BE E70XX LOW HYDROGEN.

6. ANY DEFECTS SHALL BE CORRECTED IN ACCORDANCE WITH AWS RULES AT NO ADDITIONAL COST TO THE OWNER.

CONCRETE:

1. ALL CONCRETE WORK SHALL CONFORM TO REQUIREMENTS OF THE ACI BUILDING CODE REQUIREMENT FOR STRUCTURAL CONCRETE (ACI 318-14).

2. ALL CONCRETE SHALL BE AIR ENTRAINED, 6% ± 1.5% BY VOLUME, FOR 3/4" COARSE AGGREGATE. NO CARBONACEOUS AGGREGATES SHALL BE USED.

3. ALL CONCRETE SHALL BE MIXED, TRANSPORTED AND PLACED IN ACCORDANCE WITH ACI STANDARDS 318 AND 304.

4. FOLLOW ACI STANDARD 211.1 FOR MIXING WATER REQUIREMENTS.

5. ALL CONCRETE SHALL HAVE COMPRESSIVE STRENGTH Fc' = 5000 PSI AT 28 DAYS WITH A MAXIMUM W/C RATIO OF 0.45 UNLESS NOTED OTHERWISE ON SCHEDULES OR NOTES.

6. MAXIMUM CONCRETE SLUMP SHALL BE 4", PRIOR TO THE ADDITION OF PLASTICIZING ADMIXTURES.

7. TEST CYLINDERS SHALL BE TAKEN FROM THE MIXER IN ACCORDANCE WITH ASTM C172. TESTING SHALL OCCUR:
   - EVERY 50 CY OR THE FIRST DELIVERY EACH DAY OF POURING

8. CONSTRUCTION JOINTS SHALL BE NO MORE THAN 40 FT. ON CENTER, UNLESS OTHERWISE NOTED.

9. ALL CONCRETE SHALL HAVE CORROSION INHIBITOR ADMIXTURE AT DOSAGE RATE OF 4 GAL/CY. THE CONTRACTOR SHALL SUBMIT PRODUCT DATA TO THE ENGINEER OF RECORD FOR APPROVAL.

PRECAST CONCR

MINIMUM DEVELOPMENT LENGTH SCHEDULE						
F'C=5000 PSI		FY=60000 PSI		HOT-DIP GALVANIZED REINFORCING		
BAR SIZE	ℓ d TOP (in)	ℓ d TOP	ℓ d (in)	ℓ d	ℓ dh (in)	ℓ dh (ft)
#3	17	1'-5"	13	1'-1"	7	0'-7"
#4	23	1'-11"	17	1'-5"	9	0'-9"
#5	35	2'-11"	22	1'-10"	11	0'-11"
#6	42	3'-6"	26	2'-2"	13	1'-1"
#7	49	4'-1"	38	3'-2"	15	1'-3"
#8	56	4'-8"	43	3'-7"	17	1'-7"
#9	63	5'-3"	48	4'-0"	20	1'-8"
#10	71	5'-11"	54	4'-6"	22	1'-10"
#11	78	6'-6"	60	5'-0"	24	2'-0"
#14	94	7'-10"	72	6'-0"	29	2'-5"
#18	125	10'-5"	96	8'-0"	39	3'-3"

TIDAL DATA				
	MHHW	NAVD88	NGVD29	MLLW
DESIGN FLOOD ELEVATION (DFE) (FEMA PFIRM BFE + 1' FREEBOARD + 28" SEA LEVEL RISE)	14.14	16.33	17.43	18.96
FEMA BASE FLOOD ELEVATION (PFIRM BFE - ZONE AE)	10.81	13.00	14.10	15.63
HIGHEST OBSERVED WATER LEVEL (HOWL) (HURRICANE SANDY - 10/30/2012, LOCAL TIME 01:12)	8.99*	11.27*	12.37*	14.04*
500-YEAR RETURN PERIOD STILLWATER ELEVATION	11.71	13.90	15.00	16.53
100-YEAR RETURN PERIOD STILLWATER ELEVATION	8.71	10.90	12.00	13.53
50-YEAR RETURN PERIOD STILLWATER ELEVATION	7.51	9.70	10.80	12.33
10-YEAR RETURN PERIOD STILLWATER ELEVATION	4.81	7.00	8.10	9.63
MEAN HIGH WATER SPRING (MHWS)	0.17	2.36	3.45	4.99
MEAN HIGHER-HIGH WATER (MHHW)	0.00	2.19	3.29	4.82
MEAN HIGH WATER (MHW)	-0.34	1.85	2.95	4.48
NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)	-2.19	0.00	1.10	2.63
LOCAL MEAN SEA LEVEL (LMSL)	-2.40	-0.21	0.89	2.42
MEAN DIURNAL TIDE LEVEL (DTL)	-2.41	-0.22	0.88	2.41
MEAN TIDE LEVEL (MTL)	-2.47	-0.28	0.82	2.36
NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 29)	-3.29	-1.10	0.00	1.54
MEAN LOW WATER (MLW)	-4.59	-2.40	-1.31	0.23
MEAN LOWER-LOW WATER (MLLW)	-4.82	-2.63	-1.54	0.00
LOWEST OBSERVED WATER LEVEL (LOWL - 02/02/1976)	-10.65*	-7.06*	-5.97*	-3.20*

NOTES:

1. WATER ELEVATIONS BASED ON NOAA VDATUM V. 3.9 "NEW JERSEY/NEW YORK/CONNECTICUT – NORTHERN NJ, NY HARBOR, WESTERN LONG ISLAND SOUND, V. 3.9".
2. * INDICATES TIDAL DATA TAKEN FROM NOAA TIDAL LEVEL BENCHMARKS AT THE BATTERY, NY - STATION 8518750 (PRESENT EPOCH 1983-2001):

   LONGITUDE: 73°57'42.13"W

   LATITUDE: 40°43'52.41"N
3. SEA LEVEL RISE ADJUSTMENT OF 28" IS FOR NON-CRITICAL FACILITIES WITH AN END OF USEFUL LIFE THROUGH 2080S (2070-2099). (TABLE 4 OF NYC CLIMATE RESILIENCY DESIGN GUIDELINES, V4.0, SEPTEMBER 2020).
4. RETURN PERIOD STILLWATER ELEVATIONS BASED ON FEMA FLOOD INSURANCE STUDY, CITY OF NEW YORK, NEW YORK, DECEMBER 2013.

ABBREVIATIONS:

ADD'L.	ADDITIONAL
ALT.	ALTERNATE
ARCH.	ARCHITECTURAL
BOT.	BOTTOM
BS	BOTTOM OF SLAB
CLR.	CLEAR
CL.	CENTERLINE
CONC.	CONCRETE
CONST.	CONSTRUCTION
DIA. OR Ø	DIAMETER
DWG.	DRAWING
EA.	EACH
EE.	EACH END
EF.	EACH FACE
EL. OR ELEV.	ELEVATION
EQ.	EQUAL
EW	EACH WAY
EXIST.	EXISTING
EXP. JT.	EXPANSION JOINT
FIN.	FINISH
FT. OR '	FEET OR FOOT
FTG.	FOOTING
Fy.	YIELD STRESS
GALV.	GALVANIZED
GR.	GRADE
HOR.	HORIZONTAL
HT.	HEIGHT
IN. OR "	INCHES
INV.	INVERT
KSI.	KIPS PER SQUARE INCHES
LONG.	LONGITUDINAL
MAX.	MAXIMUM
MHHW	MEAN HIGHER HIGH WATER
MHW	MEAN HIGH WATER
MIN.	MINIMUM
MISC.	MISCELLANEOUS
MLLW	MEAN LOWER LOW WATER
MLW	MEAN LOW WATER
NAVD88	NORTH AMERICAN VERTICAL DATUM
NGVD29	NATIONAL GEODETIC VERTICAL DATUM
N.T.S.	NOT TO SCALE
NYCDEP	NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION
O.C.	ON CENTER
O.D.	OUTSIDE DIAMETER
PL	PLATE
PSI.	POUNDS PER SQUARE INCH
PSF.	POUNDS PER SQUARE FOOT
R	RADIUS
REINF.	REINFORCING
REF.	REFERENCE
REQD.	REQUIRED
SECT.	SECTION
SIM.	SIMILAR
S.O.G.	SLAB ON GRADE
SS	STAINLESS STEEL
STA	STATION
STRUCT.	STRUCTURE
SYMM.	SYMMETRICAL
S.W.	SHORT WAY
T	TOP
THK. OR THKNS.	THICK OR THICKNESS
T.O.	TOP OF
T.S.	TOP OF SLAB
TYP.	TYPICAL
U.O.N.	UNLESS OTHERWISE NOTED
VAR.	VARIES
VERT.	VERTICAL
V.I.F.	VERIFY IN FIELD
W/	WITH
WP	WORK POINT
WWF	WELDED WIRE FABRIC

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STATE OF NEW YORK · CRAIG PAUL PLATE · 039297 · LICENSED PROFESSIONAL ENGINEER

DOB # BOO539478-S7

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1 JAVA OWNER LLC
200 PARK AVE, 9TH FL., NEW YORK, NY 10166

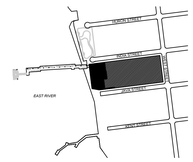
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CRAUL LAND SCIENTISTS (SOILS)
282 WHITEMAN DRIVE, CENTRE HALL, PA 16828
NORTHERN DESIGNS LLC (IRRIGATION)
2089 HARTFORD TPKE, NORTH HAVEN, CT 06473

KEY PLAN



SEAL

NYC BUILDINGS
Eric Cheng
APPROVED
Date: 06/29/2023

JAMES CORNER
REG. NO.: **LA6667253**

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REVISION / ISSUANCE

NO.	DESCRIPTION	DATE

PROJECT NAME
01 JAVA STREET
1 JAVA STREET
BROOKLYN, NY 11211

JCFO PROJ.#
1714

PROJECT PHASE
CONSTRUCTION DOCUMENTS

DESIGNED BY: CMS
DRAWN BY: EHC
CHECKED BY: VCC

SCALE NORTH

VERT: AS NOTED
HORZ: AS NOTED

SHEET TITLE
SITE STRUCTURAL GENERAL NOTES - 2

SHEET NUMBER
WSS-002.00

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ORIGINAL SHEET SIZE: 30" X 48"

FILE NAME: P:\ny\20032\01069.02\10_Dwgs\CAD\WSS-001 General Notes.dwg PLOT TIME: Fri, 30 Sep 2022 - 4:01pm LAST SAVE: Wed, 28 Sep 2022 - 3:20pm BY: echu



PROPOSED SITE PLAN

0 10' 20'
1"=10'

NOTES:
1. ALL ELEVATIONS SHOWN IN NAVD88.
2. SITE SURVEY PROVIDED BY CONTROL POINT ASSOCIATES INC. P.C. ON FEBRUARY 14, 2017 AND REVISED ON FEBRUARY 21, 2017.
3. ALL WATERLINES WERE TAKEN FROM A CONTROL POINT ASSOCIATES INC. SURVEY PERFORMED ON FEBRUARY 14, 2017 AND REVISED ON FEBRUARY 21, 2017.
4. PROPOSED BULKHEAD LOCATION SHOWN FOR REFERENCE.
5. EXCAVATION DEPTH SHALL NOT EXCEED 5 FEET.
6. ALL EXPOSED CONCRETE SHALL RECEIVE ARCHITECTURAL FINISH AS NOTED IN THE SPECIFICATIONS.
7. TOP OF GRADE BEAM ELEVATIONS VARY, SEE GRADING PLAN ON WL DRAWINGS FOR FINISH ELEVATIONS.
8. SEE TABLE ON DETAIL F ON WSS-502 FOR THE TOP OF SLAB ELEVATIONS AT THE MANHOLE LOCATIONS.

LEGEND:
- U.S. BULKHEAD LINE
- PROPERTY AND LOTS LINES
- NEW BULKHEAD
- PROPOSED 12.75"Ø x ⅜" WALL, CONCRETE FILLED (F'c=5,000 PSI) STEEL PIPE PILE DRIVEN TO 60 TON ALLOWABLE CAPACITY (120 TON ULTIMATE) (TYP.)
- CONSTRUCTION JOINT
- LIMIT OF WPAA
- OPENING IN STRUCTURAL SLAB
- MH1 MANHOLE NUMBER

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lendlease

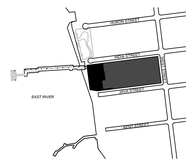
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KEY PLAN:


SEAL:
NYC DEPARTMENT OF BUILDINGS
Eric Cheng
APPROVED
Date: 06/29/2023

JAMES CORNER
REG. NO: **LA6667253**

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VERT: 1" = 10'
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PROPOSED SITE PLAN

SHEET NUMBER
WSS-101.00

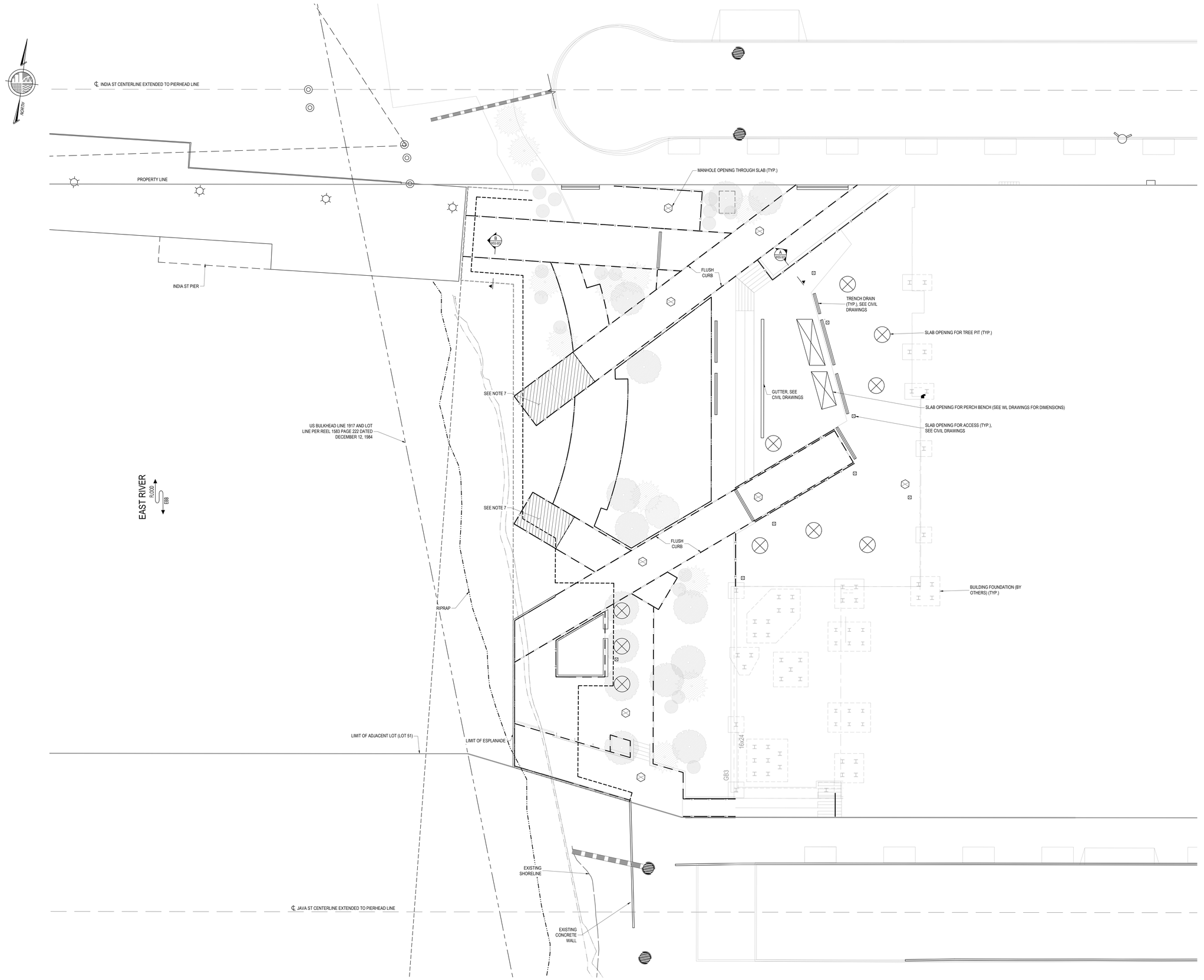
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ORIGINAL SHEET SIZE: 36" X 48"

FILE NAME: P:\Proj\2020\01069\02\10_Dwgs\CAD\WSS-101 Proposed Site Plan.dwg PLOT TIME: Fri, 30 Sep 2022 - 4:01pm LAST SAVE: Fri, 30 Sep 2022 - 12:52pm BY: ezhu



CURB AND WALL PLAN

0 10' 20'
1"=10'

NOTES:
1. ALL ELEVATIONS SHOWN IN NAVD88.
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3. ALL WATERLINES WERE TAKEN FROM A CONTROL POINT ASSOCIATES INC. SURVEY PERFORMED ON FEBRUARY 14, 2017 AND REVISED ON FEBRUARY 21, 2017.
4. PROPOSED BULKHEAD LOCATION SHOWN FOR REFERENCE.
5. EXCAVATION DEPTH SHALL NOT EXCEED 5 FEET.
6. ALL EXPOSED CONCRETE SHALL RECEIVE ARCHITECTURAL FINISH AS NOTED IN THE SPECIFICATIONS.
7. MARINE STRUCTURAL CONCRETE IN THIS AREA TO MATCH ARCHITECTURAL CONCRETE IN FINISH AND COLOR.
8. REFERENCE CIVIL DRAWINGS FOR EXACT TRENCH LOCATIONS.

LEGEND:
- U.S. BULKHEAD LINE
- PROPERTY AND LOTS LINES
- NEW BULKHEAD
- CONSTRUCTION JOINT
- LIMIT OF WPAA
- PRECAST CONCRETE CURB
- CIP CURB/WALL WITH ARCHITECTURAL CONCRETE
- CIP CURB/WALL WITH MARINE CONCRETE AND ARCHITECTURAL FINISH
- OPENING IN STRUCTURAL SLAB

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200 PARK AVE, 9TH FL., NEW YORK, NY 10166

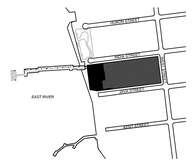
M. G. McLaren Engineering and Land Surveying P.C.
530 Chestnut Ridge Road
Woodcliff Lake, NJ 07677
T: 201.775.6000 www.mgmclaren.com

LANDSCAPE ARCHITECT:
JAMES CORNER FIELD OPERATIONS
475 10TH AVE, 9TH FLOOR, NEW YORK, NY 10018

CONSULTANTS:

FOR REFERENCE:
MARVEL ARCHITECTS (ARCHITECT)
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ONE LUX STUDIO (LIGHTING DESIGNER)
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LANGAN (CIVIL R.O.W.)
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OLA ENGINEERS (WATERFRONT ELECTRICAL)
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NORTHERN DESIGNS LLC (IRRIGATION)
2089 HARTFORD TPKE, NORTH HAVEN, CT 06473

KEY PLAN:



SEAL:

Eric Cheng
APPROVED
Date: 06/29/2023

DOB # BO0539478-S7

JAMES CORNER
REG. NO: **LA6667253**

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REVISION / ISSUANCE

NO.	DESCRIPTION	DATE

PROJECT NAME:
01 JAVA STREET
1 JAVA STREET
BROOKLYN, NY 11211

JCFO PROJ.#
1714

PROJECT PHASE:
CONSTRUCTION DOCUMENTS

DESIGNED BY: CMS
DRAWN BY: EHC
CHECKED BY: VOC

SCALE NORTH

VERT: AS NOTED
HORZ: AS NOTED

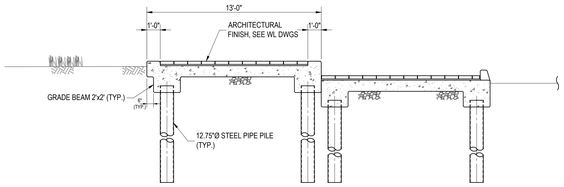
SHEET TITLE:
CURB AND WALL PLAN

SHEET NUMBER:
WSS-102.00

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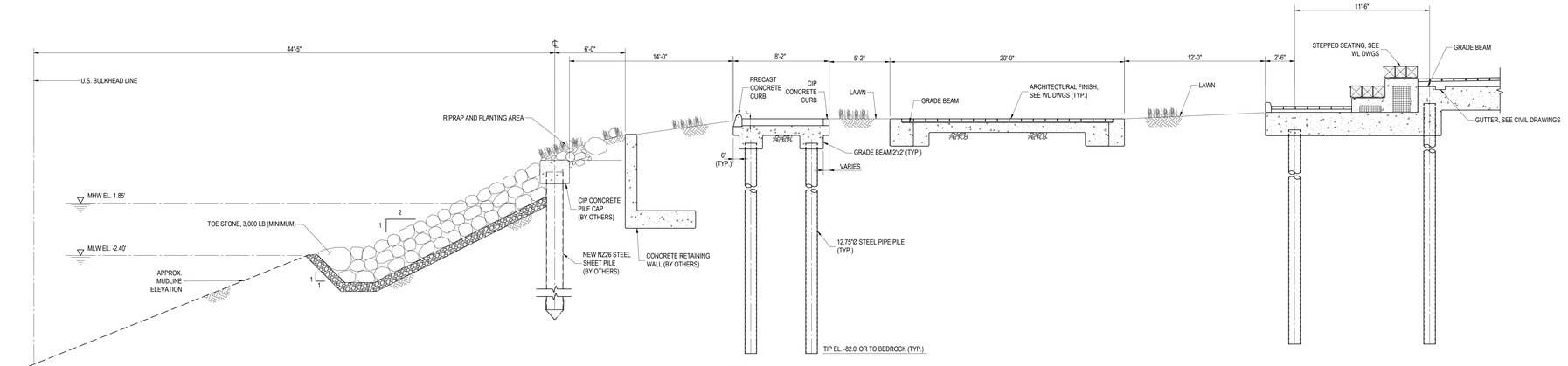
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FILE NAME: P:\ms2020\2010692\010_Dwgs\CAD\WSS-102 Curb and Wall Plan.dwg PLOT TIME: Fr, 30 Sep 2022 - 4:01pm LAST SAVE: Fr, 30 Sep 2022 - 12:56pm BY: ehhu



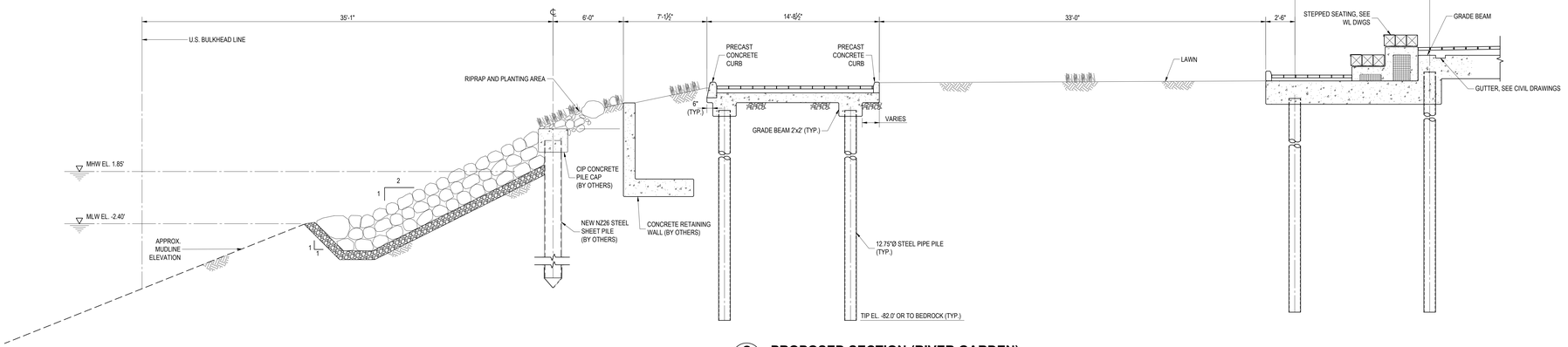
A WSS-201 **PROPOSED SECTION (FERRY LANDING APPROACH)**

1/4" = 1'-0"



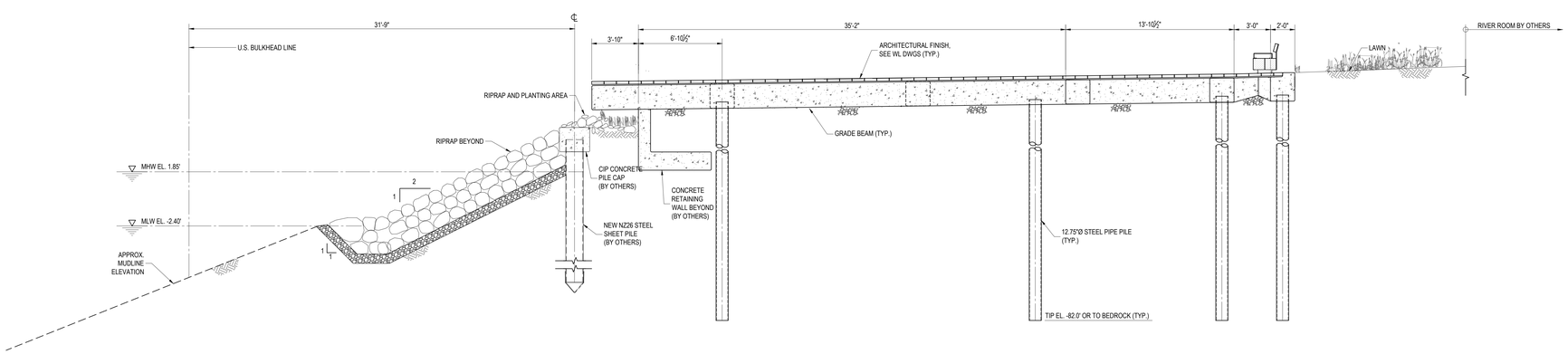
B WSS-201 **PROPOSED SECTION (RIVER GARDEN)**

1/4" = 1'-0"



C WSS-201 **PROPOSED SECTION (RIVER GARDEN)**

1/4" = 1'-0"



D WSS-201 **TYPICAL PATH SECTION**

1/4" = 1'-0"

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FILE NAME: P:\hyp2020\01069.02\10_Dwgs\CAD\WSS-201A302 Proposed Sections.dwg PLOT TIME: Fri, 30 Sep 2022 - 4:02pm LAST SAVE: Fri, 30 Sep 2022 - 3:52pm BY: echu

lendlease

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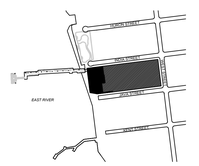
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KEY PLAN:



SEAL:

NYC BUILDINGS
Eric Cheng
APPROVED
Date: 06/29/2023

DOB # BOO539478-S7

JAMES CORNER
REG. NO.: **LA6667253**

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NO.	DESCRIPTION	DATE

PROJECT NAME:
01 JAVA STREET
1 JAVA STREET
BROOKLYN, NY 11211

JCFO PROJ.#
1714

PROJECT PHASE:
CONSTRUCTION DOCUMENTS

DESIGNED BY: CMS
DRAWN BY: EHC
CHECKED BY: VCC

SCALE: NORTH

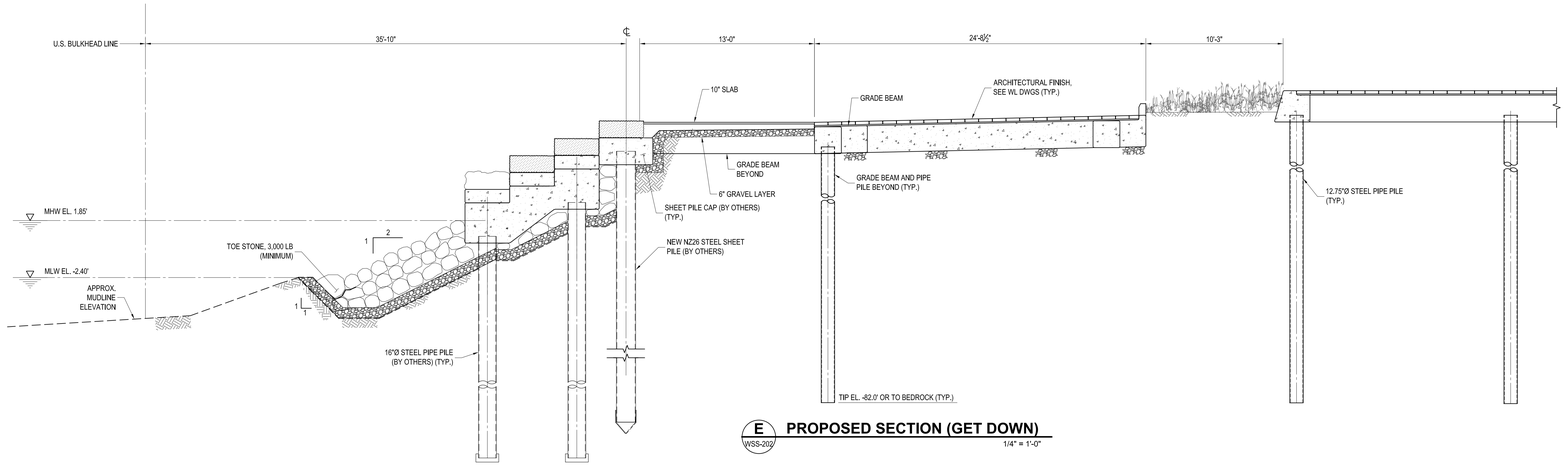
VERT: 1/4" = 1'-0"
HORZ: 1/4" = 1'-0"

SHEET TITLE:
PROPOSED SECTIONS - 1

SHEET NUMBER:
WSS-201.00

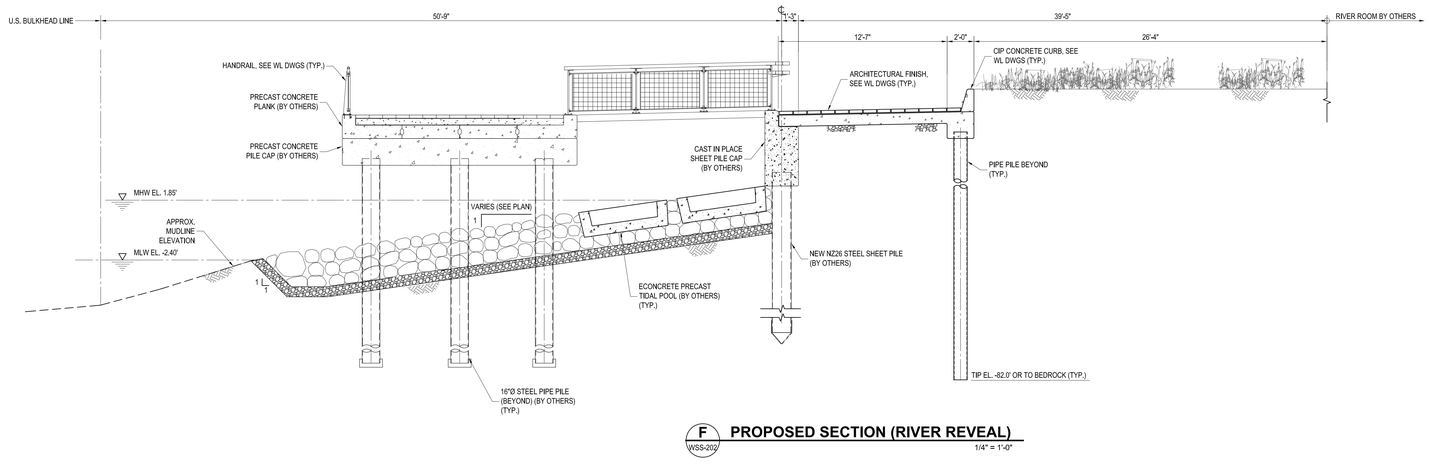
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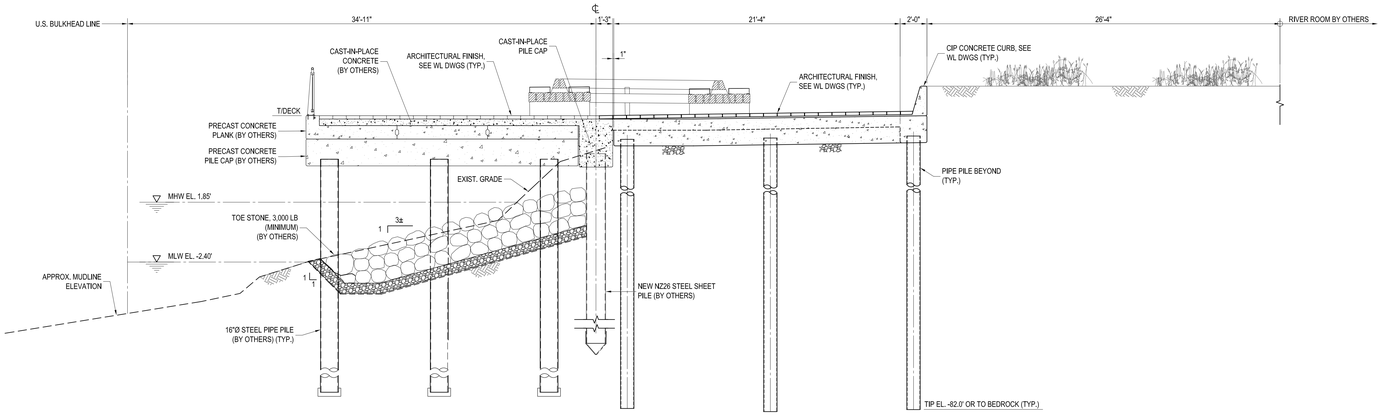
E WSS-202 **PROPOSED SECTION (GET DOWN)**

1/4" = 1'-0"



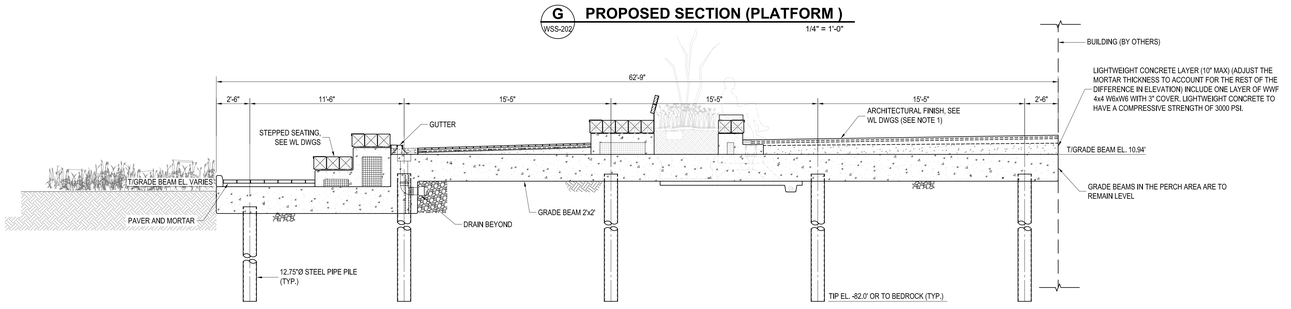
F WSS-202 **PROPOSED SECTION (RIVER REVEAL)**

1/4" = 1'-0"



G WSS-202 **PROPOSED SECTION (PLATFORM)**

1/4" = 1'-0"



H WSS-202 **PROPOSED SECTION (PERCH)**

1/4" = 1'-0"

NOTE:
1. ARCHITECTURAL FINISH AT THE PERCH AREA VARIES, SEE WATERFRONT LANDSCAPE DRAWINGS FOR ADDITIONAL INFORMATION.

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FILE NAME: P:\Proj\2020\2019\93\210_Dwg\CADD\WSS-201&202 Proposed Sections.dwg PLOT TIME: Fri, 30 Sep 2022 - 4:20pm LAST SAVE: Fri, 30 Sep 2022 - 3:52pm BY: ezhu

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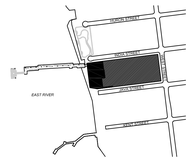
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NORTHERN DESIGNS LLC (IRRIGATION)
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KEY PLAN



SEAL

NYC BUILDINGS
Eric Cheng
APPROVED
Date: 06/28/2023

DOB # B00539478-S7

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REG. NO. **LA6667253**

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PROJECT NAME
01 JAVA STREET
1 JAVA STREET
BROOKLYN, NY 11211

JCFO PROJ.#
1714

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DESIGNED BY: CMS
DRAWN BY: EHC
CHECKED BY: VCC

SCALE NORTH

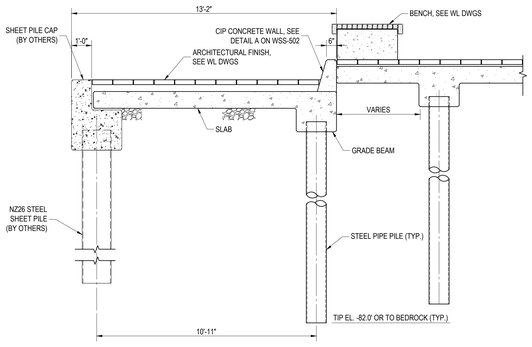
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SHEET TITLE
PROPOSED SECTIONS - 2

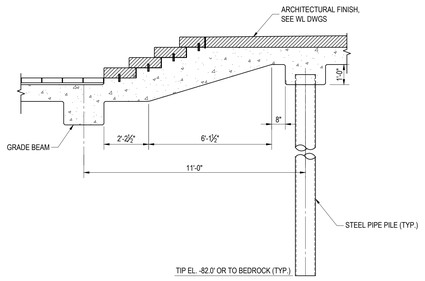
SHEET NUMBER
WSS-202.00

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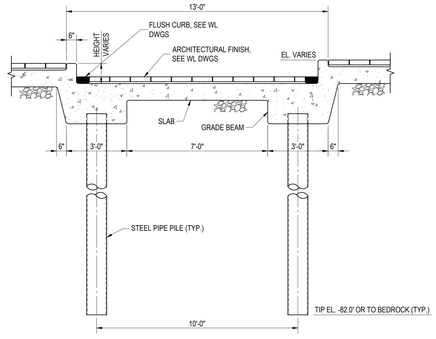
ORIGINAL SHEET SIZE: 30" X 48"



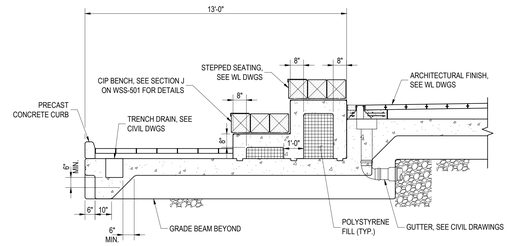
J SECTION
WSS-203 — 3/8" = 1'-0"



K SECTION
WSS-203 — 3/8" = 1'-0"

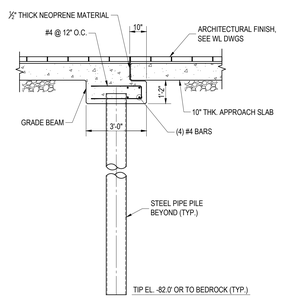


L SECTION
WSS-203 — 3/8" = 1'-0"

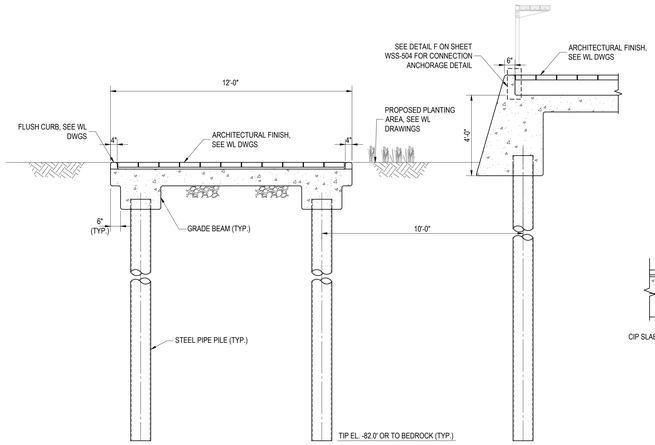


M SECTION
WSS-203 — 3/8" = 1'-0"

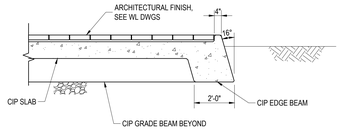
NOTE(S):
1. SEE CIVIL DRAWINGS FOR PITCH REQUIRED IN SLAB TO DRAIN UNDER DECKING AREA.



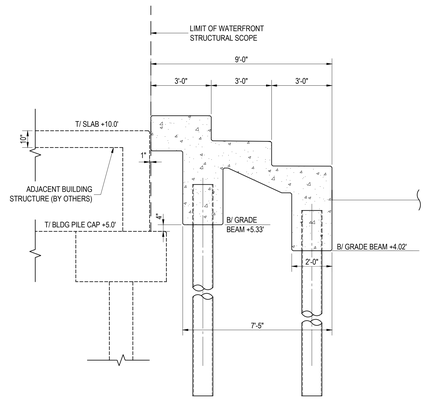
N SECTION AT TRANSITION SLAB
WSS-203 — 3/8" = 1'-0"



P SECTION
WSS-203 — 3/8" = 1'-0"

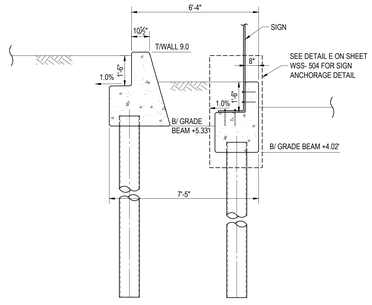


Q SECTION
WSS-203 — 3/8" = 1'-0"

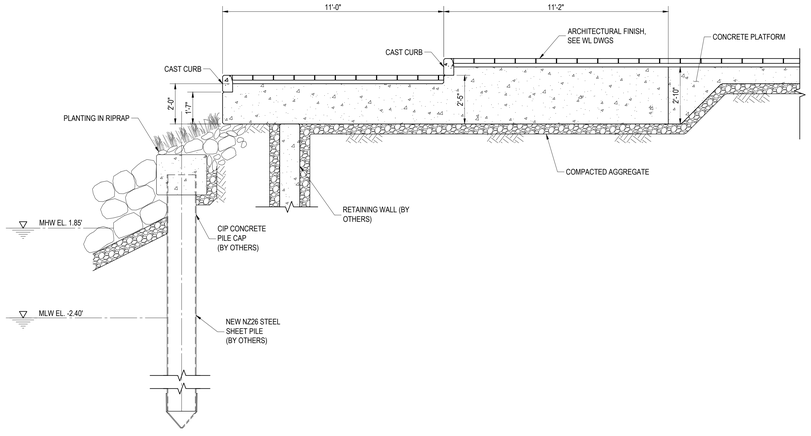


R SECTION
WSS-203 — 3/8" = 1'-0"

NOTE(S):
1. SEATING STEPS ARE TO BE CAST WITH MARINE CONCRETE WITH ARCHITECTURAL FINISH. SEE WL DRAWINGS FOR FINISH REQUIREMENTS.



S SECTION
WSS-203 — 3/8" = 1'-0"



T SLIP PLATFORM SECTION
WSS-203 — 3/8" = 1'-0"

NOTE(S):
1. ALL EXPOSED CONCRETE SURFACES SHALL BE FINISHED IN ACCORDANCE WITH THE MARINE CONCRETE SPECIFICATION.

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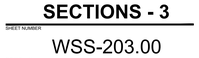
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KEY PLAN:



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Eric Cheng
APPROVED
Date: 06/29/2023

DOB # BOO539478-S7

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REG. NO. **LA6667253**

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JCFO PROJ.#
1714

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CONSTRUCTION DOCUMENTS

DESIGNED BY: CMS
DRAWN BY: EHC
CHECKED BY: VCC

SCALE — NORTH

VERT: AS NOTED
HORZ: AS NOTED

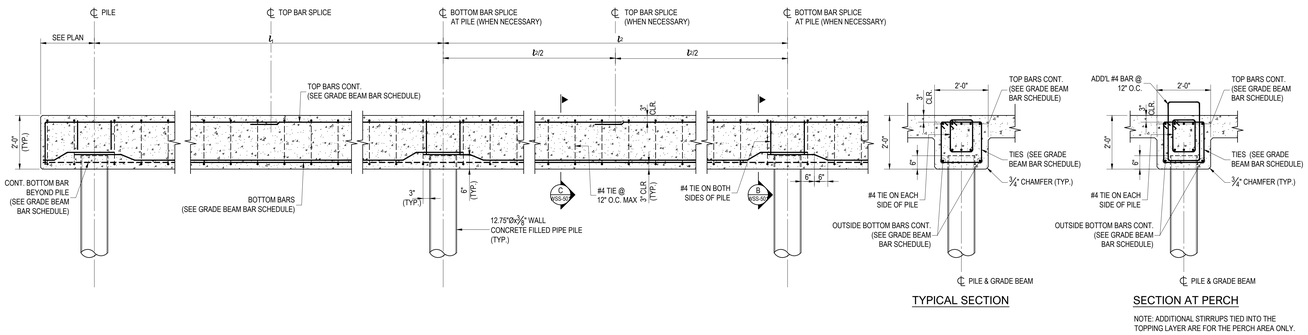
SHEET TITLE
PROPOSED SECTIONS - 3

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FILE NAME: P:\Proj\2020\2019\93.01\0_Dwgs\CAD\DWGS-2021&2022 Proposed Sections.dwg PLOT TIME: Fri, 30 Sep 2022 - 4:02pm LAST SAVE: Fri, 30 Sep 2022 - 3:52pm BY: ezhu



A TYPICAL GRADE BEAM DETAIL
WSS-501 — 1/2" = 1'-0"

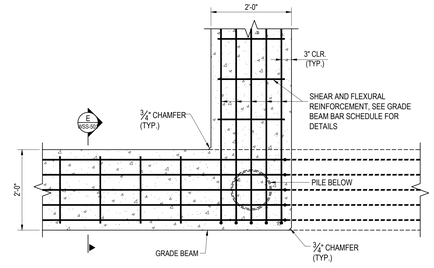
NOTES:
1. SEE GRADE BEAM BAR SCHEDULE FOR TOP AND BOTTOM REINFORCEMENT LAYOUT.
2. ALL LAP SPLICES SHOULD DEVELOP THE FULL TENSILE STRENGTH OF THE BAR TO 1.3 ld.
3. WHERE BOTTOM FULL LENGTH BARS ARE NOTED TO BE CONTINUOUS, PROVIDE LAP SPLICES CENTERED OVER SUPPORT.
8. SLAB REINFORCEMENT NOT SHOWN FOR CLARITY.

GRADE BEAM BAR SCHEDULE			
LABEL	TOP	BOTTOM	TIES
B1	5 #7	5 #7	2 #6

LAP SPLICE SCHEDULE	
REINFORCEMENT SIZE	LAP LENGTH
#6 & SMALLER	42" (MIN.)
#7 & LARGER	60" (MIN.)

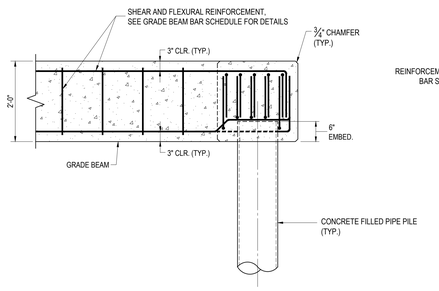
B SECTION
WSS-501 — 1/2" = 1'-0"

C SECTION
WSS-501 — 1/2" = 1'-0"



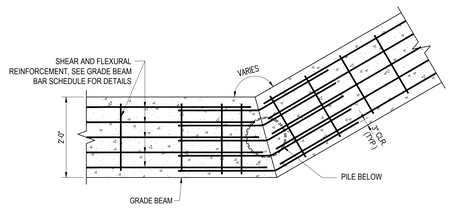
D GRADE BEAM INTERSECTION DETAIL
WSS-501 — 3/4"=1'-0"

NOTE:
SLAB REINFORCEMENT NOT SHOWN FOR CLARITY.



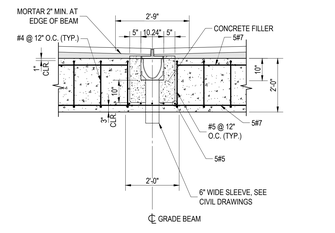
E SECTION
WSS-501 — 3/4"=1'-0"

NOTE:
SLAB REINFORCEMENT NOT SHOWN FOR CLARITY.



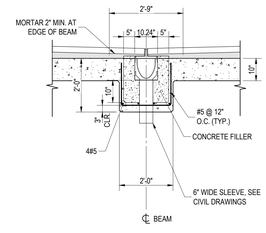
F TYP. REINFORCEMENT DETAIL AT GRADE BEAM ROTATION
WSS-501 — 3/4"=1'-0"

NOTE:
SLAB REINFORCEMENT NOT SHOWN FOR CLARITY.



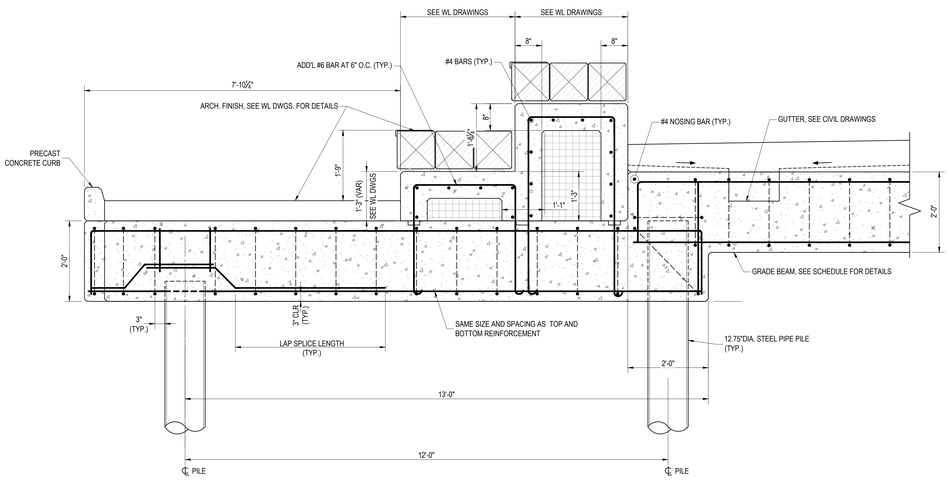
G TRENCH DRAIN AT GRADE BEAM SECTION
WSS-501 — 1/2" = 1'-0"

NOTE:
SLAB REINFORCEMENT NOT SHOWN FOR CLARITY.



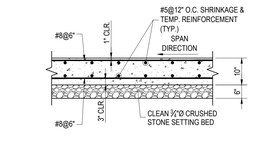
H TRENCH DRAIN SECTION
WSS-501 — 1/2" = 1'-0"

NOTE:
SLAB REINFORCEMENT NOT SHOWN FOR CLARITY.

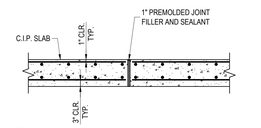


J GRADE BEAM @ STAIR LOCATION
WSS-501 — 3/4"=1'-0"

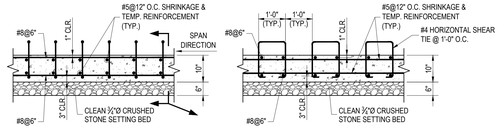
NOTE(S):
1. FOR STAIR TREAD SLOPE, SEE WATERFRONT LANDSCAPE DRAWINGS.



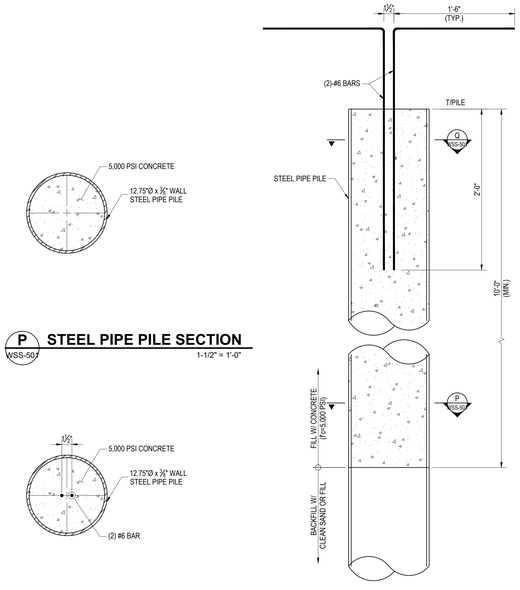
K TYPICAL SLAB SECTION
WSS-501 — 1/2" = 1'-0"



L EXPANSION JOINT DETAIL
WSS-501 — 1/2" = 1'-0"



M SLAB SECTION AT PERCH
WSS-501 — 1/2" = 1'-0"



P STEEL PIPE PILE SECTION
WSS-501 — 1-1/2" = 1'-0"

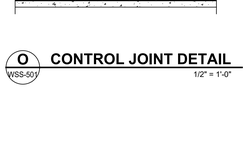
Q STEEL PIPE PILE SECTION
WSS-501 — 1-1/2" = 1'-0"

R STEEL PIPE PILE REINFORCING DETAIL
WSS-501 — 1-1/2" = 1'-0"



N CONSTRUCTION JOINT DETAIL
WSS-501 — 1/2" = 1'-0"

NOTE: CONTRACTOR SHALL INSTALL CONSTRUCTION JOINTS AS NECESSARY. CONTRACTOR SHALL PROVIDE ENGINEER WITH CONSTRUCTION JOINT PLAN FOR REVIEW AND APPROVAL.



O CONTROL JOINT DETAIL
WSS-501 — 1/2" = 1'-0"

WARNING - IT IS A VIOLATION OF NEW YORK STATE EDUCATIONAL LAW, SECTION 7209.2, FOR ANY PERSON, UNLESS HE OR SHE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER OR LAND SURVEYOR, TO ALTER THIS DOCUMENT IN ANY WAY. IF ALTERED, THE ALTERING PERSON, SHALL COMPLY WITH THE REQUIREMENTS OF NEW YORK EDUCATIONAL LAW, SECTION 7209.2.

FILE NAME: P:\Proj\2020\2010692\10_Dwgs\CAD\DWGS-501\Typical Details-1.dwg PLOT TIME: Fri, 30 Sep 2022 - 4:02pm LAST SAVE: Fri, 30 Sep 2022 - 1:52pm BY: echiu

lendlease

OWNER:
1 JAVA OWNER LLC
200 PARK AVE, 9TH FL., NEW YORK, NY 10166

McLaren ENGINEERING GROUP
M. G. McLaren Engineering and Land Surveying P.C.
530 Chestnut Ridge Road
Woodcliff Lake, NJ 07677
T: 201.775.6000 www.mgmclaren.com

LANDSCAPE ARCHITECT:

JAMES CORNER FIELD OPERATIONS
475 10TH AVE, 9TH FLOOR, NEW YORK, NY 10018

CONSULTANTS:

FOR REFERENCE:

MARVEL ARCHITECTS (ARCHITECT)
145 HUDSON STREET, NEW YORK, NY 10013

ONE LUX STUDIO (LIGHTING DESIGNER)
158 W. 29TH ST., 10TH FL., NEW YORK, NY 10001

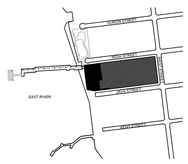
LANGAN (CIVIL R.O.W.)
360 W 31ST STREET, 8TH FL., NEW YORK, NY 10001

OLA ENGINEERS (WATERFRONT ELECTRICAL)
8 W 38TH ST., SUITE 501, NEW YORK, NY 10018

CRAUL LAND SCIENTISTS (SOILS)
282 WHITEMAN DRIVE, CENTRE HALL, PA 16828

NORTHERN DESIGNS LLC (IRRIGATION)
2089 HARTFORD TPKE, NORTH HAVEN, CT 06473

KEY PLAN:



SEAL:

NYC Buildings
Eric Cheng
APPROVED
Date: 06/28/2022

JAMES CORNER
REG. NO: **LA6667253**

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REVISION / ISSUANCE

NO.	DESCRIPTION	DATE

PROJECT NAME:
01 JAVA STREET
1 JAVA STREET
BROOKLYN, NY 11211

JOFO PROJ.#
1714

PROJECT PHASE:
CONSTRUCTION DOCUMENTS

DESIGNED BY: CMS
DRAWN BY: EHC
CHECKED BY: VCC

SCALE NORTH

VERT: AS NOTED
HORZ: AS NOTED

SHEET TITLE
TYPICAL DETAILS - 1

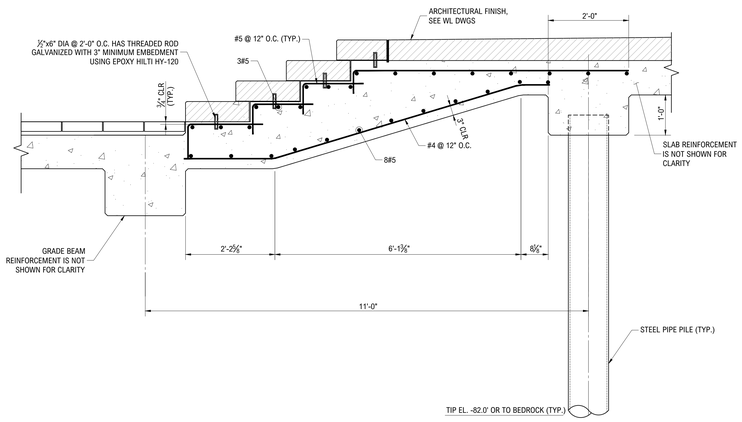
SHEET NUMBER
WSS-501.00

STATE OF NEW YORK · LICENSED PROFESSIONAL ENGINEER · GRAND PAUL KLAFF · 090578 · DEPARTMENT OF BUILDINGS

DOB # BOO539478-S7

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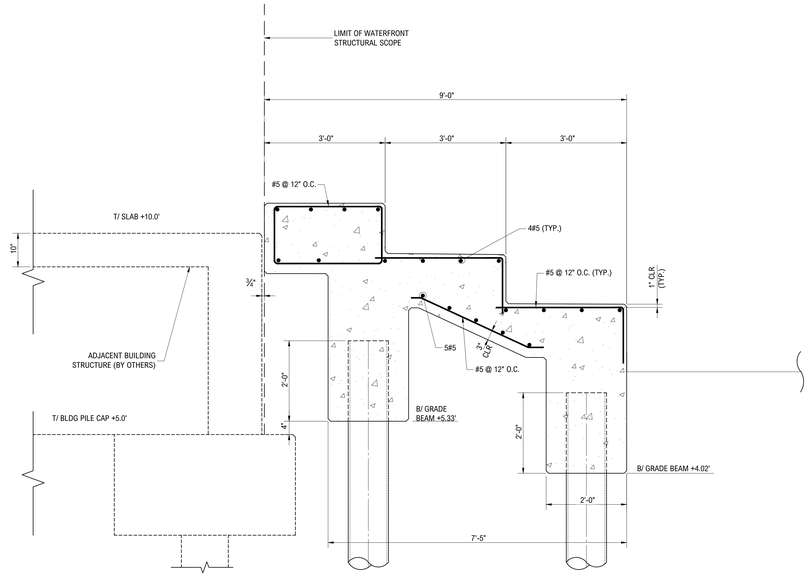
ORIGINAL SHEET SIZE: 36" X 48"



A WSS-502 **SECTION K REINFORCEMENT DETAIL**

3/4" = 1'-0"

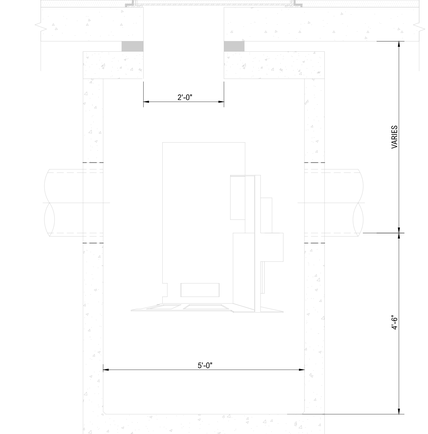
NOTE:
1. SLAB AND GRADE BEAM REINFORCEMENT NOT SHOWN FOR CLARITY.



B WSS-502 **SECTION R REINFORCEMENT DETAIL**

3/4" = 1'-0"

NOTE:
1. GRADE BEAM REINFORCEMENT NOT SHOWN FOR CLARITY.

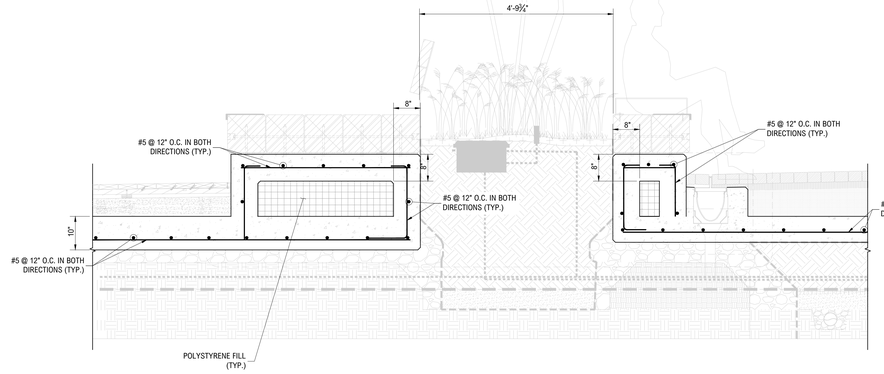


MANHOLE NUMBER	TOP OF SLAB ELEVATION (NAVD88)
MH1	1.81'
MH2	1.80'
MH3	1.63'
MH4	1.21'
MH5	-2.67'
MH6	0.43'
MH7	2.81'
MH8	4.73'

F WSS-502 **TYPICAL MANHOLE FOUNDATION**

3/4" = 1'-0"

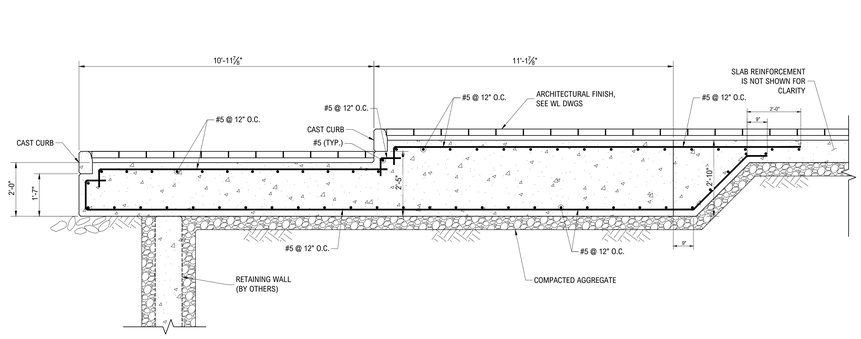
NOTE:
1. SEE TABLE FOR TOP OF SLAB ELEVATION.



G WSS-502 **PERCH BENCH REINFORCEMENT**

3/4" = 1'-0"

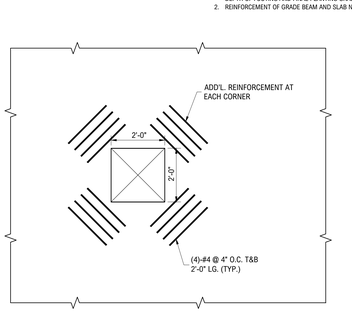
NOTES:
1. CONTRACTOR TO COORDINATE FINAL SLAB-ON-GRADE, ARCHITECTURAL FINISH ELEVATION, DEPTH OF FOOTING AND FINAL PLANTING GRADE WITH LANDSCAPE ARCHITECT.
2. REINFORCEMENT OF GRADE BEAM AND SLAB NOT SHOWN FOR CLARITY.

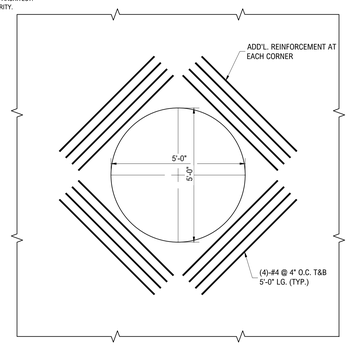


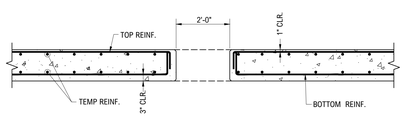
H WSS-502 **SLIP PLATFORM SECTION REINFORCEMENT**

1/2" = 1'-0"

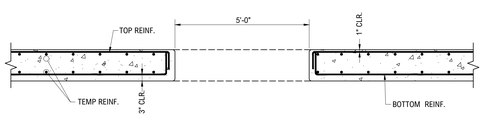
NOTE:
1. SLAB AND GRADE BEAM REINFORCEMENT NOT SHOWN FOR CLARITY.







SLAB OPENING FOR MANHOLE REINFORCEMENT DETAIL



SLAB OPENING FOR TREE PIT REINFORCEMENT DETAIL

NOTE: SEE ARCHITECTURAL DRAWINGS FOR LOCATIONS.

J WSS-502 **SLAB OPENING DETAIL**

1/2" = 1'-0"

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OWNER:
1 JAVA OWNER LLC
200 PARK AVE, 9TH FL., NEW YORK, NY 10166

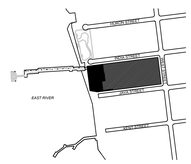
M. G. McLaren Engineering and Land Surveying P.C.
530 Chestnut Ridge Road
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T: 201.775.6000 www.mgmclaren.com

LANDSCAPE ARCHITECT:
JAMES CORNER FIELD OPERATIONS
475 10TH AVE, 9TH FLOOR, NEW YORK, NY 10018

CONSULTANTS:

FOR REFERENCE:
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2089 HARTFORD TPKE, NORTH HAVEN, CT 06473

KEY PLAN:



SEAL:

Eric Cheng
APPROVED
DATE: 06/29/2023

JAMES CORNER
REG. NO: **LA6667253**

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REVISION / ISSUANCE

NO.	DESCRIPTION	DATE

PROJECT NAME:
01 JAVA STREET
1 JAVA STREET
BROOKLYN, NY 11211

JCFO PROJ.#
1714

PROJECT PHASE:
CONSTRUCTION DOCUMENTS

DESIGNED BY: CMS
DRAWN BY: EHC
CHECKED BY: VCC

SCALE: NORTH

VERT: AS NOTED
HORZ: AS NOTED

SHEET TITLE:
TYPICAL DETAILS - 2

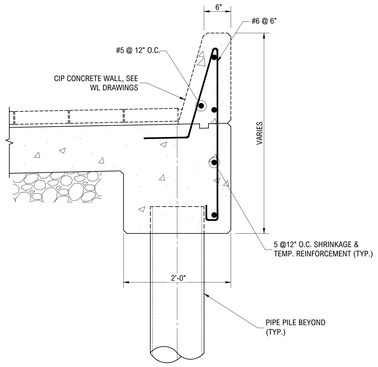
SHEET NUMBER:
WSS-502.00

DOB # BO0539478-S7

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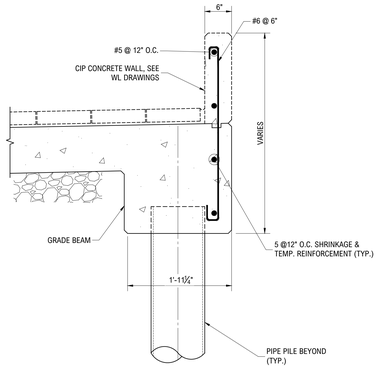
ORIGINAL SHEET SIZE: 30" X 48"

FILE NAME: P:\Proj\2020\01069.00\10_Dwgs\CADD\WSS-502 Typical Details-2.dwg PLOT TIME: Fri, 30 Sep 2022 - 4:02pm LAST SAVE: Fri, 30 Sep 2022 - 3:59pm BY: ehlu



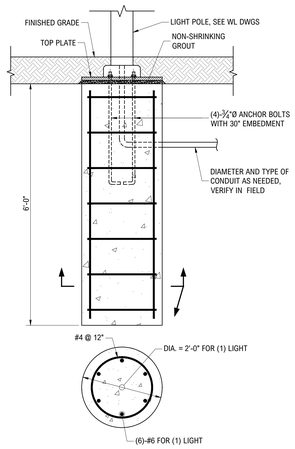
A WALL TYPE 1 SECTION BATTERED WALL AT GRADE BEAM
WSS-503 — 1" = 1'-0"

NOTE: GRADE BEAM AND SLAB REINFORCING NOT SHOWN FOR CLARITY.

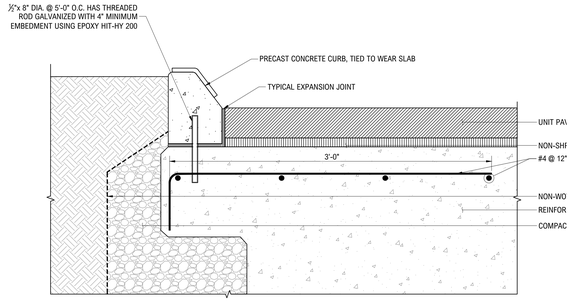


B WALL TYPE 2 SECTION VERTICAL WALL AT GRADE BEAM
WSS-503 — 1" = 1'-0"

NOTE: GRADE BEAM AND SLAB REINFORCING NOT SHOWN FOR CLARITY.

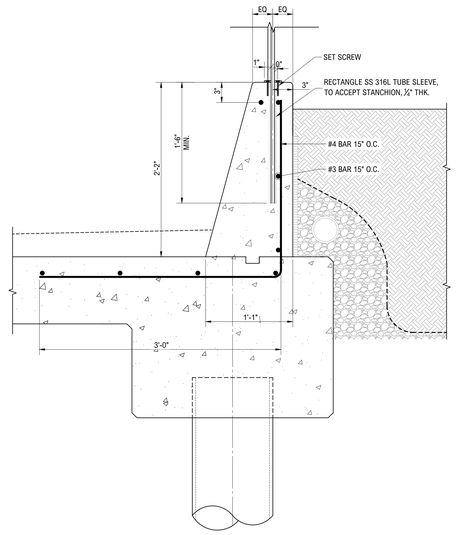


C LIGHT POLE FOUNDATION DETAILS
WSS-503 — 3/4" = 1'-0"



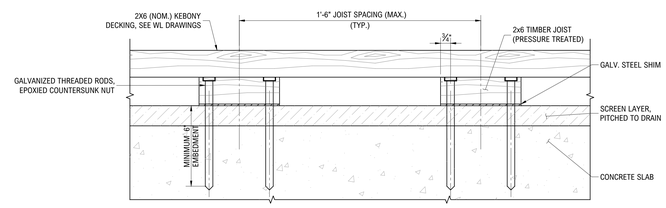
D PRECAST CONCRETE CURB ANCHROAGE DETAIL
WSS-503 — 2" = 1'-0"

NOTES:
1. CONTRACTOR TO COORDINATE FINAL SLAB-ON-GRADE, ARCHITECTURAL FINISH ELEVATION, DEPTH OF FOOTING AND FINAL PLANTING GRADE WITH LANDSCAPE ARCHITECT.
2. SLAB AND GRADE BEAM REINFORCEMENT NOT SHOWN FOR CLARITY.

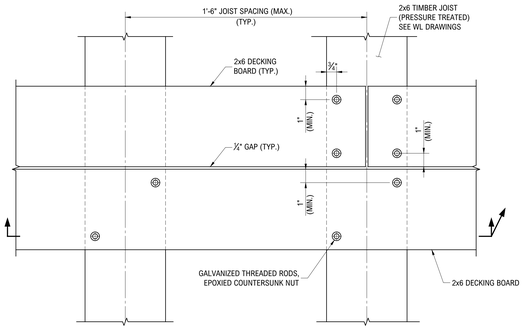


E HANDRAIL BASE
WSS-503 — 1-1/2" = 1'-0"

NOTE:
1. SLAB AND GRADE BEAM REINFORCEMENT NOT SHOWN FOR CLARITY.



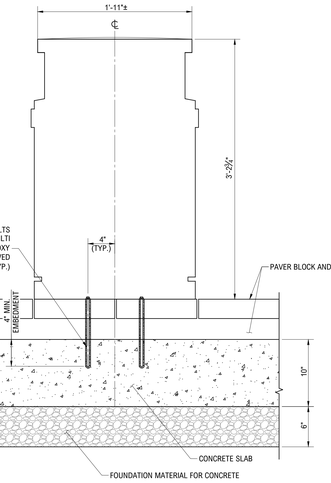
WOOD DECKING SECTION



WOOD DECKING PLAN

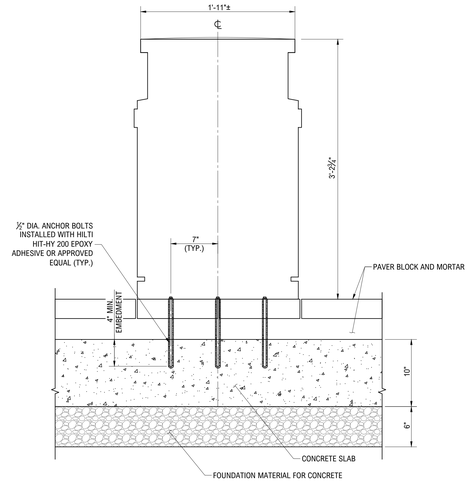
F TIMBER DECK BOARD PART PLAN
WSS-503 — 3" = 1'-0"

NOTE(S):
1. ALL DECK BOARDS TO BE PRE-DRILLED PRIOR TO FIXING.



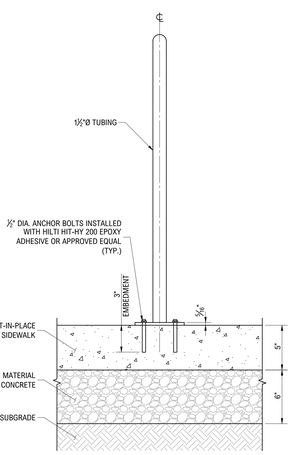
G TRASH RECEPTACLE ANCHORAGE SIDE ELEVATION
WSS-503 — 1-1/2" = 1'-0"

NOTES:
1. CONTRACTOR IS RESPONSIBLE FOR COORDINATING SLAB-ON-GRADE SURFACE FINISH WITH LANDSCAPE ARCHITECT.
2. CONTRACTOR IS RESPONSIBLE FOR COORDINATING WITH MANUFACTURER FOR PRODUCT ANCHORAGE DETAILS.



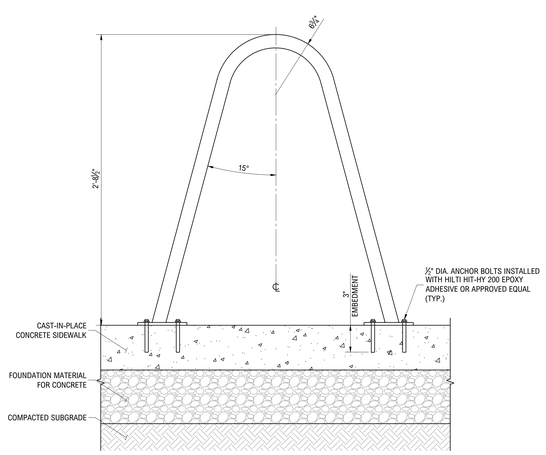
H TRASH RECEPTACLE ANCHORAGE FRONT ELEVATION
WSS-503 — 1-1/2" = 1'-0"

NOTES:
1. CONTRACTOR IS RESPONSIBLE FOR COORDINATING SLAB-ON-GRADE SURFACE FINISH WITH LANDSCAPE ARCHITECT.
2. CONTRACTOR IS RESPONSIBLE FOR COORDINATING WITH MANUFACTURER FOR PRODUCT ANCHORAGE DETAILS.



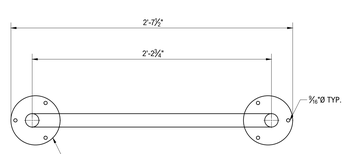
J BICYCLE RACK ANCHORAGE SECTION
WSS-503 — 2" = 1'-0"

NOTE:
1. BICYCLE RACK TO BE INSTALLED PER MANUFACTURER'S GUIDELINES.



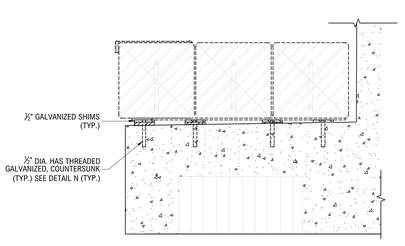
K BICYCLE RACK ANCHORAGE SECTION
WSS-503 — 2" = 1'-0"

NOTE:
1. BICYCLE RACK TO BE INSTALLED PER MANUFACTURER'S GUIDELINES.

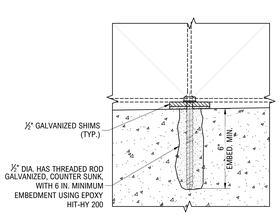


L BICYCLE RACK ANCHORAGE PLAN VIEW
WSS-503 — 2" = 1'-0"

NOTE:
1. BICYCLE RACK TO BE INSTALLED PER MANUFACTURER'S GUIDELINES.



M PERCH BENCH THREADED ROD EMBEDMENT DETAIL
WSS-503 — 1-1/2" = 1'-0"



N THREADED ROD EMBEDMENT DETAIL
WSS-503 — 6" = 1'-0"

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DOB # BO0539478-S7

lendlease

OWNER:
1 JAVA OWNER LLC
200 PARK AVE, 9TH FL., NEW YORK, NY 10166

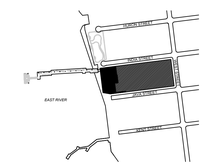
McLaren ENGINEERING GROUP
M. G. McLaren Engineering and Land Surveying P.C.
530 Chestnut Ridge Road
Woodcliff Lake, NJ 07677
T: 201.775.6000 www.mgmclaren.com

LANDSCAPE ARCHITECT:
JAMES CORNER FIELD OPERATIONS
475 10TH AVE, 9TH FLOOR, NEW YORK, NY 10018

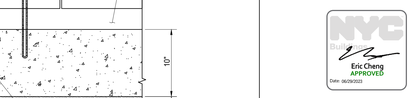
CONSULTANTS:

FOR REFERENCE:
MARVEL ARCHITECTS (ARCHITECT)
145 HUDSON STREET, NEW YORK, NY 10013
ONE LUX STUDIO (LIGHTING DESIGNER)
158 W. 29TH ST., 10TH FL., NEW YORK, NY 10001
LANGAN (CIVIL R.O.W.)
360 W 31ST STREET, 8TH FL., NEW YORK, NY 10001
OLA ENGINEERS (WATERFRONT ELECTRICAL)
8 W 38TH ST., SUITE 501, NEW YORK, NY 10018
CRAUL LAND SCIENTISTS (SOILS)
282 WHITEMAN DRIVE, CENTRE HALL, PA 16828
NORTHERN DESIGNS LLC (IRRIGATION)
2089 HARTFORD TPKE, NORTH HAVEN, CT 06473

KEY PLAN:



SEAL:



JAMES CORNER
REG. NO.: **LA6667253**

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REVISION / ISSUANCE

NO.	DESCRIPTION	DATE

PROJECT NAME:
01 JAVA STREET
1 JAVA STREET
BROOKLYN, NY 11211
JOFO PROJ.#
1714
PROJECT PHASE:
CONSTRUCTION DOCUMENTS

DESIGNED BY: CMS
DRAWN BY: EHC
CHECKED BY: VCC

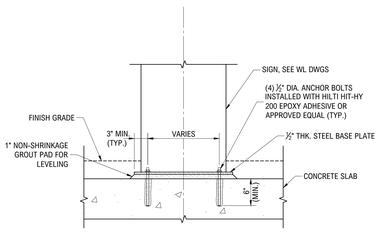
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VERT: AS NOTED
HORZ: AS NOTED

SHEET TITLE
Typical Details - 3
SHEET NUMBER
WSS-503.00

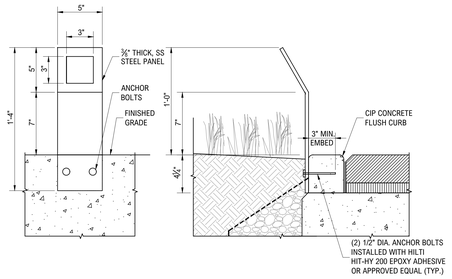
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ORIGINAL SHEET SIZE: 36" X 48"

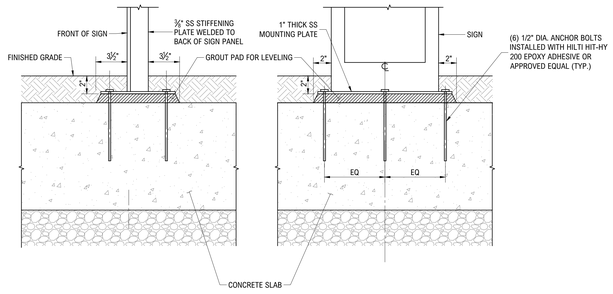
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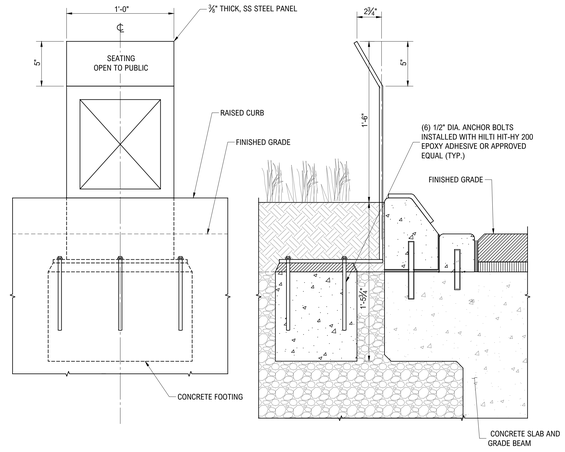
A TYPICAL SIGNAGE CONNECTION DETAILS
WSS-504 — 1" = 1'-0"



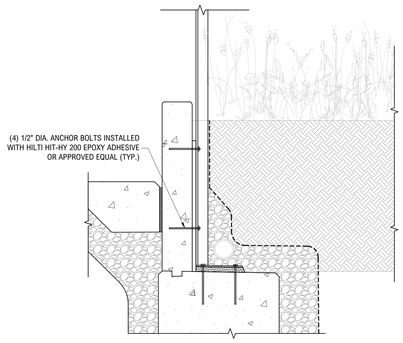
B QR CODE SIGN
WSS-504 — 2" = 1'-0"



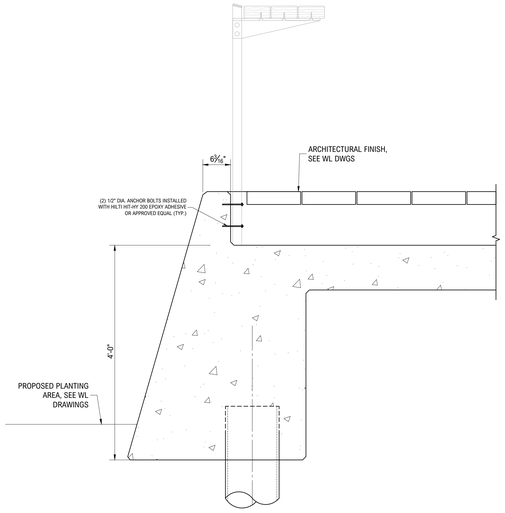
C SIGNAGE FOOTING
WSS-504 — 2" = 1'-0"



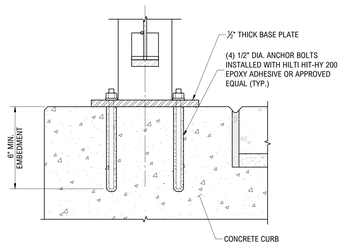
D SEATING OPEN TO PUBLIC SIGN
WSS-504 — 2" = 1'-0"



E WATERFRONT OPEN TO PUBLIC SIGN [S1A]
WSS-504 — 1-1/2" = 1'-0"



F GUARDRAIL WITH TABLETOP ANCHORAGE DETAIL
WSS-504 — 1" = 1'-0"



G GUARDRAIL BASE
WSS-504 — 3" = 1'-0"

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FILE NAME: P:\Proj\2020\01069.02\10_Dwgs\CAD\0WSS-502 Typical Details-2.dwg PLOT TIME: Fri, 30 Sep 2022 - 4:02pm LAST SAVE: Fri, 30 Sep 2022 - 3:58pm BY: ezhu

lendlease

OWNER:
1 JAVA OWNER LLC
200 PARK AVE, 9TH FL., NEW YORK, NY 10166

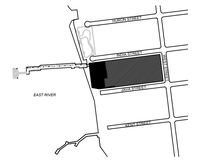
McLaren ENGINEERING GROUP
M. G. McLaren Engineering and Land Surveying P.C.
530 Chestnut Ridge Road
Woodcliff Lake, NJ 07677
T: 201.775.6000 www.mgmclaren.com

LANDSCAPE ARCHITECT:
JAMES CORNER FIELD OPERATIONS
475 10TH AVE, 9TH FLOOR, NEW YORK, NY 10018

CONSULTANTS:

FOR REFERENCE:
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282 WHITEMAN DRIVE, CENTRE HALL, PA 16828
NORTHERN DESIGNS LLC (IRRIGATION)
2089 HARTFORD TPKE, NORTH HAVEN, CT 06473

KEY PLAN:



SEAL:

NYC DOB
Eric Cheng
APPROVED
DATE: 06/29/2023

JAMES CORNER
REG. NO: **LA6667253**

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REVISION / ISSUANCE

NO.	DESCRIPTION	DATE

PROJECT NAME:
01 JAVA STREET
1 JAVA STREET
BROOKLYN, NY 11211
JCFO PROJ.#
1714
PROJECT PHASE:
CONSTRUCTION DOCUMENTS

DESIGNED BY: CMS
DRAWN BY: EHC
CHECKED BY: VCC

SCALE — NORTH
VERT: AS NOTED
HORZ: AS NOTED

SHEET TITLE
Typical Details - 4
SHEET NUMBER
WSS-504.00

STATE OF NEW YORK · GRANT PAUL HATE · LICENSED PROFESSIONAL ENGINEER

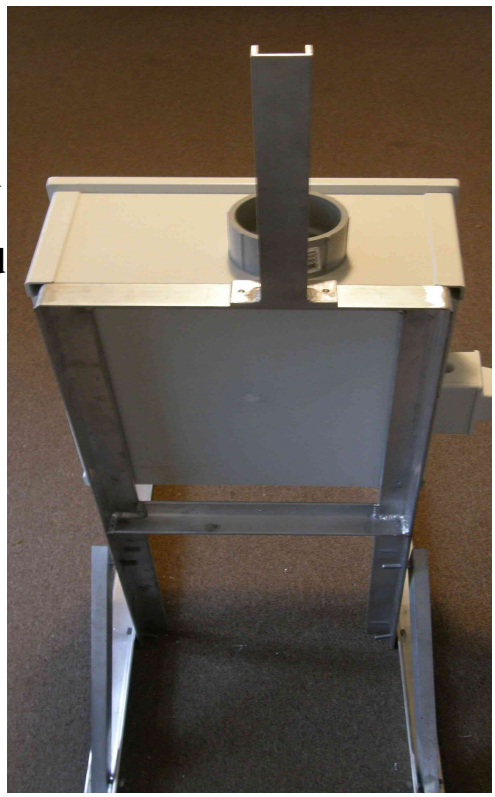
DOB # BOO539478-S7

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ORIGINAL SHEET SIZE: 30" X 48"

GBR ROOF MOUNT

The GBR Roof Mount is designed for the GBR series fans but can be adapted to accept other fans such as the Fantech HP series. Constructed of 3/16 x 1 ½ welded aluminum with stainless hardware the mount is ready for installation and does not require painting. . The mount measures 36" high, 17" wide and has a base of 40" x 17". There is an optional 12" extension to secure the discharge. The mount can be used with Pipe Pier mounts or fastened directly to curbing or other common supports.



GBR FAN MOUNT WITH GBR76 FAN



GBR FAN MOUNT WITH FANTECH ADAPTER



GBR FAN MOUNT WITH FANTECH FAN

2969 Route 23 South
Newfoundland, New Jersey 07435
800-949-OBAR
www.obarsystems.com

Operation and Maintenance for GBR Compact Radial Blowers 76SOE, 76UD, 89HA and GBR123

The GBR Series of compact radial blowers do not require any periodic maintenance or service under normal operation.

Information regarding built in protections that will automatically shut down blower operation:

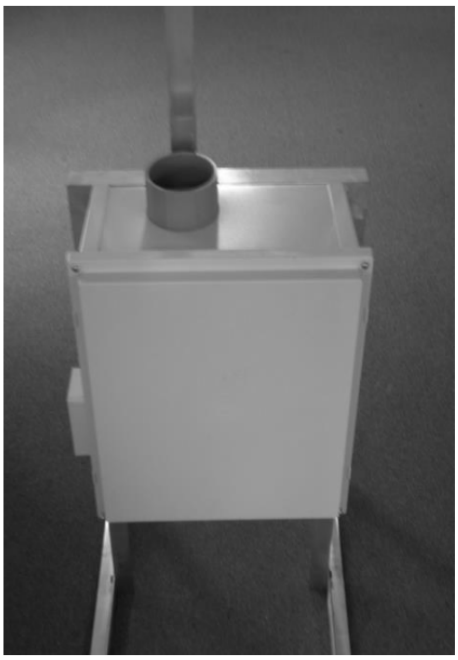
1) **Thermal Overload Protection: Extreme temperatures due to climate or over-speed operation may cause the blower to shut down to protect internal components. This can happen when internal temperatures exceed 60 degrees Celsius (140 F). Allow the blower time to cool and preform a manual restart (see below). If possible, the blower should be tuned to a lower speed to reduce the running temperatures. Vents can also be installed in blower enclosure if necessary.**
2) **Voltage Protection: In the event of a voltage spike or drop, unit will shut down to protect internal components. The building's electric service should be checked to ensure it is within the blower's operating range. Additionally, a voltage conditioner can be installed to ensure clean, constant voltage to the unit. In this case, a manual restart must be performed (see below).**
3) **Optical/Obstruction Sensor: If blower experiences a shutdown event due to a power loss and ice is allowed to form on impellers, the optical sensor will prevent a restart. Before attempting a restart (see below) ensure the impeller is free.**
4) **NOTE: It is necessary for the blower enclosure to maintain a water-tight seal. If unit has been serviced or disassembled for any reason, ensure both intake and discharge couplings have been resealed using Teflon tape and a bead of clear, waterproof silicone is reapplied where the discharge coupling meets the enclosure. Moisture in the housing can cause blower failure or shutdown due to a fogged optical sensor.**

Manual Restart Procedure: Disconnect power supply to the blower for at least 30 seconds to allow internal components to reset. Check voltage to ensure it is within blower's operating range. Check all electrical components to ensure proper connection is being made. Reconnect power supply to the blower unit.

It is recommended that these units be monitored by a pressure switch alarm adjusted to indicate a system failure at a vacuum specified by the installer. Alarms and remote monitoring solutions are available from Obar Systems.

THE OBAR GBR76
COMPACT RADIAL BLOWER

Based on 25 years of experience and 2 years of research and development, the patent pending GBR series of compact radial blowers provide the perfect combination of performance and design.



GBR76 WITH ROOF MOUNT

PERFORMANCE

- GBR76 SOE 16" WC @ 0 Max flow 155 CFM.
- GBR76 UD 40" WC @ 0 Max flow 195 CFM.
- Built in speed control to customize performance.
- Condensate bypass built in.
- 12 month warranty - 40,000 hr sealed bearings.

DESIGN

- Our modular design means the blower and manifold assembly can be removed and replaced as a unit. This makes repairs cost effective and easy and allows contractors to upgrade systems simply by swapping assemblies.
- The GBR series is based on a bypass blower designed to handle combustible materials.
- The housing is not required to be air tight, so you can add gauges and alarms without compromising the system.
- Built in condensate bypass.
- Built in speed control.
- Quick disconnect electrical harness.
- All UL listed components including UL listed enclosure for outside use.
- Wall fastening lugs included.
- GBR series roof and wall mounts available to quickly configure the blowers for your installation while providing a custom built look.
- Compact design 16"x 14"x 8" weighing only 18 lbs.
- 3" schedule 40 inlet and exhaust.
- Universal Drive model accepts voltage from 120-240V without alteration

OBAR SYSTEMS INC 2969 ROUTE 23 SOUTH NEWFOUNDLAND NJ 07435 800 949 6227

GBR76 SOE	0”	2”	4”	6”	8”	10”	12”	16”	Wattage
SOE 16	150	140	129	118	105	90	75	35	150-320
SOE 12	125	115	100	83	62	39	0		110-200
SOE 8	105	90	70	42	0				60-120
SOE 4	75	50	0						37-50

GBR SOE performance using built in potentiometer set at sealed vacuums of 16, 12, 8, and 4” WC

GBR76 UD	0”	10”	20”	30”	37”	Wattage
110V	195	158	118	63	20	700-870
220V	197	162	130	89	50	800-1100

Blower Specifications

GBR76 SOE

- **Input Voltage Range:** 108-132 Volts AC RMS, 50/60 Hz, single phase.
- **Input Current:** 6 amps AC RMS
- **Operating Temperature (Ambient Air and Working Air):** 0°C to 50°C
- **Storage Temperature:** -40°C to 85°C
- **Dielectric Testing:** 1500 Volts AC RMS 60 Hz applied for one second between input pins and ground, 3mA leakage maximum.
- **Speed Control Methods:** PWM (Pulse Width Modulation) (1 kHz to 10 kHz)
  0 to 10 VDC speed control.
  Mechanical: A potentiometer is available for speed control of the blower. The potentiometer can be preset for a specific speed. Access for speed adjustment located in motor housing.
- **Approximate Weight:** 4.8 Lbs. / 2.2 Kg
- **Regulatory Agency Certification:** Underwriters Laboratories Inc. UL507 Recognized under File E94403 and compliant under the CE Low Voltage Directive 2006/95/EC.
- **Design Features:** Designed to provide variable airflow for low NOx & CO emission in high efficiency gas fired combustion systems. Built with non-sparking materials. Blower housing assembly constructed of die cast aluminum. Impeller constructed from hardened aluminum. Rubber isolation mounts built into blower construction to dampen vibration within the motor. Two piece blower housing assembly sealed with O-ring gasket for combustion applications. Customer is responsible to check for any leakage once the blower is installed into the final application.
- **Miscellaneous:** Blower inlet, discharge, and all motor cooling inlet and discharge vents must not be obstructed. Motor ventilation air to be free of oils and other foreign particles, (i.e. breathing quality air). Blower is to be mounted so ventilation air cannot be re-circulated.
  POWER CONNECTION: Blower connector, AMP Universal MATE-N-LOK, part no. 1-350943-0.
  SPEED CONNECTION: Blower connector, Molex Mini-Fit Jr., part no. 39-30-3056.
  Mating harnesses available upon request.

GBR76 UD

- **Input Voltage Range:** 100-240 Volts AC RMS, 50/60 Hz, single phase.
- **input Current:** 10 amps AC RMS
- **Operating Temperature (Ambient Air and Working Air):** 0°C to 50°C
- **Storage Temperature:** -40°C to 85°C
- **Dielectric Testing:** 1800 Volts AC RMS 60 Hz applied for one second between input pins and ground, 3mA leakage maximum.
- **Speed Control Methods:** Mechanical- A potentiometer is provided for speed control of the blower. The potentiometer can be preset for specific speed. Access for speed adjustment located inside motor housing.
- **Approximate Weight:** 4.8 Lbs. / 2.2 Kg
- **Regulatory Agency Certification:** Underwriters Laboratories Inc. UL507 Recognized under FIle E94403 and compliant under the CE Low Voltage Directive 2006/95/EC.
- **Design Features:** Designed to provide variable airflow for low NOx & CO emission in high efficiency gas fired combustion systems. Built with non-sparking materials. Blower housing assembly constructed of die cast aluminum. Impeller constructed from hardened aluminum. Rubber isolation mounts built into blower constuction to dampen vibration within the motor. Two piece blower housing assembly sealed with O-ring gasket for combustion applications. Customer is responsible to check for any leakage once the blower is installed into the final application. **Additional Design Features:** (1) PCB coated with silicone. (2) Both bearings utilizing light contact seals. (3) Stainless steel components in working air compartment; ie shaft, washer and nut for securing the impeller, and stainless bearing thrust washer.

- **Miscellaneous:** Blower inlet, discharge, and all motor cooling inlet and discharge vents must not be obstucted. Motor ventilation air to be free of oils and other foreign particles (i.e. breathing quality air). Blower to be mounted so ventilation air cannot be re-circulated.

POWER CONNECTION: Blower connector, AMP Universal MATE-N-LOK, part no. 350767-1 mates with customer supplied AMP connector, (PN#350766-1) with female terminals. PN#350536-3 or equivalent on 16GA, 600V rated wire
GROUND LEAD: Amp pin terminal (350547-1) on green/yellow 18 GA. 105ºC, 600V rated wire.

Enclosure Specifications

Ratings:

Ingress Protection (EN 60529): 66/67

Electrical insulation: Totally insulated

Halogen free (DIN/VDE 0472, Part 815): yes

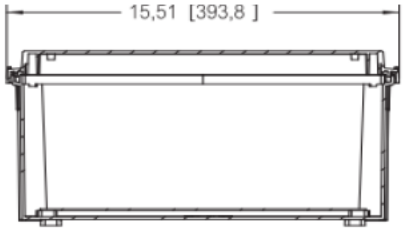
UV resistance: UL 508

Flammability Rating (UL 746 C 5): complies with UL 508

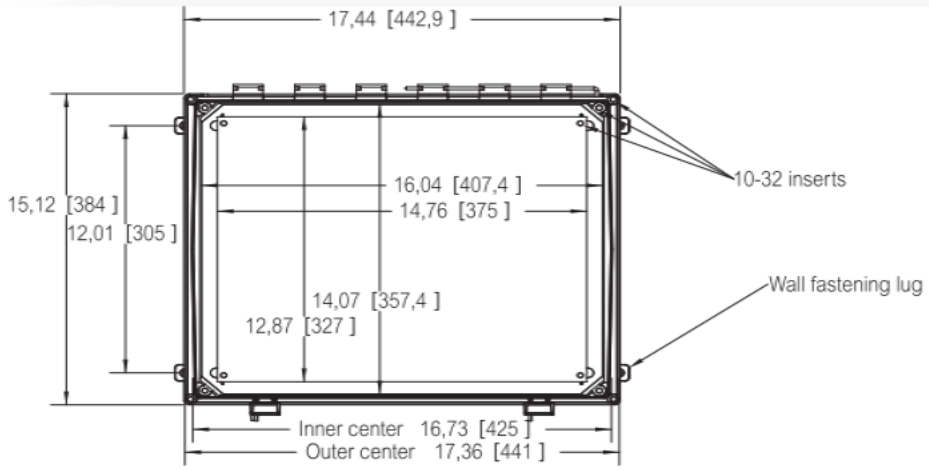
Glow Wire Test (IEC 695-2-1) °C: 960

NEMA Class: UL Type 4, 4X, 6, 6P, 12 and 13

Certificates: Underwriters Laboratories



Screw cover



Top View - cover removed

OBAR SYSTEMS INC 2969 ROUTE 23 SOUTH NEWFOUNDLAND NJ 07435 800 949 6227

Product Bulletin

Nautilair
7.6" 100-240V COMBUSTION BLOWER

GBR76UD

MECHANICAL
DIAMETER: 7.6" (193mm)
DISCHARGE TYPE: Tangential
DISCHARGE: Small Flange
APPROXIMATE WEIGHT: 4.8lbs/2,2kg

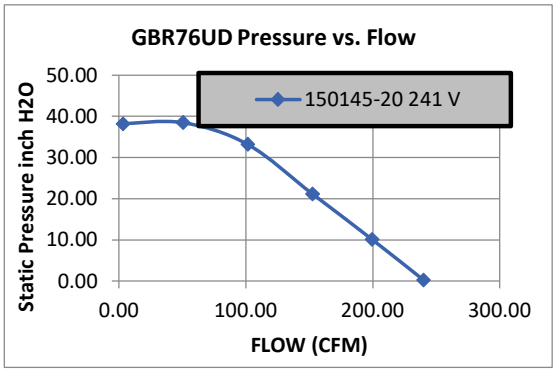
PERFORMANCE
FLOW CLASSIFICATION: High Output
STAGES: 1 stage

TEMPERATURE
OPERATING TEMP: 0°C to 50°C
CSTORAGE TEMP: -40°C to 85°C

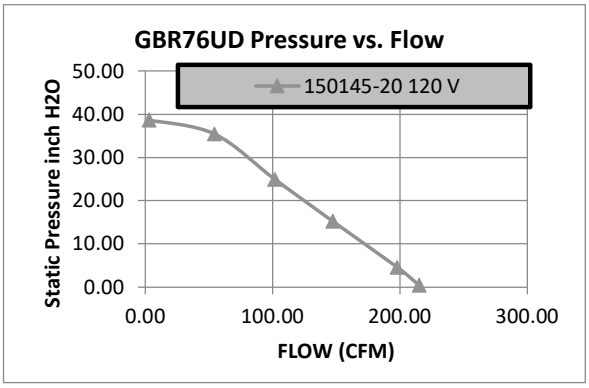
ELECTRICAL
OPERATING INPUT VOLTAGE RANGE: 101-265 VAC
OPERATING INPUT VOLTAGE: 120/240 VAC

FEATURES
SPEED CONTROL: 3 Pin Power connection, 5 Pin control Connection, Cloosed Loop

REGULATORY CERTIFICATIONS
COMPLIANCE: RoHS and Reach
UL FILE NUMBER: E94403
AGENCY FULL LOAD AMPS: 10



Flow Rate *cfm*	Total Pressure *inch H2O*	Current *A*	Power Demand *W*	Flow Temperature *°C*	Rotational Speed *rpm*	Total Efficiency *%*
240.00	0.75	10.44	1294.65	24.26	10750	1.65
199.48	10.43	10.45	1295.03	24.92	11100	19.07
152.52	21.33	10.43	1293.40	26.03	11950	29.94
101.36	33.30	10.43	1295.42	27.86	13370	31.16
50.38	38.48	8.40	1020.25	29.72	13950	22.83
3.19	38.17	5.78	688.30	25.87	13950	2.10



Flow Rate *cfm*	Total Vacuum *inch H2O*	Current *A*	Power Demand *W*	Flow Temperature *°C*	Rotational Speed *rpm*	Total Efficiency *%*
215.13	0.81	11.72	949.20	22.14	9740	2.17
197.92	4.89	11.76	948.50	22.68	9870	12.04
147.30	15.40	11.75	951.10	23.76	10630	28.22
101.81	25.05	11.69	953.16	25.10	11800	31.76
54.33	35.48	11.61	960.28	27.22	13400	23.96
2.98	38.66	8.82	668.23	23.46	14000	2.04

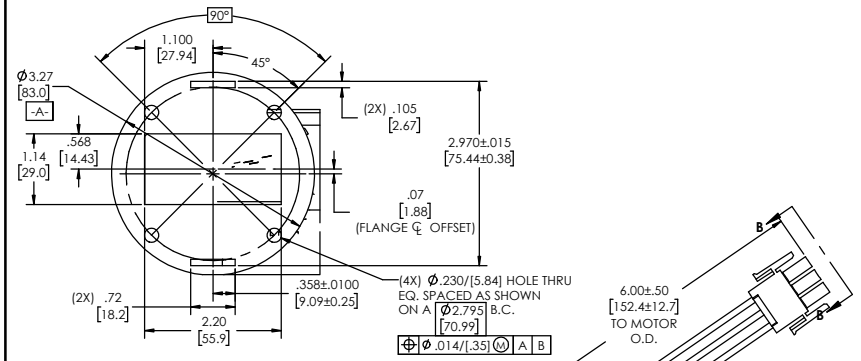
Performance data is for reference only

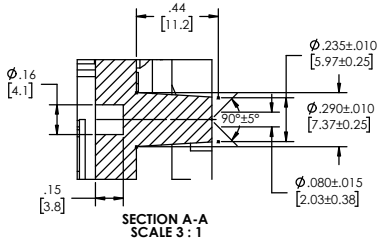
DWG NO: 150145-20-0 REV: C

NOTES:
1. ALL INTAKE, EXHAUST, COOLING DUCTS AND VENTS MUST NOT BE OBSTRUCTED BY MOUNTING.
2. MOTOR VENTILATION AIR TO BE FREE OF OILS AND OTHE FOREIGN PARTICLES, (I.E. BREATHING QUALITY AIR) MOTOR TO BE MOUNTED SO THAT MOTOR VENTILATION AIR CANNOT RECIRCULATE.
3. POWER CONNECTION: BLOWER CONNECTOR, AMP UNIVERSAL MATE-N-LOK (PN#350766-1) MATES WITH CUSTOMER SUPPLIED AMP CONNECTOR, (PN#350767-1) WITH SOCKET TERMINALS, PN#350536-3 OR EQUIV. ON 16GA, 600V RATED WIRE.
4. GROUND LEAD: AMP PIN TERMINAL (350547-1) ON GREEN/YELLOW 18 GA. 105 °C, 600V RATED WIRE.
5. RoHS AND REACH COMPLIANCE. REFERENCE AMETEK ENVIRONMENTAL SPECIFICATION ES0010 FOR DETAIL.

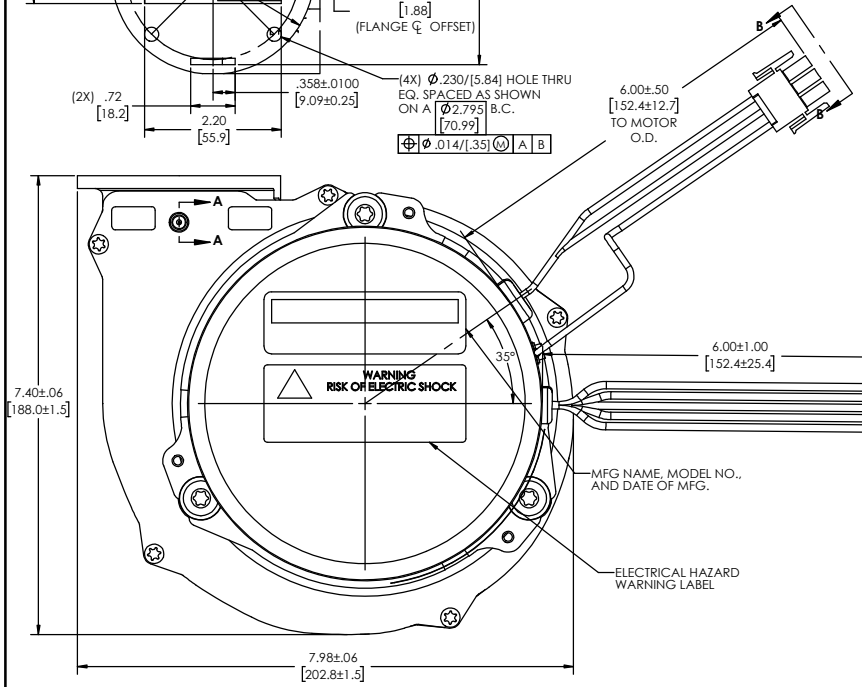
THIS PRODUCT HAS BEEN TESTED AND VALIDATED TO BE ACCEPTABLE IN OUR APPLICATION.

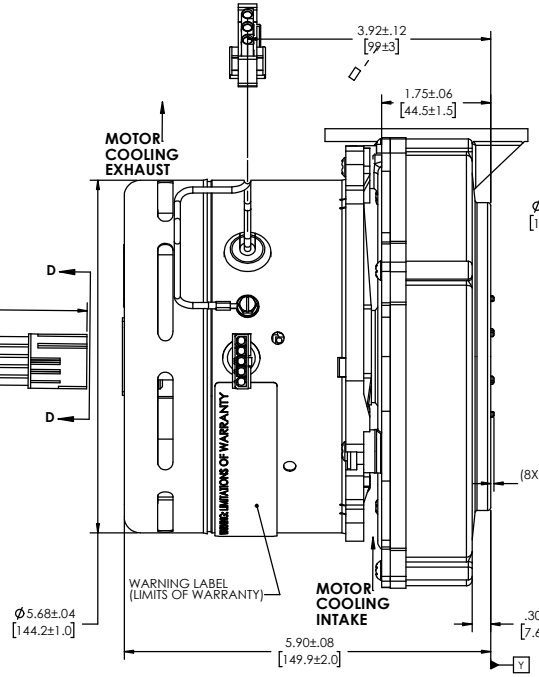
APPROVED BY:_____
PRINT NAME:_____
TITLE:_____
DATE:_____
COMPANY:_____

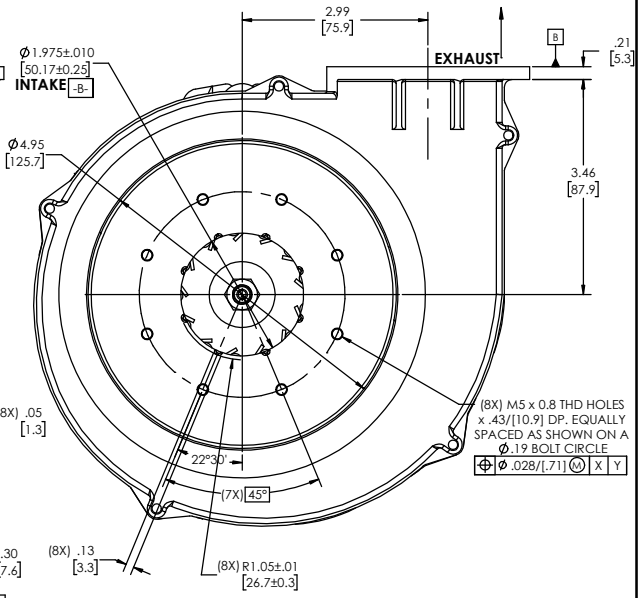


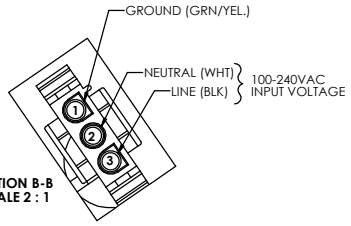


SECTION A-A
SCALE 3 : 1

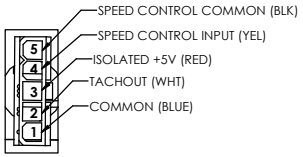




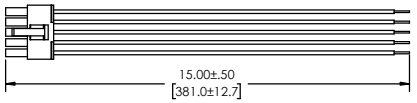


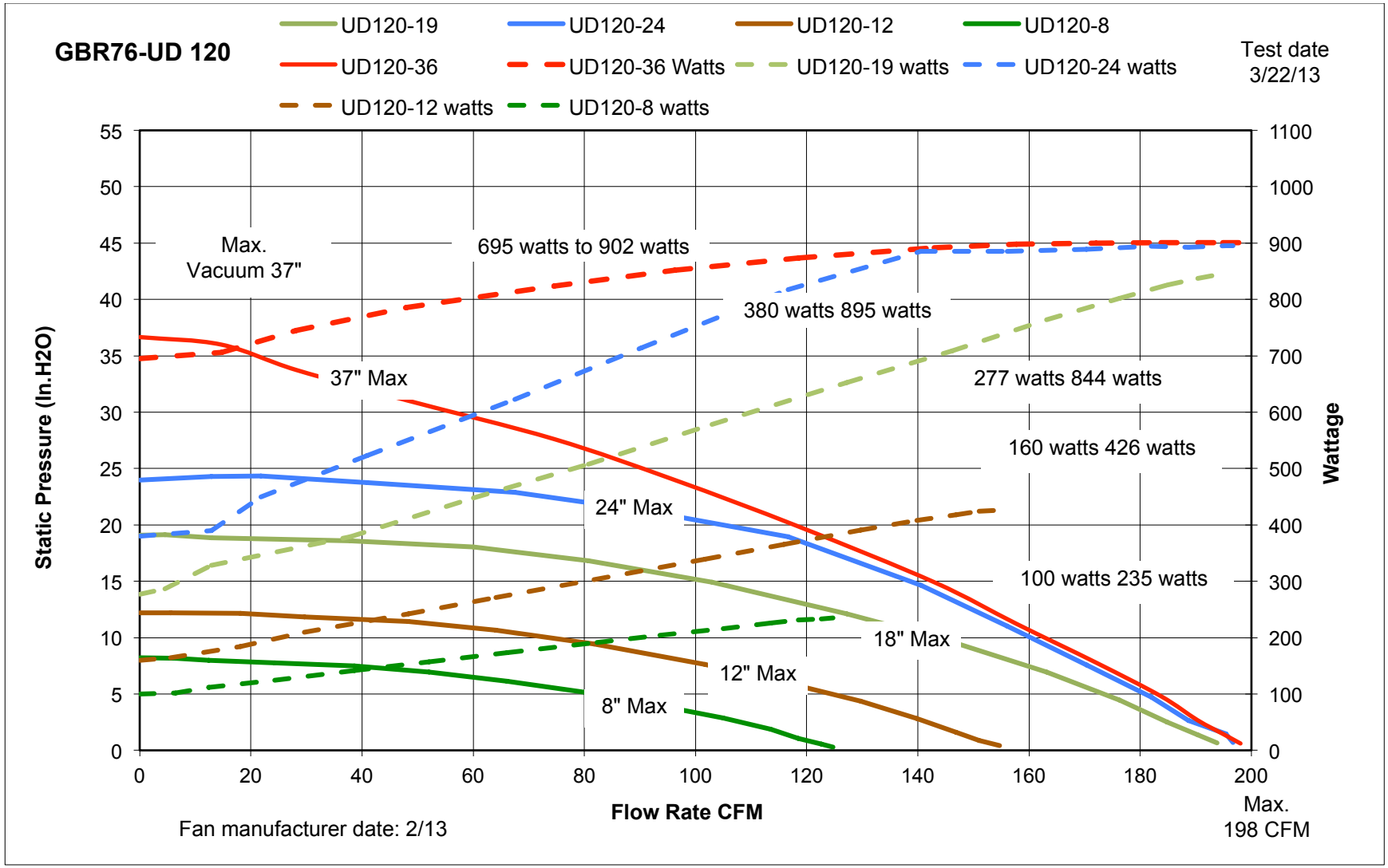


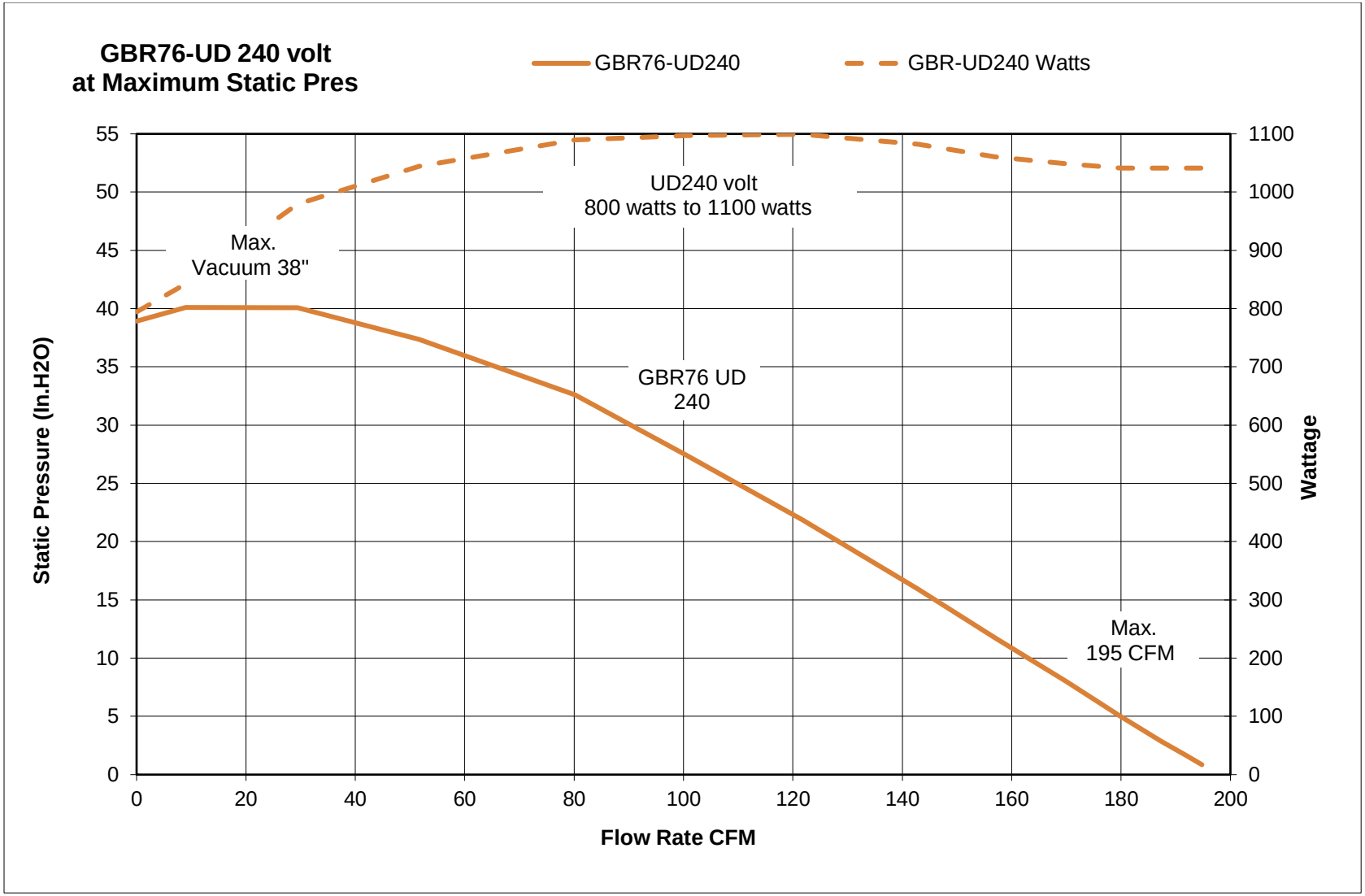
SECTION B-B
SCALE 2 : 1



VIEW D-D
SCALE 2 : 1




GBR76-UD 120
UD120-19
UD120-24
UD120-12
UD120-8
UD120-36
UD120-36 Watts
UD120-19 watts
UD120-24 watts
UD120-12 watts
UD120-8 watts
Test date
3/22/13
Max.
Vacuum 37"
695 watts to 902 watts
380 watts 895 watts
277 watts 844 watts
160 watts 426 watts
100 watts 235 watts
37" Max
24" Max
18" Max
12" Max
8" Max
Static Pressure (In.H2O)
Wattage
Flow Rate CFM
Max.
198 CFM
Fan manufacturer date: 2/13


GBR76-UD 240 volt
at Maximum Static Pres
GBR76-UD240
GBR-UD240 Watts
UD240 volt
800 watts to 1100 watts
Max.
Vacuum 38"
GBR76 UD
240
Max.
195 CFM
Static Pressure (In.H2O)
Wattage
Flow Rate CFM
0
5
10
15
20
25
30
35
40
45
50
55
0
100
200
300
400
500
600
700
800
900
1000
1100
0
20
40
60
80
100
120
140
160
180
200

Distributed by Obar Systems

Installation & Warranty

Read these instructions completely and retain for future reference.

1. Warning! The use of this fan may affect combustion devices, always check for a backdraft on all combustion devices before and after installation.
2. Warning! This fan is not intended for use in hazardous environments where a motor spark could ignite combustible or flammable materials.
3. All wiring must be performed by a licensed electrical contractor in accordance with the National Electrical Code and all local and state codes governing the municipality in which it is installed.
4. The GBR series blowers are intended for use and installation by professionals familiar with installation and design of systems for the remediation of radon and volatile organic compounds. Unqualified or unlicensed individuals should not undertake the installation or service of this product.

INSTALLATION

The installation instructions provided are for guidance only, any installation should meet all state and local codes and guidelines.

1. Temperature restrictions: The GBR SOE/UD will run and start in a temperature range from -20 to 180 degrees F. The GBR HA will run at a temperature of -20 to 180 degrees F but may not start if the motor temperature is below 0 degrees F at time of startup.
2. Ground water restrictions: The blower should not be installed at a height above water table that is less than the vacuum setting for the blower, if the water table is unknown then the base of the slab should be used as a default. The GBR series is a high vacuum blower and will draw water into the assembly and damage the impeller and motor if not properly installed.
3. Speed control: The GBR series blowers have a built in speed control that can be used to field adjust the vacuum on your system. These should only be adjusted by an experienced installer familiar advanced systems design and installation. For information regarding on site adjustments please contact Obar Systems for further information.
4. Enclosure: It is not recommended that the enclosure be opened except for repairs and adjustments. Contact Obar Systems before removing the cover.
5. Mounting: The fan should be mounted in a vertical orientation with the discharge pointing

upward. The inlet and discharge should be attached with a PipeConx or similar flexible connector of the appropriate size. The connector should provide a gap of 1.5 inches between the inlet pipe and inlet fitting and discharge pipe and discharge fitting. This will allow for motor assembly replacement in future repairs. The GBR comes with wall fastening lugs that provide for a flush installation on a flat even surface. Optional roof and wall mounts are available and are designed to reduce installation times dramatically. Contact Obar Systems for additional information on mounting systems. The fan should be located in an area that provides easy access and does not obstruct the operations of the building to which it is attached.

6. Discharge: Make sure the discharge meets or exceeds National guidelines and local codes for the installation and venting of Radon and or VOCs (Volatile Organic Compounds). In the event that there is the possibility of debris entering the discharge of the fan, it is recommended that a guard be installed to protect the blower from damage.

Warranty

Subject to any applicable consumer protection legislation, Obar Systems warrants the GBR series fans for 12 months from the date of purchase.

Obar systems will repair or replace any fan which fails due to defects in materials and workmanship. A RMA must be obtained and proof of purchase is required to be serviced by this warranty.

This warranty is contingent upon the fan having been installed as per the installation requirements set forth by Obar Systems and in accordance with the requirements of federal and state authorities governing the installation systems designed for radon and volatile organic compounds.

Obar systems is not responsible for the installation, removal or delivery costs associated with this warranty.

Except as stated, the GBR series are provided without warranty of any kind, either expressed or implied, including without limitation, implied warranties of merchantability and fitness for a particular use.

Obar systems is in no way responsible for any direct or indirect damages relating to the performance of the GBR series fan. Any liability shall not exceed the purchase price of the unit. The sole remedy under this warranty shall be the repair or replacement of the unit

Contact Obar Systems to obtain a RMA (Return Material Authorization) number for any and all warranties. If return is required, the customer is responsible for all freight charges.

Obar Systems Inc.
2969 Route 23 South
Newfoundland NJ 07435
800 949 6227

APPENDIX H

Quality Assurance Project Plan/Field Sampling Plan

Quality Assurance Project Plan/Field Sampling Plan

Greenpoint Ferry Site
1 Java Street
Brooklyn, New York 11222

July 29, 2025

Prepared for:

1 Java Owner LLC
200 Park Avenue, 9th Floor
New York, New York

Prepared by:

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

3583.0001Y181/CV

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& Management
+1.800.322.ROUX
rouxinc.com

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1. Introduction

Roux Environmental Engineering and Geology, D.P.C. (Roux), on behalf of 1 Java Owner LLC (referred to herein as the Volunteer), has prepared this Quality Assurance Project Plan/Field Sampling Plan (QAPP/FSP) to describe the measures that will be taken to ensure the data generated under the Site Management Plan (SMP) for the 1 Java Street Development Project located at 1 Java Street, Brooklyn, New York (Site) are of quality sufficient to meet project-specific data quality objectives (DQOs). This QAPP/FSP also includes field sampling procedures.

The Site is enrolled in the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP). Site Number C224272 is assigned to the Site. This QAPP/FSP was prepared in accordance with the guidance provided in NYSDEC Technical Guidance DER-10 Technical Guidance for Site Investigation and Remediation (DER-10), the NYSDEC BCP Guide, and the United States Environmental Protection Agency's (USEPA's) Guidance for the Data Quality Objectives Process (EPA QA/G 4).

1.1 Purpose

The QAPP/FSP describes in detail the field sampling and quality assurance/quality control (QA/QC) methods to be used during sampling activities that may be required during implementation of the SMP.

This QAPP/FSP was prepared in accordance with the NYSDEC's DER-10 and provides guidelines and procedures to be followed by field personnel during performance of sampling during the remediation and site management phase. Information contained in this QAPP/FSP relates to:

- Sampling objectives (Section 2);
- Project organization (Section 3);
- Sample media, sampling locations, analytical suites, sampling frequencies, and laboratory analysis (Section 4);
- Field sampling procedures (Section 5);
- Sample handling, sample analysis, and quality assurance/quality control (Section 6); and
- Site control procedures and decontamination (Section 7).

2. Sampling Objectives

The sampling program is designed to meet the data quality objectives (DQOs) set forth in DER-10. Specifically, the potential sampling objectives for this Site are:

- Analyze soil designated for offsite disposal for parameters required by the selected disposal facility;
- Analyze imported backfill/on-Site reuse soil to evaluate its suitability for use as backfill that meets the Restricted Residential SCOs the latest revision of Title 6 of New York Code of Rules and Regulations (NYCRR) Part 375 (Part 375) for those portions of the Site with a Track 4 Restricted Residential remedy.
- Analyze post-remediation groundwater samples for volatile organic compounds (VOCs), semi volatile organic compounds (SVOCs), metals, polychlorinated biphenyls (PCBs), and pesticides with comparison to the NYSDEC Ambient Water-Quality Standards and Guidance Values (AWQSGVs).
- Analyze sub-slab and indoor air samples to evaluate the performance of the SSDS.

Sampling procedures are discussed in Section 5 of this QAPP/FSP. A discussion of the DQOs and quality assurance/quality control is provided in Section 6.

3. Project Organization

A general summary of the overall management structure and responsibilities of project team members are presented below. Professional resumes are included as Appendix A.

Project Principal

Mr. Robert Kovacs, P.G., LSRP, of Roux will serve as Project Principal. The Project Principal is a New York State licensed professional geologist. The Project Principal is responsible for defining project objectives and bears ultimate responsibility for the implementation of the SMP activities.

Remedial Engineer

The Remedial Engineer for this project will be Mr. Paul Martorano, P.E. The Remedial Engineer is a registered professional engineer licensed by the State of New York. The Remedial Engineer will have primary direct responsibility for implementation of the SMP and future remedial program for the Site. The Remedial Engineer will certify that the SMP activities were observed by qualified environmental professionals under their supervision as well as any other relevant provisions of ECL 27-1419 have been achieved in full conformance with the SMP.

Project Manager

Brooke Hildebrand of Roux will serve as Project Manager. The Project Manager is responsible for defining project objectives and bears ultimate responsibility for the successful completion of the work. This individual will provide overall management for the implementation of the scope of work and will coordinate all field activities. The Project Manager is also responsible for data review/interpretation and report preparation.

Field Team Leader

The Field Team Leader will be determined prior to the start of the remedial work. The Field Team Leader bears the responsibility for the successful execution of SMP activities. The Field Team Leader will direct the activities of the technical staff in the field, as well as all subcontractors. The Field Team Leader will also assist in the interpretation of data and in report preparation. The Field Team Leader reports to the Project Manager.

Laboratory Project Manager

The Laboratory Project Manager will be determined prior to the start of the work. The Laboratory Project Manager is responsible for sample container preparation, sample custody in the laboratory, and completion of the required analysis through oversight of the laboratory staff. The Laboratory Project Manager will ensure that quality assurance procedures are followed, and an acceptable laboratory report is prepared and submitted. The Laboratory Project Manager reports to the Project Principal and Project Manager.

Quality Assurance Officer

Robert Kovacs, P.G., LSRP of Roux will serve as the Quality Assurance Officer (QAO) for this project. The QAO is responsible for conducting reviews, inspections, and audits to ensure that the data collection is conducted in accordance with the FSP and QAPP. The QAO's responsibilities range from ensuring effective field equipment decontamination procedures and proper sample collection to the review of all laboratory analytical data for completeness and usefulness. The QAO reports to the Project Manager and makes independent recommendations to the Field Team Leader.

4. Sample Media, Locations, Analytical Suites, and Frequency

This section provides a detailed discussion of the field procedures to be used during sampling of groundwater under the SMP. Additional details regarding sampling procedures and protocols are described in Roux's relevant Standard Operating Procedures (SOPs), which are provided in Appendix B. The types of containers, volumes, and preservation techniques for the aforementioned testing parameters are presented in Table 1.

4.1 Documentation Soil Sampling

Documentation samples include the proposed samples to be collected during any future construction or excavation. The proposed samples to be collected are described below.

Bottom Sampling

If required for any future excavation work in the Track 4 Restricted Residential portions of the Site, bottom documentation sampling will be conducted at a frequency of one sample per approximately 900 square feet of excavation area. The frequency of bottom sampling proposed for this alternative is in accordance with guidance provided in NYSDEC DER-10 5.4 for excavations 20 to 300 feet in perimeter.

Sidewall Sampling

If required for any future excavation work in the Track 4 Restricted Residential portions of the Site sidewall sampling will be conducted at a frequency of one sample per 30 linear feet of sidewall. The sidewall samples will be biased toward any observed impacts (i.e., staining, odor, elevated photoionization detector [PID] readings). If no impacts are observed, the sidewall samples will be collected at half the excavation depth). The frequency of sidewall sampling proposed for this alternative is consistent with guidance provided in NYSDEC DER-10 5.4.

Analytical Sampling Parameters

The bottom and sidewall documentation samples will be tested for the TCL/Part 375 plus 30/ TAL (TCL + 30/TAL) list of parameters including:

- TCL/Part 375 VOC + 10 Tentatively identified compounds (TICs);
- TCL/Part 375 Base neutral acids (BNA)/SVOCs + 20 TICs;
- TCL/Part 375 Pesticides;
- TCL/Part 375 Herbicides;
- TCL/Part 375 PCBs;
- TAL/Part 375 Metals (including hexavalent chromium);
- Total Cyanide; and
- Emerging Contaminants *

*ECs list includes 1,4-Dioxane as well as the 40 Per- and Polyfluoroalkyl Substances (PFAS) listed in the most recent April 2023 NYSDEC guidance *Sampling, Analysis, and Assessment of Per-and Polufluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs* (NYSDEC April 2023 Guidance), included as appendix C to this QAPP/FSP. 1,4-Dioxane in soil will be analyzed by USEPA Method 8270D. PFAS in soil will be analyzed by Draft USEPA Method 1633a. The 40 PFAS are shown in the table below:

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonic acids	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluoropentanesulfonic acid	PFPeS	2706-91-4
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanesulfonic acid	PFOS	1763-23-1
	Perfluorononanesulfonic acid	PFNS	68259-12-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
	Perfluorododecanesulfonic acid	PFDoS	79780-39-5
Perfluoroalkyl carboxylic acids	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUnA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTeDA	376-06-7
Per-and Polyfluoroether carboxylic acids	Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6
	4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
	Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1
	Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5
	Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6
Fluorotelomer sulfonic acids	4:2 Fluorotelomer sulfonic acid	4:2-FTS	757124-72-4
	6:2 Fluorotelomer sulfonic acid	6:2-FTS	27619-97-2
	8:2 Fluorotelomer sulfonic acid	8:2-FTS	39108-34-4
Fluorotelomer carboxylic acids	3:3 Fluorotelomer carboxylic acid	3:3 FTCA	356-02-5
	5:3 Fluorotelomer carboxylic acid	5:3 FTCA	914637-49-3
	7:3 Fluorotelomer carboxylic acid	7:3 FTCA	812-70-4
Perfluorooctane sulfonamides	Perfluorooctane sulfonamide	PFOSA	754-91-6
	N-methylperfluorooctane sulfonamide	NMeFOSA	31506-32-8
	N-ethylperfluorooctane sulfonamide	NEtFOSA	4151-50-2
Perfluorooctane sulfonamidoacetic acids	N-methylperfluorooctane sulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethylperfluorooctane sulfonamidoacetic acid	N-EtFOSAA	2991-50-6
Perfluorooctane sulfonamide ethanols	N-methylperfluorooctane sulfonamidoethanol	MeFOSE	24448-09-7
	N-ethylperfluorooctane sulfonamidoethanol	EtFOSE	1691-99-2
Ether sulfonic acids	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (F-53B Major)	9Cl-PF3ONS	756426-58-1
	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor)	11Cl-PF3OUdS	763051-92-9
	Perfluoro(2-ethoxyethane) sulfonic acid	PFEESA	113507-82-7

4.2 Imported Backfill/On-Site Reuse Soil Sampling

For offsite backfill/on-Site reuse soil materials requiring chemical testing, the following samples shall be collected:

- One sample for pre-qualification chemical testing at the source location, including the following:
    1. Chemical testing shall be performed at a minimum for the parameters listed in Table 375-6.8(b) of the latest revision of Part 375. Samples will be analyzed by the following analytical methods: Herbicides by USEPA method SW-846 8151A; Pesticides and PCBs by USEPA methods SW-846 8081B/8082A; VOCs by USEPA method SW-846 8260C; SVOCs by USEPA method SW-846 8270D; Arsenic, barium, beryllium, cadmium, copper, cyanide, lead, manganese, nickel, selenium, silver, and zinc by USEPA method SW-846 6010D/6010C; Total mercury by USEPA method SW-846 7471B; Total chromium, hexavalent chromium, and trivalent

chromium by USEPA method SW-846 7196A; 1,4-Dioxane by USEPA method 8270D; and Per- and Polyfluoroalkyl Substances (PFAS) by Draft USEPA Method 1633a.

2. Backfill/on-Site reuse soil materials excluding those materials that do not require sampling as described below, shall meet criteria presented in Section 2.0.
3. Backfill/on-Site reuse soil materials that exceed the criteria presented in Section 2.0 shall not be imported to the Site without prior approval of the NYSDEC.
4. The backfill/on-Site reuse soil material will be free of extraneous debris or solid waste.
5. If the NYSDEC agrees that the material originated from a virgin source, then a minimum of one sample (i.e., the pre-qualification sample) will be collected and analyzed per source.

- If the source is not virgin, the sampling frequency will comply with DER-10 Table 5.4(e)10 shown below:

Table 5.4(e)10
Recommended Number of Soil Samples for Soil Imported To or Exported From a Site

Contaminant	VOCs	SVOCs, Inorganics & PCBs/Pesticides	
Soil Quantity (cubic yards)	**Discrete Samples**	**Composite**	**Discrete Samples/Composite**
0-50	1	1	3-5 discrete samples from different locations in the fill being provided will comprise a composite sample for analysis
50-100	2	1	
100-200	3	1	
200-300	4	1	
300-400	4	2	
400-500	5	2	
500-800	6	2	
800-1000	7	2	
➢ 1000	Add an additional 2 VOC and 1 composite for each additional 1000 Cubic yards or consult with DER		

*The source of the offsite fill/on-Site reuse soil must be documented by the supplier, including the location where the fill/on-Site reuse soil was obtained and a brief history of the site that is the source of the fill.

Samples of offsite backfill/on-Site reuse soil will be analyzed for the following parameters:

- Herbicides by USEPA method SW-846 8151A.
- Pesticides and PCBs by USEPA methods SW-846 8081B/8082A.
- VOCs by USEPA method SW-846 8260C.
- SVOCs by USEPA method SW-846 8270D.
- Arsenic, barium, beryllium, cadmium, copper, cyanide, lead, manganese, nickel, selenium, silver, and zinc by USEPA method SW-846 6010D/6010C.
- Total mercury by USEPA method SW-846 7471B.
- Total chromium, hexavalent chromium, and trivalent chromium by USEPA method SW-846 7196A.
- 1,4-Dioxane by USEPA method 8270D.
- Per- and Polyfluoroalkyl Substances (PFAS) by Draft USEPA Method 1633.

Laboratory reporting limits for each of the 40 PFAS in soil analyzed via USEPA Method 1633 range from 0.200 to 2.00 micrograms per kilogram (µg/kg) and the method detection limits (MDLs) range from 0.0080 to 0.0340 µg/kg. The laboratory reporting limit for 1,4-Dioxane in soil analyzed via USEPA Method 8270 SIM is 0.100 mg/kg and the MDL is 0.0289 µg/kg. The Eurofins TestAmerica Standard Operating

Procedures (SOPs) for completing ECs analysis and reporting limits/minimum detection limits for EC compounds are included in Appendix D.

The following materials may be imported, without chemical testing, to be used as backfill beneath pavement, buildings or as part of the site cover, provided that it contains less than 10 percent by weight material that would pass through a size 80 sieve and consists of:

- gravel, rock or stone, consisting of virgin material from a permitted mine or quarry; or
- recycled concrete or brick from a NYSDEC registered construction and demolition debris processing facility if the material conforms to the requirements of Section 304 of the 2002 New York State Department of Transportation Standard Construction and Materials Volume 1.

4.3 Groundwater Sampling

Groundwater sampling will be conducted as part of the SMP. The well locations are meant to provide post-treatment groundwater conditions upgradient and downgradient of the Site. The SMP calls for groundwater monitoring of one monitoring well upgradient of the Track 4 area and two monitoring wells downgradient of the Track 4 area. All well locations are shown on Figure 4 of the SMP and groundwater sampling procedures are outlined below in Section 5.1.

Groundwater samples will be collected from the monitoring wells and submitted for laboratory analysis for VOCs via EPA Method 8260D, SVOCs via EPA Method 8270E/8270E SIM, target analyte list (TAL) metals via EPA Method 6020B and 7470A, PCBs via EPA Method 8082A, and pesticides via EPA Method 8081B and compared to the NYSDEC AWQSGVs. Field parameters (e.g., pH, dissolved oxygen, oxidation-reduction potential [ORP], etc.) will also be collected using a water quality meter during purging prior to sample collection.

4.4 Air Sampling

Soil vapor sampling will be performed following post-remedial construction to assess the performance of the remedy. Soil vapor sampling will include collection of soil vapor samples from all seven soil vapor monitoring points, collection of co-located indoor air samples, and collection of an ambient air sample from the building exterior. The locations of the existing soil vapor monitoring points (SVMP-1 through SVMP-7) as shown on Figure 6 of the SMP. All indoor air and soil vapor samples will be collected in accordance with the October 2006 New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York (NYSDOH Guidance), updated February 2024. If results of the soil vapor samples collected from soil vapor monitoring points and collocated indoor air locations warrant monitoring or mitigation based on the NYSDOH Guidance, then the SMP will be updated, and routine sampling shall occur.

Region of Site	Sample Identification	Sample Location
Soil vapor Monitoring Points (SVMP-1 through 7)	The following locations will be sampled following post-remedial construction then as needed based on results: SVMP-1, SVMP-2, SVMP-3, SVMP-4, SVMP-5, SVMP-6, and SVMP-7.	Below foundation slab

Region of Site	Sample Identification	Sample Location
Indoor Air Co-located with SVMPs	The following locations will be sampled following post-remedial construction then as needed based on results: IA-1, IA-2, IA-3, IA-4, IA-5, IA-6 and IA-7.	Breathing Zone
Ambient Air Outside of Building	The following location will be sampled following post-remedial construction then as needed based on results: AA-1	Breathing Zone

To the extent practicable, indoor air samples will be placed in well-ventilated and open area typical of the normal working environment. All air samples will be analyzed at a NYSDOH Environmental Laboratory Approval Program-certified laboratory using USEPA Method TO-15 SIM for VOCs. All air samples will be collected using pre-cleaned (batch certified) 2.7-liter summa canisters with regulators calibrated to collect samples over an 8-hour period.

5. Field Sampling Procedures

This section provides a detailed discussion of the field procedures to be used during sampling of the various media being evaluated (i.e., soil/backfill and air). Additional details regarding sampling procedures and protocols are described in Roux's relevant Standard Operating Procedures (SOPs), which are provided in Appendix B.

5.1 Soil Sampling

Details for the collection of soil samples are provided below. Additional necessary precautions will be taken when sampling for ECs in the field, including but not limited to:

- Using the proper field clothing or personal protective equipment (i.e., no materials will contain Gore-Tex or Tyvek);
- Avoid sampling equipment components/containers making contact with aluminum foil, low density polyethylene (LDPE), glass, or polytetrafluoroethylene materials;
- Following PFAS field sampling guidelines (i.e., using sampling materials made from high density polyethylene [HDPE], silicon, or stainless steel and avoid using equipment containing Teflon and using sharpies, permanent markers, adhesives, and waterproof/plastic clipboards and notebooks); and
- Utilizing regular ice cubes for sample presevation and only Alconox for decontamination.

5.1.1 Soil Documentation Sampling

Soil documentation samples will be observed for lithology and evidence of contamination (e.g., staining, odors, and/or visible free product) and placed immediately thereafter into large Ziploc® bags for recording headspace using a PID. After a minimum of 15 minutes for equilibration with the headspace in the Ziploc® bag, each sample will be screened for organic vapors using a PID equipped with a 10.6 eV lamp. Samples for possible VOC analysis will be placed in a laboratory-supplied jar or encore sampler prior to screening, due to the potential for loss of VOCs through volatilization. These samples will be placed in the laboratory-supplied containers and shipped to the laboratory under chain of custody procedures in accordance with Roux's SOPs in Appendix B.

5.1.2 Offsite Backfill/On-Site Reuse Soil Sampling

All imported backfill/on-Site reuse soil material samples will be collected using pre cleaned stainless steel sampling tools (i.e., trowels, spatulas, etc.) or new Ziploc® bags. As noted above, waste characterization samples will be collected as required by the selected disposal facility. In general, where composite samples are required for waste characterization or offsite fill/on-Site reuse soil material samples, composite samples will be collected from a minimum of three locations across the stockpiled materials. The exception is for VOC samples, which will be collected as grab samples.

5.2 Groundwater Sampling

Groundwater samples from the one upgradient and two downgradient monitoring wells will be collected in accordance with frequency stated in the SMP. Prior to sampling, depth to water will be measured at each well using an electronic water level meter with an accuracy of +/ 0.01 feet. All wells will then be purged and sampled using a low-flow method. Purging and sampling will be performed consistent with USEPA low-flow sampling requirements. Additional details for the collection of groundwater samples are included in

the Roux SOPs in Appendix B. All groundwater samples will be placed in the laboratory-supplied containers and shipped to the laboratory under chain of custody procedures in accordance with Roux's SOPs.

5.3 Air Sampling

Air samples will be collected from seven soil vapor monitoring points, co-located indoor air locations, and one ambient air location to assess the performance of the remedy following post-remedial construction. To the extent practicable, indoor air sample canisters will be placed in a well-ventilated and open area typical of the normal working environment. All air samples will be collected using precleaned 2.7-liter summa canisters with regulators calibrated to collect samples over an 8-hour period and analyzed using USEPA Method TO-15 for VOCs.

6. Sample Handling and Analysis

To ensure quality data acquisition and collection of representative samples, there are selective procedures to minimize sample degradation or contamination. These include procedures for preservation of the samples, as well as sample packaging, shipping procedures, and QA/QC.

6.1 Field Sample Handling

A discussion of the proposed number and types of samples to be collected during each task, as well as the analyses to be performed, can be found in Section 4 of this QAPP/FSP. The types of containers, volumes, and preservation techniques for the aforementioned testing parameters are presented in Table 1.

6.2 Sample Custody Documentation

The purpose of documenting sample custody is to ensure that the integrity and handling of the samples is not subject to question. Sample custody will be maintained from the point of sampling through the analysis (and return of unused sample portion, if applicable).

Each individual collecting samples is personally responsible for the care and custody of the samples. All sample labels should be pre printed or filled out using waterproof ink. The technical staff will review all field activities with the Field Team Leader to determine whether proper custody procedures were followed during the field work and to decide if additional samples are required.

All samples being shipped offsite for analysis must be accompanied by a properly completed chain of custody form. The sample numbers will be listed on the chain of custody form. When transferring the possession of samples, individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to/from a secure storage area, and to the laboratory.

Samples will be packaged for shipment and dispatched to the appropriate laboratory for analysis with a separate signed custody record enclosed in each sample box or cooler. Shipping containers will be locked and/or secured with strapping tape in at least two locations for shipment to the laboratory.

6.3 Sample Shipment

If sample shipment is necessary, sample packaging and shipping procedures are based upon USEPA specifications, as well as DOT regulations. The procedures vary according to potential sample analytes, concentration, and matrix and are designed to provide optimum protection for the samples and the public. Sample packaging and shipment must be performed using the general outline described below.

All samples will be shipped within 24 hours of collection and will be preserved appropriately from the time of sample collection. A description of the sample packing and shipping procedures is presented below:

1. Prepare cooler(s) for shipment:
    - tape drain(s) of cooler shut;
    - affix “This Side Up” arrow labels and “Fragile” labels on each cooler; and
    - place mailing label with laboratory address on top of cooler(s).
2. Arrange sample containers in groups by sample number.

3. Ensure that all bottle labels are completed correctly. Place clear tape over bottle labels to prevent moisture accumulation from causing the label to peel off.
4. Arrange containers in front of assigned coolers.
5. Place packaging material approximately at the bottom of the cooler to act as a cushion for the sample containers.
6. Arrange containers in the cooler so that they are not in contact with the cooler or other samples.
7. Fill remaining spaces with packaging material.
8. Ensure all containers are firmly packed in packaging material.
9. If ice is required to preserve the samples, ice cubes should be repackaged in Zip-lock™ bags and placed on top of the packaging material.
10. Sign chain of custody form (or obtain signature) and indicate the time and date it was relinquished to courier as appropriate.
11. Separate chain of custody forms. Seal proper copies within a large Zip-loc™ bag and tape to inside cover of cooler. Retain copies of all forms.
12. Close lid and latch.
13. Secure each cooler using custody seals.
14. Tape cooler shut on both ends.
15. Relinquish to overnight delivery service as appropriate. Retain air bill receipt for project records. (Note: All samples will be shipped for "NEXT A.M." delivery).

6.4 Quality Assurance/Quality Control

The primary intended use for the SMP data is to confirm that remedial action objectives have been met for groundwater samples. The primary DQO of the sampling program, therefore, is that data be accurate and precise, thus, representative of the actual Site conditions. Accuracy refers to the ability of the laboratory to obtain a true value (i.e., compared to a standard) and is assessed through the use of laboratory quality control (QC) samples, including laboratory control samples and matrix spike samples, as well as through the use of surrogates, which are compounds not typically found in the environment that are injected into the samples prior to analysis. Precision refers to the ability to replicate a value and is assessed through both field and laboratory duplicate samples.

Sensitivity is also a critical issue in generating representative data. Laboratory equipment must be of sufficient sensitivity to detect target compounds and analytes at levels below NYSDEC standards and guidelines whenever possible. Equipment sensitivity can be decreased by field or laboratory contamination of samples, and by sample matrix effects. Assessment of instrument sensitivity is performed through the analysis of reagent blanks, near-detection-limit standards, and response factors. Potential field and/or laboratory contamination is assessed through use of trip blanks, method blanks, and equipment rinse blanks (also called "field blanks").

Table 1 lists the preservation, holding times and sample container information. Table 2 lists the requirements for field and laboratory QC samples that will be analyzed to assess data accuracy and precision, as well as to determine if equipment sensitivity has been compromised.

All SMP "assessment" analyses (i.e., TCL/Part 375 plus 30/ TAL) will be performed in accordance with the NYSDEC Analytical Services Protocol (ASP), using USEPA SW 846 methods. The laboratory selected to

analyze the field samples collected during implementation of the SMP shall maintain a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) Contract Laboratory Protocol (CLP) certification for each of the “assessment” analyses listed in Section 2.

All laboratory data are to be reported in NYSDEC ASP Category B deliverables and will be delivered to NYSDEC in electronic data deliverable (EDD) format as described on NYSDEC’s website (http://www.dec.ny.gov/chemical/62440.html) and recent updated procedures enacted in November 2018. A Data Usability Report will be prepared meeting the requirements in Section 2.2(a)1.ii and Appendix 2B of DER-10 for all data packages generated for the SMP.

7. Site Control Procedures

Site control procedures have been developed to minimize both the risk of exposure to contamination and the spread of contamination during field activities at the Site. In order to accomplish this objective, the QAPP addresses three main considerations:

- The establishment of discrete work zones during performance of the Work;
- The decontamination of field equipment; and
- The disposal of all waste.

All personnel who come into designated work areas, including contractors and observers, will be required to adhere strictly to the conditions imposed herein and to the provisions of a Site-Specific Health and Safety Plan (HASP). The HASP is included as Appendix E to the SMP.

7.1 Field Work Zones

Field work zones will be limited to areas where excavation, stockpiling, and soil sampling is being conducted. Access to these areas will be limited in accordance with the HASP. Control of work zone access will be the responsibility of the individual(s) designated as a Site Health and Safety Manager. At the completion of each work day, all loose equipment (e.g., sampling equipment, coolers, etc.) will be secured. Equipment will remain onsite within an established, secured zone.

7.2 Decontamination

To avoid the spread of contamination, all sampling equipment must be decontaminated at a reasonable frequency in a properly designed and located decontamination area. Detailed procedures for the decontamination of field and sampling equipment are included in Roux's SOPs for the Decontamination of Field Equipment located in Appendix B. The location of the decontamination area will be determined prior to the start of field operations. The decontamination area will be constructed to ensure that all wash water generated during decontamination can be collected and containerized for proper disposal.

7.3 Waste Handling and Disposal

All waste materials (cuttings, decontamination water, etc.) generated during implementation of the SMP will be consolidated, and stored in appropriate labeled bulk containers (drums, etc.), and temporarily staged at an investigation derived waste storage area on-site. Roux will then coordinate waste characterization and disposal by appropriate means.

TABLES

1. Preservation, Holding Times, and Sample Containers
2. Field and Laboratory QC Summary

Table 1. Field and Laboratory Quality Control Summary

QC Check Type	Minimum Frequency	Use
Field QC**		
Duplicate	1 per matrix per 20 samples or SDG*	Precision
Trip Blank	1 per VOC cooler	Sensitivity
Field Blank	1 per matrix per 20 samples	Sensitivity
PFAS Field Blank	1 per day when sampling for PFAS	Sensitivity
Laboratory QC		
Laboratory Control Sample	1 per matrix per SDG	Accuracy
Matrix Spike/Matrix Spike Duplicate/Matrix Duplicate**	1 per matrix per SDG	Accuracy/Precision
Surrogate Spike	All organics samples	Accuracy
Laboratory Duplicate	1 per matrix per SDG	Precision
Method Blank	1 per matrix per SDG	Sensitivity

* SDG - Sample Delivery Group - Assumes a single extraction or preparation
** Provided to lab by field sampling personnel
PFAS - Per- and Polyfluoroalkyl Substances
QC - Quality Control

Table 2. Sample Preservation, Holding Times, and Containers Summary

Analysis	Matrix	Bottle Type	Preservation(a)	Holding Time(b)
TAL Metals (total) SW-846 6020B/7471B/7470A	Soil Water	8 oz glass 250 mL plastic	Cool 4 ± 2°C Nitric acid	180 days, Hg 28 days
PFAS via EPA Method 1633	Soil Water	4 or 8 oz HDPE bottle Two 250 mL HDPE bottles	Cool 0-6°C Cool 0-6°C	14 days to extraction, 40 days from extraction to analysis 14 days to extraction, 40 days from extraction to analysis
1,4-Dioxane via 8270E SIM	Water	Two 250 mL amber glass	Cool 4 ± 2°C	7 days to extraction, 40 days from extraction to analysis
TO-15	Air	2.7 liter Summa Canister	None	30 days from sample collection
Target Compound List (TCL)				
TCL Volatile Organic Compounds (VOCs) SW-846 8260D	Soil	Three 5 gram Encores	Cool 4 ± 2°C	48 hours to extract, 14 days (from collection) to analysis
	Water	Three 40mL voa vials	Hydrochloric Acid	14 days from sample collection
TCL Semivolatile Organic Compounds (SVOCs) SW-846 8270E	Soil Water	8 oz glass Two 250 mL amber glass	Cool 4 ± 2°C	14 days to extract, 40 from extraction days to analysis 7 days to extract, 40 from extraction days to analysis
TCL Pesticides SW-846 8081B	Soil Water	8 oz glass Two 250 mL amber glass	Cool 4 ± 2°C	14 days to extract, 40 from extraction days to analysis 7 days to extract, 40 from extraction days to analysis
TCL Herbicides SW-846 8151A	Soil Water	8 oz glass Two 250 mL amber glass	Cool 4 ± 2°C	14 days to extract, 40 days from extraction to analysis 7 days to extract, 40 days from extraction to analysis
TCL Polychlorinated biphenyls (PCBs) SW-846 8082A	Soil Water	8 oz glass Two 250 mL amber glass	Cool 4 ± 2°C	14 days to extract, 40 days from extraction to analysis 7 days to extract, 40 days from extraction to analysis

(a) All soil and groundwater samples to be preserved in ice during collection and transport
(b) Days from date of sample collection.
HDPE - High Density Polyethylene
TAL - Target Analyte List
TCL - USEPA Contract Laboratory Program Target Compound List
USEPA - United States Environmental Protection Agency

APPENDICES

A. Professional Resumes
B. NYSDEC PFAS Guidance
C. Roux's Standard Operating Procedures
D. Laboratory's Standard Operating Procedures

APPENDIX A

Professional Resumes

ROUX

PROFESSIONAL PROFILE

Brooke Hildebrand

Staff Scientist

TECHNICAL SPECIALTIES

Phase I and II environmental site assessments; Remedial construction and soil excavation oversight; Hazardous and non-hazardous waste disposal oversight.

Soil import oversight, Waste characterization and delineation oversight; Environmental site assessments focusing on soil, groundwater, and soil vapor investigations using multiple sampling techniques; Drilling oversight; Implementation of Community Air Monitoring Programs (CAMP); Insurance litigation support.

EXPERIENCE SUMMARY

Three years of professional experience: Staff Scientist, Roux Environmental Engineering and Geology D.P.C., Islandia, New York.

CREDENTIALS

B.S. Environmental Science, Minor in Engineering, Binghamton University, 2019
A.S. Environmental Science, Suffolk County Community College, 2017
OSHA 40-Hour HAZWOPER Training, 2019
OSHA 30-hour Construction Safety Training, 2019
OSHA 8-hour Refresher Training, 2019-2021
OSHA 8-hour Fall Protection Training, 2020
OSHA 2-hour Drug & Alcohol Awareness Training, 2020
NYSDEC 4-Hour Erosion & Sediment Control Training, 2021
Loss Prevention System (LPS) 8-Hour Certified, 2019
First Aid and CPR Certified, 2021

KEY PROJECTS

- Authored and assisted with Phase I Environmental Site Assessment portfolios for 13 parcels of land located in the southern portion of Brooklyn, New York. Responsible for maintaining report integrity and compliance with ASTM E1527-13 standards. Maintained client expectations and delivered accurate results in a timely manner to satisfy tight due diligence deadlines. Provided recommendations to the client where Phase II investigations were warranted.
- Staff on an insurance litigation case regarding the evaluation of past and future costs for the investigation and remediation of a site with past railroad, wood treating, and drum reconditioning operations. Responsibilities included the review and organization of over 20,000 documents, past cost categorization, and report writing assistance.
- Field manager for the implementation of the On-Site Environmental Monitoring (OEM) Program at a 43-acre redevelopment project in Belmont, New York. Responsibilities included ensuring environmental compliance with regards to air, stormwater, noise, traffic, and other relevant environmental concerns during the performance of any construction-related activity across the Site.
- Field manager for a site in Sleepy Hollow, New York performing soil importation and fill operation activities. Responsibilities include implementation of CAMP; management of soil importation; preparation of daily progress reports submitted to the NYSDEC; onsite soil tracking; and oversight of fill operations using onsite and imported fill.
- Field Staff for groundwater and soil vapor sampling monitoring programs at a former petroleum refinery and terminal in Brooklyn, New York. This work was done to monitor the largest subsurface free-product plume in North America. Field work responsibilities included the sampling of over fifty wells and monitoring points for petroleum contaminated groundwater and soil vapor using multiple sampling methods.
- Field Manager responsible for the implementation of groundwater sampling activities at multiple locations including a high-end shopping mall site in Norwalk, Connecticut, and a Site in Brooklyn, New York.
- Field manager for NYSDEC BCP Site located in Gowanus neighborhood in Brooklyn, NY. Industrial Site history and proximity to Superfund Site Gowanus Canal requires a USEPA-approved remediation. Responsibilities included construction oversight, CAMP implementation, SWPPP, and groundwater sampling.
- Field manager responsible for air monitoring to collect interior air quality data during construction activities at a site in Hudson Yards, New York enrolled the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP). Roux implemented monitoring by utilizing 13 stationary 5-gas meters with telemetry and 2 roaming 5-gas meters, capable of measuring the following air quality parameters: oxygen, carbon monoxide, hydrogen sulfide, methane (as LEL) and organic vapors (VOCs). Responsibilities also included construction oversight, analyzing air monitoring data and preparing associated reporting daily.
- Field Manager responsible for environmental oversight of geotechnical work at a generating station in Astoria, New York. Responsibilities included monitoring and enforcing the subcontractor's adherence to specific procedures to prevent vertical migration of NAPL, logging and screening soil with a photo ionization detector (PID), recording lithology of soil cores, and confirming depths of clay layers and bedrock.
- Field Manager responsible for the implementation of CAMP during excavation, disposal, and import activities at multiple locations in Queens, Brooklyn and Upstate, New York. Monitored airborne dust and

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VOCs that are potentially generated by remedial action work activities, reviewing the collected data for exceedances of the New York State Department of Health (NYSDOH) guidelines.

- Site Safety Officer for various remedial investigation sites. Responsibilities include preparation of health and safety plans (HASPs); development and review of job safety analysis (JSA) documents; on-site safety meeting management; safety document preparation (Lessons Learned, Near Loss, Field Audits, etc.); and planning/ execution of corrective actions.

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JUDY V. HARRY
P. O. Box 208
120 Cobble Creek Rd.
North Creek, NY 12853

Occupation: Data Validator/Environmental Technical Consultant

Years Experience: 41

Education: B.S., Chemistry, Magna cum laude, 1976, Phi Beta Kappa

Certifications: New York State Woman-Owned Business Enterprise (WBE)

Relevant Work History:

Data Validation Services: September 1989 - present

Sole proprietor of Data Validation Services, a woman-owned small business registered with SAM, providing consultation/validation services to regulatory and commercial clients.

These services include the review of analytical laboratory data for compliance with respect to specific protocols, accuracy and defensibility of data, verification of reported values, and evaluation of quality parameters for analytical usability of results. Approved by USEPA, NYSDEC, NJDEP, NYSERDA, and NYCDEP as a data validator for projects, including USEPA Superfund, Brownfield, and lead sites, and those contracted through the NYSDEC Division of Hazardous Waste Remediation, Division of Solid Waste, and Division of Water Quality.

Performed validation for compliance with laboratory analytical protocols including USEPA OLM, USEPA OLC, USEPA ILM, USEPA DFLM, USEPA SOW3/90, USEPA SOW 7/87 CLP, USEPA SOW 2/88 CLP, USEPA SW846, RCRA, AFCEE, NYS 6 NYCRR Part 360, 40 CFR, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, including TO-15, 1989/1991/1995/2000/2005 NYSDEC ASPs, and 1987 NYSDEC CLP.

Performed validation according to the USEPA National and Regional SOPs and Functional Guidelines, AFCEE requirements, NYSDEC Validation Scope of Work, NYS DUSR, and NJDEP Division of Hazardous Site Mitigation/Publicly Funded Site Remediation SOPs.

Performed validation for USEPA Superfund Sites including Salem Acres, York Oil, Port Washington L-4 Landfill, Bridgeport Rental and Oil Services, GE-MRFA, MMR/ OTIS AFB, LCP, and Peter Cooper site; and for USEPA lead sites including SJ&J Piconne, Maska, Bowe System, Jones Sanitation, and Syossett Landfill, involving CLP, RAS, and SAS protocols.

Contracted for NYSDEC Superfund Standby Contracts with LMS Engineers, HDR, CDM Smith, Malcolm-Pirnie/ARCADIS, Ecology & Environment, Shaw Environmental, CG&I, O'Brien & Gere Engineers, and EC Jordan, involving samples collected at NYS Superfund Sites and analyzed under the NYSDEC ASP.

Performed validation services for NYSDEC Phase II remedial investigations, RI/FS projects, Brownfield sites, and PRP over-site projects for hazardous waste sites.

Performed validation services for clients conducting RI/FS activities involving samples of many matrices, including waste, air, sludges, leachates, solids/sediments, aqueous, and biota.

Clients have included AECOM, ARCADIS, Barton & Loguidice, Benchmark Engineering, Bergmann Associates, Blasland, Bouck & Lee, Brown and Caldwell, CDM Smith, CB&I Shaw Environmental, C&S Consulting Engineers, Chazen Companies, Clough Harbour & Associates, Columbia Analytical Services, C.T. Male, Dames & Moore, Day Engineering, EA Engineering, EcolSciences, Ecology & Environment, Ecosystems, EC Jordan, Environmental Chemical Corporation, EHRT, ENSR Consulting, ELM, ERM-Northeast, Fagan Engineers, Fanning Phillips & Molnar, FluorDaniel GTI, Frontier, Foster Wheeler Environmental Corp, Frontier Technical, Galson Consultants, GE&R, Geomatrix Consultants, GZA Environmental, Handex of N, H2M Group, HDR, HRP, IT Corp, Jacques Whitford, JTM Associates, Labella Associates, Langan Engineers, Leader Environmental, Lockwood, Kessler & Bartlett, LMS Engineers, Malcolm-Pirnie, Metcalf & Eddy, NWEC&C, O'Brien & Gere Engineers, Pace, Parsons Engineering-Science, Plumley Engineering, Prescott Environmental, P. W. Grosser, Rizzo Associates, Roux Associates, Sear Brown Group, SECOR, Shaw Environmental, Stantec, ThermoRemediation Inc., TRC Environmental, Turnkey Environmental Restoration, TVGA Engineering, URS Consultants, Wehran Emcon, Weston, YEC, and private firms.

Provided consultation services to laboratories regarding analytical procedures and protocol interpretation, and to law firms for litigation support.

Provided services to firms involving audits of environmental analytical laboratories to determine analytical capability, particularly for compliance with NYSDEC ASP and AFCEE requirements.

Guest speaker on a panel discussing Data Review/Compliance and Usability, for an analysis workshop for the New York Association of Approved Environmental Laboratories, 1993.

Adirondack Environmental Services: June 1987 - August 1989

Senior mass spectroscopist for AES. Responsible for GC/MS analyses of environmental samples by USEPA and NYSDEC protocols, development of the GC/MS laboratory, initiating the instrumental and computer operations from the point of installation, and for implementing the procedures and methodologies for Contract Laboratory Protocol.

CompuChem Laboratories: May 1982 - January 1987

Managed a GC/MS production laboratory; developed, implemented, and supervised QA/QC criteria at three different levels of review; and was responsible for the development and production of the analysis of environmental and clinical samples. Directed a staff of 23 technical and clerical personnel, and managed the extraction and GC/MS labs and data review operations.

Research Triangle Institute: December 1979 - May 1982

Worked as an analytical research chemist responsible for development of analytical methods for the EPA Federal Register at RTI. This involved analysis of biological and environmental samples for priority pollutants, primarily relating to wastewaters and to human sampling studies. Method development included modification and interfacing of the initially developed Tekmar volatile purge apparatus to GC/MS, development and refinement of methods for entrapment and concentration of the air medium for subsequent volatile analysis, and the analysis and resolution/ identification of individual PCB congeners within Aroclor mixtures by capillary column and mass spectra.

Guardsman Chemical Company: February 1977 - November 1979

Performed all quality control functions for the manufacturing plant. Performed research and development on coatings and dyes.

Almay Cosmetics: May 1976 - December 1976

Product evaluation chemist. Responsible for analytical QC of manufactured products.

Publication

Pellizzzari, E.D., Moseley, M.A., Cooper, S.D., Harry, J.V., Demian, B., & Mullin, M. D. (1985). Recent Advances in the Analysis of Polychlorinated Biphenyls in Environmental and Biological Media. *Journal of Chromatography*, 334(3) 277-314.

PROFESSIONAL PROFILE



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EDUCATION

MEng, Biological and Environmental Engineering, Cornell University
BS, Biological and Environmental Engineering, Cornell University

PROFESSIONAL LICENSES

Professional Engineer, New York #088403

Paul Martorano, PE

Technical Director

EXPERIENCE SUMMARY

Mr. Martorano is a registered Professional Engineer with over 20 years of experience. He specializes in providing comprehensive services in design, construction, cost estimating, and program and project management for a wide range of environmental remediation and permitting projects. Experience includes Technical Director at Roux, April 2024 to present; Principal Environmental Engineer at Arcadis, 2012 to 2024; Staff Environmental Engineer at D&B Engineers and Architects, 2004 to 2011.

TECHNICAL SPECIALTIES

Mr. Martorano has a strong background in managing, scoping, budgeting, and implementing projects for both public and private sector clients. His expertise includes groundwater and soil vapor engineered treatment systems, excavation, and off-site disposal, in situ biodegradation, and abatement/demolition. His extensive experience includes treatment technologies for emerging contaminants such as 1,4-dioxane, PFAS, and VOCs. He is well-versed in digital tools for design and construction, financial estimating and reserve forecasting, multi-disciplined design management, waste characterization, and NYSDEC reporting.

REPRESENTATIVE PROJECTS

- **Design, Construction Management and Design During Construction, Groundwater Pump and Treat System Construction, Confidential Client, Long Island, New York**. Lead engineer for a large scale $40M, 3.6 MGD groundwater pump and treat system. System was installed in a 3,500 square foot PEMB with brick façade and associated building systems (electrical, HVAC, fire, sanitary, plumbing). The system treated for 1,4-dioxane (hydrogen peroxide/ozone AOP with pH adjustment), chlorinated solvents (AOP with LPGAC), and solids (horizontal pressure filtration, inclined plate clarifier, volute press). Remedial wells, vaults, and 2-miles of dual-walled HDPE piping with leak detection were installed throughout residential neighborhoods. Work was managed with a digital 3D BIM model, to easily coordinate the multi-disciplined design, create a 4D schedule to visualize the workflow and ensure all elements were properly scheduled, and create presentation-ready material for the client and public. Design and construction included permitting with the Town, Fire Marshal, Department of Health and NYSDEC and support for public meetings. Full construction management services (submittal review, RFI management, delegated design review, Change Order management, resolution of design-based conflicts) were also provided. A Construction Certification Report, Operation Maintenance and Monitoring Manual, and Site Management Plan were completed and submitted at the project conclusion in 2023.

- **Design and Procurement Services, PFAS Water Treatment System, Balt MAES AEC BRAC, Vint Hills, Virginia.** Design manager and lead engineer for a PFAS water treatment system for a potable supply well. Lead and coordinated the design process from the initial 30 percent design, though the 100 percent complete Issued for Construction package. Managed various lead engineers in their respective disciplines, to ensure the preparation of an accurate, cost effective, and safe design. The design utilized a digital 3D BIM model platform, which provided for seamless integration of the various engineering work products, checked for conflicts in a 3D space to minimize the potential for construction field issues, and ultimately provided a tool to better visualize the entire project from start-to-finish. Design work was completed on an expedited schedule, given pending commercial construction that would increase the overall water demand in the area and to meet client budget requirements. Procurement work for the building, equipment and subcontractors was also completed in support of the

construction and included preparation of respective bid scopes of work and bid tables, response to bidder questions, and summary of the bids received.

- **Construction Oversight and Management, Landfill Redevelopment, New York City Dept. of Parks & Recreation, Staten Island, New York.** Project construction management and quality assurance services for the $30M Phase I development of the North Park section of Fresh Kills Landfill. Work included management and oversight of two full-time resident engineers and Construction Quality Assurance inspection and testing for environmental capping and landfill infrastructure modifications. Oversight included: source approval, sampling, and inspection of all imported fill materials in accordance with NYSDEC Part 360; Storm Water Pollution Prevention Plan (SWPPP) inspections and reporting; SPDES monitoring, sampling, and reporting; review and processing of submittals, payment applications, RFIs, Change Orders, Schedule updates, and other project deliverables; and management of construction progress meetings. A Site Management Plan and Construction Certification Report as the "Engineer of Record" were completed and submitted to the NYSDEC at the project conclusion in 2023.
- **Construction Management and Design During Construction, Removal and Installation of Fuel Tanks, NYS Parks, Recreation and Historic Preservation, Sunken Meadow State Park, New York.** Construction management, design administration, and environmental quality control services for removal and disposal of petroleum bulk storage USTs and replacement with concrete reinforced ASTs. Advised and supported all environmental aspects for the project, including notification to NYSDEC, oversight of tank removal and decommissioning activities, endpoint sampling management, reviewing laboratory results against NYSDEC Part 375, and negotiating with regulatory agencies. Work also included review and response to contractor submittals, resolution of RFIs, coordination with contractor and vendors on Shop Drawings and delegated design submittals, and resolution of design-based conflicts that required revisions to the original Contract. Preparation of a final Tank Closure Report was completed and submitted at the project conclusion in 2023.
- **Construction Oversight and Management, Excavation and Off-Site Disposal, Glen Cove Community Development Agency, Glen Cove, New York.** Construction oversight and management of soil excavation and off-site disposal. Responsible for project management and engineering certification of the site work. Worked with the City's contractor to execute the work as specified and designed and coordinated with NYSDEC and USEPA. Site work included: surface water/sediment controls; dust, chemical, and asbestos air monitoring; contaminated soil excavation and disposal; bulkhead stabilization; fill material chemical and geotechnical sampling; unknown gasoline UST removal, disposal, and closeout; asbestos and lead-based paint abatement; and building demolition. The work also included the review and approval of all contractor submittals, weekly progress meetings, approval daily field activity reports, and review and certification of Contractor payment applications. A Final Engineering Report, in accordance with DER-10 and Part 375, was completed and submitted at the project conclusion.
- **Construction Oversight and Management, Storage Tank Removal and Disposal, Orange County, Chester, New York.** Construction oversight and management of AST and UST removal and disposal at the Glenmere Lake Brownfields Site. Work was upload of Glenmere Lake, a drinking water source for the Village of Florida, a wetland, and a habitat for a NYSDEC endangered species (Northern Cricket Frog). Project involved working with the City's contractor to execute the work as specified and designed, as well as coordination with the NYSDEC. Site work included: surface water/ sediment controls; endangered species controls and monitoring; dust and chemical air monitoring; contaminated soil excavation and disposal; backfill material chemical sampling, installation, compaction, and geotechnical testing; and tank removal, disposal, and closeout in accordance with NYS PBS permitting and NY Spills closure requirements.
- **Construction Oversight and Management, Soil Excavation and Off-Site Disposal, Long Island Railroad (LIRR), New York.** Construction oversight and management in support of metals-contaminated soil excavation and off- site disposal. Project was completed as part of a NYS Voluntary Cleanup Agreement. Site work included: surface water/sediment controls; dust and chemical air monitoring; contaminated soil excavation and disposal; fill material chemical and geotechnical sampling; and Underground Injection Control closeout of cesspools, septic systems, and drywells, in accordance with USEPA requirements.
- **Construction Oversight and Management, Soil Excavation and Off-Site Disposal, NYSDEC Bouchard Junkyard Site, New Lebanon, New York.** Construction oversight and management of PCB-contaminated soil excavation and off- site disposal. The Site was located adjacent to a Federal and State wetland. The project involved the characterization and disposal of over 44,000 cubic yards of soil and wetland sediment contaminated with hazardous and non-hazardous level of PCB's, including site and wetland restoration. Site work included: surface water/sediment controls; dust and chemical air monitoring; contaminated soil excavation and disposal; and fill material chemical and geotechnical sampling.

- **Construction Monitoring and Inspection, Sub-Slab Gas Vapor Barrier & Depressurization Systems, New York City School Construction Authority, PS48Q & PS3Q, Queens, New York.** Third-party inspection and oversight of environmental systems and components at several existing and new NYC public schools. Work involved multiple detailed inspections of contractor-installed sub-slab gas vapor barrier and depressurization systems to ensure compliance with regulatory, contract and client requirements, and preparation of detailed field activity reports to document findings.
- **B204 Remedial Action, Port Authority of NY & NJ, Jamaica, New York.** Oversight of fuel-oil contaminated soil remediation, including excavation and in situ biological degradation. Work was conducted as part of a property redevelopment at JFK Airport. Responsibilities included meetings with the client and property developer, oversight of excavation, endpoint sampling, and application of sulfate salts to facilitate aerobic biological oxidation of residual fuel oils at the groundwater interface. Upon completion of the work, field GPS assessment of the excavation extents was completed, and a final remediation report was issued to the client and regulatory agency.
- **Solid Waste Management Unit Decontamination, International Business Machines, East Fishkill, New York.** Field project engineer responsible for overseeing the decommissioning and cleaning of 50+ solid waste management units, within five months. The work included scoping and management of the entire field project, coordination with and scheduling of cleaning subcontractor, leading team project meetings with various client representatives and subcontractor, and rinse sampling the cleaned units. Upon completion, a final report with certifications was submitted to the NYSDEC to document the closure of the units.
- **Feasibility and Conceptual Design Assessments, 1,4-Dioxane/VOC Plume Remediation, Confidential Client, New York.** Project engineer and task manager for preparation of remediation construction cost estimates in support of the client's existing and future environmental liabilities. Cost estimates ranged in value from $500,000 to greater than $50,000,000, and included the coordination and management of multiple sub-discipline estimates (civil, environmental, mechanical, electrical) and review of various remedial technologies, which were ultimately consolidated into one, concise cost estimate. All estimates considered various alternatives, included preparation of a conceptual site and system layout, and were prepared under an expedited schedule, to support the client's internal strategy and business decisions.
- **Demolition and Hazardous Materials Abatement Design, New York State Department of Parks, Recreation and Historic Preservation, Kings Park Psychiatric Center, New York.** Project engineer for the design of demolition and hazardous materials abatement of 13 buildings at the former Kings Park Psychiatric Center. Project involved the on-site assessment of 13 structures/buildings, extensive review of as-built and historical files for the property to determine special requirements for the demolition, assistance with hazardous material survey and sampling, oversight of field work to assess former steam tunnels construction, oversight of core drilling of building foundations/walls to determine if asbestos containing materials were present, and preparation of detailed contract specifications and drawings to support bidding of the abatement and demolition work.
- **Program and Project Management, NYS Superfund Environmental Remediation Site, Confidential Client, New York.** Program management, project management and design-lead services related to a large and complex NYS Superfund Environmental Remediation Site on Long Island, NY. The program averaged $3-4M on a routine yearly basis. As a lead for this program, Mr. Martorano was responsible for budgeting and scoping work orders, coordinated and communicated with the client on day-to-day items, prepared updated quarterly 30-year financial forecasts for the entire program, and acted as one of a few lead professional engineers, to provide QC review and certification of engineering deliverables.
- **Remedial Technology Evaluation and Cost Estimating, Confidential Client, New York.** Remedial technology evaluation and cost estimate for a commercial/industrial site with VOC, PCB and Metal soil impacts from historic site operations. The evaluation considered various traditional and innovative remedial alternatives, including in situ thermal desorption, electrical resistive heating, ex situ thermal desorption, excavation/disposal, in situ solidification and stabilization (ISSS), and soil washing. At the conclusion of the evaluation, an option was proposed to remediate the VOC impacts with ISSS and the PCB & Metal impacts with soil washing, which was estimated to reduce the original remedy cost from an estimated $54 million to $12 million. Final deliverable included a detailed cost breakdown and a high-level cost estimate summary.
- **Remedial Technology Assessment and Selection, Brookhaven National Laboratory, Upton, New York.** Remedial technology assessment for a closed trap and skeet range. Historic usage resulted in ~2,100 pounds of lead deposited on the surface of the range, annually. The assessment reviewed excavation, soil washing, stabilization and chemical extraction. Technologies were evaluated based on their ability to meet NYSDEC requirements. The most

protective and cost effective option utilized a combined approach of in situ stabilization of hazardous areas, followed by excavation and off-site disposal.

- **Groundwater & Soil Vapor Extraction Treatment Systems Operation, Maintenance and Monitoring (OM&M), Various Clients.** Management and engineering quality control support related to OM&M of groundwater (40 gpm to 2,500 gpm) and soil vapor extraction systems. Groundwater systems utilized air stripping (VOCs) or advanced oxidation (1,4-dioxane) for groundwater and vapor phase granular activated carbon (some with steam regenerative solvent recovery) or potassium permanganate zeolite for air treatment. Work included response for alarms and troubleshooting, summary reports for identified O&M issues, field digital data collection, and SCADA programming with automatic data congregation, management, and output reporting. Quarterly and annual reports were also prepared and submitted.
- **Operation, Maintenance and Monitoring, Groundwater Extraction and Treatment, NYSDEC Franklin Cleaners Site, Hempstead, NY & Active Industrial Uniform Site, Lindenhurst, New York.** Project engineer responsible for operation, monitoring and maintenance of the groundwater pump and treatment system at two NYSDEC Class 2 Inactive Hazardous Waste Site. Initially, Mr. Martorano was responsible for performance monitoring activities at the site which included weekly system monitoring, bi-weekly sampling of influent and effluent water and air streams, and scheduling and oversight of subcontractor maintenance activities. Reports summarizing all chemical analysis, groundwater monitoring trends, system performance and maintenance activities, as well as recommendations to improve the overall treatment system performance, were completed and submitted to the NYSDEC on a quarterly schedule. Additional work completed in support of the Franklin Cleaners Site included the preparation of the Final Remediation Report for the on-site soil vapor extraction/air sparge system and remedial construction oversight for the installation of an on-site sub-slab depressurization system. Reporting deliverable included a Site Management Plan and Periodic Review Report, in accordance with NYSDEC DER-10.
- **Construction Oversight, Sub-Slab Depressurization, NYSDEC 34th Avenue/62nd Street Plume Site, Jackson Heights, New York.** Project field engineer responsible for the installation of an active sub-slab depressurization system at the NYSDEC 34th Avenue/62nd Street Plume Site. Work involved oversight of the system installation, review of contractor's submittals and final review and approval of the work.
- **Site Closure Reporting, National Grid, Glenwood Landing, New York.** Project engineer for the preparation of site closure reports for the remediation of a former manufactured gas plant site in Glenwood Landing, NY. Reports included a Final Engineering Report and Site Management Plan in accordance with NYSDEC DER-10. Also assisted with the preparation of the Environmental Easement for the property, to maintain the existing use, restrict future soil excavation activities at the site and minimize exposure to contaminated soil remaining on-site below soil and clay caps.

PROFESSIONAL TRAININGS

40-Hour Health and Safety Training for Hazardous Waste Sites (29 CFR 1910.120(e))

8-Hour Refresher for Hazardous Waste Operations Training (29 CFR 1910.120)

10-Hour OSHA Construction

Confined Space Entry Training (29 CFR 1910.146)

Asbestos Awareness Training

PROFESSIONAL PROFILE



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EDUCATION

BA, Biological Sciences,
University of Delaware,
Newark, Delaware, 1999.

PROFESSIONAL LICENSES

Licensed Site Remediation Professional, New Jersey (License No. 627589)
New York State Professional Geologist (License No. 000437)
NJDEP UST Certification Program-Subsurface Evaluator (License No. 239024)

Robert Kovacs, LSRP, PG

Principal Scientist

EXPERIENCE SUMMARY

Twenty-four years of experience: Principal, Senior, Project, Staff and Staff Assistant Environmental Scientist at Roux, Islandia, New York.

TECHNICAL SPECIALTIES

Design, implementation and management of Environmental Site Assessments, Remedial Investigations, Remedial Actions, and Construction Support at Brownfield Redevelopment, Transportation, and Industrial sites; Development of innovative cost-saving project strategies and skilful regulatory agency negotiations; Characterization and decommissioning of Industrial Manufacturing facilities; Roux Corporate QA/QC Officer.

REPRESENTATIVE PROJECTS

- **Lendlease Java Street Waterfront Redevelopment – Greenpoint, New York.** Principal-in-Charge for this large redevelopment project located on the waterfront in Greenpoint, New York. This 2.6-acre site is being redeveloped into a mixed-use development, including a residential tower with 800 residential units, retail space, and a shoreline esplanade with NYC Ferry terminal access. Work on this project has included due diligence support, involving the completion of a Phase I and Phase II ESA, NYSDEC BCP application, preparation of a Remedial Investigation Report and Remedial Action Work Plan, as well as supporting Lendlease in negotiation with NYSDEC to maximize soil reuse, site preparation and tangible tax credits. Work also included implementing an extensive In-situ Waste Characterization program, including PFAS investigation, negotiating soil reuse, and developing and implementing a complex remedial design program and community air monitoring program. The remedy for the site included design of a Sub-Slab Depressurization System (SSDS) to mitigate vapors beneath the future building, as well as negotiation with NYSDEC and NYCOER to ensure 421a schedule requirements were achieved. As part of this work, soil borings, monitoring wells, piezometers, and soil vapor monitoring points were installed, and hydrogeologic cross sections were prepared. Additionally, the tidal influence of the East River on site groundwater was studied, and a benthic sediment investigation was conducted in the East River.

  This project will achieve the highest green and sustainable standards, and includes a massive, closed loop geothermal system to provide heating and cooling. Once complete, this all-electric project will be the largest residential project in New York State to use a geothermal exchange system. Components of this system include, in part, a well field of over 320 vertical geothermal wells drilled down to a depth of approximately 500 feet below land surface. Roux is providing several critical roles on this project with respect to construction of this massive geothermal system.

- **Amtrak Sunnyside Yard State Superfund Site, Queens, New York.** Principal-in-Charge for multiple projects to support investigation and remediation activities at this State Superfund site. Mr. Kovacs was responsible for overseeing activities in all six Operable Units (OUs), including unsaturated and saturated soil, groundwater, separate-phase hydrocarbon, soil vapor and on-site sewer system. His responsibilities on these projects included PFAS investigations; UST removals; characterizing subsurface conditions, including soil (collected hundreds of soil samples to characterize the 130+ acre active railyard), as well as characterizing a 250,000-gallon PCB-contaminated separate-phase hydrocarbon plume. Additionally, he was responsible for overseeing the design and implementation of remediation activities, including soil excavation and offsite disposal, removal and abandonment of USTs ranging in sizes up to 17,000 gallons, demolition of contaminated buildings and infrastructure, and installation and operation of a dual phase high vacuum

extraction (DPVE) system to recover PCB-contaminated separate-phase hydrocarbon through a network of over 40 recovery wells. Due to the highly volatile nature of the separate-phase hydrocarbon and the urban setting of this site, extensive emissions and odor engineering controls were used when excavating and managing soil and product. Additionally, extensive Community Air Monitoring was completed during all phases of work. Mr. Kovacs was also responsible for interaction with all regulatory agencies, as well as preparing and/or reviewing all major project reports and deliverables.

- **Amtrak Infrastructure Construction Projects.** Principal-in-Charge of several large infrastructure upgrade projects for Amtrak, including the Next Generation Acela Ready Track project, the Amtrak Airo support projects, Security Enhancement project, and Water Main Upgrade projects. Mr. Kovacs is serving as Project Principal, and is involved in the planning, site characterization (including PFAS evaluations), construction oversight, and regulatory agency coordination associated with these projects. These projects include substantial soil and sewer sediments characterization and management components, including management of characteristically hazardous soils and management of free-product impacts. Additionally, these projects include large community air monitoring programs, as required by NYSDEC. Roux has been successful in integrating these environmental requirements into these construction projects with minimal impact to the construction team's schedule.
- **Pharmaceutical Manufacturing Facility, Brooklyn, New York.** Project Manager/Project Principal for environmental work associated with the seven-block former manufacturing plant. This Site included a former 700,000 square foot manufacturing plant, as well as several other former industrial facilities with operations starting as far back as the 1850s. Responsibilities included UST removals; the design and completion of multiple phases of subsurface investigations to characterize soil and groundwater quality, as well as soil vapor. Contaminants included hydrocarbons, benzene, PCBs, and heavy metals, including lead, mercury, and arsenic. Work included development and preparation of investigation and remediation work plans, coordination and management of field investigations, including the

  installation of shallow and deep monitoring wells and soil borings using sonic drilling methods, completion of a geophysical survey, collection of groundwater samples, and management of remediation activities. Remediation activities included soil excavation, UST removals, and the installation of a soil vapor extraction and air sparging system. Work was completed under several different regulatory agencies, including NYSDEC and NYCOER. Also provided presentations to school authorities, including the NYC DOE, to communicate the progress of the project and to educate administrators regarding the Site's environmental issues.
- **Industrial Warehouse Development – Bayshore, New York.** Principal-in-Charge for a 350,000 square foot industrial warehouse development located in Bayshore, Long Island, NY. As part of the project an initial Phase II investigation and PFAS evaluation was completed at this industrial site that contains a large former landfill. Roux successfully enrolled this site in the NYSDEC BCP and is currently developing the remedy for the site. Major remedial elements include an extensive Sub-Slab Depressurization System (SSDS) system to manage highly elevated methane vapor from the former landfill, as well as the management of large quantities of soil for disposal and reuse.
- **Affordable Housing Development – Bronx, New York.** Principal- in-Charge for the redevelopment of a former US Postal Service Fleet Maintenance facility located in the south Bronx. This site will be redeveloped into a 100% affordable housing complex. I was retained to complete all initial due diligence activities, including PFAS investigation, and to evaluate possible NYSDEC BCP eligibility. Once determined the site is a good candidate for the BCP, we prepared a BCP Application, and all required reporting. We also ensured that the site met 421a schedule requirements throughout the development and implementation of an Interim Remedial Measures (IRM) Plan. Full scale remediation is currently underway, including the remediation of hazardous soils, removal of USTs, and removal of multiple hydraulic lifts. Responsibilities also included design of a Sub-Slab Depressurization System (SSDS) to mitigate vapors beneath the future building.
- **Chlorinated Solvent Remediation – Parsippany-Troy Hills, New Jersey.** Principal-in-Charge for the Remedial Investigation and Remedial Action implementation associated with a former dry cleaner release located in Parsippany-Troy Hills, New Jersey. We were retained by one of the largest real estate developers in the United States to complete this project. Soil, groundwater, and subsurface vapor were impacted with chlorinated VOCs as a result of the former dry cleaner operations. Responsibilities included the design and management of a Supplemental RI that included the installation of soil borings, monitoring wells and the completion of groundwater vertical profiling. Additionally, Mr. Kovacs was responsible for the design, implementation, and management of an extensive groundwater remediation injection program in which approximately 200,000 pounds of Zero-Valent Iron (ZVI) and 2,500 gallons of Emulsified Vegetable Oil (EVO) were injected into the subsurface using pneumatic fracturing. Initial post-treatment results show over 95 percent reduction in concentrations of chlorinated VOCs in groundwater. Furthermore, he was responsible for the design,

installation, and operation of a SVE system to address impacted vadose zone soil.

- **Brookfield Hudson Exchange West – Jersey City, New Jersey.** Principal-in-Charge and LSRP for the first three towers as part of this mixed-income development near the Jersey City waterfront. Overall, this project will include 11 residential towers. To date, two towers are completed, and one is under construction. I am LSRP of record for: Phase 1A (625,000 square foot, 35-story tower), Phase 1B (432 unit, 35-story tower), and Phase 2 (60-story tower, with 802 Units and ShopRite supermarket planned for the second floor). Responsibilities included all initial site investigation, remedial design, and remedial implementation. Additionally, I was responsible for all compliance with NJDEP requirements, including preparation and certification of all reports, preparation of Remedial Action Permits, issuance of RAOs, and implementation of all post remedial activities and reporting.
- **Residential/Commercial Redevelopment – Brooklyn, New York.** Principal-in-Charge for a mixed-use development located in Red Hook, NY. Completed Phase II investigation and designed and implemented several Interim Remedial Measures. Also advised client on the most advantageous regulatory pathway to implement the redevelopment project. We are currently in the process of submitting a BCP Application to NYSDEC.
- **Chlorinated Solvent Release – Bernardsville, New Jersey.** Principal-in-Charge for the investigation of an extensive chlorinated solvent plume emanating from a former dry cleaner site. Contamination from this site has migrated far off site in groundwater, and has potentially impacted nearby surface water. Work includes installation of soil borings and monitoring wells to characterize contamination in soil, perched water, groundwater in the deep unconsolidated aquifer zone, as well as groundwater in the weathered bedrock matrix and bedrock matrix. Further, contamination from the Site is co-mingled with contamination from other solvent release sites, complicating NJDEP negotiations and investigation/remedial requirements. Mr. Kovacs serves as the LSRP of record for this project.
- **UST Spill Site – Brooklyn, New York.** Principal-in-Charge for the investigation of a Spill in Williamsburg, Brooklyn, New York. M. Kovacs lead the project team in successfully demonstrating to NYSDEC's Spills Group that impacts to a deep groundwater zone beneath the client's site were a result of offsite contamination migrating onsite from a nearby active gasoline station (not a result of the client's former industrial operations). Impacts included the presence of several feet of free-product in a deep groundwater zone. Furthermore, he was successful in getting the client's Spill Case closed, saving the client from additional investigation activities, and what will likely be a multi-million-dollar remediation to address free-product beneath a semi- confining clay zone.
- **Former Vehicle Maintenance Facility – Parlin, New Jersey.** Project Manager for the removal of (2) waste oil USTs, a subsurface oil water separator, piping, and remediation of associated petroleum contaminated soil at a former vehicle maintenance facility in Parlin, New Jersey. Roux was retained by one of the largest real estate developers in the United States to complete this project. This remediation was completed to allow for a new, national tenant to occupy this retail space. As part of this work, it was determined that a historic release occurred from the OWS, triggering a RI for petroleum-related VOCs and chlorinated VOCs in soil. Mr. Kovacs was also responsible for the development and implementation of the Remedial Action for the Site, which included excavation and off-site soil disposal. SESOIL modeling was also utilized to demonstrate groundwater (approximately 100 feet deep) was not impacted by the shallow soil contamination. As part of this project, he took a lead role in preparing the SI Report, RI Report, RAW, RAR, Receptor Evaluation, and the Unrestricted Use RAO.
- **NJ Transit Active Bus Facility, New Jersey.** Project Principal for the completion of a RI at an active bus garage located in Fairview, New Jersey for a major transit agency. Responsibilities included the delineation of a free-product plume, characterization of soil and groundwater quality, report preparation, and correspondence with the NJDEP. Moreover, Mr. Kovacs was responsible for implementing free-product Interim Remedial Measure efforts. Currently, he is finalizing the RI report for the Site, and managing the Remedial Action design, and supporting the LSRP in meeting all NJDEP administrative requirements.
- **Residential Hi-Rise Development – Manhattan, New York.** Principal-in-Charge for a redevelopment site in mid-town Manhattan working for a private developer who is building a mixed-use retail/commercial tower. Work included a Phase I ESA and Phase II ESA. As part of the Phase II shallow bedrock was identified in portions of the site, and an LNAPL plume was identified in the overburden soils. Responsibilities included bedrock evaluation, LNAPL recovery utilizing multiple different techniques. Responsibilities also included construction support, health and safety support, management of all soil excavated and transported off site, and the design of a Sub-Slab Depressurization System (SSDS) to mitigate vapors in the vadose zone beneath the new building structure that were emanating from groundwater.
- **Ship Dry Dock Facility – Hoboken, New Jersey.** Project Manager for the completion of a Preliminary Assessment and Site Investigation (PA/SI) at an active ship dry dock facility in

Hoboken, New Jersey. Responsible for the coordination and management of field investigation activities, which included soil, groundwater, and sediment sampling, as well as the preparation of a PA and SI report. This work was completed on behalf of a potential buyer of the property who planned to redevelop this site into a New York City ferry terminal.

- **BICC Cables – Yonkers, New York.** Project Manager for the investigation and remediation of the interior and subsurface soils of a former cable manufacturing facility located in Yonkers, New York to be redeveloped into a movie studio. Responsibilities included the completion of several large-scale investigations, including the collection of wipe, soil and building material samples to characterize PCB and lead impacts at this 200,000+ square foot facility Additional tasks included oversight of the remediation of interior surfaces using several different methods for the removal of PCBs and lead, and remediation of a sub-surface drainage trench and process water system. Further work included the preparation of a Remedial Investigation report and a Feasibility Study report for submittal to the NYSDEC.
- **Amtrak Electrical Substation – Rahway, New Jersey.** Project Manager for the RI and RA design and implementation at an active electrical substation in Rahway, New Jersey for a national passenger railroad agency. Responsibilities included completing an RI to delineate PCBs in soil, and the management of free- product recovery programs. Further, Mr. Kovacs was responsible for managing the RA at the Site, which included soil excavation and offsite disposal, and free- product recovery. As part of this project, he supported the Site LSRP and took a lead role in preparing the Supplemental RI Report, RAW, RAR, Receptor Evaluation, and the Unrestricted Use RAO. Additionally, he assisted the LSRP in satisfying all NJDEP administrative requirements, including preparation of forms, public notifications, and submittal of fees.
- **Echo Bay Redevelopment – New Rochelle, New York.** Project Manager for the completion of Phase I and Phase II Environmental Site Assessment activities associated with a proposed mixed-use redevelopment located in Westchester, New York. Work included management of subsurface investigation activities to characterize soil conditions, and working closely with client's architects and construction contractors to integrate the proposed site remediation into the project development plan (including evaluating multiple potential disposal scenarios). Site contaminants included hydrocarbons (including free-product plume from former USTs), and historic fill constituents.
- **Former Dry Cleaner – Ramsey, New Jersey.** Project manager for the SI, RI, and vapor intrusion investigation at a former dry cleaner in Ramsey, New Jersey. Responsibilities included managing and coordinating field investigations, preparing remedial cost estimates for redevelopment, and preparation of reports and satisfying NJDEP Administration requirements. This work is being done to support redevelopment of the Site for a large, national fitness center tenant.
- **Former Service Station – Patterson, New Jersey.** Project Manager for the implementation of a groundwater remediation injection program to address petroleum contamination at a former service station located in Paterson, New Jersey for a major transit agency. Responsibilities included implementation of a PA and SI to further investigate chlorinated VOCs at this Site. As part of this project, Mr. Kovacs took a lead role in preparing reports and the Permit-by-Rule Request, as well as assisting in satisfying all NJDEP administrative requirements.
- **NJ Transit Active Railyard – Roxbury Township, New Jersey.** Project manager for the investigation of a diesel release at an active railyard in. This release was caused by a faulty underground pipe located in the locomotive fueling area. The diesel release resulted in a free-product plume, groundwater impacts, and impacts to a subsurface drainage culvert and a nearby lake. Responsibilities included the development and coordination of a field investigation program, coordination of routine gauging and free-product recovery events, correspondence with NJDEP, and preparation of a baseline ecological evaluation. Additionally, Mr. Kovacs supported the Site LSRP in meeting all NJDEP administrative requirements.

Facility Demolition/Decommissioning

- **Former Pharmaceutical Manufacturing Facility Decommissioning, Brooklyn, New York.** Project Manager for the interior decontamination and decommissioning of a 700,000+ square foot former manufacturing facility located in Brooklyn, New York to allow for redevelopment of the building for commercial, retail, and light industrial use, and use as a movie studio, and for local food businesses. This redevelopment has earned significant positive press, as it is considered a highly beneficial reuse for the community. This project included the development of decontamination and decommissioning work plan, technical support of bidding process, and full time onsite engineering support of the entire project.

  Decontamination and decommissioning activities included removal/cleaning of hundreds of air handling units and dust collector units impacted with manufacturing dusts and residues, as well as thousands of feet of intricate vacuum, ventilation, and dust collection lines. This project also included the removal of concrete impacted with metals, PCBs, and/or VOCs, selective interior demolition, and decontamination of former laboratory, milling, compounding, blending, and packaging areas, as well as asbestos abatement. At the

conclusion of this project, a Final Report was prepared, documenting in detail the extensive work completed and the work plan objectives were achieved.

- **Former Pharmaceutical Manufacturing Facility Demolition, Brooklyn, New York.** Project Manager for the demolition of two former manufacturing buildings in Brooklyn, New York. Both buildings were impacted with hazardous levels of PCBs, mercury, and lead. Responsibilities included in situ waste characterization of building materials, oversight of hazardous waste removal, completion of waste manifests, and full-time Community Air Monitoring during all demolition activities. Additionally, Roux Associates performed daily inspections and monitoring to ensure the protection of a nearby elementary school and prepared a completion report at the conclusion of the project.
- **PCB Building Material Remediation.** Principal-in-Charge for the investigation and TSCA remediation of PCB containing paint in a former manufacturing area. This location (approximately 2,000 square feet in area, and two stories in height) was found to contain PCBs in the paint matrix at concentrations as high as 10,000 parts per million. The underlying building material (brick, concrete, and terra cotta) was also found to be impacted with PCBs from the paint. Responsibilities included preparation of a Self-Implementing Notification and Alternative Decontamination Methods and Verification Sampling Work Plan to remediate the PCBs under the TSCA regulatory framework. This project also included providing field oversight of the PCB remediation, completion of the extensive verification sampling program of the underlying porous building material, and collection of confirmation air samples and confirmation wipe samples outside of the exclusion zone to confirm proper function of all critical barriers. Following the successful completion of the project, a Final Report was prepared and submitted to USEPA documenting the entire project in detail.

Expert/Insurance Litigation Support

- Consulting Fact Witness for an insurance litigation claim where insured was seeking to be reimbursed for more than $15 million of previous environmental investigation/remediation costs. Mr. Kovacs responsibilities included a formal deposition and testifying in US District Federal Court – Eastern District of New York. Case resulted in favorable ruling for our client.
- Consulting expert for a PRP to the Gowanus Canal Superfund Site, Brooklyn, New York. Evaluated all RI data, performed fate and transport analysis, and evaluation of historic site operations to support facility *de minimis* status.

PROFESSIONAL TRAININGS

OSHA 40-Hour Health and Safety Course (29 CFR 1910.120)

OSHA 8-Hour Health and Safety Refresher Course (29 CFR 1910.120)

PUBLICATIONS

Significant Acceleration of Time Frame to Closure via Transition from Long-Term Biological Treatment to ZVI/EVO Injection, Kovacs, R., Senh, S., Silverstein, W., Moss, D., Kelley, R., Proceedings of the Tenth International Conference on Remediation of Chlorinated and Recalcitrant Compounds, 2016.

Strategy to Overcome Sub-Slab Depressurization System Design and Operational Challenges in an Existing Building With Sensitive Tenant Use, Henke, R., Kovacs, R., Kaiser, D., Proceedings of the Twelfth International Conference on Remediation of Chlorinated and Recalcitrant Compounds, 2022.

APPENDIX B

NYSDEC PFAS Guidance

NEW YORK STATE OF OPPORTUNITY.

Department of Environmental Conservation

SAMPLING, ANALYSIS, AND ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

Under NYSDEC's Part 375 Remedial Programs

April 2023



www.dec.ny.gov

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ERRATA SHEET for

SAMPLING, ANALYSIS, AND ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) Under NYSDEC's Part 375 Remedial Programs Issued January 17, 2020

Citation and Page Number	Current Text	Corrected Text	Date
Title of Appendix I, page 32	Appendix H	Appendix I	2/25/2020
Document Cover, page 1	Guidelines for Sampling and Analysis of PFAS	Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs	9/15/2020
Data Assessment and Application to Site Cleanup Page 3	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published	Until such time as Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published	3/28/2023
Water Sample Results Page 3	PFOA and PFOS should be further assessed and considered as potential contaminants of concern in groundwater or surface water if PFOA or PFOS is detected in any water sample at or above 10 ng/L (ppt) and is determined to be attributable to the site, either by a comparison of upgradient and downgradient levels, or the presence of soil source areas, as defined below.	NYSDEC has adopted ambient water quality guidance values for PFOA and PFOS. Groundwater samples should be compared to the human health criteria of 6.7 ng/l (ppt) for PFOA and 2.7 ng/l (ppt) for PFOS. These guidance values also include criteria for surface water for PFOS applicable for aquatic life, which may be applicable at some sites. Drinking water sample results should be compared to the NYS maximum contaminant level (MCL) of 10 ng/l (ppt).Analysis to determine if PFOA and PFOS concentrations are attributable to the site should include a comparison between upgradient and downgradient levels, and the presence of soil source areas, as defined below.	3/28/2023
Soil Sample Results Page 3	Soil cleanup objectives for PFOA and PFOS have been proposed in an upcoming revision to 6 NYCRR Part 375-6. Until SCOs are in effect, the following are to be used as guidance values:	NYSDEC will delay adding soil cleanup objectives for PFOA and PFOS to 6 NYCRR Part 375-6 until the PFAS rural soil background study has been completed. Until SCOs are in effect, the following are to be used as guidance values:	3/28/2023
Protection of Groundwater Page 3	PFOA (ppb) 1.1 PFOS (ppb) 3.7	PFOA (ppb) 0.8 PFOS (ppb) 1.0	3/28/2023

Citation and Page Number	Current Text	Corrected Text	Date
Footnote 2 Page 3	The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).	The Protection of Groundwater values are based on the above referenced ambient groundwater guidance values. Details on that calculation are available in the following document, prepared for the February 2022 proposed changes to Part 375 (https://www.dec.ny.gov/docs/remediation_hudson_pdf/part375techsupport.pdf). The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).	3/28/2023
Testing for Imported Soil Page 4	If the concentrations of PFOA and PFOS in leachate are at or above 10 ppt (the Maximum Contaminant Levels established for drinking water by the New York State Department of Health), then the soil is not acceptable.	If the concentrations of PFOA and PFOS in leachate are at or above the ambient water quality guidance values for groundwater, then the soil is not acceptable.	3/28/2023
Routine Analysis, page 9	"However, laboratories analyzing environmental samples…PFOA and PFOS in drinking water by EPA Method 537, 537.1 or ISO 25101."	"However, laboratories analyzing environmental samples…PFOA and PFOS in drinking water by EPA Method 537, 537.1, ISO 25101, or Method 533."	9/15/2020
Additional Analysis, page 9, new paragraph regarding soil parameters	None	"In cases where site-specific cleanup objectives for PFOA and PFOS are to be assessed, soil parameters, such as Total Organic Carbon (EPA Method 9060), soil pH (EPA Method 9045), clay content (percent), and cation exchange capacity (EPA Method 9081), should be included in the analysis to help evaluate factors affecting the leachability of PFAS in site soils."	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Data Assessment and Application to Site Cleanup Page 10	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFAS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Target levels for cleanup of PFAS in other media, including biota and sediment, have not yet been established by the DEC.	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFOA and PFOS in other media, including biota and sediment, have not yet been established by the DEC.	9/15/2020
Water Sample Results Page 10	PFAS should be further assessed and considered as a potential contaminant of concern in groundwater or surface water (…) If PFAS are identified as a contaminant of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.	PFOA and PFOS should be further assessed and considered as potential contaminants of concern in groundwater or surface water (…) If PFOA and/or PFOS are identified as contaminants of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Soil Sample Results, page 10	"The extent of soil contamination for purposes of delineation and remedy selection should be determined by having certain soil samples tested by Synthetic Precipitation Leaching Procedure (SPLP) and the leachate analyzed for PFAS. Soil exhibiting SPLP results above 70 ppt for either PFOA or PFOS (individually or combined) are to be evaluated during the cleanup phase."	"Soil cleanup objectives for PFOA and PFOS will be proposed in an upcoming revision to 6 NYCRR Part 375-6. Until SCOs are in effect, the following are to be used as guidance values. " [Interim SCO Table] "PFOA and PFOS results for soil are to be compared against the guidance values listed above. These guidance values are to be used in determining whether PFOA and PFOS are contaminants of concern for the site and for determining remedial action objectives and cleanup requirements. Site-specific remedial objectives for protection of groundwater can also be presented for evaluation by DEC. Development of site-specific remedial objectives for protection of groundwater will require analysis of additional soil parameters relating to leachability. These additional analyses can include any or all the parameters listed above (soil pH, cation exchange capacity, etc.) and/or use of SPLP. As the understanding of PFAS transport improves, DEC welcomes proposals for site-specific remedial objectives for protection of groundwater. DEC will expect that those may be dependent on additional factors including soil pH, aqueous pH, % organic carbon, % Sand/Silt/Clay, soil cations: K, Ca, Mg, Na, Fe, Al, cation exchange capacity, and anion exchange capacity. Site-specific remedial objectives should also consider the dilution attenuation factor (DAF). The NJDEP publication on DAF can be used as a reference: https://www.nj.gov/dep/srp/guidance/rs/daf.pdf. "	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Testing for Imported Soil Page 11	Soil imported to a site for use in a soil cap, soil cover, or as backfill is to be tested for PFAS in general conformance with DER-10, Section 5.4(e) for the PFAS Analyte List (Appendix F) using the analytical procedures discussed below and the criteria in DER-10 associated with SVOCs. If PFOA or PFOS is detected in any sample at or above 1 µg/kg, then soil should be tested by SPLP and the leachate analyzed for PFAS. If the SPLP results exceed 10 ppt for either PFOA or PFOS (individually) then the source of backfill should be rejected, unless a site-specific exemption is provided by DER. SPLP leachate criteria is based on the Maximum Contaminant Levels proposed for drinking water by New York State's Department of Health, this value may be updated based on future Federal or State promulgated regulatory standards. Remedial parties have the option of analyzing samples concurrently for both PFAS in soil and in the SPLP leachate to minimize project delays. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.	Testing for PFAS should be included any time a full TAL/TCL analyte list is required. Results for PFOA and PFOS should be compared to the applicable guidance values. If PFOA or PFOS is detected in any sample at or above the guidance values then the source of backfill should be rejected, unless a site-specific exemption is provided by DER based on SPLP testing, for example. If the concentrations of PFOA and PFOS in leachate are at or above 10 ppt (the Maximum Contaminant Levels established for drinking water by the New York State Department of Health), then the soil is not acceptable. PFOA, PFOS and 1,4-dioxane are all considered semi-volatile compounds, so composite samples are appropriate for these compounds when sampling in accordance with DER-10, Table 5.4(e)10. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Footnotes	None	[1] TOP Assay analysis of highly contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances. [2] The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the soil cleanup objective for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).	9/15/2020
Additional Analysis, page 9	In cases… soil parameters, such as Total Organic Carbon (EPA Method 9060), soil…	In cases… soil parameters, such as Total Organic Carbon (Lloyd Kahn), soil…	1/8/2021
Appendix A, General Guidelines, fourth bullet	List the ELAP-approved lab(s) to be used for analysis of samples	List the ELAP- certified lab(s) to be used for analysis of samples	1/8/2021
Appendix E, Laboratory Analysis and Containers	Drinking water samples collected using this protocol are intended to be analyzed for PFAS by ISO Method 25101.	Drinking water samples collected using this protocol are intended to be analyzed for PFAS by EPA Method 537, 537.1, 533, or ISO Method 25101	1/8/2021
Water Sample Results Page 9	"In addition, further assessment of water may be warranted if either of the following screening levels are met: a. any other individual PFAS (not PFOA or PFOS) is detected in water at or above 100 ng/L; or b. total concentration of PFAS (including PFOA and PFOS) is detected in water at or above 500 ng/L"	Deleted	6/15/2021

Citation and Page Number	Current Text	Corrected Text	Date
Routine Analysis, Page XX	Currently, New York State Department of Health's Environmental Laboratory Approval Program (ELAP)… criteria set forth in the DER's laboratory guidelines for PFAS in non-potable water and solids (Appendix H - Laboratory Guidelines for Analysis of PFAS in Non-Potable Water and Solids).	Deleted	5/31/2022
Analysis and Reporting, Page XX	As of October 2020, the United States Environmental Protection Agency (EPA) does not have a validated method for analysis of PFAS for media commonly analyzed under DER remedial programs (non-potable waters, solids). DER has developed the following guidelines to ensure consistency in analysis and reporting of PFAS.	Deleted	5/31/2022
Routine Analysis, Page XX	LC-MS/MS analysis for PFAS using methodologies based on EPA Method 537.1 is the procedure to use for environmental samples. Isotope dilution techniques should be utilized for the analysis of PFAS in all media.	EPA Method 1633 is the procedure to use for environmental samples.	
Soil Sample Results, Page XX	Soil cleanup objectives for PFOA and PFOS will be proposed in an upcoming revision to 6 NYCRR Part 375-6	Soil cleanup objectives for PFOA and PFOS have been proposed in an upcoming revision to 6 NYCRR Part 375-6	
Appendix A	"Include in the text… LC-MS/MS for PFAS using methodologies based on EPA Method 537.1"	"Include in the text ….EPA Method 1633"	
Appendix A	"Laboratory should have ELAP certification for PFOA and PFOS in drinking water by EPA Method 537, 537.1, EPA Method 533, or ISO 25101"	Deleted	
Appendix B	"Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1"	"Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633"	

Citation and Page Number	Current Text	Corrected Text	Date
Appendix C	"Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1"	"Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633"	
Appendix D	"Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1"	"Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633"	
Appendix G		Updated to include all forty PFAS analytes in EPA Method 533	
Appendix H		Deleted	
Appendix I	Appendix I	Appendix H	
Appendix H	"These guidelines are intended to be used for the validation of PFAS analytical results for projects within the Division of Environmental Remediation (DER) as well as aid in the preparation of a data usability summary report."	"These guidelines are intended to be used for the validation of PFAS using EPA Method 1633 for projects within the Division of Environmental Remediation (DER)."	
Appendix H	"The holding time is 14 days…"	"The holding time is 28 days…"	
Appendix H, Initial Calibration	"The initial calibration should contain a minimum of five standards for linear fit…"	"The initial calibration should contain a minimum of six standards for linear fit…"	
Appendix H, Initial Calibration	Linear fit calibration curves should have an R^2 value greater than 0.990.	Deleted	
Appendix H, Initial Calibration Verification	Initial Calibration Verification Section	Deleted	
Appendix H	secondary Ion Monitoring Section	Deleted	
Appendix H	Branched and Linear Isomers Section	Deleted	

Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs

Objective

New York State Department of Environmental Conservation's Division of Environmental Remediation (DER) performs or oversees sampling of environmental media and subsequent analysis of PFAS as part of remedial programs implemented under 6 NYCRR Part 375. To ensure consistency in sampling, analysis, reporting, and assessment of PFAS, DER has developed this document which summarizes currently accepted procedures and updates previous DER technical guidance pertaining to PFAS.

Applicability

All work plans submitted to DEC pursuant to one of the remedial programs under Part 375 shall include PFAS sampling and analysis procedures that conform to the guidelines provided herein.

As part of a site investigation or remedial action compliance program, whenever samples of potentially affected media are collected and analyzed for the standard Target Analyte List/Target Compound List (TAL/TCL), PFAS analysis should also be performed. Potentially affected media can include soil, groundwater, surface water, and sediment. Based upon the potential for biota to be affected, biota sampling and analysis for PFAS may also be warranted as determined pursuant to a Fish and Wildlife Impact Analysis. Soil vapor sampling for PFAS is not required.

Field Sampling Procedures

DER-10 specifies technical guidance applicable to DER's remedial programs. Given the prevalence and use of PFAS, DER has developed "best management practices" specific to sampling for PFAS. As specified in DER-10 Chapter 2, quality assurance procedures are to be submitted with investigation work plans. Typically, these procedures are incorporated into a work plan, or submitted as a stand-alone document (e.g., a Quality Assurance Project Plan). Quality assurance guidelines for PFAS are listed in Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS.

Field sampling for PFAS performed under DER remedial programs should follow the appropriate procedures outlined for soils, sediments, or other solids (Appendix B), non-potable groundwater (Appendix C), surface water (Appendix D), public or private water supply wells (Appendix E), and fish tissue (Appendix F).

QA/QC samples (e.g. duplicates, MS/MSD) should be collected as specified in DER-10, Section 2.3(c). For sampling equipment coming in contact with aqueous samples only, rinsate or equipment blanks should be collected. Equipment blanks should be collected at a minimum frequency of one per day per site or one per twenty samples, whichever is more frequent.

Analysis and Reporting

The investigation work plan should describe analysis and reporting procedures, including laboratory analytical procedures for the methods discussed below. As specified in DER-10 Section 2.2, laboratories should provide a full Category B deliverable. In addition, a Data Usability Summary Report (DUSR) should be prepared by an independent, third-party data validator. Electronic data submissions should meet the requirements provided at: https://www.dec.ny.gov/chemical/62440.html.

DER has developed a *PFAS Analyte List* (Appendix G) for remedial programs to understand the nature of contamination at sites. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. If lab and/or matrix specific issues are encountered for any analytes, the DER project manager, in consultation with the DER chemist, will make case-by-case decisions as to whether certain analytes may be temporarily or permanently discontinued from analysis at each site. As with other contaminants that are analyzed for at a site, the *PFAS Analyte List* may be refined for future sampling events based on investigative findings.

Routine Analysis

EPA Method 1633 is the procedure to use for environmental samples. Reporting limits for PFOA and PFOS in aqueous samples should not exceed 2 ng/L. Reporting limits for PFOA and PFOS in solid samples should not exceed 0.5 µg/kg. Reporting limits for all other PFAS in aqueous and solid media should be as close to these limits as possible. If laboratories indicate that they are not able to achieve these reporting limits for the entire *PFAS Analyte List*, site-specific decisions regarding acceptance of elevated reporting limits for specific PFAS can be made by the DER project manager in consultation with the DER chemist. Data review guidelines were developed by DER to ensure data comparability and usability (Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids).

Additional Analysis

Additional laboratory methods for analysis of PFAS may be warranted at a site, such as the Synthetic Precipitation Leaching Procedure (SPLP) and Total Oxidizable Precursor Assay (TOP Assay).

In cases where site-specific cleanup objectives for PFOA and PFOS are to be assessed, soil parameters, such as Total Organic Carbon (Lloyd Kahn), soil pH (EPA Method 9045), clay content (percent), and cation exchange capacity (EPA Method 9081), should be included in the analysis to help evaluate factors affecting the leachability of PFAS in site soils.

SPLP is a technique used to determine the mobility of chemicals in liquids, soils and wastes, and may be useful in determining the need for addressing PFAS-containing material as part of the remedy. SPLP by EPA Method 1312 should be used unless otherwise specified by the DER project manager in consultation with the DER chemist.

Impacted materials can be made up of PFAS that are not analyzable by routine analytical methodology. A TOP Assay can be utilized to conceptualize the amount and type of oxidizable PFAS which could be liberated in the environment, which approximates the maximum concentration of perfluoroalkyl substances that could be generated if all polyfluoroalkyl substances were oxidized. For example, some polyfluoroalkyl substances may degrade or transform to form perfluoroalkyl substances (such as PFOA or PFOS), resulting in an increase in perfluoroalkyl substance concentrations as contaminated groundwater moves away from a source. The TOP Assay converts, through oxidation, polyfluoroalkyl substances (precursors) into perfluoroalkyl substances that can be detected by routine analytical methodology.[1]

[1] TOP Assay analysis of highly contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances.

Commercial laboratories have adopted methods which allow for the quantification of targeted PFAS in air and biota. The EPA's Office of Research and Development (ORD) is currently developing methods which allow for air emissions characterization of PFAS, including both targeted and non-targeted analysis of PFAS. Consult with the DER project manager and the DER chemist for assistance on analyzing biota/tissue and air samples.

Data Assessment and Application to Site Cleanup

Until such time as Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFOA and PFOS in other media, including biota and sediment, have not yet been established by the DEC.

Water Sample Results

NYSDEC has adopted ambient water quality guidance values for PFOA and PFOS. Groundwater samples should be compared to the human health criteria of 6.7 ng/l (ppt) for PFOA and 2.7 ng/l (ppt) for PFOS. These human health criteria should also be applied to surface water that is used as a water supply. This guidance also includes criteria for surface water for PFOS applicable for aquatic life, which may be applicable at some sites. Drinking water sample results should be compared to the NYS maximum contaminant level (MCL) of 10 ng/l (ppt). Analysis to determine if PFOA and PFOS concentrations are attributable to the site should include a comparison between upgradient and downgradient levels, and the presence of soil source areas, as defined below.

If PFOA and/or PFOS are identified as contaminants of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.

Soil Sample Results

NYSDEC will delay adding soil cleanup objectives for PFOA and PFOS to 6 NYCRR Part 375-6 until the PFAS rural soil background study has been completed. Until SCOs are in effect, the following are to be used as guidance values:

Guidance Values for Anticipated Site Use	PFOA (ppb)	PFOS (ppb)
Unrestricted	0.66	0.88
Residential	6.6	8.8
Restricted Residential	33	44
Commercial	500	440
Industrial	600	440
Protection of Groundwater[2]	0.8	1.0

PFOA and PFOS results for soil are to be compared against the guidance values listed above. These guidance values are to be used in determining whether PFOA and PFOS are contaminants of concern for the site and for determining remedial action objectives and cleanup requirements. Site-specific remedial objectives for protection of groundwater can also be presented for evaluation by DEC. Development of site-specific remedial objectives for protection of groundwater will require analysis of additional soil parameters relating to leachability. These

[2] The Protection of Groundwater values are based on the above referenced ambient groundwater guidance values. Details on that calculation are available in the following document, prepared for the February 2022 proposed changes to Part 375 (https://www.dec.ny.gov/docs/remediation_hudson_pdf/part375techsupport.pdf). The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).

additional analyses can include any or all the parameters listed above (soil pH, cation exchange capacity, etc.) and/or use of SPLP.

As the understanding of PFAS transport improves, DEC welcomes proposals for site-specific remedial objectives for protection of groundwater. DEC will expect that those may be dependent on additional factors including soil pH, aqueous pH, % organic carbon, % Sand/Silt/Clay, soil cations: K, Ca, Mg, Na, Fe, Al, cation exchange capacity, and anion exchange capacity. Site-specific remedial objectives should also consider the dilution attenuation factor (DAF). The NJDEP publication on DAF can be used as a reference: https://www.nj.gov/dep/srp/guidance/rs/daf.pdf.

Testing for Imported Soil

Testing for PFAS should be included any time a full TAL/TCL analyte list is required. Results for PFOA and PFOS should be compared to the applicable guidance values. If PFOA or PFOS is detected in any sample at or above the guidance values then the source of backfill should be rejected, unless a site-specific exemption is provided by DER based on SPLP testing, for example. If the concentrations of PFOA and PFOS in leachate are at or above the ambient water quality guidance values for groundwater, then the soil is not acceptable.

PFOA, PFOS and 1,4-dioxane are all considered semi-volatile compounds, so composite samples are appropriate for these compounds when sampling in accordance with DER-10, Table 5.4(e)10. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.

Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS

The following guidelines (general and PFAS-specific) can be used to assist with the development of a QAPP for projects within DER involving sampling and analysis of PFAS.

General Guidelines in Accordance with DER-10

- Document/work plan section title – Quality Assurance Project Plan
- Summarize project scope, goals, and objectives
- Provide project organization including names and resumes of the project manager, Quality Assurance Officer (QAO), field staff, and Data Validator
    - The QAO should not have another position on the project, such as project or task manager, that involves project productivity or profitability as a job performance criterion
- List the ELAP certified lab(s) to be used for analysis of samples
- Include a site map showing sample locations
- Provide detailed sampling procedures for each matrix
- Include Data Quality Usability Objectives
- List equipment decontamination procedures
- Include an "Analytical Methods/Quality Assurance Summary Table" specifying:
    - Matrix type
    - Number or frequency of samples to be collected per matrix
    - Number of field and trip blanks per matrix
    - Analytical parameters to be measured per matrix
    - Analytical methods to be used per matrix with minimum reporting limits
    - Number and type of matrix spike and matrix spike duplicate samples to be collected
    - Number and type of duplicate samples to be collected
    - Sample preservation to be used per analytical method and sample matrix
    - Sample container volume and type to be used per analytical method and sample matrix
    - Sample holding time to be used per analytical method and sample matrix
- Specify Category B laboratory data deliverables and preparation of a DUSR

Specific Guidelines for PFAS

- Include in the text that sampling for PFAS will take place
- Include in the text that PFAS will be analyzed by EPA Method 1633
- Include the list of PFAS compounds to be analyzed (*PFAS Analyte List*)
- Include the laboratory SOP for PFAS analysis
- List the minimum method-achievable Reporting Limits for PFAS
    - Reporting Limits should be less than or equal to:
        - Aqueous – 2 ng/L (ppt)
        - Solids – 0.5 µg/kg (ppb)
- Include the laboratory Method Detection Limits for the PFAS compounds to be analyzed
-
- Include detailed sampling procedures
    - Precautions to be taken
    - Pump and equipment types
    - Decontamination procedures
    - Approved materials only to be used
- Specify that regular ice only will be used for sample shipment
- Specify that equipment blanks should be collected at a minimum frequency of 1 per day per site for each matrix

Appendix B - Sampling Protocols for PFAS in Soils, Sediments and Solids

General

The objective of this protocol is to give general guidelines for the collection of soil, sediment and other solid samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Containers

Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in to contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel spoon
- stainless steel bowl
- steel hand auger or shovel without any coatings

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Sampling is often conducted in areas where a vegetative turf has been established. In these cases, a pre-cleaned trowel or shovel should be used to carefully remove the turf so that it may be replaced at the conclusion of sampling. Surface soil samples (e.g. 0 to 6 inches below surface) should then be collected using a pre-cleaned, stainless steel spoon. Shallow subsurface soil samples (e.g. 6 to ~36 inches below surface) may be collected by digging a hole using a pre-cleaned hand auger or shovel. When the desired subsurface depth is reached, a pre-cleaned hand auger or spoon shall be used to obtain the sample.

When the sample is obtained, it should be deposited into a stainless steel bowl for mixing prior to filling the sample containers. The soil should be placed directly into the bowl and mixed thoroughly by rolling the material into the middle until the material is homogenized. At this point the material within the bowl can be placed into the laboratory provided container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A soil log or sample log shall document the location of the sample/borehole, depth of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix C - Sampling Protocols for PFAS in Monitoring Wells

General

The objective of this protocol is to give general guidelines for the collection of groundwater samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including plumbers tape and sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel inertia pump with HDPE tubing
- peristaltic pump equipped with HDPE tubing and silicone tubing
- stainless steel bailer with stainless steel ball
- bladder pump (identified as PFAS-free) with HDPE tubing

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Monitoring wells should be purged in accordance with the sampling procedure (standard/volume purge or low flow purge) identified in the site work plan, which will determine the appropriate time to collect the sample. If sampling using standard purge techniques, additional purging may be needed to reduce turbidity levels, so samples contain a limited amount of sediment within the sample containers. Sample containers that contain sediment may cause issues at the laboratory, which may result in elevated reporting limits and other issues during the sample preparation that can compromise data usability. Sampling personnel should don new nitrile gloves prior to sample collection due to the potential to contact PFAS containing items (not related to the sampling equipment) during the purging activities.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank per day per site and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Additional equipment blank samples may be collected to assess other equipment that is utilized at the monitoring well
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A purge log shall document the location of the sample, sampling equipment, groundwater parameters, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix D - Sampling Protocols for PFAS in Surface Water

General

The objective of this protocol is to give general guidelines for the collection of surface water samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel cup

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Where conditions permit, (e.g. creek or pond) sampling devices (e.g. stainless steel cup) should be rinsed with site medium to be sampled prior to collection of the sample. At this point the sample can be collected and poured into the sample container.

If site conditions permit, samples can be collected directly into the laboratory container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank per day per site and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A sample log shall document the location of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix E - Sampling Protocols for PFAS in Private Water Supply Wells

General

The objective of this protocol is to give general guidelines for the collection of water samples from private water supply wells (with a functioning pump) for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Drinking water samples collected using this protocol are intended to be analyzed for PFAS by EPA Method 537, 537.1, 533, or ISO Method 25101. The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials (e.g. plumbers tape), including sample bottle cap liners with a PTFE layer.

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Locate and assess the pressure tank and determine if any filter units are present within the building. Establish the sample location as close to the well pump as possible, which is typically the spigot at the pressure tank. Ensure sampling equipment is kept clean during sampling as access to the pressure tank spigot, which is likely located close to the ground, may be obstructed and may hinder sample collection.

Prior to sampling, a faucet downstream of the pressure tank (e.g., washroom sink) should be run until the well pump comes on and a decrease in water temperature is noted which indicates that the water is coming from the well. If the homeowner is amenable, staff should run the water longer to purge the well (15+ minutes) to provide a sample representative of the water in the formation rather than standing water in the well and piping system including the pressure tank. At this point a new pair of nitrile gloves should be donned and the sample can be collected from the sample point at the pressure tank.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- If equipment was used, collect one equipment blank per day per site and a minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers.
- A field reagent blank (FRB) should be collected at a rate of one per 20 samples. The lab will provide a FRB bottle containing PFAS free water and one empty FRB bottle. In the field, pour the water from the one bottle into the empty FRB bottle and label appropriately.
- Request appropriate data deliverable (Category B) and an electronic data deliverable
- For sampling events where multiple private wells (homes or sites) are to be sampled per day, it is acceptable to collect QC samples at a rate of one per 20 across multiple sites or days.

Documentation

A sample log shall document the location of the private well, sample point location, owner contact information, sampling equipment, purge duration, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate and available (e.g. well construction, pump type and location, yield, installation date). Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appendix F - Sampling Protocols for PFAS in Fish

This appendix contains a copy of the current SOP developed by the Division of Fish and Wildlife (DFW) entitled "General Fish Handling Procedures for Contaminant Analysis" (Ver. 8). This SOP should be followed when collecting fish for contaminant analysis. Note, however, that the Bureau of Ecosystem Health will not be supplying bags or tags. All supplies are the responsibility of the collector

Procedure Name: General Fish Handling Procedures for Contaminant Analysis

Number: FW-005

Purpose: This procedure describes data collection, fish processing and delivery of fish collected for contaminant monitoring. It contains the chain of custody and collection record forms that should be used for the collections.

Organization: Environmental Monitoring Section
Bureau of Ecosystem Health
Division of Fish and Wildlife (DFW)
New York State Department of Environmental Conservation (NYSDEC)
625 Broadway
Albany, New York 12233-4756

Version: 8

Previous Version Date: 21 March 2018

Summary of Changes to this Version: Updated bureau name to Bureau of Ecosystem Health. Added direction to list the names of all field crew on the collection record. Minor formatting changes on chain of custody and collection records.

Originator or Revised by: Wayne Richter, Jesse Becker

Date: 26 April 2019

Quality Assurance Officer and Approval Date: Jesse Becker, 26 April 2019

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

GENERAL FISH HANDLING PROCEDURES FOR CONTAMINANT ANALYSES

A. Original copies of all continuity of evidence (i.e., Chain of Custody) and collection record forms must accompany delivery of fish to the lab. A copy shall be directed to the Project Leader or as appropriate, Wayne Richter. All necessary forms will be supplied by the Bureau of Ecosystem Health. Because some samples may be used in legal cases, it is critical that each section is filled out completely. Each Chain of Custody form has three main sections:

   1. The top box is to be filled out **and signed** by the person responsible for the fish collection (e.g., crew leader, field biologist, researcher). This person is responsible for delivery of the samples to DEC facilities or personnel (e.g., regional office or biologist).

   2. The second section is to be filled out **and signed** by the person responsible for the collections while being stored at DEC, before delivery to the analytical lab. This may be the same person as in (1), but it is still required that they complete the section. Also important is the **range of identification numbers** (i.e., tag numbers) included in the sample batch.

   3. Finally, the bottom box is to record any transfers between DEC personnel and facilities. Each subsequent transfer should be **identified, signed, and dated**, until laboratory personnel take possession of the fish.

B. The following data are required on each **Fish Collection Record** form:

   1. Project and Site Name.

   2. DEC Region.

   3. All personnel (and affiliation) involved in the collection.

   4. Method of collection (gill net, hook and line, etc.)

   5. Preservation Method.

C. The following data are to be taken on each fish collected and recorded on the **Fish Collection Record** form:

   1. Tag number - Each specimen is to be individually jaw tagged at time of collection with a unique number. Make sure the tag is turned out so that the number can be read without opening the bag. Use tags in sequential order. For small fish or composite samples place the tag inside the bag with the samples. The Bureau of Ecosystem Health can supply the tags.

   2. Species identification (please be explicit enough to enable assigning genus and species). Group fish by species when processing.

   3. Date collected.

   4. Sample location (waterway and nearest prominent identifiable landmark).

   5. Total length (nearest mm or smallest sub-unit on measuring instrument) and weight (nearest g or

smallest sub-unit of weight on weighing instrument). Take all measures as soon as possible with calibrated, protected instruments (e.g. from wind and upsets) and prior to freezing.

6. Sex - fish may be cut enough to allow sexing or other internal investigation, but do not eviscerate. Make any incision on the right side of the belly flap or exactly down the midline so that a left-side fillet can be removed.

D. General data collection recommendations:

1. It is helpful to use an ID or tag number that will be unique. It is best to use metal striped bass or other uniquely numbered metal tags. If uniquely numbered tags are unavailable, values based on the region, water body and year are likely to be unique: for example, R7CAY11001 for Region 7, Cayuga Lake, 2011, fish 1. If the fish are just numbered 1 through 20, we have to give them new numbers for our database, making it more difficult to trace your fish to their analytical results and creating an additional possibility for errors.

2. Process and record fish of the same species sequentially. Recording mistakes are less likely when all fish from a species are processed together. Starting with the bigger fish species helps avoid missing an individual.

3. If using Bureau of Ecosystem Health supplied tags or other numbered tags, use tags in sequence so that fish are recorded with sequential Tag Numbers. This makes data entry and login at the lab and use of the data in the future easier and reduces keypunch errors.

4. Record length and weight as soon as possible after collection and before freezing. Other data are recorded in the field upon collection. An age determination of each fish is optional, but if done, it is recorded in the appropriate “Age” column.

5. For composite samples of small fish, record the number of fish in the composite in the Remarks column. Record the length and weight of each individual in a composite. All fish in a composite sample should be of the same species and members of a composite should be visually matched for size.

6. Please submit photocopies of topographic maps or good quality navigation charts indicating sampling locations. GPS coordinates can be entered in the Location column of the collection record form in addition to or instead for providing a map. These records are of immense help to us (and hopefully you) in providing documented location records which are not dependent on memory and/or the same collection crew. In addition, they may be helpful for contaminant source trackdown and remediation/control efforts of the Department.

7. When recording data on fish measurements, it will help to ensure correct data recording for the data recorder to call back the numbers to the person making the measurements.

E. Each fish is to be placed in its own individual plastic bag. For small fish to be analyzed as a composite, put all of the fish for one composite in the same bag but use a separate bag for each composite. It is important to individually bag the fish to avoid difficulties or cross contamination when processing the fish for chemical analysis. Be sure to include the fish’s tag number inside the bag, preferably attached to the fish with the tag number turned out so it can be read. Tie or otherwise secure the bag closed. **The Bureau of Ecosystem Health will supply the bags.** If necessary, food grade bags may be procured from a suitable vendor (e.g., grocery store). It is preferable to redundantly label each bag with a manila tag tied between the knot and the body of the bag. This tag should be labeled with the project name, collection location, tag number, collection date, and fish species. If scales are collected, the scale envelope should be labeled with

the same information.

F. Groups of fish, by species, are to be placed in one large plastic bag per sampling location. **The Bureau of Ecosystem Health will supply the larger bags.** Tie or otherwise secure the bag closed. Label the site bag with a manila tag tied between the knot and the body of the bag. The tag should contain: project, collection location, collection date, species and **tag number ranges**. Having this information on the manila tag enables lab staff to know what is in the bag without opening it.

G. Do not eviscerate, fillet or otherwise dissect the fish unless specifically asked to. If evisceration or dissection is specified, the fish must be cut along the exact midline or on the right side so that the left side fillet can be removed intact at the laboratory. If filleting is specified, the procedure for taking a standard fillet (SOP PREPLAB 4) must be followed, including removing scales.

H. Special procedures for PFAS: Unlike legacy contaminants such as PCBs, which are rarely found in day to day life, PFAS are widely used and frequently encountered. Practices that avoid sample contamination are therefore necessary. While no standard practices have been established for fish, procedures for water quality sampling can provide guidance. The following practices should be used for collections when fish are to be analyzed for PFAS:

No materials containing Teflon.
No Post-it notes.
No ice packs; only water ice or dry ice.
Any gloves worn must be powder free nitrile.
No Gore-Tex or similar materials (Gore-Tex is a PFC with PFOA used in its manufacture).
No stain repellent or waterproof treated clothing; these are likely to contain PFCs.
Avoid plastic materials, other than HDPE, including clipboards and waterproof notebooks.
Wash hands after handling any food containers or packages as these may contain PFCs.
Keep pre-wrapped food containers and wrappers isolated from fish handling.
Wear clothing washed at least six times since purchase.
Wear clothing washed without fabric softener.
Staff should avoid cosmetics, moisturizers, hand creams and similar products on the day of sampling as many of these products contain PFCs (Fujii et al. 2013). Sunscreen or insect repellent should not contain ingredients with “fluor” in their name. Apply any sunscreen or insect repellent well downwind from all materials. Hands must be washed after touching any of these products.

I. All fish must be kept at a temperature <45° F (<8° C) immediately following data processing. As soon as possible, freeze at -20° C ± 5° C. Due to occasional freezer failures, daily freezer temperature logs are required. The freezer should be locked or otherwise secured to maintain chain of custody.

J. In most cases, samples should be delivered to the Analytical Services Unit at the Hale Creek field station. Coordinate delivery with field station staff and send copies of the collection records, continuity of evidence forms and freezer temperature logs to the field station. For samples to be analyzed elsewhere, non-routine collections or other questions, contact Wayne Richter, Bureau of Ecosystem Health, NYSDEC, 625 Broadway, Albany, New York 12233-4756, 518-402-8974, or the project leader about sample transfer. Samples will then be directed to the analytical facility and personnel noted on specific project descriptions.

K. A recommended equipment list is at the end of this document.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF FISH AND WILDLIFE
FISH COLLECTION RECORD

Project and Site Name _____ DEC Region _____

Collections made by (include all crew) _____

Sampling Method: □Electrofishing □Gill netting □Trap netting □Trawling □Seining □Angling □Other _____

Preservation Method: □Freezing □Other _____ Notes (SWFDB survey number): _____

FOR LAB USE ONLY- LAB ENTRY NO.	COLLECTION OR TAG NO.	SPECIES	DATE TAKEN	LOCATION	AGE	SEX &/OR REPROD. CONDIT	LENGTH ( )	WEIGHT ( )	REMARKS

richter: revised 2011, 5/7/15, 10/4/16, 3/20/17; becker: 3/23/17, 4/26/19

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
CHAIN OF CUSTODY

I, _____, of _____ collected the
(Print Name) (Print Business Address)

following on _____, 20____ from _____
(Date) (Water Body)

in the vicinity of _____
(Landmark, Village, Road, etc.)

Town of _____, in _____ County.

Item(s) _____

_____

Said sample(s) were in my possession and handled according to standard procedures provided to me prior to collection. The sample(s) were placed in the custody of a representative of the New York State Department of Environmental Conservation on _____, 20_____.

_____ _____
Signature Date

I, _____, received the above mentioned sample(s) on the date specified and assigned identification number(s) _____ to the sample(s). I have recorded pertinent data for the sample(s) on the attached collection records. The sample(s) remained in my custody until subsequently transferred, prepared or shipped at times and on dates as attested to below.

_____ _____
Signature Date

SECOND RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
THIRD RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
FOURTH RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
RECEIVED IN LABORATORY BY (Print Name)	TIME & DATE	REMARKS
SIGNATURE	UNIT	
LOGGED IN BY (Print Name)	TIME & DATE	ACCESSION NUMBERS
SIGNATURE	UNIT	

richter: revised 21 April 2014; becker: 23 March 2017, 26 April, 2019

NOTICE OF WARRANTY

By signature to the chain of custody (reverse), the signatory warrants that the information provided is truthful and accurate to the best of his/her ability. The signatory affirms that he/she is willing to testify to those facts provided and the circumstances surrounding the same. Nothing in this warranty or chain of custody negates responsibility nor liability of the signatories for the truthfulness and accuracy of the statements provided.

HANDLING INSTRUCTIONS

On day of collection, collector(s) name(s), address(es), date, geographic location of capture (attach a copy of topographic map or navigation chart), species, number kept of each species, and description of capture vicinity (proper noun, if possible) along with name of Town and County must be indicated on reverse.

Retain organisms in manila tagged plastic bags to avoid mixing capture locations. Note appropriate information on each bag tag.

Keep samples as cool as possible. Put on ice if fish cannot be frozen within 12 hours. If fish are held more than 24 hours without freezing, they will not be retained or analyzed.

Initial recipient (either DEC or designated agent) of samples from collector(s) is responsible for obtaining and recording information on the collection record forms which will accompany the chain of custody. This person will seal the container using packing tape and writing his signature, the time and the date across the tape onto the container with indelible marker. Any time a seal is broken, for whatever purpose, the incident must be recorded on the Chain of Custody (reason, time, and date) in the purpose of transfer block. Container then is resealed using new tape and rewriting signature, with time and date.

EQUIPMENT LIST

Scale or balance of appropriate capacity for the fish to be collected.

Fish measuring board.

Plastic bags of an appropriate size for the fish to be collected and for site bags.

Individually numbered metal tags for fish.

Manila tags to label bags.

Small envelops, approximately 2” x 3.5”, if fish scales are to be collected.

Knife for removing scales.

Chain of custody and fish collection forms.

Clipboard.

Pens or markers.

Paper towels.

Dish soap and brush.

Bucket.

Cooler.

Ice.

Duct tape.

Appendix G – PFAS Analyte List

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonic acids	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluoropentanesulfonic acid	PFPeS	2706-91-4
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanesulfonic acid	PFOS	1763-23-1
	Perfluorononanesulfonic acid	PFNS	68259-12-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
	Perfluorododecanesulfonic acid	PFDoS	79780-39-5
Perfluoroalkyl carboxylic acids	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUnA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTeDA	376-06-7
Per- and Polyfluoroether carboxylic acids	Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6
	4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
	Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1
	Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5
	Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6
Fluorotelomer sulfonic acids	4:2 Fluorotelomer sulfonic acid	4:2-FTS	757124-72-4
	6:2 Fluorotelomer sulfonic acid	6:2-FTS	27619-97-2
	8:2 Fluorotelomer sulfonic acid	8:2-FTS	39108-34-4
Fluorotelomer carboxylic acids	3:3 Fluorotelomer carboxylic acid	3:3 FTCA	356-02-5
	5:3 Fluorotelomer carboxylic acid	5:3 FTCA	914637-49-3
	7:3 Fluorotelomer carboxylic acid	7:3 FTCA	812-70-4
Perfluorooctane sulfonamides	Perfluorooctane sulfonamide	PFOSA	754-91-6
	N-methylperfluorooctane sulfonamide	NMeFOSA	31506-32-8
	N-ethylperfluorooctane sulfonamide	NEtFOSA	4151-50-2
Perfluorooctane sulfonamidoacetic acids	N-methylperfluorooctane sulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethylperfluorooctane sulfonamidoacetic acid	N-EtFOSAA	2991-50-6
Perfluorooctane sulfonamide ethanols	N-methylperfluorooctane sulfonamidoethanol	MeFOSE	24448-09-7
	N-ethylperfluorooctane sulfonamidoethanol	EtFOSE	1691-99-2

Group	Chemical Name	Abbreviation	CAS Number
Ether sulfonic acids	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (F-53B Major)	9Cl-PF3ONS	756426-58-1
	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor)	11Cl-PF3OUdS	763051-92-9
	Perfluoro(2-ethoxyethane) sulfonic acid	PFEESA	113507-82-7

Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids

General

These guidelines are intended to be used for the validation of PFAS using EPA Method 1633 for projects within the Division of Environmental Remediation (DER). Data reviewers should understand the methodology and techniques utilized in the analysis. Consultation with the end user of the data may be necessary to assist in determining data usability based on the data quality objectives in the Quality Assurance Project Plan. A familiarity with the laboratory's Standard Operating Procedure may also be needed to fully evaluate the data. If you have any questions, please contact DER's Quality Assurance Officer, Dana Barbarossa, at dana.barbarossa@dec.ny.gov.

Preservation and Holding Time

Samples should be preserved with ice to a temperature of less than 6°C upon arrival at the lab. The holding time is 28 days to extraction for aqueous and solid samples. The time from extraction to analysis for aqueous samples is 28 days and 40 days for solids.

Temperature greatly exceeds 6ºC upon arrival at the lab*	Use professional judgement to qualify detects and non-detects as estimated or rejected
Holding time exceeding 28 days to extraction	Use professional judgement to qualify detects and non-detects as estimated or rejected if holding time is grossly exceeded

*Samples that are delivered to the lab immediately after sampling may not meet the thermal preservation guidelines. Samples are considered acceptable if they arrive on ice or an attempt to chill the samples is observed.

Initial Calibration

The initial calibration should contain a minimum of six standards for linear fit and six standards for a quadratic fit. The relative standard deviation (RSD) for a quadratic fit calibration should be less than 20%.

The low-level calibration standard should be within 50% - 150% of the true value, and the mid-level calibration standard within 70% - 130% of the true value.

%RSD >20%	J flag detects and UJ non detects

Continuing Calibration Verification

Continuing calibration verification (CCV) checks should be analyzed at a frequency of one per ten field samples. If CCV recovery is very low, where detection of the analyte could be in question, ensure a low level CCV was analyzed and use to determine data quality.

CCV recovery <70 or >130%	J flag results

Blanks

There should be no detections in the method blanks above the reporting limits. Equipment blanks, field blanks, rinse blanks etc. should be evaluated in the same manner as method blanks. Use the most contaminated blank to evaluate the sample results.

Blank Result	Sample Result	Qualification
Any detection	<Reporting limit	Qualify as ND at reporting limit
Any detection	>Reporting Limit and >10x the blank result	No qualification
>Reporting limit	>Reporting limit and <10x blank result	J+ biased high

Field Duplicates

A blind field duplicate should be collected at rate of one per twenty samples. The relative percent difference (RPD) should be less than 30% for analyte concentrations greater than two times the reporting limit. Use the higher result for final reporting.

RPD >30%	Apply J qualifier to parent sample

Lab Control Spike

Lab control spikes should be analyzed with each extraction batch or one for every twenty samples. In the absence of lab derived criteria, use 70% - 130% recovery criteria to evaluate the data.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects

Matrix Spike/Matrix Spike Duplicate

One matrix spike and matrix spike duplicate should be collected at a rate of one per twenty samples. Use professional judgement to reject results based on out of control MS/MSD recoveries.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only
RPD >30%	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only

Extracted Internal Standards (Isotope Dilution Analytes)

Problematic analytes (e.g. PFBA, PFPeA, fluorotelomer sulfonates) can have wider recoveries without qualification. Qualify corresponding native compounds with a J flag if outside of the range.

Recovery <50% or >150%	Apply J qualifier
Recovery <25% or >150% for poor responding analytes	Apply J qualifier
Isotope Dilution Analyte (IDA) Recovery <10%	Reject results

Signal to Noise Ratio

The signal to noise ratio for the quantifier ion should be at least 3:1. If the ratio is less than 3:1, the peak is discernable from the baseline noise and symmetrical, the result can be reported. If the peak appears to be baseline noise and/or the shape is irregular, qualify the result as tentatively identified.

Reporting Limits

If project-specific reporting limits were not met, please indicate that in the report along with the reason (e.g. over dilution, dilution for non-target analytes, high sediment in aqueous samples).

Peak Integrations

Target analyte peaks should be integrated properly and consistently when compared to standards. Ensure branched isomer peaks are included for PFAS where standards are available. Inconsistencies should be brought to the attention of the laboratory or identified in the data review summary report.

APPENDIX C

Roux's Standard Operating Procedures

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for decontamination of all field equipment potentially exposed to contamination during drilling, and soil and water sampling. The objective of decontamination is to ensure that all drilling, and soil-sampling and water-sampling equipment is decontaminated (free of potential contaminants): 1) prior to being brought onsite to avoid the introduction of potential contaminants to the site; 2) between drilling and sampling events/activities onsite to eliminate the potential for cross-contamination between boreholes and/or wells; and 3) prior to the removal of equipment from the site to prevent the transportation of potentially contaminated equipment offsite.

In considering decontamination procedures, state and federal regulatory agency requirements must be considered because of potential variability between state and federal requirements and because of variability in the requirements of individual states. Decontamination procedures must be in compliance with state and/or federal protocols in order that regulatory agency(ies) scrutiny of the procedures and data collected do not result in non-acceptance (invalidation) of the work undertaken and data collected.

2.0 PROCEDURE FOR DRILLING EQUIPMENT

The following is a minimum decontamination procedure for drilling equipment. Drilling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

2.1 The rig and all associated equipment should be properly decontaminated by the contractor before arriving at the test site.

2.2 The augers, drilling casings, rods, samplers, tools, rig, and any piece of equipment that can come in contact (directly or indirectly) with the soil, will be steam cleaned onsite prior to set up for drilling to ensure proper decontamination.

2.3 The same steam cleaning procedures will be followed between boreholes (at a fixed on-site location[s], if appropriate) and before leaving the site at the end of the study.

2.4 All on-site steam cleaning (decontamination) activities will be monitored and documented by a member(s) of the staff of Roux Associates, Inc.

2.5 If drilling activities are conducted in the presence of thick, sticky oils (e.g., PCBs) which coat drilling equipment, then special decontamination procedures may have to be utilized before steam cleaning (e.g., hexane scrub and wash).

2.6 Containment of decontamination fluids may be necessary (e.g., rinseate from steam cleaning) or will be required (e.g., hexane), and disposal must be in accordance with state and/or federal procedures.

3.0 PROCEDURE FOR SOIL-SAMPLING EQUIPMENT

The following is a minimum decontamination procedure for soil-sampling equipment (e.g., split spoons, stainless-steel spatulas). Soil-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

3.1 Wear disposable gloves while cleaning equipment to avoid cross-contamination and change gloves as needed.

3.2 Steam clean the sampler or rinse with potable water. If soil-sampling activities are conducted in the presence of thick, sticky oils (e.g., PCBs) which coat sampling equipment, then special decontamination procedures may have to be utilized before steam cleaning and washing in detergent solution (e.g., hexane scrub and wash).

3.3 Prepare a non-phosphate, laboratory-grade detergent solution and distilled or potable water in a clean bucket.

3.4 Disassemble the sampler, as necessary and immerse all parts and other sampling equipment in the solution.

3.5 Scrub all equipment in the bucket with a brush to remove any adhering particles.

3.6 Rinse all equipment with copious amounts of potable water followed by distilled or deionized water.

3.7 Place clean equipment on a clean plastic sheet (e.g., polyethylene)

3.8 Reassemble the cleaned sampler, as necessary.

3.9 Transfer the sampler to the driller (or helper) making sure that this individual is also wearing clean gloves or wrap the equipment with a suitable material (e.g., plastic bag, aluminum foil.

As part of the decontamination procedure for soil-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

4.0 PROCEDURE FOR WATER-SAMPLING EQUIPMENT

The following is a decontamination procedure for water-sampling equipment (e.g., bailers, pumps). Water-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

4.1 Decontamination procedures for bailers follow:

a. Wear disposable gloves while cleaning bailer to avoid cross-contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a bucket.

c. Disassemble bailer (if applicable) and discard cord in an appropriate manner and scrub each part of the bailer with a brush and solution.

d. Rinse with potable water and reassemble bailer.

e. Rinse with copious amounts of distilled or deionized water.

f. Air dry.

g. Wrap equipment with a suitable material (e.g., clean plastic bag, aluminum foil).

h. Rinse bailer at least three times with distilled or deionized water before use.

4.2 Decontamination procedures for pumps follow:

a. Wear disposable gloves while cleaning pump to avoid cross-contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a clean bucket, clean garbage can, or clean 55-gallon drum.

c. Flush the pump and discharge hose (if not disposable) with the detergent solution and discard disposable tubing and/or cord in an appropriate manner.

d. Flush the pump and discharge hose (if not disposable) with potable water.

e. Place the pump on clear plastic sheeting.

f. Wipe any pump-related equipment (e.g., electrical lines, cables, discharge hose) that entered the well with a clean cloth and detergent solution, and rinse or wipe with a clean cloth and potable water.

g. Air dry.

h. Wrap equipment with a suitable material (e.g., clean plastic bag).

As part of the decontamination procedure for water-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for sample handling which will allow consistent and accurate results. Valid chemistry data are integral to investigations that characterize media-quality conditions. Thus, this SOP is designed to ensure that once samples are collected, they are preserved, packed and delivered in a manner which will maintain sample integrity to as great an extent as possible. The procedures outlined are applicable to most sampling events and any required modifications must be clearly described in the work plan.

2.0 CONSIDERATIONS

Sample containers, sampling equipment decontamination, quality assurance/quality control (QA/QC), sample preservation, and sample handling are all components of this SOP.

2.1 Sample Containers

Prior to collection of a sample, considerations must be given to the type of container that will be used to store and transport the sample. The type and number of containers selected is usually based on factors such as sample matrix, potential contaminants to be encountered, analytical methods requested, and the laboratory's internal quality assurance requirements. In most cases, the overriding considerations will be the analytical methodology, or the state or federal regulatory requirements because these regulations generally encompass the other factors. The sample container selected is usually based on some combination of the following criteria:

a. Reactivity of Container Material with Sample

Choosing the proper composition of sample containers will help to ensure that the chemical and physical integrity of the sample is maintained. For sampling potentially hazardous material, glass is the recommended container type because it is chemically inert to most substances. Plastic containers are not recommended for most hazardous wastes because the potential exists for contaminants to adsorb to the surface of the plastic or for the plasticizer to leach into the sample.

In some instances, however, the sample characteristics or analytes of interest may dictate that plastic containers be used instead of glass. Because some metals species will adhere to the sides of the glass containers in an aqueous matrix, plastic bottles (e.g., nalgene) must be used for samples collected for metals analysis. A separate, plastic

container should accompany glass containers if metals analysis is to be performed along with other analyses. Likewise, other sample characteristics may dictate that glass cannot be used. For example, in the case of a strong alkali waste or hydrofluoric solution, plastic containers may be more suitable because glass containers may be etched by these compounds and create adsorptive sites on the container's surface.

b. Volume of the Container

The volume of sample to be collected will be dictated by the analysis being performed and the sample matrix. The laboratory must supply bottles of sufficient volume to perform the required analysis. In most cases, the methodology dictates the volume of sample material required to complete the analysis. However, individual laboratories may provide larger volume containers for various analytes to ensure sufficient quantities for duplicates or other QC checks.

To facilitate transfer of the sample from the sampler into the container and to minimize spillage and sample disturbance, wide-mouth containers are recommended. Aqueous volatile organic samples must be placed into 40-milliliter (ml) glass vials with polytetrafluoroethylene (PTFE) (e.g., TeflonTM) septums. Non-aqueous volatile organic samples should be collected in the same type of vials or in 4-ounce (oz) wide-mouth jars provided by the laboratory. These jars should have PTFE-lined screw caps.

c. Color of Container

Whenever possible, amber glass containers should be used to prevent photodegradation of the sample, except when samples are being collected for metals analysis. If amber containers are not available, then containers holding samples should be protected from light (i.e., place in cooler with ice immediately after filling).

d. Container Closures

Container closures must screw on and off the containers and form a leak-proof seal. Container caps must not be removed until the container is ready to be filled with the sample, and the container cap must be replaced (securely) immediately after filling it. Closures should be constructed of a material which is inert with respect to the sampled material, such as PTFE (e.g., TeflonTM). Alternately, the closure may be separated from the sample by a closure liner that is inert to the sample material such as PTFE sheeting. If soil or sediment samples are being collected, the threads of the container must be wiped clean with a dedicated paper towel or cloth, so the cap can be threaded properly.

e. Decontamination of Sample Containers

Sample containers must be laboratory cleaned by the laboratory performing the analysis. The cleaning procedure is dictated by the specific analysis to be performed on the sample. Sample containers must be carefully examined to ensure that all containers appear clean. Do not mistake the preservative as unwanted residue. The bottles should not be field cleaned. If there is any question regarding the integrity of the bottle, then the laboratory must be contacted immediately and the bottle(s) replaced.

f. Sample Bottle Storage and Transport

No matter where the sample bottles are, whether at the laboratory waiting to be packed for shipment or in the field waiting to be filled with sample, care must be taken to avoid contamination. Sample shuttles or coolers, and sample bottles must be stored and transported in clean environments. Sample bottles and clean sampling equipment must never be stored near solvents, gasoline, or other equipment that is a potential source of cross-contamination. When under chain of custody, sample bottles must be secured in locked vehicles, and custody sealed in shuttles or in the presence of authorized personnel. Information which documents that proper storage and transport procedures have been followed must be included in the field notebook and on appropriate field forms.

2.2 Decontamination of Sampling Equipment

Proper decontamination of all re-usable sampling equipment is critical for all sampling episodes. The SOP for Decontamination of Field Equipment and SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for decontamination of various types of equipment.

2.3 Quality Assurance/Quality Control Samples

QA/QC samples are intended to provide control over the proper collection and tracking of environmental measurements, and subsequent review, interpretation and validation of generated analytical data. The SOPs for Collection of Quality Control Samples, for Evaluation and Validation of Data, and for Field Record Keeping and Quality Assurance/Quality Control must be referred to for detailed guidance regarding these respective procedures. SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for QA/QC procedures.

2.4 Sample Preservation Requirements

Certain analytical methodologies for specific analytes require chemical additives in order to stabilize and maintain sample integrity. Generally, this is accomplished under the following two scenarios:

a. Sample bottles are preserved at the laboratory prior to shipment into the field.

b. Preservatives are added in the field immediately after the samples are collected.

Many laboratories provide pre-preserved bottles as a matter of convenience and to help ensure that samples will be preserved immediately upon collection. A problem associated with this method arises if not enough sample could be collected, resulting in too much preservative in the sample. More commonly encountered problems with this method include the possibility of insufficient preservative provided to achieve the desired pH level or the need for additional preservation due to chemical reactions caused by the addition of sample liquids to pre-preserved bottles. The use of pre-preserved bottles is acceptable; however, field sampling teams must always be prepared to add additional preservatives to samples if the aforementioned situations occur. Furthermore, care must be exercised not to overfill sample bottles containing preservatives to prevent the sample and preservative from spilling and therefore diluting the preservative (i.e., not having enough preservative for the volume of sample).

When samples are preserved after collection, special care must be taken. The transportation and handling of concentrated acids in the field requires additional preparation and adherence to appropriate preservation procedures. All preservation acids used in the field should be trace-metal or higher-grade.

2.5 Sample Handling

After the proper sample bottles have been received under chain-of-custody, properly decontaminated equipment has been used to collect the sample, and appropriate preservatives have been added to maintain sample integrity, the final step for the field personnel is checking the sample bottles prior to proper packing and delivery of the samples to the laboratory.

All samples should be organized and the labels checked for accuracy. The caps should be checked for tightness and any 40-ml volatile organic compound (VOC) bottles must be checked for bubbles. Each sample bottle must be placed in an individual Ziploc® bag to protect the label, and placed on ice. The bottles must be carefully packed to prevent breakage during transport. When several bottles have been collected for an individual sample, they should not be placed adjacent to each other in the cooler to prevent possible breakage of all bottles for a given sample. If there are any samples which are known or suspected to be highly

contaminated, these should be placed in an individual cooler under separate chain-of-custody to prevent possible cross contamination. Sufficient ice (wet or blue packs) should be placed in the cooler to maintain the temperature at 4 degrees Celsius (°C) until delivery at the laboratory. Consult the work plan to determine if a particular ice is specified as the preservation for transportation (e.g., the United States Environmental Protection Agency does not like the use of blue packs because they claim that the samples will not hold at 4°C). If additional coolers are required, then they should be purchased. The chain-of-custody form should be properly completed, placed in a "zip-lock" bag, and placed in the cooler. One copy must be maintained for the project files. The cooler should be sealed with packing tape and a custody seal. The custody seal number should be noted in the field book. Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time. If overnight mail is utilized, then the shipping bill must be maintained for the files and the laboratory must be called the following day to confirm receipt.

3.0 EQUIPMENT AND MATERIALS

3.1 General equipment and materials may include, but not necessarily be limited to, the following:

a. Sample bottles of proper size and type with labels.

b. Cooler with ice (wet or blue pack).

c. Field notebook, appropriate field form(s), chain-of-custody form(s), custody seals.

d. Black pen and indelible marker.

e. Packing tape, "bubble wrap," and "zip-lock" bags.

f. Overnight (express) mail forms and laboratory address.

g. Health and safety plan (HASP).

h. Work plan/scope of work.

i. Pertinent SOPs for specified tasks and their respective equipment and materials.

3.2 Preservatives for specific samples/analytes as specified by the laboratory. Preservatives must be stored in secure, spillproof glass containers with their content, concentration, and date of preparation and expiration clearly labeled.

3.3 Miscellaneous equipment and materials including, but not necessarily limited to, the following:

a. Graduated pipettes.

b. Pipette bulbs.

c. Litmus paper.

d. Glass stirring rods.

e. Protective goggles.

f. Disposable gloves.

g. Lab apron.

h. First aid kit.

i. Portable eye wash station.

j. Water supply for immediate flushing of spillage, if appropriate.

k. Shovel and container for immediate containerization of spillage-impacted soils, if appropriate.

4.0 PROCEDURE

4.1 Examine all bottles and verify that they are clean and of the proper type, number, and volume for the sampling to be conducted.

4.2 Label bottles carefully and clearly with project name and number, site location, sample identification, date, time, and the sampler's initials using an indelible marker.

4.3 Collect samples in the proper manner (refer to specific sampling SOPs).

4.4 Conduct preservation activities as required after each sample has been collected. Field preservation must be done immediately and must not be done later than 30 minutes after sample collection.

4.5 Conduct QC sampling, as required.

4.6 Seal each container carefully and place in an individual "zip lock" bag.

4.7 Organize and carefully pack all samples in the cooler immediately after collection (e.g., bubble wrap). Insulate samples so that breakage will not occur.

4.8 Complete and place the chain-of-custody form in the cooler after all samples have been collected. Maintain one copy for the project file. If the cooler is to be transferred several times prior to shipment or delivery to the laboratory, it may be easier to tape the chain-of-custody to the exterior of the sealed cooler. When exceptionally hazardous samples are known or suspected to be present, this should be identified on the chain-of-custody as a courtesy to the laboratory personnel.

4.9 Add additional ice as necessary to ensure that it will last until receipt by the laboratory.

4.10 Seal the cooler with packing tape and a custody seal. Record the number of the custody seal in the field notebook and on the field form. If there are any exceptionally hazardous samples, then shipping regulations should be examined to ensure the sample containers and coolers are in compliance and properly labeled.

4.11 Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time.

4.12 Maintain the shipping bill for the project files if overnight mail is utilized and call the laboratory the following day to confirm receipt.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish guidelines for the collection of soil samples for laboratory analysis. This SOP is applicable to soil samples collected from split-spoon samplers during drilling, hand auger samples, grab samples from stockpiled soils, surface samples, test pit samples, etc.

2.0 CONSIDERATIONS

Soil samples may be collected in either a random or biased manner. Random samples can be based on a grid system or statistical methodology. Biased samples can be collected in areas of visible impact or suspected source areas. Soil samples can be collected at the surface, shallow subsurface, or at depth. When samples are collected at depth the water content should be noted, since generally "soil sampling" is restricted to the unsaturated zone. Equipment selection will be determined by the depth of the sample to be collected. A thorough description of the sampling locations and proposed methods of sample collection should be included in the work plan.

Commonly, surface sampling refers to the collection of samples at a 0 to 6-inch depth interval. Certain regulatory agencies may define the depth interval of a surface sample differently, and this must be defined in the work plan. Collection of surface soil samples is most efficiently accomplished with the use of a stainless-steel trowel or scoop. For samples at greater depths a decontaminated bucket auger or power auger may be needed to advance the hole to the point of sample collection. Another clean bucket auger should then be used to collect the sample. To collect samples at depths of greater than approximately six feet the use of a drill rig and split spoon samples will usually be necessary. In some situations, sample locations are accessed with the use of a backhoe.

3.0 MATERIALS/EQUIPMENT

a. A work plan which outlines soil sampling requirements.

b. Field notebook, field form(s), maps, chain-of-custody forms, and custody seals.

c. Decontamination supplies (including: non-phosphate, laboratory grade detergent, buckets, brushes, potable water, distilled water, regulatory-required reagents, aluminum foil, plastic sheeting, etc.).

d. Sampling device (split-spoon sampler, stainless steel hand auger, stainless steel trowel, etc.).

e. Stainless steel spoons or spatulas.

f. Disposable sampling gloves.

g. Laboratory-supplied sample containers with labels.

h. Cooler with blue or wet ice.

i. Plastic sheeting.

j. Black pen and indelible marker.

k. Zip-lock bags and packing material.

l. Tape measure.

m. Paper towels or clean rags.

n. Masking and packing tape.

o. Overnight (express) mail forms.

4.0 DECONTAMINATION

All reusable sampling equipment will be thoroughly cleaned according to the decontamination SOP. Where possible, thoroughly pre-cleaned and wrapped sampling equipment should be used and dedicated to individual sampling locations. Disposable items such as sampling gloves, aluminum foil, and plastic sheeting will be changed after each use and discarded in an appropriate manner.

5.0 PROCEDURE

5.1 Prior to collecting soil samples, ensure that all sampling equipment has been thoroughly cleaned according to the decontamination SOP. If samples are to be collected at depth, then the boring must be advanced with thoroughly cleaned equipment to the desired sampling horizon and a different thoroughly cleaned sampler must be used to collect the sample.

5.2 Using disposable gloves and a pre-cleaned, stainless steel spatula or spoon, extract the soil sample from the sampler, measure the recovery, and separate the wash from the true sample. Where allowed by regulatory agency(ies), disposable plastic spoons may be used.

5.3 Place the sample in a laboratory-supplied, pre-cleaned sample container. This should be done as quickly as possible and this is especially important when sampling for volatile organic compounds (VOCs). Samples to be analyzed for VOCs must be collected prior to other constituents.

5.4 The sample container will be labeled with appropriate information such as, client name, site location, sample identification (location, depth, etc.), date and time of collection, and sampler's initials.

5.5 Using the remaining portion of soil from the sampler, log the sample in detail and record sediment characteristics (color, odor, moisture, texture, density, consistency, organic content, layering, grain size, etc.).

5.6 If soil samples are to be composited in the field, then equal portions from selected locations will be placed on a clean plastic sheet and homogenized. Alternately, several samples may be submitted to the laboratory for compositing by weight. The method used is dependent upon regulatory requirements. Specific compositing procedures shall be approved by the appropriate regulatory agency and described in the work plan. Samples to be analyzed for VOCs will not be composited unless required by a regulatory agency.

5.7 After the sample has been collected, labeled, and logged in detail, it is placed in a zip-lock bag and stored in a cooler at 4°C.

5.8 A chain-of-custody form is completed for all samples collected. One copy is retained and two are sent with the samples in a zip-lock bag to the laboratory. A custody seal is placed on the cooler prior to shipment.

5.9 Samples collected from Monday to Friday are to be delivered to the laboratory within 24 hours of collection. If Saturday delivery is unavailable, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if any analytes require a shorter delivery time.

5.10 The field notebook and appropriate forms should include, but not be limited to the following: client name, site location, sample location, sample depth, sample identification, date and time collected, sampler's name, method of sample collection, number and type of containers, geologic description of material, description of decontamination procedures, etc. A site map should be prepared with exact measurements to each sample location in case follow-up sampling is necessary.

5.11 All reusable sampling equipment must be thoroughly cleaned in accordance with the decontamination SOP. Following the final decontamination (after all samples are collected) the sampling equipment is wrapped in aluminum foil. Discard any gloves, foil, plastic, etc. in an appropriate manner that is consistent with site conditions.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for sample handling which will allow consistent and accurate results. Valid chemistry data are integral to investigations that characterize media-quality conditions. Thus, this SOP is designed to ensure that once samples are collected, they are preserved, packed and delivered in a manner which will maintain sample integrity to as great an extent as possible. The procedures outlined are applicable to most sampling events and any required modifications must be clearly described in the work plan.

2.0 CONSIDERATIONS

Sample containers, sampling equipment decontamination, quality assurance/quality control (QA/QC), sample preservation, and sample handling are all components of this SOP.

2.1 Sample Containers

Prior to collection of a sample, considerations must be given to the type of container that will be used to store and transport the sample. The type and number of containers selected is usually based on factors such as sample matrix, potential contaminants to be encountered, analytical methods requested, and the laboratory's internal quality assurance requirements. In most cases, the overriding considerations will be the analytical methodology, or the state or federal regulatory requirements because these regulations generally encompass the other factors. The sample container selected is usually based on some combination of the following criteria:

a. Reactivity of Container Material with Sample

Choosing the proper composition of sample containers will help to ensure that the chemical and physical integrity of the sample is maintained. For sampling potentially hazardous material, glass is the recommended container type because it is chemically inert to most substances. Plastic containers are not recommended for most hazardous wastes because the potential exists for contaminants to adsorb to the surface of the plastic or for the plasticizer to leach into the sample.

In some instances, however, the sample characteristics or analytes of interest may dictate that plastic containers be used instead of glass. Because some metals species will adhere to the sides of the glass containers in an aqueous matrix, plastic bottles (e.g., nalgene) must be used for samples collected for metals analysis. A separate, plastic

container should accompany glass containers if metals analysis is to be performed along with other analyses. Likewise, other sample characteristics may dictate that glass cannot be used. For example, in the case of a strong alkali waste or hydrofluoric solution, plastic containers may be more suitable because glass containers may be etched by these compounds and create adsorptive sites on the container's surface.

b. Volume of the Container

The volume of sample to be collected will be dictated by the analysis being performed and the sample matrix. The laboratory must supply bottles of sufficient volume to perform the required analysis. In most cases, the methodology dictates the volume of sample material required to complete the analysis. However, individual laboratories may provide larger volume containers for various analytes to ensure sufficient quantities for duplicates or other QC checks.

To facilitate transfer of the sample from the sampler into the container and to minimize spillage and sample disturbance, wide-mouth containers are recommended. Aqueous volatile organic samples must be placed into 40-milliliter (ml) glass vials with polytetrafluoroethylene (PTFE) (e.g., TeflonTM) septums. Non-aqueous volatile organic samples should be collected in the same type of vials or in 4-ounce (oz) wide-mouth jars provided by the laboratory. These jars should have PTFE-lined screw caps.

c. Color of Container

Whenever possible, amber glass containers should be used to prevent photodegradation of the sample, except when samples are being collected for metals analysis. If amber containers are not available, then containers holding samples should be protected from light (i.e., place in cooler with ice immediately after filling).

d. Container Closures

Container closures must screw on and off the containers and form a leak-proof seal. Container caps must not be removed until the container is ready to be filled with the sample, and the container cap must be replaced (securely) immediately after filling it. Closures should be constructed of a material which is inert with respect to the sampled material, such as PTFE (e.g., TeflonTM). Alternately, the closure may be separated from the sample by a closure liner that is inert to the sample material such as PTFE sheeting. If soil or sediment samples are being collected, the threads of the container must be wiped clean with a dedicated paper towel or cloth, so the cap can be threaded properly.

e. Decontamination of Sample Containers

Sample containers must be laboratory cleaned by the laboratory performing the analysis. The cleaning procedure is dictated by the specific analysis to be performed on the sample. Sample containers must be carefully examined to ensure that all containers appear clean. Do not mistake the preservative as unwanted residue. The bottles should not be field cleaned. If there is any question regarding the integrity of the bottle, then the laboratory must be contacted immediately and the bottle(s) replaced.

f. Sample Bottle Storage and Transport

No matter where the sample bottles are, whether at the laboratory waiting to be packed for shipment or in the field waiting to be filled with sample, care must be taken to avoid contamination. Sample shuttles or coolers, and sample bottles must be stored and transported in clean environments. Sample bottles and clean sampling equipment must never be stored near solvents, gasoline, or other equipment that is a potential source of cross-contamination. When under chain of custody, sample bottles must be secured in locked vehicles, and custody sealed in shuttles or in the presence of authorized personnel. Information which documents that proper storage and transport procedures have been followed must be included in the field notebook and on appropriate field forms.

2.2 Decontamination of Sampling Equipment

Proper decontamination of all re-usable sampling equipment is critical for all sampling episodes. The SOP for Decontamination of Field Equipment and SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for decontamination of various types of equipment.

2.3 Quality Assurance/Quality Control Samples

QA/QC samples are intended to provide control over the proper collection and tracking of environmental measurements, and subsequent review, interpretation and validation of generated analytical data. The SOPs for Collection of Quality Control Samples, for Evaluation and Validation of Data, and for Field Record Keeping and Quality Assurance/Quality Control must be referred to for detailed guidance regarding these respective procedures. SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for QA/QC procedures.

2.4 Sample Preservation Requirements

Certain analytical methodologies for specific analytes require chemical additives in order to stabilize and maintain sample integrity. Generally, this is accomplished under the following two scenarios:

a. Sample bottles are preserved at the laboratory prior to shipment into the field.

b. Preservatives are added in the field immediately after the samples are collected.

Many laboratories provide pre-preserved bottles as a matter of convenience and to help ensure that samples will be preserved immediately upon collection. A problem associated with this method arises if not enough sample could be collected, resulting in too much preservative in the sample. More commonly encountered problems with this method include the possibility of insufficient preservative provided to achieve the desired pH level or the need for additional preservation due to chemical reactions caused by the addition of sample liquids to pre-preserved bottles. The use of pre-preserved bottles is acceptable; however, field sampling teams must always be prepared to add additional preservatives to samples if the aforementioned situations occur. Furthermore, care must be exercised not to overfill sample bottles containing preservatives to prevent the sample and preservative from spilling and therefore diluting the preservative (i.e., not having enough preservative for the volume of sample).

When samples are preserved after collection, special care must be taken. The transportation and handling of concentrated acids in the field requires additional preparation and adherence to appropriate preservation procedures. All preservation acids used in the field should be trace-metal or higher-grade.

2.5 Sample Handling

After the proper sample bottles have been received under chain-of-custody, properly decontaminated equipment has been used to collect the sample, and appropriate preservatives have been added to maintain sample integrity, the final step for the field personnel is checking the sample bottles prior to proper packing and delivery of the samples to the laboratory.

All samples should be organized and the labels checked for accuracy. The caps should be checked for tightness and any 40-ml volatile organic compound (VOC) bottles must be checked for bubbles. Each sample bottle must be placed in an individual Ziploc® bag to protect the label, and placed on ice. The bottles must be carefully packed to prevent breakage during transport. When several bottles have been collected for an individual sample, they should not be placed adjacent to each other in the cooler to prevent possible breakage of all bottles for a given sample. If there are any samples which are known or suspected to be highly

contaminated, these should be placed in an individual cooler under separate chain-of-custody to prevent possible cross contamination. Sufficient ice (wet or blue packs) should be placed in the cooler to maintain the temperature at 4 degrees Celsius (°C) until delivery at the laboratory. Consult the work plan to determine if a particular ice is specified as the preservation for transportation (e.g., the United States Environmental Protection Agency does not like the use of blue packs because they claim that the samples will not hold at 4°C). If additional coolers are required, then they should be purchased. The chain-of-custody form should be properly completed, placed in a "zip-lock" bag, and placed in the cooler. One copy must be maintained for the project files. The cooler should be sealed with packing tape and a custody seal. The custody seal number should be noted in the field book. Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time. If overnight mail is utilized, then the shipping bill must be maintained for the files and the laboratory must be called the following day to confirm receipt.

3.0 EQUIPMENT AND MATERIALS

3.1 General equipment and materials may include, but not necessarily be limited to, the following:

a. Sample bottles of proper size and type with labels.

b. Cooler with ice (wet or blue pack).

c. Field notebook, appropriate field form(s), chain-of-custody form(s), custody seals.

d. Black pen and indelible marker.

e. Packing tape, "bubble wrap," and "zip-lock" bags.

f. Overnight (express) mail forms and laboratory address.

g. Health and safety plan (HASP).

h. Work plan/scope of work.

i. Pertinent SOPs for specified tasks and their respective equipment and materials.

3.2 Preservatives for specific samples/analytes as specified by the laboratory. Preservatives must be stored in secure, spillproof glass containers with their content, concentration, and date of preparation and expiration clearly labeled.

3.3 Miscellaneous equipment and materials including, but not necessarily limited to, the following:

a. Graduated pipettes.

b. Pipette bulbs.

c. Litmus paper.

d. Glass stirring rods.

e. Protective goggles.

f. Disposable gloves.

g. Lab apron.

h. First aid kit.

i. Portable eye wash station.

j. Water supply for immediate flushing of spillage, if appropriate.

k. Shovel and container for immediate containerization of spillage-impacted soils, if appropriate.

4.0 PROCEDURE

4.1 Examine all bottles and verify that they are clean and of the proper type, number, and volume for the sampling to be conducted.

4.2 Label bottles carefully and clearly with project name and number, site location, sample identification, date, time, and the sampler's initials using an indelible marker.

4.3 Collect samples in the proper manner (refer to specific sampling SOPs).

4.4 Conduct preservation activities as required after each sample has been collected. Field preservation must be done immediately and must not be done later than 30 minutes after sample collection.

4.5 Conduct QC sampling, as required.

4.6 Seal each container carefully and place in an individual "zip lock" bag.

4.7 Organize and carefully pack all samples in the cooler immediately after collection (e.g., bubble wrap). Insulate samples so that breakage will not occur.

4.8 Complete and place the chain-of-custody form in the cooler after all samples have been collected. Maintain one copy for the project file. If the cooler is to be transferred several times prior to shipment or delivery to the laboratory, it may be easier to tape the chain-of-custody to the exterior of the sealed cooler. When exceptionally hazardous samples are known or suspected to be present, this should be identified on the chain-of-custody as a courtesy to the laboratory personnel.

4.9 Add additional ice as necessary to ensure that it will last until receipt by the laboratory.

4.10 Seal the cooler with packing tape and a custody seal. Record the number of the custody seal in the field notebook and on the field form. If there are any exceptionally hazardous samples, then shipping regulations should be examined to ensure the sample containers and coolers are in compliance and properly labeled.

4.11 Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time.

4.12 Maintain the shipping bill for the project files if overnight mail is utilized and call the laboratory the following day to confirm receipt.

END OF PROCEDURE

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for measuring water levels using an electronic water level meter at the Ultra-Chem Site. A water level meter is an electronic sounding device that is typically used to measure the depth to groundwater in a monitoring well. These measurements are made from an established (surveyed) measuring point (MP). Measuring the depth to water (DTW) below the surveyed MP provides information for calculating groundwater elevations needed to construct groundwater elevation maps and determine the direction of groundwater flow.

2.0 DECONTAMINATION

The water level meter must be pre-cleaned (decontaminated) using a non-phosphate, laboratory-grade solution and rinsed with copious amounts of distilled or deionized water. This process is repeated before each measurement and following the final measurement.

3.0 CALIBRATION

There is no specific calibration procedure for a water level meter. If the water level meter is not working (i.e., does not detect water), the probe is to be returned to the supplier for repair; It is not to be repaired in the field. The probe's cord (typically a rubber-coated wire) provides a measurement scale to the nearest 0.01 foot.

4.0 PROCEDURE

4.1 Safety first. Obtain the appropriate work permit, Job Safety Analysis (JSA) and personal protection equipment (PPE), as specified in the site Health and Safety Plan (HASP).

4.2 If the well is not vented, then remove the cap and wait several minutes for the water level to equilibrate. Take several measurements to ensure that the water level measured is in equilibrium with the aquifer (i.e., not changing substantially).

4.3 The manufacturer's model must be noted because some have switches, lights, beepers, or a combination of the above.

4.4 Check on a periodic basis that the cord has not kinked.

4.5 The water-level measurement is taken by lowering the probe into the well until the instrument-specific detection method (e.g., light, beeper, or both) is activated by contacting the water.

4.6 The electrical line is held at the MP and the DTW is determined by the measurement on the cord at the MP. All measurements will be recorded to the nearest 0.01 foot.

4.7 After measuring all wells in an area, always re-measure at least one well, preferably the first well measured, to see if the static water level has changed (e.g., due to pumping in the area, tidal effects, etc.). If a significant change has occurred, it may be necessary to re-measure other wells.

4.8 If there are previous water-level measurements available for the wells, then have these data available to compare the measurements with those just taken. Use these data to determine if water levels are similar or if they have changed. If water levels have changed, then check if the changes are consistent (i.e., all up or all down) and make sense.

4.9 Water-level elevations are calculated by subtracting the DTW from the MP, and correcting for the presence of separate-phase product if necessary. Water-elevation maps are then developed (contoured) on a well location map. This also provides a check to evaluate if the water levels make sense (or anomalies are evidenced). Re-measure the well(s) where anomalies are found as a check on the initial measurement(s).

4.10 If anomalies persist or water-level trends are different from the historical database, then check to see if hydrogeologic conditions and/or stresses have changed (e.g., discharge areas, pumping and/or injection wells, etc.).

4.11 All pertinent data will be documented in the field notebook, and initialed and dated.

END OF PROCEDURE

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for sampling monitoring wells.

As part of the SOP for the sampling of groundwater monitoring wells, sample collection equipment and devices must be considered, and equipment decontamination and pre-sampling procedures (e.g., measuring water levels, and purging wells) must be implemented. The sampling objectives will be provided in specific investigation work plans that will be approved by the DTSC.

Unless otherwise specified in the DTSC-approved work plan, all groundwater purging and sampling will be performed using low stress (low flow) sample collection equipment in general accordance with the USEPA Region I Final Ground Water SOP for low stress (low flow) purging and sampling procedures for the collection of groundwater samples from monitoring wells, dated January 19, 2010. Low flow purging and sampling results in the collection of groundwater samples from monitoring wells that are representative of groundwater conditions in the geological formation by minimizing stress on the geological formation, and minimizing the disturbance of sediment in the bottom of the well. This procedure also minimizes aeration of the groundwater during sample collection, which improves the sample quality of the VOC analysis.

2.0 EQUIPMENT AND MATERIALS

2.1 In order to sample groundwater from monitoring wells, specific equipment and materials are required. The equipment and materials list may include, but not necessarily be limited to, the following:

a. Safety first. Obtain the appropriate work permit, Job Safety Analysis (JSA) and personal protection equipment (PPE), as specified in the site Health and Safety Plan (HASP).

b. Adjustable rate, groundwater sampling pump (e.g., low-flow centrifugal submersible pump, bladder pump, peristaltic pump).

c. Teflon or Teflon-lined polyethylene tubing with ¼-inch or 3/8-inch inner diameter to collect samples for organic analysis. Teflon or Teflon-lined polyethylene tubing, PVC, Tygon or polyethylene tubing with ¼-inch or 3/8-inch inner diameter to collect samples for inorganic analysis. Sufficient tubing of the appropriate material must be available so that each well has dedicated tubing.

d. Appropriate power source (compressor or compressed gas tank, controller, generator, etc.).

e. Monitoring instrument for water quality indicator parameters (Horiba U-22 or equivalent) including temperature, dissolved oxygen, turbidity, specific conductance, pH and redox potential (Eh).

f. Flow measurement supplies (e.g., graduated cylinder and stop watch or in-line flow meter).

g. Electronic water level meter with a minimum of 0.01 foot accuracy.

h. Decontamination supplies including Non-phosphate laboratory-grade detergent, distilled/deionized water and potable water.

i. Roux Associates' low flow well sampling/purging data form and field notebook.

j. Well construction data logs, field data from previous sampling event, and site map with well locations.

k. Well security keys.

l. Plastic sheeting.

m. Paper towels, clean rags.

n. Teflon™ tape, electrical tape.

o. Calculator.

p. Black pen and water-proof marker.

q. Tools (e.g., wrenches, screwdrivers, hammer, pliers, flashlight, etc.) or alternatives recommended in the JSAs.

r. Disposable Nitrile gloves.

s. Laboratory-supplied sample containers with labels.

t. Cooler(s).

u. Ice (wet, blue packs).

v. Masking, duct, and packing tape.

w. Chain-of-custody form(s) and custody seal(s).

x. Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP) or equivalent summary.

y. Site health and safety plan (HASP).

z. Packing material (e.g., bubble wrap)

aa. "Zip-lock" plastic bags.

bb. Overnight (express) mail forms (or schedule courier pickup if available).

3.0 DECONTAMINATION

3.1 Make sure all equipment is decontaminated and cleaned before use (refer to the field equipment decontamination SOP; a summary of pump decontamination procedures is provided below). Use new, clean materials when decontamination is not appropriate (e.g., tubing, disposable gloves). Document, and initial and date the decontamination procedures on the appropriate field form and in the field notebook.

A. Before sampling:

The manufacturer recommendations on pump disassembly for cleaning, if any, should take precedence to the disassembly recommendations presented below.

1) Wear disposable Nitrile and cut proof gloves.

2) Pre-rinse: Operate the pump first in an appropriate container with potable water for 5 minutes.

3) Wash: Operate the pump in an appropriate container with a non-phosphate, laboratory-grade detergent such as Alcanox and potable water solution for 5 minutes.

4) Rinse: Operate the pump in an appropriate container for 5 minutes with potable water.

5) Disassemble pump (refer to manufacturer's manual).

6) Wash pump parts: Place the disassembled parts of the pump into an appropriate container with non-phosphate detergent solution. Scrub the disassembled pump parts with an appropriate (e.g., test tube) brush.

7) Rinse pump parts with potable water.

8) Rinse the following parts with distilled/deionized water: inlet screen, shaft, suction interconnector, motor lead assembly, and stator housing.

9) Rinse impeller with potable water.

B. After each sample collection, decontaminate by:

1) Wear disposable Nitrile gloves.

2) Pre-rinse: Operating the pump first with potable water for 5 minutes.

3) Wash: Operate the pump in an appropriate container with a non-phosphate, laboratory-grade detergent such as Alcanox and potable water solution for 5 minutes.

4) Rinse: Operate the pump in an appropriate container for 5 minutes with potable water

5) Final Rinse: Operate the pump in an appropriate container to pump out 1 to 2 gallons of distilled/deionized water

6) Wipe pump-related equipment (e.g., electrical lines, cables) first with a clean cloth and detergent solution and then rinsing or wiping with a clean cloth and distilled/deionized water or potable water.

3.2 Note that the decontamination procedures for pumps are the minimum that must be performed. Check the work plan to determine if additional chemicals specified by individual state regulatory agencies also must be used for decontamination procedures (e.g., hexane, nitric acid, acetone, isopropanol, etc.).

4.0 CALIBRATION OF FIELD ANALYSIS EQUIPMENT

Calibrate field analysis equipment before use (e.g., water quality meter, photoionization detector, flame ionization detector) according to the Manufacturer's calibration instructions. Document, initial and date the calibration procedures on the appropriate field form, and in the field notebook.

5.0 PROCEDURE

5.1 As practicable under field conditions, start at the well that is known or believed to have the least contaminated groundwater and proceed systematically to the well that is known or believed to have the most contaminated groundwater.

5.2 Document, initial and date well identification, pre-sampling information, and problems encountered on the appropriate field form and in the field notebook as needed.

5.3 Inspect the protective casing of the well and the well casing, and note any items of concern such as a missing lock, or bent or damaged casing(s).

5.4 Place plastic sheeting around the well to protect sampling equipment from potential cross contamination.

5.5 Measure VOCs at the rim of the unopened well with a photoionization detector (PID) or flame ionization detector (FID) instrument and record the reading in the field notebook.

5.6 Remove the well cap or plug and, if necessary, clean the top of the well off with a clean rag. Place the cap or plug on the plastic sheeting. If the well is not vented, allow several minutes for the water level in the well to equilibrate. Never inhale the vapors.

5.7 Measure the depth to water (DTW) to 0.01 ft from the measuring point (MP) on the well (top of well casing) using an electronic water level meter. Calculate the water-level elevation. Document, initial and date the information on the appropriate field form and in the field notebook.

5.9 Decontaminate the water level meter with a non-phosphate, laboratory-grade detergent solution followed by a distilled/deionized water rinse.

5.10 Install Pump: Slowly lower the pump, safety cable, tubing and electrical lines into the well at midpoint of the immerged well screen or at the most permeable zone within the immerged well screen. The pump intake is to be kept at least two feet above the bottom of the well to prevent disturbance and re-suspension of any sediment or a sinking separate phase product (DNAPL) present in the bottom of the well.

If separate-phase product was identified in a measurable quantity, then the tubing should be installed using PVC with a tethered cap inserted into the well to bypass the LNAPL. The sample tubing should be inserted through the PVC, pushing out the cap at a depth below the LNAPL in order to sample the groundwater below the LNAPL.

5.11 Measure Water Level: Before starting the pump, measure the water level again with the pump in the well. Leave the electronic interface probe in the well.

5.12 Purge well: Start pumping the well at 200 to 500 milliliters per minute (mL/min). The water level should be monitored approximately every five minutes. Ideally, a steady flow rate should be maintained that results in a stabilized water level (drawdown of 0.3 ft or less). Pumping rates should be, if needed, reduced to the minimum capabilities of the pump to ensure stabilization of the water level. The flow rate should, however, be sufficient to maintain pump suction and to avoid cascading or air bubble formation in the tubing. Record each adjustment made in the pump rate and the water level measured immediately after each adjustment.

5.13 Record the physical appearance of the water (i.e., color, turbidity, odor, etc.) on the appropriate field form and in the field notebook, as it is purged. Note any changes that occur during purging.

5.14 Monitor Indicator Parameters: During purging of the well, monitor and record the field indicator parameters (turbidity, temperature, specific conductance, pH, redox potential, and dissolved oxygen) approximately every five minutes. The well is considered stabilized and ready for sample collection when the indicator parameters have stabilized for three consecutive readings as follows:

±0.1 for pH
±3% for specific conductance and temperature
±10 mV for redox potential
±10% for DO and turbidity

And turbidity to be less than 50 NTU prior to sampling

The pump must not be removed from the well between purging and sampling.

ADDRESSING POTENTIAL PROBLEMS

Insufficient Yield

If the formation cannot produce enough water to sustain purging, then the well should be pumped to "near-dry" conditions (i.e., leaving some water in the well). Purging should be interrupted before the water level in the well drops below the top of the pump, as this may induce cascading of the sand pack. Pumping the well dry should be avoided to the extent possible in all cases. When preparing to conduct a sampling round, review drilling, well development and previous sampling information (if available) to identify low-yielding wells in order to purge them first, and potentially allow time for the well to recover for sampling.

Sampling should commence as soon as the volume in the well has recovered sufficiently to allow collection of samples. However, depending on the rate of recovery and the time needed to complete the sampling round, one of the following procedures may have to be implemented:

1) The well may have to be sampled over a period of more than one day.
2) The well may not yield enough water to collect a complete suite of samples and only select (most important) samples will be collected.
3) The well may not recover, which will preclude sampling.

Regardless of the option that must be followed, the sampling procedure must be fully documented in the field notebook.

Failure to Stabilize Key Indicator Parameters

If one or more key indicator parameters fail to stabilize after 4 hours or after 5 well volumes have been purged, one of four options should be considered:

1) Continue purging in an attempt to achieve stabilization.
2) Discontinue purging, do not collect samples, and document attempts to reach stabilization in the field notebook.
3) Discontinue purging, collect samples, and document attempts to reach stabilization in the field notebook.
4) Secure the well, purge and collect samples the next day (preferred)

The key indicator parameter for VOCs is dissolved oxygen.
The key indicator parameter for all other samples is turbidity.

Regardless of the option that is followed, the sampling procedure must be fully documented in the field notebook.

5.15 Collect Samples: Collect samples at a flow rate between 100 and 250 mL/min and such that drawdown of the water level within the well does not exceed the maximum allowable drawdown of 0.3 ft.

VOC samples must be collected first. If a bladder pump is used, best practice would have it to match one compression stroke to the fill one VOC sampling vial.

Remove each appropriate container's cap only when ready to fill each with the water sample, and then replace and secure the cap immediately.

5.16 Fill each appropriate, pre-labeled sample container by allowing the ground water to flow from the tubing gently down the inside of the container to prevent: 1) agitating or creating turbulence; 2) breaking the container; 3) entry of, or contact with, any other medium; and 4) spilling/splashing the sample and exposing the sampling team to contaminated water. Immediately place the filled sample container in an ice-filled (wet ice or blue pack) cooler for storage. If wet ice is used it is recommended that it be repackaged in zip-lock bags to help keep the cooler dry and the sample labels secure. Check the work plan as to whether wet ice or blue packs are specified for cooling the samples because certain regulatory agencies may specify the use of one and not the other.

5.17 "Top-off" containers for VOCs and tightly seal with Teflon™-lined septums held in place by open-top screw caps to prevent volatilization. Ensure that there are no bubbles by turning the container upside down and tapping it gently.

5.18 Consult the work plan if filtered sampled should also be collected for dissolved metals analysis.

5.19 Collect quality control (QC) samples as required in the work plan to monitor sampling and laboratory performance.

5.20 Note and record the "final" physical appearance of the water (after purging and sampling) on an appropriate field form and in the field notebook.

5.21 Remove pump and tubing.

5.22 Measure the total depth of the well from the MP with a water level meter. Document, initial and date the information on the appropriate field form and in the field notebook.

5.23 Wipe the well cap/j-plug with a clean rag, replace the well cap/j-plug and protective cover. Lock the protective cover in applicable.

5.24 Verify that each sample is placed in an individual "zip-lock" bag, wrapped with "bubble wrap," placed in the cooler, and that the cooler has sufficient ice (wet ice or blue packs) to preserve the samples for transportation to the analytical laboratory.

5.25 Decontaminate field equipment according to the decontamination of field equipment SOP. Wrap decontaminated equipment with a suitable material (e.g., clean plastic bag or aluminum foil). Discard rags, gloves, etc. in a manner consistent with site conditions.

5.26 Complete all necessary field forms, field notebook entries, and the chain-of-custody forms. Retain one copy of each chain-of-custody form. Secure the cooler with sufficient packing tape and a custody seal.

5.27 Samples will be delivered according to the QAPP schedule.

6.0 REFERENCES

U.S. Environmental Protection Agency – Region I. Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells. Revised January 19, 2010.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for screening soil samples for volatile organic vapors using a portable photoionization detector (PID). This SOP is applicable to soil samples collected from split-spoon samplers during drilling, hand auger samples, and grab samples from stockpiled soils.

2.0 CONSIDERATIONS

The primary objective of photoionization screening of soil samples is to obtain a qualitative understanding of the distribution of volatile organic compounds (VOCs) in soil. The proper design of an organic vapor screening program requires an understanding of site hydrogeology, potential source areas, and potential constituents of concern. Sample locations and frequency must be fully defined in the work plan. The work plan should outline the type of lamp to be utilized in the PID based on the ionization potentials and response factors of the constituents of concern. The work plan must also clearly describe the heating or equilibration procedures to be employed if they differ from those described in this SOP. Regardless of the specific equilibration procedure employed, it is imperative that each sample be treated identically to allow the photoionization results from different locations to be compared. Observations such as water, clay, and organic content should be noted to facilitate interpretation of the data. Every effort should be made to collect a representative portion of soil from the sampling device.

3.0 MATERIALS/EQUIPMENT

a. A work plan which outlines photoionization screening requirements.

b. Decontamination supplies (including: non-phosphate, laboratory grade detergent, buckets, brushes, potable water, distilled water, regulatory-required reagents [e.g., acetone, nitric acid, hexane, etc.], aluminum foil, plastic sheeting, etc.).

c. Field notebook, field form(s), maps, chain-of-custody forms.

d. Sampling device (split-spoon sampler, stainless steel hand auger, stainless steel trowel, etc.).

e. Stainless steel spoons or spatulas.

f. Disposable plastic spoons.

g. Plastic sheeting.

h. Aluminum foil.

i. Mason jars or driller's jars.

j. Water bath (hot plate, extension cord, water tray, thermometer).

k. Photoionization detector with charging unit.

l. Calibration gases with regulator.

m. Indelible marker.

n. Masking tape.

o. Disposable sampling gloves.

4.0 DECONTAMINATION

Where possible, thoroughly pre-cleaned and wrapped sampling equipment must be used and dedicated to individual sampling locations. Disposable items such as sampling gloves, aluminum foil, and sample jars will be changed after each use and discarded in an appropriate manner. If only photoionization results are to be obtained, then split-spoon samples and hand augers may be cleaned with a soap and water wash and potable water rinse or steam cleaning, and a final distilled water rinse. However, if samples are to be collected concurrently for laboratory analytical results, then all reusable sampling equipment must be thoroughly decontaminated according to the SOP for decontamination of field equipment.

5.0 CALIBRATION

The PID must be calibrated according to the manufacturer's specifications at a minimum frequency of once per day prior to collecting photoionization readings. In addition, periodic checks (e.g., every 2 hours or every ten samples) with the standard gas will be conducted to confirm that the calibration has not drifted. The time, date, and calibration procedure must be clearly documented in the field notebook and the calibration log. If at any time the photoionization results appear erratic or inconsistent with field observations, then the unit must be recalibrated. If calibration is difficult to achieve, then the unit's lamp should be checked for dirt or moisture and cleaned, as necessary. During humid or wet conditions, the unit should be calibrated on a more frequent basis as determined by field personnel.

6.0 PROCEDURE

6.1 Extract the soil sample from the sampler, quickly measure the recovery, and separate the wash from the true sample by using a dedicated, stainless steel spatula. Where allowed by regulatory agency(ies), disposable plastic spoons may be used.

6.2 Place the sample in a pre-cleaned glass jar (as quickly as possible to avoid loss of VOCs) filling the jar half full. Place an aluminum foil seal between the glass and metal cap and screw tight.

6.3 Label jars with the boring number, depth of sample, date of collection and blow counts. In addition, the field personnel will ensure the following: samples are taken at appropriate depths; unrepresentative portions of the sample are discarded properly; that the sampler is decontaminated properly between use; and the driller uses proper methods during sample collection and does not use oil or grease on tools entering the borehole.

6.4 Log the sample in detail and record sediment characteristics (color, odor, moisture, texture, density, consistency, organic content, and layering).

6.5 After the sample has been collected, heat the sample under controlled conditions in a water bath for a 2 minute period.

6.6 Ensure that the PID has been calibrated and that the calibration information is documented in the field book. Pierce the aluminum foil seal with the probe from the PID and measure the relative concentration of VOCs in the headspace of the soil sample. The initial (peak) reading must be recorded.

6.7 Record the PID reading in the field notebook, on an appropriate field form, and on the base map, if appropriate.

6.8 Place any material not representative of the interval sampled in a pile with the other cuttings from the borehole.

6.9 If only photoionization results are to be obtained, then reusable sampling devices may be cleaned with a soap and water wash and a potable water rinse. The sampler will then be rinsed with distilled water, assembled and placed on plastic sheeting for reuse. A more rigorous decontamination procedure is required when samples are also being collected for laboratory analysis. Refer to the SOP for collection of soil samples for laboratory analysis for additional information.

END OF PROCEDURE

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for measuring quality parameters of groundwater samples collected from groundwater monitoring wells at the Ultra-Chem Site. The parameters are measured in the field using a water quality meter (Horiba U-22 or equivalent). The water quality parameters include pH, temperature, conductivity, ORP, dissolved oxygen and turbidity. The manufacturer's instrument manual for each water quality meter, which is maintained with the instrument, will be referred to for calibration, use, repair, maintenance, or trouble-shooting operations.

The sampling objectives are provided in the work plan for conducting the investigative activities for the Ultra-Chem Site.

The pH will be measured in standard units (SU) and can be recorded with or without the SU designation. The conventional means of recording a pH value is without a unit designation (e.g., 7.0); however, the SU designation may be used provided the term is defined as standard units when first referenced. The pH is measured in the field to provide the pH of the water under ambient (in situ) conditions. The pH is a measure of the acidic (<7.0) or basic (>7.0) nature of the water and is used to assist in evaluating the mobility of contaminants. In addition, pH measurements can be used during well purging to help determine when sufficient groundwater has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer).

Conductivity will be measured and recorded in micromhos/centimeter (µmhos/cm). Some water quality meters measure directly in µmhos/cm while others have to be converted to this unit. The specific conductivity is measured in the field as a measure of the total dissolved solids (TDS) in the water samples. TDS data can then be used as a qualitative measure of contamination and to assist in evaluating electrical resistivity and borehole geophysical data. In addition, specific conductivity measurements can be used during well purging to help determine when sufficient groundwater has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer).

Temperature will be measured and recorded in degrees Celsius/Centigrade (° C). Temperature data is collected in the field to determine the temperature of the water sample under ambient (in-situ) conditions. Temperature data can be used to evaluate the mobility of compounds in groundwater and flow conditions. In addition, temperature measurements can be used during well purging to help determine when sufficient groundwater has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer).

ORP will be measured and recorded in millivolts (mV). ORP data is collected in the field for monitoring and controlling chemical addition of oxidizing or reducing agents. In addition, ORP data can be used during well purging to help determine when sufficient groundwater has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer).

Dissolved Oxygen (DO) will be measured and recorded in mg/L. DO data is collected in the field for monitoring the amount of oxygen dissolved in a unit volume of water. In addition, DO data can be used during well purging to help determine when sufficient groundwater has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer).

Turbidity will be measured and recorded in Nephelometric Turbidity Units (NTU). Turbidity data is collected to measure the presence of suspended particulates in water.

2.0 CALIBRATION

Prior to calibration, all water quality meters must be cleaned and the battery checked according to the manufacturer's instructions. Document, initial and date the pre-calibration procedure on the appropriate field form, and in the field notebook.

2.1 Safety first. Obtain the appropriate work permit, Job Safety Analysis (JSA) and personal protection equipment (PPE), as specified in the site Health and Safety Plan (HASP).

2.2 Calibration of the water quality meter(s) is to be performed at the beginning of each day's use in accordance with the manufacturer's specific calibration instructions. At the end of each day, a calibration check is performed to verify that the instrument(s) remained in calibration throughout the day. This check is to be performed while the instrument(s) is in measurement mode, not calibration mode. Usual procedures are given below.

2.3 Recalibration must occur if: 1) the parameter being measured is outside the previous calibration range (if meter readings are zero or a negative number for DO, pH, conductivity or turbidity [negative value only]); 2) the procedure or use conditions warrant frequent calibrations.

2.4 The volume of the calibration solutions must be sufficient to cover both the probe and temperature sensor (see manufacturer's instructions for the volume to be used). Note that most instrument manuals state there is no calibration for the temperature sensor, but the temperature sensor must be checked to determine its accuracy. If the accuracy check date/information is not included with the instrument or the last check was over a year, the temperature sensor accuracy needs to be checked at the beginning of the water quality measuring event.

2.5 A minimum of two standards should be used to bracket the instruments measurement range for all parameters except ORP (refer to manufacturer's instructions).

2.6 The following information is documented in the calibration logbook and /or field notebook at the time of calibration:

a. Date.
b. Water Quality meter identification.
c. Pre-cleaning and battery check.

d. Calibration results.
e. Initials of the individual performing calibration.

3.0 PROCEDURE

3.1 A warm-up period may or may not be necessary for the instrument, depending on instrument requirements. The manufacturer's instrument manual must be followed.

3.2 See Ultra-Chem SOP-3 for information regarding low flow well sampling/purging procedures.

3.3 The groundwater quality parameters will be continuously measured by the water quality meter coupled with a flow-through-cell. If the accumulation of sediment buildup in the cell is observed, continue pumping and disconnect the cell for cleaning, then reconnect after cleaning and continue monitoring activities. If air bubbles accumulation is observed in the cell, place the meter at a 45 degree angle with the port facing upward to help evacuate any air bubble buildup.

3.5 Pertinent data are documented in the field notebook or appropriate field form, initialed and dated.

3.6 The electrodes are rinsed with distilled or deionized water and the unit stored properly in accordance with the manufacturer's instructions (e.g., capping and storing in a buffer such as altex electrode storage solution). The electrodes are not to be stored in potable water, or distilled or deionized water.

END OF PROCEDURE

APPENDIX D

Laboratory's Standard Operating Procedures

Title: Mercury Analysis for Solid and Semisolid Waste Samples using the Leeman Mercury Analyzer (Cold Vapor Technique) by SW846 Method 7471B

Once printed, this is considered an uncontrolled document

Approvals (Signature/Date):

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	08/11/22		08/11/22
Carl Armbruster Quality Assurance Manager	Date	Mark Acierno Laboratory Director	Date
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1.0 Scope and Application

1.1. Analytes, Matrix(s), and Reporting Limits

SW846 Method 7471B is applicable to the determination of total mercury (organic and inorganic) in soils, sediments, bottom deposits, and sludge-type materials. All samples must be digested prior to analysis. If this digestion procedure is not sufficient to dissolve a specific matrix type or sample, then this method is not applicable for that matrix.

The typical detection limit using a 0.6 gram sample size is 0.017 mg/Kg Hg.

On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in Sections 7 (Review of Work Request) and 19 (Test Methods and Method Validation) of TestAmerica Edison's Quality Assurance Manual (ED-QA-LQM).

2.0 Summary of Method

The sample is digested as described in this SOP and is analyzed using cold vapor atomic absorption. The mercury is reduced to the elemental state and aerated from solution in a closed system. The mercury vapor passes through a cell positioned in the light path of an atomic absorption spectrophotometer. Absorbance at 253.7-nm is measured as a function of mercury concentration.

3.0 Definitions

For a complete list of definitions refer to Appendix 2 in the most current revision of TestAmerica Edison's Quality Assurance Manual (ED-QA-LQM).

4.0 Interferences

4.1 Potassium permanganate is added to eliminate possible interferences from sulfide.

4.2 Copper may also be a potential interference although no effect has been observed for samples containing up to 10 mg/Kg Copper.

4.3 Samples high in chlorides require additional permanganate (as much as 25 mL) because, during the oxidation step, chlorides are converted to free chlorine, which also absorbs radiation of 254 nm. Care must therefore be taken to ensure that free chlorine is absent before the mercury is reduced and swept into the cell. This may be accomplished by using an excess of hydroxylamine hydrochloride reagent (25 mL).

4.4 Certain volatile organic materials that absorb at 253.7 nm may also cause interference. The analysis of the undigested sample should determine if this type of interference is present.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001) and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1. Specific Safety Concerns or Requirements

Samples that contain high concentrations of carbonates or organic material or samples that are at elevated pH can react violently when acids are added.

5.2. Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Mercury (1,000 PPM in Reagent)	Oxidizer Corrosive Poison	0.1 mg/M^3 Ceiling (Mercury Compounds)	Extremely toxic. Causes irritation to the respiratory tract. Causes irritation. Symptoms include redness and pain. May cause burns. May cause sensitization. Can be absorbed through the skin with symptoms to parallel ingestion. May affect the central nervous system. Causes irritation and burns to eyes. Symptoms include redness, pain, and blurred vision; may cause serious and permanent eye damage.
Sulfuric Acid	Corrosive Oxidizer Dehydrator Poison	1 mg/M^3-TWA	Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. Symptoms may include irritation of the nose and throat, and labored breathing. Symptoms of redness, pain, and severe burn can occur. Contact can cause blurred vision, redness, pain and severe tissue burns. Can cause blindness.
Nitric Acid	Corrosive Oxidizer Poison	2 ppm-TWA 4 ppm-STEL	Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison. Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract. Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Hydrochloric Acid	Corrosive Poison	5 PPM-Ceiling	Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death. Can cause redness, pain, and severe skin burns. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Potassium Permanganate	Oxidizer	5 Mg/M^3 for Mn Compounds	Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath. Dry crystals and concentrated solutions are caustic causing redness, pain, severe burns, brown stains in the contact area and possible hardening of outer skin layer. Diluted solutions are only mildly irritating to the skin. Eye contact with crystals (dusts) and concentrated solutions causes severe irritation, redness, and blurred vision and can cause severe damage, possibly permanent.
1 – Always add acid to water to prevent violent reactions.			
2 – Exposure limit refers to the OSHA regulatory exposure limit.			

6.0 Equipment and Supplies

6.1. Instrumentation

6.1.1. Leeman Laboratories Inc. Hydra IIAA Automated Hg Analyzer

6.1.2. Computer and Monitor with Leeman Envoy software.

6.1.3. Top loader balance, 300gm capacity, and minimum sensitivity of ±1.0 mg

6.1.4. Hotblock digestor: Adjustable and capable of maintaining a temperature between 95 ±3°C.

6.2. Supplies

6.2.1 Pipettes and tips in various sizes

6.2.2 100 ml volumetric flasks

6.2.3 15 ml sample cups

6.2.4 Pump tubing:

- Sample, viton, blue tab
- Reductant, red tab
- Drain, blue tab

- Rinse, Black tab

.

6.2.5 Drying Tube – Purchased pre-packed with Magnesium Perchlorate from Leeman Labs. Located prior to the optical cell.

6.2.6 Nitrogen or Argon supply - capable of producing 80 PSI.

7.0 Reagents and Standards

Storage requirements: store at room temperature

Life of Reagent: Concentrated acids: refer to manufacturer's instructions
Laboratory prepared reagents and diluted acids: one year

Record reagent preparations in the TALS Reagent Module.

7.1 Reagents

7.1.1 Nitric acid - Concentrated (Trace Grade or Equivalent); store at room temperature; for stability information, refer to manufacturer's instructions

7.1.2 Hydrochloric acid-Concentrated (Trace Grade or Equivalent); store at room temperature; for stability information, refer to manufacturer's instructions.

7.1.3 Potassium Permanganate (ACS Grade); store at room temperature; for stability information, refer to manufacturer's instructions.

7.1.4 Sodium Chloride (analytical reagent grade); store at room temperature; for stability information, refer to manufacturer's instructions.

7.1.5 Hydroxylamine Hydrochloride (ACS Grade); store at room temperature; for stability information, refer to manufacturer's instructions.

7.1.6 Stannous Chloride (ACS Grade); store at room temperature; for stability information, refer to manufacturer's instructions.

7.1.7 Deionized water - 18 megohm minimum

7.1.8 10% Hydrochloric Acid- Cautiously add 200 ml of concentrated HCl to a container and bring to final volume of 2 liters with deionized water. Store at room temperature; stable for one year.

7.1.9 Stannous chloride solution - Add 50 g of $SnCl_2$ to 500 ml 10% HCl solution. Store at room temperature; stable for one year.

7.1.10 Sodium chloride/Hydroxylamine Hydrochloride solution - Dissolve 120 g of NaCl and 120 g of hydroxylamine hydrochloride in deionized water and dilute to 1 liter using deionized water. Store at room temperature; stable for one year.

7.1.11 Potassium permanganate ($KMnO_4$) 5% solution w/v - Dissolve 100 g of $KMnO_4$ in deionized water and dilute to 2 liters using deionized water. Store at room temperature; stable for one year.

7.1.12 0.15% Nitric Acid- Add approximately 5 liters of deionized water into an 8 liter carboy container. Cautiously add 12mL of concentrated HNO_3 and bring the final volume up to 8 liters with deionized water.

7.2 Standards

Storage requirements: all standards are stored at room temperature

Shelf-life:	Stock standards – refer to manufacturer's instructions Intermediate standards – made fresh daily Working standards – made fresh daily (Note: expiration date must not go beyond the expiration date of the source stock).
Concentration:	see Attachment 1 for example certificates of analysis (COA) of Hg standards listed below. The COA lists the manufacturer's Lot number, certified concentration and shelf life.

Document standard preparation in TALS, see Sec 11.5.3.

7.2.1 Stock Mercury Calibration (10 ppm Hg) - Purchase from SCP Science; store at room temperature; for stability information, refer to manufacturer's instructions.

7.2.2 Secondary Stock Mercury Calibration Standard (10 mg/L Hg) - Purchase from Inorganic Ventures; store at room temperature; for stability information, refer to manufacturer's instructions.

7.2.3 Intermediate Calibration Standard (DCAL-Int), 100 ug/L Hg: Dilute 1 ml of Hg calibration stock standard solution (Sec 7.2.1) to 100 ml with 0.15% HNO_3.

7.2.4 Intermediate Initial Calibration Verification Standard (DQCS-Int), 100 ug/L Hg: Dilute 1 ml of Hg stock Calibration Verification standard, 10ppm Hg (Sec 7.2.2) solution to 100 ml with 0.15% HNO_3.

7.2.5 Calibration Standards: Use six 50 ml hotblock cups to prepare the standards. Spike the calibrations standards cups as follows:

Calibration Standard	DCAL-Int Spike Volume (mL)	0.15% HNO_3 (mL)	Final Conc (ug/L)
Std1 (Cal Blk)	0	5	0
Std 2	0.1	4.9	0.2
Std 3	0.5	4.5	1
Std 4	1	4	2
Std 5	2.5	2.5	5
Std 6	5	0	10

Digest the standards following Sample preparation in Section 10.1.

7.2.6 Initial Verification Standard (ICV) 5.0 ppb: Using a hotblock cup, add 2.5 mL of 0.15 HNO_3 and 2.5 ml of DQCS-INT, (Sec 7.2.4). Digest the standard following Section 10.1. After digestion, the ICV will contain 5.0 ppb of Hg.

7.2.7 Continuing Calibration Verification Standard (CCV) 5.0 ppb: Follow the preparation instructions for Std 5 (see Sec 7.2.5)

8.0 Sample Collection, Preservation, Shipment and Storage

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client requests. Listed below are the holding times and the references that include preservation requirements.

Matrix	Sample Container	Min. Sample Size	Preservation	Holding Time [1]	Reference
Soils	Plastic Glass	5 grams	Cool 4 ± 2ºC	28 Days	SW846 Method 7471B

[1] Inclusive of digestion and analysis.

Samples are to be analyzed without drying. A separate procedure is used to determine the percent solids in the sample.

For sample homogenization procedures refer to TestAmerica Edison SOP ED-GEN-007 (Subsampling).

9.0 Quality Control

9.1. **Sample QC** - The following quality control samples are prepared with each batch of samples.

Quality Controls	Frequency	Control Limit
Method Blank (MB)	1 in 20 or fewer samples	< RL; 5% of the regulatory limit; 5% of the measured concentration in the sample
Laboratory Control Soil Sample Reference Material (LCSSRM) in soil samples	1 in 20 or fewer samples	Vendor's certified limit
Matrix Duplicate (DUP)[1]	1 in 20 or fewer samples	If original sample and dup are both ≥ 5X RL, then 20% RPD. If original sample and duplicate are less than the RL, the RPD is not calculated; otherwise ±RL.
Matrix Spike (MS)[1]	1 in 20 or fewer samples	80-120%
Matrix Spike Duplicate (MSD)[2]	1 in 20 or fewer samples	80-120%; If original sample and dup are both ≥ 5X RL, then 20% RPD. If original sample and duplicate are less than the RL, the RPD is not calculated; otherwise ±RL.
Serial Dilution (SD)	1 in 20 or fewer samples	±10%

[1] The sample for DUP and MS are randomly selected, unless specifically requested by a client; Use the same environmental sample for the matrix spike and matrix duplicate sample whenever possible. If insufficient sample amount is available, another environmental sample may be used for the duplicate sample.
[2] A MSD is prepared and analyzed when requested by the client.

9.1.1. Method Blank: One laboratory method blank will be analyzed with each batch of samples prepared together (not to exceed 20 samples). The method blank is used to identify possible contamination during acid digestion. Results must be less than the RL, 5% of the regulatory limit for that analyte, or 5% of the measured concentration in the sample. If the analyte concentration in the method blank is above this control limit, the batch must be prepared again and the samples reanalyzed.

9.1.2. Laboratory Control Sample Soil Reference Material (LCSSRM: A laboratory control sample must be analyzed with each group of samples digested. For solid matrices, a vendor supplied solid matrix with certified values is carried through the same preparation procedure as the samples. The results of the solid LCS must fall within the 'QC Performance acceptance limits' of the reference material used for that sample. If not, all samples prepared in association with the LCS must be redigested and reanalyzed.

9.1.3 Matrix Duplicate (DUP): A duplicate is analyzed for each batch of samples digested. If original sample and duplicate are both ≥ RL, then 20% RPD. If original sample and duplicate are less than the RL, the RPD is not calculated; otherwise, ±RL.

9.1.4 Matrix Spike (MS): A matrix spike is prepared and analyzed for each batch of samples. A portion of sample is spiked with 0.5 mL of DCAL-Int (Sec 7.2.3). This is equivalent to 1.0 ppb Hg (on instrument). A recovery of 80-120% is required.

9.1.5 Matrix Spike Duplicate (MSD): A matrix spike duplicate is prepared and analyzed when requested by the client. A portion of sample is spiked with 0.5 mL of DCAL-Int (Sec 7.2.3). This is equivalent to 1.0 ppb Hg (on instrument). A recovery of 80-120% is required. If matrix spike sample and matrix spike duplicate sample are both ≥ RL, then 20% RPD. If original sample and duplicate are less than the RL, the RPD is not calculated; otherwise, ±RL

9.1.6 Serial Dilution (SD): A five fold serial dilution must be performed on one sample per batch. The sample should contain a sufficiently high concentration; minimally a factor of 25 times the estimated detection limit. Dilute the sample by a minimum of five fold (1+4) and reanalyze. The results must agree within 10% of the original determination. If not, a chemical or physical effect should be suspected.

9.2. Instrument QC

9.2.1 Initial Calibration Verification (ICV): Initial calibration is verified after calibration using an independent check standard at a concentration near

the mid-point of the calibration (5.0ppb); see Sec 7.2.6 for preparation instructions. The results must be within 10% of the true value. If it's outside of the acceptable limits, terminate the analysis, correct the problem and recalibrate the instrument.

9.2.2 **Continuing Calibration Verification (CCV):** Calibration verification is performed after the calibration, after every 10 samples, and at the end of the run. Use a concentration of mercury at the midpoint of the calibration range (5.0 ppb). See Sec. 7.2.7 for preparation instructions. The value obtained must be within 10% of the true value. If not, stop the analysis and recalibrate. Re-analyze the previous ten samples following the last good calibration verification. .

9.2.3 **Initial and Continuing Calibration Blank (ICB/CCB):** ICB/ CCB must be analyzed after the calibration curve, every 10 samples, and at the end of the analytical run. The absolute value of the calibration verification blank must not exceed the reporting limit. If it does, terminate the analysis, correct the problem, recalibrate and reanalyze the samples following the last good CCB. The calibration verification blank is the same blank solution as used for the calibration blank.

10 Procedure

10.1. Sample Preparation (includes all samples, standards, and blanks)

10.1.1 Mix the sample well and weigh 0.5 - 0.6 grams of sample (including the LCSSRM) and place in the bottom of an appropriately identified 50 mL hotblock cup. For QA samples, weigh three portions of 0.5 - 0.6 grams of sample and place in the bottoms of three hotblock cups labeled as SAMPLE, DUP, and MS. Before adding any reagents, spike the MS sample with 0.5 mL of DCAL-Int standard.

10.1.2 Except the calibration standards, add 5 mL of deionized water to all hotblock cups (i.e., all field samples, MB, LCSSRM, Dup, and MS).

10.1.3 Add 1.5 ml concentrated HNO_3 and 4.5 ml concentrated HCl. Heat 2 min on the hotblock at 95 $\pm$3°C. Cool.

10.1.4 Add 15 mL deionized water and 15 mL potassium permanganate solution (Sec 7.1.11) to each hotblock cup. Mix well. The same amount of $KMnO_4$ must be added to the standards and samples.

10.1.5 Cap the hotblock cups loosely enough so that pressure does not build up but also tight enough so that the caps stay on and that volume loss due to heating is minimized. Heat 30 min on the hotblock at 95 $\pm$3°C. Cool.

10.1.6 To each hotblock cup, add 6 ml Sodium chloride - Hydroxylamine hydrochloride solution to reduce excess permanganate.

10.1.7 Using deionized water, bring to a 50 mL final volume. Cap and mix well.

10.2. Calibration

10.2.1 The instrument must be calibrated daily or once every 24 hours and each time the instrument is set up. The instrument is calibrated according to the manufacturer's specifications and must contain at least four standards and a blank. The laboratory currently uses five standards and a blank. The correlation coefficient of the calibration curve must be ≥0.995. If it does not, the problem must be corrected, and the instrument must be recalibrated. Standard preparations must be documented in the in TALS reagent module.

10.2.2 Prepare the calibration standards and Calibration Verification Standards as stated in Sections 7.2.5, 7.2.6., & 7.2.7.

10.2.3. Calibration Curve Read-Back:

10.2.3.1. Low-Level Readback (at the RL) – evaluate the 0.2 ug/L calibration standard. The %RE (relative error) must be +/- 20% of the true value (see Sec 11.4). If %RE is outside of the criteria limits, stop the analysis and recalibrate.

10.2.3.2. Mid- Level Readback – evaluate the 5.0 ug/L calibration standard (the mid-level calibration standard). The %RE (relative error) must be +/- 10% of the true value (see Sec 11.4). If %RE is outside of the criteria limits, stop the analysis and recalibrate

10.3. Sample Analysis

10.3.1 Following a sample digestion procedure, the samples are ready for instrumental analysis. It is advisable to investigate each matrix for any complexities, which might adversely affect the acquisition of valid data.

10.3.2 The following analytical run sequence is currently used for samples analyzed under Method 7471B:

Instrument Calibration (Blank and five standards)
ICV
ICB
CCV
CCB

10 Samples
CCV
CCB
10 Samples
CCV
CCB
Repeat until run is complete
CCV
CCB

10.3.3 Instrument Operation:

10.3.3.1 Turn on instrument, computer and monitor.

10.3.4 Plumbing the Reagent Lines:

10.3.4.1 One at a time, feed each of the pump tubes into a pump cassette, sliding the tube through the plastic clips at the bottom until the plastic tab is secure. Then, holding the tube taut, slide the loaded cassette onto the pump head and click the clamp, lever up. The tab end of the tube should be located at the front of the pump head.

10.3.4.2 Reductant (Red); Connect tab end of tube to the reductant bottle and the other end to the bottom of the mixing tee.

10.3.4.3 Sample (Blue); Connect tab end of tube to the autosampler probe and the other end to the top of the mixing tee.

10.3.4.4 Drain (Blue) Connect the tab end of tube to the sample discharge tube connected on the Liquid/Gas separator and the other end to the waste line.

10.3.4.5 Rinse (Black): Connect tab end of tube to rinse tubing that is connected to the rinse bottle. Connect the other end to the rinse tubing leading to the rinse cup.

10.3.5 Preparation of Reagents:

10.3.5.1 Pour the $SnCl_2$ solution into the reductant bottle and connect to the red reductant tube connector.

10.3.5.2 Pour the ten percent HCl solution into the Rinse reservoir bottle.

10.3.6 Starting Program:

10.3.6.1 Click the Envoy icon on the computer desktop

10.3.6.2 Click Method, select 7471_7471B, and select OK
10.3.6.3 On the main screen, click the StartUp icon. Wait 15 minutes before analyzing calibrating.
10.3.6.4 Click Sequence Tab on bottom of screen
10.3.6.5 Click Sequence on top of screen
10.3.6.6 Select Open, then select New
10.3.6.7 Using the Prep Batch Sheet and hand scanner, enter the sample barcodes into the Sample ID column. Include the Serial Dilution and all needed sample dilutions
10.3.6.8 Pour out the digested calibration standards and samples into the proper locations on the autosampler.
10.3.6.9 Click the Run Sequence icon to begin calibration and to run samples.

10.3.7 Creating the Raw Data PDF:

10.3.7.1 Click the Analysis Tab, select Detailed

10.3.7.2 Click Load, select Use This To Make PDF

10.3.7.3 Click Report, Click Printer

10.3.7.4 Include the calibration curve graph:

10.3.7.4.1 Go to Methods Tab and click Calibration, click Print

10.3.7.5 Combine both documents using the PDF Creator program. The new document is located in the Documents folder on the C:\ drive. Add this document to the "Doc's" location in the analytical batch.

10.3.8 Shutting Down the Instrument:

10.3.8.1 Click the Stop icon on the main screen

11.0. Calculations / Data Reduction

11.1. Accuracy:

$$\text{ICV / CCV, LCS \% Recovery} = \frac{\text{observed concentration}}{\text{known concentration}} \times 100$$

11.2. Precision (RPD):

Matrix Duplicate (MD) = $\frac{|\text{orig. sample value - dup. sample value}|}{[(\text{orig. sample value + dup. sample value})/2]} \times 100$

11.3. Concentration: (mg/Kg) = $\frac{C \times V1 \times D}{W}$

Where: C= Element concentration from instrument (ppb)
V1= Final volume of sample digested (in liters)
D= Dilution performed on sample
W= Initial weight of sample digested (in gram)

NOTE: All dry weight corrections are made in LIMS at the time the final report is prepared.

11.4. Relative Error (%RE):

% Relative Error = (100) (MC-TC)/TC

MC = Measured Concentration of the calibration standard
TC = True Concentration for the calibration standard

11.5. Data Processing:

11.5.1. All data is recorded directly in TALS' Analyst Desktop II program.

11.5.2. Import Data to TALS

11.5.2.1. Click the Analysis tab
11.5.2.2. Select the analytical run that needs to be imported
11.5.2.3. Select Statistics
11.5.2.4. Click Load and select TALS Import, click OK
11.5.2.5. Click Report, click CSV File
11.5.2.6. Name the import file (e.g., batch name, today's date)
11.5.2.7. The newly created import file is in the Import Folder on the desktop. Send to TALS Import Folder

11.5.3. Sample and standard preparations must be documented in the Analyst Desktop II program located in TestAmerica Laboratory System (TALS). The analyst must enter the following information: Source standard, Initial and final sample volume, spike name and amount used, all reagents and their corresponding lot numbers, creation and expiration dates.

11.5.4. All reagents must be recorded in TALS Reagent Module.

11.5.5. Complete the Data Review Checker (DRC) in TALS: Prior to data submission (i.e., prior to 1st leveling data in the Analyst Desktop II module in TALS), the analyst must execute the DRC (Data Review Checker) program in the applicable preparation batch.

11.5.5.1. Open the preparation batch and click on the Edit tab above to enter the Edit Mode.

11.5.5.2. Press F8 command key on the computer keyboard or right click anywhere on the batch worksheet then click on 'Run checklist.'

11.5.5.3. Acknowledge by filling in responses to all unacknowledged findings.

11.5.5.3.1. Highlight the checklist with findings, then highlight the associated list of findings; right click and choose 'Acknowledge Item.'

11.5.5.3.2. Fill in appropriate comments in the response box, then hit 'OK.'

11.5.5.3.3. Acknowledge all Finding items in the 'Manual Batch Checklist' except for the *"2nd Level review complete?"* this is to be completed by the 2nd level reviewer.

11.5.6. Record the following reagents and the volume used for sample preparation in the batch information page under "batch comments" in TALS Analyst Desktop II: concentrated sulfuric acid, concentrated nitric acid, potassium permanganate, potassium persulfate and sodium chloride-hydroxylamine hydrochloride. Record reagents in TALS by opening the prep batch, click on "edit" and then right click to choose "view batch information." Enter the information in the "batch comments" section.

12.0. Method Performance

12.1. Method Detection Limit Study (MDL)

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure in Section 19 (Test Methods and Method Validation) of TestAmerica Edison's Quality Assurance Manual (ED-QA-LQM). MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method requirements require a greater frequency.

12.2 Instrument Detection Limit

The IDL for each analyte must be determined for each wavelength used on each instrument. The IDL must be determined annually or if the instrument is adjusted in any way that may affect the IDL. The IDL is determined by multiplying the average of the standard deviations obtained from the analysis of seven reagent blanks by 3.14.

12.3 Demonstration of Capabilities

For DOC procedure refer to Section 20 in the most current revision of TestAmerica Edison's Quality Assurance Manual (ED-QA-LQM).

12.4 Training Requirements

Refer to TestAmerica SOP No. ED-GEN-022, Training, for the laboratory's training program.

12.5. Lower Limit of Quantitation (LLOQ)

12.5.1. LLOQ verification: prior to analyzing samples under method 7470A, after any change that may affect the LLOQ, and quarterly, the LLOQ must be verified. The LLOQ is initially verified by the analysis of 7 replicate samples spiked at the LLOQ (0.2 ppb). The seven replicates must be digested prior to analysis. The LLOQ is verified when the mean recovery of the 7 replicates is +/-30% of the true value and the RSD < 20%.

12.5.2. LLOQ on-going verification: the LLOQ is re-verified quarterly by the analysis of a method blank (MB) and 1 blank sample (deionized water spiked at the LLOQ (0.2 ppb). The MB and LLOQ samples must be digested prior to analysis. The LLOQ is re-verified if the MB result is +/- 0.5 times the reporting limit for each analyte and when the recovery of the LLOQ sample is +/-30% of the .true value.

13.0. Pollution Control

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention.

14.0. Waste Management

14.1. Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to TestAmerica SOP No. ED-SPM-008 (Laboratory Waste Disposal Procedures).

14.2. The following waste streams are produced when this method is carried out:

- Digested Samples: Corrosive Acid- Materials that are not above regulatory limits will be submitted for elementary neutralization with 50% sodium hydroxide solution (Siedler Chemical SC-1824-03). Major concern is heat generated from the neutralization process. Initial volume of acid waste to be neutralized should be no more than 15 gallons. Finished neutralization with sodium bicarbonate (Siedler Chemical SC-0219-25) to a pH of 6 – 9 in the primary tank. Once pH has been established the primary tank is transferred through filter housing to a secondary tank. The pH is rechecked. If the pH is within specifications, the secondary tank is released to the municipal sewer system.

- Samples above regulatory limits and expired RCRA metals standards (Waste Corrosive Liquid, Acidic, Inorganic, n.o.s.) are collected in satellite accumulation and sent off site through a Waste disposal vendor.
  Onyx Profile WIP Number: 590598
  Teris Profile Number 50016653

15.0. References / Cross-References

15.1. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, 3rd ed.,U.S. Environmental Protection Agency, SW846 Manual, Method 7471B, Revision 2, January 1998.

15.2. Leeman Hydra IIAA Operating Manual.

15.3. TestAmerica Edison Document ED-QA-LQM, *Laboratory Quality Manual*, most current revision.

15.4. TestAmerica Edison SOP No. ED-SPM-008, *Laboratory Waste Disposal Procedures*, current revision.

15.5. Corporate Environmental Health and Safety Manual CW-E-M-001, most current revision.

15.6. TestAmerica Edison Subsampling SOP, *ED-GEN-007,* most current revision.

15.7. TestAmerica Edison SOP ED-GEN-022, *Training*, most current revision.

16.0. Method Modifications:

Item	Method #	Modification
1 (Sec 10.3.5.1)	7471B	Stannous Chloride is automatically added via the instrument versus the manual addition of Stannous Chloride as stated in the method. This is an instrument manufacturer's

		improvement that will reduce error due to loss of Mercury.
Sample preparation	7471B	The amount of DI water added to the sample at digestion is decreased to 15 ml from 50 ml (water bath procedure), while keeping the volume of reagents added during sample digestion the same. Sample final volume for hotblock procedure is modified to 50 ml (100 ml – water bath procedure) which allows for lesser sample volume hence less sample waste produced; hotblock digestion cup has maximum volume of 50 ml.

17.0. Attachments

Attachment 1: Certificate of Analysis of stock standards

18.0. Revision History

- Revision 5, dated 11 August 2022
  - Sec 12.5: Added the lower limit of quantitation (LLOQ), associated instructions and recovery limits.
- Revision 4, dated 03 August 2020
  - Updated SOP header with Eurofin logo.
  - Sec 6.1.1 & 15.2: Replaced Hydra AA with Hydra IIAA.
  - Sec 9.1 Table and 9.1.1: Revised MB control limits to <RL.
  - Sec 9.1, 9.1.4 and 9.1.5: Revised MS and MSD acceptance limits to 80-120%.
  - Sec 9.2.2: Revised CCV acceptance limits to +/-10%.
  - Sec 10.2.3: Added calibration curve read-back criteria.
  - Sec 11.4: Added Relative % error calculation.
  - Sec 11.5: Added Relative % error calculation.
  - Sec 11.5.6.: Added requirements to record reagent volumes in the batch information page of TALS ADII; subsequent sections adjusted accordingly.
- Revision 3, dated 12 October 2018
  - Sec 6.1.2: Removed WinHg instrument software reference and replaced with current instrument software, Envoy.
  - Sec 9.1.2: Revised to clarify the acceptance criteria used in the COA when evaluating recoveries for LCS in soil matrix
  - Sec 10.3.6: Updated the Starting Program instructions to reflect the new instrument software, Envoy.
  - Sec 10.3.7 & 10.3.8: Updated instructions for creating raw data pdf and shutting down instrument.
  - Sec 11.4.2: Updated instructions for importing data to TALS.
  - Sec 11.4.5: Replaced Metals Data Review Checklist with Data Review Checker (DRC) in TALS.

- Sec 15.8 & 15.9: Removed reference to EDS-WI-007 & EDS-WI-125; WI not applicable.

- Revision 2, dated 29 Nov 2016
  - Sec 6.1.4, Sec 10.1.3, & 10.1.5: updated the hotblock temperature range per method 7471B requirements
  - Sec 6.2.7: added Argon gas
  - Sec 7.2.4: the name of the intermediate ICV standard has been changed from DICV-Int to DQCS-Int
  - Sec 7.2.6: removed the CCV preparation instructions using the second source standard. The name of the intermediate ICV standard has been changed from DICV-Int to DQCS-Int
  - Sec 7.2.7: added preparation instructions for the CCV using the primary source standard
  - Sec 9.1: added the quality control sample MSD to the table
  - Sec 9.1.5: added quality control information for the MSD
  - Sec 11.4.5: Metals Data Review Checklist control # has been updated from ED-WI-007 to CA-Q-WI-042

- Revision 1, dated 12 May 2014
  - Sec 1.1: Revised the typical detection limit from 0.033 mg/kg to 0.017 mg/kg to reflect the 50mL final volume – hotblock procedure.
  - Sec 1 & 12: Updated LQM section references to reflect the most current LQM revision.
  - Sec 6.1.4: Added hotblock digestor to the list of equipment; removed autoclave from the list.
  - Sec 6.2: Added 50 mL hotblock digestion cups to replace the BOD bottles. Removed supplies which are no longer applicable (BOD bottles, graduated cylinders).
  - Sec 7.0 & 11.4.4: Removed Hg Reagent Logbook and replaced with TALS Reagent Module
  - Sec 7.1. Deleted Sulfuric Acid (previously referenced in Sec 7.1.1). Added 0.15% HNO_3 to list of reagents.
  - Sec 7.2.5: Updated Calibration standards' spiking instructions to reflect the 50 ml final volume.
  - Sec 7.2.6: Updated ICV/CCV spiking instructions to reflect the 50 ml final volume.
  - Sec 8.1: Added plastic container to the list of acceptable sample containers.
  - Sec 9.1 & 9.1.3: Clarified the acceptance limits for Matrix duplicate to reflect actual laboratory practices.
  - Sec 9.1.4: Revised the spiking amount added to the MS sample.
  - Replaced LCSS reference with LCSSRM in various sections of the SOP to reflect TALS QC type reference.
  - Sec 10.1: Revised sample preparation procedure to include hotblock digestor procedure; deleted all reference to autoclave digestion procedure.

- Sec 11.4.5 & 15.9: Added Work instructions EDS-WI-125 (TestAmerica Edison Metals Initial Calibration Data Review for Mercury).
- Sec 16: Added Sample prep method modification (i.e. final volume).

- Revision 0, dated 04 February 2011
  New

Attachment 1

Certificate of Analysis

Catalogue Number :	141-110-111/141-110-112/141-110-115
Description :	*Plasma*CAL - **ICP-MS Verification Standard 1 Solution B**
Lot Number :	**SC8298812**
Expiration Date :	**January 2010**

Analysis of Solution Standard by Inductively Coupled Plasma Spectroscopy (ICP-AES) traceable to NIST Standard Reference Materials : 3133

Actual Concentrations

Hg : 9.98 µg/ml

Matrix : **10% HNO_3**
Density : **1.040 g/ml @ 22.0°C**

MS 0882
Rec'd
1/14/09

Certified by : _____
Thomas Znoj, Chemistry Manager

Certification Date : **October 28, 2008**

This ICP-AES & ICP-MS Standard is guaranteed to be stable and accurate to within plus or minus 1.0% of the actual concentration up to the expiry date, provided the solution is kept tightly capped and stored under normal laboratory conditions. For these solutions, 18 megohm/cm double deionized water, high-purity acids, Class A glassware and acid-cleaned bottles are used. The Material Safety Data Sheet and this Certificate of Analysis are available on our web site. (Également disponible en Français)

Manufactured according to an ISO 9001:2000 Quality System and ISO 17025 (in-process)

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CERTIFICATE OF ANALYSIS

MS0879
Rec'd 1-12-09

1.0 **INORGANIC VENTURES** is an ISO Guide 34 "General Requirements for the Competence of Reference Material Producers" and ISO 9001:2000 registered manufacturer. Our manufacturing laboratory is accredited to ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories."

2.0 **DESCRIPTION OF CRM** **10 µg/mL Mercury in 10% (v/v) HCL**

Catalog Number:	MSHG-10PPM
Lot Number:	**B2-HG02061**
Starting Material:	Hg metal
Starting Material Purity (%):	99.999549
Starting Material Lot No:	05214TX
Matrix:	10% (v/v) HCL

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Concentration: 10.027 ± 0.020 µg/mL

Certified Density: 1.019 g/mL (measured at 22° C)

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

$$\text{Certified Value } (\bar{x}) = \frac{\Sigma x_i}{n}$$

$$\text{Uncertainty } (\pm) = \frac{2[(\Sigma s_i)^2]^{1/2}}{(n)^{1/2}}$$

$(\bar{x})$ = mean
x_i = individual results
n = number of measurements
Σs_i = The summation of all significant estimated errors (Most common are the errors from instrumental measurement, weighing, dilution to volume, and the fixed error reported on the NIST SRM certificate of analysis.)

4.0 **TRACEABILITY TO NIST AND VALUES OBTAINED BY INDEPENDENT METHODS**

- "Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM, 2nd ed., 1993, definition 6.10)
- This product is Traceable to NIST via an unbroken chain of comparisons to the following NIST SRMs:

eurofins	Always check on-line for validity. **EPA Methods TO-15 and TO-3, Determinations of VOCs in Ambient Air**	Level: **Standard Operating Procedure**
Document number: **AIR-SOP48257**		
Old Reference: **BR-AT-004**		
Version: **16**		Organisation level: **4-Business Unit**
Approved by: **J8TG, YE6O** Effective Date: **13-FEB-2024**	Document users: **6_EUUS80_BUR_Organic Inst_GCMS VOA_Air**	Responsible: **5_EUUS80_BUR_GCMS VOA and Air Supervisor**

The information contained herein is of a highly confidential and proprietary nature. Eurofins Environment Testing specifically prohibits the dissemination, copy, disclosure, transfer, or modification of this information without the express written approval of Eurofins Environment Testing Burlington QA.

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Revision Log

Revision: 16.0	**Effective Date**	This version
Section	**Justification**	**Changes**
Throughout	Added	Cross-reference links to related documents in D4
Section 5	Updated	Current standard Safety language
Sections 6 & 7	Added	Catalog # disclaimer and storage conditions
Section 10.2.2.1	Added	Percent Error acceptance criteria for individual points in the calibration

Revision: 15.0	**Effective Date**	21 April 2023
Section	**Justification**	**Changes**
Entire Document	Format	Update to D4 format
Section 10.2.4	Updated	Removed reference to DoD specific QA requirements.
Section 10.3.4	Added	Client specific QA requirements

Previous revisions maintained by QA Department

References

- EPA Compendium Method TO-15, "Determination of Volatile Organic Compounds in Ambient Air using Specially Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry", US EPA, January, 1999.
- USEPA Compendium Method TO-3 “Method for the Determination of Volatile Organic Compounds In Ambient Air Using Cryogenic Pre Concentration Techniques and Gas Chromatography with Flame Ionization and Electron Capture Detection”, USEPA, April 1984
- New Jersey Department of Environmental Protection Site Remediation Program Vapor Intrusion Technical Guidance, Version 3.1, March 2013.

Cross References

- *SOP52862 Quality Assurance Manual*
- *SOP48255 Canister Cleaning, Certification and Sampling Kit Preparation*
- *QP46060 NDSC HSE Manual*
- *SOP49961 Burlington Corporate Safety Manual Addendum*
- *SOP52272 Traceability, Handling and Storage of Standards and Reagents*
- *SOP49959 Sample Management*
- *SOP49967 Nonconformance and Corrective Action Procedures*
- *SOP43862: Manual Integrations*
- *SOP49966 Management, Retention Storage and Archive of Data Records*
- *SOP52264 Employee Training and Analyst Demonstration of Proficiency*
- *SOP47863 Tracking and Collecting of Hazardous Waste*
- *SOP48269 Procedure for Acceptance and Handling of USDA Regulated Domestic and Foreign Soil*

1) Scope and Application

This SOP describes the laboratory procedure for the analysis of polar and non-polar volatile organic compounds (VOCs) in ambient and non-ambient air. The procedure is applicable to those VOCs that have been evaluated by the laboratory for their consistent performance in meeting the control criteria put forth in Compendium Method TO-15.

While the compendium method is specifically written for the analysis of ambient air samples collected in leak-free passivated stainless-steel canisters, it may be applied to the analysis of samples that have employed the use of other collection devices such as Tedlar bags and are from sources other than ambient air such as indoor air, vapor intrusion impacted air, soil gas, landfill gas, gas cleaning apparatuses and stack emissions.

This procedure may also be used to report a variety of carbon ranges, constituent groups like TVOC (total volatile organic compounds), or as unresolved complex mixtures (e.g. Total Hydrocarbons).

1.1) Analytes, Matrix(s), and Reporting Limits

The target compound list and reporting limits for each compound are provided in the Appendix.

2) Summary of Method

An aliquot of sample is pulled from the canister through a solid multi sorbent bed trap which reduces the water content of the sample. The sample is thermally desorbed, and the VOCs are carried onto a GC column coupled to a mass spectrometer. Compounds are identified by comparison of the mass spectra for individual peaks in the total ion chromatogram to the fragmentation patterns of ions corresponding to VOCs including the intensity of primary and secondary ions as well as the patterns of stored spectra acquired under similar conditions.

The concentration of the target compound is calculated by internal standard technique using the average response factor or slope and intercept of that compound as determined by the initial calibration.

If the laboratory has modified the method, a list of these adjustments may be found in the Method Modifications section of this SOP.

3) Definitions

A list of terms and definitions are provided in the Appendix. Refer to the Laboratory *SOP52862 Quality Assurance Manual* (QAM) for additional Glossary of Terms, Definitions, and Acronyms.

4) Interferences

Contamination may occur if canisters or other equipment is not properly cleaned before use. The laboratory procedures for canister and flow controller cleaning are provided in *SOP48255 Canister Cleaning, Certification and Sampling Kit Preparation*.

5) Safety

Employees must abide by the policies and procedures in the Eurofins NDSC-US EHS-*QP46060 NDSC HSE Manual*, the *SOP49961 Burlington Corporate Safety Manual Addendum* and this document. This procedure may involve hazardous material, operations and equipment.

This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the SDS for each material before using it for the first time or when there are major changes to the SDS.

5.1) Specific Safety Concerns or Requirements

The analytical system contains zones with elevated or depressed temperatures that are capable of causing injury upon direct contact. The analyst needs to be aware of the locations of those zones and allow them to return to room temperature prior to maintenance activities or take measures to avoid contact with hot and/or cold surfaces. There are areas of high voltage in the analytical system. Depending on the type of work involved, either turn the power to the instrument off, or disconnect it from its source of power.

Liquid nitrogen (LN2) is used for cryogenic purposes. In addition to avoiding contact with LN2 cooled surfaces, analysts must be aware of the potential for oxygen depletion in a confined space in the event of an unexpected large release of the product. Users should evacuate a confined space in which large amounts of LN2 have been released.

Sample canisters are occasionally pressurized for cleaning or sample dilution purposes. Lab systems are designed to ensure that the cans are not pressurized above 40 psi. Eye protection must be worn when cans are pressurized in the event of a canister failure.

5.2) Primary Materials Used

There are no materials used in this method which have a serious or significant hazard rating.
NOTE: This section does not include all materials used in the method. A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the SDS for each material before using it for the first time or when there are major changes to the SDS.

6) Equipment and Supplies

Catalog numbers listed in this SOP are subject to change at the discretion of the vendor. Analysts are cautioned to be sure equipment meets the specification of this SOP.

6.1) Sampling Equipment

- 6L and 1L SUMMA® Canisters: Leak-Free, Passivated Stainless Steel, with Swagelok DSS4 Valves, or equivalent. Maximum rated pressure 40 psig.
- 6L SUMMA® Canisters: Silicon Lined-Leak-Free, Passivated Stainless Steel, with Swagelok DSS4 valves or equivalent. Maximum rated pressure 40 psig.
- Flow Controllers: Restek Catalog #24239 or equivalent.
- Flow Controller Orifice: Various sizes ranging from 0.008” to 0.060”, Restek or equivalent.
- Flow Controller Vacuum Gauges: Capable of measuring vacuum to an absolute vacuum of -30” Hg, and pressure up to 30 psi, Grainger Catalog #5WZ37 or equivalent
- Rain Guard: Stainless Steel Tubing ¼”, 10ft. Grainger or Equivalent. Cut 8” and bend into a J shape using a pipe bender.
- Stainless Steel Pre-Filter (7 um): Swagelok Catalog# SS-4F-T7-7 or equivalent
- Teflon Tape: Home Depot Brand or equivalent.

6.2) Analytical System

- Mass Spectrometer: Agilent 5973, 5975, 5975B, 5977C MSD or equivalent.
- Gas Chromatograph: Agilent 6890, 7890, 8890 or equivalent.
- VOC Autosampler: Entech 7016CA or equivalent.
- Cryogenic Concentrator: Equipped with an electronic mass flow controller that maintains a constant flow for carrier gas and sample over a range of 0-200 cc/min. Entech 7100A, 7200, 7200A or equivalent.
- Low Pressure Liquid Nitrogen: Air Gas or equivalent.
- Glass Bead Cryotrap: Capable of effectively removing water while trapping polar and non-polar compounds. Entech catalog# 01-04-11320.
- TENAX Sorbent Trap: Capable of removing CO2 and trapping the polar and non-polar compounds. Entech catalog # 01-04-11330.Primary Column: Fused silica capillary column (60 m x 0.32 mm x 1.8 µm), Restek RTX-624 or equivalent.
- Data System: PC software for Entech instrumentation. Hewlett-Packard ChemStation data acquisition software, Environment Testing Chrom and Environment Testing LIMS (TALS).
- NIST Mass Spectral Library and Search Program, 2020 release or newer

6.3) Cleaning System

- Canister Cleaner Module and Software: Capable of filling canisters with humidified air and evacuating canisters to 50 mtorr, Entech Model 3100A or equivalent.
- Vacuum Pump: Capable of evacuating sample canisters to full vacuum. Vacuubrand or equivalent.
- Cleaning Manifold: Equipped with stainless steel and Teflon transfer lines and connections for cleaning up to twelve canisters simultaneously.
- Heating Belts: Individual thermal-stated heating belts used to heat canisters to 100ºC during the manifolds cleaning cycles. Entech or equivalent.
- Cleaning oven: Capable of cleaning 6 Summa Cans simultaneously at a temperature of 100ºC. Entech or equivalent.
- Flow Controller Cleaning Manifold: Capable of flushing hot Nitrogen through 24 flow controllers simultaneously for cleaning.

6.4) Miscellaneous Supplies

- Mass Flow Controller, NIST Traceable: Capable of flow rate of 70 mL/min, Alicat MC5005CCM or equivalent. Use for the preparation of calibration and working standards.
- Syringes: Gas tight with a Luer-Lok tip, assorted sizes ranging from 1.0 mL to 1.0 L, SGE or equivalent.
- Digital Pressure Gauges, NIST Traceable: Capable of measuring pressure in the range of -30" Hg to 100 psi, Dwyer Models DPGA-12 and 67100 or equivalent
- Digital Flow Meter, NIST Traceable: Alltech or equivalent.

- Nitrogen Gas
- Digital Stop watch, NIST traceable, Thomas Scientific or equivalent

7) Reagents and Standards

Catalog numbers listed in this SOP are subject to change at the discretion of the vendor. Analysts may use equivalent-quality materials based on factors including availability. Permanent changes will be noted in future SOP revisions. All reagent and standards must be labeled with their Name and/or ID #; the Expiration Date; and the Date Prepared.

All reagents and standards are stored at room temperature in the Air Lab work area, unless noted otherwise.

For additional information refer to the *SOP52272 Traceability, Handling and Storage of Standards and Reagents*

7.1) Reagents

- Argon - Gas off bulk Liquid Argon tank. UHP Air Gas or equivalent vendor
- Nitrogen- Gas off bulk Liquid Nitrogen tank. UHP Air Gas or equivalent vendor
- Helium- UHP from Airgas or equivalent
- VOA free water

7.2) Standards

Certified stock standard solutions are purchased from approved commercial vendors. From these, intermediate and working standard solutions are prepared by diluting a known volume of standard in an appropriate solvent to the desired final concentration.

Formulations for the preparation of intermediate and working standard solutions are provided in the Appendix. Unless otherwise specified, assign an expiration date of 12 months from date of preparation, unless the parent component expires earlier in which case use the earliest expiration date.

There are small variations in analyte concentrations in the preparation of air standards. For simplicity, the nominal concentrations are referenced in this SOP.

Note: *When entering the concentrations of source standards in TALS, use the nominal concentration and not the actual concentration. Unless the actual has a > 15% difference from the nominal value. In these cases, use the actual value.*

Purchase the following stock standard mixtures from commercial vendors:

- Mixed Gas Stock Standard: - Commercially prepared standard that includes internal standard and tune standard compounds: Bromofluorobenzene, Bromochloromethane, 1,4-Difluorobenzene, and Chlorobenzene-d5, at a concentration of 100 ppbv each. Linde or equivalent.
- Calibration Stock Standard: - Commercially prepared custom gaseous stock standard that includes all target analytes except ethanol at a concentration of 1.0 ppmv. Linde or equivalent.
- Calibration Ethanol Neat Material. >99.5%
- ICV / LCS Stock Standard: - Custom made gaseous stock standard prepared from a different lot(s) of the source material(s) used to manufacture the calibration stock standard. The ICV/LCS stock standard includes all target analytes at a concentration of 1.0 ppmv. Linde.
- ICV/LCS Ethanol Neat material. >99.5% from a source other than the calibration source.

Prepare calibration and working standards mixtures by diluting a known volume of the stock standard with nitrogen to a specified volume into a humidified summa canister. The summa canister is humidified by adding 100ul of VOA free reagent water. The volume of the standard added to the canister is calculated using the set flow rate of 70mL/min using a mass flow meter multiplied by the time of the standard addition, plus the inclusion of the 25ml volume for the tubing connecting the mass flow meter to the summa canister. The formulations for standard preparation are provided in the Appendix along with recommended expiration dates and storage conditions.

Each stock standard is assigned a 1-year expiration date from manufacture and recertified annually. See *SOP52272 Traceability, Handling, and Storage of Standards and Reagents* for details on the recertification process. The ethanol neat material is assigned the expiration date given by the manufacturer.

If a new standard cannot be received prior to the expiration of the standard presently in use, the lab will notify the QA manager. The QA manager will perform a control chart review (see *SOP49965 Control Charts*). If the standard is determined to be acceptable, the lab may assign a new expiration date of not more than 30 days from the date of the last data point in the control chart review. When the new standard ID is created in TALS, the COA and the Control Chart verifying the standards stability will be attached to the reagent ID.

8) Sample Collection, Preservation, Shipment and Storage

The laboratory does not perform sample collection, so these procedures are not included in this SOP. Sampling requirements may be found in the published reference method.

Matrix	Sample Container	Minimum Sample Size	Preservation	Holding Time	Reference
Air	1L or 6L Passivated Summa Canister	1L	NA	30 days from collection	EPA TO-15

1-liter Tedlar bags are only provided upon client request; however, clients are discouraged from using Tedlar bags due to the shortened holding time of 72 hours from collection.

All samples should be collected in passivated stainless-steel canisters that have been certified clean prior to sampling. The laboratory will provide certified clean canisters to the client upon request. The procedures for clean canister certification are provided in Laboratory SOP 48255: Canister Cleaning, Certification and Sampling Kit Preparation.

The laboratory can also provide flow controllers set to the appropriate flow rate for the sampling time required by the client.

The laboratory ships air canisters in custom made boxes. The boxes are equipped with custom-made foam inserts to hold the pre-set flow-controllers. The shipping materials are designed to prevent damage of equipment to and from the sampling site. The laboratory checks the equipment to ensure it is in proper working order before shipment to the client and additional checks are performed on return of the equipment to the laboratory. Sampling instructions are provided with each sampling kit. The sampling crew is advised to handle the sampling equipment using the instructions provided by the laboratory to ensure optimum performance.

The laboratory's sample acceptance policy for air samples in canisters requires that the sampling crew record the ID of the flow controller used for sample collection on the tag attached to each canister, but the association may also be recorded on the Field Test Data Sheet or a COC. With this information the laboratory can review the history of use of the FC as needed to troubleshoot potential equipment problems. Without the association, the history of use of the FC is unknown. The laboratory strongly recommends that field samplers be instructed to provide this information for each sampling event.

The return pressure of each canister should be between -10" Hg to -1"Hg, except for "grab" samples or samples with a collection rate of 100 or 200 mL/min, which must have a pressure greater than or equal to -10" Hg. The residual vacuum criteria ensure that the sample was collected over the time period the flow controller was calibrated for.

9) Quality Control

9.1) Sample QC

The following quality control samples are prepared with each batch of samples.

QC Item	Frequency	Acceptance Criteria
Method Blank (MB)	1 in 20 or fewer samples	See QC Summary Table
Laboratory Control Sample (LCS)	1 in 20 or fewer samples	See QC Summary Table
Internal Standard (ISTD)	Every Sample	See QC Summary Table
Laboratory Control Sample Duplicate (LCSD)	Client request or if insufficient sample for Sample Duplicate	See QC Summary Table
Sample Duplicate (SD)	1 in 20 or fewer samples if sample volume allows	See QC Summary Table
Trip Blank (TB)	Client Request	See QC Summary Table

NOTE: *The compendium reference method does not require the analysis of a laboratory control sample (LCS) or provide criteria for the evaluation of an LCS. The laboratory performs an LCS at the above-mentioned frequency as an evaluation of percent recovery in a blank matrix. The laboratory uses statistically derived control limits for the LCS.*

Unless otherwise specified by the client during project initiation, the LCSD will be used to measure precision only. The LCS will be used for evaluations for percent recovery and to determine if corrective action is necessary.

9.2) Instrument QC

The following instrument QC is performed:

QC Item	Frequency	Acceptance Criteria
Tune Standard (BFB)	Each Analytical Window	See Appendices
Initial Calibration (ICAL)	Initially; when ICV or CCV fail	See Appendices
Initial Calibration Verification (ICV)	Once, after each ICAL	See Appendices
RT Window Establishment	Once per ICAL	See Appendices

Relative Retention Time (RRT)	With each sample	See Appendices
Continuing Calibration Verification (CCV)	Daily, after each BFB	See Appendices

10) Procedure

10.1) Support Equipment Calibration

Verify the calibration is valid for the following;

- Mass flow controller used to prepare standards.
- Digital flow meter used to set and check the flow rates of the FC(s) used for sample collection.
- Digital pressure gauges used to check return canister pressure.
- Stopwatch used to measure standard addition time is current to the year.

Immediately notify the QA department if the calibration is not current and wait for further instruction. Equipment whose calibration has expired may not be used without documented approval from the QA department.

NOTE: *The QA department schedules the annual calibrations of the support equipment and maintains all Certificates of Calibration. The flow controllers are checked against a NIST traceable standard. This check is performed by the manufacturer of the equipment, when possible, or by an approved vendor that provides certification service.*

10.2) Instrument Calibration

All Calibration Standards and Quality Control samples have the same concentration of Internal Standards and Surrogates that are added for field sample analysis. Refer to the Analytical Sequence section for additional information.

10.2.1) Tune Standard

Analyze a tune standard (BFB) prior at the beginning of each analytical window. The tune standard is a commercially prepared mixed gas stock standard that includes Bromofluorobenzene (BFB) at a concentration of 100 ppbv.

To analyze the tune standard:

1. Establish the instrument operating conditions specified in the Sample Analysis section of this SOP. Once established these settings must be maintained for the analysis of all quality control and environmental samples.
2. Attach the mixed gas stock standard to the Entech concentrator by attaching the cylinder to the line dedicated for introduction of the internal standard (ISTD). The concentrator directly injects 20 mL of the 100 ppbv stock standard onto the instrument to yield an on-column concentration of 10 ppbv.
3. Acquire the data and evaluate the results against the acceptance criteria in the Tune Standard Criteria table in the appendix.
4. Criteria must be met prior to further analysis.
5. The official start time of the 24-hour analytical window is the injection time of a passing tune standard. All samples must be injected within 24 hours of that time.

NOTE: *The data processing system averages three scans (apex scan, scan prior, and scan following) and performs background subtraction of the single scan prior to the elution of BFB.*

10.2.2) Initial Calibration (ICAL)

The instrument must be calibrated with a minimum of five calibration standards for each target analyte at concentrations that span the working range of the method.

The laboratory routinely analyzes 8 standards at the recommended concentrations of 0.035, 0.20, 0.50, 5.0, 10.0, 15.0, 20 and 40 ppbv, except for Ethanol. For Ethanol, a 6-point curve is analyzed at the following concentrations: 5, 10, 15, 20, 40, and 100 ppbv.

Note: *These are nominal concentrations, dependent on parent can stock concentrations. The nominal 0.035 ppbv concentration is prepared to ensure the actual low calibration standard is below the reporting limit (RL).*

Even though eight calibration standards are routinely analyzed not every calibration standard is used for each analyte. Each analyte has been assigned to an analyte group that includes a calibration range of at least five standards. The analyte group associations for each target analyte are provided in Tables in the appendix. The calibration range for each analyte group is as follows:

- Group A: This analyte group is associated with a seven-point calibration curve. The calibration range is 0.20 to 40 ppbv with the 0.035 ppbv standard excluded. The limit of quantitation (LOQ) for this group of analytes is 0.20 ppbv

- Group B: This analyte group is associated with a six-point calibration curve. The calibration range is 0.50 to 40 ppbv with the 0.04 and 0.20ppbv standards excluded. The limit of quantitation (LOQ) for this group of analytes is 0.50 ppbv.

- Group C: This analyte group is associated with a five-point calibration curve. The calibration range is 5.0 to 40 ppbv with the 0.04, 0.20, and 0.50ppbv standards excluded. The limit of quantitation (LOQ) for this group of analytes is 5.0 ppbv.

- Group D: This analyte group is an eight-point calibration curve. The calibration range is 0.035 to 40 ppbv. The limit of quantitation (LOQ) for this group of analytes is 0.035 ppbv.

- Group E: (Ethanol): This analyte has a six-point calibration curve. The calibration range is 5 to 100 ppbv. The limit of quantitation (LOQ) for this analyte is 5 ppbv.

Prepare the calibration standards using the formulations provided in Appendix B.

Analyze the standards in a sequence from lowest to highest concentration using the instructions provided in the Sample Analysis section.

10.2.2.1) Initial Calibration Acceptance Criteria

The data processing system calculates a relative response factor (RRF), for each analyte and isomer pair using the assigned internal standard. The internal standard associations for each target analyte are provided in tables in the Appendix. The data processing system also calculates a mean relative response factor, relative standard deviation (RSD), relative retention time (RRT) and the mean RRT.

The following criteria must be met for a calibration to be considered acceptable:

- The RSD for each target analyte must be <30% with at most 2 exceptions up to a limit of 40%. If linear regression is used the R2 must be greater than 0.996

- The area response for the primary quantitation ion for the internal standard for each ICAL standard must be within 40% of the mean area response over the calibration range for each internal standard.

    - The RRT for each target compound at each calibration level must be within 0.06 RRT units of the mean RRT for the compound. The retention time shift for each of the internal standards at each calibration level must be within 20 seconds of the mean retention time over the initial calibration range for each internal standard.

If these criteria are not met inspect the system for problems and perform corrective action. See the corrective action section and the QC Summary Table in the appendix for guidance.

Whichever calibration model is selected, it must be subjected to an additional check to establish the representativeness of the data that were used to produce it. This check is the refitting of each calibration point response back to the calibration model, or the comparison of the calculated amount of the standard against the expected amount.

Calculate the concentration of each calibration standard from the final calibration curve. Calculate the %Error for each point. All points must have an absolute %Error of < 30%, except the low point % Error must be < 50%.

If these conditions are not met, perform corrective action and recalibrate the instrument.

The laboratory CHROM software provides an Initial Calibration %Drift report which shows the % Error for each calibration point. This report must be reviewed in addition to the %RSD / Linear Response Factor.
%Error is the absolute value of the difference between the calculated concentration and the true concentration divided by the true concentration x100%.

- For example, if the 0.20mg/L standard reads back as 0.17mg/L:
  $[(0.20 - 0.17)/0.20] \times 100\% = 15\%$

Repeat initial calibration whenever instrument operating conditions are changed, a new column is installed, when significant instrument maintenance has been performed, and when the result of the CCV indicate the calibration is no longer valid.

10.2.3) Second Source Calibration Verification (ICV)

Immediately following an acceptable initial calibration verify the accuracy of the calibration by the analysis of the second source calibration verification standard (ICV).

Prepare the ICV following the formulation provided in the Appendix.

Analyze the ICV following the instructions provided in Sample Analysis section.

The percent recovery (%R) for each target analyte must be within 70-130%. If criteria are not met, perform corrective action. Recommended corrective actions are provided in QC Summary Table. If corrective action is not successful, remake your standards and recalibrate.

If after successful analysis of the ICV, time remains in the 24-hour analytical window, QC and field samples may be analyzed without analysis of a continuing calibration verification check standard. If time does not remain in the analytical window, a new analytical sequence must be initiated with a Tune Standard followed by daily calibration (CCV).

10.2.4) Continuing Calibration Verification (CCV)

Analyze the CCV immediately after the tune standard unless the analytical window includes ICAL, in which case, a CCV is not required.

Prepare the CCV standard using the formulation given in the Appendix. The recommended concentration of the CCV for each target analyte is 10.0 ppbv.

Analyze the CCV following the instructions provided in Sample Analysis section. The data system calculates a response factor for each analyte and calculates the percent difference (%D) of the RRF relative to the mean RRF in the most recent initial calibration.

- The %D for each target analyte must be within ±30%. If the above criteria are not met, repeat the analysis of the CCV once. If the second CCV meets criteria, continue with the analytical sequence. If it fails, evaluate the data to determine if one of the following conditions is met. If these conditions are not met corrective action must be taken. Guidance for troubleshooting is provided in the Troubleshooting and Corrective Action sections. After corrective action the analytical sequence may be continued only if two immediate, consecutive CCVs at different concentrations are within acceptance criteria. If these two CCVs do not meet the criteria, recalibration is required prior to further analysis.

- If the CCV criteria are exceeded high, indicating a high bias, and the associated samples have non-detects for those analytes, the analytical data may be considered usable. In the absence of instructions otherwise, proceed with analysis.

- If the CCV criteria are exceeded low, indicating a low bias, analytical results may be reported if those results exceed the project's regulatory decision level. In other words, if the analytical results are sufficiently high to counter the low bias, results may be reported. Consult with the project manager to determine if the exception is allowable for each project.

10.2.5) Troubleshooting

Check the following items in case of calibration failures:

- Loss of sensitivity or unstable ISTD recoveries are usually the result of a leak. Check the union between the GC column and Entech transfer line.
- Loss of sensitivity for individual compounds may be a result of either an active site in a transfer line or a bad trap. Troubleshoot and perform maintenance as necessary.
- Poor chromatography usually requires GC column maintenance, perform as necessary.
- Carryover is usually caused by excessive amounts of analyte introduced to the system. Analyze blanks until the system is cleaned or replace the traps and transfer lines if necessary.

10.3) Sample Preparation

10.3.1) Post Sampling Canister Pressure Check Procedure

The post-sampling canister pressure check is performed at the time of sample login by sample management staff so that any problems found are quickly identified and communicated to the client.

Refer to the current version of *SOP49959 Sample Management* for the procedure to take and record the post sampling canister pressure check.

10.3.2) Sample Screening

At the laboratory's discretion unknown samples may be screened prior to initial analysis to determine if the sample requires dilution. Unless otherwise requested by the client the laboratory does not provide screen data with the data package report even when primary dilutions are performed based on the results of the screen analysis.

To prepare a sample for screen analysis, connect the sample canister to the autosampler connected to screening instrument and analyze 20 mL of sample. Acquire and evaluate the results. If the results of screen analysis indicate that a target compound is above its upper range of calibration, calculate a recommended dilution factor (DF) by dividing the concentration of analyte found by 30. Record the recommended DF on the screen worksheet.

NOTE: *Samples are screened on a GC/MS instrument that is programmed with the operating conditions referenced in this SOP. The calibration is checked weekly with a single point calibration standard at a concentration of 10 ppbv for all target analytes. The calibration is checked more frequently when the results of instrument analysis do not correlate well with the results of the screen analysis.*

10.3.3) Sample Dilutions & Pressure Adjustment

Field samples should be diluted prior to initial analysis when the screen results indicate that the concentrations are above calibration range or when the laboratory has sufficient knowledge of the sample (history) to know that the sample will require dilution. Field samples must be reanalyzed at a dilution when the concentration of target compounds in initial analysis exceed of the upper range of calibration.

When the return negative pressure of a canister is greater than -10” Hg, make-up gas may be added to provide sufficient volume of make-up gas in order to have an adequate sample volume for analysis. The addition of make-up gas is considered a canister dilution. Some concentrators are able to pull full sample volume even if the residual vacuum is lower than -10” Hg so make-up air may not be necessary.

For samples analyzed for constituent groups (e.g., TVOC as Toluene), ranges, and or unresolved complex mixtures (Total Hydrocarbons), samples must be diluted such that the maximum peak height of any sample constituent under consideration does not exceed the equivalent peak height generated by highest calibration level standard. For evaluation it may be useful to graphically overlay sample chromatograms with that of the high point calibration standard.
To dilute the sample:

1) Attach the sample canister to the nitrogen gas line equipped with a pressure gauge that reads negative pressure in (“Hg) and positive pressure in (psig).

2) Ensure the valve of the nitrogen gas line is closed then open the valve of the sample canister. Record the negative pressure reading in the Canister Dilution Worksheet or on the canister’s tag.

3) Slowly open the valve of the nitrogen gas line and fill the canister until canister pressure gauge reads -10” Hg. Do not open the valve to such an extent that the nitrogen gas line pressure drops below 15 psig and do not allow the nitrogen gas line to reach equilibrium otherwise you will contaminate the nitrogen gas line.

4) When the desired pressure is achieved, close the canister valve and the valve on the nitrogen gas line; wait 15 seconds. The pressure should not exceed 40 psig.

5) Open the canister valve and record the final pressure reading in psig.

6) Close the canister valve and remove the valve from the zero air-line.

7) Record the initial and final pressure readings in the TALS canister dilution tracking module. If the final pressure is below ambient, the pressure will be in “Hg. Be sure to change the units in the TALS dilution tracking module.

When the return pressure of a canister is positive, the pressure must be adjusted to near ambient (0” Hg) prior to analysis. To adjust the pressure to ambient, vent the canister to ambient in a fume hood by opening the canister value for ~4-5 seconds, close the valve. For higher pressure canisters, open the valve and listen for a release of air then close the valve when the sound recedes.

If a trip blank is provided under vacuum, pressurize the trip blank canister to 10 psig. The pressurization of the trip blank is not considered a dilution.

10.3.4) QC Sample Preparation

To prepare the method blank (MB): Fill a clean canister that has never been used to collect environmental samples and has never left the laboratory to 20 psig with nitrogen gas. Continue to use this canister as the MB until the pressure of the canister reaches 0 psig, at which time, recharge with nitrogen gas to 20 psig and reuse.

To prepare the LCS: Follow the instructions provided in the Appendix for preparation of the working ICV/LCS standard. If an LCSD is requested, analyze the LCSD from the same canister as the LCS, unless client makes a specific request for an independent LCSD can.

10.4) Sample Analysis

10.4.1) Instrument Operating Conditions

Optimize the GC and MS conditions for compound separation and sensitivity.

The recommended operating conditions are as follows:

Thermal Desorb:	Initial Trap #1 Temperature: -110ºC. Desorb Temperature from Trap #1 to #2: 0 ºC. Total Volume Transfer by Mass Flow Controller: 40 mL Initial Trap #2 Temperature: -15 ºC Desorb Temperature from Trap #2 to #3: 200ºC. Transfer time 3.5 minutes Initial Trap #3 Temperature: -165 ºC Injection Trap #3 Temperature: 70ºC Injection Time: 1.5 minutes Trap #3 Temperature after Injection: -165 ºC
Carrier Gas:	Helium, Ultra High Purity
Cryogenic Focusing Gas:	Liquid Nitrogen
Flow Rate:	~1.5 mL/min
Temperature Program:	Initial Temperature: 40ºC Initial Hold Time: 4 minutes Ramp1 Rate: 20ºC/min. to 200ºC. Ramp 2 Rate: 40ºC/min. to 220ºC Final Temperature: 220ºC Final Hold Time: 6.5 minutes
Electron Energy:	70 electron volts
Mass Range:	35-265 amu
Scan Time:	≥1 scan per second.

These operating conditions may be changed but once the operating conditions are established for initial calibration the same conditions must be used until a new calibration is performed.

The mass spec tune profile may be changed to optimize the BFB tune analysis but once set, it cannot be changed until another BFB tune is analyzed.

10.4.2) Daily Instrument Maintenance

Prior to analysis initiate the flushing sequence using the Entech software. Then initiate the bake program using the Entech software.

10.4.3) Bi-Weekly Instrument Maintenance

At a minimum frequency of once every two weeks, perform an autosampler leak check. Cap all autosampler ports and initiate the leak check program using the Entech software. Record this check in the instrument maintenance log.

10.4.4) Analytical Sequence

All Calibration Standards, batch QA and field samples, except for the BFB analysis, have 20mls of the Mixed Gas Stock Standard added in conjunction with any other additions. This addition adds the internal standards and surrogates.

An example analytical sequence that includes initial calibration (ICAL) is provided below. When ICAL is not performed, the sequence begins with the tune standard and is followed by the CCV, LCS, LCSD, and method blank. If sufficient time remains in the 24 hours analytical window after initial calibration, QC and field samples may be analyzed without the CCV and the ICV will serve as the LCS for the sequence. The MB, LCS and LSCD must be analyzed at a frequency of every 20 samples or with each analytical sequence whichever is more frequent.

1. Tune Standard (BFB)
2. ICAL
3. ICV
4. CCV
5. LCS (repeat every 20 samples)
6. LCSD (when requested)
7. MB (repeat every 20 samples)
8. Field Samples (including trip blanks)

Attach the canisters to the autosampler inlet in the order of the analytical sequence then initiate the analytical sequence. The autosampler introduces 200 mL of sample volume from each canister to the instrument system and adds 20 mL of the mixed gas

standard to each sample.

Acquire the data and evaluate the results to confirm qualitative identification and quantification.

10.5) Corrective Action

An out-of-control situation may occur that is not adequately addressed in the corrective action table or troubleshooting section. The analyst must use their best analytical judgment and available resources to determine the corrective action to be taken. The analyst should seek the assistance of their immediate supervisor, QA manager or other experienced staff if they are uncertain of the cause of the out-of-control situation.

The analysis must not be resumed until the source of the problem and an in-control status is re-established. All samples associated with the out-of-control situation must be reanalyzed after in-control status has been re-established.

If authorization is received from the Supervisor or QA Manager for release with data qualification, a Non-Conformance Memo (NCM) must be created to notify the project manager, who then notifies the client of the out-of-control situation. Also, the situation may be significant enough that the Supervisor or QA Manager would create a Corrective Action Report (CAR). Refer to the *SOP49967 Nonconformance and Corrective Action Procedures* for further guidance.

11) Calculations/Data Reduction

11.1) Qualitative Identification

The data processing system tentatively identifies target analytes by comparing the retention time of the peaks to the window set around the continuing calibration standard, and searches in that area for the primary ion and up to two secondary ions characteristic of the target analyte.

All tentative identifications made by the computer are reviewed and either accepted or rejected by the primary analyst. The identification made by the system is accepted when the following criteria are met:

- The target analyte is identified by comparison of its background subtracted mass spectrum to a reference spectrum in the NIST14 database. In general, all ions that are present above 10% relative abundance in the mass spectrum of the standard should be present in the mass spectrum of the sample component and their relative abundances should agree within 20%. For example, if an ion has a relative abundance of 30% in the standard spectrum, its abundance in the sample spectrum should be in the range of 10-50%. Some ions, particularly the molecular ion, are of special importance if a tentative identification is to be made and should be evaluated even if they are below 10% relative abundance.
- The GC retention time for the target analyte should be within 0.06 RRT units of the daily standard.

Identification requires expert judgment when sample components are not resolved chromatographically and produce mass spectra containing ions contributed by more than one analyte. When GC peaks obviously represent more than one sample component (i.e., broadened peak with shoulder(s) or valley between two or more maxima), appropriate analyte spectra and background spectra can be selected by examining plots of characteristic ions for tentatively identified components.

When analytes coelute (i.e., only one GC peak is apparent), the identification criteria can be met but each analyte spectrum will contain extraneous ions contributed by the coeluting compound. If the data system does not properly integrate a peak, perform manual integration. All manual integration must be performed and documented in accordance with corporate *SOP43862 Manual Integrations*.

11.2) Quantification of Target Analytes

After a compound has been identified, the data system quantifies the on-column concentration of the target compound based on the integrated abundance of the characteristic ion from the EICP. If there is matrix interference with the primary ion, a secondary ion may be used for quantification by calculating a mean RF factor for that ion and using that ion to quantify the analyte in the sample. When secondary ion calculations are required, include this information in the non-conformance report and project narrative.

Samples analyzed for constituent groups, ranges, and or unresolved complex mixtures are quantified as follows;

11.2.1) TVOC as Toluene

An internal standard type of quantification response factor is generated using the RIC peak response measured for Toluene and its associated internal standard (as detailed in the calculation section). That response factor is used to quantify all RIC chromatographic sample response with the exception of those peak responses associated with internal standards. The results are reported as 'TVOC (as Toluene)'.

Retention Time Range: Propene to Naphthalene

11.2.2) GRO as Octane

An internal standard type of quantification response factor is generated using the RIC peak response measured for Octane and its associated internal standard (as detailed in the calculation section). That response factor is used to quantify all RIC chromatographic sample response with the exception of those peak responses associated with internal standards that eluted within the retention time range as defined by the elution of 2-Methyl-Butane through Decane (C5-C10). The results are reported as 'GRO (as Octane).

Retention Time Range: 2-Methyl-Butane to n-Decane

11.2.3) Unresolved Complex mixtures

An internal standard type of quantification response factor is generated using the RIC peak response measured for the un-resolved complex mixture (i.e. the gasoline envelope) and its associated internal standard (as detailed in the calculation section). That response factor is used to quantify all similarly chromatographing RIC sample response with the exception of those peak responses associated with internal standards. The results are reported using the name of the unresolved complex mixture used in the calibration (e.g. Total Hydrocarbons).

Retention Time Range: Propene to Naphthalene

Final results are calculated in TALS

11.3) Calculations

Analytical results are calculated as follows:

Dilution Factor

DF = (V2/V1) x (V4/V3)

Where:
V1 = Pre-Dilution Canister Volume
V2 = Post-Dilution Canister Volume
V4 = Base Sample Amount (200 mL)

Relative Response Factor (RRF)

RRF = (Ax)(Cis)/(Ais)(Cx)

Where:
Ax = Area of the quantitation ion of the analyte
Ais = Area of the quantitation ion of the internal standard
Cx = Concentration of analyte in concentration units (ppbv)
Cis = Concentration of internal standard in concentration units (ppbv)

Sample Concentration

Cx = [(Ax)(Cis)/(Ais)(Mean RRF)] x (DF)

Where:
Cx = Compound concentration (ppbv)
Cis = Concentration of associated internal standard (ppbv)
Ais = Area of quantitation ion for associated internal standard
Ax = Area of quantitation ion for compound
DF = Dilution Factor
Mean RRF = Average Relative Response Factor from initial calibration.

Unit Conversion from ppbv to ugm3

Analytical Result(ug/m3) = Result(ppbv) x (MW/24.45)

Where:
MW = molecular Weight

Example:
Benzene Result = 56 ppbv
Benzene mw = 78.108

Analytical Result(ug/m3) = 56ppbv x (78.108/24.45)

Result(ug/m3) = 178.9 ug/m3 reported as 180 ug/m3

Percent Recovery (%R)

%R = (Cs/Cn) x 100

Where:
Cs = Concentration of the spiked sample (ppbv)
Cn = Nominal concentration of spike added (ppbv)

Precision (%RPD)

%RPD = [(|C1-C2|)/((C1+C2)/2) x 100

Where:
C1 = Measured concentration of the first sample aliquot
C2 = Measured concentration of the second sample aliquot

Formula of Standard Addition:

Volume (mL) = (FR x T) + 25 mL

Where:
FR = flow rate in mL/min
T= time in minutes

Example:
FR = 70ml/min
Time = 10.69 minutes
Volume = 25+ (70 x 10.69) = 773 mL

Total Volume of diluted standard

Volume (mL) = CV x P

Where:
CV = canister volume in mL
P = pressure in Bar (14.7psi per Bar)

Example:
CV = 6185 mL
P= 2.5 Bar
Volume = 15462 mL

11.4) Data Review

11.4.1) Primary Review (Performed by Primary Analyst)

Upload the data files to TALS. Enter batch editor information and add the standards and reagents to the TALS batch. Review the results against acceptance criteria. If acceptance criteria are not met, make arrangements to perform corrective action.

Check the results of samples analyzed immediately after high concentration samples for signs of carry-over. Reanalyze the sample if carry over is suspected.

Dilute and reanalyze samples whose results exceed the calibration range. The diluted analysis should result in a determination within the upper half of the calibration curve.

If samples are run at dilution, there should be a target peak that is at least 20% of the calibrated range but preferably in the upper half of the range or there should be an abundance of TICs which preclude a more concentrated analysis, or the sample should show matrix effects which preclude a more concentrated analysis. If a sample is diluted due to TICs or matrix, an NCM should be written explaining the reason for dilution.

Set results to primary, secondary, acceptable or rejected as appropriate.

Verify corrective action was taken for all results not within acceptance criteria. If corrective action is not taken or was unsuccessful, record all instances where criteria are not met with a nonconformance memo (NCM). Be sure to provide

explanation of your decision making in the internal comment section of the NCM. The internal comment section should list the reason the NCM is suspected, which action (if any) was taken and why, and the outcome of the action taken. Refer to the *SOP49967 Nonconformance and Corrective Action Procedures* for further guidance.

Review project documents such as the Project Plan (PP), Project Memo or any other document/process used to communicate project requirements to ensure those project requirements were met. If project requirements were not met, immediately notify the project manager (PM) to determine an appropriate course of action.

Review that QC links have been properly made and run the data review checker (DRC) and address any anomalies.

Set the batch to 1st level review and record your review on the data review checklist.

11.4.2) Secondary Review (Performed by Peer Reviewer)

Review the project documents such as the Project Plan (PP), Project Memo or any other document/process used to communicate project requirements and verify project requirements were met. If project requirements were not met, immediately notify the project manager (PM) to determine an appropriate course of action.

Review records (these records include but are not limited to the Pre-Shipment Clean Canister Certification Report, Flow Controller Set Flow Rate and Leak Check Record, Field Test Data Sheets, and the Air Canister Return Pressure Check Record) associated with release and return of air sampling equipment to ensure all anomalies are properly recorded. Compare any problems noted in these documents with the analytical results and record any findings in the narrative note program or otherwise communicate your findings to the PM for inclusion in the project narrative.

Review the TALS batch editor to verify information is complete. Review the batch to verify that the procedures in this SOP were followed. If discrepancy is found, resolve the discrepancy and verify any modifications to the SOP were approved and properly documented.

Spot-check 15% of samples in the batch to verify quantitative and qualitative identification. If the samples are being analyzed under DoD methods 100% of data must be checked during secondary review.

If manual integrations were performed:

- Review all integrations to verify that the integration meets the requirements for manual integration as specified in corporate SOP CA-Q-S-002. If an error is suspected or found, consult with the analyst that performed the integration and request correction or notify the Department Manager or QA Manager. Do not "fix" the integration. Reintegration by a secondary data reviewer must not be performed except in limited circumstances as approved by the department supervisor or other laboratory management. If those instances where the secondary reviewer performs the integration, this person is now considered the primary analyst and each integration performed by the secondary reviewer must be subsequently reviewed by a peer analyst or the department supervisor to verify the integration is consistent and compliant with the requirements specified in corporate SOP CA-Q-S-002.
- Check to ensure an appropriate technical reason code is provided for all manual integrations.

Verify that the performance criteria for the QC items listed in TO15 QC Summary & Recommended Corrective Action table in Appendix were met. If the results do not fall within the established limits, verify that corrective actions were performed. If corrective action was not performed; verify the reason is provided and that the situation is properly documented with an NCM. Set samples to 2nd level review. Record second level review on the data review checklist.

Run and review the deliverable. Fix any problems found. When complete set the method chain to lab complete and forward any paperwork to report/project management.

11.5) TO15 Poor Performing Analytes

NOTE: *Statistically derived limits will be no wider than 50-150%R for poor performing compounds.*

Compounds with a high boiling point which is beyond the range of typical gas compounds.

- Dodecane
- 1,2,4-Trichlorobenzene
- Hexachlorobutadiene
- Naphthalene
- 1,2,3-Trichlorobenzene

The following compounds change how they act on the traps depending on the humidity of the standard.

- 3-chloro-1-propene
- Bromoform

The following compounds are very polar and are linked to the water in the standard. Since we remove most of the water during the trapping process, a little change can produce a big result. For example removing 95% of the water instead of 94% of the water will have a negligible affect on non-polar compounds, but a 20% difference for polar compounds.

- Ethanol (made from neat material and is not part of the standard TO-15 calibration gas mix due to high reactivity
- Ethyl ether
- Acrolein
- Acetone
- Isopropyl alcohol
- 2-butanone
- Tetrahydrofuran
- 2-hexanone

11.6) Data Reporting

Report analytical results above the reporting limit (RL) as the value found. Report analytical results less than the RL, to the adjusted RL with a "U" data qualifier. If the data is to be reported to the method detection limit (MDL) the analytical results between the RL and the MDL are reported with an "estimated" footnote. Adjust the RL and MDL for sample dilution/concentration. The unadjusted RL for each target analyte is provided in Routine Compound List and TO-3 Analyte List tables. For Method TO3 the laboratory does not report values below the reporting limit.

Data reporting and creation of the data deliverable is performed by TALS using the formatters set by the project manager during project initiation.

Electronic and hardcopy data are maintained as described in laboratory *SOP49966 Management, Retention Storage and Archive of Data Records*.

12) Method Performance

12.1) Method Detection Limit Study (MDL)

Perform a method detection limit (MDL) study at initial method set-up following the procedures specified in laboratory SOP BR-QA-005,

12.2) Training Requirements and Demonstration of Capabilities

The Group Leader is responsible for ensuring that this procedure is performed by an associate who has been properly trained in its use and has the required experience. The Group Leader is also responsible for the documentation of this training.

All personnel are required to perform an initial demonstration of proficiency (IDOC) on the portion of the method they will be performing prior to working independently. Annually thereafter, the analyst must document continuing demonstration of capability (CDOC). See requirements for demonstration of analyst proficiency in *SOP52264 Employee Training and Analyst Demonstration of Proficiency*.

13) Pollution Control

It is Eurofins Burlington's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in NDSC-USEHS-*QP46060 NDSC HSE Manual*.

14) Waste Management

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to *SOP47863 Tracking and Collecting of Hazardous Waste* and *SOP48269 Procedure for Acceptance and Handling of USDA Regulated Domestic and Foreign Soil*.

The following waste streams are produced when this method is carried out:

- None

15) Method Modifications

- This SOP utilizes and alternative detector (mass spectrometer) vs that of a FID and/or ECD as listed in the published method. (TO3)

- This SOP describes a method where an aliquot of a whole air sample collected in a passivated stainless-steel canister is cryogenically trapped and concentrated prior to injection into the MS detector equipped GC. (TO3)
- This Method SOP utilizes an RTX-624 capillary column (60M x 0.32 mm ID x 0.18um). (TO3, TO15)
- Additional quality control aspects are employed in the use of this method based on the alternative detector type, specifically, the detector tune is verified at the beginning of each period of analysis prior to the acquisition on any standard, blank, QC sample or field sample. (TO3)
- This Method SOP does not utilize sub ambient column oven temperature programming. (TO3, TO15)
- Sample traps consist of a multi bed system employing Tenax and glass beads (see manufactures system description: Entech Model 7100 Sample Pre-Concentrator). (TO15)
- Sampling apparatus consists of passivated stainless-steel canister specifically design for the collection of ambient air samples for volatile analysis (TO3)
- Nafion dryers are not used. The analytical pre-concentration system employs a moisture control system consisting of multi sorbent bed traps. (TO15)
- System calibration is verified every 24 hours within which samples are analyzed. System linearity is not verified every 4-6 hours as described. (TO3)
- Published Method requires weekly multi-point calibration be performed. Laboratory performs multi-point calibrations as necessary see section 10.2 (TO3)
- System linearity is determined through multi point calibration utilizing average response factors and internal standard technique quantification (see Section 10).(TO3)
- This SOP is applied to more than just the ambient air listed as a matrix by the method (TO15)

16) Appendices

16.1) Routine Compound List, Reporting Limit, Internal Standard and Ion Assignments

Analyte	CAS #	6L RL (ppbv)	1L RL (ppbv)	Quantifier Mass	Qualifier Mass	Qualifier Mass	ISTD Group	Analyte Group
Dichlorodifluoromethane	75-71-8	0.5	5	85	87		1	B
Chlorodifluoromethane	75-45-6	0.5	5	51	67	69	1	B
1,2-Dichlorotetrafluoroethane	76-14-2	0.2	2	85	135	87	1	A
Chloromethane	74-87-3	0.5	5	50	52		1	B
n-Butane	106-97-8	0.5	5	43	41	58	1	B
Vinyl Chloride	75-01-4	0.035	0.35	62	64		1	D
1,3-Butadiene	106-99-0	0.035	0.35	54			1	D
Bromomethane	74-83-9	0.2	2	94	96		1	A
Chloroethane	75-00-3	0.5	5	64	66		1	B
Isopentane	78-78-4	0.2	2	43	57	56	1	A
Bromoethene (Vinyl Bromide)	593-60-2	0.2	2	106	108	81	1	A
Trichlorofluoromethane	75-69-4	0.2	2	101	103		1	A
Pentane	109-66-0	0.5	5	43	57	56	1	B
EthylEther	60-29-7	0.2	2	59	45	74	1	A
Acrolein	107-02-8	5	50	56	55	37	1	C
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	0.2	2	101	151	103	1	A
1,1-Dichloroethene	75-35-4	0.035	0.35	96	161	63	1	A
Acetone	67-64-1	5	50	43	58		1	C
Isopropyl Alcohol	67-63-0	5	50	45	43		1	C
Carbon Disulfide	75-15-0	0.5	5	76			1	B
3-Chloropropene (Allyl Chloride)	107-05-1	0.5	5	41	76		1	B
Acetonitrile	75-05-8	5	50	41	40	39	1	C
Methylene Chloride	75-09-2	0.5	5	49	84	86	1	B
tert-Butyl Alcohol	75-65-0	5	50	59	41	43	1	C
Methyl tert-Butyl Ether	1634-04-4	0.5	5	73	43		1	B
trans-1,2-Dichloroethene	156-60-5	0.2	2	61	96		1	A
n-Hexane	110-54-3	0.2	2	57	86		1	B
1,1-Dichloroethane	75-34-3	0.035	0.35	63	65	83	1	A
Methyl Ethyl Ketone	78-93-3	0.5	5	72	43		1	B
cis-1,2-Dichloroethene	156-59-2	0.035	0.35	96	98	83	1	A
Tetrahydrofuran	109-99-9	5	50	42	72		2	C
Chloroform	67-66-3	0.2	2	83	85		1	A

1,1,1-Trichloroethane	71-55-6	0.2	2	97	99	61	2	A
Cyclohexane	110-82-7	0.2	2	84	56		2	A
Carbon Tetrachloride	56-23-5	0.035	0.35	117	119		2	D
2,2,4-Trimethylpentane	540-84-1	0.2	2	57	41	43	2	A
1,2-Dichloroethene (total)	540-59-0	0.2	2	61	96		1	A
Benzene	71-43-2	0.2	2	78	77		2	A
1,2-Dichloroethane	107-06-2	0.2	2	62	98		2	A
n-Heptane	142-82-5	0.2	2	43	71		2	A
Trichloroethene	79-01-6	0.035	0.35	95	130	132	2	D
Methyl Methacrylate	80-62-6	0.5	56	69	41	39	2	B
1,2-Dichloropropane	78-87-5	0.2	2	63	41		2	A
1,4-Dioxane	123-91-1	5	50	88	58		2	C
Dibromomethane	74-95-3	0.2	2	174	93	172	2	A
Bromodichloromethane	75-27-4	0.2	2	83	85		2	A
cis-1,3-Dichloropropene	10061-01-5	0.2	2	75	110		2	A
Methyl Isobutyl Ketone	108-10-1	0.5	5	43	58		2	B
n-Octane	111-65-9	0.2	2	43	57	114	2	A
Toluene	108-88-3	0.2	2	92	91		3	A
trans-1,3-Dichloropropene	10061-02-6	0.2	2	75	110		2	A
1,1,2-Trichloroethane	79-00-5	0.2	2	83	97	85	3	A
Tetrachloroethene	127-18-4	0.035	0.35	166	168	129	3	D
Methyl Butyl Ketone	591-78-6	0.5	5	43	58		3	B
Dibromochloromethane	124-48-1	0.2	2	129	127		3	A
1,2-Dibromoethane	106-93-4	0.2	2	107	109		3	A
Nonane	111-84-2	0.2	2	57	71	128	3	A
Chlorobenzene	108-90-7	0.2	2	112	77	114	3	A
Ethylbenzene	100-41-4	0.2	2	91	106		3	A
Xylene (m,p)	1330-20-7	0.5	5	106	91		3	A
Xylene (o)	95-47-6	0.2	2	106	91		3	A
Styrene	100-42-5	0.2	2	104	78		3	A
Bromoform	75-25-2	0.2	2	173	175	171	3	A
Cumene	98-82-8	0.2	2	105	120	77	3	A
1,1,2,2-Tetrachloroethane	79-34-5	0.2	2	83	131	85	3	A
Xylene (total)	1330-20-7	0.2	2	106	91		3	A
n-Decane	124-18-5	0.5	5	57	71	142	3	B
n-Propylbenzene	103-65-1	0.2	2	91	120	92	3	A
1,2,3-Trichoropropane	96-18-4	0.5	5	75	110	112	3	B
4-Ethyltoluene	622-96-8	0.2	2	105	120		3	A
1,3,5-Trimethylbenzene	108-67-8	0.2	2	105	120		3	A
2-Chlorotoluene	95-49-8	0.2	2	91	63		3	A
tert-Butylbenzene	98-06-6	0.2	2	119	91	134	3	A
1,2,4-Trimethylbenzene	95-63-6	0.2	2	105	120		3	A
sec-Butylbenzene	135-98-8	0.2	2	105	134	91	3	A
4-Isopropyltoluene	99-87-6	0.2	2	119	134	91	3	A
1,3-Dichlorobenzene	541-73-1	0.2	2	146	111	148	3	A
1,4-Dichlorobenzene	106-46-7	0.2	2	146	111	148	3	A
n-Undecane	1120-21-4	5	50	57	71	156	3	C
Benzyl Chloride	100-44-7	0.2	2	91	126	65	3	A
n-Butylbenzene	104-51-8	0.2	2	91	134	92	3	A
1,2-Dichlorobenzene	95-50-1	0.2	2	146	111	148	3	A
n-Dodecane	112-40-3	5	50	57	71	170	3	C
1,2,4-Trichlorobenzene	120-82-1	0.5	5	180	182		3	B
1,3-Hexachlorobutadiene	87-68-3	0.2	2	225	223		3	A
Naphthalene	91-20-3	0.5	5	128			3	B
1,2,3-Trichlorobenzene	87-61-6	0.2	2	180	182	145	3	A
Propylene	115-07-1	5	50	41	42	39	1	C

Vinyl Acetate	108-05-4	5	50	43	86		1	C
Ethyl Acetate	141-78-6	5	50	43	74		1	C
Ethanol	64-17-5	5	50	46	45		1	E
Bromochloromethane	74-97-5	NA	NA	128	49	130	1	NA
1,4-Difluorobenzene	540-36-3	NA	NA	114			2	NA
Chlorobenzene-d5	3114-55-4	NA	NA	117			3	NA

16.2) TO-3 Analyte List, Reporting Limit, Internal Standard and Ion Assignments

Analyte	CAS No.	RL (ppbv)	Qualifier Ion	Qualifier Ion	Qualifier Ion	ISTD Group
n-Octane	111-65-9	0.2	43	57	114	2
Toluene	108-88-3	0.2	92	91		3
TVOC as Toluene	NA	11				NA
GRO as Octane	NA	14				NA
Total Hydrocarbons	NA	76 ug/m3				NA
Internal Standards						
Bromochloromethane	74-97-5	NA	128	49	130	1
1,4-Difluorobenzene	540-36-3	NA	114			2
Chlorobenzene-d5	3114-55-4	NA	117			3

16.3) Tune Standard Criteria

Mass	Ion Abundance Criteria
50	8.0 to 40.0 percent of mass 95
75	30.0 to 66.0 percent of mass 95
95	Base Peak, 100 percent relative abundance
96	5.0 to 9.0 percent of mass 95
173	Less than 2.0 percent of mass 174
174	50.0 to 120.0 percent of mass 95
175	4.0 to 9.0 percent of mass 174
176	93.0 to 101.0 percent of mass 174
177	5.0 to 9.0 percent of mass 176

16.4) QC Summary & Recommended Corrective Action (Routine and DoD)

QC Check	Frequency	Acceptance Criteria	Recommended Corrective Action
Tune Standard	Prior to calibration and every 24 hours	See Tune Standard Criteria table	Correct Problem. Reanalyze. No samples may be analyzed without a valid tune.
Initial Calibration	Prior to sample analysis and when CCV fails	RSD for each analyte ≤ 30% with 2 exceptions up to 40% (if allowed). Individual Calibration points: < 30% Error, except < 50% for the lowest calibration point	Correct problem and repeat calibration

RRT	With each calibration	RRT of each target analyte in each calibration standard within ± 0.006 RRT units	Correct Problem. Repeat ICAL
ICV	Once after each ICAL	%R 70-130 for all analytes	Correct Problem. Reanalyze, re-make, re-verify & re-analyze. If that fails, re-make all standards and repeat calibration
CCV	Daily before sample analysis after tune standard	%Difference ≤ 30	Correct Problem. Reanalyze once. If that fails, see Section 10.3.9 for instruction.
LCS	Each batch or every 20 samples, whichever is sooner.	%Recovery 70-130%	Reanalyze LCS, re-prep and reanalyze LCS, and all associated samples if sufficient sample volume is available. If corrective action not successful, initiate nonconformance report and qualify sample results.
LCSD	Each batch or every 20 samples, only if there is no Sample Duplicate, or per client request	Relative Percent Difference (RPD) ≤ 25%	Reanalyze LCSD, re-prep and reanalyze LCS, LCSD and all associated samples if sufficient sample volume is available. If corrective action not successful, initiate nonconformance report and qualify sample results.
Method Blank	Each batch or every 20 samples, whichever is sooner.	< Reporting Limit	Reanalyze along with associated samples, unless detects for same compounds found in blank are greater than 10X the concentration found in the blank.
Internal Standards	All standards, field and QC samples	+/- 40% area response from last acceptable calibration. RT +/- 0.33 min (20 seconds) from last acceptable calibration.	Inspect system for malfunction. Reanalyze samples. Qualify data.
Sample Duplicate	Each batch or every 20 samples, if volume allows	Relative Percent Difference (RPD) ≤ 25%	Consult with PM. Reanalyze or qualify data.

16.5) In-house LCS limits

Analyte	CAS #	In-House Lower Limit (%R)	In-House Upper Limit (%R)	Relative Percent Difference (%)
Dichlorodifluoromethane	75-71-8	61	142	25
Chlorodifluoromethane	75-45-6	60	147	25
1,2-Dichloro-1,1,2,2-tetrafluoroethane	76-14-2	71	141	25
Chloromethane	74-87-3	56	141	25
n-Butane	106-97-8	53	151	25
Vinyl Chloride	75-01-4	61	135	25
1,3-Butadiene	106-99-0	58	139	25
Bromomethane	74-83-9	72	124	25
Chloroethane	75-00-3	68	130	25
Isopentane	78-78-4	56	150	25
Bromoethene (Vinyl Bromide)	593-60-2	75	125	25
Trichlorofluoromethane	75-69-4	70	129	25
Pentane	109-66-0	59	152	25
EthylEther	60-29-7	71	143	25
Acrolein	107-02-8	50*	150*	25
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	70	121	25
1,1-Dichloroethene	75-35-4	68	120	25
Acetone	67-64-1	54	154	25
Isopropyl Alcohol	67-63-0	53	142	25
Carbon Disulfide	75-15-0	71	138	25
3-Chloropropene (Allyl Chloride)	107-05-1	50*	150*	25

Acetonitrile	75-05-8	60	154	25
Methylene Chloride	75-09-2	59	137	25
tert-Butyl Alcohol	75-65-0	66	132	25
Methyl tert-Butyl Ether	1634-04-4	70	127	25
trans-1,2-Dichloroethene	156-60-5	69	137	25
n-Hexane	110-54-3	63	138	25
1,1-Dichloroethane	75-34-3	66	130	25
Methyl Ethyl Ketone	78-93-3	72	124	25
cis-1,2-Dichloroethene	156-59-2	72	121	25
Tetrahydrofuran	109-99-9	60	149	25
Chloroform	67-66-3	73	124	25
1,1,1-Trichloroethane	71-55-6	72	127	25
Cyclohexane	110-82-7	76	124	25
Carbon Tetrachloride	56-23-5	71	133	25
2,2,4-Trimethylpentane	540-84-1	68	131	25
1,2-Dichloroethene (total)	540-59-0	73	126	25
Benzene	71-43-2	73	119	25
1,2-Dichloroethane	107-06-2	68	135	25
n-Heptane	142-82-5	60	142	25
Trichloroethene	79-01-6	73	122	25
Methyl Methacrylate	80-62-6	73	129	25
1,2-Dichloropropane	78-87-5	69	128	25
1,4-Dioxane	123-91-1	66	129	25
Dibromomethane	74-95-3	68	126	25
Bromodichloromethane	75-27-4	75	127	25
cis-1,3-Dichloropropene	10061-01-5	74	125	25
Methyl Isobutyl Ketone	108-10-1	58	144	25
n-Octane	111-65-9	62	144	25
Toluene	108-88-3	75	122	25
trans-1,3-Dichloropropene	10061-02-6	74	128	25
1,1,2-Trichloroethane	79-00-5	75	126	25
Tetrachloroethene	127-18-4	70	125	25
Methyl Butyl Ketone	591-78-6	57	143	25
Dibromochloromethane	124-48-1	73	125	25
1,2-Dibromoethane	106-93-4	78	122	25
Nonane	111-84-2	70	131	25
Chlorobenzene	108-90-7	76	119	25
Ethylbenzene	100-41-4	74	122	25
Xylene (m,p)	1330-20-7	76	121	25
Xylene (o)	95-47-6	73	123	25
Styrene	100-42-5	74	125	25
Bromoform	75-25-2	53	149	25
Cumene	98-82-8	73	123	25
1,1,2,2-Tetrachloroethane	79-34-5	74	126	25
Xylene (total)	1330-20-7	75	122	25
n-Decane	124-18-5	68	134	25
n-Propylbenzene	103-65-1	73	127	25
1,2,3-Trichoropropane	96-18-4	71	125	25
4-Ethyltoluene	622-96-8	75	129	25
1,3,5-Trimethylbenzene	108-67-8	72	126	25
2-Chlorotoluene	95-49-8	74	126	25
tert-Butylbenzene	98-06-6	71	125	25
1,2,4-Trimethylbenzene	95-63-6	71	129	25
sec-Butylbenzene	135-98-8	70	128	25
4-Isopropyltoluene	99-87-6	68	130	25
1,3-Dichlorobenzene	541-73-1	69	131	25
1,4-Dichlorobenzene	106-46-7	67	132	25
n-Undecane	1120-21-4	62	136	25
Benzyl Chloride	100-44-7	60	136	25
n-Butylbenzene	104-51-8	65	137	25

1,2-Dichlorobenzene	95-50-1	68	129	25
n-Dodecane	112-40-3	50*	150*	25
1,2,4-Trichlorobenzene	120-82-1	50*	150*	25
1,3-Hexachlorobutadiene	87-68-3	58	130	25
Naphthalene	91-20-3	50*	150*	25
1,2,3-Trichlorobenzene	87-61-6	50*	150*	25
Propylene	115-07-1	50*	150*	25
Vinyl Acetate	108-05-4	59	149	25
Ethyl Acetate	141-78-6	70	131	25
Ethanol	64-17-5	50*	150*	25

*These are poor performing compounds. Limits for poor performing compounds will be no wider than 50-150%.
**The limits in this table are those in effect as of the published date of this SOP. These limits are based on historical data and are subject to change. Current in-house limits are populated in the LIMS database. Contact a laboratory representative for the most current set of limits. Limit Ref: 2019CCTO15

16.6) Appendix A: Terms and Definitions

Acceptance Criteria: Specified limits placed on characteristics of an item, process or service defined in requirement documents.
Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.
Analyte: The specific chemicals or components for which a sample is analyzed. (EPA Risk Assessment Guide for Superfund, OSHA Glossary).
Batch: Environmental samples that are prepared and/or analyzed together with the same process, using the same lot(s) of reagents. A preparation/digestion batch is composed of one to 20 environmental samples of similar matrix, meeting the above criteria. An analytical batch is composed of prepared environmental samples (extracts, digestates and concentrates), which are analyzed together as a group.
Calibration: a set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material and the corresponding values realized by the standards.
Calibration Curve: the graphical relationship between the known values or a series of calibration standards and their instrument response.
Calibration Standard: A substance or reference used to calibrate an instrument.
Continuing Calibration Verification (CCV): An analytical standard gas mixture containing all target analytes and internal standard compounds that is used to evaluate the performance of the instrument system with respect to a defined set of method criteria.
Corrective Action: the action taken to eliminate the cause of an existing nonconformity, defect or other undesirable occurrence in order to prevent recurrence.
Cryogen: A refrigerant used to obtain very low temperatures in the cryogenic trap of the analytical system. A typical cryogen is liquid nitrogen (bp -195.8°C) or liquid argon (bp -185.7°C).
Demonstration of Capability (DOC): procedure to establish the ability to generate acceptable accuracy and precision.
Holding Time: the maximum time that a sample may be held before preparation and/or analysis as promulgated by regulation or as specified in a test method.
Initial Calibration: Analysis of analytical standards for a series of different specified concentrations used to define the quantitative response, linearity and dynamic range of the instrument to target analytes.
Initial Calibration Verification (ICV): An analytical standard mixture containing all target analytes and internal standard compounds that are prepared from a source independent of the source of the initial calibration standards. The purpose of the ICV is to verify that the initial calibration is in control.
Intermediate Standard: a solution made from one or more stock standards at a concentration between the stock and working standard. Intermediate standards may be certified stock standard solutions purchased from a vendor and are also known as secondary standards.
Internal Standards (IS): Non-target analytes that are similar to the target analytes but are not expected to be found in environmental media (generally, isotopically labeled target analytes are used for this purpose). IS are added to every standard, quality control sample, and field sample at a known concentration prior to analysis. IS responses are used as the basis for quantitation of target analytes.
Laboratory Control Sample (LCS): A QC sample of known composition spiked with analytes of interest. The LCS evaluates method performance and ability to successfully recover target analytes from a clean matrix. LCS recovery is typically expressed as percent recovery and provides a measure of accuracy. A LCSD is a duplicate LCS prepared and analyzed from a separate canister to provide a measure of replicate precision.
Method Blank (MB): A canister of humidified ultra pure zero air that is treated exactly as a sample. The MBLK is used to determine if method analytes or other interferences are present in the laboratory environment, the reagents, or the apparatus.
Method Detection Limit (MDL): the minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific measurement system. The MDL is a statistical estimation at a specified confidence interval of the concentration at which relative uncertainty is ±100%. The MDL represents a range where qualitative detection occurs. Quantitative results are not produced in this range.
Non-conformance: an indication, judgment, or state of not having met the requirements of the relevant specification, contract or regulation.

Precision: the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves.
Quality Control Sample (QC): a sample used to assess the performance of all or a portion of the measurement system.
Reporting Limit (RL): the level to which data is reported for a specific test method and/or sample.
Stock Gas Mixture: A Commercially purchased concentrated gas mixture containing one or more method analytes

16.7) Appendix B: Standard Preparation Tables

The standard formulations contained in this appendix are recommended and are subject to change. If the concentration or volume of any of the stock standard changes, the standard preparation instructions must be adjusted accordingly. See laboratory *SOP52272 Traceability, Handling, and Storage of Standards and Reagents* for further guidance on the preparation of standard solutions.

Prepare all standards using the McMillan Company 80SD mass flow controller. Prepare the standard in zero air, demonstrated to be analyte free. Store the standard at ambient temperature. Unless otherwise specified, assign an expiration date of 30 days from date of preparation unless the parent standard expires earlier, in which case, use the earliest expiration date.

Intermediate Calibration Standard

Parent Standard	Vendor	Stock Standard Concentration (ppmv)	Volume Added (mL)	Final Volume (L)	Final Concentration (ppbv)
Custom Calibration Stock Standard	Spectra Gases Custom Made	1.0	7500	37.5	200

Prepare in 15 L Summa Canister. Expiration Period 3months
This standard contains all the target analytes listed in the Routine Compound Table.

Working Calibration Standards

Parent Standard	Calibration Standard	Parent Standard Concentration (ppbv)	Volume Added (mL)	Final Volume (L)	Final Concentration (ppbv)
Cal Standard 20 ppbv	Cal Standard 0.2 ppbv	20	155	15.46	0.2
Cal Standard 20 ppbv	Cal Standard 0.5 ppbv	20	386	15.46	0.5
Intermediate Calibration Standard	Cal Standard 5 ppbv	200	386	15.46	5
Intermediate Calibration Standard	Cal Standard 10 ppbv	200	773	15.46	10
Intermediate Calibration Standard	Cal Standard 15 ppbv	200	1160	15.46	15
Intermediate Calibration Standard	Cal Standard 20 ppbv	200	1546	15.46	20
Intermediate Calibration Standard	Cal Standard 40 ppbv	200	3092	15.46	40

Prepare in 6 L Summa Canister Expiration Period 3 months
Each calibration standard contains all the analytes listed in the Routine Compound Table at the above concentrations.

Intermediate ICV/LCS Standard

Parent Standard	Vendor	Stock Standard Concentration (ppmv)	Volume Added (mL)	Final Volume (L)	Final Concentration (ppbv)
ICV Stock Standard	Spectra Gases Custom Made	1.0	7500	37.5	200

Prepare in 15L Summa Canister Expiration period 3 months
This standard contains all target analytes listed in Routine Compound Table.

Working ICV/LCS Standard

Parent Standard	Calibration Standard	Stock Standard Concentration (ppbv)	Volume Added (mL)	Final Volume (L)	Final Concentration (ppbv)
Intermediate ICV/LCS Standard	ICV Standard 10 ppbv	200	773	15.46	10

Prepare in 6L Summa Canister Expiration period 3 months
This standard contains all target analytes listed in Routine Compound Table.

Calibration Level	Working Calibration Standard	Volume Analyzed (mL)	Concentration on Column (ppbv)
Calibration Level 1	Cal Standard 0.2 ppbv	40	0.04
Calibration Level 2	Cal Standard 0.2 ppbv	200	0.2

Calibration Level 3	Cal Standard 0.5 ppbv	200	0.5
Calibration Level 4	Cal Standard 5 ppbv	200	5
Calibration Level 5	Cal Standard 10 ppbv	200	10
Calibration Level 6	Cal Standard 15 ppbv	200	15
Calibration Level 7	Cal Standard 20 ppbv	200	20
Calibration Level 8	Cal Standard 40 ppbv	200	40
ICV	Intermediate ICV 10ppb	200	10

Prepare in 6L Summa Canister

Intermediate Ethanol Calibration Standard at 500ppbv/v

1. Fill a 44 ml VOA vial with VOA free water. Remove 197ul of water from the vial.
2. Add 197 ul of >99.5% Ethanol neat material
3. Cap and shake/roll vial for 1 minute
4. Inject 10ul of the prepared water/ethanol mix into a fully evacuated 15 liter summa canister
5. Pump the syringe plunger 5 times to insure complete transfer of material
6. Immediately fill the canister to 22 psig with zero air.

Calibration Level	Working Calibration Standard	Volume added (mL)	Concentration on Column (ppbv)
Calibration Level 1	Cal Standard 0.5 ppbv	124	5
Calibration Level 2	Cal Standard 5.0 ppbv	309	10
Calibration Level 3	Cal Standard 10ppbv	464	15
Calibration Level 4	Cal Standard 15 ppbv	618	20
Calibration Level 5	Cal Standard 20 ppbv	1237	40
Calibration Level 6	Cal Standard 40 ppbv	3092	100

DC-SOP49966 Management, Retention, Storage and Archive of Data Records
EHS-SOP47863 Tracking and Collecting of Hazardous Waste
EHS-SOP48269 Procedure for Acceptance and Handling of USDA Regulated Domestic and Foreign Soil
EHS-SOP49961 Burlington Laboratory Corporate Safety Manual Addendum and Contingency Plan
EQ-SOP48255 Canister Cleaning, Certification and Sampling Kit Preparation
EQ-SOP52272 Traceability, Handling, & Storage of Standards & Reagents
ML-SOP49965 Procedures for Control Charts, Trend Analysis and In-House Limits
NC-SOP49967 Nonconformance and Corrective Action Procedures
QA-QM52862 Quality Assurance Manual
SM-SOP49959 Sample Management
TR-SOP52264 Employee Training and Analyst Demonstration of Competence
NDSC-ETHC-SOP43862 Manual Integrations
NDSC-US-EHS-QP46060 NDSC HSE Manual

End of document

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14	03.FEB.2022		
15	21.APR.2023	Conversion to HTML format and full review	
16	29.JAN.2024	SOP Review & Update. Due to database migration, some review by analysts and approval by supervisors are documented outside of D4 in QA SOP directory.	

Title: Analysis of Total and Amenable Cyanide in Water, Drinking water, Wastewater and Soil- Automated by Method EPA SW846 9012B; 335.4 and Standard Method 4500 CN^-C, G

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Approvals (Signature/Date):

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1.0 Scope and Application

1.1 Analytes, Matrix(s), and Reporting Limits

1.1.1 Methods EPA 335.4, SW846 9012B, Lachat 10-204-00-1-A and SM 4500 CN^-C, G are described in this SOP. The SOP is applicable to water, drinking water, wastewater, soil and waste samples requiring cyanide determination. The method detects inorganic cyanides that are present as either soluble salts or complexes. It is used to determine values for both total cyanide, free cyanide and cyanide amenable to chlorination.

1.1.2 The automated method has a detector that is sensitive to approximately to 0.005 mg CN-/L. The laboratory's reporting limit are as follows:

Analyte	Water Reporting Limit (mg/L)	Soil Reporting Limit (mg/Kg) Micro Distillation
Cyanide	**0.01**	**0.24**

1.1.3 On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in Sections 7 (Review of Work Request) and 19 (Test Methods and Method Validation) of TestAmerica Edison's Quality Assurance Manual (ED-QA-LQM).

2.0 Summary of Method

Cyanide is extracted by means of reflux distillation (MICRO DIST apparatus). Sample is distilled in a strongly acidic solution which breaks down cyanide complexes and converts the cyanide to hydrocyanic acid (HCN). HCN is absorbed into a sodium hydroxide absorber solution and the cyanide ion in the absorbing solution is determined by automated UV colorimetry at 570nm.

3.0 Definitions

For a complete list of definitions refer to Appendix 5 in the most current revision of TestAmerica Edison's Quality Assurance Manual (ED-QA-LQM).

4.0 Interferences

4.1 Interferences can be reduced or eliminated by using the distillation procedure.

4.2 The presence of sulfide in the sample matrix adversely effects the determination of total cyanide. Samples that contain hydrogen sulfide, metals sulfides or other compounds that may produce hydrogen sulfide during distillation should be treated.

4.2.1 Place a drop of the sample on lead acetate test paper (which has been pre-moistened with pH 4 acetate buffer solution) to detect the presence of sulfides. If sulfides are present (test strip turns black), the sample volume

required for the cyanide determination should be increased by 25 milliliters (ml).

4.2.2 The total volume of sample should be treated with powdered cadmium carbonate or lead carbonate. Yellow cadmium sulfide precipitates if the sample contains sulfide.

4.2.3 Repeat this operation until a drop of the treated sample solution does not darken the lead acetate test paper

4.2.4 Filter the solution through a dry filter paper into a dry beaker, and from the filtrate measure the sample to be used for analysis.

NOTE: Avoid a large excess of cadmium carbonate and a long contact time in order to minimize a loss of cyanide on the precipitated material.

4.3 Oxidizing agents such as chlorine decompose most cyanides.

4.3.1 To determine if oxidizing agents are present test a drop of sample with potassium iodine-starch paper. If a blue color appears that indicates the need for treatment. Add ascorbic acid, a few crystals at a time, to the sample until a drop of sample produces no blue color on the indicator paper. Add an additional 0.6g of ascorbic acid for each liter of sample volume.

4.4 Nitrates and nitrites may give high biased results. During distillation they form nitrous acid, which will react with some organic compounds to form oximes. These compounds once formed will decompose to generate HCN. They are interferences when present above 10 mg/L with other specific organic compounds.

4.4.1 Nitrate and nitrite interferences are eliminated by treatment with sulfamic acid just before distillation.

4.5 Thiocyanate is reported to be an interference when present at very high levels. Levels of 10 mg/L were not found to interfere.

4.6 Fatty acids, detergents, surfactants may cause foaming during the distillation process, making the endpoint difficult to detect. If this occurs, samples can be acidified with acetic acid (1.6M) to pH 6.0-7.0.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001) and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1. Specific Safety Concerns or Requirements

Ensure cooling water is turned on to the distillation unit. Otherwise the samples may boil over and come into contact with the heating plates. Potassium Cyanide will give off Hydrogen Cyanide (HCN) gas if combined with strong acids. Inhalation of CN gas can cause irritation, dizziness, nausea, unconsciousness and potentially death.

5.2. Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Phosphoric Acid	Corrosive	1 Mg/M3 TWA	Inhalation is not an expected hazard unless misted or heated to high temperatures. May cause redness, pain, and severe skin burns. May cause redness, pain, blurred vision, eye burns, and permanent eye damage.
Sodium Hydroxide	Corrosive	2 Mg/M3-Ceiling	Severe irritant. Effects from inhalation of dust or mist vary from mild irritation to serious damage of the upper respiratory tract, depending on severity of exposure. Symptoms may include sneezing, sore throat or runny nose. Contact with skin can cause irritation or severe burns and scarring with greater exposures. Causes irritation of eyes, and with greater exposures it can cause burns that may result in permanent impairment of vision, even blindness.
Pyridine	Flammable Irritant	5 ppm-TWA	Inhalation causes severe irritation to the respiratory tract. Symptoms of overexposure include headache, dizziness, nausea, and shortness of breath. Causes severe irritation possibly burns, to the skin. Symptoms include redness and severe pain. Absorption through the skin may occur, resulting in toxic effects similar to inhalation. May act as a photosensitizer. Vapors cause eye irritation. Splashes cause severe irritation, possible corneal burns and eye damage.
Barbituric Acid	Irritant	Not established	Limited information. Inhalation may irritate respiratory tract. Causes skin and eye irritation. Should be treated as potential health hazard; do not ingest.
Hydrochloric Acid	Corrosive Poison	5 ppm – Ceiling	Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death. Can cause redness, pain, and severe skin burns. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Potassium Hydroxide	Poison Corrosive Reactive	2 mg/m3 – Ceiling	Inhalation symptoms may include coughing, sneezing, damage to the nasal or respiratory tract. High concentrations can cause lung damage. Swallowing may cause severe burns of mouth, throat and stomach. Other symptoms may include vomiting, diarrhea. Severe scarring of tissue and death may result. Contact with skin can cause irritation or severe burns and scarring. Causes irritation of eyes with tearing, redness, swelling. Greater exposures cause severe burns with possible blindness.
Potassium Cyanide	Poison Corrosive	5 Mg/M3 TWA as CN	This material will form Hydrogen Cyanide (HCN) gas when combined with strong acids. Breathing HCN gas may result in death. Corrosive to the respiratory tract. May cause headache, weakness, dizziness, labored breathing nausea and vomiting, which can be followed by weak and irregular heartbeat, unconsciousness, convulsions, coma and death. Solutions are corrosive to the skin and eyes, and may cause deep ulcers, which heal slowly. May be absorbed through the skin, with symptoms similar to those noted for inhalation. Symptoms may include redness, pain, blurred vision, and eye damage.
Sodium Cyanide	Poison Corrosive	5 mg/m3 TWA as CN (skin)	This material will form Hydrogen Cyanide (HCN) gas when combined with strong acids. Breathing HCN gas may result in death. Corrosive to the respiratory tract. May cause headache, weakness, dizziness, labored breathing nausea and vomiting, which can be followed by weak and irregular heartbeat, unconsciousness, convulsions, coma and death. Solutions are corrosive to the skin and eyes, and may cause deep ulcers, which heal slowly. May be absorbed through the skin, with symptoms similar to those noted for inhalation. Symptoms may include redness, pain, blurred vision, and eye damage.
Silver Nitrate	Poison Corrosive Oxidizer	0.01mg/m3 (TWA) for silver metal dust and fume as Ag	Inhalation symptoms may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting. May be absorbed into the body following inhalation. Swallowing can cause severe burns of the mouth, throat and stomach. Can cause sore throat, vomiting, and diarrhea. Poison. Symptoms include pain and burning in the mouth, blackening of the skin and mucous membranes, throat, and abdomen, salivation, vomiting of black material, diarrhea, collapse, shock, coma and death. Skin contact can cause redness, pain and severe burns. Eye contact can cause blurred vision, redness, pain, severe tissue burns and eye damage.
1 – Always add acid to water to prevent violent reactions.			
2 – Exposure limit refers to the OSHA regulatory exposure limit.			

6.0 Equipment and Supplies

6.1. Instrumentation

- MICRO DIST distillation apparatus with sample distillation tube press (Hach).

- Lachat 8000 and 8500 series: Flow injection analysis equipment-designed to deliver and react sample and reagents in the required order and ratios. Lachat 8000 series

  - Multichannel proportioning pump
  - Reaction manifold
  - Colorimetric detector
  - Data system
  - Heating Unit

6.2. Supplies

- Lachat Micro Distillation Tubing, p/n A17117 (collector tubes, caps, membranes, and sample tubes) or equivalent, disposable
- Various Class A volumetric flask and pipettors
- pH-indicator strips (pH 0-14)
- Potassium Iodine-starch paper
- Lead-Acetate paper (pre-moistened with pH 4 acetate buffer solution)
- Analytical balance
- Vacuum pump
- Specimen cups
- Transfer pipettes
- Graduated cylinder (class A)
- Micro-buret

7. Reagents and Standards

7.1. Reagents

7.1.1. Deionized water-18 megohm reagent grade Type II water.

7.1.2. Acetone – store at room temperature; for stability information refer to manufacturer's instructions.

7.1.3. Rhodanine indicator - p-dimethyl-aminobenzalrhodanine: Place 20 mg of p-dimethyl-aminobenzalrhodanine in a 100ml volumetric flask and dilute to the

mark with acetone. Store at room temperature. Stable for six months.

7.1.4. Acetate Buffer - Dissolve 82.0 gram of $NaC_2H_3O_2$ x $3H_2O$ in 100ml DI water. Add sufficient glacial acetic acid and adjust pH to 4.5 (approx. 10 drops). This solution is stable for 6 months, store at 4ºC.

7.1.5. Cadmium Carbonate (powder) ACS reagent –store at room temperature; discard after 5 years from date receipt or earlier if necessary.

7.1.6. Reagents for cyanides amenable to chlorination.

7.1.6.1. Calcium hypochlorite solution, (0.35M), $Ca(OCl)_2$. Dissolve 5 g of calcium hypochlorite in 100 ml of deionized water. Prepare the solution fresh daily, store at room temperature. Solution is stable for 1 month, Note: store in an amber bottle if not used immediately.

7.1.6.2. 0.25 N NaOH. Dissolve 10.0 g NaOH into 1 L of deionized water. Dilute to mark with deionized water and invert to mix. Solution is stable for 6 months, store at room temperature.

7.1.6.3. Sodium Arsenite, NaAsO2. Dissolve 2g of Sodium Arsenite in 100ml of DI water. Prepare solution every month; store at room temperature.

7.1.7. Reagents for cyanide distillation.

7.1.7.1. 0.25 M NaOH. See section 7.1.6.2

7.1.7.2. Sulfamic Acid Solution: Dissolve 9.6 g. H_2NSO_3H into 100ml of deionized water. Solution is stable for 6 months, store at room temperature.

7.1.7.3. Micro Distillation Releasing Agent (7.11 M sulfuric acid/ 0.79M magnesium chloride): In a hood, place a 500ml beaker on a top-loading balance and tare. Then add 110.8g DI water. Then add and dissolve completely 32.2g magnesium chloride hexahydrate ($MgCl_2$ x $6H_2O$) in this water. Slowly add 139g concentrated sulfuric acid a little at a time, swirling and allowing to cool. Solution is stable for 6 months, store at room temperature.

7.1.7.4. Bismuth nitrate Solution: Dissolve 3 g of $Bi(NO)_3$•$5H_2O$ in 10 mls DEIONIZED WATER , add 25 mls glacial acetic acid while stirring and dilute to a 100 ml final volume.

7.1.8. Reagents for automated colorimetric determination.

7.1.8.1. Pyridine-Barbituric acid Reagent: In a fume hood, place 15.0 g barbituric acid in a 1 L beaker and add 100 ml DEIONIZED WATER, rinsing down the sides of the beaker to wet the barbituric. Add 75 ml pyridine (C_5H_5N) while stirring and mix until

barbituric acid dissolves. Add 15 ml conc. HCl (12 M HCl) and mix. Transfer to a 1 L volumetric flask, dilute to mark and invert to mix. Prepare weekly, store solution in amber bottle and at room temperature.

7.1.8.2. Chloramine-T: Dissolve 2.0g chloramine-T hydrate in 500 ml deionized water. Prepare fresh daily. Store at room temperature.

7.1.8.3. Phosphate buffer: In a 1 L volumetric flask, dissolve 97.0 g potassium phosphate, monobasic, anhydrous, (KH_2PO_4) in approximately 800 ml of DEIONIZED WATER. Dilute to mark and invert to mix. Solution is stable for one month. Store at room temperature.

7.1.8.4. 0.25 M NaOH (carrier) See section 7.1.6.2.

7.2. Standards

7.2.1. Standard 0.0192N Silver nitrate solution (1 ml = 1 mg CN): Prepared by weighing 3.2647 g of dried $AgNO_3$, dissolved in deionized water and dilute to 1000ml. Solution is stable for 6 months or when QC check is outside the acceptable limits, whichever comes first, store at 4ºC.

7.2.2. Primary (Simple) Cyanide stock solution, 1000 mg/L: This standard is used for the preparation of calibration standards (Sec 10.2). Purchased commercially from Accustandard (catalog number WC-CN-10X-5). Follow manufacturer's instructions for storage and stability. Standardize the solution against 0.0192N silver nitrate solution quarterly.

If prepared in house, prepare as follows: Primary Cyanide stock solution, 1000 mg/L: Dissolve 2.51 gm of KCN and 2.0 gm of KOH in 900 ml of deionized water. Standardize the solution against 0.0192N silver nitrate solution weekly and dilute to the appropriate concentration so that 1ml=1mg CN. Solution is stable for 6 months, store at 4ºC. Standardize the solution as follows::

- Take 5.0 ml of the primary stock cyanide solution (Sec. 7.2.2) and dilute it to 50ml using the 0.25 M NaOH. Add 10-12 drops of the rhodanine indicator (Sec. 7.1.3) to produce a bright yellow color.
- Using the 10 ml micro buret, titrate the stock cyanide solution from a bright yellow color to a salmon hue endpoint. Record the volume of silver nitrate solution used for the titration in the Standardization logbook.
- Titrate a blank using 50mls of 0.25N NaOH, 10-12 drops of rhodanine indicator. Record the volume of silver nitrate solution used for the titration in the Standardization logbook.
- Calculate CN concentration as follows:

Based on the following: $Ag^{+} + 2\ CN \rightarrow [Ag(CN)_2]^{-}$

$$CN^{-}(mg/L) = \frac{A-B}{C} \times N \times \frac{2\ mol\ CN}{1\ eq\ AgNO_3} \times \frac{26.02g\ CN}{1\ mol\ CN} \times \frac{1000mg}{1\ g}$$

Where:
A= ml $AgNO_3$ for titration of sample
B=ml $AgNO_3$ for titration of blank
C= ml or g of sample
N= normality of $AgNO_3$

- Record the preparation in the reagent TALS. Record final concentration in the Standardization logbook.

- **Note***:/standardizedconcentration* .

7.2.3. Secondary (Simple) Cyanide Stock Solution, 1000mg/L: The secondary cyanide stock solution must come from a source different from the primary cyanide stock solution (ERA, cat# 997 or Accustandard, cat# WC-CN-10X-5). Follow manufacturer's instructions for storage and stability. Standardize the solution against 0.0192N silver nitrate solution quarterly. This standard is used for the preparation of ICV and CCV standards (Sec 9.2.1 and 9.2.2).

If prepared in house, prepare as follows: Dissolve 2.51 gm of KCN and 2.0 gm of KOH in 900 ml of deionized water. Note: the secondary cyanide stock solution must be prepared from a different source than the primary cyanide stock solution. Standardize the solution with 0.0192N silver nitrate solution weekly and dilute to the appropriate concentration so that 1ml=1mg CN. The solution is stable for 6 months, store at 4ºC. Follow the standardization procedure in 7.2.2.

Note: */standardizedconcentration* .

7.2.4. Primary Working Solution, 6 mg/L: Take 0.6 mL of the Primary Cyanide Stock Solution (Sec. 7.2.2) and dilute to a final volume of 100ml with 0.25N NaOH. Prepare fresh daily.

7.2.5. Secondary Working Solution, 6 mg/L: Take 0.6 mL of the Secondary Cyanide Stock Solution (Sec. 7.2.3) and dilute to a final volume of 100ml with 0.25N NaOH. Prepare fresh daily.

7.2.5.1. Secondary Working Solution for Easy-Dist: 10mg/L: Take 1.0 mL of the Secondary Cyanide Stock Solution (Sec. 7.2.3) and dilute to a final volume of 100ml with 0.25N NaOH. Prepare fresh daily.

7.2.6. Complex Cyanide stock solution (Potassium Ferrocyanide Trihydrate in 0.5 NAOH), 1000 mg/L: Purchased commercially from ERA (catalog number 998). Follow manufacturer's instructions for storage and stability. This

standard is used for the preparation of QC samples which are distilled prior to analysis (LCS and MS/MSD).

7.2.7. Complex Cyanide Working solution, 6 mg/L: Take 0.6 mL of the Complex Cyanide stock solution (Sec 7.2.6) and dilute to a final volume of 100 ml with 0.25N NaOH. Prepare fresh daily.

7.2.7.1. Complex Cyanide Working solution for Easy-Dist, 10 mg/L: Take 1.0 mL of the Complex Cyanide stock solution (Sec 7.2.6) and dilute to a final volume of 100 ml with 0.25N NaOH. Prepare fresh daily.

7.2.8. Soil Standard Reference Materia (LCSSRM): Purchased commercially from ERA or Phenova. Follow manufacturer's instructions for storage and stability. This standard is used for the preparation of QC samples which are distilled prior to analysis.

8. Sample Collection, Preservation, Shipment and Storage

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client requests. Listed below are the holding times and the references that include preservation requirements.

Matrix	Sample Container	Min. Sample Size	Preservation	Holding Time [1]	Reference
Waters	Glass or plastic	200 ml	NaOH, pH > 12; Cool 4 ± 2°C	14 Days	Method 335.4; SW846 Method 9012B
Soils	Glass	5.0 grams	Cool 4 ± 2°C	14 Days	Method 335.4; SW846 Method 9012B

[1] Inclusive of digestion and analysis.

9. Quality Control

9.1. Sample QC: Waters and soils, are separated into different QC batches.

9.1.1. Method Blank (MB): 0.25N NaOH is used for the blank and is carried through the entire sample preparation and analytical process. Add 6ml of 0.25 N NaOH to a disposable distillation sample tube. Results must be less than the reporting limit, or the batch must be redistilled and reanalyzed. One method blank must be analyzed with each set up of samples or every 20 samples, whichever is more frequent.

9.1.2. Laboratory Control Sample (LCS) 0.10 mg/L: A LCS (aqueous batches) or LCSSRM (soil batches) must be analyzed with each distillation batch or every

20 samples, whichever is more frequent. Prepare the solution fresh daily by adding 0.1 mL of the 6 mg/L Complex CN working solution (Sec. 7.2.7) and 5mL of 0.25 NaOH. The results must be within the control limits; if not, the batch must be redistilled and reanalyzed. Control limits: for 9012B ±15% of the true value; for 335.4 ±10% of the true value; and for SM4500CN ±10% of the true value.

- *Soil - Laboratory Control Sample Standard Reference Material (LCSSRM),* weigh out 0.25g of the standard reference material, add 5.0 ml DI water to the disposable distillation tube. The results must be within vendor specified QC limits or the batch must be redistilled and reanalyzed.

9.1.3. Matrix Spike/Matrix Spike Duplicate (MS/MSD) One MS/MSD pair must be analyzed for every 10 samples.

- Aqueous samples (drinking water and wastewater): **MICRO DIST, 0.2 mg/L:** two portions of the same sample (matrix spike and matrix spike duplicate), each 6 ml, are added to separate disposable distillation tubes then add 0.2 mL of the 6 mg/L Complex CN primary working solution (Sec 7.2.7) into each sample. The results must be within 90-110 %..

- Soil samples: **MICRO DIST, 4.8 mg/Kg:** add 0.25g of the sample to two separate disposable distillation tubes (matrix spike and matrix spike duplicate) and add 5.0 ml of deionized water. Spike these samples with 0.2 mL of the 6 mg/L Complex CN primary working solution (Sec. 7.2.7). The results must be within laboratory generated limits.

- Amenable to chlorination: MS/MSD – For aqueous samples, measure 6 ml of sample for both the MS and MSD and add to a 40ml glass vial. Add 0.2 ml of the 6mg/L Complex CN primary working solution (Sec 7.2.7) into each sample; the spiking concentration is 0.20mg/L. For soils samples, weigh out 0.25g of sample and add 5.0ml of water then follow spiking procedure for aqueous samples. The spike must be added before the chlorination step begins. The form of cyanide used for spiking is completely amenable to decomposition with chlorine and therefore, the recovery of the spikes is expected to be 0%. If cyanide remains following the chlorination step, it is evident that the chlorination was not complete.

9.2. Instrument QC

9.2.1. Initial Calibration Verification (ICV), 0.20 ppm: The ICV must be analyzed immediately after an acceptable calibration and before any samples are analyzed. The ICV will be prepared from the secondary Simple CN source (Sec 7.2.3). See Sec 10.2.3.3 for the ICV preparation instructions by Micro Dist. The determined concentration must be within the ICV control limits; if not the analysis should be terminated until the source of the problem is identified and corrected. ICV control limits for 9012B is ±15% of the true

value; for 335.4 ±10% of the true value and for SM4500CN ±15% of the true value.

9.2.2. Continuing Calibration Verification (CCV), 0.20 ppm: A CCV is analyzed after every 10 samples and at the end of the sample run. The CCV will be prepared from the same source as the ICAL. CCV control limits for 9012B is ±15% of the true value; for 335.4 ±10% of the true value and for SM4500CN ±10% of the true value. If the result exceeds the limit, the analysis should be terminated until the source of the problem is identified and corrected and all samples following the last acceptable CCV must be reanalyzed.

9.2.3. Initial Calibration Blank (ICB): An ICB is analyzed immediately after the ICV to verify calibration and acceptable instrument performance. The results must be less than the reporting limit. Use 0.25N NaOH for the ICB.

9.2.4. Continuing Calibration Blank (CCB): A CCB must be analyzed after every 10 samples and at the end of the sample run. The results must be less than the reporting limit. If the CCB result exceeds the reporting limit, all samples following the last acceptable CCB must be reanalyzed. Use 0.25N NaOH for the CCB.

9.2.5. Minimum Reporting Level (MRL), 0.01 mg/L: The MRL is required for 335.4 Drinking water samples only. The MRL must be analyzed immediately after the ICV/ICB pair and before any samples are analyzed. The MRL is prepared in the same manner as the low level standard. Add 5ml of 0.25N NaOH solution to the sample tube, then add 0.01ml of 6ppm Primary Standard (Sec. 7.2.4). Follow procedure for sample prep in Sec. 10.1.3. The recovery for the MRL should be within 50-150% of the true value. If not, re-analyze the entire batch (see exception note below). If the MRL is biased high, non-detect (ND) samples can be reported with flags and add NCM in report.

Note: For Method 335.4, if MRL fails and samples are not drinking water samples, place an 'x' in front of the MRL when data is uploaded into TALS; the MRL will not be reported with the non-drinking water samples.

10. Procedure

10.1. Sample Preparation

10.1.1. Each sample matrix must be spot tested for the presence of interfering ions.

10.1.1.1. Check that pH of each sample is >12 using the pH indicator strip.

10.1.1.2. Check for the presence of chlorine using KI-Starch paper. See section 4.3.1.

10.1.1.3. Check for the presence of sulfide using lead acetate paper (pre-moistened with pH4 acetate buffer solution). See section 4.2.1. – 4.2.4. Method 9012B: If positive add bismuth nitrate to the sample. At the same time add bismuth nitrate to all standards before distillation, see Section 10.2.3.

10.1.2. Procedure for the pretreatment of cyanides amenable to chlorination. **Note**: If total cyanide is detected, the laboratory would need to analyze both the cyanide amenable to chlorination sample and to re-perform (repeat) the total cyanide sample that was originally analyzed through the entire procedure.

10.1.2.1. Divide the sample into two equal aliquots of 6 ml sample and chlorinate one for the determination of cyanide amenable to chlorination. For aqueous samples, measure the 6 ml of sample and add into a 40 ml glass vial. For soils samples, weigh out 0.25g of sample and add 5ml of water. Add calcium hypochlorite solution (Section 7.1.6.1) drop-wise while agitating the mixture using a magnetic stir plate and maintaining the pH at between 11 and 12 with sodium hydroxide solution (Section 7.1.6.2). Cover the vials with aluminum foil to protect the samples from the light.

Note: A MS/MSD must be performed for samples requiring cyanide amenable to chlorination as a negative quality control; see Sec 9.1.3.

CAUTION: Toxic cyanogen chloride is the initial reaction product during an alkaline chlorination. This reaction should take place in a fume hood.

10.1.2.2. Excess residual chlorine must be maintained in the solution for 1 hour while agitating. Monitor pH with pH test paper and chlorine with KI-starch paper. A distinct blue color on the paper indicates sufficient chlorine in solution. If necessary add more calcium hypochlorite and/or NaOH.

10.1.2.3. Following one hour, remove any residual chlorine by dropwise addition of NaAsO2 solution (Sec. 7.1.6.3). Test with KI starch paper to ensure that there is no residual chlorine present as a reducing agent..

10.1.2.4. Test for total cyanide in both the chlorinated and unchlorinated aliquot of the sample. Cyanide amenable to chlorination is determined by the difference between the total cyanide result of the un-chlorinated aliquot and the chlorinated aliquot.

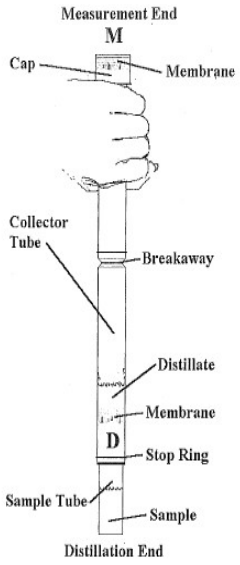
10.1.3. <u>MICRO DIST Distillation Procedure</u>

10.1.3.1. Set the controller to 120 deg C. Allow the block to warm up which takes approximately 40 minutes.

10.1.3.2. With the 'M' end or 'measuring end' up, place the collector tubes for the samples into the tube rack. Add 2 mL of 0.25N NaOH solution and add a membrane and cap. Label the top of the tube with the sample ID. Up to 21 samples tubes can fit on one block.

10.1.3.3. Pipet 6.0ml of aqueous sample into each sample tube or weigh out 0.25 to 0.30 grams of sample plus 5.0 ml of DI water for soil samples. Add 0.25ml of the sulfamic acid solution and 0.75ml of the releasing agent to all tubes. Label the tube with the sample ID.

***NOTE**: Homogenize soil samples properly prior to taking an aliquot for analysis.



10.1.3.4. Immediately push the 'D' end or 'distillation or discarded' end of the collector tube over the open end of each sample tube to start the seal.

10.1.3.5. Place the assembly into the press, putting the sample tube through the hole in the white base. Before pressing, the user should hold the collector tube firmly at the breakaway point to ensure the tube does not shift during the pressing procedure.

10.1.3.6. Press down on the press handle until the stop ring on the sample tube hits the 'D' end of the collector tube.

10.1.3.7. Put on heat resistant gloves and push the sample tube and 'D' end of each tube into the preheated block so that the collector tube stop ring touches the block.

10.1.3.8. Set timer for 30 minutes. Do not pull the tubes out before the 30 minutes to check them. This will cause the sample to suck-back.

10.1.3.9. After the 30 minutes have passed, put on heat resistant gloves. Remove the first tube from the block and immediately pull off its sample tube using a downward, twisting motion. Important: Remove the sample tube within 4 seconds of removing it from the block or suck-back of the sample will occur, which may cause low recoveries. Dispose of the sample tube and remaining hot solution by dropping it into the sink or waste bucket.

Note: Do not pull out all the samples at once. Each sample needs to be separated immediately upon removal from the block.

10.1.3.10. Place the tubes in the collector tube rack with the 'M' end up. Parafilm the 'D' end of the tube and allow the tubes to cool for at least 10 minutes.

10.1.3.11. For each collector tube, hold the tube horizontally and rinse the walls with the distillate in order to homogenize it. Slowly roll the distillate around the tube to gather any droplets clinging to the walls. Then slowly return the collector tube to an upright position with the 'D' end up.

10.1.3.12. With the 'D' end up, break the collector tube in half by pulling the 'D' end hard towards the user to break it and twisting and tearing off the 'D' end. Rinse the 'D' end with a small volume of DI water and pour into the 'M' end. The 'D' end can be discarded.

10.1.3.13. Do not invert the sample. With the 'M' end down, place the tube in the collector tube rack. Dilute to the mark with deionized water. Seal the open end with parafilm if the sample is not going to be analyzed immediately.

10.1.3.14. The solution is now ready for semi-automated colorimetry.

10.1.4. <u>MICRO DIST Distillation Procedure using reuse, preclean Microdistillation tube</u>

10.1.4.1. With the D end up, place the collector tubes in the tube rack.

10.1.4.2. In the sample tube, pipet 6.0ml of aqueous sample into each sample tube or weigh out 0.25 to 0.30 grams of sample plus 5.0 ml of DI water for soil samples. Add 0.25ml of the sulfamic acid solution and 0.75ml of the releasing agent to all tubes. Label the tube with the sample ID.

10.1.4.3. Place the sample tube into the press, putting the sample tube through the whole in the white base. Place the D end on top of the sample tube and press until the D end meets the ring around the sample tube.

10.1.4.4. Add 2 mL of 0.25N NaOH solution to the D end which is connected to the with sample tube.

10.1.4.5. Attach a silicone tubing about 1.5" long to the tube labeled M end (labeled with sample ID). Then connect the tube labeled M end to the tube labeled D end (which is connected to sample tube).

10.1.4.6. Put on heat resistant gloves and push the sample tube and 'D' end of each tube into the preheated block so that the collector tube stop ring touches the block.

10.1.4.7. Set timer for 30 minutes. Do not pull the tubes out before the 30 minutes to check them. This will cause the sample to suck-back.

10.1.4.8. After the 30 minutes have passed, put on heat resistant gloves. Remove the first tube from the block and immediately flip the tube upside down and gently tap the tube on the counter a couple times. Remove the D end connected to sample tube. Rinse the D end/sample tube with few drops of DI water and add to the M end tube. The D end/sample tube can now be placed in a bucket for cleaning, refer to SOP ED-GEN-013, Glassware cleaning, for the full procedure.

10.1.4.9. Place the tubes in the collector tube rack with the 'M' end up.

10.1.4.10. Dilute to the mark with deionized water. The solution is now ready for semi-automated colorimetry. Seal the open end with parafilm, if the sample is not going to be analyzed immediately.

10.2. Calibration

10.2.1. All standards (Calibration Standards, calibration blank, ICV/CCV) must be distilled in the same manner as samples. A calibration must be analyzed each day before sample analysis.

10.2.2. Preparation of Standards for samples without sulfide:

10.2.2.1. Use the primary working solution (Sec. 7.2.4) to prepare the calibration standards below.

10.2.2.2. Prepare calibration standards and CCV for Micro Distillation batch as follows; the final volume in collector tube is 6.0 ml.

Volume (mL) of 6 mg/L CN primary working solution	Volume (mL) of 0.25N NaOH added to each Distillation Sample Tube	Concentration CN-(mg/L)
0.40	5	0.40
0.20	5	0.20
0.10	5	0.10
0.05	5	0.05
0.025	5	0.025
0.010	5	0.010
0	5	0.0
CCV	5	0.20

Note: [1] Add a calibration standard of 0.005 CN mg/l as directed on special projects.
[2] Prepare CCV with each distillation batch.
[3] Due to limited volume of the distillate, it may be necessary to prepare and distill two or three CCVs in the batch.

10.2.2.3. Prepare ICV using a secondary Simple CN source (Sec 7.2.3) as follows:

Volume (mL) of 6 mg/L CN secondary working solution (ICV)	Volume (mL) of 0.25N NaOH added to each Distillation Sample Tube	Concentration CN-(mg/L)
0.20	5	0.20

10.2.2.4. Correlation coefficient of 0.995 or greater must be obtained.

10.2.2.5. After running the calibration, recalculate each of the standard's concentration. Review Table 1 of the instrument report specifically the *%Residual* and *Det. Conc. (mg N/L)* column for the resulting concentration. The % Residual of the calibration standards should be within 50% for the first calibration standard, 0.01 mg/L (1 to 2 times the RL), 20% for 0.025 mg/L and 0.050 mg/L standards (3 to 5 times the RL) and 10% the rest of the standards (greater than 5 times the RL). If this criteria is not met, re-analyze the calibration standards (in some cases, new calibration standards may need to be prepared).

10.2.3. Method 9012B: Preparation of Standards for samples with sulfide:

10.2.3.1. From the 6 mg/L primary working standard prepare five standards as above to be distilled in the same manner as the samples using the method of standard additions. Note: Bismuth Nitrate must also be added to the standards. Standards distilled in this way will give a linear curve at lower concentrations but as concentration increased the recovery decreases.

10.2.3.2. Correlation coefficient of 0.995 or greater must be obtained.

10.3. Sample Analysis

10.3.1. System startup:

10.3.1.1. Follow manifold scheme for this method.

10.3.1.2. Turn on heating unit at 60° C for 15 minutes before analysis.

10.3.1.3. Put all reagent lines into deionized water and turn pump on. Check for leaks and slow flow rate.

10.3.1.4. Switch over reagent lines to proper reagent. Let reagent run through manifold for 15 minutes before analysis to allow baseline to stabilize.

10.3.2. Set up tray table with all appropriate QC checks. CCV/CCB every 10 samples and at the end of the run. The following analytical sequence must be used:

Instrument Calibration
ICV (QCS)
ICB
MRL
CCV
CCB
MB
LCS or LCSSRM for soils
8 Samples with Analytical Spikes
CCV (IPC)
CCB
10 samples
CCV (IPC)
CCB
Repeat until run is complete
CCV (IPC)
CCB

10.3.3. Place standards and samples into autosampler cups.

10.3.4. Run tray.

10.3.5. Dilute and reanalyze samples that exceed the calibration curve using the distilled calibration blank or CCB.

11.0. Calculations / Data Reduction

11.1. Accuracy:

$$\text{ICV / CCV, LCS \% Recovery} = \frac{\text{observed concentration}}{\text{known concentration}} \times 100$$

$$\text{MS \% Recovery} = \frac{\text{(spiked sample) - (unspiked sample)}}{\text{spiked concentration}} \times 100$$

11.2. Precision (RPD):

$$\text{Matrix Duplicate (MD)} = \frac{|\text{orig. sample value - dup. sample value}|}{[(\text{orig. sample value + dup. sample value})/2]} \times 100$$

11.3. Final results calculation in aqueous samples:

Concentration = mg/L

Concentration (mg/L) from instrument is imported to TALS
Samples with dilution factor are calculated in TALS for final results

11.4. Final results calculation in solid samples:

$$\text{Concentration mg/kg} = \frac{C \times V \times D}{W}$$

Where:
C = sample concentration in extract (mg/L)
V = Volume of extract (mL)
D = Dilution Factor
W = Weight/Volume of sample aliquot extracted (grams)

NOTE: All dry weight corrections are made in TALS.

11.5. Final results calculation amenable to chlorination:

mg CN^- amenable to chlorination/L = A - B

where:
A: mg CN^-/L: found in unchlorinated portion of sample
B: mg CN^-/L: found in chlorinated portion of sample

11.6. Data Reduction

11.6.1. Cyanide soil and waters are batched separately in TALS Analyst Desktop. Update Cyanide prep batches as follows:.

11.6.1.1. For soils, enter in 0.25-0.30g under the 'initial amount' column and 6ml under the 'final amount' column for each sample including the MB and LCSSRM.

11.6.1.2. For waters, enter 6ml under the columns 'initial amount' and 'final amount' for each sample including the MB and LCS. Under the columns 'chlorinechk' and 'sulfidechk' record the results from the test strip paper. 'N' designates the interference was not present. Record 'pH>12' under the column 'DistillpHchk.'

11.6.1.3. Since the calibration standards are distilled, they will be recorded in the prep batch. Under the column 'Lab ID,' type in "IC' for 7 rows. Enter 6ml under the columns 'initial amount' and 'final amount' for each standard. Enter how many milliliters of the 6ppm primary working solution were used for each calibration standard following the chart in Sec. 10.2.2.1.

11.6.1.4. For both soil and water batches, record reagent information including reagent ID and expiration date on the batch information page. Record the actual time the samples were distilling under 'batch comments.' This should be designated as distillation start and end time.

11.6.2. Instrument data is imported to TALS by following these steps:

11.6.2.1. After the run has finished, click the data icon at the top of the screen. Choose the correct file. Go to 'File" and choose "Export Data' from the drop down menu. A screen will pop up, click 'ok' and then another screen will pop up, click 'ok.'

11.6.3. From the desktop, open the 'LIMSdata' icon on the Lachat 8000 and the 'Exports' icon on the Lachat 8500. Select the correct file, and then right click. Go to 'Send to-> LimsImport ->' Choose the correct method. The data has now been imported to TALS.

11.6.4. All reagent information is recorded in the "Batch Information" page. Use the 'Worksheet tab' if additional pages are necessary.

11.6.5. Record special notes and observations in the "worksheet" tab (i.e. sample appearance and notes on why samples were rejected or diluted).

11.6.6. All raw data is attached as a pdf file. The raw data includes the instrument report and calibration curve.

11.6.7. Complete the Data Review Checker (DRC) in TALS: Prior to data submission the analyst must execute the DRC (Data Review Checker) program in the applicable analytical batch (TALS Analyst Desktop II module).

11.6.7.1. Open the analytical batch and click on the Edit tab above to enter the Edit Mode.

11.6.7.2. Press F8 command key on the computer keyboard or right click anywhere on the batch worksheet then click on 'Run checklist.'

11.6.7.3. Acknowledge by filling in responses to all unacknowledged findings. Highlight the checklist with findings, then highlight the associated list of findings; right click and choose 'Acknowledge Item.'

11.6.7.4. Fill in appropriate comments in the response box, then hit 'OK.' 'The column labeled 'unacknowledged findings' should show '0' for all questions once completed; then batch is ready for 2nd level review.

12.0. Method Performance

12.1. Method Detection Limit Study (MDL)

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure in Section 19 (Test Methods and Method Validation) of TestAmerica Edison's Quality Assurance Manual (ED-QA-LQM). MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method requirements require a greater frequency.

12.2. Demonstration of Capabilities

For DOC procedure refer to Section 19 in the most current revision of TestAmerica Edison's Quality Assurance Manual (ED-QA-LQM).

12.3. Training Requirements

Refer to TestAmerica SOP No. ED-GEN-022, Training, for the laboratory's training program.

13.0. Pollution Control

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention."

14.0. Waste Management

14.1. Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal

restrictions are followed. Waste disposal procedures are incorporated by reference to TestAmerica SOP No. ED-SPM-008 (Laboratory Waste Disposal Procedures).

14.2. The following waste streams are produced when this method is carried out:

- Pyridine/Hydroxide Solution: Hazardous Waste Liquid, n.o.s. This material is collected at satellite accumulation in 30 gallon Poly containers. When the container is full, the container is transferred to the waste room and held in secondary containment until a waste vendor is called for a pick up.

  Teris Profile Number: 50016717
  Onyx Profile WIP Number: 584650

15.0. References / Cross-References

15.1. Methods for the Determination of Inorganic Substances in Environmental Samples, EMSL-Cincinnati, EPA/600/R-93/100, August 1993, Method - 335.4 Determination of Total Cyanide by Semi-Automated Colorimetry

15.2. Standard Methods for the Examination of Water and Wastewater, American Public Health Association, Washington, DC, Method 4500 CN C, G-2016.

15.3. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, 3rd ed., U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. U.S. Government Printing Office: Washington, DC, 1995; SW846 Method 9012B.

15.4. QuikChem Method 10-204-00-1-A, Determination of Cyanide in Waters.

15.5. TestAmerica Edison Document No. ED-QA-LQM, *Laboratory Quality Manual*, most current revision.

15.6. TestAmerica Edison SOP ED-GEN-022, *Training*, most current revision.

15.7. TestAmerica Edison SOP No. ED-SPM-008, *Laboratory Waste Disposal Procedures*, current revision.

15.8. TestAmerica Corporate Environmental Health and Safety Manual, Document No. CW-E-M-001, most current revision.

15.9. TestAmerica Edison SOP No. ED-GEN-013, *Glassware cleaning*, current revision.

16.0. Method Modifications:

Item	Method no.	Modification
1	335.4	Sec 4.3.1: This SOP referenced method 335.4 (not SW846) when treating samples suspected to contain chlorine and nitrates/nitrites.

2	QuikChem Method 10-204-001-41-A	Sec 7.1.8.3: Preparation procedure for the Phosphate buffer follows Quikchem method 10-204-001-41-1 (not Method 335.4).
3	SM 4500 CN^- C	Sec 10.1.3.3: Sulfamic acid solution is added to all samples during distillation. Addition of Sulfamic acid is a procedure described in Standard methods 18th ed, Method 4500 CN^- C. Methods SW846 9012B and EPA 335.4 require the addition of Sulfamic acid for samples which are known to contain NO3 and/or NO2.
5	335.4; SW9012B	Sec 7.1.7.2-7.1.7.3; 10.1.4.2; 10.1.4.3- Modified procedure for reagent preparation and amount of reagent added in sample while keeping the reagent sample volume ratio and concentration the same.
6	335.4; SW9012B	*335.4 & 9012B: It is recommended that at least two standards (a high and a low) be distilled and compared to similar values on the curve to ensure that the distillation technique is reliable.* Sec 9.1.2: For Micro Distillation, one LCS (0.10 mg/L) will be prepared for each distillation batch; however calibration standards, ICV and CCV will be distilled in the same manner as the samples.
7	335.4; SW9012B	*Method 335.4; SW9012B: Distill standards for samples with Sulfide.* This SOP follows the procedure described in the Hach Micro Dist User Manual, Method Number 10-204-00-1-X when distilling samples by Micro Dist- *It is imperative that the standards be distilled with the samples.*
8	Micro Dist (Method No. 10-204-00-1-X)	Add between 0.50-1.0g of soil/sludge to 5 ml DI water. This SOP will use 0.25g of soil sample to 5 ml DI water. Improved accuracy with the soil LCS when using 0.25g rather than 0.50g sample weight.

17.0. Attachments

N/A

18.0. Revision History

- Revision 18, dated 08 November 2023
  - Sec. 10.1.3.12 & 10.1.4.8: Revised solution to use when rinsing the CN sample tube after distillation from 0.25N NaOH to DI water.
  - Sec. 10.2.2.5: Added criteria to use when evaluating the calibration curve.

- Revision 17, dated 23 February 2023
  - Sec. 9.2.5: Clarified the applicable matrix, procedure, and corrective action for the QC – MRL.

- Revision 16, dated 22 September 2022
  - Sec. 7.1.6.3 and 10.1.2.3: Replaced ascorbic acid with sodium arsenite to remove residual chlorine.
  - Sec. 9.2.5: Fixed MRL acceptance range to 50-150%.
  - Sec. 10.3.2: Revised instrument tray set up to reflect actual laboratory practices.
  - Sec 15: Revised Standard Method reference to Rev 2016.

- Revision 15, dated 06 January 2021
  - Sec 7.1.6.1: Clarified the stability information for the reagent $Ca(OCl)_2$.

- Revision 14, dated 16 December 2020
  - Sec 3: Revised the Definitions locations as per the most current LQM.
  - Deleted all reference to Easy-Dist (midi-dist) and wipes distillation, not applicable in this SOP.
  - Sec. 7.1.6.1: Revised Calcium Hypochlorite storage requirements and preparation frequency to daily.
  - Sec. 9.1.2: Clarified that only soil LCS should be designated LCSSRM in TALS sample worksheet.
  - 9.1.3: Clarified the MS/MSD procedure for the Cyanide amenable to chlorination.
  - Sec 9.2.5: Added MRL to the list of instrument QC.
  - Sec. 10.1.2: Added requirements that sample which is detected for total cyanide must be re-analyzed and prepared with the cyanide amenable to chlorination sample.
  - Sec 10.1.2.1 & 10.1.2.2: Revised to clarify the procedures for CN amenable to chlorination (i.e. taking identical samples for total and amenable samples; 'excess' added in Sec 10.1.2.2).
  - Sec 10.1.4: Added procedure for setting up distillation using the reuse, preclean distillation tubes.
  - Sec. 11.6.7: Replaced EDS-WI-008, Wetchem Data Review Checklist with TALS DRC; procedures added for DRC.
  - Sec 15.9: Deleted WI EDS-WI-008, not applicable; subsequent sections adjusted.
  - Sec 15.10: Added reference – SOP ED-GEN-013.

- Revision 13.1, dated 23 October 2017
  - Updated SOP header with Eurofins emblem.

- Revision 13, dated 23 October 2017
  - Sec. 9.1.2: Corrected preparation instructions for LCS from 0.20 mg/L to 0.10 mg/L. Updated control limits for Method 9012B to +/-15%.
  - Sec. 9.2.1: Updated the ICV control limits for Method 9012B.
  - Sec. 9.2.2: Updated the CCV control limits for Method 9012B; removed instructions to prepare a CCV with each Micro-Distillation batch.
  - Sec. 10.3.2: Updated the example analytical sequence for Micro Dist and Easy Dist.
  - Sec 16, Item 6 of Method Modification – Deleted text- CCV (0.20 mg/L) will be distilled with each distillation batch.

- Revision 12, dated 26 September 2017
  - Sec. 1.1.2: Updated the Soil RL to 0.24 mg/Kg to reflect the initial soil sample weight change from 0.5g to 0.25g.
  - Sec. 6.2: Added Lachat Micro Distillation tubes and pH test strips to list of supplies.
  - Sec. 7.1.7.2: Revised preparation instructions for sulfamic acid solution; revised to use a double strength concentration sulfamic acid solution, however the amount added in sample is reduced in half.
  - Sec. 7.1.7.3: Replaced 2.5M MgCl2 and 1:1 H2SO4 solution with Microdistillation releasing agent (7.11 M sulfuric acid/ 0.79M magnesium

chloride) to be used instead of the separate H2SO4 and MgCl2 solution; equivalent reagent concentration is added in sample.
  - Sec. 7.2.3: Added ERA cat# 997 as an alternative source for a Simple CN secondary standard.
  - Sec 7.2.4 & 7.2.5: Added preparation instructions for the Micro Dist Primary/Secondary Working standards.
  - Sec 7.2.6: Deleted LCSH
  - Sec 7.2.7: Updated preparation instructions for the Complex CN Working Solution (Micro Dist).
  - Sec 7.2.8: Added soil standard reference material.
  - Sec 9.1.1: Updated preparation instructions for MB from deionized water to 0.25 N NaOH to reflect actual laboratory practices.
  - Sec 9.1.2: Updated preparation instructions for LCS needed for Micro-Dist; removed LCSH prep for Micro Distillation. Revised the LCS sample weight to use from 0.5g to 0.25g. Added Easy Dist prep instructions for LCSSRM.
  - Sec 9.1.3: Updated the matrix spike preparation instructions for Micro Dist for soil and water.
  - Sec 9.2.1: Updated the ICV preparation instructions for Micro-Dist;
  - Sec 9.2.2: Revised the standard source used for preparing CCV; source will be the same source as the calibration standards and will be distilled with each Micro Dist distillation batch.
  - Sec 10.1.1.1: Added instructions to check pH of each sample.
  - Sec 10.1.4.2: Revised the volume to add in collector tube to 2.0ml of 0.25N NaOH.
  - Sec 10.1.4.3: Revised the reagents and amount of reagents added into the sample/distillation tube; Revised the initial weight used for solid samples from 0.5g to 0.25-0.30g. Added note to homogenize soil sample prior to taking aliquot.
  - Sec 10.1.4.12: Added instructions to rinse the D-end and add rinsate to the M-end.
  - Sec 10.2.2: Added instructions to distill all standards used for the analysis of CN by Micro Distillation.
  - Sec 10.2.3.2 & 10.2.3.3: Added preparation instructions for the calibration standards and check standards (ICV,CCV) by Micro Distillation. Added note that CCV must be distilled with each distillation batch.
  - Sec 10.3.2: Clarified analytical sequence for Micro Dist and Easy Dist.
  - Sec 10.3.5: Updated instructions for sample dilutions.
  - Sec 11.7.1: Added instructions for completing Batch information page in TALS.
  - Sec 16: Method modification items 5-8 added.

- Revision 11, dated 11 August 2014
  - Sec. 7.2.2 & 7.2.3: Clarified procedure as to when to apply the standardized value of the CN stock solution.
  - Sec. 9.1.2: LLCS and HLCS will be analyzed for both methods SW9012 and EPA335.4 Deleted text: *'Distillation of two LCSs (LLCS and HLCS) is not a method requirement for Method 335.4. Use HLCS as the QC sample for Method 335.4.*

- Revision 10, dated 12 March 2014
  - Deleted Method 9012A reference throughout the SOP; replaced SW method reference with 9012B.

- Sec 15.3 Added reference to Standard Methods Editorial revision 2011; subsequent sections adjusted accordingly.

- Revision 9, dated 12 November 2012
  - Sec 1.1.2: Revised RL for solids from 0.12 mg/kg to 0.10 mg/kg; sample final volume is 5 ml.
  - Sec 9.1.2 & 9.1.3: Deleted text: *After micro-distillation, volume is brought up to 6 ml with deionized water.* The final volume of the distillate is not adjusted.
  - Deleted Sec 10.1.4.13, final distillate will not to be diluted to 6 ml; subsequent sections adjusted accordingly.
  - Sec 10.1.4.13 (formerly Sec 10.1.4.14): deleted text: *Shake the tube with a gentle whipping motion to mix in diluent water.* Added text: *With the 'M' end down, place the tube in the collector tube rack.*

- Revision 8, dated 25 October 2012
  - Deleted Sec 7.2.4 (5 mg/L primary working solution), standard not applicable; subsequent sections adjusted accordingly.
  - Sec 7.2.2, 7.2.3 & 7.2.6: Clarified to include which QC samples these standards are applicable to.
  - Sec 7.2.6 & 7.2.7: Added complex cyanide standard, 1000 mg/L stock standard and 10 mg/L working solution to be used for distilled QC samples (LCS and MS/MSD).
  - Sec 9.1.2: Added note: *Distillaton of two LCSs (LLCS and HLCS) is not a method requirement for Method 335.4. Use HLCS as the QC sample for Method 335.4.*
  - Sec 9.1.2: Revised the LLCS concentration to 0.10 mg/L; revised to reflect the correct spiking amount (ml) and source standard (complex CN working solution) in the preparation procedure.
  - Sec 9.1.3: Revised the spiking solution from simple to complex CN.

- Revision 7, dated 13 September 2012
  - Sec 1: Revised to include the RL for microdistillation in soils.
  - Sec. 2.0: Revised to include 'MICRO DIST' as one of the ways to distill samples.
  - Sec. 6.0: Updated list of equipment (added MICRO DIST and Lachat 8000 and 8500 series).
  - Sec. 9.1.1: Changed the frequency for the Method Blank analysis from 1 per 10 samples to 1 per 20 samples.
  - Sec. 9.1.2: Changed the frequency for the LLCS/HLCS analysis from 1 per 10 samples to 1 per 20 samples. Also, included the micro distillation preparation procedure for LLCS/HLCS.
  - Sec. 9.1.3: Clarified the requirement of one MS/MSD per 10 samples. Also, included the micro distillation preparation procedure for MS/MSD.
  - Sec. 10.1.4: Added procedure for micro distillation of samples.

- Revision 6, dated 22 March 2012
  - Sec. 1.1.1: added method 4500 CN G to the list of methods.
  - Sec 1.1.3, 12.1 & 12.2: Revised QAM references to reflect the most recent QAM revision.
  - Sec. 7.2.2/7.2.3: Added information on commercially purchased CN stock standard.

- Sec 9.1.3: Added MS/MSD requirement for cyanide amenable to chlorination under sample QC.
- Sec. 10.1.2.1: Added prep for soil samples requiring cyanide amenable to chlorination.
- Sec 11.6: Added calculation formula for CN amenable to chlorination; subsequent sections adjusted accordingly.
- Sec 15.9: Added applicable reference.

- Revision 5, dated 22 November 2010
  - Sec. 1.1.1: Added wipes to list of applicable matrices.
  - Sec. 1.1.2: Added reporting limit for wipes.
  - Sec. 6.2: Added specimen cups, transfer pipettes, graduated cylinder and micro-burets to the list of supplies.
  - Sec. 7.1.4: Changed the amount of acetic acid added from “approximately 100 ml” to “approximately 10 drops” to reflect actual laboratory practices.
  - Sec. 7.1.6.2: Clarified reagent prep
  - Sec. 8.0: Added wipes to section.
  - Sec. 9.1: Added sample QC requirements for wipe batches.
  - Sec. 9.1.1: Included the prep of the method blank for wipe batches
  - Sec. 9.1.2: Revised the prep of the LLCS and HLCS to reflect actual laboratory practices. Also, included prep of the LCS/LCSD for wipe batches.
  - Sec. 9.1.3: Revised MS/MSD prep for aqueous and soil.
  - Sec. 9.2.2: Deleted text “If the CCV is not within the control limits, a second analysis should be performed.”
  - Sec 9.2.3 & 9.2.4: Clarified the type of solution utilized for the ICB and CCB.
  - Sec. 10.1.3.1: Revised step of the distillation procedure to reflect actual laboratory practices.
  - Sec. 10.2.2.1: Revised calibration standards prep Table.
  - Sec. 10.3.2: Added comment on how to set up the analytical sequence for wipe samples.
  - Sec. 11.5: Included calculation for wipe samples.
  - Sec. 11.6: Added steps to import data to TALS.
  - Section 16: Added method revision for addition of wipe matrix to SW846 9012A/9012B.

- Revision 4, dated 28 September 2009
  - Revised SOP format in accordance with TestAmerica Corporate Quality SOP No. CW-QS-002 (Rev 0) Writing a Standard Operating Procedure (SOP).
  - Incorporated SOP ED-WET-007 (Analysis of Total Cyanide in Drinking water-Automated, Method 335.4) into this SOP; retired SOP ED-WET-007 at the effective date of this SOP.
  - Sec. 7.2.2: Added information for the standardization of the Cyanide Stock. Replace frequency of the standardization from monthly to weekly to comply with Standard methods.
  - Sec 7.2.3 – 7.2.6: Added standards and preparation instructions.
  - Sec 9.1.3: Clarified % recovery limits for water and solid samples.
  - Sec 9.2.1 & 9.2.2: Clarified corrective actions to be taken if QCS/ICV and IPC/CCV results are outside the acceptable limits.
  - Sec 10.3.2: Revised sample analytical sequence to comply with method 335.4.
  - Sec. 11.5: Revised new data reduction procedures in accordance with new TALS.

- Sec. 15: Replace reference 335.2 and 335.3 with the EPA 335.4 reference; added applicable reference.
- Sec 16: Added Method modification to specify actual source of reagent information.

- Revision 3b, dated 13 July 2009
  - Sec 2.1: .For each batch of ten samples or less, a matrix spike and matrix spike duplicate will be distilled and analyzed. (Replaced 20 samples to 10 samples per batch).
  - Sec 9.5.1.3 & 9.5.2.2.: Revised Correlation coefficient from 0.997 to 0.995 as per corporate SOP on Calibration curves.
  - Sec 10.3: Up to 10 samples can be put in a batch. .Revised number of samples in a batch from 20 to 10 samples.

- Revision 3a, dated 13 March 2009
  - Sec 1.1: Delete Methods 335.1/.3; Add Method Lachat 10-204-00-1-A (Methods deleted in response to MUR).
  - Sec 3.6: Delete text: If this occurs, a Dow Corning 544 can be added to prevent the foam from collecting in the condenser. Replace the above procedure with: *If this occurs, samples can be acidified with acetic acid (1.6M) to pH 6.0-7.0.*
  - Sec 5.2: Add: Solution is stable for 6 months or when QC check is outside the acceptable limits, whichever comes first, store at 4ºC.
  - Sec 5.4: Acetate Buffer-Dissolve 82.0g of NaC2H3O2 x 3 H2O in 100ml DI water. Add glacial acetic acid drop by drop until the pH is 4.5. This solution is stable for 6 months, store at 4ºC. (Changed amount of acetic acid added to reflect actual laboratory practices).
  - Sec 5.6: Remove: Dow Corning 544 antifoam agent. Lab does not use this reagent , samples will be acidified with acetic acid.
  - Sec. 5.7.1, 5.8.2, 5.8.3, 5.8.4: Add: Solution is stable for 6 months, store at room temperature.
  - Sec 5.7.2: 0.25M NaOH. Add: Dissolve 10.0g NaOH into 1L deionized water. Solution is stable for 6 months, store at room temperature.
  - Sec. 5.9.1 & 5.9.2: Add: Store at room temperature.
  - Sec. 5.9.3: Phosphate buffer: In a 1L volumetric flask, dissolve 97g of potassium phosphate, monobasic, anhydrous (KH2PO4) in approximately 800ml of deionized water. Dilute to the mark. Solution is stable for one month. Store at room temperature. (Changed reagent preparation to comply with the Lachat method).
  - Sec 6.3: Add: Laboratory Control Sample (LCS): Prepare a 5ppm and 10ppm CN standard by diluting the 1000ppm Primary CN stock. Prepare fresh daily.
    - LLCS: Take 0.25ml of the 5ppm CN standard and bring up to a 50ml final volume with 0.25N NaOH. The true value is 0.025ppm.
    - HLCS: Take 1.0ml of the 10ppm CN standard and bring up to a 50ml final volume with 0.25N NaOH. The true value is 0.2ppm

  - Sec 9.10: Delete text: “Free Cyanide is estimated using the weak acid dissociable procedure following the colorimetric procedure without distillation. For reference refer to SM 4500-CN-A.” Revise the above text to: “*Free Cyanide will be treated following the procedure for the Cyanide Amenable to chlorination and therefore must be distilled.” See Section 9.2*

- Sec. 10.7: MS and MSD Recovery: Delete: The recovery must be within laboratory generated limits. Revise the above text to: *The recovery must be within 90-110% (*Revise MS/MSD recovery to comply with method 335.4).
- Sec. 15.1: References: Replace 335.2 & 335.3 reference with EPA 335.4 reference

Title: SW846 Method 8082A, Analysis of Polychlorinated Biphenyls by Gas Chromatography

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Approvals (Signature/Date):

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1.0 Scope and Application

This method is used to quantify specific polychlorinated biphenyls (PCBs) as Aroclors (see Table 1 below) in extracts from aqueous, soil, sludge, leachate, wipe or oil matrices by direct injection dual capillary column gas chromatography using SW846 Method 8082A. An electron capture detector (ECD) is employed for detection.

1.1 Analytes, Matrix(s), and Reporting Limits

The specific analytes determined by this method are identified in Table 1.

Table 1
Polychlorinated Biphenyls

Compound Name	CAS Registry No.
Aroclor 1016	12674-11-2
Aroclor 1221	11104-28-2
Aroclor 1232	11141-16-5
Aroclor 1242	53469-21-9
Aroclor 1248	12672-29-6
Aroclor 1254	11097-69-1
Aroclor 1260	11096-82-5
Aroclor 1262	37324-23-5
Aroclor 1268	11100-14-4

The routine Eurofins Edison reporting limits (RLs) by analyte and matrix are summarized in Table 2 (below).

Table 2
Reporting Limits by Matrix

Parameter	Soil	Soil	Water	Leachate	Oil	Wipe
	Reporting Limits (ug/kg) LOW Level	Reporting Limits (ug/kg) MED Level	Reporting Limits (ug/L)	Reporting Limits (mg/L)	Reporting Limits (ug/kg)	Reporting Limits (ug/wipe)
Aroclor-1016	67	500	0.50	0.0050	1000	0.40
Aroclor-1221	67	500	0.50	0.0050	1000	0.40
Aroclor-1232	67	500	0.50	0.0050	1000	0.40
Aroclor-1242	67	500	0.50	0.0050	1000	0.40
Aroclor-1248	67	500	0.50	0.0050	1000	0.40
Aroclor-1254	67	500	0.50	0.0050	1000	0.40
Aroclor-1260	67	500	0.50	0.0050	1000	0.40
Aroclor-1262	67	500	0.50	0.0050	1000	------
Aroclor-1268	67	500	0.50	0.0050	1000	------

The most current MDLs and RLs for this method can be found in the active Eurofins LIMS (TALS) SW846 8082A Method Limit Group (MLG) database.

1.2 On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in Section 7 (*Review of Work Request*) and Section 19 (*Test Methods and Method Validation)* of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

2.0 Summary of Method

2.1. Samples undergo a preparation step prior to analysis by SW846 Method 8082A. A measured volume or weight of sample is extracted using the appropriate matrix-specific sample extraction technique (reference the applicable Organic Sample Prep SOPs listed below). The extract is exchanged into hexane and concentrated to a final volume between 1 and 20 ml depending upon the prep technique used.

2.1.1. Aqueous and leachate samples are extracted at a neutral pH using either SW846 Method 3510C (SOP No. ED-ORP-014: *Extraction of Pesticides and PCBs in Water by Separatory Funnel*) or SW846 Method 3511 (SOP No. ED-ORP-051: *Extraction of Semivolatile Organic Compounds in Water by Microextraction using SW846 Method 3511*)

2.1.2. Wipe samples are extracted using SW846 Method 3550B: Sonication (*SOP No. ED-ORP-018: Extraction of Pesticides/PCBs in Soil Using Low-Level Extraction, SW846 Method 3550B*)

2.1.3. Solid samples are extracted using SW846 Method 3546 (*SOP No. ED-ORP-0044: Procedure for the Microwave Extraction of Solids,SW846 Method 3546*).

2.1.4. Organic liquids are prepared using SW846 Method 3580A (*SOP No. ED-ORP-019: Waste Dilution for Pesticides and PCBs, SW846 Method 3580A*).

2.1.5. Extract cleanup steps are employed as need depending on the nature of the matrix interferences encountered. Suggested cleanups include SW846 Method 3620B (*SOP No. ED-ORP-020: Florisil Cleanup for Pesticide/PCB Sample Extracts*), SW846 Method 3660B (*SOP No. ED-ORP-021: The Removal of Elemental Sulfur from Pesticide/PCB Sample Extracts*) and SW846 Method 3665A (*SOP No. ED-ORP-022, Sulfuric Acid Cleanup for PCB Extracts, SW846 Method 3665A*) for heavy organic interferences.

2.2. After cleanup, the extract is analyzed by injecting a known volume of sample into a gas chromatograph equipped with a dual wide-bore fused silica capillary columns and dual electron capture detectors (GC/ECD). The GC is temperature programmed to separate and detect the analytes recovered during the extraction step. Quantitation is accomplished by comparing the area response of each target analyte relative to an internal standard established through a five-point initial calibration (six points for second order regression). Specific calibration and quality control steps are detailed in this SOP and meet the specification of SW846 Method 8082A.

2.3. Samples are analyzed only after all the necessary calibration and QC checks have been performed.

2.4. Acquired data from sample analysis is manually reviewed. Secondary column confirmation of target compounds and quantitation are conducted by the analyst as required.

3.0 Definitions

For a complete list of definitions refer to Appendix 2 in the most current revision of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

4.0 Interferences

4.1. Interferences from phthalate esters introduced during sample preparation can pose major difficulties for PCB determinations.

4.1.1. Interferences from phthalate esters can be minimized by avoiding contact with any plastic materials and checking all solvents and reagents for phthalate contamination. Exhaustive cleanup of solvents, reagents and glassware may be required to eliminate background phthalate ester contamination.

4.2. The presence of elemental sulfur will result in broad peaks that interfere with the detection of early-eluting PCBs. Sulfur contamination should be expected with sediment samples. Employ SW846 Method 3660B (*SOP No. ED-ORP-021: The Removal of Elemental Sulfur from Pesticide/PCB Sample Extracts*) for removal of sulfur.

4.3. Co-eluting chlorophenols are eliminated by using SW846 Method 3620B (*SOP No. ED-ORP-020: Florisil Cleanup for Pesticide/PCB Sample Extracts*),

4.4. Interferences from other organic compounds can effectively be removed using a sulfuric acid treatment, SW846 Method 3665A (*SOP No. ED-ORP-022, Sulfuric Acid Cleanup for PCB Extracts, SW846 Method 3665A*). This destructive technique can be employed only when the sample extract is being analyzed solely for PCBs (i.e., it is not to be used prior to analysis for pesticides).

4.5. Compounds extracted from the sample matrix to which the detector will respond, such as single-component chlorinated pesticides, including the DDT analogs (DDT, DDE, and DDD) will cause interference. A standard of the DDT analogs should be injected to determine which of the PCB or Aroclor peaks may be subject to interferences on the analytical columns used. There may be substantial DDT interference with the last major Aroclor 1254 peak in some soil and sediment samples. A System Performance Check (DDT/Endrin) is analyzed daily to assist in evaluation of potential DDT interference with this Aroclor 1254 peak.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001) and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum

5.1. Specific Safety Concerns or Requirements

The gas chromatograph contains zones that have elevated temperatures. The analyst needs to be aware of the locations of those zones, and must cool them to room temperature prior to working on them.

There are areas of high voltage in the gas chromatograph. Depending on the type of work involved, either turn the power to the instrument off, or disconnect it from its source of power.

5.2. Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Acetone	Flammable	1000 ppm-TWA	Inhalation of vapors irritates the respiratory tract. May cause coughing, dizziness, dullness, and headache.
Hexane	Flammable Irritant	500 ppm-TWA	Inhalation of vapors irritates the respiratory tract. Overexposure may cause lightheadedness, nausea, headache, and blurred vision. Vapors may cause irritation to the skin and eyes.
Methylene Chloride	Carcinogen Irritant	25 ppm-TWA 125 ppm-STEL	Causes irritation to respiratory tract. Has a strong narcotic effect with symptoms of mental confusion, light-headedness, fatigue, nausea, vomiting and headache. Causes irritation, redness and pain to the skin and eyes. Prolonged contact can cause burns. Liquid degreases the skin. May be absorbed through skin.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Sulfuric Acid	Corrosive Oxidizer Dehydrator Poison Carcinogen	1 Mg/M3-TWA	Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. Symptoms may include irritation of the nose and throat, and labored breathing. Symptoms of redness, pain, and severe burn can occur. Contact can cause blurred vision, redness, pain and severe tissue burns. Can cause blindness.
1 – Always add acid to water to prevent violent reactions.			
2 – Exposure limit refers to the OSHA regulatory exposure limit.			

6.0 Equipment and Supplies

6.1 Gas Chromatograph:

6.1.1 Agilent Technologies (Avondale, PA) model 5890/6890 Gas Chromatograph (GC), equipped for simultaneous quantitation and confirmation columns using two separate detector channels on dual megabore capillary columns that are suitable for the analysis of organochlorine pesticides and PCB's. All operations are as automated as possible with the equipment utilized.

6.1.2 Injection system: Sample injection is accomplished by a single auto injector. The auto injector is serviced by a robot arm that shuttles a single sample between the sample tray and the injector turret.

6.1.2.1 The sample is injected into a split/splitless injection port equipped with electronic pressure control (EPC). The injection port is normally operated in splitless mode during injection. The EPC is operated in the ramp pressure mode.

6.1.3 Liners: The injection port is each fitted with a replaceable, heavy-walled glass double gooseneck liner. The liner contains a plug of silanized glass wool approximately 1 cm in length. The glass wool is positioned in the liner between the double gooseneck. The liner is replaced on a regular maintenance schedule.

6.1.4 Oven and Columns: Temperature programmable gas chromatograph ovens are required, capable of integrated temperature control between 35^{O}C and 350^{O}C.

6.1.4.1 Two dissimilar columns are used for analysis. A Restek StxCLPesticides, 30m x 0.53mm ID x 0.5um film thickness column (or equivalent) is used for sample quantitation. The secondary column is a Restek StxCLPesticides II, 30m x 0.53mm ID x 0.42um film thickness column (or equivalent).

6.1.5 Detectors: Sample detection is by electron capture. The GC is equipped with dual Electron Capture Detectors (ECD), one for each column.

6.1.5.1 Each detector is supplemented with make-up gas to provide sufficient detector flow for maintaining the electron plasma. This is in addition to the gas exiting the column. The make-up gas is fed from a supply other than the injection port.

6.2 Data System:

6.2.1 The data systems consist of Agilent Technologies GC Chemstation Revision A.08.02 and Agilent Technologies Enviroquant Chemstation G1701AA Version A.03.00 upgraded to A.03.02 which is used for acquisition and Eurofins Chrom (chromatography data processing software).

7. Reagents and Standards

7.1. Reagents

7.1.1. Gases: Ultra high purity (99.999%) Hydrogen is used as the carrier and injection port purge gas. It is introduced to the GC at the injection port. Ultra high purity (99.999%) Nitrogen is used as make-up gas. (Alternatively, ultra-high purity Helium with P-5 make-up gas may be used). Make-up gas is introduced to the GC via the make-up gas adapter at the end of the capillary column. Gases are supplied at tank pressures of 2000-2400 psig for a 300 cft tank. The tank pressure is regulated to an outlet pressure of 70 psig. Each tank is used until the tank pressure drops to less than 500 psig.

7.1.1.1. The gas streams are polished using three traps or filters before introduction to the G.C. The traps are as follows:

- Hydrocarbon trap
- H_2O (moisture) trap
- O_2 scrubber

7.1.1.2. Both the moisture trap and the Oxygen scrubber are of the indicating type. They require either replacement or reconditioning upon color change of the active agents. Refer to the instructions for the individual traps to determine if it is still active. The hydrocarbon trap is a simple activated carbon trap. With high quality gas, it should last for an extended period of time (1-yr. minimum).

7.1.2. Solvents used in the extraction, clean up procedures and dilutions include Hexane, Methylene Chloride, and Acetone that are exchanged to Hexane prior to analysis. All solvents must be pesticide quality or equivalent. Each lot of solvent is screened for contaminants before being used for analysis.

7.2. Standards

7.2.1. Standards are purchased as concentrated solutions. Standard compounds or mixtures for this analysis include an Aroclor 1016/1260 mix, Aroclor

1221, 1232, 1242, 1248, 1254, 1262, 1268 and the surrogate compound Decachlorobiphenyl (DCB) (packaged with the Tetrachloro-m-xylene (TCMX), a surrogate used in pesticide analysis).

NOTE: Two independent sources are used for quantitation standards and spiking standards

7.2.1.1. Most stock solutions are diluted (in volumetric glassware) to working concentration using hexane as the diluent.

7.2.2. Standards mixes and sources: *

Standard Name	Source	Concentration
TCMX/DCB Surrogate Calibration Mix	Restek 32000	200 ug/ml
TCMX/DCB Surrogate Spike Mix	Supelco 861275	10 ug/ml
Aroclor 1016 Calibration Standard	Supelco 48097	1000 ug/ml
Aroclor 1221 Calibration Standard	Restek 32007	1000 ug/ml
Aroclor 1232 Calibration Standard	Restek 32008	1000 ug/ml
Aroclor 1242 Calibration Standard	Restek 32009	1000 ug/ml
Aroclor 1248 Calibration Standard	Restek 32010	1000 ug/ml
Aroclor 1254 Calibration Standard	Restek 32011	1000 ug/ml
Aroclor 1260 Calibration Standard		1000 ug/ml
Aroclor 1262 Calibration Standard	Restek 32409	1000 ug/ml
Aroclor 1268 Calibration Standard	Restek 32410	1000 ug/ml
Aroclor 1660 Mix (Arolcors 1016 & 1260)	Restek 32039	1000 ug/ml
Aroclor 1016/1260 Calibration Standard (Second Source)	Restek 32039.sec	1000 ug/ml
1-Bromo-2-nitrobenzene (internal standard)	Restek 32279	1000 ug/ml

*Suppliers with equivalent standards may be used.

7.2.3. Aroclor 1016/1260 & Surrogate Calibration Standard Solution Preparation

Five levels of calibration standards are prepared using the above referenced Aroclor 1660 Mix (Restek – 23039) and TCMX/DCB Surrogate Calibration standard mix (Restek 32000). They are prepared as follows:

Final Concentration of Aroclor 1016/1260 (Concentration of DCB)	Volume (ul) of Aroclor 1660 Mix (1000 ug/ml)	Volume (ul) of TCMX/DCB Surrogate Calibration Mix (200 ug/ml)	Final Volume in hexane (ml)
50 ppb (25 ppb DCB) (1)	5	6.25	100
500 ppb (50 ppb DCB)	50	25	100
1000 ppb (100 ppb DCB)	1000	500	1000
1500 ppb (150 ppb DCB)	150	75	100
2500 ppb (200 ppb DCB)	250	100	100

(1): The low level Aroclor 1016/1260 standard is 50 ppb and 12.5 ppb for the surrogate DCB (prepare by making a 2x dilution of the 100 ppb standard in hexane).

7.2.4. Surrogate Spiking Solution (soil and water)

A TCMX/DCB Surrogate Spike Mix is prepared by diluting 10 ml of Restek 32000 (see Table 1 above) to 200 ml of Acetone. Final solution concentration is 10 ug/ml. For reduced volume LVI preps a secondary dilution of this mix is utilized. This is prepared by diluting 20 ml of the 10 ug/ml solution to 100 ml acetone with a final solution concentration of 2 ug/ml.

7.2.5. Aroclor 1016/1260 Spiking Solution (soil, water and wipe)

An Aroclor 1660 Mix is prepared by diluting 10 ml of Restek 32039 (See Tables 1 and 2 above) to 100 ml acetone. Final solution concentration is 100 ug/ml. For reduced volume LVI preps a secondary dilution of this mix is utilized. This is prepared by diluting 20 ml of the 100 ug/ml solution to 200 ml with a final solution concentration of 20 ug/ml. used spiking soils and waters as received from Supelco without further dilution.

7.2.6. Individual Aroclor Calibration Solutions (1221, 1232, 1242, 1248, 1254, 1262 & 1268)

A 1000 ppb calibration standard is prepared for each remaining Aroclor from the stock standards detailed in Section 7.2.1. 200ul of 1000 ug/ml individual Aroclor solution and 100ul of 200 ug/ml TCMX/DCB is diluted to 200ml with Acetone. The final concentration of surrogates is 100 ppb.

7.2.7. Aroclor 1016/1260 Initial Calibration Verification (ICV) Standard Solution Preparation

A mid-point Aroclor 1016/1260 ICV standard is prepared using the second source Aroclor 1016/1260 Calibration Standard (Restek 32039.sec) detailed in Section 7.2.2. 1000 ul of 1000 ug/ml standard along with 500 ul of 200 ug/ml TCMX/DCB surrogate standard (Restek 32000) is diluted to 1000 ml with acetone for a final ICV concentration of 1 ug/ml (1000 ppb).

7.2.8. PCB Internal Standard Spike Mix (1 ug/ml)

The PCB 1 ug/ml internal standard spike mix is prepared by dilution 500ul of 1000 ug/ml of the 1-Bromo-2-Nitrobenzene standard (Restek 32279) in to 500 ml of Hexane. 20 ul of this solution is added to all standards, QC samples and field sample extracts prior to analysis.

7.2.9. System Performance Solution (3,3-DDT and Endrin at 0.25 ug/ml):
The DDT/Endrin performance solution is prepared by taking 250 ul of 500 ug/ml DDT/Endrin Mix (Supelco Catalog No 48282) and bringing it up to a volume of 500 ml with hexane.

8. Sample Collection, Preservation, Shipment and Storage

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client requests. Listed below are the holding times and the references that include preservation requirements.

Matrix	Sample Container	Min. Sample Size	Preservation	Holding Time	Reference
Waters	Amber glass, 250 ml (SW3510), 40 or 60 ml (SW3511)	250 ml (SW3510), 40 or 60 ml (SW3511)	Cool 4 ± 2°C	7 days to extraction; Analyze within 40 days of extraction	SW846
Soils	Glass, 2 or 4 oz	100 g	Cool 4 ± 2°C	14 days to extraction; Analyze within 40 days of extraction	SW846

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8.1. Extracts must be stored under refrigeration in the dark and analyzed within 40 days of extraction.

8.2. Samples from chlorinated water sources must be treated with sodium thiosulfate (0.008% solution) at the time of collection to remove chlorine. NOTE: containers pre-preserved with sodium thiosulfate must be requested in bottle orders for samples from chlorinated water sources.

9. Quality Control

9.1. **Sample QC** - The following quality control samples are prepared with each batch of samples.

Quality Controls	Frequency	Control Limit
Method Blank (MB)	1 in 20 or fewer samples	< Rpt. Limit
Laboratory Control Sample (LCS)[1]	1 in 20 or fewer samples	Statistical Limits [4]
Matrix Spike (MS)[2]	1 in 20 or fewer samples	Statistical Limits [4]
MS Duplicate (MSD)[2]	1 in 20 or fewer samples	Statistical Limits [4]
Surrogates	every sample[3]	Statistical Limits [4]
Internal Standard	every sample[3]	Response within -50% to +100% of most recent cal standard.

[1] LCS Duplicate (LCD) is performed only when insufficient sample is available for the MS/MSD or when requested by the client/project/contract.
[2] The sample selection for MS/MSD are randomly selected, unless specifically requested by a client….predetermined by the extraction lab.
[3] Analytical and QC samples (MB, LCS, MS/MSD)
[4] Statistical control limits are updated annually and are updated into LIMS.

9.1.1. **Method Blanks** are extracted with each sample batch on each day that samples are extracted. The analytical results for the method blank must fall below the reporting limit for each compound of interest. If a target compound is detected in the blank at a concentration higher than the reporting limit, first the extract is reanalyzed for confirmation. If results are still outside of limits the entire batch of samples extracted with the affected blank must be re-extracted and reanalyzed.

9.1.2. **Laboratory Control Sample (LCS):** A Laboratory Control Sample (LCS) or blank spike must be extracted and analyzed for with each batch of 20 environmental samples. The LCS data is used to assess method performance and serves to determine whether the methodology is in control at the time of preparation and analysis. The recoveries of the LCS must fall within lab generated acceptance criteria. If the LCS recovery results are outside QC limits, the extract is reanalyzed. If upon reanalysis the recoveries remain outside of recovery limits the following evaluations are made:

- If LCS results fall outside the laboratory generated limits with low recoveries (refer to the current TALS Method Limit Group database), the LCS and all associated samples should be re-extracted and re-analyzed.

- If LCS results fall outside the laboratory generated limits with high recoveries (refer to the current TALS Method Limit Group database), the LCS and associated sample results may be reported with an Non-Conformance Memo (NCM) detailing the issue.

9.1.3. **Matrix Spike/Matrix Spike Duplicate (MS/MSD):** A Matrix Spike/Matrix Spike Duplicate (MS/MSD) pair is extracted and analyzed with every batch of 20 environmental samples. MS/MSD recoveries are evaluated against lab generated limits (refer to the current TALS Method Limit Group database). If the MS/MSD recovery limits fall outside of lab limits the LCS recovery is evaluated. If the LCS recoveries meet criteria the data is reported and a Non-Conformance Memo (NCM) is written.

9.1.4. **Surrogate Standards:** All samples, blanks and QC samples are spiked with a 2 component surrogate standard mix containing TCMX & DCB (see Section 7.2). The percent recovery of the DCB surrogate standard is calculated and compared to lab generated limits (refer to the current TALS Method Limit Group database). (Note: the surrogate must pass CCV criteria to be reportable and must be reported from the same column as sample target analyte results). If the DCB recovery is outside of acceptance limits the sample extract is reanalyzed to confirm. If the recoveries are still outside of limits the sample must be re-extracted and reanalyzed or the data flagged as “estimated concentration”.

9.1.5. Internal Standard: The internal standard (1-bromo-2-nitrobenzne) must elute within 30 seconds of and have an area response of 50 to 100% as compared to the most recent preceding calibration standard.

9.2. Instrument QC

9.2.1. Initial Calibration Range and Initial Calibration Verification (ICV)

9.2.1.1. *Initial Calibration Range*: Aroclors 1016/1260 and the surrogate (DCB) are calibrated using a five-point calibration range using a minimum of five (5) peaks per Aroclor. The reporting limit (RL) is equal to the low point of the calibration range. The initial calibration block must include at least one level with Aroclor 1016 analyzed separately for pattern recognition purposes (note: this run does not need to be part of the actual calibration). If the 1016/1260 calibration meets the required average RF criteria all other Aroclors are then calibrated at the anticipated midpoint of the calibration range with a single point calibration using a minimum of five (5) peaks for each Arolcor (minimum of 3 peaks for Aroclor 1221). All peaks selected must be at least 25% the peak height of the largest peak in the Aroclor (except for Aroclor 1268 where the requirement is 10%). The following Aroclors can be analyzed together: 1016/1260, 1221/1254, 1232/1262 and 1242/1268. Standards are prepared following the instructions in Section 7.2.

9.2.1.2. *Initial Calibration Verification (ICV):* An Initial Calibration Verification (ICV) standard is analyzed immediately after the Initial Calibration Range and before any samples are analyzed. The ICV is prepared as detailed in Section 7.2.7 and must be from a source separate from the standards used in the Initial Calibration Range.

9.2.2. Continuing Calibration Verification (CCV): A mid-point Continuing Calibration Verification (CCV) standard (typically Aroclors 1016/1260) must be analyzed after every 20 samples at minimum. If the samples being analyzed are being specifically targeted for a different Aroclor, that Aroclor may be analyzed as the CCV instead of 1016/1260. If an Aroclor other than Aroclors 1016/1260 is detected a CCV of the identified Arolcor must be analyzed within 12 hours of the sample. If that CCV does not meet criteria the sample must be reanalyzed under an acceptable CCV using the detected Arolcor. The response factors for the CCV must be within +/- 20 % of the initial calibration RF.

9.2.3. Calibration Acceptance Summary

9.2.3.1. Retention Time Windows: Retention time (RT) windows must be determined for all analytes.

9.2.3.1.1 Initial determination of RT windows.

9.2.4.1.1.1. The center of the retention time (RT) window shall be updated based on the middle level in the initial calibration of the first CCV in the daily sequence, whichever is most recent.

9.2.3.1. **Initial Calibration Range**. The internal standard calibration technique is employed for this method. The response factor (defined as the ratio of the area to the standard concentration) is calculated for each characteristic peak in the Aroclor 1016/1260 standard at each calibration concentration. The percent relative standard deviation (% RSD) of the response factors for each individual peak in the Aroclor 1016/1260 mix on each column is then determined (both columns must pass calibration criteria).

9.2.3.1.1. Calculate the percent Relative Standard Deviation of the response factors for each compound at each level:

% RSD = (RF Standard Deviation/RF Mean) X 100

RF = Response Factor

9.2.3.1.2. Linear Calibration: If the % RSD is less than 20% over its working range for at least five peaks in the Aroclor 1016/1260 mix, the linearity of the range is assumed for all Aroclors over the same analytical range. Each individual peak's response factor is used for quantitation of all the samples and verification standards. The average of the value calculated for each individual peak is used to report the concentration in the samples.

9.2.3.1.3. Linear Calibration Using Least Squares Regression: If the % RSD is >20% for any given compound, a first order linear regression can be applied to the data to calculate the calibration curve and determine sample concentration. If this method is employed, the r squared value must be > 0.99 for the calibration to be acceptable

9.2.3.1.4. **Relative Standard Error:** The percent relative standard error (% RSE) from the calibration curve is used to evaluate the initial calibration. This provides a measure of how much error is associated with using the calibration curve for quantitation. The average Relative Standard Error (RSD for average response factors) of the calibration points from the curve used must be ≤ 20%.

Some data systems will not measure the %RSE from a linear or quadratic fit. For the linear case, the correlation coefficient may be used as an alternative to the %RSE, and must be greater than or equal to 0.990. For the

quadratic case the Coefficient of Determination may be used, and must be greater or equal to 0.990.

Note: The Relative Standard Error (RSE) is superior to the Correlation Coefficient (*r*) and Coefficient of Determination (r_2) for testing the fit of a set of calibration points to a line. The lower points on a curve have little effect on *r.* As a result, a curve may have a very good correlation coefficient (>0.990) while also having > 100% error at the low point

9.2.3.2. Initial Calibration Verification (ICV):

9.2.3.2.1. After the initial calibration range has been analyzed, an Initial Calibration Verification standard is analyzed on each column to verify the validity of the initial calibration range. The ICV standard must be from a standard lot independent of the standards used in the initial calibration range. The verification standard for PCBs is the mid-range Aroclor 1016/1260 standard at 1000ppb. (See Section 7.2.7 for details on the preparation of the ICV).

9.2.3.2.2. At least five characteristic peaks of each Aroclor 1016/1260 plus surrogates in the ICV must be checked to verify the Initial Calibration Verification. The calculated concentration of the ICV must be within ±20%D of the expected concentration. Should the %D exceed 20%, the analyst should take corrective action (check standard solution, perform instrument maintenance, etc.) and re-inject the ICV. If the %D still exceeds 20% after a single ICV reinjection, a new Initial Calibration Range must be analyzed.

9.2.3.3. Continuing Calibration Verification (CCV) and System Performance Check:

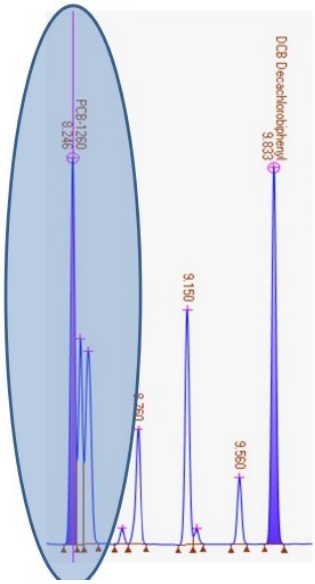
9.2.3.3.1. On each day of analysis the System Performance Check (see Section 7.2.9) is analyzed to assist in the evaluation of possible DDT interferences with the last major peak in Aroclor 1254.

9.2.3.3.2. A mid-point Continuing Calibration Verification (CCV) standard (typically Aroclors 1016/1260) must be analyzed after every 20 samples at minimum. If the samples being analyzed are being specifically targeted for a different Aroclor, that Aroclor may be analyzed as the CCV instead of 1016/1260.

9.2.3.3.3. If there are Aroclor hits in the associated samples then the calculated concentration of the CCV must be within

±20%D of the expected concentration on both columns. If there are no Aroclor hits in the associated samples one column may exceed the ±20%D criteria on the hight side (alternatively a low level Aroclor 1016/1260 standard may be analyzed to demonstrate adequate sensitivity. Should the foregoing criteria not be met the analyst must take corrective action (check standard solution, perform instrument maintenance, etc.) and re-inject the CCV. If the %D still exceeds 20% after a single CCV reinjection, a new Initial Calibration Range must be analyzed. The surrogate (DCB) must also meet CCV criteria on both columns.

9.2.3.3.4. Resolution (Aroclor 1260): The CCV level Aroclor 1016/1260 standard must meet the following resolution critieria: Resolution (degree of overlap) for the triplet towards the end of the 1260 chromatogram must be <75% on <u>one</u> of the two columns used. The resolution requirement must be met for peak 1/2 and peak 2/3:



The circled triplet of peaks is observed towards the end of the 1260 pattern on columns such as CLP 1. Minimum resolution (degree of overlap) requirement between peak 1 / 2 and peak 2 / 3 is <75%. This chromatogram shows overlap of about 50% between peak 2 and 3, and 30% between peak 1 and 2.

Resolution (degree of overlap) is calculated as

[Height of the valley / (Sum of the two peak heights / 2)] x 100%

The acceptance criteria for the Initial Calibration Range, the ICV and the CCV are detailed in the table below.

Step	Standards	Type	Control Limit	Frequency
Method # 8082A				
Initial Calibration Range	50, 500, 1000, 1500 and 2500 ppb for Aroclor 1016/1260, 1000 ppb for all remaining Aroclors	*Average response factor or 1st order linear regression*	*For average RF: <20%RSD all analytes. For linear regression: r^2 ≥0.990*	*Initially and as required when ICV or CCV do not meet requirements*
ICV	*1000 ppb*	*Average*	*± 20%D*	*Once after each initial calibration*
CCV	*1000 ppb*	*Average*	*± 20%D (see Section 9.2.3.4.2 for exceptions); Acceptable Resolution*	*Every 20 samples*
System Performance Standard			*For evaluation of DDT intereference with Ar1254*	*Once daily*

10. Procedure

10.1. Gas Chromatograph (GC) Operation

10.1.1. The sequence of events for GC analysis involves many steps. First the injection system and column performance and calibration must be verified. Maintenance operations are performed as needed. Then samples must be run on the instrument. Chromatograms and reports must be evaluated for content, integration and concentration. Re-runs and dilutions must be made based on the calibrations that were in effect at the time the sample was run. Lastly, a detailed analysis and calculations must be performed to determine the concentration of all the parameters for which the sample was analyzed.

10.1.2. General Instrument Operating Conditions:

10.1.2.1. **Injection System**: A splitless injection port with electronic pressure control (EPC) is used. Seventy-five seconds after sample injection, the purge valve is turned on to facilitate the sweeping of any remaining residual solvent/sample from the injection port.

10.1.2.2. The EPC is used in the pressure Ramp mode. The ramp pressure program is as follows:

Initial Pressure	InitialTime	Rate	Final Pressure	Hold
25 psi	0.50 min	20psi/min	15 psi	2.00 min
		8 psi/min	12 psi	6.60 min
		10.0 min	16 psi	2.00 min

10.1.2.3. For PCB analysis the normal operating conditions of the injection port are as follows:

Injection Temperature:	250ºC
Injection Port Pressure: Column flow:	25ml/min 33.2 ml/minute
Split vent flow:	60.0 ml/minute
Purge vent flow:	1.2 ml/minute
EPC:	Ramp pressure mode

10.1.2.4. In addition to the EPC, the injection port is also equipped with a siltek-coated glass double goose neck liner that contains a 1 cm glass wool plug. This liner/glass wool combination provides many functions.

10.1.2.5. The glass wool serves as a heat sink rapidly vaporizing solvent and samples resulting in higher response factors. The liner also protects the column head from accumulation of high boiling residuals and particulates.

10.1.2.6. Regular maintenance is performed on the injection port. When the glass wool/liner is changed, the septa also must be changed. Injection port, oven and detector temperatures are lowered to ambient prior to "cracking" the system. This is so as to introduce a minimum of damaging oxygen molecules into the system.

10.1.2.6.1. After the system has cooled, the old liner is removed. The injection port should be checked for particulate residues and cleaned as needed. A flashlight is usually required for this. After a new liner has been prepared it is placed into the injection port. A graphite seal is placed around the liner. The edges of the seal must be flat, not knife-edged, and free of nicks or burrs. If any of these conditions are not met, the graphite seal must be replaced as well. The graphite seal is critical to proper operation of the injection port. If in doubt, replace it.

10.1.2.6.2. The locking ring on the top of the injection port should be turned, with the wrench, about 1/8 turn past finger tight. The septum nut should never be tightened more than finger tight. After the injection port is reassembled, all column nuts inside the oven should be checked for leaks using Snoop (Supelco) or another suitable leak tester.

10.1.2.6.3. The septa should be changed each time the injection port is opened. Another routine maintenance operation

to improve column performance is the removal of the first 3 cm of the column.

10.1.2.6.4. Once the signal from both detectors has stabilized, it is time to re-heat the zones. The zones should be heated in the order of detectors, oven and then injectors. This is to ensure that volatilized contaminants do not condense on the column or detector.

10.1.2.7. Oven: With the megabore columns installed, temperature programming is employed to achieve higher resolution of compounds and shorter run times than could be accomplished using isothermal methods.

10.1.2.7.1. The oven program and pressure ramping for PCB analysis is employed for all columns as follows:

Initial Temp	Hold Time 1	Rate1	Temp1
164°C	0.0min	12°/min	234°C
Hold Time2	**Rate2**	**FinalTemp**	**FinalTime**
2.4 min	40°/min	325°C	1.5min

10.1.2.8. If the detectors are particularly contaminated, they must be sent to Agilent Technologies in Avondale, Pennsylvania for reconditioning. This should occur if the detector baseline is greater than 100 Hz. Detector reconditioning should be required at a maximum of biannually.

10.1.2.9. Chemstation: The Chemstation is utilized for automation of runs and acquisition. The system is dedicated to a single GC and does not multitask. Therefore, data manipulation cannot be done while sample analysis is in progress. The data system acquires and stores all chromatographic data.

10.1.2.10. Eurofins Chrom data processing software is used for the processing of the chromatography data files. Calibrations, verification standards and samples are processed and reviewed using this database. Chrom is integral to Eurofins LIMS (TALS) which is used to generate all reports.

10.2. Analytical Sequence

10.2.1. The instrument operating conditions should be set as detailed in Section 10.1.

10.2.2. Once instruments conditions have been established, the Initial Calibration Range, calibration verifications and retention time windows must be established Section 9.2.

10.2.3. The analytical sequence is established via the "SEQUENCE" macro of the Chemstation data system. The sequence file contains the name of Method file corresponding to the type of analysis to be performed, the range of samples to be run, and the number of injections per bottle. It is common practice to run the calibration and/or calibration verification standards, evaluate the instrument status, and, finally, (if all meet criteria) complete the Sample Table and Sequence File. If everything else is complete, the run is initiated using the START SEQUENCE soft-key of the SEQUENCE macro

10.2.4. An idealized analytical sequence including an Initial Calibration Range is presented in the table below.

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Idealized Analytical Sequence with Initial Calibration Range	
Injection Number	**Identification**
1	Hexane
2	Instrument Blank
3	Aroclor-1660 Level 1 Cal Std (50 ppb)
4	Aroclor-1660 Level 2 Cal Std (500 ppb)
5	Aroclor-1660 Level 3 Cal Std (1000ppb)
6	Aroclor-1660 Level 4 Cal Std (1500 ppb)
7	Aroclor-1660 Level 5 Cal Std (2500 ppb)
8	Aroclor-1221 Level 3 Cal Std (1000 ppb)
9	Aroclor-1232 Level 3 Cal Std (1000 ppb)
10	Aroclor-1242 Level 3 Cal Std (1000 ppb)
11	Aroclor-1248 Level 3 Cal Std (1000 ppb)
12	Aroclor-1254 Level 3 Cal Std (1000 ppb)
13	Aroclor-1262 Level 3 Cal Std (1000 ppb)
14	Aroclor-1268 Level 3 Cal Std (1000 ppb)
15	Initial Calibration Verification (Aroclor 1660)
16	Hexane
17	Continuing Calibration Verification (Aroclor1660)
18 thru 37	Client samples and QC Samples (MS/MSD, LCS, Method Blank)
19	Continuing Calibration Verification (Aroclor1660) (*every 20 samples*)

10.2.5. After each 20 samples a CCV standard mix must be analyzed. If this standard fails the criteria listed in Section 9.2.3.4, all samples analyzed during the previous period must be re-analyzed with a passing CCV.

10.2.6. PCB Data Reporting: The Chrom data system calculates the concentrations of the selected Aroclor Peaks. The reporting limit is based

on the concentration of the lowest standard in the initial calibration, adjusted for the sample wt/vol, final volume, dilution factor and % moisture (No unqualified analytical results or non detects may be reported which correspond to an extract concentration less than the lowest standard in the calibration range).

10.2.7.1. The quantitative values for all confirmed analytes must agree within 40% between the primary column and the confirmation column.

10.2.7.2. If the quantitative values do not agree within 40%, the discrepancy must be noted in the report with a qualification

10.3 Dual Column Approach

NOTE: Data generated under the NJDEP DKQP requires the reporting of the higher concentration in all cases unless it can be demonstrated that interfering compounds are the cause of the higher results in which case the lower value can be reported with a narrative explanation. Other programs may also require a dual column reporting approach different than the one described below in which case the lab will report as required by that program.

10.3.1. The laboratory designates the rear column as the primary column and the front column as the secondary column. Results are reported from the primary column unless the difference in concentration between the two columns results in ≥40% RPD in which case the lower concentration is reported (unless the client or program requirements dictate otherwise).

10.3.2. The values are calculated from the chromatographic peaks that fall within the daily retention time windows established from the most recent preceding calibration verification.

10.3.3. If the calculated values are greater than 40% RPD of each other, report the lower concentration regardless of whether that result is from the primary or secondary column. Report the result with a flag of P*.

10.3.4. If the surrogates on one column are very different (>40% RPD) compared to the other column, this may be indicative of a bad injection or columnar blockage. The sample should be reanalyzed. If similar results are obtained following reanalysis, report the lower of the two numbers and describe the circumstances in the job summary and report case narrative.

10.3.5. If one of the columns fails CCV criteria (but the CCV is between 15%-40% greater than expected value), the sample results shall be reported from the compliant column. If the recovery falls outside of acceptance criteria on the low side, reanalysis shall be performed.

10.3.6. If the CCV on one of the columns is more than 40% different from the correct value, it can be assumed that there has been significant drift on that column. The sample shall be reanalyzed against an acceptable calibration.

10.3.6.1. An exception to this requirement would be if the CCV recovery on one column fails on the high side and >40% RPD but the associated samples were non-detect for all target analytes on both columns. In this case the non-detect results may be reported from the compliant column.

10.3.7. In some cases where the sample chromatography is complex and has largely varying peaks concentrations, the chromatographic separation may not be sufficient on the 0.53mm ID columns. In this case a confirmatory analysis on an instrument with 0.32 ID columns may be required. The supplemental data produced using analysis on the 0.32mm ID 'microbore' column may minimize overlapping and baseline interference difficulties, and better resolves potential positive identifications. Use of this alternative chromatographic technique shall be noted in the job summary and report case narrative.

10.3.8. In summary, the flow chart in Attachment 1 presents a recommended approach to selecting the better number to report for dual column data. It shall be noted that these recommendations may be overridden by project specific requirements and that they cannot cover all eventualities. The complexity of some data set will require the final decision to be made utilizing the judgment of experienced analysts. In some cases further cleanup steps to remove interferences may be appropriate.

10.4 Extract Cleanup

10.4.1. Cleanup methods are dictated by the original sample matrix and the parameters being determined.

10.4.2. Cleanup of all water samples, if needed, is performed using Sulfuric Acid Permanganate and/or TBA sulfite. Refer to Eurofins Edison SOP No. ED-ORP-021: *The Removal of Elemental Sulfur from Pesticide/PCB Sample Extracts, SW846 Method 3660B,* most current revision and Eurofins Edison SOP No. ED-ORP-022: *Sulfuric Acid Cleanup for PCB Extracts, SW846 Method 3665A*, *SW846 Method 3665A,* most current revision. Blanks must also undergo cleanup following the same procedures as samples..

10.4.3. Cleanup of all soil samples is conducted using TBA sulfite and Sulfuric Acid Permanganate. Blanks must also undergo cleanup following the same procedures as samples.

10.4.4. Cleanup using Sulfuric Acid Permanganate effectively destroys the majority of organic material in the sample extract and should be used only when PCB is the only analysis to be performed on the sample extract.

10.5 Documentation

10.5.1 Before the analysis sequence is initiated the GC Performance and Repairs logbook must be filled out. It should contain the following information: date, injector temp, oven temp, detector temp, column A flow, column B flow, signal A, signal B, analysts initials, and notes for any necessary repairs.

10.5.2 After samples have been run, each standard and sample must be entered into the Instrument Run Log. The Instrument Run Log should contain the following information: run date, data file name, vial position, sample number, initial volume/weight, final volume, dilution factor method, job number, QA number, extraction date, lab prep batch, target batch signature of analyst at the bottom of each page, lot numbers for standards used, and result of run (O.K., dilution, non-inject, etc.).

11.0. Calculations / Data Reduction

11.1. Accuracy:

$$\text{ICV / CCV, LCS \% Recovery} = \frac{\text{observed concentration}}{\text{known concentration}} \times 100$$

$$\text{MS \% Recovery} = \frac{\text{(spiked sample) - (unspiked sample)}}{\text{spiked concentration}} \times 100$$

11.2. Precision (RPD):

$$\text{Matrix Duplicate (MD)} = \frac{|\text{orig. sample value - dup. sample value}|}{[(\text{orig. sample value + dup. sample value})/2]} \times 100$$

11.3. Calculation of Sample Amounts (Internal Standard Procedure)

11.3.1 Aqueous Samples

$$\text{Concentration } (\mu g/L) = \frac{(As)(Cis)(D)}{(Ais)(RF)(Vs)\ (Vi)\ (1000)}$$

Where:

As	=	Area of the target analyte peak in the sample
Cis	=	Concentration of the internal standard (ug/L)
D	=	Dilution factor, if the sample or extract was diluted prior to analysis. If no dilution is performed, D = 1.
Vi	=	Volume of the extract injected (ul)
Ais	=	Area of the internal standard peak
RF	=	Average response factor from the initial calibration.
Vs	=	Volume of sample extracted (ml)

The 1000 in the denominator represents the number of ul in 1 ml.

11.3.2 Solid Samples

$$\text{Concentration (µg/kg)} = \frac{(As)(Cis)(D)(Vt)}{(Ais)(RF)(Ws)\,(Vi)\,(1000)}$$

Where:

As	=	Area of the target analyte peak in the sample
Cis	=	Concentration of the internal standard (ug/L)
D	=	Dilution factor, if the sample or extract was diluted prior to analysis. If no dilution is performed, D = 1.
Vi	=	Volume of the extract injected (ul)
Ais	=	Area of the internal standard peak
RF	=	Average response factor from the initial calibration.
Vt	=	Volume of concentrated extract (ul)
Ws	=	Weight of sample (g)

The 1000 in the denominator represents the number of ul in 1 ml

11.3.3 Wipe Samples

$$\text{Concentration (µg/kg)} = \frac{(As)(Cis)(D)(Vt)}{(Ais)(RF)(W)\,(Vi)\,(1000)}$$

Where:

As	=	Area of the target analyte peak in the sample
Cis	=	Concentration of the internal standard (ug/L)
D	=	Dilution factor, if the sample or extract was diluted prior to analysis. If no dilution is performed, D = 1.
Vi	=	Volume of the extract injected (ul)
Ais	=	Area of the internal standard peak
RF	=	Average response factor from the initial calibration.
Vt	=	Volume of concentrated extract (ul)
W	=	Wipe

The 1000 in the denominator represents the number of ul in 1 ml

11.4 Relative Response Factors

$$RRF = \frac{A_x}{A_{is}} \times \frac{C_{is}}{C_x}$$

Where:

A_x = Area of target analyte peak
Ais = Area of internal standard peak
Cis = Concentration of internal standard
Cx = Concentration of compound in standard

11.5 Percent Relative Standard Deviation (% RSD):

$$\% \text{ RSD} = \frac{\text{Standard Deviation of RRFs}}{\text{Mean RRF}}$$

11.6 Percent Difference (% D):

$$\overline{\% \text{ D}} = \frac{RRF_c - \overline{RRF_i}}{\overline{RRF_i}} \times 100$$

Where: RRFc = RRF from continuing calibration

$\overline{RRF_i}$ = Mean RRF from current initial calibration

11.7 Relative Standard Error (RSE)

$$\%\,RSE = 100\% \times \sqrt{\frac{\sum_{i=1}^{N}\left[\frac{C_i - PC_i}{C_i}\right]^2}{(N-P)}}$$

Where:

N = Number of points in the curve
P = Number of parameters in the curve (= 1 for average response factor, 2 for linear, 3 for quadratic)
CI = True concentration for level i
PCi = Predicted concentration for level i

11.8 Percent Recovery (% R): Surrogates and Spikes

$$\text{Recovery (\%)} = \frac{\text{Concentration (or amount) found}}{\text{Concentration (or amount) added}} \times 100$$

11.9 Dry Weight Correction: All solid samples must be corrected for dry weight using the following formula for dry weight determination

$$DW = \frac{Gd}{Gw} \times 100$$

Where:

DW	=	Percent % Dry Weight
Gd	=	Dry weight of selected sample aliquot
Gw	=	Wet weight of selected sample aliquot

Multiply the DW value times the wet weight of the sample extracted.

NOTE: All dry weight corrections are made in TALS at the time the final report is prepared.

12.0. Method Performance

12.1. Method Detection Limit Study (MDL) The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure in Section 19 (Test Methods and Method Validation) of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM). MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method requirements require a greater frequency.

12.2. Lower Limit of Quantitation (LLOQ) (aka Reporting Limit) Verification: The LLOQ is the lowest concentration at which the laboratory has demonstrated target analytes can be reliably measured and reported with a certain degree of confidence, which must be ≥ the lowest point in the calibration curve. The lab verifies the LLOQ annually to demonstrate the capability of quantiation at lower analyte concentrations. The verification is performed by the extraction and analysis of an MDL spike at a concentration of 0.5-2 times the established LLOQ. Recovery of target analytes in the LLOQ verification should be within established in-house limits or within other such project-specific acceptance limits to demonstrate acceptable method performance at the LLOQ. Until the laboratory has sufficient data to determine acceptance limits, the LCS criteria ± 20% (i.e., lower limit minus 20% and upper limit plus 20%) will be used for the LLOQ acceptance criteria. The annual LLOQ verification is completed and documented with the required annual MDL evaluation.

12.3. Demonstration of Capabilities

For DOC procedure refer to Section 19 in the most current revision of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

12.4. Training Requirements

Refer to Eurofins SOP No. ED-GEN-022, *Training*, for the laboratory's training program.

13.0. Pollution Control

13.1. Pollution prevention encompasses any technique that reduces or eliminates the quantity or toxicity of waste at the point of generation. Numerous opportunities for pollution prevention exist in laboratory operation. The USEPA has established a prevention hierarchy of environmental management techniques that places pollution prevention as the management option of first choice. Whenever feasible, laboratory personnel should use pollution prevention techniques to address their waste generation. When wastes cannot be feasibly reduced at the source, the agency recommends recycling as the next best option.

13.2. The quantity of chemical purchased should be based on expected usage during its shelf life and disposal cost of unused material. Actual reagent preparation volumes should reflect anticipated usage

14.0. Waste Management

14.1. The U.S. Environmental Protection Agency requires that laboratory waste management practices conducted be consistent with all applicable rules and regulations. All waste will be disposed of in accordance with Federal, State and Local regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees will abide by this method and the policies in section 13 of the Corporate Safety Manual for "Waste Management and Pollution Prevention."

14.2. The following waste streams are generated as a result of this analysis:

- Auto sampler vials and expired standards: These vials are collected in satellite accumulation within the instrument laboratory. The vials are then placed into a 55 steel open top drum in the waste room. When the drums are full, the drum will be collected by the waste vendor for disposal. This waste is treated for incineration.
  Teris Profile Number: 50016652
  Onyx Profile WIP Number: 282493

- Mixed Solvent Waste: Mixed solvent waste is collected in a small beaker inside the bench top hood. This waste is then transferred into the satellite accumulation container in the Organic Prep. Lab. on a daily basis. This material is transferred into 5 gallon solvent cans as satellite accumulation. These cans are emptied every 24 hours into a steel drum in the waste room. This drum is kept in the walk in hood until it is full. The full drum is then

removed from the hood and placed on secondary containment in the waste room.

Teris Profile Number: 50016624
Onyx Profile WIP Number: 545240

- Soil Retain Samples - These samples if not flagged in the system for any hazardous constituents are transferred to poly-lined cubic yard boxes. These boxes when full are sent to stabilization or incineration. These materials are sent out as hazardous for lead and chromium

  Teris Profile Number (incineration): 50016710
  Onyx Profile Number: (stabilization) 402535

15.0. References / Cross-References

15.1. United States Environmental Protection Agency, "Method SW8000C: Determinative Chromatographic Separations,", Test Methods for Evaluating Solid Wastes, SW846, Revision 3, March 2003.

15.2. United States Environmental Protection Agency, "Method 8082A, Organochlorine Pesticide by Gas Chromatography", Test Methods for Evaluating Solid Wastes, SW846 Third Edition, Volume 1B: Laboratory Manual, Physical/Chemical Methods, Revision 1, February 2007.

15.3. Eurofins Edison Document No. ED-QA-LQM, *Laboratory Quality Manual*, most current revision.

15.4. Eurofins Edison SOP No. ED-ORP-014: *Extraction of Pesticides and PCBs in Water by Separatory Funnel, SW846 Method 3510C,* most current revision.

15.5. Eurofins Edison SOP No. ED-ORP-018*: Extraction of Pesticides/PCBs in Soil Using Low-Level Extraction, SW846 Method 3550B,* most current revision.

15.6. Eurofins Edison SOP ED-ORP-044, *Procedure for the Microwave Extraction of Solids, SW846 3546*

15.7. Eurofins Edison SOP No. ED-ORP-019*: Waste Dilution for Pesticides and PCBs, SW846 Method 3580A,* most current revision.

15.8. Eurofins Edison SOP No. ED-ORP-051: *Extraction of Semivolatile Organic Compounds in Water by Microextraction using SW846 Method 3511*

15.9. Eurofins Edison SOP No. ED-ORP-020*: Florisil Cleanup for Pesticide/PCB Sample Extracts*, SW846 Method 3620B, most current revision.

15.10. Eurofins Edison SOP No. ED-ORP-021: *The Removal of Elemental Sulfur from Pesticide/PCB Sample Extracts, SW846 Method 3660B,* most current revision.

15.11. Eurofins Edison SOP No. ED-ORP-022: *Sulfuric Acid Cleanup for PCB Extracts, SW846 Method 3665A*, *SW846 Method 3665A,* most current revision.

15.12. Eurofins Edison SOP No. ED-GEN-022, *Training,* most current revision.

15.13. Eurofins Corporate Work Instruction No. CA-T-WI-003, PCB Minimum Requirements, most current revision.

16.0. Method Modifications:

None

17.0. Attachments

Attachment 1: Dual Column Approach

18.0. Revision History

Revision 8, dated 06/07/2024

- Updated to include SW846 3511 as aqueous prep method.

Revision 7, dated 21 Oct 2022

- Section 4.5 added which details possible DDT and analogs interference with the last major DDT peak.
- Section 7.2.9: Added System Performance Standard (DDT/Endrin) for use in evaluating potential interference of DDT with last major Aroclor 1254 peak.
- Section 9.2.3.3.1: Added requirement to analyze System Performance standard daily for evaluation of DDT interference with Aroclor 1254 quantitation.

Revision 6 dated 17 Oct 2022

- Updated to Eurofins branding, removed TestAmerica references
- Added Section 8.2 to include requirement to treat samples from chlorinated sources with sodium thiosulfate
- Section 9.2.3.1.4: Section 9.2.4.3: Included details of evaluation of initial calibration for Relative Standard Error (RSE).
- Section 11.7: added formula for calculation of RSE.
- Section 12.2 added: details the annual LLOQ verification requirement.

Revision 5 dated 01 Apr 2020

- Updated to Eurofins branding
- Section 7.2.5: added wipe matrix
- Added Section 11.3.3 – calculation for wipe samples

Revision 4 dated 15 Dec 2016

- Section 7.2.8: clarified text to more accurately describe the PCB Internal Standard Mix.

Revision 3 dated 16 May 2016

- Section 2.1: removed SW846 3550 as a prep method for solids and added it as a prep method for wipe samples.
- Section 2.1.1 and 15.0: removed reference to SW846 Method 3520C (SOP No. ED-ORP-003: *Extraction of Semi-Volatile Organic Compounds in Water by Continuous Liquid-Liquid Extraction, SW846 Method 3520C).*
- Section 2.2: expanded to include reference to internal standard calibration.
- Section 7.1.1: revised to clarify that the primary carrier:make-up gas combo is hydrogen and nitrogen.
- Section 7.2.2: added 1-Bromo-2-nitrobenzene (internal standard) to the list of standards (Restek 32279). Components and concentration added to the table
- Added Section 7.2.8 which describes the preparation of the internal standard solution.
- Section 9.1: added internal standard to 'Sample QC' table
- Section 9.1.2: completely re-written to clarify LCS evaluation and corrective action.
- Section 9.1.4: clarified that surrogates must pass CCV criteria in order to be reportable and must be reported from the same column as target analyte results.
- Added Section 9.1.5 which describes acceptance criteria for internal standards (retention time and response)
- Section 9.2.1.1: added following sentence for clarity and compliance with TestAmerica PCB Minimum Requirements document (WI No. CA-T-WI-003): "All other Aroclors are calibrated using a single point calibration up to 8 peaks at the anticipated midpoint of the calibration range if the 1016/1260 calibration meets the required average RF criteria." Added language detailing which Aroclor standards can be analyzed together.
- Section 9.2.1.1: added this sentence: "The initial calibration block must include at least one level with 1016 analyzed separately for pattern recognition purposes (note: this run does not need to be part of the actual calibration)."
- Section 9.2.1.1: clarified that a minimum of five peaks are required for quantitation of each Aroclor (except for Aroclor 1221 which requires a minimum of three peaks). Added requirement that selected peaks must be at least 25% of height of largest peak in Aroclor (except Aroclor 1268 where the requirement is 10%).
- Section 9.2.2: Revised first sentence to read: "A mid-point Continuing Calibration Verification (CCV) standard must be analyzed after every 20 samples at minimum," (i.e., removed the closing CCV requirement and 12 hour requirement).
- Section 9.2.2: clarified that the CCV typically consists of a 1016/1260 standard. Also added the following sentence: "If the samples being analyzed are being

specifically targeted for a different Aroclor, that Aroclor may be analyzed as the CCV instead of 1016/1260."

- Section 9.2.2: added requirement to analyze a CCV for each detected Aroclor within 12 hours of detection.
- Table 2: updated with the expected RT acceptance criteria from Minimum Requirements document (0.03 minutes).
- Section 9.2.3.2: Revised 'External standard' to 'Internal Standard'. Emphasized that both columns must pass calibration criteria.
- Section 9.2.3.2.2: revised to require that 5 peaks must be selected (was 3) and evaluated for initial calibration (per corporate Minimum Requirements).
- Section 9.3.3.3.1: corrected section reference for preparation of ICV (was Section 7.2.9; now Section 7.2.7);
- Section 9.2.3.3.2: revised first sentence to read: "At least five characteristic peaks of each Aroclor 1016/1260 plus surrogates in the ICV must be checked to verify the Initial Calibration Verification." (it had previously required three peaks).
- Section 9.2.4.3.1: updated text reflect corporate Minimum Requirements document.
- Added Section 9.2.3.4.2: more fully describes CCV acceptance criteria and corrective actions. Updated table with calibration criteria.
- Added Section 9.2.3.4.3: details resolution requirements per the corporate Minimum Requirements document.
- Section 10.2.5: revised to remove 12 hour requirement (replaced solely with 20 sample requirement) and bracketing requirement. Corrected section reference for CCV acceptance criteria.
- Section 11: completely re-written to include internal standard result calculations and other required QC calculations.
- Section 15 (References): added following document reference: TestAmerica Corporate Work Instruction No. CA-T-WI-003, PCB Minimum Requirements, most current revision.
- Attachment 1: revised completely.

- Revision 2, dated 08 Jun 2015

  - Section 1.1: Corrected Method Limit Group (MLG) reference to 8082 (was incorrectly listed as 8081B,
  - Table 2: updated RLs for leachates from 0.0050 mg/L to 0.00050 mg/L.
  - Throughout document: updated the default initial volumes for aqueous preps (250 ml) and leachate (TCLP/SPLP/ASTM) preps (250 ml).
  - Throughout document: removed any notes referencing option for 'reduced volume' extractions since this is now standard as defined in SOP.
  - Section 2.2.2: replaced SW846 3541 (Soxtherm) prep with SW846 3546 (Microwave) prep.
  - Section 6.2.1 (and throughout document): replaced Target software references with references to TestAmerica's Chrom chromatography data processing software.
  - Section 7.2.2 and throughout document: updated source of standards from Supelco to Restek.
  - Section 7.2.3 and throughout document revised concentration of low calibration standard to 50 ppb.
  - Section 7.29: updated ICV prep instructions using Restek standards.

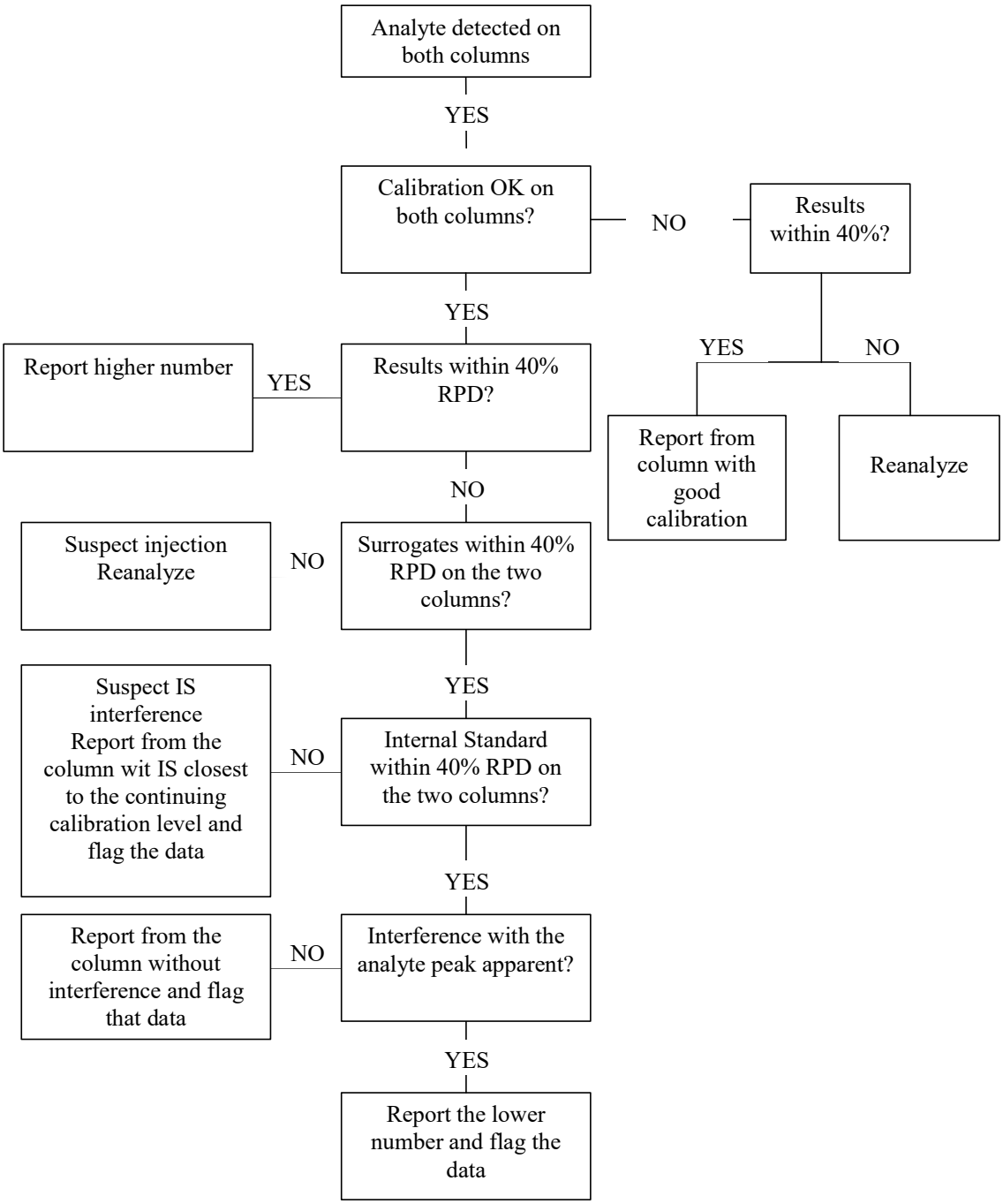
- Section 8: updated sample container from 1000ml to 250ml; updated minimum sample size to 250ml.
- Section 10.3: added note explaining NJDEP DKQP requirement to report the higher concentration in all cases.
- Section 10.3 and Attachment 1: revised to reflect current TestAmerica dual column reporting rules.
- Section 15: removed outdated references.

- Revision1, dated 11 October 2012

  - Throughout document: Revised LQM section references to reflect the most current LQM revision
  - Revised Table 2 to reflect RLs for reduced initial/final volume prep option.
  - Section 2.1.1: added description of reduced initial volume (125ml)/final volume (1ml) extraction option.
  - Section 2.1.2 and Section 15.0: Added reference to TestAmerica Edison SOP ED-ORP-044, *Procedure for the Microwave Extraction of Solids, SW846 3546.*
  - Section 7.2.3: added procedure for prep and analysis of a lower level Aroclor 1016/1260 standard (50 ppb) and for the surrogate DCB (12.5 ppb) when analyzing samples prepped using the reduced initial/final volume procedure.
  - Section 9.2.3.4.1: Added reference to 50 ppb 1016/1260 ICAL standard for the reduced initial/final volume method.
  - Section 10.2.4: Added 50 ppb 1016/1260 ICAL standard to the sequence for the reduced initial/final volume method

- Revision 0, dated 02/16/2011: NEW

Attachment 1
Dual Column Approach


Analyte detected on both columns
YES
Calibration OK on both columns?
NO
Results within 40%?
YES
NO
Report from column with good calibration
Reanalyze
YES
Report higher number
YES
Results within 40% RPD?
NO
Suspect injection Reanalyze
NO
Surrogates within 40% RPD on the two columns?
YES
Suspect IS interference Report from the column wit IS closest to the continuing calibration level and flag the data
NO
Internal Standard within 40% RPD on the two columns?
YES
Report from the column without interference and flag that data
NO
Interference with the analyte peak apparent?
YES
Report the lower number and flag the data

Title: Trace Metals Analysis for Water, Wastewater, Soil and Sediment Samples by ICP-MS EPA Method 200.8

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1.0 Scope and Application

1.1 Analytes, Matrix(s), and Reporting Limits

This SOP describes the procedures used to determine the concentration of various elements in surface, drinking, and ground water, wastewater, by Inductively Coupled Plasma - Mass Spectrometry (ICP-MS) using EPA Method 200.8.

The routine target analytes and reporting limits are as follows:

Table 1

Analyte List and Method Reporting Limits (RL)

Element	Drinking Water RL	Non-Drinking Water RL
	(ug/L)	200.8 NPDES (ug/L)
Aluminum (Al)	50	40
Antimony (Sb)	0.4	2
Arsenic (As)	1	2
Boron (B)	20	80
Barium (Ba)	2	4
Beryllium (Be)	0.3	0.8
Cadmium (Cd)	0.5	0.92
Calcium (Ca)	250	500
Cobalt (Co)	2.5	2
Chromium (Cr)	0.9	4
Copper (Cu)	2.5	4
Iron (Fe)	250	120
Lead (Pb)	2.0	1.2
Magnesium (Mg)	250	200
Manganese (Mn)	25	8
Molybdenum (Mo)	2.5	4
Nickel (Ni)	0.5	4
Potassium (K)	250	200
Selenium (Se)	8	2.5
Silver (Ag)	2.5	2
Sodium (Na)	250	500
Strontium (Sr)	2.5	4
Thallium (Tl)	0.3	0.5
Tin (Sn)	4	16
Titanium (Ti)	2.5	4
Vanadium (V)	2.5	4
Zinc (Zn)	20	16

On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in Sections 7 (Review of Work Request) and 19 (Test Methods and Method Validation) of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

2.0 Summary of Method

Prior to analysis by ICP-MS, the sample must be solubilized or digested using the sample preparation method appropriate to the matrix. Sample digestates are aspirated and nebulized into a spray chamber. A stream of argon gas carries the sample aerosol through the innermost of three concentric tubes and injects it into the middle of the donut-shaped plasma. The sample elements are dissociated, atomized, and excited to a higher energy level. The ions that are produced are entrained in the plasma and introduced, by means of an interface, into a mass spectrometer. The ions are sorted according to their mass to charge ratios and quantified with a channel mass spectrometer.

For total recoverable analysis of aqueous samples containing undissolved material and for drinking water samples with turbidity $\geq$ 1 NTU, samples must undergo digestion prior to analysis. Refer to Eurofins Edison SOP Nos. ED-MTP-001. For the determination of dissolved analytes in a filtered aqueous sample and in a drinking water sample with turbidity < 1 NTU, samples don't require digestion prior to analysis. Samples are ready for analysis after the addition of nitric acid.

3.0 Definitions

For a complete list of definitions refer to Appendix 5 in the most current revision of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

4.0 Interferences

4.1. Isobaric elemental interferences are caused by isotopes of different elements which form singly or doubly charged ions of the same nominal mass-to-charge ratio and which cannot be resolved by the mass spectrometer in use. Isobaric polyatomic/molecular ion interferences are caused by ions consisting of more than one atom which have the same nominal mass-to-charge ratio as the isotope of interest and which cannot be resolved by the mass spectrometer in use. Most isobaric interferences that could affect the ICP-MS analysis for elements in this SOP have been identified. These can be managed by the selection of an alternate isotope, the use of the collision/reaction cell (used for non-potable samples only), or by the use of elemental interference equations when the collision/reaction cell is not in use.

4.2. For Drinking Water analysis (standards, samples, and relating QC) the collision/reaction cell can not be used; therefore, the following interference equations should be used to reduce interferences:

Mass	Equation
6:	(6)*1 - (7)*0.082

44: (44)*1 - (88)*0.015
51: (51)*1 – (53)*3 + (52)*0.34
66: (66)*1 – (69)*0.00141
75: (75)*1 – (77)*2.9 + (82)*2.23 – (83)*2.23
82: (82)*1 – (83)*1
111: (111)*1 – (108)*1.073 + (106)*0.712
115 (115)*1 – (118)*0.016
208: (208)*1 + (206)*1 + (207)*1 (used for both drinking and non-drinking water analysis)

The basic elemental interference equations are based on natural isotopic abundances. The most precise coefficients for an instrument must be determined from the ratio of the net isotope signals that are observed for a known standard solution at a concentration sufficient to produce suitable counting statistics.

4.3. Krypton affects the determination of both arsenic and selenium but can be greatly reduced with the use of high purity Krypton free argon. Krypton must be analyzed for every sample and standard.

4.4. Physical interferences are effects associated with the sample nebulization and transport processes as well as ion-transmission efficiencies. Changes in viscosity can cause significant inaccuracies, especially in samples containing high concentrations of dissolved solids or high acid concentrations. These changes in matrix can cause significant signal suppression or enhancement. Dissolved solids can deposit on nebulizer tips and interface cones (reducing the orifice size and the instrument's performance). Internal standards can be used to correct for physical interferences if they are carefully matched to the analyte so that both elements react similarly to the matrix changes.

4.5. Memory interferences can occur when analytes from a previous sample contribute to signals measured from subsequent samples. The memory effects can result from analyte deposition of sample on the sample tubing, joints, nebulizer, spray chamber, torch, and/or interface cones. Routine maintenance on the sample introduction system is necessary in order to minimize the memory interferences. The memory effects must be taken into account when setting up a suitable rinse times. The evaluation of a minimum of three replicate integrations will help to determine memory problems.

4.6. Contamination of the sample can occur when the preparation glassware and/or reagents contain the target elements. Reagent blanks (method blanks) must be analyzed as a check on contamination due to the sample digestion.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001) and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1. Specific Safety Concerns or Requirements

The ICP plasma emits strong UV light and is harmful to vision. All analysts must avoid looking directly at the plasma.

5.2. Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material	Hazards	Exposure Limit (1)	Signs and symptoms of exposure
Hydrochloric Acid	Corrosive Poison	5 ppm-Ceiling	Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death. Can cause redness, pain, and severe skin burns. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Nitric Acid	Corrosive Oxidizer Poison	2 ppm-TWA 4 ppm-STEL	Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison. Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract. Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
1 – Exposure limit refers to the OSHA regulatory exposure limit.			

6.0 Equipment and Supplies

6.1. Instrumentation

- Agilent 7800 and Agilent 7900: inductively coupled plasma mass spectrometer with data system (microprocessor, monitor, printer) and autosampler. Mass Range 2-260 amu. Vacuum purged spectrophotometer with an axial plasma torch. Collision/Reaction Cell.

- Heat exchanger –PolyScience Model 6106T Recirculating Chiller or equivalent

- Autosampler – Agilent SPS 4 Autosampler

6.2. Supplies

- Reagent Water -18 megohm Reagent grade Type II water
- Volumetric Flasks (Class A): 50 mLs, 100 mLs, 500mls & 1000mls
- Eppendorf & Fisher Pipettes, varying volumes
- Polypropylene tubes

7.0. Reagents and Standards

7.1. Reagents

7.1.1. Concentrated Nitric Acid (HNO3) - Trace Grade or Equivalent; store at room temperature; for stability information, refer to manufacturer's instructions. The assay sheet of each lot of acid received into the lab must be reviewed to ensure the quality of the acid is sufficient for trace analysis of metals.

7.1.2. Concentrated Hydrochloric Acid (HCL) - Trace Grade or Equivalent; store at room temperature; for stability information, refer to manufacturer's instructions. The assay sheet of each lot of acid received into the lab must be reviewed to ensure the quality of the acid is sufficient for trace analysis of metals.

7.1.3. Argon supply - 99.9% (Liquid)

7.1.4. Helium and Hydrogen supply – 99.999% (Gas)

7.1.5. 18 megohm Reagent grade Type II water.

7.1.6. Reagent water, 2% HNO3 + 0.5% HCl by volume: Add 200ml of concentrated HNO3 and 50ml of concentrated HCl to deionized water and bring to 10 liter volume with deionized water. For potable samples not requiring digestion, the reagent water is prepared without HCL. Note: Always add acid to water. Record preparation in the TALS Reagent Module Prepare every 12 months or refer to manufacturer's expiration date; store at room temperature.

7.1.7. 5% HNO3 + 5% HCl: Add 1 liter of concentrated HNO3 and 1 liter of concentrated HCl to deionized water and bring to 20 liter volume with deionized water. For potable samples not requiring digestion, the reagent water is prepared without HCl. Varying amounts of this reagent may be made (e.g., 10L) by proportionally adjusting the volume of acids used. Note: Always add acid to water. Record preparation in the TALS Reagent Module Prepare every 12 months or refer to manufacturer's expiration date; store at room temperature.

7.2. Standards

Calibration and spike solutions are prepared from either certified stock solutions or from stock solutions purchased from vendors. Certificates of analysis or purity must be received with all neat compounds or stock solutions. Certificate of analysis are filed in Metals managers office.

Storage requirements: all standards are stored at room temperature

Shelf-life: Stock standards – refer to manufacturer's instructions
Working calibration standards – two weeks
Working Initial calibration verification standard – daily
Interference Check Standards (A&B) - weekly
Intermediate and all other standards – 6 months
(Note: expiration date must not go beyond the expiration date of the source stock).

Concentration: Final concentrations for the calibration standards are given in Attachment 1. All standards must be prepared in reagent water (Sec. 7.1.6 & 7.1.7).

Standards must be prepared in accordance to the shelf life (Sec 7.2) "or sooner if needed or required." "If needed" means the standard has been exhausted; "if required" means that the standard does not meet the QC criteria.

All standards must be prepared in reagent water (Sec. 7.1.6 and 7.1.7). Final concentrations for the calibration standards are given in Attachment 1. Varying amounts of these standards may be made by proportionally adjusting the volume of standards and reagent water used.

7.2.1. Calibration Standards: ICPMS-Cal (Custom Calibration Standard Stock Solution) purchased from Inorganic Ventures and from CPI International. Refer to manufacturer's instructions for stability and storage information.

6020B RL Standard (p/n IV-77460) contains: 20 mg/L Ca, K, Mg, Na
12 mg/L Fe
8 mg/L B
4 mg/L Al
1.6 mg/L Sn, Zn
0.09 mg/L Cd
0.8 mg/L Mn
0.4 mg/L Ba, Cr, Cu, Mo, Ni, Sr, Ti, V
0.25 mg/L Se
0.2 mg/L Ag, As, Co, Sb,
0.12 mg/L Pb
0.08 mg/L Be
0.05 mg/L Tl

TA-CAL-1 contains: 1,000 mg/L Si

100 mg/L As, Ba, Be, Cd, Co, Cr, Cu, Li, Mn, Mo, Ni, Pb, Sb, Se, Si, Sn, Sr, Ti, Tl, V

TA-CAL-2 contains: 1,000 mg/L Al, Ca, Fe, K, Mg, Na

Single Element Standard: Ag 1,000 mg/L

Single Element Standard: B 1,000 mg/L

Single Element Standard: Zn 1,000 mg/L

200.8 Potable RL Std contains: 25000 ug/L Ca, Fe, K, Mg, Na
2500 ug/L Al, Mn,
2000 ug/L B
800 ug/L Se
400 ug/L Sn, Zn,
250 ug/L Ag, Co, Cu, Mo, Sr, Ti, V
200 ug/L Ba, Pb
100 ug/L As
90 ug/L Cr
50 ug/L Cd, Ni
40 ug/L Sb
30 ug/L Be, Tl

7.2.2. Working Calibration Standards:

For Non-Drinking Waters:

CAL5: Add 100ml of 5% HNO3 / 5% HCl (Sec 7.1.7) to a clean 200ml flask. Add 0.4ml of TA-CAL-1 and 5ml of TA-CAL-2. Add 10 ml of MS-Cal-Int. Bring to volume with 5% HNO3 / 5% HCl.

CAL4/CCV: Add 20ml of 5% HNO3 / 5% HCl (Sec 7.1.7) to a clean 50ml polypropylene tube. Add 20ml of working Cal5 and mix. Alternatively, add 300ml of 5% HNO3 / 5% HCl (Sec 7.1.6) to a clean 500ml flask. Add 0.5ml of TA-CAL-1 and 6.25ml of TA-CAL-2. Add 12.5 ml of MS-Cal-Int (see Sec 7.2.2.1). Bring to volume with 5% HNO3 / 5% HCl.

CAL3: Add 15ml of 5% HNO3 / 5% HCl (Sec 7.1.7) to a clean 50ml polypropylene tube. Add 5ml of working Cal5 and mix.

CAL2: Add 100ml of 5% HNO3 / 5% HCl (Sec 7.1.7) to a clean 200ml flask. Add 10ml of 6020B RL Standard (p/n IV-77460). Bring to volume with 5% HNO3 / 5% HCl.

CAL1: Add 16ml of 5% HNO3 / 5% HCl (Sec 7.1.7) to a clean 50ml polypropylene tube. Add 4ml of working Cal2 and mix.

MS-Cal-Int: Add 100ml of 5% HNO3 / 5% HCl (Sec 7.1.7) to a clean 200ml flask. Add 2ml each of B and Zn. Add 0.4ml of Ag. Bring to volume with 5% HNO3 / 5% HCl (Sec 7.1.7).

For Drinking Waters:

CAL5: Add 100ml of reagent water (Sec 7.1.6) to a clean 200ml flask. Add 0.2ml TA-CAL-1, 0.5ml of TA-CAL-2, 0.04ml of 1000ppm B, and 0.02ml each of 1000ppm Ag & Zn. Bring to volume with reagent water (Sec 7.1.6).

CAL4/CCV: Add 10ml of reagent water (Sec 7.1.6) to a clean 50ml polypropylene tube. Add 10ml of Cal5 (drinking water) and mix.

CAL3: Add 15ml of reagent water (Sec 7.1.6) to a clean 50ml polypropylene tube. Add 5ml of Cal5 (drinking water) and mix.

CAL2: Add 18ml of reagent water (Sec 7.1.6) to a clean 50ml polypropylene tube. Add 2ml of Cal5 (drinking water) and mix.

CAL1: Add 100ml of reagent water to a clean 200mL flask. Add 2 mL of the 200.8 Potable RL Std. Bring to volume with reagent water (Sec 7.1.6). This standard is used as the Reporting Limit standard (CRI).

Note: see Attachment 1 for final elemental concentrations.

7.2.3. Initial Calibration Verification Stock standards: purchased from CPI International. Refer to manufacturer's instructions for stability and storage information. Standards must be from a different source than those used for the calibration standards.

TA-CAL1-SS contains: 1,000 mg/L Si
100 mg/L As, Ba, Be, Cd, Co, Cr, Cu, Li, Mn, Mo, Ni, Pb, Sb, Se, Si, Sn, Sr, Ti, Tl, V

TA-CAL2-SS contains: 1,000 mg/L Al, Ca, Fe, K, Mg, Na

2nd Source Single Element Standard: Ag 1,000 mg/L

2nd Source Single Element Standard: B 1,000 mg/L

2nd Source Single Element Standard: Zn 1,000 mg/L

7.2.4. ICV Working Standard:

7.2.4.1. ICV Potable: The ICV Working Standard must be at a concentration different from the concentrations used for the CCV working standard. Prepare by adding 100ml of reagent water (Sec 7.1.6) to a clean 500ml flask. Add 0.2ml TA-CAL-1-SS, 0.5ml of TA-CAL-2-SS, 0.04ml of 1000ppm B (2nd source std), and 0.02ml each of 1000ppm Ag & Zn (both 2nd source std). Bring to volume with reagent water (Sec 7.1.6). The final concentrations of the various elements are listed in Attachment 1. This standard is prepared fresh quarterly or as needed and stored at room temperature.

7.2.4.2. ICV Non-Potable: The ICV Working Standard must be at a concentration different from the concentrations used for the CCV working standard. Add 10ml of 5% HNO3 / 5% HCl (Sec 7.1.7) to a clean 50ml polypropylene tube. Add 10ml of working Interm_ICV (Sec 7.2.4.2.2) and mix. The final concentrations of the various elements are listed in Attachment 1. This standard is prepared fresh daily or as needed and store at room temperature.

7.2.4.2.1. MS-ICV-Int: Add 100ml of 5% HNO3 / 5% HCl (Sec 7.1.7) to a clean 200ml flask. Add 2ml each of 2nd Source: B & Zn. Add 0.4ml of 2nd Source: Ag. Bring to volume with 5% HNO3 / 5% HCl (Sec 7.1.7).

7.2.4.2.2. Interm ICV: Add 100ml of 5% HNO3 / 5% HCl (Sec 7.1.7) to a clean 200ml flask. Add 0.32ml of TA-CAL-1-SS and 1.6ml of TA-CAL-2-SS. Add 8 ml of MS-ICV-Int (see Sec 7.2.4.2.1). Bring to volume with 5% HNO3 / 5% HCl

7.2.5. Continuing Calibration Verification standard, Non-potable: see CAL4/CCV (Sec. 7.2.2).

7.2.6. Continuing Calibration Verification standard, Potable: see CAL4/CCV (Sec. 7.2.2).

7.2.7. Internal Standards and EPA Tune Check:

The following elements are used as the internal standards: Bi, In, Li6, Sc, Tb, and Ge.

7.2.7.1. Internal Standards Stock Solutions**:**

7.2.7.1.1. Internal Standard Multi-Element Mix 4 purchased from Agilent Technologies. Refer to manufacturer's instructions for stability and storage information. Contains: 50 mg/L each: ^{6}Li, Sc; 25 mg/L each: Ge, Te; 10 mg/L each: Bi, In, Tb.

7.2.7.1.2. Triton X-100 (Standard Stock Solution: Non-ionic

Surfactant) purchased from Fisher Scientific, p/n BP151-100. Refer to manufacturer's instructions for stability and storage information. According to the ICPMS manufacturer (Agilent Technologies), Triton-X 100 will reduce the 3 replicate %RSD during analysis.

7.2.7.2. Working Internal Standard Solution: *For Non-Potable*: Add 100ml of reagent water to a clean 1000ml flask. Add 5 ml of Internal Standard Multi-Element Mix 4 and 0.1 ml of Triton X-100. Bring to volume with reagent water. *For Potable*: Add 100ml of reagent water to a clean 250ml flask. Add 2.5 ml of Internal Standard Multi-Element Mix 4 and 0.05 ml of Triton X-100. Bring to volume with reagent water.

The following are the recommended analysis masses, tune steps, and internal standards:

Element	IS
Be9	Li6
B11	Li6
Na23	Sc45
Mg24	Sc45
Al27	Sc45
K39	Sc45
Ca40	Sc45
Ti47	Sc45
V51	Sc45
Cr52	Sc45
Mn55	Sc45
Fe56	Sc45
Co59	Sc45
Ni60	Sc45
Cu63	Sc45
Zn 66	Sc45
As75	Sc45
Se78	Sc45
Sr88	In115
Kr83**	(none)
Mo95	In115
Ag107	In115
Cd111	In115
Sn118	In115
Sb121	In115
Ba137	Tb159
Tl205	Bi209
Pb 208*	Bi209

*Pb 208 = Pb 208 + Pb 207 + Pb 206
**Kr83 is used for monitoring Krpyton levels only.

Different masses and internal standards may be utilized, as matrix issues deem necessary. Non-drinking waters are analyzed using collision/reaction cell technology (helium/hydrogen gas mode). Typical non-drinking water Collision/Reaction Cell usage: Calcium, Iron, and Selenium are analyzed in the Hydrogen reaction mode; Beryllium and Boron are analyzed in the No Gas mode; all other elements are analyzed in the helium collision mode. For drinking water analyses, collision cell technology is not allowed; therefore, the no-gas mode is utilized. Use masses Ca44, Fe57, Cu65, and Se82 instead of their respective masses listed above.

Tune check criteria:

Instrument tunes must be performed daily, before calibration. A solution at ~10ppb of Be, Mg, Co, In, and Pb is analyzed, and the precision, mass calibration, and resolution are checked. Resolution is checked by analyzing Magnesium isotopes 24, 25, 26 and Lead isotopes 206, 207, 208.

The following limits are used to evaluate mass calibration, resolution, and instrument stability:

The following limits are used to evaluate the tune:

Mass calibration: +/-0.1 amu
Resolution check: ≤0.9 amu at 10% peak height. Note: This also satisfies Method 200.8, 1.0 amu at 5% peak height)
Stability (5reps): <5%

7.2.7.3. EPA Tune Check Stock Standard: 2008TS purchased from Inorganic Ventures. Refer to manufacturer's instructions for stability and storage information. Contains: 10 ug/mL each: Be, Co, In, Mg, Pb.

7.2.7.4. Working EPA Tune Check Standard: add 100ml of reagent water to a clean 1000ml flask. Add 1 mL of 2008TS. Bring to volume with reagent water. This solution contains 10 ug/L of Be, Co, In, Mg, and Pb

7.2.8. Reporting Limit (CRI) Check standard:

For Non-Drinking Water: See Section 7.2.2, CAL1
For Drinking Water: See Section 7.2.2, CAL1.

7.2.9. ICP Interference Check Solutions: Stock solutions for ICSA and ICSAB, purchased from Inorganic Ventures (6020ICS-8A & 6020ICS-8B) and CPI International (TA-ICPMS-ICSA & TA-ICPMS-ICSAB), contains the following elemental concentrations:

TA-ICPMS-ICSA contains: 10000 mg/L Chloride; 2000 mg/L Carbon; 1000 mg/L ea: Al, Ca, Fe, K, Mg, Na, P, S; 20 mg/L ea: Mo, Ti

TA-ICPMS-ICSAB contains: 100 mg/L W; 10 mg/L ea: As, Ba, Be, Cd, Co, Cr, Cu, Li, Mn, Ni, Pb, Se, Si, Sn, Sr, V; 5 mg/L ea: Sb, Tl;

Single Element Standard: Ag 1,000 mg/L

Single Element Standard: Zn 1,000 mg/L

7.2.10. Working Interference Standards (ICSA/ICSAB):

For Non-Drinking Waters:

ICSA: Add 50ml of 5% HNO3 / 5% HCl (Sec 7.1.7) to a clean 100ml flask. Add 10ml of TA-ICPMS-ICSA stock solution. Bring to volume with 5% HNO3 / 5% HCl (Sec 7.1.7). This standard is made fresh weekly; store at room temperature. Refer to Attachment 2 for final elemental concentrations.

ICSAB: Add 50ml of 5% HNO3 / 5% HCl (Sec 7.1.7) to a clean 100ml flask. Add 10ml of TA-ICPMS-ICSA, 2 ml of TA-ICPMS-ICSAB, and 0.02 ml each of 1000 mg/L Ag and Zn. Bring to volume with 5% HNO3 / 5% HCl (Sec 7.1.7). This standard is made fresh weekly; store at room temperature. Refer to Attachment 2 for final elemental concentrations.

For Drinking Waters:

ICSA: Add 50ml of reagent water (Sec 7.1.6) to a clean 100ml flask. Add 2.5ml of TA-ICPMS-ICSA stock solution. Bring to volume with reagent water (Sec 7.1.6). This standard is made fresh weekly; store at room temperature. Refer to Attachment 2 for final elemental concentrations.

ICSAB: Add 50ml of reagent water (Sec 7.1.6) to a clean 100ml flask. Add 2.5ml of TA-ICPMS-ICSA, 0.5ml of TA-ICPMS-ICSAB, and 0.005ml each of 1000 mg/L Ag and Zn. Bring to volume with reagent water (Sec 7.1.6). This standard is made fresh weekly; store at room temperature. Refer to Attachment 2 for final elemental concentrations.

7.2.11. ICP-MS Matrix Spiking Solution, ICPMS LCS/SPK: purchased from High-Purity Standards. Refer to manufacturer's instructions for stability and storage information. Refer to attachment 2 for final elemental concentrations. Stock solution contains the following elemental concentrations:

Element	Conc. Of Stock (mg/L)
Aluminum (Al)	500
Antimony (Sb)	5
Arsenic (As)	10
Barium (Ba)	10
Beryllium (Be)	5
Boron (B)	100
Cadmium (Cd)	5
Calcium (Ca)	500
Chromium (Cr)	10
Cobalt (Co)	5
Copper (Cu)	10
Iron (Fe)	500
Lead (Pb)	5
Magnesium(Mg)	500
Manganese (Mn)	50
Molybdenum (Mo)	10
Nickel (Ni)	10
Potassium (K)	500
Selenium (Se)	10
Silver (Ag)	5
Sodium (Na)	500
Strontium (Sr)	10
Thallium (Tl)	4
Tin (Sn)	10
Titanium (Ti)	10
Vanadium (V)	10
Zinc (Zn)	50

8.0. Sample Collection, Preservation, Shipment and Storage

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client requests. Listed below are the holding times and the references that include preservation requirements.

Matrix	Sample Container	Min. Sample Size[2]	Preservation	Holding Time [1]	Reference
Metals Waters except Hg	Polyethylene or Glass	250 mLs	HNO_3 to pH < 2 prior to shipment; if not, acidify upon receipt in lab [3,4]	6 months	40 CFR Part 136.3

[1] Inclusive of digestion and analysis.
[2] Drinking water samples may require 1000ml sample volume.

[3] Acid preservation may be omitted for shipping; however, acid must be added upon receipt in the lab. Following acidification, mix the sample and hold for at least 24 hours. Just prior to digestion or direct analysis, verify pH<2. If pH≥2, repeat steps (i.e., add acid, hold for 24 hrs, verify ph<2).
[4] Aqueous samples may be stored at room temperature.

Note: If drinking water samples are properly preserved with nitric acid to a pH<2 and the turbidity is <1 NTU, then acid digestion is not required. The laboratory must maintain documentation of the turbidity reading.

Samples for dissolved metals should be filtered in the field before acid is added to the sample. If the sample is to be filtered in the lab, no preservative is added to the sample until the sample is filtered. Properly filtered and nitric preserved samples requiring analysis for dissolved analytes don't require digestion prior to analysis.

9.0. Quality Control

Note: If a batch of samples requires digestion, then the relating QC samples must be carried through the entire digestion process.

9.1. Sample QC - The following quality control samples are prepared with each batch of samples.

Quality Control	Frequency	Control Limit
Preparation blank	One per batch of twenty samples or less	**200.8**: < RL or <10% sample concentration.
Lab Control Sample Water (LCSW)	One per batch of twenty samples or less	**200.8**: +/- 15%
Matrix Duplicate	One in 20 or fewer samples	20% RPD
Matrix Spike (200.8)[1]	One, if 10 or less samples in batch; two, if 11 or more samples	70-130%
Matrix Spike Duplicate	When requested by client	70-130%; If MS and MSD are both ≥ 5X CRDL, then 20% RPD. If MS and MSD are less than the CRDL, the RPD is not calculated; otherwise ±CRDL.
Post Digestion Spike	One per batch of twenty samples or less	See Section 9.1.6.4

[1] The sample for MS is randomly selected, unless specifically requested by a client.

9.1.1. Preparation Blank/Method Blank: One laboratory method/preparation blank will be analyzed with each batch of samples prepared together (not to exceed 20 samples). Preparation blank is used to identify possible

contamination during acid digestion. results must be less than the reporting limit (RL) or less than 10% of the determined analyte concentration for a sample. If any analyte concentration in the blank is above the control limit, the batch must be prepared again for the element in question and the samples reanalyzed.

9.1.2. Laboratory Control Sample Water (LCS): A laboratory control sample must be analyzed with each group of samples digested. Refer to Water Matrix Spike concentration in Attachment 1 for final elemental concentrations. Results must be within the acceptable control limits, if not, all samples prepared in association with the LCS must be redigested and reanalyzed.

- Method 200.8: wastewater samples - prepare the LCS by adding 0.25 ml of ICP-MS LCS/SPK (Sec. 7.2.11) in 50 ml deionized water. Results must be within ± 15% of the true value.
- Method 200.8: drinking water samples - prepare the LCS by adding 0.10 ml of ICP-MS LCS/SPK (Sec. 7.2.11) in 50 ml deionized water. Results must be within ± 15% of the true value.
- For dissolved aqueous samples not undergoing a preparation procedure, the CCV may serve as the LCS.

9.1.3. Matrix Duplicate: A duplicate is analyzed for each batch of samples digested. The relative percent difference between the results of the sample and the duplicate must fall within 20% RPD for samples greater than five times the reporting limit.

9.1.5. Matrix Spike (MS): A matrix spike is prepared and analyzed for each batch of samples digested.

- For aqueous MS sample, spike 0.25 ml of ICP-MS LCS/SPK (Sec 7.2.11) into 50 ml sample.
- For drinking water MS sample spike 0.10 ml of ICP-MS LCS/SPK into 50 ml sample.
- Method 200.8: a recovery of 70-130% is required.
  An exception to this occurs if the sample concentration exceeds the spike concentration by a factor of four or more. If the recovery is not within specified limits a post digestion spike is required to be analyzed at a concentration between 10 to 100 times the instrument detection limit. If the Post digestion spike recovery is not recovered within 85-115% for 200.8, a matrix effect should be suspected. See Attachment 1 for final Matrix spike concentration for water and soil.

9.1.6. Post-Digestion Spike: To check for possible matrix interference, analyze a post digestion spike on a representative sample (minimum of 1 per batch). Post-Digestion Spike sample should be evaluated if serial dilution fails.

9.1.6.1. Transfer 10mL of a digestate to a suitable vial.

9.1.6.2. For Non-Potable samples, spike the sample with 0.05ml of ICP-MS LCS/SPK. For Potable samples, spike the sample with 0.01ml of ICP-MS LCS/SPK. Analyze the spiked aliquot and an

un-spiked aliquot (the un-spiked may have been analyzed previously and does not need to be reanalyzed). The final concentration of the post digestion spike is as follows:

Element	Non-Potable Post Spike concentration (ug/L)	Potable Post Spike concentration (ug/L)
Aluminum (Al)	2500	500
Antimony (Sb)	25	5
Arsenic (As)	50	10
Barium (Ba)	50	10
Beryllium (Be)	25	5
Boron (B)	100	20
Cadmium (Cd)	25	5
Calcium (Ca)	2500	500
Chromium (Cr)	50	10
Cobalt (Co)	25	5
Copper (Cu)	50	10
Iron (Fe)	2500	500
Lead (Pb)	25	5
Magnesium(Mg)	2500	500
Manganese (Mn)	250	50
Mercury (Hg)	2.5	0.5
Molybdenum (Mo)	50	10
Nickel (Ni)	50	10
Potassium (K)	2500	500
Selenium (Se)	50	10
Silver (Ag)	25	5
Sodium (Na)	2500	500
Strontium (Sr)	50	10
Thallium (Tl)	20	4
Tin (Sn)	50	10
Titanium (Ti)	50	10
Vanadium (V)	50	10
Zinc (Zn)	50	10

9.1.6.3. Calculate the percent recovery of the post digestion spike as follows:

$$\%REC = \frac{Cps - Cs}{C2} \otimes 100$$

Where: Cps = concentration of post digestion spike (ug/L)
Cs = concentration of un-spiked sample (ug/L)
C2 = concentration of spike (ug/L

9.1.6.4. Limits for post digestion spike recoveries: 85-115%. Results must be within the acceptable limits, if not, repeat analysis and/or re-prepare the sample and reanalyze. If necessary dilute the QC sample (DU, MS, and PDS) to compensate for the matrix effect and reanalyze.

The post digestion spike must not be applied to samples analyzed at a dilution that produces a significant negative response. The analyst must use good judgment when evaluating data where the sample response is negative. Where a significant negative response is present, the digestate should be diluted and reanalyze to determine the extent of the matrix interferences. If necessary, adjust the interference corrections and reanalyze the samples.

9.1.7. Matrix Spike Duplicate (MSD): A matrix spike duplicate is prepared and analyzed when requested by the client. See Sec 9.1.5 for spiking procedures and acceptance limits.

- If matrix spike sample and matrix spike duplicate are both ≥ CRDL, then 20% RPD. If matrix spike sample and matrix spike duplicate are less than the CRDL, the RPD is not calculated; otherwise, ±CRDL.

9.2. Instrument QC

Table 2 below describes the frequency, criteria, and corrective actions for the calibration and Quality control samples.

Table 2: Calibration, Quality control and Corrective Action Summary

QC Item	Frequency	Criteria	Corrective Action
Tune validation-Mass Calibration	Daily	Within 0.1amu from mass unit	Terminate analysis, fix problem and repeat
Tune validation-Resolution Check	Daily	≤0.9amu full width at 10% peak height	Terminate analysis, fix problem and repeat
Instrument Stability Check	Daily	<5% RSD for five replicates	Terminate analysis, fix problem and repeat
Initial Calibration: Multi-point-minimum 5 stds and 1 blank	Daily	Correlation ≥0.995	Recalibrate
Initial Calibration Verification Standard (ICV)	At the beginning of the analysis	+/- 10%	Recalibrate
Continuing Calibration Verification Standard (CCV)	At the beginning and end of the analysis, and every 10 samples	Within +/- 10% of the true value	Fix the problem and reanalyze the previous 10 samples.
Calibration Blank (ICB/CCB)	After ICV and every CCV	Absolute value of the calibration blank must be less than the RL.	Terminate the analysis, correct the problem and reanalyze the previous 10 samples
Interference check standards	At the beginning of an	Pay attention to false	If an element is

QC Item	Frequency	Criteria	Corrective Action
(ICSA/ICSAB)	analysis and after every 12 hours of analysis	positives and false negatives for elements not present in the solutions. Results of the spiked elements should fall within +/- 20%.	consistently out of the +/- 20% range in the ICSAB solution, the problem should be investigated.
Serial Dilution (1/5 dilution)	One per batch of twenty samples or less	See Section 9.2.6	
Reporting Limit Check Standard (CRI)	At the beginning of analysis run	For *non-drinking water* analysis: Recovery +/- 50% of the true concentration. For *drinking water* analysis: Recovery +/- 50% of the true concentration for Sb, Ba, Be, Cd, Cr, Ni, Tl. All others +/- 15% of the true concentration	Stop the analysis, fix the problem and reanalyze the affected samples
Internal Standards	Analyzed with every standard and sample	200.8- 60-125%	Standard-terminate the analysis and recalibrate Sample- dilute (The analyst should check the IS response for the bracketing CCV/CCBs to see if there is a similar response to the sample. Recalibration may be required.)

9.2.1. Initial Calibration Verification (ICV): Analyze an initial calibration verification solution at the beginning of the run. ICV solution must have the same acid matrix as the calibration standard and it must come from a source other than the calibration standard source. The final concentrations of the various elements are listed in Attachment 1. The results for the target elements in the initial calibration verification (ICV) must be within +/-10% of the true value. If results are outside of the specified limits, terminate the analysis, correct the problem and recalibrate the instrument. See Sec 7.2.4 for the ICV standard preparation instructions.

9.2.2. Continuing Calibration Verification (CCV): The calibration of the ICP-MS must be verified every 10 samples and at the end of the analysis run by analyzing the QC Check Solutions (CCV). For non-drinking waters, use Cal4/CCV. For drinking waters, use Cal3/CCV. The concentration of the CCV standard must be at or near mid-range levels of the calibration. The final concentrations of the various elements are listed in Attachment 1. The

results for the target compounds must be within +/-10% of the true value. If results are outside of the specified limits, terminate the analysis, correct the problem, recalibrate the instrument, and reanalyze the samples following the last good CCV.

9.2.3. Initial and Continuing Calibration Blank (ICB/CCB): ICB and CCB must be analyzed after the calibration curve, every 10 samples and at the end of the analytical run. The absolute value of the calibration verification blank must not exceed the reporting limit. If it does, terminate the analysis, correct the problem, recalibrate and reanalyze the samples following the last good CCB. Use reagent water for the blank solution.

9.2.4. Reporting Limit Check Standard (CRI): At the beginning of the analysis run verify the accuracy at the RL by analyzing a solution at the RL. RL/PQL Check Solution is analyzed to demonstrate that the ICPMS is capable of detecting the target compounds at the reporting limit (RL). For non-drinking water analysis, the determined concentration must be within +/-50% of the true concentration. For drinking water analysis, the determined concentration must be within +/-50% of the true concentration for Sb, Ba, Be, Cd, Cr, Ni, and Tl; for all others, +/-15% of true concentration. See Attachment 1 for list of Rep Lim standard concentration in ug/L. Refer to Sec 7.2.8 for the RL/PQL standard preparation instructions.

9.2.5. Interference Check Sample (ICSA & ICSAB): Verify the inter-element and background corrections by analyzing the interference check solutions (ICSA & ICSAB) at the beginning of the analysis run and after every 12 hours of analysis. The ICS is analyzed in order to demonstrate that proper corrections are being utilized for known interferences. Analyst must evaluate these solutions in order to detect trends that require corrective actions. Pay particular attention to false positives and false negatives for elements not present in the interference check solutions. Results should be within 20% of the true value for each element. See Attachment 2 for list of elements and the corresponding concentrations in ppb.

9.2.6. Serial Dilution QC Check: A 1/5 dilution is prepared and analyzed on one sample per batch (one for every ten samples for Method 200.8, or whichever is greater) to determine if matrix interferences are present.

9.2.6.1. Select a sample digestate that contains one or more target analytes at concentrations greater than 10X the reporting limit.

9.2.6.2. Dilute the digestate by a factor of 5 (DF=5) and analyze the dilution using the same procedures used for the un-diluted aliquot.

9.2.6.3. Compare the results of the diluted and un-diluted aliquots of sample digestate.

9.2.6.4. If the results of the dilution are within ±10% of the results of the undiluted sample, no matrix interference is present. If not, matrix interference should be suspected and the sample digestate should be subjected to a post-digestion spike.

9.2.7. Determination of Linear Range of the ICP-MS

Determine the linear dynamic range of the instrument by analyzing a minimum of three high standards at the upper limit of the instrument. The analytically determined concentration of these standards must be within 10% of the true value. The linear ranges should be redetermined annually or if the instrument is significantly changed.

9.2.7.1. Prepare the standard at concentrations that are expected to define the linear range of the instrument. The calibration standards and the linear range standards should be matrix matched; that is, they have the same percentage of hydrochloric and nitric acids. See Attachment 1 for Linear Range concentrations in ug/L.

9.2.7.2. Analyze the standard(s) after the initial calibration is validated.

9.2.7.3. Compare the concentration of the linear range standard with its true concentration using the following equation:

$$\text{Percent Difference} = \left|\frac{Ccal - Ctrue}{Ctrue}\right| \otimes 100$$

Where:
Ccal = concentration determined from analysis
Ctrue = true concentration of the standard

Note: If the percent difference is less than or equal to 10%, the linear range is confirmed at that concentration. If the percent difference is greater than 10%, repeat the analysis with a lower concentration. For elements validated in this manner you may report data up to 90% of that linear range before a dilution is required.

10.0. Procedure

10.1. Sample Preparation

10.1.1. For non-potable samples to be analyzed for total analytes by Method 200.8, follow Eurofins Edison SOP No. ED-MTP-001.

10.1.2. For Drinking water samples, if turbidity is ≥1, follow the digestion procedure for Total recoverable in Eurofins SOP No. ED-MTP-001.

10.2. Calibration

10.2.1. Turn the ICP-MS on and initiate the tune screen. Start the tune screen to allow the instrument to become thermally stable before beginning to analyze the calibration standards. While the instrument is warming up, aspirate the interference check solution (or similar solution) to precondition

the cones.

10.2.2. Check the tune parameters for the proper sensitivities, precision, oxides, and double charged values following the instrument manufacturer's recommendations. Refer to sections *Preparations Before Analysis*, *Plasma ON/Executing a Startup*, and *Appendix (Recommended Values for Tuning Parameters)* of the MassHunter Workstation User Guide (*Agilent Technologies 7800/7900, p/n G7201-90403).*

10.2.3. Prior to calibration, run an EPA Tune check solution. Refer to Sec. 7.2.7 for the Tune check criteria.

10.2.4. The instrument is required to be calibrated daily or once every 24 hours. For Non-Drinking Water analysis, use instrument method *BM New Method.icpms.template.* For Drinking Water analysis, use instrument method *DW New Method.icpms.template*. These are programs in the Mass Hunter Workstation software containing calibration standards, check tables, etc. Calibrate the instrument using a blank and five standards. Refer to the section *Creating a Method* in the instrument manufacturer's instructions *Agilent ICP-MS (7800/7900) MassHunter Workstation User Guide (p/n G7201-90403)*.

10.2.5. Internal standards are added to the calibration standards, blank and samples in-stream by the use of T-fitting.

10.2.6. Analyze the calibration standards and calibrate the ICP-MS in accordance with the manufacturer's recommendations and the Eurofins Corporate SOP No. CA-Q-S-005 Calibration Curves (General).

10.2.7. Calibration Curve Read-Back:

10.2.7.1. Low-Level readback – evaluate Cal 1 which is at the LLOQ. The %RE (relative error) must be +/- 50% (see Sec 11.4); if not, stop the analysis and recalibrate.

10.2.7.2. Mid-Level readback – evaluate Cal 4. The %RE (relative error) must be +/- 10% (see Sec 11.4); if not, stop the analysis and recalibrate.

10.3. Sample Analysis

10.3.1. All sample measurements must be made within 90% of the linear range of the instrument. Preparation of all reference materials used for calibration must be documented.

10.3.2. All potable and non-potable samples are typically analyzed undiluted. Dilutions must be prepared in reagent water (Sec 7.1.6 for Potable; Sec 7.1.7 for Non-Potable).

10.3.3. The samples are analyzed only after the ICB/CCB and ICV/CCV criteria are met.

10.3.4. The samples are analyzed in a sequence as follows:

Typical Analytical Sequence
INSTRUMENT WARM-UP (approx. 30 minutes)
TUNE CHECK
STANDARDIZATION/CALIBRATION (Blank, 5 Cal Stds)
ICV
ICB
CRI
ICSA
ICSAB
CCV
CCB
10 Samples
CCV
CCB
10 Samples
CCV
CCB
{continue until done; after 12 hrs run ICSA/ICSAB}

Note: The analytical sequence must end with the analysis of the CCV and CCB. The 10 samples include all QC samples/standards with the exception of CCVs and CCBs.

10.3.5. Determine the concentration of the samples and QC items using the procedures of Section 11.

10.3.5.1. If the sample concentration is greater than 90% of the linear range, the sample digestate must be diluted and reanalyzed.

10.3.5.2. The amount of sample digestate needed to prepare the desired dilution is determined from the following equation:

$$\text{V digest} = \frac{Vf\ vol}{DF}$$

Where:
Vf vol = final volume of diluted sample (mL)
V digest = volume of sample digestate used to make the dilution (mL)
DF = Dilution Factor

10.3.5.3. The dilution factor is calculated as follows:

$$\text{DF} = \frac{Vf\ vol}{V\ digest}$$

Where: Vf vol = final volume of diluted sample extract (mL)

V digest = volume of sample extract used to make the dilution (mL)

Note: The following examples are based on a final volume of 100mL. It may be more convenient to prepare dilutions at smaller final volumes.

EXAMPLE

A sample digestate is analyzed and one of the target analytes exceeds the linear range of the ICP-MS. 1.0mL of the digestate is added to a 100mL volumetric flask and the extract brought up to volume with reagent water. What is the dilution factor?

$$DF = \frac{100ml}{1.0ml} = 100$$

Some samples may require multiple dilutions; that is, a dilution of a dilution will have to be made. In this case, the final dilution factor is the product of the individual dilutions.

11.0. Calculations / Data Reduction

11.1. Accuracy:

$$\text{ICV / CCV, LCS \% Recovery} = \frac{\text{observed concentration}}{\text{known concentration}} \times 100$$

$$\text{MS \% Recovery} = \frac{\text{(spiked sample) - (unspiked sample)}}{\text{spiked concentration}} \times 100$$

11.2. Precision (RPD):

$$\text{Matrix Duplicate (MD)} = \frac{|\text{orig. sample value - dup. sample value}|}{[(\text{orig. sample value + dup. sample value})/2]} \times 100$$

11.3. Final results calculation:

$$\text{Concentration = ug/ L} = \frac{C \times V1 \times D}{V2}$$

Where:

C= Element concentration from instrument (ug/L)

V1= Final volume of sample digested (in liters)

D= Dilution performed on sample)

V2= Initial volume of sample digested

(in liters).

11.4. Relative Error (%RE):

% Relative Error = (100) (MC-TC)/TC

MC = Measured Concentration of the calibration standard
TC = True Concentration for the calibration standard

11.5. Data Reduction

11.5.1. All data is recorded directly into the TALS Analyst Desktop II program.

11.5.2. Standard and standard preparations must be documented in the Analyst Desktop II program located in Eurofins Laboratory System (TALS). The analyst must enter the following information: Source standard, Initial and final sample volume, spike name and amount used, all reagents and their corresponding lot numbers.

11.5.3. Generate Raw Data PDF file for TALS

11.5.3.1. Using a scanner, scan all raw data, i.e., instrument printouts. This includes, the calibration, calibration curve info, and all samples analyzed (includes instrument and batch QC). Attach the pdf to the Docs section of the analytical batch in TALS (ADII).

11.5.4. Complete the Data Review Checker (DRC) in TALS: Prior to data submission (i.e., prior to 1st leveling data in the Analyst Desktop II module in TALS), the analyst must execute the DRC (Data Review Checker) program in the applicable analytical batch.

11.5.4.1. Open the analytical batch and click on the Edit tab above to enter the Edit Mode.
11.5.4.2. Press F8 command key on the computer keyboard or right click anywhere on the batch worksheet then click on 'Run checklist.'
11.5.4.3. Acknowledge by filling in responses to all unacknowledged findings.
11.5.4.4. Fill in appropriate comments in the response box, then hit 'OK.'
11.5.4.5. Acknowledge all Finding items in the 'Manual Batch Checklist' except for the *"2nd Level review complete?"* this is to be completed by the 2nd level reviewer.

12.0. Method Performance

12.1. Method Detection Limit Study (MDL)

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is

present. The MDL is determined according to the laboratory's MDL procedure in Section 19 (Test Methods and Method Validation) of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM). MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method requirements require a greater frequency.

The IDL for EPA Method 200.8 is defined as the concentration equivalent to the analyte signal which is equal to 3 times the standard deviation of a series of ten replicate measurements of the calibration blank signal at the selected mass(es) and should be determined annually.

12.2. Demonstration of Capabilities

For DOC procedure refer to Section 19 in the most current revision of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

12.3. Training Requirements

Refer to Eurofins Edison SOP No. ED-GEN-022, Training, for the laboratory's training program.

13.0. Pollution Control

It is Eurofins's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention."

14.0. Waste Management

14.1. Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to Eurofins Edison SOP No. ED-SPM-008 (Laboratory Waste Disposal Procedures).

14.2. The following waste streams are produced when this method is carried out.

- Digested Samples: Corrosive Acid- Materials that are not above regulatory limits will be submitted for elementary neutralization. The neutralization system consists of a 55-gallon poly open top container. There is also a local snorkel exhaust for venting any noxious odors. Once the liquid is transferred into the container, the contents are sparged with air and a representative pH is measured and the amount of material is recorded in the discharge log. The pH value is recorded in the discharge log, and the liquid is neutralized to a pH of 6-9 SU using food grade sodium bicarbonate. Once the secondary pH has

been taken, confirmed and recorded, the discharge valve is opened to the municipal sewer system and the neutralization process is complete. The date, type of waste stream, and volume discharged are recorded on a discharge log.

- Samples above regulatory limits and expired RCRA metals standards (Waste Corrosive Liquid, Acidic, Inorganic, n.o.s.) are collected in satellite accumulation and sent off site through a Waste disposal vendor.
  TSDF under Veolia Profile Number: 590598

- Soil Retain Samples - These containers are stored in the main sample-receiving laboratory cooler until they are designated for disposal. Once designated for disposal, the samples are transferred to the waste disposal area and placed into cubic-yard disposal containers, e.g., Jupiter-boxes. This waste is shipped directly to the TSDF under Veolia Profile Number 402535 and is subject to incineration.

15.0. References / Cross-References

15.1. Methods for the Determination of Metals in Environmental Samples; US EPA Office of Research and Development. Washington, DC, May 1994. Method 200.8, Revision 5.4.

15.2. Eurofins Corporate SOP No. CA-Q-S-005, *Calibration Curves (General)*, most current revision.

15.3. Eurofins Edison Document No. ED-QA-LQM, *Laboratory Quality Manual*, most current revision.

15.4. Eurofins Edison SOP ED-GEN-022, *Training*, most current revision.

15.5. Eurofins Corporate Environmental Health and Safety Manual, Document No. CW-E-M-001, most current revision.

15.6. Eurofins Edison SOP ED-MTP-001, *Digestion of Aqueous Samples for Analysis by ICP and ICPMS USEPA Method No(s). 200.2, 200.7 (Rev 4.4), 200.8 & CLP SOW ISM01.2*, most current revision.

15.7. Agilent ICP-MS (7800/7900) MassHunter Workstation User Guide, p/n G7201-90403, Rev. A, June 2017

16.0. Method Modifications:

None

17.0. Attachments

Attachment 1: Standards and Matrix Spiking concentrations – Drinking water and non Drinking water.

Attachment 2: Interference Check standard elemental concentrations - Drinking water and non Drinking water.

18.0. Revision History

- **Revision 16, dated 16 April 2025**
  - Sec 1.1: Table 1: Updated the reporting limits of Cd, Co, and Tl for method 200.8 (non-potable water).
  - Sec 7.2.1: Updated the reporting limit stock standard for non-potable water, now using p/n IV-77460, Inorganic Ventures.
  - Sec 7.2.2: Updated Cal2 & Cal4/CCV preparation instructions for non-potable waters to reflect current procedure.
  - Sec 7.2.7.2: Removed Titanium from the list of analytes analyzed in the 'No-Gas' mode.
  - Attachment 1: Revised Cal-1 & Cal-2 concentrations for Co, Cd, and Tl to meet NJGWQ limits, non-potable waters.

- **Revision 15, dated 17 September 2024**
  - Sec 7.2 & 7.2.4.2: Updated the non-potable ICV preparation frequency to daily.
  - Sec 7.2.2: Updated the preparation procedures for Non-potable standards Cal1 and CCV4/CCV to reflect current procedures.
  - Sec 7.2.7.1.1: Replaced Internal standard stock solution Testamerica-1 with Internal Standard stock solution Multi-Element Mix 4.
  - Sec 7.2.7.1.2: Deleted stock standard MSGE-100PPM, no longer in use.
  - Sec 7.2.7.2: Updated preparation instructions for potable and non-potable Working Internal Standard solutions to reflect current practices
  - Sec 10.3.4 Removed LRC A, LRC B, and Rn Chks from the typical analytical sequence Table, not applicable to this method.
  - Attachment 1: Updated CAL4/CCV and CAL5 Matrix Spiking Concentrations for Drinking Waters.

- **Revision 14, dated 15 January 2023**
  - Sec 1.1, Table1: Updated reporting limit for Al and Zn in Drinking water, and Ca & Na for NPW to reflect current laboratory limits.
  - Sec 2.0 & 8.0: Clarified instructions for the analysis of dissolved samples (i.e., digestion not required for the analysis of dissolved samples).
  - Sec 7.2.2: Updated the preparation instructions for the Working calibration standards (drinking water and non-drinking water) to reflect current lab practices.
  - Sec 7.2.4.2.2: Updated the preparation instructions for the ICV Non-Potable.
  - Sec 7.2.4.2.2: Added preparation instructions for Interm_ICV std
  - Sec 7.2.6: Replaced CAL3/CCV with CAL4/CCV.
  - Sec 7.2.7.2: Updated preparation instructions for the potable Working Internal standard; Added titanium to the list of analytes in the no-gas mode; Updated concentration of tune check analytes.
  - Sec 7.2.7.4: Updated preparation instructions for the Working EPA Tune Check Std.
  - Sec 9.2, Table 2: Revised the minimum number of standards to 5 and 1 blank.
  - Sec 10.1: Revised to specify 'total analytes' for samples which require digestion prior to analysis.
  - Sec 14.2: Updated waste management information to reflect current practices.

- Attachment 1, Table for Drinking water standards: Updated Cal-3 standard concentrations to reflect current lab practices.

- **Revision 13, dated 08 October 2020**
  - Sec 1.1, Table1: Updated the Drinking water reporting limit concentrations for Sb, Ba, Be, Cd, Cr, Ni, Se, and Tl to reflect current laboratory limits.
  - Sec 3: Updated the Definitions locations as referenced in the Laboratory Quality Manual.
  - Sec 7.1.6: Updated the preparation instructions for the reagent water.
  - Sec 7.2: Added instructions to make varying amounts of standards
  - Sec 7.2.1: Removed stock standards TANJ-STD-1, TANJ-STD-2, TA-88, STLNJ-STD-1, STLNJ-STD-2, and TA-72REV2 from this SOP; Added stock standard 200.8 Potable RL standards.
  - Sec 7.2.2: Updated preparation instructions for Drinking Water standards.
  - Sec 7.2.3: Deleted stock standard ICV1ICPMS and ICV2ICPMS, no longer applicable.
  - Sec 7.2.4.1: Updated preparation instructions for ICV (Potable).
  - Sec 7.2.7.2: Added preparation instructions for the Potable working internal standard.
  - Sec 7.2.9: Deleted Interference stock standards 6020ICS-8A & 6020ICS-8B.
  - Sec 7.2.10: Updated preparation instructions for ICSA/ICSAB drinking water.
  - Sec 9.1.6.2: Updated Non-Potable PDS spiking instructions; updated Non-Potable PDS concentrations in Table.
  - Sec 9.2, Table 2 & Sec 9.2.4:Updated reporting limit (CRI) criteria limits for Sb, Ba, Be, Cd, Cr, Ni, Tl.
  - Sec 18.0, Attachment 1 (Potable): Updated calibration, ICV, CCV concentrations.
  - Sec 18.0, Attachment 2 (Potable): Updated ICSA & ICSAB concentrations

- **Revision 12, dated 18 June 2020**
  - Updated SOP header to Eurofins emblem.
  - Throughout the SOP removed all SW846 Method 6020 references.
  - For Non-Drinking Water preparations: Throughout the SOP, replaced all references to 2%HNO3/0.5%HCl with 5%HNO3/5%HCl.
  - Sec 1.1, Table 1: Removed references to typical dilutions and updated the RLs for Non-Drinking Water.
  - Sec 6.1: Added two ICPMS instruments, Agilent 7800 & 7900; removed reference to resolution and grating; added instrument mass range. Updated the models of the heat exchanger and autosampler.
  - Sec 7.1.7: Added preparation instructions for 5%HNO3/5%HCl.
  - Sec 7.2.1: Added CPI stock standard concentrations; CPI International is added as the vendor for the stock cal stds.
  - Sec 7.2.2: Updated preparation instructions for the non-drinking water working cal standards and added preparation instructions for MS-Cal-Int.
  - Sec 7.2.3: Updated the Initial calibration verification stock standards.
  - Sec 7.2.4.2: Updated preparation instructions for the non-potable ICV working standard.
  - Sec 7.2.4.2.1: Added preparation instructions for MS-ICV-Int.
  - Sec 7.2.7.1.2: Replaced Inorganic Ventures with CPI International as the vendor source for the Ge stock standard.

- Sec 7.2.7.2: Updated preparation instructions for the Internal standard. Changed recommended mass for Ca (non-potable) from 44 to 40. Updated typical referenced internal std for As & Se from Ge to Sc. Updated typical analysis mode for non-potable Ca & Fe. Added Ca44 as the typical mass used for Calcium during potable analysis.
- Sec 7.2.9 & 7.2.10: Added ICSA/ICSAB stock standards from CPI International and updated Non-Potable preparation instructions for working ICSA & ICSAB.
- Sec 9.1 & 9.11: Updated control limit criteria for the Preparation blank.
- Sec 9.1.2 & 9.1.5: Updated preparation instructions for the LCS water samples and aqueous matrix spikes (MS).
- Sec 10.2.2: Added reference material, MassHunter Workstation User Guide, for the ICPMS instruments 7800 & 7900. Removed references to ICPMS1&2 (includes Chemstation software and relating Operation Manuals) from this SOP.
- Sec 10.2.4: Added instrument method program and reference material, MassHunter Workstation User Guide, for the ICPMS instruments 7800 & 7900.
- Sec 10.2.7.1 & 10.2.7.2: Added Low-Level readback and Mid-Level readback evaluation instructions.
- Sec 10.3.2: Updated typical dilution instructions.
- Sec 10.3.4: Updated Typical Analytical Sequence table to reflect current laboratory practices.
- Sec 11.3.2: Added final results calculation instructions.
- Sec 11.5: Added %Relative Error calculation equation.
- Sec 11.6.5: Added instructions for the Data Review Checker (DRC); removed reference to the Metals data review checklist EDS-WI-146, not applicable.
- Sec 15.3, 15.11, & 15.12: Deleted references for the Agilent 7500 Manuals, not applicable.
- Sec 15.13: Deleted reference to the ICPMS Data Review Checklist, CA-Q-WI-044.
- Sec 15.14: Added reference for the Agilent ICPMS 7800/7900 User Guide.
- Sec 18.0, Attachment 1 (Non-Potable): Updated calibration, ICV, CCV concentrations; removed dilution instructions.
- Sec 18.0, Attachment 2 (Non-Potable & Potable): Updated ICSA & ICSAB analyte list and concentrations.

- **Revision 11, dated 26 April 2018**
  - Sec 7.2.7.4: Added Magnesium as one of the working tune check solution's constituents.
  - Sec 9.1.2: Revised to clarify the acceptance criteria used in the COA when evaluating recoveries for LCS in soil matrix.

- **Revision 10, dated 15 November 2016**

  - Sec 1.1, Table 1: Changed the Drinking water RL from 2.5 ug/L to 2 ug/L. Removed reference to Method 3005.
  - Sec 2.0: Removed reference to method 3005 and replaced SOP ED-MTP-007 with SOP ED-MTP-001.
  - Sec 7.1.6: Reagent recording in ICPMS Reagent Dilution logbook is replaced with TALS Reagent Module.
  - Sec 7.2.1: Replaced stock standard TA-72 with standard TA-72REV2.
  - Sec 7.2.2: Replaced standard TA-72 with TA-72REV2 for CAL1 standard-Drinking Water.

- Sec 7.2.7.2: Tune check criteria: updated the resolution check criteria to reflect laboratory practices.
- Sec 7.2.10: Added the preparation instructions for ICSA & ICSAB standards used when analyzing drinking water samples.
- Sec 9.2, Table 2: Updated Tune validation-Resolution Check criteria to reflect laboraotry practices
- Sec 10.1: Replaced SOP ED-MTP-007 reference with SOP ED-MTP-001.
- Sec 11.5.4: Replaced checklist CA-Q-WI-004 with Work Instruction EDS-WI-146.
- Attachment 1, Drinking water: Replaced the Calibration concentration and RL Std.Conc. of Pb from 2.5 to 2 ug/L.
- Attachment 2: Added ICSA & ICSAB elemental concentrations for Drinking water analysis.

- **Revision 9, dated 02 April 2015**

  - Throughout the SOP: Removed all reference to SOP# ED-MTP-002.
  - Sec 7.2.1: Added calibration standards TA-88 and TA-72.
  - Sec 7.2.2: Added the new low-level cal std (CAL2) for non-potable water and updated the preparation instructions for the potable cal standards.
  - Sec 7.2.7.1.3: Added Triton X-100 to the list of internal standard stock solutions.
  - Sec 7.2.7.2: Updated the preparation instruction of the working internal standard solution to include Triton X-100; Revised note to state that Selenium is now analyzed under the Hydrogen reaction mode.
  - Sec 7.2.8: CAL1 is now used as the RL check standard for drinking water analysis.
  - Sec 9.1.6.4: Added PDS recovery limits (85-115%) for method 200.8. Clarified the procedure when PDS is outside the acceptable limits.
  - Sec 9.1 and 9.1.7: Added Matrix Spike Duplicate (MSD) to the list of Sample QC.
  - Sec 11.5.4: Updated the metals data review checklist form number.
  - Sec 15.13: Added TestAmerica Corp form No. CA-Q-WI-044 to the list of references.
  - Attachment 1 (non-Drinking Waters): Updated the calibration concentrations for all metals; updated the matrix spike concentration for Zinc (water & soil).
  - Attachment 1 (Drinking Waters): Updated the calibration concentrations for As, B,Sn and Zn.

- **Revision 8, dated 05 December 2012**

  - Sec 1 and 12: Updated LQM section references to reflect the most current LQM revision.
  - Sec 2.0: Deleted the exception that silver analysis does not undergo digestion. Silver may be directly analyzed for drinking waters provided the turibidity <1.
  - Sec 7.1.6: Revised to include the reagent water prep for potable samples not requiring digestion. Revised preparation frequency to 12 months to reflect actual laboratory practices.
  - Sec 7.2.2 & 7.2.3: Sections deleted to remove Hg stock standard info and the preparation instructions of Hg intermediate standard; subsequent sections adjusted accordingly.
  - Sec 7.2.2 (formerly Sec 7.2.4): Removed all references to Hg. Clarified M1CAL3 as the reporting limit for Drinking Water standard. Clarified M1CAL2 is not the reporting limit for Boron.
  - Sec 7.2.3 and 7.2.4 (formerly Sec 7.2.5 & 7.2.6): Hg references have been removed.
  - Sec 7.2.6: Section added; subsequent sections adjusted accordingly.

- Sec 7.2.7 (formerly Sec 7.2.8): Added 'EPA Tune Check' to the section header. Removed the use of gold standard from this SOP. Hg is not analyzed by this method.
- Sec 7.2.7.1. Added internal standard stock solutions.
- Sec 7.2.7.2: Added internal standard preparation instructions. Also clarified that drinking water samples are analyzed without the use of collision cell technology.
- Sec 7.2.7.3: Added Tune Check stock standard
- Sec 7.2.7.4: Added preparation instructions of the EPA Tune Check standard.
- Sec 7.2.11 (formerly Sec 7.2.12): Changed standard vendor for the Matrix spike stock solution to High-Purity Standards.
- Sec 8: Revised the wait time for sample preparation after in-lab preservation to 24 hours to comply with the updated 40CFR Part 136.
- Sec 9.1: Preparation Blank's control limits have been updated to reflect method requirements.
- Sec 9 and 10: Revised section references of standard solutions where applicable.
- Sec 10.1.2: Revised SOP number reference to reflect actual laboratory practices.
- Sec 10.2.2: Included Tuning Handbook reference for ICPMS2.
- Sec 10.2.4: Included Operation Manual for Masshunter software to ICPMS2.
- Sec 11.5: Added instructions for data recording, raw data PDF creations and Metals Data Review Checklist.
- Sec 15.4: Deleted SOP No. ED-MTP-007 reference, not applicable; subsequent sections adjusted accordingly.
- Sec 15.11 through 15.13: Added applicable references.
- Sec 17.0: Attachments 3 and 4 have been removed.
- Attachment 1: Deleted 'Linear range conc.' column; new linear range studies are updated on instruments. Updated MS concentration for Boron.

- **Revision 7, dated 16 July 2010**

  - Sec 1.1 Table 1: Revised Reporting Limits for drinking water and Soil.
  - Sec 3: Revised definitions reference to Appendix 2 of ED-QA-LQM.
  - Sec 7.2.1: Added STLNJ-STD-1 and STLNJ-STD-2 to the list of Calibration Stds
  - Sec 7.2.4: Revised working calibration standard including preparation procedure to reflect actual lab practices.
  - Sec 7.2.9: Revised prep procedure for RL check standard. Also deleted RL/PQL working standard, previously section 7.2.10. Subsequent sections adjusted accordingly.
  - Sec 18.0 Attachment 1: Table updated to reflect correct calibration standard concentrations and drinking water reporting limits.

- **Revision 6, dated 11 September 2009**

  - Sec 9.2 Table 2 & Sec. 9.2.4: Revised Reporting limit criteria for drinking water analysis to ± 15%.

- **Revision 5, dated 08 July 2009**

  - Sec 4.1: Expanded section to include the isobaric polyatomic/molecular ion interferences; clarified using collision/reaction cell for non-potable samples only.
  - Sec 4.2: Added equations used for drinking water analysis when collision/reaction cell can not be used.
  - Sec 4.3: Added Krypton interference which affects arsenic and selenium, and the

use of high purity Krypton free argon.
- Sec 6.1 Instrumentation: Add collision/reaction cell.
- Sec 7.2.4: Added a low calibration standard (M1CAL1) increasing the number of calibration standards to five; five cal standards will only be analyzed for elements Be, Fe, Pb and Mn.
- Sec 7.2.8: Added Kr83 in the list of elements in order to monitor Kr levels.
- Added text in Tune check criteria, Sec 7.2.8: *Resolution is checked by analyzing Magnesium isotopes 24, 25, 26 and Lead isotopes 206, 207, 208.*
- Sec 8: Clarified holding time and procedure for acidifying unpreserved samples.
- Sec 9: Added text: *If a batch of samples requires digestion, then the relating QC samples must be carried through the entire digestion process.*
- Sec 9.1 & 9.1.2: Changed LCS control limit for Method 6020 from ± 25% to ± 20%.
- Sec 9.2.2: CCV standard- changed solution to M1CAL4.
- Sec 10.2.4: Calibration- changed the number of standards from three to four standards.
- Sec 10.3.2: Added in the procedure the requirement for diluting samples 5x (water) and 20x (soil) prior to analysis; subsequent section numbers were adjusted accordingly.
- Sec 10.3.5.1: revised to include that samples will be diluted if the concentration is >90% of the linear range.
- Attachment 1: Revised calibration standard concentration specifically Cal std 2 to reflect the correct concentration. Additionally, a fifth cal standard was added to the four elements (Be, Fe, Pb, and Mn) so the RL will be at or above the low level standard; Reporting limits were also revised for these elements.
- Attachment 3: Revised dilution requirement for soil analysis from 10x to 20x.

- **Revision 4, dated 24 March 2009**
  - Revised SOP format in accordance with TestAmerica Corporate Quality SOP No. CW-QS-002 (Rev 0) Writing a Standard Operating Procedure (SOP).
  - Section 1.1: Relocated Table 1 to this section. Updated 6020 Soil RLs. Revised several RLs for Drinking Water and Digested Water
  - Sec. 2: Added the method and SOP references for digestion of samples to be analyzed for metals via ICPMS.
  - Sec 6.1: Added Heat exchanger and autosampler to the list of instruments.
  - Sec 7.1.6: Added reagent water and its prep instructions to the list of reagents.
  - Sec 7.2 Standards: Included vendor and storage information of standards.
  - Sec 7.2.2: Revised the vendor source and stock concentration of the Hg standard from 1000 ppm to 10 ppm; revised preparation instructions of the Intermediate standard (Hg-Cal-Int).
  - Sec 7.2.4: Revised prep instructions for the working calibration standards (i.e. amount of spiking solution and final volume).
  - Sec 7.2.5: Deleted ICV stock standards STLNJ-Cal 6 & 7 and added ICV stock standards ICVICPMS and ICV2ICPMS.
  - Hg Secondary stock solution in Sec 7.2.5: Revised the vendor source and stock concentration of the Hg secondary standard from 1000 ppm to 10 ppm; revised preparation instructions of the Intermediate standard (Hg-ICV-Int).
  - Sec. 7.2.8: added statement: “Drinking Water Analysis: All tune steps = 3 (thereby eliminating the use of the Collision/Reaction Cell.) Use masses Fe57, Cu65, and Se82 instead of their respective masses listed above.”
  - Sec 7.2.9: Deleted ICPMS RL stock standard and added custom standards (STLNJ-STD-1 & 2) for Reporting Limit Check standard.

- Sec 7.2.10: Revised prep instructions for the RL/PQL Working standard.
- Sec 7.2.11: Revised prep instructions for the Working Interference check standards (final volume reduced from 100ml to 50ml; spiking amount adjusted).
- Sec 8: Sample collection, preservation and storage: Reformat section into Table format and included minimum sample size and reference information.
- Sec. 9.1: Added prep instruction to the QC samples (MB, LCS, BS and MS).
- Deleted Single point method of standard addition; previously identified Sec.9.2.8.
- Sec 10.1: Clarified the digestion procedure utilized for digesting different matrices (wastewater, drinking water and soil).
- Sec 15: Added applicable references.
- Sec 17: Added Attachment 2 (Interference Check Standard elemental concentrations).

- **Revision 3, dated March 2007**
  - Section 16. Attachment 1. Modified the 'Linear Range Concentration' of 11 elements (Sb, Be, B, Cd, Co, Pb, Se, Ag, Sr, Tl, V) to reflect the most recent LDR study.

- **Revision 2**, **dated February 2007**
  - Revised various sections of the SOP to include the specific sections in the Operator's manual where applicable information can be found. These sections are Sec. 5.3, 10.1.2., 10.1.3, Appendix A – Analytical Sequence Table.
  - Section 6.3 Calibration Standards. Modified the frequency for the preparation of calibration standards from six months to two weeks as per Method 200.8.
  - Section 6.4. Linearity Check Standards. Revised the HNO3 acid concentration used in the preparation of linearity check solutions to '2% by volume' to reflect actual laboratory practices.
  - Section 6.5 (Internal Standards). Revised the concentration of the element Au, both spiking and resulting concentrations.

    '*A solution of 1 mg/L (internal standard elements) and 2 mg/L of Au is prepared and added in-stream by the use of a T-fitting. The resulting concentration (in-stream) of the standard is ~100 ug/L (Au) and ~50 ug/L (internal standard elements).'*

  - Section 7.4. Section deleted; contents not applicable to this SOP.
  - Section 8.1.1 (MDL and IDL determination). Modified the solution used in the analysis of IDL to 'reagent blank solution' to reflect actual laboratory practices.
  - Section 8.1.2 (MDL and IDL determination). Added an SOP reference to further describe MDL determination.
  - Section 10.3.2. The name of the Reporting limit solution in the analysis sequence was changed from 'Detection Limit Check Solution' to 'Reporting Limit Standard (RL).'
  - Section 15.1, deleted; reference not applicable. Subsequent section numbers adjusted accordingly.
  - Section 15.1 (previously identified as section 15.2), was revised to include the specific method in the reference information, in this case method 6020.
  - Section 15.2 (previously identified as section 15.3), was revised to include the specific method in the reference information, in this case method 200.8.
  - Section 15.6. Added Operator's instructions manual in the list of references. The section previously identified as 15.6 is now 15.5.

- Section 16. Attachment 1. Modified the 'Linear Range Conc. (ug/L)' to reflect the most recent LDR study. Updated the 'RL Std. conc.' for Boron, Iron, Tin and Zinc to reflect actual laboratory's reporting limits for these elements.
- Appendix A (Sample Preparation). Specified the name of the SOP used in the digestion of samples.
- Appendix A (Calibration, Quality Control and Corrective action summary). Revised the criteria for the ICSA/ICSAB to clarify that ICSA when used as linear range sample the determined analyte concentrations >90% must be diluted and reanalyzed.
- Appendix B (ICV Solution). Added the frequency for the preparation of the ICV solution.

- **Revision 1, dated January 2007**

  - Specified Operator's manual '*Agilent 7500 ICP-MS Chemstation (G1834B)*' in various sections: Sections 5.3, 10.1.2, 10.1.3, Appendix A – Analytical Sequence section.
  - All references to '6020A' are updated to '6020' to reflect actual method reference (i.e. sections 1.1, 2.2, 8.1.2 etc.).
  - Section 10.1.3. Filename '2008.M' is specified as the program/filename used in the ChemStation software.
  - Section 16 Table 1. Updated Reporting limits of 8 elements (As, Cd, Co, Cu, Ni, Ag, Sr, Sn) to reflect current standard concentrations and laboratory's reporting limits.
  - Section 16 Attachment 1. Revised Matrix spike concentrations for water and soil to include the actual final expected concentrations of the matrix spike.
  - Appendix B – Calibration, Quality Control and Corrective action summary. Criteria for internal standards was changed from >30% to 30-120% to reflect actual method criteria limits.
  - Appendix B – ICP Interference Check Solutions for SW846 6020. Added the frequency of preparation for the Working Interference Standards ICSA and ICSAB, 'these standards are made fresh weekly.'
  - Appendix B. Added data qualifiers for ICP-MS
  - Section 15.4. Added USEPA CLP ILM05.3 to the list of references.

Attachment 1

STANDARDS AND MATRIX SPIKING CONCENTRATIONS
For Non-Drinking Waters

Name	Mass	Cal1 CRI	Cal-2	Cal-3	Cal-4/CCV	Cal-5	ICV	*LCS/MS Conc*
		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	*(ug/L)*
Be	9	0.8	4	50	100	200	80	*25*
B	11	80	400	125	250	500	200	*500*
Na	23	200	1000	12500	25000	50000	20000	*2500*
Mg	24	200	1000	12500	25000	50000	20000	*2500*
Al	27	40	200	12500	25000	50000	20000	*2500*
K	39	200	1000	12500	25000	50000	20000	*2500*
Ca	40	200	1000	12500	25000	50000	20000	*2500*
Ti	47	4	20	50	100	200	80	*50*
V	51	4	20	50	100	200	80	*50*
Cr	52	4	20	50	100	200	80	*50*
Mn	55	8	40	50	100	200	80	*250*
Fe	56	120	600	12500	25000	50000	20000	*2500*
Co	59	2	10	50	100	200	80	*25*
Ni	60	4	20	50	100	200	80	*50*
Cu	63	4	20	50	100	200	80	*50*
Zn	66	16	80	125	250	500	200	*250*
As	75	2	10	50	100	200	80	*50*
Se	78	2.5	12.5	50	100	200	80	*50*
Sr	88	4	20	50	100	200	80	*50*
Mo	95	4	20	50	100	200	80	*50*
Ag	107	2	10	25	50	100	40	*25*
Cd	111	0.9	4.5	50	100	200	80	*25*
Sn	118	16	80	50	100	200	80	*50*
Sb	121	2	10	50	100	200	80	*25*
Ba	137	4	20	50	100	200	80	*50*
Tl	205	0.5	2.5	50	100	200	80	*20*
Pb	208	1.2	6	50	100	200	80	*25*

STANDARDS AND MATRIX SPIKING CONCENTRATIONS
For Drinking Waters

Name	Mass	Cal1 CRI	Cal-2	Cal-3	Cal-4/CCV	Cal-5	ICV	*LCS/MS Conc*
		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	*(ug/L)*
Be	9	0.3	10	25	50	100	80	*25*
B	11	20	20	50	100	200	200	*500*
Na	23	250	500	1250	2500	5000	20000	*2500*
Mg	24	250	500	1250	2500	5000	20000	*2500*
Al	27	25	500	1250	2500	5000	20000	*2500*
K	39	250	500	1250	2500	5000	20000	*2500*
Ca	44	250	500	1250	2500	5000	20000	*2500*
Ti	47	2.5	10	25	50	100	80	*50*
V	51	2.5	10	25	50	100	80	*50*
Cr	52	0.9	10	25	50	100	80	*50*
Mn	55	25	10	25	50	100	80	*250*
Fe	57	250	500	1250	2500	5000	20000	*2500*
Co	59	2.5	10	25	50	100	80	*25*
Ni	60	0.5	10	25	50	100	80	*50*
Cu	65	2.5	10	25	50	100	80	*50*
Zn	66	4	10	25	50	100	200	*250*
As	75	1	10	25	50	100	80	*50*
Se	82	8	10	25	50	100	80	*50*
Sr	88	2.5	10	25	50	100	80	*50*
Mo	95	2.5	10	25	50	100	80	*50*

Attachment 2

Interference Check Standard (ICSA & ICSAB) Elemental Concentrations				
ELEMENT	Non-Potable		Potable	
	ICSA (ug/L)	ICSAB (ug/L)	ICSA (ug/L)	ICSAB (ug/L)
Sodium	100000	100000	25000	25000
Magnesium	100000	100000	25000	25000
Aluminum	100000	100000	25000	25000
Potassium	100000	100000	25000	25000
Calcium	100000	100000	25000	25000
Titanium	2000	2000	500	500
Iron	100000	100000	25000	25000
Molybdenum	2000	2000	500	500
Carbon	200000	200000	50000	50000
Chloride	1000000	1000000	250000	250000
Phosphorus	100000	100000	25000	25000
Sulfur	100000	100000	25000	25000
Silver	n/a	200	n/a	50
Arsenic	n/a	200	n/a	50
Barium	n/a	200	n/a	50
Beryllium	n/a	200	n/a	50
Cadmium	n/a	200	n/a	50
Cobalt	n/a	200	n/a	50
Chromium	n/a	200	n/a	50
Copper	n/a	200	n/a	50
Lithium	n/a	200	n/a	50
Manganese	n/a	200	n/a	50
Nickel	n/a	200	n/a	50
Lead	n/a	200	n/a	50
Antimony	n/a	100	n/a	25
Selenium	n/a	200	n/a	50
Silicon	n/a	200	n/a	50
Tin	n/a	200	n/a	50
Strontium	n/a	200	n/a	50
Thallium	n/a	100	n/a	25
Vanadium	n/a	200	n/a	50
Tungsten	n/a	2000	n/a	500
Zinc	n/a	200	n/a	50

Title: Procedure for the Microwave Extraction of Solids, SW846 3546

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Approvals (Signature/Date):

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1.0 Scope and Application

The procedure uses microwave energy to produce elevated temperature and pressure conditions (i.e., 100° -115°C and 50 - 175 psi) in a closed vessel containing the sample (soil, sediment and sludge) and organic solvent(s) to achieve analyte recoveries equivalent to those from Automated Soxhlet extraction (Method 3541), using less solvent and taking significantly less time than the Automated Soxhlet procedure.

This method is applicable to the extraction of semi-volatile petroleum products in soil, sediment and sludge which may then be analyzed by a variety of chromatographic procedures. The method may also be applicable for the extraction of additional target analytes, provided that the analyst demonstrates adequate performance for the intended application as further described in Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

This method only is applicable to solid samples with small particle sizes. If practical the sample may be air dried and ground to a fine powder prior to extraction.

1.1 **Analytes, Matrix(s), and Reporting Limits:** This standard operating procedure details the procedures used by Eurofins Edison for the microwave extraction of soils, sediments, sludges, and waste solids for semivolatile organic compounds by SW846 Method 3546 for subsequent analysis of:

- Diesel Range Organics (C10-C28 & C8-C44) by SW846 Method 8015D (see Eurofins Edison SOP No. ED-GCS-020);
- Organochlorine Pesticides and PCBs by SW846 8081B and 8082A (see Eurofins Edison SOPs No. ED-GCS-016 and ED-GCS-017)
- Semivolatile Organic Compounds by Gas Chromatography/ Mass Spectrometry (GC/MS) by SW846 8270E (Eurofins Edison SOP No. ED-MSS-009)
- PCBs by GC/MS using EPA Method 680 (Eurofins Edison SOP ED-MSS-010)

1.2 The microwave prep for NJDEP Extractable Petroleum Hydrocarbons (EPH) (10/08), current revision, is addressed separately in Eurofins Edison SOP ED-GCS-012 (current revision).

1.3 For a complete discussion of analytes and reporting limits (RLs) please refer to the applicable Eurofins Edison analytical SOPs referenced in Section 1.1 and in References (Section 14.0).

1.4 On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in Section 9 (*Review of Work Request*) and 19 (*Test Methods and Method Validation*) of Eurofins Edison's Quality Assurance Manual.

2.0 Summary of Method

A representative soil, clay, sediment, sludge, solid or waste sample is weighed and placed into a 75mL Teflon vessel and extracted using an appropriate solvent in a microwave extractor. The extraction vessel containing the sample and solvent system is heated to the extraction

temperature and extracted for 10 minutes. The mixture is allowed to cool. The vessel is opened and the contents are filtered. The solid material is rinsed and the various solvent fractions are combined. The extract is then dried, concentrated using a nitrogen blow down device, and as necessary, solvent exchanged for use in clean up, fractionation, or determinative methods.

3.0 Definitions

For a complete list of definitions refer to Appendix 5 in the most current revision of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

4.0 Interferences

4.1 Solvents, reagents, glassware, and other sample processing hardware may contribute to interferences with sample analysis. All materials must be demonstrated to be free from interferences under the conditions of the analysis by analyzing a method blanks.

4.2 Phthalate esters are commonly extracted from laboratory items. Plastics in particular, must be avoided because phthalates are easily extracted from these materials. The presence of these contaminants in extracts is problematic because it will give false positive results for the methods that list phthalates as target compounds or it will interfere with the target compounds of other methods that are co-extracted with them.

4.3 All glassware used must be scrupulously cleaned before use in trace analysis. Refer to Eurofins Edison SOP No. ED-GEN-013 (*Glassware Cleaning*), current revision.

4.4 Use caution if sodium sulfate is used for this method. Salts are known to super heat when used in microwave. Typically samples are analyzed with the addition of 5.0 grams sodium sulfate.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Safety Manual, Radiation Safety Manual and this document.

This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1 Specific Safety Concerns or Requirements

Nitrile gloves should be used when performing this extraction. Latex and vinyl gloves provide no significant protection against the organic solvents used in this SOP, and should not be used. During Kuderna-Danish (KD) concentration, do not allow the extract to boil to dryness. The solvent vapors remaining in the KD apparatus may superheat and create an explosion or fire hazard.

The use of the microwave to extract samples creates excessive pressure and temperature within the digestion vessels very rapidly. Cooling the sample after digestion is extremely important.

5.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. NOTE: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table. A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Acetone	Flammable	1000 ppm-TWA	Inhalation of vapors irritates the respiratory tract. May cause coughing, dizziness, dullness, and headache.
Hexane	Flammable Irritant	500 ppm-TWA	Inhalation of vapors irritates the respiratory tract. Overexposure may cause lightheadedness, nausea, headache, and blurred vision. Vapors may cause irritation to the skin and eyes.
Methylene Chloride	Carcinogen Irritant	25 ppm-TWA 125 ppm-STEL	Causes irritation to respiratory tract. Has a strong narcotic effect with symptoms of mental confusion, light-headedness, fatigue, nausea, vomiting and headache. Causes irritation, redness and pain to the skin and eyes. Prolonged contact can cause burns. Liquid degreases the skin. May be absorbed through skin.
1 – Always add acid to water to prevent violent reactions.			
2 – Exposure limit refers to the OSHA regulatory exposure limit.			

6.0 Equipment and Supplies

6.1 Instrumentation

- Zymark Turbovap II concentrator
- Electronic Balance, capable of weighing to 0.01g.
- N-Evap Analytical Evaporator
- Fisher 8 Position Steam Bath
- MARS 5 microwave oven with temperature sensor (CEM Corp) capable of sensing temperature within 2.5°C and adjusting microwave field output within 2 sec of sensing.
- MARS 40 position carousel (CEM Corp)
- Visiprep DL column holder

6.2 Supplies

- 10, 50 and 200 mL Concentrator tubes.
- Vials, - 1ml, 4ml, and 10ml with PTFE lined snapcaps.

- Glass syringes, 25ul, 50ul, 100ul, 500ul, 1000ul
- Pastuer pipets
- Glass Buchner funnels (stainless steel funnels may be substituted) – Fisher Scientific.
- 500 ml Kuderna-Danish (KD) flask
- Stainless steal spatulas
- Glass wool- Contaminant-free (silane treated or oven baked at 400^{O}C)
- 75mL Teflon Express vessels with stopper and cap (CEM Corp.)
- Glass fiber filter paper - #1 185mm (Whatman)
- Weigh boats
- Tongue depressors, wood

7.0 Reagents and Standards

Note: Each solvent lot is screened for contaminants before being used for analysis as detailed in Eurofins Corporate Quality SOP No. CA-Q-S-001 (*Solvent & Acid Lot Testing & Approval*) and Eurofins Edison SOP No. ED-GEN-023 (*Bulk Solvent Testing and Approval*).

7.1. Reagents

7.1.1 Organic free reagent water - Reagent water is defined as a water in which an interference is not observed at the MDL of each parameter of interest (ASTM Specification D1193, Type ii). At Eurofins Edison this water is generated by the Barnstead/Thermolyne Water System (Model # D11991 Serial # 1191020210415).

7.1.2 Methylene Chloride, JT Baker Resi-analyzed, P/N 9254-03 (or equivalent)

7.1.3 Hexane – JT Baker Ultra-Resi 73513-42-5 or equivalent

7.1.4 Acetone, J.T. Baker Ultra- ResiAnalyzed, Catalog No. 9264-03 (or equivalent)

7.1.5 Nitrogen, high-purity

7.1.6 Construction Sand (Home Depot or Lowes), free from organic compounds. (Baked in the muffle furnace for four hours at 400^{O}C and stored in a desiccator prior to use.)

7.1.7 Sodium Sulfate Anhydrous Powder, Mallinckrodt MA8020-06 or equivalent (Must be baked in the muffle furnace for four hours at 400^{O}C and stored in a dessicator prior to use.)

7.2. Standards

7.2.1 Stock target analyte standard spiking solutions are purchased as prepared solutions (see table below). Stock solutions are diluted (in volumetric glassware) to a working concentration using methylene chloride ($MeCl_2$) hexane or Acetone as the diluent as indicated below

below. Stock standards of similar quality from other suppliers may be substituted as required.

NOTE: Second sources (from separate lots) are used for quanitation standards and spiking.

Stock Standards (Methods 8015D DRO)				
Standard Mix	**Concentration**	**Source**	**Catalog #**	**Used in method(s):**
o-Terphenyl	10000 ppm	Sigma Aldrich	47580U	*SW846 8015D DRO
Custom TPH Mixed	1000 ppm	Agilent	CUS-3860	*SW846 8015D DRO
Diesel Fuel #2	50000 ppm	Restek	31259	*SW846 8015D

Stock Standards - Pesticides/PCBs* (Methods SW846 8081B and 8082A)				
Standard Mix	**Concentration**	**Source**	**Catalog #**	**Used in method(s):**
Pesticide Surrogate Spike Mix ("Pest/PCB Surrogate")	10 ug/ml	Supelco	861275	SW846 8081B/8082A
Aroclor Spike Mix ("PCB Spike")	100 ug/ml	Supelco	861274	SW846 8082A
SS CLP Organochlorine Pesticides Mix ("Pest Spike")	2000 ug/ml	Supelco	4S7426-U	SW846 8081B
Chlordane (technical) ("Technical Chlordane Spike")	1000 ug/ml	Supelco	48065-U	SW846 8081B
Toxaphene	1000 ug/ml	Supelco	48065-U	SW846 8081B

*May be substituted with equivalent standards from alternate sources.

Components of Pesticide/PCB Standard Mixes (Methods SW846 8081B and 8082A)			
Parameter	**Catalog Nos.**	**Lab Standard Name**	**Concentration (ug/ml)**
Decachlorobiphenyl (DCB)	Supelco – 4S8913	Pest/PCB Surrogate	10.0
2,4,5,6-Tetrachloro-m-xylene (TCMX)	Supelco – 4S8913	Pest/PCB Surrogate	10.0
Aroclor 1016	Supelco - 861274	PCB Spike	100
Aroclor 1260	Supelco - 861274	PCB Spike	100
Aldrin	Supelco - 4S7426-U	Pest Spike	2000
Alpha-BHC	Supelco - 4S7426-U	Pest Spike	2000
Alpha-Chlordane	Supelco - 4S7426-U	Pest Spike	2000
Beta-BHC	Supelco - 4S7426-U	Pest Spike	2000
Delta-BHC	Supelco - 4S7426-U	Pest Spike	2000
Dieldrin	Supelco - 4S7426-U	Pest Spike	2000
Endosulfan I (Alpha)	Supelco - 4S7426-U	Pest Spike	2000
Endosulfan II (Beta)	Supelco - 4S7426-U	Pest Spike	2000

Components of Pesticide/PCB Standard Mixes (Methods SW846 8081B and 8082A)			
Parameter	**Catalog Nos.**	**Lab Standard Name**	**Concentration (ug/ml)**
Endosulfan Sulfate	Supelco - 4S7426-U	Pest Spike	2000
Endrin Aldehyde	Supelco - 4S7426-U	Pest Spike	2000
Endrin Ketone	Supelco - 4S7426-U	Pest Spike	2000
Endrin	Supelco - 4S7426-U	Pest Spike	2000
Gamma-BHC (Lindane)	Supelco - 4S7426-U	Pest Spike	2000
Gamma-Chlordane	Supelco - 4S7426-U	Pest Spike	2000
Heptachlor	Supelco - 4S7426-U	Pest Spike	2000
Heptachlor Epoxide (Isomer B)	Supelco - 4S7426-U	Pest Spike	2000
Methoxychlor	Supelco - 4S7426-U	Pest Spike	2000
4,4'-DDD	Supelco - 4S7426-U	Pest Spike	2000
4,4'DDE	Supelco - 4S7426-U	Pest Spike	2000
4,4'-DDT	Supelco - 4S7426-U	Pest Spike	2000
Chlordane (technical)	Supelco – 48065-U	Technical Chlordane Spike	1000
Toxaphene	Supelco 48103	Toxaphene Spike	1000

Stock Standards – BNAs (Method 8270E)			
Standard Mix	**Concentration (ug/ml)**	**Lab Vendor**	**Catalog #**
8270 List 1/ Std#1 MegaMix	500/1000/2000	RESTEK	567672
8270 List 1/ Std#5 N-Nitrosodiphenylamine	2000	RESTEK	567676
8270 List 1/ Std#2 Amines	2000	RESTEK	567673
8270 List 1/ Std#3 Benzoic Acid	2000	RESTEK	567674
Custom SVO Mix	2000	SPEX	SVO-TANJ-16-5
Bisphenol A	1000	SPEX	S-509-MC
8270 List 1/ Std#8	2000	RESTEK	568724
8270 Surrogate Standard	5000	RESTEK	567685
Aromatic Amines Custom Mix	2000	Supelco	21467482

Stock Standards – PCB Homologues (Method 680)			
Standard Mix	**Concentration (ug/ml)**	**Lab Vendor**	**Catalog #**
Retention Time Calibration Standard Mixture	Varies by component (100 to 200)	Ultra	CB-682MN
Concentration Calibration Standard Mix	Varies by component (50 to 250)	Ultra	CB-681MN
13C12-Decachlorobiphenyl Surrogate	40	Cambridge	EC-1410-3
Lindane13C6	100	Cambridge	CLM-1282-S

Components of PCB Homologue Mixes (Methods 680)			
Parameter	**Catalog Nos.**	**Lab Standard Name**	**Concentration (ug/ml)**
PCB-104	Ultra CB-682MN	Retention Time Calibration Standard Mixture	100
PCB-208	Ultra CB-682MN	Retention Time Calibration Standard Mixture	200
PCB-77	Ultra CB-682MN	Retention Time Calibration Standard Mixture	100
Total Nonachlorobiphenyls	Ultra CB-682MN	Retention Time Calibration Standard Mixture	200
DCB Decachlorobiphenyl	Ultra CB-681MN	Concentration Calibration Standard Mix	250
Total Dichlorobiphenyls	Ultra CB-681MN	Concentration Calibration Standard Mix	50
Total Heptachlorobiphenyls	Ultra CB-681MN	Concentration Calibration Standard Mix	150
Total Hexachlorobiphenyls	Ultra CB-681MN	Concentration Calibration Standard Mix	100
Total Monochlorobiphenyls	Ultra CB-681MN	Concentration Calibration Standard Mix	50
Total Octachlorobiphenyls	Ultra CB-681MN	Concentration Calibration Standard Mix	150
Total Pentachlorobiphenyls	Ultra CB-681MN	Concentration Calibration Standard Mix	100
Total Tetrachlorobiphenyls	Ultra CB-681MN	Concentration Calibration Standard Mix	100
Total Trichlorobiphenyls	Ultra CB-681MN	Concentration Calibration Standard Mix	50

7.2.2 Spiking Standards Prep for GC FID (DRO): The table below provides instruction in preparation of the various working spiking standards for use in this preparation method using the applicable standards listed in 7.2.1. Use volumetric glassware. Dilute to the volume marker with the indicated solvent.

Working Spiking Standards Preparation					
Standard Name	**Vendor/ Cat #**	**Initial Conc. (ug/ml)**	**Vol. of Standard (ml)**	**Vol. of solvent ml (solvent)**	**Final Conc. (ug/ml)**
QAM-025 LCS Spike Diesel Fuel #2	Restek/31259	50000	4	100 ($MeCl_2$)	2000

Working Spiking Standards Preparation					
Standard Name	**Vendor/ Cat #**	**Initial Conc. (ug/ml)**	**Vol. of Standard (ml)**	**Vol. of solvent ml (solvent)**	**Final Conc. (ug/ml)**
DRO Surrogate -o-terphenyl	Supelco/47580U	10000	1.0	500 (Acetone)	20
QAM-025 MS/MSD Spike TPH Mix 3	Sigma/861394-U	1000	1.47	10 ($MeCl_2$)	147

7.2.3 Spiking Standards Prep for GC ECD(8081/8082):

7.2.3.1 All standard stock solutions are diluted to the working concentrations with hexane or acetone (as indicated) using Class A volumetric glassware. **Note:** septa on all surrogate and spike vials are to be replaced immediately after use. Additionally, all surrogate and spike vials are to be returned to the standards refrigerator immediately after use.

7.2.3.2 Pesticide Spiking Standard (LCS/MS/MSD): The Pesticide Mix BS/MS/MSD solution with 20 single component pesticides is prepared at a final concentration of 20 ug/ml by diluting 500 ul (0.50 ml) of the 2000 ppm Pest Spike stock solution (Supelco 4S7426-U, see tables in Section 7.2.1) to a 50 ml final volume with acetone. For spiking instructions refer to Section 10.

7.2.3.3 PCB Spiking Standard (LCS/MS/MSD): The PCB spiking solution (Supelco – 861274, see Tables 1 and 2) is a custom mix received from the vendor at its working concentration of 100 ug/ml in Acetone. For spiking instructions refer to Section 10.

7.2.3.4 Technical Chlordane Spiking Standard (LCS/MS/MSD): A technical Chlordane spiking solution is prepared at a final concentration of 100 ug/ml by diluting 1 ml of the 1000 ug/ml Technical Chlordane Spike solution (Supelco 48065-U, see tables in Section 7.2.1) to a 10 ml final volume using acetone. For spiking instructions refer to Section 10.

7.2.3.5 Toxaphene Spiking Standard (LCS/MS/MSD): A Toxaphene spiking solution is prepared at a final concentration of 100 ug/ml by diluting 1 ml of the 1000 ug/ml Toxaphene Spike solution (Supelco 48103, see tables in Section 7.2.1) to a final volume 10 ml. using acetone. For spiking instructions refer to Section 10.

7.2.3.6 Pesticide/PCB Surrogate Spiking Standard: The Pesticide/PCB surrogate spiking solution is a concentrated 10 ml solution of DCB/TCMX at a concentration of 10 ug/ml. (Supelco Catalog # 861275, see tables in Section 7.2.1). The concentrate is used without further dilution prior to the spiking of samples.

7.2.4 Spiking Standard for BNA: For use in spiking Soils samples prepared for BNA analysis by SW846 Method 8270. Prepare the spiking solution for MS/MSD/Blank Spike (LCS) as detailed in the following table using the applicable standards listed in 7.2.1. Use volumetric glassware. Dilute to the volume marker with methanol

Standard Name	Concentration	Volume of Standard added to final volume of 200ml (solvent)	Final Concentration
8270 List 1/ Std#1 MegaMix	500/1000/2000pmm	20 ml (methanol)	50/100/200 ppm
8270 List 1/ Std#5 N-Nitrosodiphenylamine	2000ppm	10 ml (methanol)	100 ppm
8270 List 1/ Std#2 Amines	2000ppm	10 ml (methanol)	100 ppm
8270 List 1/ Std#3 Benzoic Acid	2000ppm	10 ml (methanol)	100 ppm
Custom SVO Mix	2000ppm	10 ml (methanol)	100 ppm
Bisphenol A	1000ppm	10ml (methanol)	50ppm
8270 List 1/ Std#8	2000ppm	20ul (methanol) 100ul(methanol)	Used neat for LVI Used neat for non-LVI
Aromatic Amines Custom Mix**	2000ppm	10 ml (methylene chloride)	100 ppm

*** As needed based on clients requirement.*

7.2.4.1 BNA Surrogate Standard Spiking Solution: For use in spiking all blanks, samples and associated QC prior to extraction. Prepare as detailed in the following table using the applicable standards listed in 7.2.1. Use volumetric glassware. Dilute to the volume marker with methanol.

Standard Name	Concentration	Volume of Standard added to final volume of 1000 ml methanol	Final Concentration
8270 Surrogate Standard	5000 ppm	20 ml	100 m

7.2.5 Spiking Standard for PCB Homologues (EPA 680): For use in spiking LCS and MS/MSD prior to extraction. Prepare by adding 1.0ml of the Retention Time Calibration Standard and 1.0ml of the Concentration Calibration Standard Mix to hexane in volumetric glassware and dilute to final volume of 100ml. 1.0mL of this solution is spiked into LCS/MS/MSD prior to extraction.

7.2.5.1 PCB Homologue Surrogate Standard Spiking Solution (EPA 680): (2.0ug/mL and 2.5ug/mL) – Add 3.125mL of $^{13}C_{12}$-Decachlorobiphenyl

and 1.0mL of Lindane13C6 and dilute to a final volume of 50mL in hexane in volumetric glassware. 1.0mL of this solution is spiked into all blanks, samples and QC items prior to extraction.

7.2.6 The preparation of all standards must be documented in a standard preparation logbook or in the TALS reagent module. Information such as standard supplier, lot number, original concentration, and a description of how standard was prepared are required along with a laboratory lot number, analyst's initials, date prepared and verification signature. Standards must be made every 6 months or sooner if signs of degradation appear.

8.0 Sample Collection, Preservation, Shipment and Storage

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client requests. Listed below are the holding times and the references that include preservation requirements.

Matrix	Sample Container	Min. Sample Size	Preservation	Holding Time [1]	Reference
Soils	Glass	4 oz	Cool 4 ± 2°C	14 Days	SW846 Method 8000

Samples are collected in amber jars with Teflon lined caps.
[1]All sample extracts must be analyzed within forty (40) days of extraction.

9.0 Quality Control

9.1. Sample QC – The following quality control samples are prepared with each batch of samples.

QC Analysis	Frequency	Acceptance Criteria	Corrective Action
Laboratory Control Sample (LCS/LCSD)[1]	1 in 20 or fewer samples	See applicable analytical SOPs	See applicable analytical SOPs for control criteria
Method Blank (MB)	1 in 20 or fewer samples	See applicable analytical SOPs	See applicable analytical SOPs for control criteria
MS\MSD[2] (Client specified)	1 in 20 or fewer samples	See applicable analytical SOPs	See applicable analytical SOPs for control criteria
Surrogates[3]	All Samples including QC	See applicable analytical SOPs	See applicable analytical SOPs for control criteria

[1] LCS Duplicate (LCSD) is performed only when insufficient sample is available for the MS/MSD or when requested by the client/project/contract except for NJDEP EPH 10/09 where LCS/LCSD is required.
[2] The sample selections for MS/MSD are randomly selected, unless specifically requested by a client. For NJDEP EPH 10/09, only MS is required (MSD for NJDEP EPH 10/09 is by client request only).
[3] Analytical and QC samples (MB, LCS, MS/MSD)
[4] Statistical control limits are updated annually and are updated into LIMS.

9.2. Instrument QC

N/A

10.0 Procedure

10.1. Sample Preparation

10.1.1 Decant and discard any water layer on a sediment sample. Discard any foreign objects such as rocks, leaves and sticks. Mix sample thoroughly with wooden tongue depressor prior to subsampling

10.1.2 The initial amount and treatment of soil samples is method dependent:

- For DRO (8015): 15 grams of soil is weighed into a 75mL Teflon microwave vessel (the weight is recorded to two significant figures). Where practical samples should be air dried and ground prior to extraction. Drying should be performed in a hood to avoid contamination.
- For 8270: 15 grams of soil is weighed into an aluminum weighing dish (the weight is recorded to two significant figures). 15 ml of acetone is added to the dish and the soil/acetone mixture is stirred well with a wooden tongue depressor to create a slurry. The soil/acetone slurry is transferred to a 75 ml Teflon microwave vessel. The dish is then rinsed with 15 ml of methylene chloride which is also added to the microwave vessel.
- For 8081/8082: 15 grams of Soil is weighed into an aluminum dish. 15 ml of Acetone is added to the dish and the soil / acetone mixture is stirred well with a wooden tongue depressor to create a slurry. Then, the mixture is transferred into a 75ml Teflon vessel. The dish is then rinsed with 15 ml of Hexane which is also added to the microwave vessel.
- For EPA 680: 30 grams of soil is weighed into a 75mL Teflon microwave vessel (the weight is recorded to two significant figures).

10.1.3 For laboratory blanks and control spikes, an equal portion of clean sand is prepped along with samples.

10.1.4 All samples, blanks, and spikes are fortified with an appropriate amount of the applicable method surrogates. All matrix spikes and lab control spikes are fortified with an appropriate amount of the applicable method spiking solution. See Attachment 1 for general spiking instructions. (Refer to Section 7.2 for information on preparation of spiking solutions):

- PCBs (8082): add 50 ul of the PCB Spike solution to each LCS and designated MS/MSD;

- Pesticides (total, 8081): 100 ul of the Pest Spike solution to each LCS and designated MS/MSD;
- Technical Chlordane: 100 ul of the Technical Chlordane Spike mix to each LCS and designated MS/MDS;
- Toxaphene: 100 ul of the Toxaphene Spike mix to each LCS and designated MS/MSD;
- BNA (8270): 500ul of spike/Surrogate solution to each LCS and designated MS/MSD);
- PCB Homologues (EPA 680): 1.0 ml each of Spiking solution (see Sec.7.2.5) and Surrogate solution (see Sec. 7.2.5.1) to each LCS and designated MS/MSD.

  NOTE: When spiking the samples, it is critical to remove all bubbles from the syringe.

10.1.5 Add the following solvent to each sample vessel depending upon the fraction (**note**: for Pesticides and PCBs by methods 8081 and 8082 the solvent addition is addressed in Section 10.1.2 above)

- 30mL of methylene chloride for DRO (8015);
- 30 mL of Methylene Chloride/Acetone blend (50:50) for BNA (8270)

30 mL of Hexane for PCB homologues by EPA 680

10.1.6 A stopper is placed over the opening along with the vessel cap. The vessel is then tightened using the MARS capping wrench. This capping wrench tightens the cap to the appropriate torque.

10.1.7 The sample vessels are placed into the 40-position carousel. Each position has an insulator sleeve that the vessel slides into – slide the vessel into the appropriate sleeve – and press firmly down to ensure a complete connection.

10.1.8 Place the carousel (with samples and vessels) into the microwave unit.

Start Run: (load method – using key pad on face of unit)
Press: Home
Press Select: load method
Press Select: from user directory
Press Select: 3546 Microwave – Xpress method
Press Start.

Microwave Operating Parameters				
Power Max	**Power %**	**Oven Ramp**	**Degrees Celsius**	**Hold Time**
1200W	100	10.0 minutes	110	10.0 minutes
1600W[1]	100	20.0 minutes	115	10.0 minutes

[1] For pesticide/PCB and BNA samples only

10.1.9 A 5-minute cool down will close out the run.

10.1.10 Remove vessels from carousel and allow cooling (either at room temperature or in a cold water bath).

10.1.11 When cool down is complete, remove carousel from microwave.

10.1.12 Pre-wash a funnel filled with sodium sulfate with three successive washings of 30 ml acetone. Pour the extract carefully through the sodium sulfate funnel (to remove any moisture) into the 200mL concentrator tube. Rinse the 75mL vessel with 10 mL methylene chloride three times to ensure quantitative transfer.

10.1.13 Set the water temperature in the concentrator to 35°C and adjust the pressure to around 5psi of nitrogen.

10.1.14 Place the tube into the apparatus and slowly raise the pressure to 20psi. If splashing occurs, start with a lower pressure and raise it when the solvent gets lower.

10.1.15 Concentrate to just under the 1mL mark on the nipple of the tube. Remove from the bath and transfer to an auto sampler vial with a glass Pasteur pipette..

10.1.16 Add a few drops of clean methylene chloride to the tube, rinsing the narrow part and add to the vial to adjust to 1mL or other method specific final volume. If solvent exchange to hexane is required, add approximately 30mL (mix well) and return to concentrator set at 35°C. See Attachment 2.

10.1.17 Total concentration time should be approximately 20 minutes for methylene chloride. If a sample takes a longer than usual amount of time to concentrate or if the extract becomes viscous the final volume should be adjusted to a larger volume and documented.

10.1.18 The extract is now ready for the appropriate clean up and or analysis.

10.2. Calibration

10.2.1 The balance calibration is checked daily prior to use. Refer to Eurofins Edison SOPs ED-GEN-010, *Calibration of Analytical Balances*, current revision and ED-GEN-006, *Standard Operating Procedure for Preventive Maintenance and Calibration Procedures for All Analytical Instruments and Ancillary Equipment*, current revision.

11.0 Calculations / Data Reduction

N/A

12.0 Method Performance

12.1. Method Detection Limit Study (MDL)

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure in Section 19 (Test Methods and Method Validation) of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM). MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method requirements require a greater frequency.

12.2. Demonstration of Capabilities

For demonstration of capability procedure refer to Section 19 in the most current revision of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

12.3. Training Requirements

Refer to Eurofins SOP No. ED-GEN-022, *Training*, for the laboratory's training program.

13.0 Pollution Control

13.1. It is Eurofins's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention."

14.0 Waste Management

14.1 Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are

disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to Eurofins Edison SOPs No. ED-SPM-008 (*Laboratory Waste Disposal Procedures, current revision).* The following waste streams are produced when this method is carried out:

- *Mixed Solvent Waste*: Mixed solvent waste is collected in a small beaker inside the bench top hood. This waste is then transferred into the satellite accumulation container in the Organic Prep. Lab. on a daily basis. This material is transferred into 5 gallon solvent cans as satellite accumulation. These cans are emptied every 24 hours into a steel drum in the waste room. This drum is kept in the walk in hood until it is full. The full drum is then removed from the hood and placed on secondary containment in the waste room.

  Teris Profile Number: 50016624
  Onyx Profile WIP Number: 545240

- *Auto sampler vials and expired standards*: These vials are collected in satellite accumulation within the instrument laboratory. The vials are then placed into a 55 steel open top drum in the waste room. When the drums are full, the drum will be collected by the waste vendor for disposal. This waste is treated for incineration.

  Teris Profile Number: 50016652
  Onyx Profile WIP Number: 282493

15.0 References / Cross-References

15.1 United States Environmental Protection Agency, “Method SW3546, Microwave Extraction”, Test Methods for Evaluating Solid Wastes, SW846 Laboratory Manual, Physical/Chemical Methods, February 2007.

15.2 United States Environmental Protection Agency, Method SW8015D, Test Methods for Evaluating Solid Wastes, SW846 Third Edition, Volume 1B: Laboratory Manual, Physical/Chemical Methods, Revision 4, June 2003.

15.3 United States Environmental Protection Agency, “Method 8081B, Organochlorine Pesticide by Gas Chromatography”, Test Methods for Evaluating Solid Wastes, SW846 Third Edition, Volume 1B: Laboratory Manual, Physical/Chemical Methods, Revision 2, February 2007.

15.4 United States Environmental Protection Agency, “Method 8082A, Organochlorine Pesticide by Gas Chromatography”, Test Methods for Evaluating Solid Wastes, SW846 Third Edition, Volume 1B: Laboratory Manual, Physical/Chemical Methods, Revision 1, February 2007.

15.5 United States Environmental Protection Agency, “Method SW8270E, Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry”, Test Methods for Evaluating Solid Wastes, SW846 Update VI, Revision 6, June 2018.

15.6 Eurofins Edison SOP No. ED-GCS-020, *Preparation of Water Samples by SW846 Methods 3510C (Separatory Funnel) and Analysis of Diesel Range Organics in Soil and Water Samples by SW846 Method 8015D (GC/FID)*current revision.

15.7 Eurofins Edison SOP No. ED-GCS-016, *Analysis of Organochlorine Pesticides by Gas Chromatograph, SW846 Method 8081B*, current revision.

15.8 Eurofins Edison SOP No. ED-GCS-017, *Analysis of Polychlorinated Biphenyls by Gas Chromatograph, SW846 Method 8082A*, current revision

15.9 Eurofins Edison SOP No. ED-MSS-010, *Determination of PCBs in Water and Soil/Sediment by GC/MS, EPA Method 680,* current revision.

15.10 Eurofins Edison Document No. ED-QA-LQM, *Laboratory Quality Manual*, current revision.

15.11 Eurofins Environmental Health and Safety Manual, CW-E-M-001.

15.12 Eurofins Corporate Quality SOP No. CA-Q-S-001, *Solvent & Acid Lot Testing& Approval*, current revision.

15.13 Eurofins Edison SOP No. ED-GEN-023, *Bulk Solvent Testing and Approval*, current revision.

15.14 Eurofins Edison SOP No. ED-GEN-013, *Glassware Cleaning,* current revision

15.15 Eurofins Edison SOP No. ED-GEN-022, *Training,* current revision

15.16 Eurofins Edison SOP No. ED-SPM-008, *Laboratory Waste Disposal Procedures,* current revision.

15.17 Eurofins Edison SOP No. ED-GEN-006, *Standard Operating Procedure for Preventive Maintenance and Calibration Procedures for All Analytical Instruments and Ancillary Equipment,* current revision.

15.18 Eurofins Edison SOP No. ED-GEN-010, *Calibration of Analytical Balances,* current revision.

15.19 Eurofins Edison SOP No. ED-GEN-007, *Subsampling*, current revision.

15.20 Operation Manuals for the Zymark Turbo Vap II Concentrator.

15.21 Operating manual for the MARS 5 Microwave unit.

16.0 Method Modifications:

N/A

17.0 Attachments

Attachment 1: Spiking information
Attachment 2: Specific Extraction Conditions

18.0 Revision History

Rev 12, July 2, 2024

- Updated to reflect Eurofins branding and formatting.
- Section 1.1: updated method/SOP references as needed.
- Throughout document: updated Lab Quality Manual section references as needed.
- Section 14 (References): updated to reflect current documents.
- Section 7.2.1: updated DRO spiking solution.
- Section 10.1.2: updated procedure for 8081/8082 such that acetone: hexane is now the extraction solvent (methylene chloride eliminated).

Rev 11, March 12, 2018

- Updated Section 10.1 to revise procedures for the microwave extraction of solids for subsequent analysis by EPA methods 8081, 8082 and 8270.
- Updated to remove all references to addition of sodium sulfate to samples prior to microwave extraction.
- Fixed section numbering and formatting errors.

Rev 10, May 16, 2017

- Updated throughout to add procedures for microwave extractions of solids for subsequent analysis by EPA Method 680 (PCBs by GC/MS).

Rev 9, Dec 15, 2016

- Updated throughout to remove procedures for microwave extraction of solids for NJ EPH method. Those procedures are fully covered in Eurofins Edison SOP ED-GCS-012, Preparation and Analysis of Extractable Petroleum Hydrocarbons (EPH) in Solid and Water Samples using NJDEP EPH Method 10/08, August 2010 (Rev. 3): Analysis of Extractable Petroleum Hydrocarbon Compounds (EPH) in Aqueous and Soil/Sediment/Sludge Matrices (current revision)
- Added following text to Section 1.2: The microwave prep for NJDEP Extractable Petroleum Hydrocarbons (EPH) (10/08), current revision, is addressed separately in Eurofins Edison SOP ED-GCS-012 (current revision).
- All references to NJDEP EPH methodology removed.

Rev 8, Jan 22, 2015

- Updated to include procedures for microwave extraction of solids for analysis my SW846 Methods 8270C and 8270D (Semivolatile Organic Compounds by Gas Chromatography/ Mass Spectrometry (GC/MS). Specifically
- Added 8270 method references and SOP numbers to Sections 1.1 and 15.0
- Added a table to Section 7.2.1 detailing the BNA standard mixes.
- Added new Section 7.2.4 detailing the preparation of BNA spiking standards
- Added Section 7.2.4.1 detailing the preparation of BNA surrogate spiking standards.
- Added details of 8270 spiking and extraction to Section 10.0 as appropriate.
- Added BNA Spiking details to Attachments 1 and 2. COAs for BNA spiking not included in SOP but are on-file in the department.

Rev 7, June 14, 2013

- Section 1.1: updated the DRO method references to include SW8015C and SW8015D. Also update the SOP references for the DRO analytical methods.
- Section 7.2.1: updated stock standards table to include SW8015C and 8015D. Revised source for o-Terphenyl stock. Removed TPH Mix 1 from list. Removed 8015x DRO from the list of methods for which TPH Mix 3 is used. Added 8015x DRO to the list of methods for which Diesel Fuel #2 is used.
- Section 7.2.2.1: Revised DRO surrogate spike source and prep instructions. Revised DRO and QAM-025 spiking standard source and prep instructions.
- Section 15.0: References: added references for methods SW8015C and 8015D.
- Attachment 1: updated spiking information for DRO.

Rev 6, October 10, 2012

- Throughout document:: Revised LQM reference sections to reflect the most current revision
- Throughout document: updated as detailed below to include prep instructions for solid samples undergoing analysis by SW846 8081A/B and 8082/A.
- Section 1.1: added references to the 8081/8082 SOPs: Eurofins Edison SOPs No.ED-GCS-003, ED-GCS-004, ED-GCS-016 and ED-GCS-017.
- Section 6.2: added weigh boats and wooden tongue depressors.
- Section 7.2.1: added acetone as a diluent and added tables detailing the Pestcide and PCB standards.
- Section 7.2.2: added “GCFID (DRO/EPH/QAM)” to section header.
- Section 7.2.3: added instructions for prep of Pest/PCB spiking standards.
- Section10.1.4: Added Pest/PCB spiking instructions.

- Section 10.1.5: added instructions for addition of extraction solvent (Methylene Chloride:Acetone for Pest/PCB).
- Section 10.1.8: updated table to include Microwave Parameters for Pest/PCB prep.
- Section 10.1.12: added a methylene chloride rinse.
- Section 15: added method and SOP references for SW846 8081A/8081B and SW846 8082/8082A.
- Attachments: updated to include Pest/PCB information.

Rev 5, August 26, 2011

- Section .6.2: added vendor and part number details for silica gel columns (Phenomenex Part No:8L-S012-JCH)
- Section 10.1.2: Added details for the pre-washing of sodium sulfate funnels with three successive 30 ml volumes of acetone. Added details for the rinsing of the 75 ml vessel with three successive volumes of methylene chloride.

Rev 4, April 21, 2010

- Section 7.2.1: Corrected the footnotes in the tables 'Stock Standards – Aliphatics (Method NJDEP EPH 10/08)' and 'Stock Standards-Aromatics (Method NDJEP EPH 10.08)'.
- Attachment 3: Added this attachment which consists of select certificates of analysis for Method NJDEP EPH 10/08.
- Section 7.2.2.1: Table 'Working Spiking Standards Preparation'" replaced asterisks (*) with dashes (-) in order to clarify that these are simply bullets rather than referencing footnotes.

Rev 3, April 19, 2010

- Section 7.2.2.1: added procedure for preparation of a 500 ppm Aliphatic Neat Spike Mix.
- Section 7.2.2: Spiking Standards Prep: revised the procedure for prep of the EPH Aliphatic Spike in the 'Working Spiking Standards Preparation' table as follows:
    - Replaced 'MA EPH-n-Hydrocarbons (Absolute/91488) with the 'Florida TRPH Standard (Restek/31266)'
    - Included used of the intermediate 500 Aliphatic Neat Spike Mix.

Rev 2, February 9, 2009

- Section 3.0, Definitions – updated to reflect current location of definitions (Appendix 2 of Lab Quality Manual
- Section 5.2, Primary Materials Used – added 'hexane' to table (used in the NJDEP EPH method).
- Section 7.2.1: added stock standards associated with NJDEP EPH 10/08 method.
- Section 7.2.2: Spiking Standards Prep: updated 'Working Spike Standards' table to include revised NJDEP EPH 10/09 spiking standards; revised other as required.
- Section 9.1, Sample QC: updated with revise NJDEP EPH 10/09 QC requirements.

- Section 10.1, Sample Preparation: revised initial sample weight to 15 grams.
- Section 10.1.8: added Microwave Operating Parameters for the NJDEP EPH 10/09 method.
- Section 10.2.1: changed the specifications of the silica column.
- Section 10.2.5: changed the volume of the hexane rinsate.
- Section 10.2.7: changed the volume of the methylene chloride rinsate.
- Section 10.2.11: Added text describing procedures for NJDEP EPH 10/09 Demonstration of Fractionation Capability.
- Section 14.1 and Section 15.0 : Removed reference to Eurofins Edison SOP No. ED-SPM-007 (*Disposal of Samples and Associated Laboratory Waste, current revision)* (SOP is now retired).
- Section 15.0: updated references to NJDEP EPH method as well as Eurofins Edison SOP for NJDEP EPH analysis.
- Section 17.0, Attachments: corrected descriptions of attachments.

Rev 1, June 29, 2009

- Section 1.0, Scope and Application – corrected typo in the temperature range 100 – 115°C
- Section 5.2, Primary Materials Used – removed ‘sodium hydroxide’ and ‘sulfuric acid’ from table as they are not used in this method.
- Section 6.1, Instrumentation – added Visiprep DL column holder to the instrumentation list
- Section 6.2, Supplies – added 5 g silica gel column (20 ml capacity)
- Sections 7.2.1, 7.2.2, Attachment 1 and Attachment 2: corrected a typo in the abbreviation for Methylene Chloride ($MeCl_2$).
- Section 10.1.1.2 - sentence correction to show actual process and typo error correction. Phrase ‘may also’ changed to ‘shall’.
- Section 10.1.12 – replaced the word ‘salt’ with ‘Sodium Sulfate’ to show actual reagent being used.
- Section 10.1.17 – typo error correction to ’20 minutes’
- Section 10.2.5 – Added the following text to the end of the section: “The amount on hexane will need to be adjusted with every lot of silica columns. The Hexane amount should never exceed 20 mls.”
- Corrected carbon ranges for the reference DRO SOPs throughout the document.

Rev 0, March 27, 2009: New

Attachment 1

Spiking Information – Microwave Extraction

Method	Surrogate Amount (all samples and QC)	Spike Amount (LCS/MS/ MSD)	Final volume	Initial Solvent	Final Solvent
DRO (8015)	1 mL	1 mL	1 mL	$MeCl_2$	$MeCl_2$
Pest/PCB (8081/8082)	0.05 mL	0.1/0.05 mL	10 mL	MeCl2/Acetone (50:50)	Hexane Exchange from MeCl2/Acetone
BNA (8270)	500uL	500uL	1 mL	MeCl2/Acetone (50:50)	$MeCl_2$
PCB Homologues (EPA 680)	1.0	1.0	1 mL	Hexane	Hexane

Attachment 2

Specific Extraction Conditions

Method	Initial extraction pH	Secondary extraction pH	Final Solvent	Volume of extract required for cleanup(mL)	Final extract volume for analysis (mL)
DRO (8015)	as received	NA	$MeCL_2$	NA	1.0
Pest/PCB (8081/8082)	as received	NA	Hexane	3	10.0
BNA (8270)	as received	NA	$MeCL_2$	NA	1.0
PCBs (EPA 680)	as received	NA	Hexane	NA	1.0

Title: SW846 Method SW8081B, Analysis of Organochlorine Pesticides by Gas Chromatography

Approvals (Signature/Date):

Catalina Dalangin SVOA GC Manager	1/17/25 Date	Dan Helfrich Health & Safety Manager	1/17/25 Date
Carl Armbruster Quality Assurance Manager	1/17/25 Date	Mark Acierno Laboratory Director	1/17/25 Date
Sylvanus Klusey Operations Manager - Organics	1/17/25 Date		

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1.0 Scope and Application

1.1 Analytes, Matrix(s), and Reporting Limits

Method 8081B is used to determine the concentrations of various organochlorine pesticides in extracts from solid and liquid matrices, using dual fused-silica, open-tubular, capillary columns with electron capture detectors (ECD). The list of analytes and their corresponding reporting limits are as follows:

Parameter		Soil	Water	Leachate
	CAS Registry No.	Reporting Limits (ug/Kg)	Reporting Limits (ug/L)	Reporting Limits (mg/L)
Aldrin	309-00-2	6.7	0.02	---
Alpha-BHC	319-84-6	2.0	0.02	---
Beta-BHC	319-85-7	2.0	0.02	---
Delta-BHC	319-86-8	2.0	0.02	---
Gamma-BHC (Lindane)	58-89-9	6.7	0.02	0.00050
Chlordane	57-74-9	67	0.50	0.0050
4,4' –DDD	72-54-8	6.7	0.02	---
4,4' –DDE	72-55-9	6.7	0.02	---
4.4' –DDT	50-29-3	6.7	0.02	---
Dieldrin	60-57-1	2.0	0.02	---
Endosulfan I	959-98-8	6.7	0.02	---
Endosulfan II	33213-65-9	6.7	0.02	---
Endosulfan sulfate	1031-07-8	6.7	0.02	---
Endrin	72-20-8	6.7	0.02	0.00050
Endrin aldehyde	7421-93-4	6.7	0.02	---
Endrin ketone	53494-70-5	6.7	0.02	---
Heptachlor	76-44-8	6.7	0.02	0.00050
Heptachlor epoxide	1024-57-3	6.7	0.02	0.00050
Methoxychlor	72-42-5	6.7	0.02	0.00050
Toxaphene	8001-35-2	67	.50	0.0050
Gamma- Chlordane	5103-74-2	6.7	0.02	---
Alpha-Chlordane	5103-71-9	6.7	0.02	---
Mirex	2385-85-5	6.7	0.010	---

The most current MDLs and RLs for this method can be found in the active Eurofins LIMS (TALS) SW846 8081B Method Limit Group (MLG) database.

1.2 On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in Section 7 (*Review of Work Request*) and Section 19 (*Test Methods and Method Validation)* of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

2.0 Summary of Method

2.1. Samples undergo a preparation step prior to analysis by SW846 Method 8081B. A measured volume or weight of sample is extracted using the appropriate matrix-specific sample extraction technique. (Reference the applicable Organic Sample Prep SOPs listed below). The effective final volume is usually between 5 and 20 ml in hexane.

2.1.1. Aqueous samples are extracted using either SW846 Method 3510C (SOP No. ED-ORP-014: *Extraction of Pesticides and PCBs in Water by Separatory Funnel*) or SW846 Method 3511 (SOP No. ED-ORP-051: *Extraction of Semivolatile Organic Compounds in Water by Microextraction using SW846 Method 3511*)

2.1.2. Solid samples are extracted using SW846 Method 3550B: Sonication (*SOP No. ED-ORP-018: Extraction of Pesticides/PCBs in Soil Using Low-Level Extraction*) or SW846 Method 3546: Microwave (SOP No. ED-ORP-044: *Procedure for the Microwave Extraction of Solids,SW846 3546).*

2.1.3. Organic liquids are prepared using SW846 Method 3580A (*SOP No. ED-ORP-019: Waste Dilution for Pesticides and PCBs*).

2.1.4. Extract cleanup steps are employed depending on the nature of the matrix interferences. Suggested cleanups include SW846 Method 3620B (*SOP No. ED-ORP-020: Florisil Cleanup for Pesticide/PCB Sample Extracts*) and SW846 Method 3660B (*SOP No. ED-ORP-021: The Removal of Elemental Sulfur from Pesticide/PCB Sample Extracts*).

2.2. After cleanup, a small aliquot of the extract is injected into a gas chromatograph (GC) equipped with a capillary column. The GC is temperature programmed to separate the compounds which were recovered during the extraction step by boiling point. The effluent of the gas chromatograph is interfaced to an Electron Capture Detector (ECD) which is used to detect the compounds eluting from the GC.. Quantitation is accomplished by comparing the area response of each target analyte relative to an internal standard established through a five-point calibration (six points for second order regression). Specific calibration and quality control steps are included in the method that must be performed and must meet the specifications of SW846 Method 8081B.

2.3. For pesticide analysis a system performance check (DDT/Endrin breakdown) and a calibration verification standard must be run prior to analysis. Failure of either will generally indicate the need for injection port/column maintenance and/or recalibration.

2.4. Samples are analyzed after all the necessary checks have been performed. Samples analyzed for pesticides require an additional post analysis Quant Report to be printed and attached to the chromatographic report.

2.5. All samples are then manually reviewed. Secondary column confirmation of target compounds and quantitation are conducted by the analyst as required.

3.0 Definitions

For a complete list of definitions refer to Appendix 5 in the most current revision of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

4.0 Interferences

4.1. Interferences by phthalate esters introduced during sample preparation can pose a major problem in pesticide determinations.

4.1.1. Interferences from phthalate esters can be minimized by avoiding contact with any plastic materials and checking all solvents and reagents for phthalate contamination. Exhaustive cleanup of solvents, reagents and glassware may be required to eliminate background phthalate ester contamination.

4.2. The presence of elemental sulfur will result in broad peaks that interfere with the detection of early-eluting organochlorine pesticides. Sulfur contamination should be expected with sediment samples. If sulfur is encountered, employ the sulfur removal procedures detailed in SW846 Method 3660B (*SOP No. ED-ORP-021: The Removal of Elemental Sulfur from Pesticide/PCB Sample Extracts*). Note that the recover of Endrin Aldehyde is adversely affected by the TBA cleanup procedure detailed in this method. Accordingly, this compound must be determined prior to sulfur cleanup.

4.3. Co-eluting chlorophenols are eliminated by using SW846 Method 3620B (*SOP No. ED-ORP-020: Florisil Cleanup for Pesticide/PCB Sample Extracts*).

4.3.1. Check Florisil prior to use to assure quantitative recovery of targeted analytes. Duplicate checks are required for each new lot or every three hundred samples whichever is more frequent.

4.3.2. Check Florisil by spiking 1ml of the Pest Std Mix A midpoint (Supelco Catalog No. 47977) and 0.5 ml of trichlorophenol (Absolute Standardsl Catalog No. 20024) onto the cartridge and concentrating to final volume of 1 ml. Inject 1 ul onto a capillary column, conducting the elution and analyzing the extract. Recovery is acceptable if all pesticides are recovered at 80 - 110% and the recovery of trichlorophenol is <5% and co-eluting interfering peaks are absent from the extract.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001) and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1. Specific Safety Concerns or Requirements

The gas chromatograph contains zones that have elevated temperatures. The analyst needs to be aware of the locations of those zones, and must cool them to room temperature prior to working on them.

There are areas of high voltage in the gas chromatograph. Depending on the type of work involved, either turn the power to the instrument off, or disconnect it from its source of power.

5.2. Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Acetone	Flammable	1000 ppm-TWA	Inhalation of vapors irritates the respiratory tract. May cause coughing, dizziness, dullness, and headache.
Hexane	Flammable Irritant	500 ppm-TWA	Inhalation of vapors irritates the respiratory tract. Overexposure may cause lightheadedness, nausea, headache, and blurred vision. Vapors may cause irritation to the skin and eyes.
Methanol	Flammable Poison Irritant	200 ppm-TWA	A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Symptoms of overexposure may include headache, drowsiness and dizziness. Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure. Irritant to the eyes.
Methylene Chloride	Carcinogen Irritant	25 ppm-TWA 125 ppm-STEL	Causes irritation to respiratory tract. Has a strong narcotic effect with symptoms of mental confusion, light-headedness, fatigue, nausea, vomiting and headache. Causes irritation, redness and pain to the skin and eyes. Prolonged contact can cause burns. Liquid degreases the skin. May be absorbed through skin.
1 – Always add acid to water to prevent violent reactions.			
2 – Exposure limit refers to the OSHA regulatory exposure limit.			

6.0 Equipment and Supplies

6.1. Instrumentation:

6.1.1. Gas Chromatograph: The system used is an HP and an Agilent Technologies (Avondale, PA) model 5890/6890 Gas Chromatograph (GC). Each GC is equipped for simultaneous quantitation and confirmation columns using two separate detector channels on dual megabore capillary columns that are suitable for the analysis of organochlorine pesticides. All operations are as automated as possible with the equipment utilized.

6.1.2. Injection system: Sample injection is accomplished by a single auto injector. The auto injector is serviced by a robot arm that shuttles samples between the sample tray and the injector turret.

6.1.2.1. The samples are injected into a split/splitless injection port equipped with electronic pressure control (EPC). The injection port is normally operated in splitless mode during injection. The EPC is operated in the ramp pressure mode.

6.1.2.2. Liners: The injection port is each fitted with replaceable, heavy-walled siltek-coated glass double gooseneck liner. The liner contains a plug of silanized glass wool approximately 1 cm in length. The glass wool is positioned in the liner between the double gooseneck. The liner is replaced on a regular maintenance schedule.

6.1.2.3. Oven and Columns: Temperature programmable gas chromatograph ovens are required, capable of integrated temperature control between 35^{O}C and 350^{O}C.

6.1.2.3.1. Two dissimilar columns are used for analysis. A Restek RtxCLPesticides, 30m x 0.53mm ID x 0.5um film thickness column is used for sample quantitation. The secondary confirmation column is a Restek RtxCLPesticides II, 30m x 0.53mm ID x 0.42um film thickness column.

6.1.2.4. Detectors: Sample detection is by electron capture. The GC is equipped with dual Electron Capture Detectors (ECD), one for each column.

6.1.2.4.1. Each detector is supplemented with make-up gas to provide sufficient detector flow for maintaining the electron plasma. This is in addition to the gas exiting the column. The make-up gas (P-5 & Nitrogen) is fed from a supply other than the injection port.

7. Reagents and Standards

7.1. Reagents

7.1.1. Gases: Hydrogen is used as the carrier and injection port purge gas. It is introduced to the GC at the injection port. P-5 and Nitrogen) is used as make-up gas. It is introduced to the GC via the make-up gas adapter at the end of the capillary column. Hydrogen is supplied via a Parker Balston H2 Generator. Nitrogen & P-5 is supplied by Air Gas

7.1.1.1. The gas streams are polished using three traps or filters before introduction to the GC The traps are as follows:

7.1.1.1.1. Hydrocarbon trap
7.1.1.1.2. H_2O trap
7.1.1.1.3. O_2 scrubber

7.1.1.2. Both the moisture trap and the Oxygen scrubber are of the indicating type. They require either replacement or reconditioning upon color change of the active agents. Refer to the instructions for the individual traps to determine if it is still active. The hydrocarbon trap is a simple activated carbon trap. With high quality gas, it should last for an extended period of time (1-yr. minimum).

7.1.2. Solvents used in the extraction and cleanup procedures include n-hexane, methylene chloride, and acetone that are exchanged to n-hexane prior to analysis.

7.1.3. Hexane is required in this procedure. All solvents must be pesticide quality or equivalent. Each lot of solvent is screened for contaminants before being used for analysis as detailed in Eurofins Corporate Quality SOP No. CA-Q-S-001 (*Solvent & Acid Lot Testing & Approval*) and Eurofins Edison SOP No. ED-GEN-023 (*Bulk Solvent Testing and Approval*).

7.2. Standards

7.2.1. Standards are purchased as concentrated solutions (see Section 7.2.2).

NOTE: Independent sources are used for quantitation standards and spiking standards

7.2.1.1. Most stock solutions are diluted (in volumetric glassware) to working concentration using hexane as the diluent as described in Section 7.2.2.1.

7.2.2. Standard mixes and sources *.

Standard Name	Source
Organochlorine Pesticide Mix AB #3	Restek Catalog No. 32415
Organochlorine Pesticide Mix AB #3.sec	Restek Catalog No. 32415.sec (second source)
Pesticide Surrogate Mix	Restek Catalog No. 32000
Endrin/DDT	Supelco Catalog No 48282
Chlordane	Restek Catalog No. 32021
Toxaphene	Restek Catalog No. 32005
Toxaphene (different pattern)	Restek Catalog No. 32071
Mirex	Accustandard Cat. No. P-066S-10X
1-Bromo-2-nitrobenzene (internal standard)	Restek Cat. No. 32279

*Suppliers with equivalent standards may be substituted..

The components of each standard mix are as follows (note: 'sec' indicates second source):

Parameter	Supplier	Catalog No.	Concentration of Standard (ug/ml)
Aldrin	Restek	32415 & 32415.sec	2000
Alpha-BHC	Restek	32415 & 32415.sec	2000
Beta-BHC	Restek	32415 & 32415.sec	2000
Delta-BHC	Restek	32415 & 32415.sec	2000
Gamma-BHC (Lindane)	Restek	32415 & 32415.sec	2000
Alpha -Chlordane	Restek	32415 & 32415.sec	2000
Gamma -Chlordane	Restek	32415 & 32415.sec	2000
Technical Chlordane	Restek	32021	1000
4,4' –DDD	Restek	32415 & 32415.sec	2000
4,4' –DDE	Restek	32415 & 32415.sec	2000
4.4' –DDT	Restek	32415 & 32415.sec	2000
Dieldrin	Restek	32415 & 32415.sec	2000
Endosulfan I	Restek	32415 & 32415.sec	2000
Endosulfan II	Restek	32415 & 32415.sec	2000
Endosulfan sulfate	Restek	32415 & 32415.sec	2000
Endrin	Restek	32415 & 32415.sec	2000
Endrin aldehyde	Restek	32415 & 32415.sec	2000
Endrin ketone	Restek	32415 & 32415.sec	2000
Heptachlor	Restek	32415 & 32415.sec	2000
Heptachlor epoxide	Restek	32415 & 32415.sec	2000
Methoxychlor	Restek	32415 & 32415.sec	2000
Toxaphene	Restek	32005	1000
Toxaphene	Restek	32071	5000
Mirex	Accustandard	861428-U	1000
4,4-DDT	Supelco	18282	500
Endrin	Supelco	48282	500
Decachlorobiphenyl (DCB)	Restek	32000	200
Tetrachloro-m-xylene (TCmX)	Restek	32000	200

Parameter	Supplier	Catalog No.	Concentration of Standard (ug/ml)
1-Bromo-2-nitrobenzene (internal standard)	Restek	32279	1000

7.2.2.1. Standards Preparation

7.2.2.1.1. Calibration Mix (Organochlorine Pesticide Mix)

The 5 point calibration standards are prepared as detailed in the following table using volumetric glassware and hexane as the diluent:

Initial Calibration Standards Prep (Organochlorine Pesticide Mix)					
Stock Std	**2.5 ppb**	**50 ppb**	**100 ppb**	**250 ppb**	**500 ppb**
Organochlorine Mix AB#3 *(2000 ug/ml)* *Restek (Cat No..32415)in Hexane:Toluene*	Volume brought up to 200 ml hexane: *0.25 ul*	Volume brought up to 200 ml hexane: *5.0 ul*	Volume brought up to 500 ml hexane: *25 ul*	Volume brought up to 200 ml hexane: *25 ul*	Volume brought up to 200 ml hexane: *50 ul*
Initial Calibration Standards Prep (TCMX/DCB Surrogate Mix)					
Stock Std	**25 ppb***	**50 ppb**	**100 ppb**	**150 ppb**	**200 ppb**
Tetrachloro-m-xylene/ Decachlorobiphenyl Surrogates Mix (200 ug/ml) *Restek (Cat, No, 32000) in Acetone*	Volume brought up to 200 ml hexane: *6.25 ul*	Volume brought up to 200 ml hexane: *50 ul*	Volume brought up to 500 ml hexane: *250 ul*	Volume brought up to 200 ml hexane: *150 ul*	Volume brought up to 200 ml hexane: *200 ul*
Initial Calibration Standards Prep (Mirex)					
Stock Std	**2.5 ppb**	**50 ppb**	**100 ppb**	**250 ppb**	**500 ppb**
Mirex *(1000 ug/ml)* *Accustandard (Cat. No. P-066S-10x) in Methanol*	20x dilution of 50 ppb	10x dilution of 500 ppb	5x dilution of 500 ppb	2x dilution of 500 ppb	Volume brought up to 100 ml hexane: *50 ul*

Note: 20 ul of 5 ug/ml Internal Standard solution is added to all calibration standards prior to analysis.

7.2.2.2. **Pesticide Surrogate Spike Mix (10 ug/ml**) : The Pesticide 10ug/ml surrogate spiking solution is prepared by diluting 10 ml of 200 ug/ml of the Pesticide Surrogate Mix (Restek-32000) in to 200 ml of Acetone. For spiking instructions refer to the applicable prep SOP.

7.2.2.3. **Pesticide Surrogate Spike Mix (2 ug/ml) for the reduced volume extraction option:** prepare a 2 ug/ml spiking solution by diluting 10 ml of the 10 ug/ml stock standard described in

7.2.2.2 to a final volume of 50ml in acetone. For spiking instructions refer to the applicable prep SOP.

7.2.2.4. **Pesticide Internal Standard Spike Mix (5 ug/ml):** The Pesticide 5 ug/ml internal standard spike mix is prepared by dilution 1 ml of 1000 ug/ml of the 1-Bromo-2-Nitrobenzene standard (Restek 32279) in to 200 ml of Hexane. 20 ul of this solution is added to all standards, QC samples and field sample extracts prior to analysis.

7.2.2.5. **Pesticide Spiking Standard (20 ug/ml):** The Pesticide Spiking Mix containing the single component pesticides is prepared at a final concentration of 20 ug/ml by diluting 500 ul of the Organochlorine Pesticide Mix AB#3 (Restek 32415 to a 50 ml final volume with acetone. For spiking instructions refer to the applicable prep SOP.

7.2.2.6. **Pesticide Spiking Standard (4 ug/ml) for the reduced volume extraction option**: prepare a 4 ug/ml spiking solution by diluting 10 ml of the 20ug/ml standard prepared in Section 7.2.2.4 above to a final volume of 50ml in acetone. For spiking instructions refer to the applicable prep SOP.

7.2.2.7. **System Performance Solution (Breakdown Check)** 3,3-DDT and Endrin at 0.25 ug/ml): The breakdown check is prepared by taking 250 ul of 500 ug/ml DDT/Endrin Mix (Supelco Catalog No 48282) and bringing it up to a volume of 500 ml with hexane

7.2.2.8. **Technical Chlordane Calibration Solution** (1.0 ug/ml solution w/ surrogates TCMX & DCB at 0.10 ug/ml): 100 ul of 1000 ug/ml Technical Chlordane Standard (Restek Catalog No 32021) and 50 ul of 200 ug/ml Surrogate Mix (Restek Catalog No. 32000). Dilute to 100 ml in Hexane. ***NOTE:*** ICAL consists of single midpoint calibration standard for multiple responders Technical Chlordane and Toxaphene.

7.2.2.9. **Toxaphene Calibration Solution** (1.0 ug/ml solution w/surrogates TCMX & DCB at 0.1 ug/ml) : 20 ul of 5000 ug/ml Toxaphene stock (Restek Catalog No 32071) and 50 ul of 200 ug/ml Surrogate Mix (Restek Catalog No. 32000). Dilute to 100 ml in Hexane. ***NOTE:*** ICAL consists of single midpoint calibration standard for multiple responders Technical Chlordane and Toxaphene.

7.2.2.10. **Initial Calibration Verification (ICV)** Preparation: follow the instructions above for midpoint standards substituting the second source standard (catalog no. suffix = sec) for the primary standards.

8. Sample Collection, Preservation, Shipment and Storage

8.1. Extracts must be stored under refrigeration in the dark and analyzed within 40 days of extraction.

8.2. Samples from chlorinated water sources must be treated with sodium thiosulfate (0.008% solution) at the time of collection to remove chlorine. NOTE: containers pre-preserved with sodium thiosulfate must be requested in bottle orders for samples from chlorinated water sources.

Matrix	Sample Container	Min. Sample Size	Preservation	Holding Time	Reference
Waters	Amber glass, 250 ml, 40 ml or 60 ml	250 ml (3510C prep)	Cool 4 ± 2ºC	7 days to extraction; Analyze within 40 days of extraction	SW846
Soils	Glass, 2 or 4 oz	100 g	Cool 4 ± 2ºC	14 days to extraction; Analyze within 40 days of extraction	SW846

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client requests. Listed below are the holding times and the references that include preservation requirements.

9. Quality Control

9.1. **Sample QC** - The following quality control samples are prepared with each batch of samples.

Quality Controls	Frequency	Control Limit
Method Blank (MB)	1 in 20 or fewer samples	< Rpt. Limit
Laboratory Control Sample (LCS)[1]	1 in 20 or fewer samples	Statistical Limits [4]
Matrix Spike (MS)[2]	1 in 20 or fewer samples	Statistical Limits [4]
MS Duplicate (MSD)[2]	1 in 20 or fewer samples	Statistical Limits [4]
Surrogates	every sample[3]	Statistical Limits [4]
Internal Standard [1]	Every sample[3]	Response within -50% to +100% of most recent cal standard

LCS Duplicate (LCSD) is performed only when insufficient sample is available for the MS/MSD or when requested by the client/project/contract.

[2] The sample selection for MS/MSD are randomly selected, unless specifically requested by a client….predetermined by the extraction lab.

[3] Analytical and QC samples (MB, LCS, MS/MSD)

[4] Statistical control limits are updated annually and are updated into LIMS.

9.1.1. Method Blanks are extracted with each sample batch on each day that samples are extracted. The analytical results for the method blank must fall below the reporting limit for each compound of interest. If a target compound is detected in the blank at a concentration higher than the reporting limit, first the extract is reanalyzed for confirmation. If results are still outside of limits the entire batch of samples extracted with the affected blank must be re-extracted and reanalyzed.

9.1.2. Laboratory Control Sample (LCS): A Laboratory Control Sample (LCS) or blank spike must be extracted and analyzed for with each batch of 20 environmental samples. The recoveries of the LCS must fall within lab generated acceptance criteria (refer to the current TALS Method Limit Group database). If the LCS recovery results are outside of these limits, the extract is reanalyzed. If LCS recoveries are still outside of QC limits after extract reanalysis but recoveries for the Matrix Spike/ Matrix spike Duplicate (MS/MSD) are within QC limits, the data is reported and a Non Conformance Memo (NCM) is written.

9.1.3. Matrix Spike/Matrix Spike Duplicate (MS/MSD): A Matrix Spike/Matrix Spike Duplicate (MS/MSD) pair is extracted and analyzed with every batch of 20 environmental samples. MS/MSD recoveries are evaluated against lab generated limits (refer to the current TALS Method Limit Group database). If the MS/MSD recovery limits fall outside of lab limits the LCS recovery is evaluated. If the LCS recoveries meet criteria the data is reported and a Non-Conformance Memo (NCM) is written.

9.1.4. Surrogate Standards: All samples, blanks and QC samples are spiked with a 2 component surrogate standard mix containing TCMX & DCB (see Section 7.2). The percent recovery of the surrogate standards is calculated and compared to lab generated limits (refer to the current TALS Method Limit Group database). Minimum requirements for surrogate evaluation:

- Both surrogates must have reportable results that meet the acceptance criteria;
- Reported surrogates must be from a column with a passing CCV;
- At least one surrogate must pass on any column from which target analytes are identified and reported.

If both TCMX and DCB recovery are outside of acceptance limits the sample extract is reanalyzed to confirm. If the recoveries are still outside of limits the sample must be re-extracted and reanalyzed or the data flagged as “estimated concentration”.

9.1.5. Internal Standard: The internal standard (1-bromo-2-nitrobenzene) must elute within 30 seconds of and have an area response of 50 to 100% as compared to the most recent preceding calibration standard.

9.1.6. Lower Limit of Quantitation (LLOQ) (aka Reporting Limit) Verification: The LLOQ is the lowest concentration at which the laboratory has

demonstrated target analytes can be reliably measured and reported with a certain degree of confidence, which must be ≥ the lowest point in the calibration curve. The lab verifies the LLOQ annually to demonstrate the capability of quantiation at lower analyte concentrations. The verification is performed by the extraction and analysis of an MDL spike at a concentration of 0.5-2 times the established LLOQ. Recovery of target analytes in the LLOQ verification should be within established in-house limits or within other such project-specific acceptance limits to demonstrate acceptable method performance at the LLOQ. Until the laboratory has sufficient data to determine acceptance limits, the LCS criteria ± 20% (i.e., lower limit minus 20% and upper limit plus 20%) will be used for the LLOQ acceptance criteria. The annual LLOQ verification is completed and documented with the required annual MDL evaluation.

9.2. Instrument QC

9.2.1. GC System Performance Check

9.2.1.1. **Endrin/4,4'-DDT Breakdown:** Prior to performing any standards or sample analysis, a daily check is made on the chromatographic performance of the system. This performance check is made by injecting a standard of Endrin and DDT, each at a 250-ppb level (see Section 7.2), and calculating the percentage breakdown for each compound.

9.2.1.2. Ideally, only two peaks will be seen (one for Endrin and one for DDT). As a rule, this is not the case. It is normal to observe up to six peaks. Three peaks are attributable to Endrin and its degradation products: Endrin Aldehyde (EA) and Endrin Ketone (EK). Three peaks are attributable to DDT and its degradation products: DDE and DDD. Calculate the percentage breakdown as follows:

Endrin:

$$\frac{\text{(Areas of EA + EK)}}{\text{(Areas of EA + EK + Endrin)}} \times 100 = \%\ \text{breakdown Endrin}$$

DDT:

$$\frac{\text{(Areas of DDE + DDD)}}{\text{(Areas of DDE + DDD + DDT)}} \times 100 = \%\ \text{breakdown DDT}$$

9.2.1.3. If the percentage breakdown for either Endrin or DDT is greater than 15%, the system CANNOT be used for pesticide analysis. If the Endrin/DDT performance check fails, injection port/column maintenance must be performed. Usually, changing the glass wool/liner will cure most breakdown problems in the injection port.

Depending upon the nature of the samples, the entire injection port will occasionally need to be cleaned. This cleaning is best done with 1:1 Acetone: Hexane. Another routine maintenance operation to improve column performance is the removal of the first 3 cm of the column. (Note: the septa should be changed each time the injection port is opened).

9.2.1.4. After injection port/column maintenance has been performed, and the columns have been given time to equilibrate (baseline back down to normal) the Endrin/DDT must be re-injected and the system performance re-evaluated.

9.2.2. Initial Calibration Range and Initial Calibration Verification (ICV)

9.2.2.1. ***Initial Calibration Range*:** Single component pesticides are calibrated using a five-point calibration range. Multi-component pesticides are calibrated using a single point calibration at the anticipated midpoint of the calibration range. Standards are prepared following the instructions in Section 7.2.

9.2.2.2. Single response Pesticide Calibration: All single component pesticides and two surrogates are calibrated with a minimum of 5 concentrations. Single component pesticides are analyzed at 10, (5 ppb for the 125 ml initial volume method) 5, 100, 250 and 500 ppb. Surrogate standards are analyzed at 25, 50, 100, 150 and 200 ppb. See Section 7.2 for details on standard prep.

9.2.2.3. Multi-response Pesticide Calibration: Chlordane (technical) and Toxaphene initial calibration is accomplished by analysis of a single point at 1000 ppb (see Section 7.2 for details on standard prep).

9.2.2.4. ***Initial Calibration Verification (ICV):*** An Initial Calibration Verification (ICV) standard is analyzed immediately after the Initial Calibration Range and before any samples are analyzed. The ICV is prepared as detailed in Section 7.2 and must be from a source separate from the standards used in the Initial Calibration Range.

9.2.3. Continuing Calibration Verification (CCV): For single component pesticides, a mid-point Continuing Calibration Verification (CCV) must be analyzed every 12-hours or 20 samples (whichever is more frequent). 'Samples' here are defined as field samples and batch QC (MB, LCS, MS, MSD) and do not include CCVs, PEMs, instrument blanks, etc… For multi-response pesticides a CCV must be analyzed within 12 hours of any multi-response pesticide detects.

9.2.3.1 Analysis of Replicate CCVs: Occasionally dual, sequential CCVs may (for a variety of reasons) be included in an analytical

sequence. When such replicate CCVs are injected both must be evaluated as detailed in the table below (reference Eurofins Document CA-Q-W-008, 'Technical Guidance on the Use and Evaluation of Replicate Continuing Calibration Verification (CCV)').

Dual CCV Evaluation Decision Tree		
Inejection	**QC Acceptance**	**Action**
CCV1 **CCV2**	**Pass** **Pass**	Continue analytical sequence. Data acceptable based on calibration.
CCV1 **CCV2**	**Pass** **Fail**	Analyses before CCV1 may be accepted. Re-analyze all samples that were analyzed after failed CCV2.
CCV1 **CCV2**	**Fail** **Pass**	Re-analyzed all samples that were analyzed before CCV1 and after the previous compliant CCV. Analyses after CCV2 may continue.
CCV1 **CCV2**	**Fail** **Fail**	Re-analyze all samples since the last acceptable CCV. Perform maintenance and/or recalibration prior to re-analysis.

9.2.3.2 In the event that replicate CCVs are included in a sample injection sequence, the acceptance of the associated sample analyses must be properly evaluated and the evaluation process must be documented. Under no circumstances is it allowable to accept sample data based on the evaluation of only 1 of the CCV replicates.

9.2.3.3 Clear documentation of the evaluation of the CCV must be included in the analytical sequence run log (i.e., 'Pass' or 'Fail' in the comment section for each CCV). Additionally, clear documentation of corrective action taken in the event of CCV failures must be included in the run log (see table above for actions that need documentation).

Note: It is acceptable to use the CCV solution as a primer at the beginning of an analytical sequence however the injection should be documented as a 'Primer' in the sequence rather than as a CCV.

9.2.4. Calibration Acceptance Summary

9.2.4.1. Retention Time Windows: Retention time windows must be established to compensate for minor shifts in absolute retention

times as a result of sample loading and normal chromatographic variability (for more detail on the following procedures refer to Eurofins Corporate Technical Services Policy No. CA-T-P-005, “Policy for Determining RT Windows for GC/ECD Tests” and Eurofins Corporate Technical Services Work Instruction No. CA-T-WI-010, “Further Guidance on the RT Window Policy No. CA-T-P-005”).

9.2.4.1.1. Initial determination of RT windows.

9.2.4.1.1.1. The center of the retention time (RT) window shall be updated based on the middle level in the initial calibration of the first CCV in the daily sequence, whichever is most recent.

9.2.4.1.1.2. Use a default RT window of 0.01 minutes. At the end of the batch evaluate all CCVs and LCSs in the batch. If necessary, widen the window such that all analytes fall within the RT window. Reprocess the batch using the new RT windows.

9.2.4.1.1.3. Multiply the maximum deviation by 1.5. This is the retention time window, unless the result is less than 0.01 minutes, in which case the window is set at 0.01 minutes. For example, if the maximum RT deviation for a specific analyte is 0.008 minutes, then the RT window is set at ±0.012 minutes.

NOTE: For the multi-component analytes, for example Aroclors, Toxaphene and Technical Chlordane, the maximum deviation must be evaluated for each of the 3 to 6 major peaks used for sample calculations.

9.2.4.1.1.4. Retention time windows for analytes of interest must not overlap for GC analysis.

9.2.4.1.2. Ongoing evaluation of retention time windows

9.2.4.1.2.1. Evaluate the retention time windows on an ongoing basis. The center of the RT window is updated on the first CCV of the day. All analytes for all subsequent CCVs, LCS and matrix spikes must fall within the retention time window (except as discussed below).

9.2.4.1.2.2. Matrix spike analytes may fall outside of the retention time window if there is a large non-

target peak coeluting with the analyte in the matrix spike.

9.2.4.1.2.3. If any analytes fall outside of the retention time window in CCVs, LCS or matrix spikes (except as discussed above for matrix spikes) then the RT windows for those analytes shall be widened to the minimum degree required for the analyte to fall within the RT window. All samples in the batch shall be reprocessed with the new RT window, and the wider RT window shall remain in place for subsequent batches.

9.2.4.1.2.4. Retention time windows should be reliably narrower than ±0.03 minutes. If RT windows wider that this are necessary, the instrument should be evaluated and maintenance performed as needed. Subsequent to maintenance, RT windows shall be narrowed to the extent that is consistent with the data obtained.

9.2.4.2. **Initial Calibration Range:** Internal standard calibration is employed for this method. A response factor is calculated for each analyte at each calibration concentration.

Response factor = $((A_x)\ (C_{is}))/((A_{is})\ (C_x))$

Where:
A_x = area of the compound
C_x = Concentration of the compound
A_{is} = area of the internal standard
C_{is} = Concentration of the internal standard

9.2.4.2.1. Calculate the percent Relative Standard Deviation of the response factors for each compound at each level:

% RSD = (RF Standard Deviation/RF Mean) X 100

Where:
RF = Response Factor

9.2.4.2.2. If the % RSD across the 5 point range is <20% for any given compound the calibration can be assumed to be linear and the average response factor can be used to calculate concentrations of target compounds in samples.

9.2.4.2.3. If the % RSD is >20% for any given compound, a first order linear regression may be applied to the data to calculate the calibration curve and determine sample

concentration. If this method is employed, the r^1 (Correlation Coefficient) value must be $\geq$ 0.990 for the calibration to be acceptable. Calibration is checked every 12 hours or after every twenty (20) samples, whichever comes first, by injecting a calibration verification standard for all single component pesticide standards.

9.2.4.2.4. Chlordane and Toxaphene Calibration: Chlordane and Toxaphene are multiple response pesticides and are calibrated with a minimum of five (5) points as required (i.e, within 12 hours of either analyte being detected in a sample). Five (5) peaks are used for calculation of response factors and the same criteria detailed above is applied to determine acceptability of calibration.

9.2.4.2.5. Resolution: All single component analyte peaks must exhibit at least 80% chromatographic resolution. The analyst performs a visual check of the mid-level initial calibration standard and all subsequent calibration checks (ICV/CCV). If the resolution requirement is not met instrument maintenance should be performed followed by re-calibration. Percent resolution can be calculated when necessary as follows:

$$\% \text{ Resolution} = V/H \times 100$$

Where:

V= Depth of the valley between two peaks. The depth of the valley is measured along a vertical line from the level of the apex of the shorter peak to the floor of the valley between the two peaks

H = Height of the shorter of the adjacent peaks

9.2.4.3. **Relative Standard Error:** The percent relative standard error (% RSE) from the calibration curve is used to evaluate the initial calibration. This provides a measure of how much error is associated with using the calibration curve for quantitation. The average Relative Standard Error (RSD for average response factors) of the calibration points from the curve used must be ≤ 20%.

Some data systems will not measure the %RSE from a linear or quadratic fit. For the linear case, the correlation coefficient may be used as an alternative to the %RSE, and must be greater than or equal to 0.990. For the quadratic case the Coefficient of Determination may be used, and must be greater or equal to 0.990.

Note: The Relative Standard Error (RSE) is superior to the Correlation Coefficient (*r*) and Coefficient of Determination (r_2) for testing the fit of a set of calibration points to a line. The lower points on a curve have little effect on *r.* As a result, a curve may have a very good correlation coefficient (>0.990) while also having > 100% error at the low point

9.2.4.4. Initial Calibration Verification (ICV): An ICV will consist of a second source standard at or near the midpoint of the Initial Calibration Range analyzed at the frequency specified in Section 9.2.2.4. The calculated concentration of the ICV must be within ±20%D of the expected concentration. Should the %D exceed 20% the analyst should take corrective action (check standard solution, perform instrument maintenance, etc.) and re-inject the ICV. If the %D still exceeds 20% after a single ICV reinjection, a new Initial Calibration Range must be analyzed. All single component analyte peaks must exhibit 80% resolution (see Section 9.2.4.2.5)

9.2.4.5. Continuing Calibration Verification (CCV): A CCV will consist of a second source standard at or near the midpoint of the Initial Calibration Range analyzed at the frequency specified in Section 9.2.3.. The calculated concentration of the CCV must be within ±20%D of the expected concentration. Should the %D exceed 20% the analyst should take corrective action (check standard solution, perform instrument maintenance, etc.) and re-inject the CCV. If the %D still exceeds 20% after a single CCV reinjection, a new Initial Calibration Range must be analyzed. All single component analyte peaks must exhibit 80% resolution (see Section 9.2.4.2.5).

Step	***Standards***	***Type***	***Control Limit***	***Frequency***
Method # 8081B				
GC System Performance Check	*Endrin/DDT, 250 ppb*	*Performance check*	*15% breakdown*	*At beginning of 12 hour clock and after system maintenance*
*Initial Calibration**	2.5, 50, 100, 250 and 500 ppb for single response, 1000 ppb for multi response	*Average response factor or 1st order linear regression*	*For average RF: <20%RSD all analytes. For linear regression: r ≥0.990 or <20%RSE*	*As required when ICV or CCV do not meet requirements*
ICV	*100 ppb*	*Average*	*± 20%D*	*Once after each initial calibration*
CCV	*100 ppb*	*Average*	*± 20%D*	*Every 12 hrs or 20 samples, whichever is more frequent*

9.2.4.6. Internal Standard Area Acceptance: The measured area of the internal standard must be no more than 50% different from the average area calculated during the initial calibration. This can be automatically calculated in the software by designating the ICIS with the QC code ICISAV. When the internal standard area is outside the limit, all samples that fall outside the QC criteria must be re-analyzed.

10. Procedure

10.1. Gas Chromatograph Operation

10.1.1. The sequence of events for GC analysis involves many steps. First the injection system and column performance and calibration must be verified. Maintenance operations are performed as needed. Then samples must be run on the instrument. Chromatograms and reports must be evaluated for content, integration and concentration. Re-runs and dilutions must be made based on the calibrations that were in effect at the time the sample was run. Lastly, a detailed analysis and calculations must be performed to determine the concentration of all the parameters for which the sample was analyzed.

10.1.2. General Operating Conditions

10.1.2.1. Injection System: A split/splitless injection port with electronic pressure control (EPC) is used. Thirty seconds after sample injection, the purge valve is turned on to facilitate the sweeping of any remaining residual solvent/sample from the injection port.

10.1.2.2. The EPC is used in the ramp pressure mode. The ramp pressure program is as follows:

Initial Pressure	InitialTime	Rate	Final Pressure	Hold
12 psi	2.5 min	7 psi/min	4 psi	1.50 min
		5 psi/min	9 psi	1.40 min
		9 psi/min	13 psi	2.00 min

10.1.2.3. For pesticide analysis the normal operating conditions of the injection port are as follows:

Injection port Temperature:	250^{o}C
Column flow:	12.3 ml/minute
Split vent flow:	5 ml/minute
EPC:	Pressure Ramp
Detector temperature	330C

10.1.2.4. In addition to the EPC, the injection port is also equipped with a siltek-coated glass double goose neck liner that contains a 1 cm glass wool plug. The plug of glass wool is located in the liner between the double goose neck.

10.1.2.5. This liner/glass wool combination provides many functions. The glass wool serves as a heat sink rapidly vaporizing solvent and samples resulting in higher response factors. The liner also protects the column head from accumulation of high boiling residuals and particulates.

10.1.2.6. The glass wool will be changed when changing the liner. The changing of the glass wool/liner is based upon the breakdown of an Endrin/DDT standard. This is covered in further detail in section 10.2.1.

10.1.2.7. Regular maintenance is performed on the injection port. When the glass wool/liner is changed, the septa also must be changed. Injection port, oven and detector temperatures are lowered to ambient prior to "cracking" the system. This is so as to introduce a minimum of damaging oxygen molecules into the system.

10.1.2.8. After the system has cooled, the old liner is removed. The injection port should be checked for particulate residues and cleaned as needed. A flashlight is usually required for this. After a new liner has been prepared it is placed into the injection port. A graphite seal is placed around the liner. The edges of the seal must be flat, not knife-edged, and free of nicks or burrs. If any of these conditions are not met, the graphite seal must be replaced as well. The graphite seal is critical to proper operation of the injection port. If in doubt, replace it.

10.1.2.9. The locking ring on the top of the injection port should be turned, with the wrench, about 1/8 turn past finger tight. The septum nut should never be tightened more than finger tight. After the injection port is reassembled, all column nuts inside the oven should be checked for leaks using Snoop (Supelco) or another suitable leak tester.

10.1.2.10. Once the signal from both detectors has stabilized, it is time to re-heat the zones. The zones should be heated in the order of detectors, oven and then injectors. This is to ensure that volatilized contaminants do not condense on the column or detector.

10.1.2.11. Oven: With the megabore columns installed, temperature programming is employed to achieve higher resolution of compounds and shorter run times than could be accomplished using isothermal methods.

10.1.2.11.1. A standard oven program for pesticide analysis is employed for all columns as follows:

Initial Temp	Hold Time1	Rate1	Temp1
160°C	0.62 min	30°/min	244°C
Hold Time2	**Rate 2**	**Final Temp**	**Final Time**
2.5min	21°/min	315°C	3.0min

10.1.2.12. Detectors: Detectors operate at 330°C and need to be supplied with 60 ml/min total flow. They are essentially maintenance free on a day-to-day basis. They are routinely baked out at 330°C to remove persistent contaminants. On occasion the detectors may be baked out at a higher temperature to remove contaminants with an extremely high boiling point (CAUTION: Do not exceed the maximum detector temperature of 380°C).

10.1.2.12.1. If the detectors are particularly contaminated, they must be sent to Agilent Technologies in Avondale, Pennsylvania for reconditioning. This should occur if the detector baseline is greater than 100 Hz. Detector reconditioning should be required at a maximum of biannually.

10.1.2.13. Chemstation: HP Chemstation software is used for automation of runs and data acquisition. The system is dedicated to a single GC and does not multitask. Therefore, data manipulation cannot be done while sample analysis is in progress. The data system acquires and stores all chromatographic data.

10.1.2.14. Eurofins Chrom data processing software is used for the processing of the chromatography data files. Calibrations, verification standards and samples are processed and reviewed using this database. Chrom is integral to Eurofins LIMS (TALS) which is used to generate all reports..

10.2. Analytical Sequence

10.2.1. The analytical sequence for performance checks, initial calibration, calibration verifications and sample analysis is described in the following sections.

10.2.2. Before calibration standards are analyzed the GC Performance Check Standard (see Section 9.2.2.1) must first be analyzed and evaluated to check the performance of the injection port and column with regard to catalytic active sites. The breakdown for both Endrin and DDT in the Performance Check Standard must be less than 15%. If the performance check fails this criteria system maintenance must be performed and the check successfully reanalyzed before proceeding with calibration.

10.2.3. A five point initial calibration (ICAL) is analyzed and evaluated for each of the 21 single response pesticides plus surrogates as described in Section 9.2.4.2. When needed a 5 point ICAL is also analyzed for Mirex.

10.2.4. Calibration for Technical Chlordane and Toxaphene: Chlordane and Toxaphene are multiple response pesticides containing at least 3-8 primary peaks each. A single point calibration check standard at a concentration of 1000ug/l is analyzed for Chlordane and Toxaphene. A full 5 point calibration range is analyzed for these compounds should they be detected in client samples..

10.2.5. A second source initial calibration verification (ICV) is analyzed and evaluated for each of the 21 single response pesticides as described in Section 9.2.4.3. When needed an ICV is also analyzed for Mirex. **NOTE**: The 12 hour time clock for Pesticides commences with the injection of the first Pesticide Calibration Standard or Verification.

10.2.6. GC Performance Check Standard is analyzed and the breakdown of Endrin/DDT is measured again before samples are analyzed and at the beginning of each subsequent 12 hour shift. If the breakdown check fails, then injection port/column maintenance is required

10.2.7. Client samples and QC samples may be analyzed after the analysis of the performance check. Sample analysis may proceed for up to 20 samples or 12 hours prior to analysis of another calibration verification (whichever is more frequent).

10.2.8. A Continuing Calibration Verification (CCV) for the 21 single response pesticides plus surrogates must be analyzed and evaluated every 12 hours or 20 samples (whichever is more frequent) as described in Section 9.2.4.4.. This is accomplished by running the midpoint calibration standard as a CCV (Pest Mix 100 ppb check standard and Mirex 100 ppb check standard; see Section 7.2.2.1). The calculated concentration for each compound in the CCV must be +/- 20 % of the expected concentration. Any samples analyzed after a failing CCV must be reanalyzed under a passing CCV. If, after performing instrument maintenance, the reanalysis of a CCV fails criteria, a new initial calibration range must be analyzed (see Section 9.2.4.2). Any data reported against a failing CCV must have a Non-Conformance Memo detailing the issue.

10.2.9. Analytical Sequence: The automation of GC runs is accomplished via the "SEQUENCE" macro of the Chemstation. The sequence file contains the name of Method file corresponding to the type of analysis to be performed, the range of samples to be run, and the number of injections per bottle. It is common practice to run the check standards, evaluate the instrument status, and then complete the Sample Table and Sequence File. If everything else is complete, the run is initiated using the START SEQUENCE soft-key of the SEQUENCE macro.

Example Analytical Sequence	
1. Hexane 2. Instrument Blank 3. Endrin/DDT Breakdown 4. Pesticide Mix 1 (2.5 ppb) 5. Pesticide Mix 2 (50 ppb) 6. Pesticide Mix 3 (100 ppb) 7. Pesticide Mix 4 (250 ppb) 8. Pesticide Mix 5 (500 ppb) 9. Chlordane (1000 ppb) 10. Toxaphene (1000 ppb) 11. Pesticide ICV (100 ppb)	12. Mirex 1 (10 ppb) (if needed) 13. Mirex 2 (20 ppb) (if needed) 14. Mirex 3 (100 ppb) (if needed) 15. Mirex 4 (250 ppb) (if needed) 16. Mirex 5 (500 ppb) (if needed) 17. Mirex ICV (100 ppb) (if needed) 18. Instrument Blank 19. Endrin/DDT Breakdown 20. Pest Mix 3 (100 ppb)…CCV 21. Mirex 3 (100 ppb) …CCV (if needed) 22. 20 or fewer samples or 12 hours 23. Instrument Blank 24. Endrin/DDT Breakdown 25. Pest Mix 3 (100 ppb)…CCV 26. Mirex 3 (100 ppb) …CCV (if needed) 27.20 or fewer samples or 12 hours

10.3. Dual Column Approach

10.3.1. The laboratory designates the rear column as the primary column and the front column as the secondary column. If the difference between the dual columns results in ≤40% RPD report the higher concentration.

10.3.2. The values are calculated from the chromatographic peaks that fall within the daily retention time windows. Retention times are updated using the retention times found in opening CCV for the most recent 12 hour period.

10.3.3. If the calculated values are greater than 40% RPD of each other, report the lower concentration regardless of whether that result is from the primary or secondary column. Report the result with a flag of P*. **Exception:** NJDEP DKQP protocols require reporting the higher concentration in all instances.

10.3.4. If the surrogates on one column are >40% RPD compared to the other column, this may be indicative of a bad injection or columnar blockage. The sample should be reanalyzed. If similar results are obtained following reanalysis, report the lower of the two numbers and describe the circumstances in the job summary and report case narrative.

10.3.5. If one of the columns fails CCV criteria (but the CCV is between 15%-40% greater than expected value), the sample results shall be reported from the compliant column. If the falls outside of acceptance criteria on the low side, reanalysis shall be performed.

10.3.6. If the CCV on one of the columns is more than 40% different from the correct value, it can be assumed that there has been significant drift on that column. The sample shall be reanalyzed against an acceptable calibration.

10.3.6.1. An exception to this requirement would be if the CCV recovery on one column fails on the high side and >40% RPD but the associated samples were non-detect for all target analytes on both columns. In this case the non-detect results may be reported from the compliant column.

10.3.7. In some cases where the sample chromatography is complex and has largely varying peaks concentrations, the chromatographic separation may not be sufficient on the 0.53mm ID columns. In this case a confirmatory analysis on an instrument with 0.32 ID columns may be required. The supplemental data produced using analysis on the 0.32mm ID 'microbore' column may minimize overlapping and baseline interference difficulties, and better resolves potential positive identifications. Use of this alternative chromatographic technique shall be noted in the job summary and report case narrative.

10.3.8. In summary, the flow chart in Attachment 1 presents a recommended rational approach to selecting the better number to report for dual column data. It shall be noted that these recommendations may be overridden by project specific requirements and that they cannot cover all eventualities. The complexity of some data set will require the final decision to be made utilizing the judgment of experienced analysts. In some cases further cleanup steps to remove interferences may be appropriate.

10.4. Extract Cleanups

10.4.1. Cleanup methods are dictated by the original sample matrix and the parameters being determined.

10.4.2. Cleanup of all water samples, if needed, is performed using Florisil (Eurofins Edison SOP No. ED-ORP-020*: Florisil Cleanup for Pesticide/PCB Sample Extracts*, SW846 Method 3620B, most current revision) and TBA sulfite (Eurofins Edison SOP No. ED-ORP-021: *The Removal of Elemental Sulfur from Pesticide/PCB Sample Extracts, SW846 Method 3660B,* most current revision). Blanks must also undergo cleanup following the same procedures as samples.

10.4.3. Cleanup of all soil samples is conducted using Florisil (Eurofins Edison SOP No. ED-ORP-020*: Florisil Cleanup for Pesticide/PCB Sample Extracts*, SW846 Method 3620B, most current revision) and, if needed, TBA sulfite (Eurofins Edison SOP No. ED-ORP-021: *The Removal of Elemental Sulfur from Pesticide/PCB Sample Extracts, SW846 Method 3660B,* most current revision). Blanks must also undergo cleanup following the same procedures as samples.

10.4.4. Check Florisil prior to use to assure quantitative recovery of target analytes. (see Section 4.3.2 above and Eurofins Edison SOP No. ED-ORP-020*:* *Florisil Cleanup for Pesticide/PCB Sample Extracts*, SW846 Method 3620B,

10.5. Data Processing and Documentation

10.5.1. Before the analysis sequence is initiated the GC Maintenance logbook must be filled out. It should contain the following information: date, injector temp, oven temp, detector temp, injector flow, signal A, signal B, analysts initials, and notes for any necessary repairs.

10.5.2. After samples have been run, each standard and sample must be entered into the Instrument Run Log. The Instrument Run Log should contain the following information: run date, data file name, vial position, sample number, initial volume/weight, final volume, dilution factor, method, job number, QA number, extraction date, lab prep batch, Chrom batch signature of analyst at the bottom of each page, lot numbers for standards used, and result of run (O.K., dilution, non-inject, etc.).

10.5.3. The reporting limit is based on the concentration of the lowest standard in the initial calibration, adjusted for the sample wt/vol, final volume, dilution factor and %moisture (No unqualified analytical results or non detects may be reported which correspond to an extract concentration less than the lowest standard in the calibration range).

10.5.4. Any compound concentration that exceeds the concentration of the calibration range must be diluted and re-analyzed.

11.0. Calculations / Data Reduction

11.1. Accuracy:

$$\text{ICV / CCV, LCS \% Recovery} = \frac{\text{observed concentration}}{\text{known concentration}} \times 100$$

$$\text{MS \% Recovery} = \frac{\text{(spiked sample) - (unspiked sample)}}{\text{spiked concentration}} \times 100$$

11.2. Precision (RPD):

$$\text{Matrix Duplicate (MD)} = \frac{|\text{orig. sample value - dup. sample value}|}{[(\text{orig. sample value + dup. sample value})/2]} \times 100$$

11.3. Calculation of Sample Amounts (Internal Standard Procedure)

11.3.1.1 Aqueous Samples

$$\text{Concentration } (\mu g/L) = \frac{(As)(Cis)(D)}{(Ais)(RF)(Vs)\ (Vi)\ (1000)}$$

Where:

As	=	Area of the target analyte peak in the sample
Cis	=	Concentration of the internal standard (ug/L)
D	=	Dilution factor, if the sample or extract was diluted prior to analysis. If no dilution is performed, D = 1.
Vi	=	Volume of the extract injected (ul)
Ais	=	Area of the internal standard peak
RF	=	Average response factor from the initial calibration.
Vs	=	Volume of sample extracted (ml)

The 1000 in the denominator represents the number of ul in 1 ml.

11.3.1.2 Solid Samples

$$\text{Concentration } (\mu g/kg) = \frac{(As)(Cis)(D)(Vt)}{(Ais)(RF)(Ws)\ (Vi)\ (1000)}$$

Where:

As	=	Area of the target analyte peak in the sample
Cis	=	Concentration of the internal standard (ug/L)
D	=	Dilution factor, if the sample or extract was diluted prior to analysis. If no dilution is performed, D = 1.
Vi	=	Volume of the extract injected (ul)
Ais	=	Area of the internal standard peak
RF	=	Average response factor from the initial calibration.
Vt	=	Volume of concentrated extract (ul)
Ws	=	Weight of sample (g)

The 1000 in the denominator represents the number of ul in 1 ml.

11.4. Relative Response Factors

$$RRF = \frac{A_x}{A_{is}} \times \frac{C_{is}}{C_x}$$

Where:

A_x = Area of target analyte peak
Ais = Area of internal standard peak
Cis = Concentration of internal standard
Cx = Concentration of compound in standard

11.5. Percent Relative Standard Deviation (% RSD):

$$\% \text{ RSD} = \frac{\text{Standard Deviation of RRFs}}{\text{Mean RRF}}$$

11.6. Relative Standard Error (RSE)

$$\%\,RSE = 100\% \times \sqrt{\frac{\sum_{i=1}^{N}\left[\frac{C_i - PC_i}{C_i}\right]^2}{(N-P)}}$$

Where:

N = Number of points in the curve
P = Number of parameters in the curve (= 1 for average response factor, 2 for linear, 3 for quadratic)
CI = True concentration for level i
PCi = Predicted concentration for level i

11.7. Percent Difference (% D):

$$\% \text{ D} = \frac{RRF_c - \overline{RRF_i}}{\overline{RRF_i}} \times 100$$

Where: RRFc = RRF from continuing calibration

$\overline{RRF_i}$ = Mean RRF from current initial calibration

11.8. Percent Recovery (% R): Surrogates and Spikes

$$\text{Recovery (\%)} = \frac{\text{Concentration (or amount) found}}{\text{Concentration (or amount) added}} \times 100$$

11.9. Dry Weight Correction: All solid samples must be corrected for dry weight using the following formula for dry weight determination.

$$DW = \frac{Gd}{} \times 100$$

$$DW = \frac{Gd}{Gw}$$

Where:

DW	=	Percent % Dry Weight
Gd	=	Dry weight of selected sample aliquot
Gw	=	Wet weight of selected sample aliquot

Multiply the DW value times the wet weight of the sample extracted.

NOTE: All dry weight corrections are made in TALS at the time the final report is prepared.

12.0. Method Performance

12.1. Method Detection Limit Study (MDL)

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure in Section 20 (Test Methods and Method Validation) of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM). MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method requirements require a greater frequency.

12.2. Lower Limit of Quantitation (LLOQ) (aka Reporting Limit) Verification:

The LLOQ is the lowest concentration at which the laboratory has demonstrated target analytes can be reliably measured and reported with a certain degree of confidence, which must be ≥ the lowest point in the calibration curve. The lab verifies the LLOQ annually to demonstrate the capability of quantiation at lower analyte concentrations. The verification is performed by the extraction and analysis of an MDL spike at a concentration of 0.5-2 times the established LLOQ. Recovery of target analytes in the LLOQ verification should be within established in-house limits or within other such project-specific acceptance limits to demonstrate acceptable method performance at the LLOQ. Until the laboratory has sufficient data to determine acceptance limits, the LCS criteria ± 20% (i.e., lower limit minus 20% and upper limit plus 20%) will be used for the LLOQ acceptance criteria. The annual LLOQ verification is completed and documented with the required annual MDL evaluation.

12.3. Demonstration of Capabilities

For DOC procedure refer to Section 19 in the most current revision of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

12.4. Training Requirements

Refer to Eurofins SOP No. ED-GEN-022, *Training*, for the laboratory's training program.

13.0. Pollution Control

13.1. Pollution prevention encompasses any technique that reduces or eliminates the quantity or toxicity of waste at the point of generation. Numerous opportunities for pollution prevention exist in laboratory operation. The USEPA has established a prevention hierarchy of environmental management techniques that places pollution prevention as the management option of first choice. Whenever feasible, laboratory personnel should use pollution prevention techniques to address their waste generation. When wastes cannot be feasibly reduced at the source, the agency recommends recycling as the next best option.

13.2. The quantity of chemical purchased should be based on expected usage during its shelf life and disposal cost of unused material. Actual reagent preparation volumes should reflect anticipated usage.

14.0. Waste Management

14.1. The U.S. Environmental Protection Agency requires that laboratory waste management practices conducted be consistent with all applicable rules and regulations. All waste will be disposed of in accordance with Federal, State and Local regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees will abide by this method and the policies in section 13 of the Corporate Safety Manual for "Waste Management and Pollution Prevention."

14.2. The following waste streams are generated as a result of this analysis:

- Expired Standards – The vials are collected in a 1 gallon polyethylene bucket. These vials are then transferred to an open top 55 gallon steel or polyethylene waste drum. These drums are transported to a waste facility for proper disposal.

- Auto sampler vials and expired standards: These vials are collected in satellite accumulation within the instrument laboratory. The vials are then placed into a 55 steel open top drum in the waste room. When the drums are full, the drum will be collected by the waste vendor for disposal. This waste is treated for incineration.

  Teris Profile Number: 50016652
  Onyx Profile WIP Number: 282493

- Mixed Solvent Waste: Mixed solvent waste is collected in a small beaker inside the bench top hood. This waste is then transferred into the satellite accumulation container in the Organic Prep. Lab. on a daily basis. This material is transferred into 5 gallon solvent cans as satellite accumulation. These cans are emptied

every 24 hours into a steel drum in the waste room. This drum is kept in the walk in hood until it is full. The full drum is then removed from the hood and placed on secondary containment in the waste room.

Teris Profile Number: 50016624
Onyx Profile WIP Number: 545240

- Soil Retain Samples - These samples if not flagged in the system for any hazardous constituents are transferred to poly-lined cubic yard boxes. These boxes when full are sent to stabilization or incineration. These materials are sent out as hazardous for lead and chromium

  Teris Profile Number (incineration): 50016710
  Onyx Profile Number: (stabilization) 402535

15.0. References / Cross-References

15.1. United States Environmental Protection Agency, "Method SW8000C: Determinative Chromatographic Separations,", Test Methods for Evaluating Solid Wastes, SW846, Revision 3, March 2003.

15.2. United States Environmental Protection Agency, "Method 8081B, Organochlorine Pesticide by Gas Chromatography", Test Methods for Evaluating Solid Wastes, SW846 Third Edition, Volume 1B: Laboratory Manual, Physical/Chemical Methods, Revision 2, February 2007.

15.3. Eurofins Edison Document No. ED-QA-LQM, *Laboratory Quality Manual*, most current revision.

15.4. Eurofins Edison SOP No. ED-ORP-014: *Extraction of Pesticides and PCBs in Water by Separatory Funnel, SW846 Method 3510C,* most current revision.

15.5. Eurofins Edison SOP No. ED-ORP-018*: Extraction of Pesticides/PCBs in Soil Using Low-Level Extraction, SW846 Method 3550B,* most current revision.

15.6. Eurofins Edison SOP ED-ORP-044, *Procedure for the Microwave Extraction of Solids, SW846 3546*

15.7. Eurofins Edison SOP No. ED-ORP-019*: Waste Dilution for Pesticides and PCBs, SW846 Method 3580A,* most current revision

15.8. Eurofins Edison SOP No. ED-ORP-051: *Extraction of Semivolatile Organic Compounds in Water by Microextraction using SW846 Method 3511*

15.9. Eurofins Edison SOP No. ED-ORP-020*: Florisil Cleanup for Pesticide/PCB Sample Extracts*, SW846 Method 3620B, most current revision.

15.10. Eurofins Edison SOP No. ED-ORP-021: *The Removal of Elemental Sulfur from Pesticide/PCB Sample Extracts, SW846 Method 3660B,* most current revision.

15.11. Eurofins Edison SOP No. ED-GEN-022, *Training,* most current revision.

15.12. Eurofins Corporate Quality SOP No. CA-Q-S-001 (*Solvent & Acid Lot Testing & Approval*), most current revision.

15.13. Eurofins Edison SOP No. ED-GEN-023 (*Bulk Solvent Testing and Approval*), most current revision.

15.14. Eurofins Document CA-Q-W-008, 'Technical Guidance on the Use and Evaluation of Replicate Continuing Calibration Verification (CCV), most current version.

15.15. Eurofins Corporate Quality SOP No. CA-Q-P-004, "Reporting Results for Methods that Require Second-Column Confirmation", most current revision.

15.16. Eurofins Corporate Work Instruction No. CA-T-WI-008, "Minimum Requirements for Pesticide Analysis by SW846 Method 8081B", most current revision.

15.17. Eurofins Corporate Policy CA-T-P-004, "Policy for Determining RT Windows for GC/ECD Tests", most current revision.

15.18. Eurofins Corporate Technical Services Work Instruction No. CA-T-WI-010, "Further Guidance on the RT Window Policy No. CA-T-P-005", most current revision.

16.0. Method Modifications:

None

17.0. Attachments

Attachment 1: Dual Column Reporting Flowchart

18.0. Revision History

Revision 10, dated 1/17/2025. .

- Section 9.2.4.2.4: Revised to clarify the use of 5 major peaks to generate calibration response factors and the same criteria used to determine daily calibration verification.

Revision 9, dated 12/13//2024.

- Added section 9.2.4.6 with procedure to evaluate internal standard for acceptance.

Revision 8, dated 06/12/2024

- Updated to include SW846 3511 as aqueous prep method.

Revision 7, dated 10/17/2022:

- Updated to Eurofins branding throughout document.

- Revised Section 8 to include requirement to treat samples from chlorinated sources with sodium thiosulfate
- Section 9.2.4.3: Included details of evaluation of initial calibration for Relative Standard Error (RSE).
- Section 11.6: added formula for calculation of RSE.
- Section 12.2 added: details the annual LLOQ verification requirement.

Revision 6, dated 03/25/2021:

- Added Section 10.5.3 which details how the reporting limit is established.
- Added Section 10.5.4 which discusses requirement to dilute analytes into range of calibration.

Revision 5, dated 10/12/2020:

- Edited throughout to reflect Eurofins branding and policy.
- Updated Lab Quality Manual section references as needed.

Revision 4, dated 09/13/2016:

- Section 9.2.4.1: completely rewrote this section to reflect requirements of Eurofins Corporate Technical Services Policy No. CA-T-P-005, “Policy for Determining RT Windows for GC/ECD Tests” and TestAmerica Corporate Technical Services Work Instruction No. CA-T-WI-010
- Section 15 (References): added references to TestAmerica Corporate Technical Services Policy No. CA-T-P-005, “Policy for Determining RT Windows for GC/ECD Tests” and TestAmerica Corporate Technical Services Work Instruction No. CA-T-WI-010, “Further Guidance on the RT Window Policy No. CA-T-P-005”.
- Attachment 1: RT Windows for Single Analytes/Surrogates: DELETED and renamed subsequent attachments.

Revision 3, dated 01/05/2016:

- Section 2.2: expanded to include summary of internal standard calibration.
- Section 7.2.2: added 1-Bromo-2-nitrobenzene (internal standard) to the list of standards (Restek 32279). Components and concentration added to table.
- Added Section 7.2.2.4 which describes the preparation of the internal standard solution. All subsequent sections renumbered accordingly.
- Section 7.2.2.1.1: added footnote to ICAL standard prep table detailing requirement to spike each standard with internal standard solution.
- Section 7.2.2.4: describe internal standard spiking protocol (20 ul of 5.0 ug/ml solution into all standards, QC extracts and field sample extracts.
- Section 9.1: added internal standard to ‘Sample QC’ table.
- Section 9.1.4: added following minimum requirements for surrogate evaluation and reporting: a) Both surrogates must have reportable results that meet the acceptance criteria; b)reported surrogates must be from a column with a passing

CCV; c)At least one surrogate must pass on any column from which target analytes are identified and reported. (per corp "Minimum Requirements" document).

- Section 9.1.5: added this section which describes acceptance criteria for internal standards (retention time and response).
- Section 9.2.3: Added the following sentence: "'Samples' here are defined as field samples and batch QC (MB, LCS, MS, MSD) and do not include CCVs, PEMs, instrument blanks, etc… ". Deleted the phrase 'and at the end of every sequence'. (both changes reflect 'Minimum Requirements for Pesticide Analysis' document).
- Added Section 9.2.4.1.3: "Updating absolute retention times: Update retention times with the retention times found in the opening CCV for that 12 hour period."
- Section 9.2.4.2: replaced 'external standard' with 'internal standard'. Added formula for calculation of response factors by internal standard method. Deleted text regarding calibration acceptance criteria from this section as it is duplicated in subsequent sections.
- Section 9.2.4.2.2: added phrase 'for any given compound.'
- Added section 9.2.4.2.5: describes resolution check.
- Sections 9.2.4.3 and 9.2.4.4: added statement concerning 80% resolution requirement.
- Section 9.2.4.4: changed 'ICV' to 'CCV' in last sentence.
- Section 10.1.2.13: Revised first sentence to read: ": HP Chemstation software is used for automation of runs and data acquisition."
- Section 10.2.2: corrected reference to Section 9.2.2.1 (was incorrectly listed as 7.2.2.1).
- Section 10.2.8: revised to clarify that CCV bracketing is not required and that only samples analyzed after a failing CCV must be reanalyzed (i.e., samples analyzed immediately prior to a failing CCV need not be reanalyzed).
- Section 10.3.2: added the following regarding updating retention times: "Retention times are updated using the retention times found in opening CCV for the most recent 12 hour period."
- Section 11: added formulas for calculation of sample concentrations as well as %RSD, %D, % Recovery, RRF and dry weight correction.
- Section 15: removed reference to SOP No. ED-ORP-016*: Automated Soxhlet Extraction of Solid Samples – Pesticides/PCBs, SW846 Method 3541* as it is no longer is use.
- Section 15: added reference to TestAmerica Corporate Quality SOP No. CA-Q-P-004, "Reporting Results for Methods that Require Second-Column Confirmation"
- Section 15: added reference to TestAmerica Corporate Work Instruction No. CA-T-WI-008, "Minimum Requirements for Pesticide Analysis by SW846 Method 8081B".
- Section 15: added reference to TestAmerica Corporate Policy Memorandum No. CA-Q-QM-006, "Technical Guidelines for Analysis of Complex GC/ECD Chromatograms".

- Revision 2, dated 13 May 2015:
  - Section 1.1: updated RLs to reflect current lab practice.
  - Section 2.1 and throughout: revised initial aqueous/TCLP sample volumes to reflect current lab practice
  - Section 2.1.1: removed note describing option for Reduced Volume Extraction (RVE) as this is now standard lab practice.

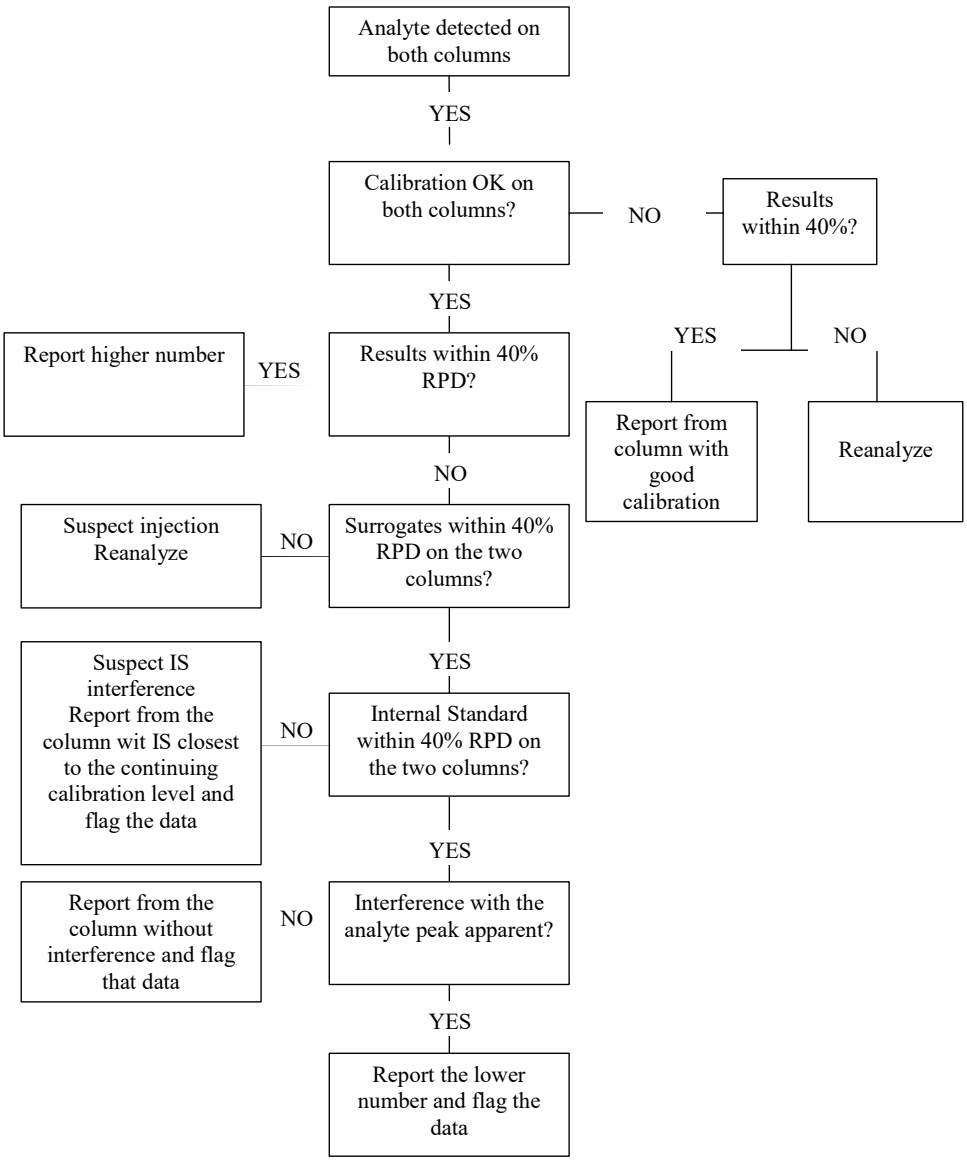
- Section 2.1.2 and throughout document: removed reference to prep by SW3541 as this method is no longer in use at Edison lab.
- Section 4.3.2 and throughout: updated source of standards used for Florisil check.
- Section 6.1.2.3.1: updated name of analytical GC columns currently in use.
- Section 6.1.2.4.1: updated make-up gas to P-5 & Nitrogen.
- Section 7.1.1: updated carrier gas to Hydrogen and make-up gas to P-5&Nitrogen.
- Section 7.2.2 and throughout document: updated source and catalog numbers for analytical standards (Restek is now primary source of standards).
- Section 7.2.2.1: updated standards prep instructions. Removed outdated references to standards and spiking mixes. Removed notes pertaining to RVE since this procedure is now standard and incorporated into instructions.
- Section 7.2.2.10: added instructions for preparation of ICVs.
- Section 8.1: adjusted water sample container from 1000ml to 250ml.
- Section 9.2.2: removed references and instructions pertaining to the Pesticide Resolution Check (a CLP requirement we no longer perform).
- Section 9.2.3.1: Added extensive discussion regarding the analysis of replicated CCVs.
- Section 9.2.4.4: updated table to include new concentration for low standard (2.5 ppb).
- Section 10.1.2.14 and throughout document: replaced references to Target with TestAmerica Chrom.
- Section 10.2: made extensive revisions to discussion of the analytical sequence (removing duplicate entries and adjusting to reflect current procedures).
- Section 10.3: added note concerning NJ DKQP requirements for reporting highest concentration of dual columns.
- Section 15 (References): updated to include “Technical Guidance on the Use and Evaluation of Replicate Continuing Calibration Verification (CCV), most current version.”
- Added Sections 7.2.2.11 and 7.2.2.12 reflecting the addition and preparation of Internal standard

- Revision 1, dated 09 October 2012
  - Throughout: Revised LQM section number references to reflect the most current LQM revision.
  - Section 2.1.1: added description of reduced initial volume (125ml)/final volume (1ml) option.
  - Section 2.1.2: Added reference to TestAmerica Edison SOP ED-ORP-044, *Procedure for the Microwave Extraction of Solids, SW846 3546.*
  - Section 7.2.2.1.1 added preparation of 5ppb standard for the reduced volume method.
  - Section 9.2.2.2 Added 5ppb standard for the reduced volume method
  - Section 9.2.4.4 Added 5 ppb standard to the initial calibration for the reduced volume method
  - Section 10.2.6 Added 5 ppb to the Analytical sequence for the low level method Section 15.0: Removed reference to TestAmerica Edison SOP EDS-GEN-019, *Organic Calculations,* most current revision.
  - Section 15.0: Added reference to TestAmerica Edison SOP ED-ORP-044, *Procedure for the Microwave Extraction of Solids, SW846 3546*

- Revision 0, dated 02/17/2011: New

ATTACHMENT 1

Dual Column Reporting Flowchart
(Note: NJDEP DKQP requires reporting the higher concentration in all instances)



Title: Method SW846 3060A, The Alkaline Digestion of Soil and Wipe Samples for the Analysis of Hexavalent Chromium

Once printed, this is considered an uncontrolled document

Approvals (Signature/Date):

Jasmine Parillo 12/23/24	Dan Helfrich 12/26/24
Jasmine Parillo Date	Dan Helfrich Date
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1.0 Scope and Application

1.1 Analytes, Matrix(s), and Reporting Limits

1.1.1 SW846 Method 3060A is an alkaline digestion procedure for extracting Hexavalent Chromium [Cr(VI)] from soluble, adsorbed, and precipitated forms of chromium compounds in soils, sludges, sediments, and similar waste materials. Materials applicable to this method include soil, sediment, debris, brick, concrete, sludge, and precipitate. Eurofins Edison has modified the method to include digestion of surface wipe samples. To quantify total Cr(VI) in a solid matrix, three criteria must be satisfied: 1) the extracting solution must solubilize all forms of Cr(VI), 2) the conditions of the extraction must not induce reduction of native Cr(VI) to Cr(III), and 3) the method must not cause oxidation of native Cr(III) contained in the sample to Cr(VI). Method 3060A meets these criteria for a wide spectrum of solid matrices.

1.1.2 Method 3060A digestates can be analyzed for hexavalent chromium using Method 7196 (colorimetrically by UV-VIS spectrophotometry). Reference the applicable analytical method SOP for details on reporting limits.

1.1.3 On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in Sections 7 (Review of Work Request) and 19 (Test Methods and Method Validation) of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

2.0 Summary of Method

2.1. This method uses an alkaline digestion to solubilize both water-insoluble (with some exceptions) and water soluble Cr(VI) compounds in solid waste samples. The pH of the digestate must be carefully adjusted during the digestion procedure. The sample is digested using 0.28M Na_2CO_3/0.5M NaOH solution and heating at 90-95ºC for 60 minutes to dissolve the Cr(VI) and stabilize it against reduction to Cr(III).

2.2. Under the alkaline conditions of the extraction, minimal reduction of Cr (VI) or oxidation of native Cr(III) occurs. The addition of Mg^{+2} in a phosphate buffer to the alkaline solution has been shown to suppress oxidation, if observed. The accuracy of the extraction procedure is assessed using spike recovery data for soluble and insoluble forms of Cr(VI) (e.g. K_2Cr2O_7 and $PbCrO_4$), coupled with measurement of ancillary soil properties, indicative of the potential for the soil to maintain a Cr(VI) spike during digestion, such as oxidation reduction potential (ORP), pH, organic matter content, ferrous iron, and sulfides. Recovery of an insoluble Cr(VI) spike can be used to assess the first two criteria, and method-induced oxidation is usually not observed except in soils high in Mn and amended with soluble Cr(III) salts or freshly precipitated $Cr(OH)_3$.

3.0 Definitions

For a complete list of definitions refer to Appendix 5 in the most current revision of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

4.0 Interferences

4.1 When analyzing a sample digestate for total Cr (VI), the reducing/oxidizing tendency of each sample matrix can be determined at the client's request. Establishing the tendency of Cr(VI) to exist or not exist in the unspiked sample(s), assists in the interpretation of QC data for matrix spike recoveries outside conventionally accepted criteria for total metals.

4.1.1 This can be accomplished by characterization of each sample for additional analytical parameters such as pH, ferrous iron, sulfides, and Oxidation Reduction Potential. Other indirect indicators of reducing/oxidizing tendency include Total Organic Carbon (TOC), Chemical Oxygen Demand (COD), and Biological Oxygen Demand (BOD).

4.2 Certain substances, not typically found in the alkaline digests of soils, may interfere in the analytical methods for Cr(VI) following alkaline extraction if the concentrations of these interfering substances are high and the Cr(VI) concentration is low. Refer to the SOP for Method 7196A for the specific agents that may interfere with Cr(VI) quantification.

4.3 For waste materials or soils containing soluble Cr(III) concentrations greater than four times the laboratory Cr(VI) reporting limit, Cr(VI) results obtained using this method may be biased high due to method-induced oxidation. The addition of Mg^{2+} in a phosphate buffer to the alkaline extraction solution has been shown to suppress this oxidation

4.4 A sample containing a high buffering capacity may need to be digested using additional digestion solution.

4.5 It is very important to monitor the temperature of the digestion solution during the digestion to maintain a temperature of 90-95^{O}C during the entire time period.

4.6 Do not use Ghost wipe, Whatman, mixed cellulose ester (MCE) or glass fiber filters for sampling wipes because they convert Cr(VI) to Cr(III). Use either PVC filters or binderless quartz fiber filters.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001) and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1. Specific Safety Concerns or Requirements

Samples that contain high concentrations of carbonates or organic material or samples that are at elevated pH can react violently when acids are added.

5.2. Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials Section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Nitric Acid	Corrosive Oxidizer Poison	2 ppm-TWA 4 ppm-STEL	Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison. Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract. Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Potassium Dichromate	Oxidizer Corrosive Carcinogen	0.1 Mg/M3 TWA as CrO3	Extremely destructive to tissues of the mucous membranes and upper respiratory tract. May cause ulceration and perforation of the nasal septum. Symptoms of redness, pain, and severe burn can occur. Dusts and strong solutions may cause severe irritation. Contact can cause blurred vision, redness, pain and severe tissue burns. May cause corneal injury or blindness.

6.0 Equipment and Supplies

6.1. Equipment

- Digestion vessel: water bath equipped with shaker (Precision, Model 50)
- pH meter: Orion benchtop or equivalent
- Vacuum filtration apparatus
- Analytical balance capable of accurate weighings to 0.01 grams

6.2. Supplies

- Class A volumetric flasks with stoppers
- Filter paper 0.45 and 0.1 um size.
- Nalgene 115-ml filter disposable unit with 0.45um filter
- Binderless quartz fiber filter, 37 or 47 mm diameter, 0.45 mm thick (for wipe analysis)
- Digestion container: 125ml Nalgene small-mouth polypropylene bottles
- Certified thermometer (NIST traceable)-capable of reading 100ºC
- Finnpipet (1-5 ml) with tips
- Graduated cylinder (class A)
- Specimen cups
- Transfer pipettes
- Wood spatulas

7. Reagents and Standards

7.1. Reagents

7.1.1. The following Reagent grade chemicals are used for all solutions required in this test. For stability information, refer to manufacturer's instructions or 2 years from date opened if no instructions are available. All reagents are stored at room temperature:

7.1.1.1. Concentrated Nitric acid
7.1.1.2. Anhydrous Sodium Carbonate
7.1.1.3. Sodium Hydroxide
7.1.1.4. Potassium Dichromate
7.1.1.5. Magnesium Chloride-$MgCl_2$ (anhydrous)
7.1.1.6. Potassium Phosphate, Dibasic
7.1.1.7. Potassium Phosphate, Monobasic

7.1.2. Phosphate Buffer- 0.5M K_2HPO_4/0.5M KH_2PO_4 buffer at pH 7: Dissolve 87.09g K_2HPO_4 and 68.04g KH_2PO_4 into 700ml reagent water. Bring up to a final volume of 1 liter. Record the pH of the phosphate buffer solution in the reagent logbook to ensure that when prepared, the pH is approximately 7. Store at room temperature. Stable for 6 months.

7.1.3. Digestion Solution: Weigh 60g of NaOH and 90g of Na_2CO_3 and dissolve in a 3 liter volumetric flask using Type I water. Dilute to the mark and then transfer the solution to a tightly capped polyethylene bottle. Store at room temperature. Prepare fresh monthly. **Note**: Check the pH of the digestion solution to be certain it has a pH of greater than 11.5 before using it. If the pH drops below 11.5, a new solution must be prepared.

7.1.4. 1:1 HNO3: Add 500ml DI to a 1 Liter volumetric flask and then slowly add 500ml of concentrated HNO3. Solution is stable for 6 months. Store at room temperature.

7.2. Standards

7.2.1. Potassium Dichromate Primary Standard Solution (1000 mg/L Cr+6): Weigh 0.2829 g of Potassium Dichromate ACS grade, J.T. Baker, cat# 3093-01 or equivalent (dried for 1 hour at 105ºC) and dissolve in deionized water in a 100 ml flask. Dilute to the mark. Store at room temperature. Solution is stable for 6 months.

7.2.2. Potassium Dichromate Secondary Standard Solution (1000 mg/L Cr+6): Weigh 0.2829 g of Potassium Dichromate ACS grade, J.T. Baker, cat# 3090-04 or equivalent (dried for 1 hour at 105ºC) and dissolve in deionized water in a 100 ml flask. Dilute to the mark. **Note**: Prepare the Secondary standard solution from a different source than what was used to prepare the primary standard solution. Stable for 6 months, store at room temperature.

7.2.3. Hexavalent Chromium Primary Spiking Solution (100 mg/L Cr+6) Prepare by adding 10 ml of 1000 mg/L Cr+6 primary standard (Section 7.2.1) to a 100 ml volumetric flask and dilute to volume with deionized water. Stable for 6 months, store at room temperature.

7.2.4. Hexavalent Chromium Secondary Spiking Solution (100 mg/L Cr+6) Prepare by adding 10 ml of 1000 mg/L Cr+6 Secondary standard (Section 7.2.2) to a 100 ml volumetric flask and dilute to volume with deionized water. Stable for 6 months, store at room temperature.

7.2.5. Lead Chromate-AR Grade; for storage and stability information, refer to manufacturer's instructions

8. Sample Collection, Preservation, Shipment and Storage

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client requests. Listed below are the holding times and the references that include preservation requirements.

Matrix	Sample Container[1]	Min. Sample Size	Preservation	Holding Time[3]	Reference
Soils	Glass or plastic	2.50g[2]	Cool 4 ±2ºC	30 Days	SW 846 Method 3060A
Wipes[4]	Glass or plastic	1 wipe	Cool 4 ±2ºC	30 Days	SW 846 Method 3060A

[1] Containers should not contain stainless steel
[2]Additional volume may be required if the sample is chosen for QC or if a re-prep is required.
[3]The alkaline digestate must be analyzed within 168 hours after extraction from the soil or wipe.
[4]In chrome plating environments, wipe samples taken on a PVC filter or an uncoated binderless quartz fiber filter, should be placed in a vial containing 5 mL of an aqueous solution containing 10% Na_2CO_3 with 2% $NaHCO_3$ immediately after sampling to eliminate

the interference from the acid used in the chrome plating process. An alternate medium which does not require extraction in the field is a binderless quartz fiber filter coated with 1% NaOH.

9. Quality Control

9.1. Sample QC - The following quality control samples are prepared and digested daily with each batch of 20 samples or less, whichever is more frequent. Soil and wipe samples must be divided into separate QC batches.

9.1.1. Method Blank:

- *Soil Samples:* One method blank must be digested and analyzed per soil batch. A method blank consists of 50 ml digestion solution and is carried through the entire analytical procedure. The concentration of the method blank must be less than the reporting limit or the entire batch must be re-digested and re-analyzed.

- *Wipe Samples:* One method blank must be digested and analyzed per wipe batch. The method blank will consist of a blank wipe and 50 ml digestion solution and will be carried through the entire analytical procedure. The concentration of the method blank must be less than the reporting limit or the entire batch must be re-digested and re-analyzed.

9.1.2. Laboratory Control Sample (Soils and wipes): Laboratory control samples from Secondary sources, shall be digested and analyzed per batch as follows:

9.1.2.1 Soil LCS:

- **LCS Soluble (LCSSRM):** Obtained from an independent source (ERA). Prepare the LCS soluble solution by diluting the concentrated LCS solution as indicated in the manufacturer's instructions. If necessary, prepare a different dilution so that the concentration after analysis falls within the calibration curve. Add 5ml of the diluted LCS soluble solution into 50ml digestion solution. The results must be within vendor specified QC limits or the entire batch must be re-digested and re-analyzed. Document the preparation of the LCS soluble solution in the TALS reagent module.

- **LCS Insoluble (LCSI):** Prepared by adding 0.011g of $PbCrO_4$ into 50ml digestion solution. The results must be within 80-120% of the true value or the entire batch must be re-digested and re-analyzed.

- **LCS matrix matched (LCSSRM):** Obtained from an independent source (ERA). Add 2.5g of the soil LCS into 50ml digestion solution. The results must be within vendor specified QC limits or the entire batch must be re-digested and re-analyzed. This LCSSRM is included in DKQP guidelines however it is not reported to clients.

9.1.2.2 Wipe LCS/LCSD:

For wipe sample batches, a Laboratory Control Sample (LCS)/Laboratory Control Sample Duplicate must be prepared using the LCS soluble solution. Add a blank wipe to the digestion bottles for each of the LCS and LCSD and follow the prep for LCS Soluble detailed in Section 9.1.2.1 above.

9.1.3. **Predigestion Matrix Spikes (Soils only):** Both the soluble and insoluble pre-digestion matrix spikes must be analyzed per batch of ≤ 20 soil samples.

9.1.3.1. **Soluble Matrix Spike (MSS):** spike the sample with 1.0 ml of the 100 ppm Cr (VI) primary spiking solution prepared in Section 7.2.3 (equivalent to 40mg/kg Cr (VI)).

9.1.3.2. **Insoluble Matrix Spike (MSI):** to a separate sample aliquot add 0.011g of $PbCrO_4$. It is used to evaluate the dissolution during the digestion process.

9.1.3.3. Both matrix spikes are then carried through the digestion process. The acceptance range for the matrix spike recoveries is 75-125%. If the matrix spike recoveries fall outside these recovery limits, the entire batch must be rehomogenized, redigested, and reanalyzed.

9.1.3.4. If either matrix spike recovery is outside of the acceptable range of 75-125% but, the LCS is within the criteria specified in Section 9.1.2, additional laboratory characterization of each sample in the batch for ORP and pH can be performed at the client's request to determine if the sample exhibits reducing conditions. Further characterization for total sulfides, total organic carbon, chemical oxygen demand, or biological oxygen demand may be required by the client.

9.1.4. **Duplicate (DU) (Soils only):** One duplicate laboratory sample must be analyzed per soil batch. The sample used for the predigestion spike should be used for this purpose. Duplicate samples must have a Relative Percent Difference (RPD) of ≤20%, if both the original and the duplicate are ≥ four times the laboratory reporting limit. A control limit of ± 2.0mg/kg (laboratory reporting limit) is used when either the original or the duplicate sample is < four times the laboratory reporting limit.

9.1.5. **Post Digestion Spike (PDS) (Soils only):** Following the analysis (colorimetric determination), a post-digestion spike must be analyzed per soil batch. The spike concentration must be equivalent to 40mg/kg or twice the sample concentration, whichever is greater. The post digestion spike must be performed on a field sample, not on a field blank or preparation blank. It would be helpful to perform this analysis on the sample used for the matrix spike. Recovery limits for the post-digestion spike are 85-115%. If the post digestion spike fails to meet the recovery limits, a new aliquot of the sample

must be re-spiked and re-analyzed as described in SOP ED-WET-011 (The Analysis of Digestates for Hexavalent Chromium by SW846 7196A).

9.2. **Instrument QC** Calibration standards, ICV, ICB, CCV, and CCB are prepared and digested with each sample batch.

See applicable analytical SOP, ED-WET-011 (The Analysis of Digestates for Hexavalent Chromium by SW846 7196A).

9.2.1. Label 6 digestion bottles for each of the calibration standards: 0.0, 0.05, 0.1, 0.5, 0.75, and 1.25mg/L. Aliquot 0, 0.05, 0.1, 0.5, 0.75 and 1.25 mls of 100ppm Cr (VI) Primary Spiking Solution (Sec 7.2.3) respectively into the digestion bottles containing 50mls of digestion fluid (Sec. 7.1.3), 0.5ml Phosphate buffer (Sec. 7.1.2), and 0.4g MgCl2 (Sec 7.1.1.5).

9.2.2. Initial Calibration Verification (ICV), 0.50 mg/L Cr (VI: Prepare the ICV by adding 0.5 ml of 100 ppm Cr (VI) Secondary Spiking Solution (Sec. 7.2.4) into a digestion bottle containing 50 ml of digestion fluid, 0.5ml phosphate buffer, and 0.4g MgCl2. The ICV is analyzed immediately after an acceptable initial calibration. The ICV standard must be from a source separate from the calibration standards (i.e., different manufacturer or separate lot).

9.2.3. Continuing Calibration Verification (CCV), (0.5ppm): Prepare the CCV by adding 0.5 ml of 100 ppm Cr (VI) Secondary Spiking Solution (Sec. 7.2.4) into a digestion bottle containing 50 ml of digestion fluid, 0.5ml phosphate buffer, and 0.4g MgCL2. A CCV is a mid-point calibration Cr (VI) standard from a different source than the calibration standards.

9.2.4. Initial Calibration Blank and Calibration Check Blank (ICB,CCB): Prepare the CCB by adding 50 ml of digestion fluid, 0.5ml phosphate buffer, and 0.4g MgCL2 into a digestion bottle. An initial calibration blank (ICB) must be analyzed immediately following the calibration curve and a continuing calibration blank (CCB) is analyzed after each CCV. . The concentration of the CCB must be below the reporting limit if not, all samples following the last acceptable CCB must be re-analyzed

10. Procedure

10.1. Sample Preparation

10.1.1. Homogenize soil samples following Eurofins Edison SOP ED-GEN-007 (Subsampling).

10.1.2. Weigh 2.5g ± 0.10g of sample into a clean labeled 125ml nalgene bottle. Record weight up to two decimal places. For wipe samples, add 1 sample wipe into a clean labeled 125 ml nalgene bottle.

10.1.3. Add 50 +/- 1.0ml of digestion solution to each sample. Then add 400mg of MgCl2 and 0.5ml of 1.0M Phosphate Buffer.

10.1.4. Matrix spike preparation (soils only): Spike the samples designated MS soluble and MS insoluble as detailed in Section 9.1.3. Add 50 +/- 1.0ml of digestion solution to each sample followed by 400mg of MgCl2 and 0.5ml of 1.0M Phosphate Buffer.

10.1.5. LCS preparation: For soil samples, prepare as detailed in Section 9.1.2.1. For wipe samples, prepare as detailed in Section 9.1.2.2. Add 400mg of MgCl2 and 0.5ml of 1.0M Phosphate Buffer.

10.1.6. Prior to beginning the heating process, stir samples continuously unheated for at least five minutes Place samples in a water bath set at room temperature and start the shaker to shake samples for at least 5 minutes. After 5 minutes, transfer samples in a hot water bath set at temperature of 90-95ºC and begin shaking samples at 175rpm for 5 minutes. After 5 minutes, release pressure of each samples by venting the caps. After the caps are resealed tightly, begin heating and shaking for 60 minutes. Start timing after the water bath has returned to 90-95ºC and maintain this temperature throughout the 60 minute digestion.

10.1.7. Measure and record the digestion start time and temperature, time and temperature after 30 minutes, and the digestion end time and temperature. Use a calibrated thermometer to measure the temperature of one of the samples in the water bath.

10.1.8. Following the heated digestion, gradually cool samples with agitation to room temperature. To do this, transfer digested sample bottles from the heated water bath to a separate water bath with cool water (temperature set at room temperature). Turn shaker on and agitate until samples are cooled to room temperature. Quantitatively transfer the contents of the bottle to the vacuum filtration apparatus with Type I water rinses. Filter the digestate through a 0.45um filter (commercially purchased filter). Transfer the rinsates and filtrate to a clean labeled 100ml plastic cup. (**Note**: Use a polyethylene bottle if the colorimetric analysis is not following immediately).

10.1.9. Determine the concentration of hexavalent chromium in the sample extract using Method 7196A USEPA SW846 3rd Edition, (Eurofins Edison SOP ED-WET-011, The Analysis of Digestates for Hexavalent Chromium by SW846 7196A).

10.2. Calibration:

Calibration standards are prepared and digested with each batch of samples.

10.3. Sample Analysis

Refer to the applicable analytical SOPs: Eurofins Edison SOP ED-WET-011, The Analysis of Digestates for Hexavalent Chromium by SW846 7196A.

11.0. Calculations / Data Reduction

11.1. Calculations:

Refer to the applicable analytical SOP (ED-WET-011) for calculations.

11.2. Data Reduction:

11.2.1. All sample preparation information is recorded directly in the logbook and in TALS at the time of sample preparation.

11.2.2. Record reagent information in the prep batch information (this can be viewed in the "batch information" page).

11.2.3. Record special comments and observations in the 'worksheet' tab.

11.2.4. The logbook pages for the prep are attached to the analytical batch as pdf files.

11.2.5. Complete the Data Review Checker (DRC) in TALS: Prior to data submission the analyst must execute the DRC (Data Review Checker) program in the applicable analytical batch (TALS Analyst Desktop II module).

11.2.5.1. Open the analytical batch and click on the Edit tab above to enter the Edit Mode.

11.2.5.2. Press F8 command key on the computer keyboard or right click anywhere on the batch worksheet then click on 'Run checklist.'

11.2.5.3. Acknowledge by filling in responses to all unacknowledged findings. Highlight the checklist with findings, then highlight the associated list of findings; right click and choose 'Acknowledge Item.'

11.2.5.4. Fill in appropriate comments in the response box, then hit 'OK.' 'The column labeled 'unacknowledged findings' should show '0' for all questions once completed; then batch is ready for 2nd level review.

12.0. Method Performance

12.1. Method Detection Limit Study (MDL)

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure in Section 19 (Test Methods and Method Validation) of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM). MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for

analyses performed; these are verified at least annually unless method requirements require a greater frequency.

12.2. Demonstration of Capabilities

For DOC procedure refer to Section 19 in the most current revision of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

12.3. Training Requirements

Refer to Eurofins Edison SOP No. ED-GEN-022, Training, for the laboratory's training program.

13.0. Pollution Control

It is Eurofins Edison policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention."

14.0. Waste Management

14.1. Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to Eurofins Edison SOP No. ED-SPM-008 (Laboratory Waste Disposal Procedures).

14.2. The following waste streams are produced when this method is carried out:

- Soil Retain Samples - These samples if not flagged in the system for any hazardous constituents are transferred to poly-lined cubic yard boxes. These boxes when full are sent to stabilization or incineration. These materials are sent out as hazardous for lead and chromium.

  Teris Profile Number (incineration): 50016710
  Onyx Profile Number: (stabilization) 402535

- Sample waste-After analysis, the samples and standards are collected in a polyethylene container labeled 'Cr (VI) waste.' Once the container is full, it is brought to the waste room for disposal.

15.0. References / Cross-References

15.1. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, 3rd ed., U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. U.S. Government Printing Office: Washington, DC, 1995; SW-846, Method 3060A.

15.2. Occupational Health and Safety Administration (OSHA) Method W4001, Hexavalent Chromium, Methods Development Team, OSHA Salt Lake Technical Center, Salt Lake City, UT, April 2001.

15.3. Eurofins Edison Document No. ED-QA-LQM, *Laboratory Quality Manual*, most current revision.

15.4. Eurofins Edison SOP ED-GEN-022, *Training*, most current revision.

15.5. Eurofins Edison SOP No. ED-SPM-008, *Laboratory Waste Disposal Procedures*, current revision.

15.6. Eurofins Edison SOP ED-WET-011, The Analysis of Digestates for Hexavalent Chromium by SW846 7196A, most current revision.

16.0. Method Modifications:

The method has been modified to include procedures specific to the digestion of wipe samples.

17.0. Attachments

N/A

18.0. Revision History

- **Revision 14, dated 26 December 2024**
  - Updated to Eurofins branding throughout the SOP.
  - Sec. 7.1.2: Added requirement to record the pH of the Phosphate buffer solution at preparation to ensure the pH is at 7.
  - Sec. 7.1.3: Revised preparation instructions for the Digestion solution to 3L to reflect actual laboratory practice.
  - Sec. 9.1: Added word 'digested' to clarify digestion of calibration standards.
  - Sec. 9.2: Added note that calibration standards, ICV/ICB, CCV/CCB are prepared and digested with each sample batch.
  - Sec. 9.2.1: Added preparation instructions for calibration standards.
  - Sec. 9.2.2 through 9.2.4: Added preparation instructions for ICV, CCV and CCB.
  - Sec. 10.1.6: Added procedure to stir samples unheated for at least five minutes prior to heating samples at 90-95 degC. .
  - Sec 10.1.8: Added procedures for gradually cooling samples with agitation.
  - Sec 10.6: Clarified that calibration standards are digested prior to analysis.

- **Revision 13.1, dated 08 January 2021**
  - Updated SOP header with Eurofins emblem; no procedural change.
  - Sec 3: Revised the Definitions location as per the most current LQM.

- **Revision 13, dated 14 February 2019**

  - Sec. 9.1.2: Added matrix matched LCS applicable to DKQP projects.
  - Sec. 11.2.5: Revised the use of data review paper checklist to TALS DRC review, instructions added.
  - Deleted reference WI# EDS-WI-008 in Sec 15.7, not applicable.
  - Updated approval signatures to current.

- **Revision 12, dated 20 November 2014**

  - Removed references to SW846 7199 throughout the SOP; laboratory no longer perform this method.
  - Sec. 9.1.2: Revised the LCSS limits from +/-15% to vendor's certified limits to reflect actual laboratory practices.
  - Sec. 9.1.3.3: Removed notation that redigestion/reanalysis of batch is only for NJ sites or with PM/client's advice; Re-digestion and reanalysis is performed for all failed QC batch and is a method requirement.
  - Sec. 10.1.7: Revised procedures for checking sample temperature during sample digestion; temperature of the sample will be checked at start, middle and end of digestion.

- **Revision 11, dated 11 December 2012**

  - Sec 1 and 12: Updated LQM section references to reflect the most current LQM revision.
  - Sec 9.1.2 (LCSI) and 9.1.3.2 (MSI): Deleted 0.012g to reflect actual laboratory practices.

- **Revision 10, dated 18 November 2010**

  - Section 1.1: included statement regarding the modification of the method for preparation of wipe samples.
  - Section 1.1.2: removed soil RL details and included statement referring reader to the applicable method SOP for RL details.
  - Section 4.1: Oxidizing/reducing parameters will be analyzed if requested by the client.
  - Section 4.6: Added interferences for wipe samples.
  - Section 6.2: Removed bottle top dispenser from list of supplies. Added graduated cylinder, specimen cups, transfer pipettes, and binderless quartz fiber filters to the list of supplies.
  - Section 7.1: Reformatted Reagents Section. Added Potassium Phosphate, Dibasic and Potassium Phosphate, Monobasic to list of reagents.
  - Section 8.0: Added wipes to the sample collection, preservation, shipment, and storage Section.

- Section 9.1: Modified Sample QC Section to specify wipe criteria. Added Sections 9.1.2.1 and 9.1.2.2 to differentiate the LCS procedures for soils and wipes.
- Section 9.1.3.4: Section was revised to specify the additional laboratory characterization only when required by the client.
- Sections 9.1.3, 9.1.4 and 9.1.5: added language to clarify that these QC types apply only to soils (and not to wipes).
- Section 10.1.2: added procedures for wipe sample preparation.
- Section 10.1.5 and 10.1.6: added to detail the QC sample (LCS and matrix spike) prep procedures for soils and wipes.
- Section 11.0: Replaced all calculations with a reference to the applicable analytical method SOP. Add
- Section 15.0: Added reference for OSHA Method W4001, Hexavalent Chromium (wipe sample methodology).
- Section 16.0: added method modification language for addition of wipe samples.

- **Revision 9, dated 03 February 2010**
  - Section 9.1.3.1: Changed MS to MSS to be consistent with TALS naming convention.
  - Section 10.1.3: Added Section (previously part of Section 10.1.4) to clarify that spike should be added directly to the sample aliquot prior to the addition of the digestion solution, magnesium chloride, and phosphate buffer. Subsequent Sections adjusted.
  - Section 10.1.4: Section added to include LCS soluble and LCS insoluble. Subsequent Sections adjusted.

- **Revision 8, dated 25 August 2009**
  - Revised SOP format in accordance with TestAmerica Corporate Quality SOP No. CW-QS-002 (Rev 0) Writing a Standard Operating Procedure (SOP).
  - Section 1.1.2: Added reporting limit.
  - Section 7.1.8: Added prep information.
  - Removed midpoint calibration checks standard (CCS) and Calibration blank in the QC Section, both QC samples are not applicable to this SOP.
  - Deleted pH adjustment procedure, previously named Section 9.6; this procedure will be included in the analytical SOP.
  - Section 15: Added applicable references.

- **Revision 7b, dated 30 April 2009**
  - Section 5.6: Added stability and storage information.
  - Section 5.7: Added stability information
  - Section 5.8: Added stability information

- Section 10.8: Added information about the pH adjusted PS to conform to method requirements.
- Section 15: Added applicable references.

- **Revision 7a, dated 10 February 2009**

  - Section 4.4: Add filter size to Nalgene 115-ml disposable filter.
  - Section 4.10: Add Bottle top dispenser use for adding the digestion solution.
  - Section 4.11: Add Wood spatulas; Use wooden spatulas instead of the stainless steel spatulas.
  - Section 6.1: Delete pre-made standard purchased from Inorganic Ventures. Cr6+ Primary Standard will be prepared in the lab.
  - Section 6.2: Specified source of the 1000 ppm Cr6+
  - Section 6.3 and 6.6: Delete 10mg/l Cr6+ standards; Working standard 10mg/L Cr+6 is not utilize for soil analysis.
  - Section 10.3: expanded LCS information to include preparation information for both LCSs.
  - Section 10.4.2: Specified the exact amount of PbCrO4 added to the insoluble matrix spike.
  - Section 6.5: Added storage information.
  - Section 6.4: Added text: source must be different from the primary standard.
  - Section 9.3: Expanded Section to include the spiking of LCS and MS.
  - Section 9.4: Expanded Section to include recording specific information for the water bath.

- **Revision 7, dated March 2007**

  - Section 10.3: Revised to specify the types of LCS used including their source and acceptance limits.
  - Section 10.6: Deleted the requirement that ‘CCS is taken through the entire digestion process to reflect actual laboratory practices.

- **Revision 6, dated 30 October 2006**

  - Section 9.6.3: Corrected referenced SOP number from EDS-WET-010 to EDS-WET-011.
  - Section 10.5:Revised first sentence to read “One duplicate laboratory sample per batch *must* be analyzed.” (‘Must’ previously read ‘should’).
  - Section 10.4.3: The text in italics was added to the following sentence in Section 10.4.3:
    “NOTE: If the spiked sample concentration is greater than 4x the predigestion spike concentration, no redigestion/reanalysis is required unless the samples are from a NJ site in which case the lab project manager should be contacted for further guidance.”
  - Section 10.8: Added the following text:
    “If the Post Digestion Spike fails to meet recovery limits, a new aliquot of the sample must be re-spiked and re-analyzed.

Title: The Analysis of Digestates for Hexavalent Chromium by EPA SW846 7196A

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Approvals (Signature/Date):

Jasmine Parillo Department Manager	12/19/2024 Date	Dan Helfrich Health and Safety Manager	12/19/2024 Date
Carl Armbruster Quality Assurance Manager	12/19/2024 Date	Mark Acierno Laboratory Directo	12/19/2024 Date

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1.0 Scope and Application

1.1 Analytes, Matrix(s), and Reporting Limits

1.1.1 This SOP is applicable to the determination of hexavalent chromium digestates of solid samples using SW846 Method 7196A. Solid samples must be first digested according to Method 3060A USEPA SW846 3rd Edition, Eurofins Edison SOP ED-WET-010 (The Alkaline Digestion of Soil Samples for the analysis of hexavalent chromium).

1.1.2 The laboratory's reporting limit for hexavalent chromium in soil is 2.0 mg/kg.

1.1.3 On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in Sections 7 (Review of Work Request) and 19 (Test Methods and Method Validation) of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

2.0 Summary of Method

Solid samples are digested utilizing SOP ED-WET-010, alkaline digestion of soil samples via Method 3060A. Following the sample preparation and digestion procedure, dissolved hexavalent chromium is determined spectrophotometrically at 540 nm by reaction with diphenylcarbazide in acid solution.

3.0 Definitions

For a complete list of definitions refer to Appendix 2 in the most current revision of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

4.0 Interferences

4.1 Molybdenum and Mercury react to form color with diphenylcarbazide, however the intensity of color is much lower than those for chromium at the specified pH. Concentrations up to 200 mg/L can be accepted.

4.2 Vanadium interferes strongly, but can be tolerated up to 10 times the concentration of Cr (VI) present.

4.3 Iron may cause a yellow color but should not affect the colorimetric measurement at 540 nm.

4.4 Reducing matter may reduce hexavalent Cr to trivalent Cr in varying amounts. No preventative measure is available at this time; however, interference is checked by post digestion spike samples.

4.4.1 The reducing/oxidizing tendency of each matrix may be determined by characterization of samples for additional analytical parameters, such as pH, ferrous iron, sulfides, and Oxidation Reduction Potential. Other indirect indicators of reducing/oxidizing tendency include Total Organic Carbon

(TOC), Chemical Oxygen Demand (COD), and Biological Oxygen Demand (BOD).

4.5 For waste materials or soils containing soluble Cr (III) concentrations greater than four times the laboratory Cr (VI) reporting limit, Cr (VI) results obtained using this method may be biased high due to method-induced oxidation.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001) and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1. Specific Safety Concerns or Requirements

Samples that contain high concentrations of carbonates or organic material or samples that are at an elevated pH can react violently when acids are added.

5.2. Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Nitric Acid	Corrosive Oxidizer Poison	2 ppm-TWA 4 ppm-STEL	Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison. Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract. Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Potassium Dichromate	Oxidizer Corrosive Carcinogen	0.1 Mg/M3 TWA as CrO3	Extremely destructive to tissues of the mucous membranes and upper respiratory tract. May cause ulceration and perforation of the nasal septum. Symptoms of redness, pain, and severe burn can occur. Dusts and strong solutions may cause severe irritation. Contact can cause blurred vision, redness, pain and severe tissue burns. May cause corneal injury or blindness.
Sulfuric Acid	Corrosive Oxidizer Dehydrator Poison Carcinogen	1 Mg/M3-TWA	Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. Symptoms may include irritation of the nose and throat, and labored breathing. Symptoms of redness, pain, and severe burn can occur. Contact can cause blurred vision, redness, pain and severe tissue burns. Can cause blindness.

6.0 Equipment and Supplies

6.1. Instrument

- Spectrophotometer for use at 540 nm, providing a light path of 1cm or longer
- pH meter, Orion benchtop or equivalent

6.2. Supplies

- Nalgene 115-ml disposable filter unit with 0.45um filter
- Membrane filters, 0.45um and 0.1 um
- Specimen cups (plastic)
- Eppendorf or Finnpipettes, varying volumes
- Class A volumetric flasks
- Class A graduated cylinder
- Vacuum pump
- Magnetic stirrer (Teflon coated)
- Transfer pipettes

7. Reagents and Standards

7.1. Reagents

7.1.1. Sulfuric acid (10% v/v): Measure 100 ml of concentrated reagent grade H_2SO_4 into a 1000 ml volumetric flask (1/2 filled w/D.I. water) and dilute to mark with deionized water. Stable for six months, store at room temperature.

7.1.2. Indicator solution (DPC): Place 5.0 g 1,5-Diphenylcarbazide (AR Grade) in an amber 1000 ml volumetric flask and dilute to mark with acetone. Prepare monthly or when solution becomes cloudy. Store at room temperature.

7.1.3. Acetone: reagent grade; for stability and storage information refer to manufacturer's instructions.

7.1.4. 1:1 HNO3: Add 500ml DI to a 1 Liter volumetric flask and then slowly add 500ml of concentrated reagent grade HNO3. Solution is stable for 6 months. Store at room temperature.

7.1.5. 1N NaOH: Place 4.0g reagent grade NaOH in a 100ml volumetric flask and dilute to the mark with deionized water. Stable for six months, store at room temperature.

7.2 Standards

7.2.1 Potassium Dichromate Primary Standard Solution (1000 mg/L Cr+6): Weigh 0.2829 g of Potassium Dichromate ACS grade, J.T. Baker, cat# 3093-01 or equivalent (dried for 1 hour at 105ºC) and dissolve in deionized water in a 100 ml flask. Dilute to the mark. Stable for 6 months, store at room temperature.

7.2.2 Potassium Dichromate Secondary Standard Solution (1000 mg/L Cr+6): Weigh 0.2829 g of Potassium Dichromate ACS grade, J.T. Baker, cat# 3090-04 or equivalent (dried for 1 hour at 105ºC) and dissolve in deionized water in a 100 ml flask. Dilute to the mark. **Note**: Prepare the secondary standard from a source or lot different from the primary standard solution. Stable for 6 months, store at room temperature.

7.2.3 Hexavalent Chromium Primary Spiking Solution (100 mg/L Cr+6): Prepare by adding 10 ml of 1000 mg/L Cr+6 primary standard (Sec 7.2.1) to a 100 ml volumetric flask and dilute to volume with deionized water. Stable for 6 months, store at room temperature.

7.2.4 Hexavalent Chromium Secondary Spiking Solution (100 mg/L Cr+6) Prepare by adding 10 ml of 1000 mg/L Cr+6 secondary standard (Sec 7.2.2) to a 100 ml volumetric flask and dilute to volume with deionized water. Stable for 6 months, store at room temperature.

7.2.5 Lead Chromate: AR Grade; for stability and storage information refer to manufacturer's instructions.

8. Sample Collection, Preservation, Shipment and Storage

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client requests. Listed below are the holding times and the references that include preservation requirements.

Matrix	Sample Container [1]	Min. Sample Size[2]	Preservation	Holding Time [3]	Reference
Soils	Glass, plastic	2.5 grams	Cool 4 ± 2°C	30 Days - *from sampling to extraction*	SW846 Method 3060A
				168 Hours – *from extraction to determinative analysis*	SW846 Method 7196A

[1] Containers should not contain stainless steel
[2] Additional volume may be required if the sample is chosen for QA or if a re-prep is required.
[3]The alkaline digestate must be analyzed within 168 hours after extraction from the soil.

9. Quality Control

9.1. **Sample QC** - The following quality control samples are prepared and digested with each batch of 20 samples or less.

9.1.1. Method Blank: One method blank must be digested and analyzed per batch. A method blank consists of 50 ml digestion solution and is carried through the entire digestion and analytical procedure. The concentration of the method blank must be less than the reporting limit or the entire batch must be re-digested and re-analyzed.

9.1.2. Laboratory Control Sample: Two secondary source (LCS) shall be digested and analyzed per batch.

- **LCS soluble (LCSSRM)** is obtained from an independent source (Phenova). Prepare the LCS soluble solution by diluting the concentrated LCS solution as indicated in the manufacturer's instructions. If necessary, prepare a different dilution so that the concentration after analysis falls within the calibration curve. Add 5ml of the diluted LCS soluble solution into 50ml digestion solution. The results must be within vendor specified QC limits or the entire batch must be redigested and re-analyzed. Document the preparation of the LCS soluble solution in the Reagent module in TALS.

- **LCS insoluble (LCSI)** is prepared by adding 0.010g-0.020g of PbCrO4 into 50ml digestion solution. The results must be within 80-120% of the true value or the entire batch must be redigested and re-analyzed. (Typical amount of $PbCrO_4$ added to LCSI is 0.011g, this is equivalent to 708 mg Cr (VI)/Kg).

9.1.3. Predigestion Matrix Spikes: Both a soluble and insoluble pre-digestion matrix spikes must be analyzed per batch of ≤ 20 field samples.

9.1.3.1 Soluble matrix spike (MSS): spike the sample with 1.0 ml of the 100 ppm Cr (VI) primary spiking solution prepared in Sec 7.2.3 (equivalent to 40mg/kg Cr(VI)).

9.1.3.2 Insoluble matrix spike (MSI): to a separate sample aliquot add 0.010g- 0.020g of $PbCrO_4$. It is used to evaluate the dissolution during the digestion process. Typical amount of $PbCrO_4$ added to LCSI is 0.011g, this is equivalent to 708 mg Cr (VI)/Kg.

9.1.3.3 Both matrix spikes are then carried through the digestion process. The acceptance range for the matrix spike recoveries is 75-125%. If the matrix spike recoveries fall outside these recovery limits, the entire batch must be rehomogenized, redigested, and reanalyzed.

- Note: If redigesting/reanalyzing the batch, the Soluble matrix spike (MSS) is spiked at twice the sample concentration or 40mg/kg Cr(VI) whichever is greater.

9.1.3.4 If upon reanalysis, the matrix spike is not within the recovery limits of 75%-125%, but the LCS is within the criteria specified in Section 9.1.2, additional laboratory characterization of each sample in the batch for ORP (see Eurofins Edison SOP ED-WET-066, Redox by SM2580) and pH (see Eurofins Edison SOP ED-WET-061, pH Soil by SW846 9045C) may be required by the client to determine if the sample exhibits reducing conditions. Further characterization for total sulfides, Total Organic Carbon (TOC), Chemical Oxygen Demand (COD), or Biochemical Oxygen Demand (BOD) may also be required by the client.

9.1.4. Duplicate (DU): One duplicate laboratory sample must be analyzed per batch. The sample used for the predigestion spike should be used for this purpose. Duplicate samples must have a Relative Percent Difference (RPD) of ≤20%, if both the original and the duplicate are ≥ four times the laboratory reporting limit. A control limit of ± 2.0mg/kg (laboratory reporting limit) is used when either the original or the duplicate sample is < four times the laboratory reporting limit.

9.1.5. Post Digestion Spike (PDS): Following the analysis (colorimetric determination), a post-digestion spike must be analyzed per batch. The spike concentration must be equivalent to 40mg/kg or twice the sample concentration, whichever is greater. To spike the extract with 40mg/Kg Cr

(VI), add 0.50 ml of 100 ppm Cr (VI) primary standard to a 50.0 ml alkaline extract, pour out 45.0 ml of the spiked sample and add color indicator and adjust pH (see Sec 10.3.4 & 10.3.5); bring the final volume to 50ml with deionized water. The post digestion spike must be performed on a field sample, not on a field blank or preparation blank. If possible perform the post digestion spike analysis on the sample used for the matrix spike. Recovery limits for the post-digestion spike are 85-115% of the true value. If the post digestion spike fails to meet the recovery limits, a post spike must be re-analyzed using the alkaline extract. Adjust the pH of the sample Duplicate (alkaline extract) back up to 8.0-8.5 using 1N NaOH; then respike and reanalyze following Sec. 10.3.4-10.3.5.

9.2. Instrument QC

ICV/ICB and CCV/CCB are prepared/digested for each batch of samples.

9.2.1. Initial Calibration Verification (ICV): The ICV (0.50 mg/L Cr (VI)) is analyzed immediately after an acceptable initial calibration. The ICV standard must be from a source separate from the calibration standards (i.e., different manufacturer or separate lot) and its recovery must be within ±10% of the expected value. If the measured concentration exceeds the ±10% limit, a second analysis should be performed. If the result still exceeded the ±10% limit, the analysis should be terminated until the source of the problem is identified and corrected.

9.2.2. Continuing Calibration Verification (CCV): A CCV is a mid-point calibration Cr (VI) standard (0.5ppm) from a different source than the calibration standards. The CCV is analyzed after every 10 samples (20 readings including backgrounds), and after reading the last sample. Acceptance criteria for the CCV are 90-110% of the true value. If the result is not within the acceptance limits, all samples following the last acceptable CCV must be re-analyzed.

9.2.3. Initial Calibration Blank and Calibration Check Blank (ICB,CCB): An initial calibration blank (ICB) must be analyzed immediately following the calibration curve and a continuing calibration blank (CCB) is analyzed after each CCV. The concentration of the CCB must be below the reporting limit if not, all samples following the last acceptable CCB must be re-analyzed.

10. Procedure

10.1. Sample Preparation:

10.1.1. Just prior to analysis, SLOWLY adjust the pH of the sample extract to a pH of 7.0-8.0 with constant stirring using 1:1 nitric acid. Record pH and time. If a flocculent precipitate forms after the addition of 1:1 HNO3, filter the sample through a 0.45 um membrane filter, a larger size filter may be used to pre-filter the sample. Monitor the pH with a calibrated pH meter. If

the pH drops below 7.0, discard the sample extract and re-digest the sample.

10.1.1.1. Remove and rinse the stir bar. Quantitatively transfer the sample extract to a 100 ml volumetric flask and dilute to the mark with deionized water.

10.1.1.2. If necessary, the solution can be diluted to eliminate the effects of color on the analytical determination. Use the smallest dilution necessary and record results.

10.2. Calibration

10.2.1. Prepare and digest fresh calibration standards everyday or before each analysis. See SOP ED-WET-010 (The Alkaline digestion of soil and wipe samples for the analysis of Hexavalent chromium).

10.2.2. Pour out digested calibration standards into labeled cups.

10.2.3. Adjust pH to 7.5±0.5 with 1:1 HNO_3 and dilute to 100 ml with DI water. Record pH reading and analysis time in the logbook.

10.2.4. Develop the color for the standards as explained in Section 10.3 of this SOP.

10.2.5. Following the preparation of the calibration standards, “zero” the spectrophotometer with the 0 ppm standard. Analyze the standards.

10.2.6. The correlation coefficient must be 0.995 or better.

10.2.7. After calibration is entered into TALS, calculate %RE (%relative error) on two calibration standards, the standard at or near the mid-point of the calibration and the standard at the lowest level. Go to calibration events and click on details, review the column labeled ‘read back amount’ and ‘% Error’ for the low standard and midpoint standard.

Low standard (10ppb): The %RE (relative error) must be +/- 50%; if not, stop the analysis and recalibrate.

Mid-point normal (75ppb): The %RE (relative error) must be +/- 10%; if not, stop the analysis and recalibrate

10.2.8. Immediately following calibration of the spectrophotometer and before reading samples, verify the calibration of the spectrophotometer by analyzing an ICV and ICB.

10.3. Sample Analysis

10.3.1. Warm up spectrophotometer and set to 540nm.

10.3.2. Prepare two rows of plastic cups and label them accordingly (first row with sample no. and the 2nd row as background).

10.3.3. Pour out 45.0 ml of the sample extracts, which have already been pH adjusted to between 7.0 and 8.0, into the appropriately labeled cups. Do the same for the background cups using 10 ml of the sample extract.

10.3.4. Add 1.0 ml indicator solution and swirl. (Do not add reagent to background sample).

10.3.5. Slowly add 10% H_2SO_4 (Sec 7.1.1) dropwise while swirling and monitoring pH until pH is 2 ±0.5. Record reading in the appropriate logbook.

10.3.6. Transfer sample to 50 ml volumetric flask and bring to volume with deionized water. Empty contents into labeled specimen cup to mix.

10.3.7. Let stand 5-10 minutes for full color development.

10.3.8. Read calibration standards, QC samples, and samples in a 1 cm cell on a spectrophotometer at 540 nm. (Note: Calibration standards and samples must be read within the same timeframe following full color development).

10.3.9. Continue analyzing samples and quality control samples by first reading the sample followed by its background sample.

10.3.10. Dilute samples that exceed calibration curve using deioinized water and analyze following Sec. 10.3.3-10.3.7. Add dilution factor to TALS under "dilution" column. Note: The dilution should be made from the sample extract that has not had the indicator added.

10.3.11. After every twenty readings (10 samples) and after reading the last sample in the batch, verify the spectrophotometer calibration by reading a calibration check standard (CCV) and calibration check blank (CCB).

11.0. Calculations / Data Reduction

11.1. Accuracy:

$$\text{ICV / CCV, LCS \% Recovery} = \frac{\text{observed concentration}}{\text{known concentration}} \times 100$$

$$\text{MS \% Recovery} = \frac{\text{(spiked sample) - (unspiked sample)}}{\text{spiked concentration}} \times 100$$

11.2. Precision (RPD):

$$\text{Matrix Duplicate (MD)} = \frac{|\text{orig. sample value - dup. sample value}|}{[(\text{orig. sample value + dup. sample value})/2]} \times 100$$

11.3. Concentration = Hexavalent Chromium in mg/Kg = $\frac{A \times B \times E * 100}{C \times D}$

Where:
A = Concentration from the calibration curve in mg/L
B = Final digested volume in Liters
C = Wet sample weight in kg
D = percent solids
E = Dilution (if necessary)

NOTE: All dry weight corrections are made in TALS at the time the final report is prepared.

11.4. Trivalent Chromium Calculation: When required, the calculation for trivalent chromium is completed using TALS Method '7196a_CR3.' Samples must be logged in under this method as well as the methods for Total chromium (metals) and Hexavalent chromium. Upon completion of the total and hexavalent chromium analyses the analyst may process the trivalent chromium results as follows:

- In order for TALS to perform an automated trivalent chromium calculation enter '1' (for 'yes') in trivalent chromium batch information page in response to the prompt 'automatically perform calculation.' As long as both methods are at 2nd level review status in TALS the program will automatically pull in the metals results for chromium and the hexavalent chromium results to perform the automated calculation. TALS will display an 'ok' message on the worksheet tab if the Cr6 result is less than Total Cr result.
- In cases where Total Cr results are not linked to TALS method 7196a_CR3, trivalent chromium is calculated manually. Enter '0' (for 'no') in batch information page 'Perform calculation.' Results will be entered manually.

11.5. Data reduction:

11.5.1. All data is recorded directly in TALS and recorded in the logbook at the time the analysis is performed.

11.5.2. Attach the prep and analytical logbook pages and calibration curve to the batch as a pdf file.

11.5.3. On the worksheet tab, enter the sample absorbance under 'Uncorrected Abs' and background absorbance under 'Color Blank Abs.' Also, enter the pH between 7-8 as 'initial pH',' pH between 1.5-2.5 as 'Final pH' and the background pH under 'Notes.'

11.5.4. Record special notes and observations in the "worksheet" tab and record reagent information in the prep batch information page (see "view batch information" page of ADII).

11.5.5. Complete the Data Review Checker (DRC) in TALS: Prior to data submission the analyst must execute the DRC (Data Review Checker) program in the applicable analytical batch (TALS Analyst Desktop II module).

11.5.5.1. Open the analytical batch and click on the Edit tab above to enter the Edit Mode.

11.5.5.2. Press F8 command key on the computer keyboard or right click anywhere on the batch worksheet then click on 'Run checklist.'

11.5.5.3. Acknowledge by filling in responses to all unacknowledged findings. Highlight the checklist with findings, then highlight the associated list of findings; right click and choose 'Acknowledge Item.'

11.5.5.4. Fill in appropriate comments in the response box, then hit 'OK.' 'The column labeled 'unacknowledged findings' should show '0' for all questions once completed; then batch is ready for 2nd level review.

12.0. Method Performance

12.1. Method Detection Limit Study (MDL)

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure in Section 19 (Test Methods and Method Validation) of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM). MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method requirements require a greater frequency.

12.2. Demonstration of Capabilities

For DOC procedure refer to Section 19 in the most current revision of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

12.3. Training Requirements

Refer to Eurofins Edison SOP No. ED-GEN-022, Training, for the laboratory's training program.

13.0. Pollution Control

It is Eurofins 's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention."

14.0. Waste Management

14.1. Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal

restrictions are followed. Waste disposal procedures are incorporated by reference to Eurofins Edison SOP No. ED-SPM-008 (Laboratory Waste Disposal Procedures).

14.2. The following waste streams are produced when this method is carried out:

- Expired Standards – The vials are collected in a 1 gallon polyethylene bucket. These vials are then transferred to an open top 55 gallon steel or polyethylene waste drum. These drums are transported to a waste facility for proper disposal.
- Sample waste-After analysis, the samples and standards are collected in a polyethylene container labeled 'Cr6+ waste.' Once the container is full, it is brought to the waste room for disposal.

15.0. References / Cross-References

15.1. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, 3rd ed., U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. U.S. Government Printing Office: Washington, DC, 1995; SW-846, Method 7196A.

15.2. Test America Edison SOP ED-WET-010, The Alkaline Digestion of Soil Samples for the Analysis of Hexavalent Chromium, most current revision.

15.3. Eurofins Edison Document No. ED-QA-LQM, *Laboratory Quality Manual*, most current revision.

15.4. Eurofins Edison SOP ED-GEN-022, *Training*, most current revision.

15.5. Eurofins Edison SOP No. ED-SPM-008, *Laboratory Waste Disposal Procedures*, current revision.

15.6. Eurofins Edison SOP ED-WET-066, Redox, Analysis of Oxidation-Reduction Potential, most current revision.

15.7. Eurofins Edison SOP ED-WET-061, Analysis of pH for soil and organic samples electrochemically, Method 9045C, most current revision.

15.8. Eurofins Corporate Environmental Health and Safety Manual, Document No. CW-E-M-001, most current revision.

16. Method Modifications:

N/A

17. Attachments

N/A

18. Revision History

- **Revision 15, dated 19 December 2024**
  - Sec 9.1 & 9.2: Added notation that all QC samples and instrument QCs are digested.
  - Sec. 10.2.1: Revised to include digesting calibration standards prior to analysis.

- **Revision 14, dated 23 September 2024**
  - Updated TestAmerica references to Eurofins throughout the document.
  - Sec 10.2.7: Added requirements and procedures to evaluate %RE in the calibration.

- **Revision 13, dated 14 June 2024**
  - Updated SOP header to Eurofins logo.
  - Sec. 11.5.6: Removed reference to WI EDS-WI-008, manual wetchemistry data review checklist; TALS DRC is used as outlined in Sec. 11.5.5.
- **Revision 12, dated 17 June 2020**
  - Updated SOP header with Eurofins emblem.
  - Sec. 9.1.2: Changed LCS source vendor from ERA to Phenova.
  - Sec. 11.5.5: Revised data review procedure to include TALS DRC procedures.
  - Sec 15.8: Deleted Wetchem Data Review Checklist Work Instruction # EDS-WI-008, not applicable.

- **Revision 11, dated 05 March 2018**
  - Sec 11.4: Added procedure for Trivalent chromium calculation using TALS method 7196a_CR3; subsequent section adjusted accordingly.

- **Revision 10, dated 23 February 2016**
  - Sec 9.1.2 and 9.1.3.2: Revised the allowable amount of PbCrO4 to add to the QC sample LCSI to reflect the range referenced in the Method. Also included the typical amount of $PbCrO_4$ that is added to the QC sample (LCSI and MSI).
  - Sec 9.1.3.3: Added spiking instructions for MSS when redigesting a batch; MSS should be spiked at 2x sample concentration or 40mg/kg, whichever is greater.

- **Revision 9, dated 25 September 2013**
  - Sec 1 & 12: Updated LQM section references to reflect the most current LQM revision.
  - Sec. 9.1.2: Changed nomenclature to LCSSRM and revised the acceptance limits from 85-115% to vendor specified QC limits.
  - Sec. 9.1.3.3: Deleted text: '*Note: If the spiked sample concentration is greater than 4X the predigestion spike concentration, no redigestion/reanalysis is required unless the samples are from a NJ site in which case the project manager should be contacted for further guidance.'*

    Per method 3060a, all batches must be rehomogenized, redigested and

reanalyzed if MSS or MSI fail regardless of location.

- Sec. 10.3.5: Changed pH range from 1.6-2.2 to pH 2.0 +/-0.5 as per the method.
- Sec. 11.4.3: Changed pH range from 1.6-2.2 to pH 1.5-2.5 as per the method.

- **Revision 8, dated 06 September 2011**
  - Sec 3: Revised the LQM reference for the list of definitions.
  - Sec 9.1.3.4: Clarified lab procedures for failing matrix spikes.
  - Sec. 9.2.2: Added procedure if the CCV is not within acceptance limits.
  - Sec. 9.2.3: Added procedure if CCB is not below reporting limit.
  - Sec. 11.4: Revised data reduction section to reflect actual laboratory practices.
  - Sec 15.9: Reference added.

- **Revision 7, dated 25 August 2009**
  - Revised SOP format in accordance with TestAmerica Corporate Quality SOP No. CW-QS-002 (Rev 0) Writing a Standard Operating Procedure (SOP).
  - Sec 1.1: added laboratory's reporting limit; change the range of analysis to 0.05-1.25mg/L to reflect actual laboratory practices.
  - Sec 9.1.5: Added preparation instruction for Post digestion spike.
  - Sec. 9.2: added ICV in the Instrument QC.
  - Sec 10.1: Added procedure for adjusting pH of sample extract; procedure formerly described in the Digestion SOP (ED-WET-010).
  - Sec 15: Added applicable references.

- **Revision 6a, dated 21 April 2009**
  - Sec.4.3: Added membrane filters, 0.45um and 0.1um.
  - Sec 4.4: Delete Erlenmeyer flasks and beakers
  - Sec 4.8:Add: Eppendorf or Finnipettes; varying volume
  - Sec 5.1, 5.2 & 5.4: Add stability and storage information.
  - Sec 5.5: Added reagent used for the pH adjusted PS: 1N NaOH: Place 4.0g NaOH in a 100 volumetric flask and dilute to the mark with deionized water. Solution is stable for 6 months. Store at room temperature.
  - Sec. 6.1: Potassium Dichromate Primary Standard Solution (1000mg/L Cr+6): Weight 0.2829g of dried (105ºC) potassium dichromate and dissolve in deionized water in a 100ml flask. Dilute to the mark. Store at room temperature. Solution is stable for 6 months.
  - Sec 6.1: Deleted pre-made standard purchased from Inorganic Ventures. Cr6+ Primary Standard will be prepared in the lab.
  - Sec 6.2: Specified source of the 1000 ppm Cr(VI).
  - Sec 6.3 and 6.6: Deleted the 10mg/L Cr (VI) working standard for soil analysis.

- Sec 6.5: Add storage information.
- Sec 6.4: Add text: Source must be different from the primary standard.
- Sec 9.2.2: Replace 100 ppm stock standard with 100 ppm Cr6+ Primary spiking solution.
- Sec. 9.2.3: Add text: Record pH reading in the logbook.
- Sec. 9.3.8: Add text: Make the dilution from the sample that has not had the indicator added.
- Sec 9.3.6: Add text: Before reading samples, verify the calibration of the spectrophotometer by analyzing a CCV and CCB.
- Sec. 10.7: Added procedure for reanalyzing Post Spike sample to conform to method requirements: *If the post digestion spike fails to meet the recovery limits, a post spike must be reanalyzed using the alkaline extract. Adjust the pH of the sample Duplicate (alkaline extract) back up to pH 8.0-8.5 using 1N NaOH; then respike and reanalyze*.

- **Revision 6, dated March 2007**
  - Section 7.2: Section deleted (start color development for digested samples within one hour after adjusting pH between 7.5±0.5); section not applicable.
  - Section 9.3.7: The text in italics was inserted to clarify the time period for measuring sample absorbance.

    "Note: Calibration standards and samples must be read within the same timeframe following full color development."
  - Section 10.2: Deleted the requirement that 'CCS is taken through the entire digestion process' to reflect actual laboratory practices.
  - Section 10.4. Revised to specify the types of LCS used including their source and acceptance limits.

- **Revision 5, dated 30 October 2006**
  - Section 9.2.2: Revised the high point of the calibration curve from 1.0 ppm to 1.25 ppm. Standards preparation instructions revised accordingly.
  - Section 9.2.2: Revised to include instructions for preparation of a second source mid-point Calibration Check Standard.
  - Section 10: Inserted a new Section 10.1 explaining the QA batching system and inserted a new section 10.4 detailing the LCS requirements. All existing sections renumbered accordingly.
  - Section 10.6 (previously Section 10.5): The italicized text was added to the following sentence:

    "NOTE: If the spiked sample concentration is greater than 4x the predigestion spike concentration, no redigestion/reanalysis is required *unless the samples are from a NJ site in which case the lab project manager should be contacted for further guidance."*

- Section 10.6 (previously Section 10.5): Added STL Edison SOP and method references for ORP and pH.
- Section 10.7 (previously Section 10.6): Added the following text: “If the post digestion spike fails to meet the recovery limits, a new aliquot of the sample must be re-spiked and re-analyzed.”
- Section 10.8 (previously Section 10.7): Revised first sentence to read “One duplicate laboratory sample per batch *must* be analyzed.” (‘Must’ previously read ‘should’).

Title: The Analysis of Waters for Hexavalent Chromium by EPA SW846 Method 7196A

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Approvals (Signature/Date):

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1.0 Scope and Application

1.1. SW846 Method 7196A may be used to determine the hexavalent chromium content of groundwater samples or digestates of solid samples. This SOP is applicable for the determination of hexavalent chromium in groundwater samples. Groundwater samples associated with regulated drinking water samples (i.e. potable water wells) are not applicable to this Method.

1.2. The range of analysis by this method is 10-200 ug/l hexavalent chromium.

1.3. On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in Sections 7 (Review of Work Request) and 19 (Test Methods and Method Validation) of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

2.0 Summary of Method

Hexavalent chromium is determined spectrophotometrically at 540nm by reaction with diphenylcarbazide in acid solution. For each batch of samples a method blank, a laboratory control sample, matrix duplicate, and a post verification spike are analyzed and compared to method limits and laboratory control limits.

3.0 Definitions

For a complete list of definitions refer to Appendix 2 in the most current revision of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

4.0 Interferences

4.1. Molybdenum and Mercury react to form color with diphenylcarbazide, however the intensity of color is much lower than those for chromium at the specified pH. Concentrations up to 200 mg/L can be accepted.

4.2. Vanadium interferes strongly, but can be tolerated up to 10 times the concentration of hexavalent chromium present.

4.3. Iron may cause a yellow color but should not affect the colorimetric measurement at 540 nm.

4.4. Reducing matter may reduce hexavalent Cr to trivalent Cr in varying amounts. No preventative measure is available at this time; however, interference is checked by a post verification spike samples.

4.4.1. The reducing/oxidizing tendency of each matrix may be determined by characterization of samples for additional analytical parameters, such as pH, ferrous iron, sulfides, and Oxidation Reduction Potential. Other indirect indicators of reducing/oxidizing tendency include Total Organic Carbon (TOC), Chemical Oxygen Demand (COD), and Biological Oxygen Demand (BOD).

4.5. For waste materials containing soluble trivalent chromium concentrations greater than four times the laboratory hexavalent chromium reporting limit, the hexavalent chromium results obtained using this method may be biased high due to method-induced oxidation.

5.0. Safety

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001) and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1. Specific Safety Concerns or Requirements

Samples that contain high concentrations of carbonates or organic material or samples that are at elevated pH can react violently when acids are added.

5.2. Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure

Nitric Acid	Corrosive Oxidizer Poison	2 ppm-TWA 4 ppm-STEL	Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison. Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract. Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Potassium Dichromate	Oxidizer Corrosive Carcinogen	0.1 Mg/M3 TWA as CrO3	Extremely destructive to tissues of the mucous membranes and upper respiratory tract. May cause ulceration and perforation of the nasal septum. Symptoms of redness, pain, and severe burn can occur. Dusts and strong solutions may cause severe irritation. Contact can cause blurred vision, redness, pain and severe tissue burns. May cause corneal injury or blindness.
Sulfuric Acid	Corrosive Oxidizer Dehydrator Poison Carcinogen	1 Mg/M3-TWA	Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. Symptoms may include irritation of the nose and throat, and labored breathing. Symptoms of redness, pain, and severe burn can occur. Contact can cause blurred vision, redness, pain and severe tissue burns. Can cause blindness.

6.0. Equipment and Supplies

6.1. Instrumentation

- pH meter, Orion benchtop or equivalent
- Spectrophotometer for use at 540 nm with a light path of 1 cm (Hach DR2800 or equivalent).

6.2. Supplies

- Membrane filters, 0.45 um and 0.1 um (NALGENE disposable)
- Glasswares: volumetric pipets (class A) and volumetric Flasks (class A)
- Graduated Cylinder (class A)
- Transfer pipettes
- Calibrated pipettes: Eppendorf or equivalent
- Vacuum pump
- Specimen Cups (plastic)
- Magnetic stirrer (teflon-coated)

7.0. Reagents and Standards

7.1. Reagents

7.1.1. Sulfuric acid (10% v/v) - Measure 100 ml of concentrated reagent grade H_2SO_4 into a 1000 ml volumetric flask (1/2 filled w/D.I. water) and dilute to mark with deionized water. Reagent is stable for 6 months. Store at room temperature.

7.1.2. Indicator solution - Place 5.0 g 1, 5-Diphenylcarbazide (AR Grade) in an amber 1000ml volumetric flask and dilute to mark with acetone. Prepare monthly or when solution becomes cloudy. Store at room temperature.

7.1.3. Acetone (reagent grade) - Store at room temperature. For stability information, refer to manufacturer's instructions or 2 years from date opened if no instructions are available.

7.2. Standards

7.2.1. Primary Potassium Dichromate ($K_2Cr_2O_7$) Stock Standard (1000 mg/L Cr+6) - Weigh 0.2829 g of dried (105°C) analytical reagent grade (or better) potassium dichromate ($K_2Cr_2O_7$) crystals (J.T.Baker catalog nos. 3090, 3093 or equivalent). Dissolve in deionized water in a 100ml flask. Dilute to the mark. Standard solution is stable for 6 months. Store at room temperature.

7.2.2. Hexavalent Chromium Primary Spiking Solution (100 mg/L Cr+6) - Prepare by adding 10ml of the 1000 mg/L Primary Potassium Dichromate Standard (see Section 7.2.1) to a 100ml volumetric flask and dilute to volume with deionized water. Standard solution is stable for 6 months. Store at room temperature.

7.2.3. Hexavalent Chromium Primary Spiking Solution (10 mg/L Cr+6) - Prepare by adding 1.0ml of 1000 mg/L Cr+6 Standard (see Section 7.2.1) to a 100ml volumetric flask and diluting to volume with deionized water. Standard solution is stable for 6 months. Store at room temperature.

7.2.4. Secondary Potassium Dichromate ($K_2Cr_2O_7$) Stock Standard (1000 mg/L Cr+6) - Weigh 0.2829 g of dried (105°C) analytical reagent grade (or better) potassium dichromate ($K_2Cr_2O_7$) crystals (J.T.Baker catalog nos. 3090, 3093 or equivalent). *The source of this standard must be from a different lot or manufacturer than the Primary Potassium Dichromate Stock Standard detailed in Section 7.2*.1. Dissolve in deionized water in a 100ml flask. Dilute to the mark. Standard solution is stable for 6 months. Store at room temperature.

7.2.5. Hexavalent Chromium Secondary Spiking Solution (100 mg/L Cr+6) - Prepare by adding 10ml of 1000 mg/L Cr+6 Secondary Standard (see Section 7.2.4) to a 100ml volumetric flask and diluting to volume with deionized water. Standard solution is stable for 6 months. Store at room temperature.

7.2.6. Hexavalent Chromium Secondary Spiking Solution (10 mg/L Cr+6) - Prepare by adding 1.0ml of 1000 mg/L Cr+6 Secondary Standard (see Section 7.2.4) to a 100ml volumetric flask and diluting to volume with deionized water. Standard solution is stable for 6 months. Store at room temperature.

8.0. Sample Collection, Preservation, Shipment and Storage

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client requests. Listed below are the holding times and the references that include preservation requirements.

Matrix	Sample Container	Min. Sample Size	Preservation	Holding Time [1]	Reference
Waters	HDPE[2]	250 mL	Cool 4 ±2°C	24 Hours	SW 7196A

[1] Samples must be analyzed within 24 hours from time of collection. Store samples at 4°C before analysis.
[2] High-density polypropylene container

9.0. Quality Control

9.1. **Sample QC** - - The following MB, LCS, and PVS are analyzed with each batch of 20 samples or each time samples are setup, whichever is more frequent. The DU is analyzed at a frequency of 1 per 10 samples or each time samples are set up, whichever is more frequent.

9.1.1. Method Blank (MB): Use deionized water for the method blank. Analyze using all reagents in the same volumes as used in the analysis of samples. The blank value should fall below the reporting limit if not, all samples associated with the method blank must be re-analyzed. Do not subtract the blank value from sample values.

9.1.2. Post Verification Spike (PS): The PVS concentration must be two times the concentration of Cr(VI) found in the sample or 30.0 ug/L (whichever is greater). If necessary, dilute the PS to fall within the range of the calibration curve. If the PS recovery is not within 85-115%, dilute the sample and re-analyze.

Note: The post spike is identified as “MS” in TALS QC.

9.1.3. Matrix Duplicate (DU): A duplicate is prepared and analyzed in exactly the same manner as the original sample. The relative percent difference (RPD) between the sample and duplicate should be less than or equal to 20%.

9.1.4. Laboratory Control Sample (LCS): The hexavalent chromium LCS is a certified QC standard purchased from Phenova (Catalog WP

Hexavalent Chromium). The LCS is used to monitor the accuracy of the entire analytical process. The LCS recovery must be within vendor specified QC limits or all samples associated with the LCS must be reanalyzed.

9.2. Instrument QC

9.2.1. Initial Calibration Verification (ICV): The ICV (75.0 ug/L Cr (VI)) is analyzed immediately after an acceptable initial calibration. The ICV standard must be from a source separate from the calibration standards (i.e., different manufacturer or separate lot) and its recovery must be within ±10% of the expected value. The ICV is prepared by adding 0.375ml of a 10 mg/L Cr6+ Hexavalent Chromium Secondary Spiking Solution (Section 7.2.6) into a 50 ml volumetric flask and diluting to 50ml with deionized water. If the measured concentration exceeds the ±10% limit, a second analysis should be performed. If the result still exceeded the ±10% limit, the analysis should be terminated until the source of the problem is identified and corrected.

9.2.2. Calibration Check Verification (CCV): A midpoint Calibration Check Verification spiked at 75.0 ug/L is prepared in the same way as the ICV (See Section 9.2.1). The CCV is analyzed after every 10 samples (20 readings including backgrounds) and after reading the last sample. The result must be within ± 10% of the true value. If not, all samples following the last acceptable CCV must be re-analyzed.

9.2.3. Initial and Continuing Calibration Blank (ICB/CCB): Initial Continuing Calibration Blank (ICB) must be analyzed after the ICV. Continuing Calibration Blank (CCB) must be analyzed after every 10 samples or after each Calibration Check Verification (CCV). Use deionized water for the ICB/CCB. The value of the ICB/CCB should be less than the RL. If not, all samples following the last acceptable ICB/CCB must be re-analyzed.

9.2.4. Minimum Reporting Level (MRL), 10ppb: The MRL must be analyzed daily before samples are analyzed. Prepare the MRL by adding 0.05ml of a 10 mg/L Hexavalent Chromium Primary Spiking Solution (Section 7.2.3) into a 50 ml volumetric flask and diluting to 50ml with deionized water. The results must fall within 50-150% of the true value.

10.0 Procedure

10.1. Calibration

10.1.1. Prepare fresh calibration standards everyday before analysis.

10.1.2. Initial Calibration Standards: (6 points). Place about 25 mL of deionized (DI) water in six 50 ml flasks. Prepare the six points as follows:

Cr(6+) Standard conc. (ug/L)	Volume (ml) of 10 mg/L Cr+6 (Section 7.2.3) to add	Final volume (ml) using Deionized water

0.0	0.0	50
10.0	0.05	50
50.0	0.25	50
75.0	0.375	50
100	0.50	50
200	1.0	50

10.1.3. Analyze the calibration standards in the manner detailed in Sections 10.2.1 thru 10.2.7. Zero the spectrometer with the 0 ug/L standard.

10.1.4. Perform linear regression on data resulting from analysis of the initial calibration. The correlation coefficient must be 0.995.

10.1.5. After calibration is entered into TALS, calculate %RE (%relative error) on two calibration standards, the standard at or near the mid-point of the calibration and the standard at the lowest level. Go to calibration events and click on details, review the column labeled 'read back amount' and '% Error' for the low standard and midpoint standard.

Low standard (10ppb): The %RE (relative error) must be +/- 50%; if not, stop the analysis and recalibrate.

Mid-point normal (75ppb): The %RE (relative error) must be +/- 10%; if not, stop the analysis and recalibrate

10.1.6. Analyze the Initial Calibration Verification (ICV) standard in the same manner as the initial calibration standards detailed above. If the ICV meets the criteria listed in Section 9.2.1, the analyst may continue with sample analysis (Section 10.2).

10.2. Sample Analysis

10.2.1. Warm up spectrophotometer and set to 540 nm.

10.2.2. Place 45.0 mL of sample into a 100 ml specimen cup. Also, place 45 mL of sample in a separate cup for background.

10.2.3. Add 1.0 ml indicator solution (see Section 7.1.2) and swirl. (Do not add indicator to background sample).

10.2.4. Slowly add 10% H_2SO_4 (See Section 7.1.1) dropwise to sample and background while measuring pH until pH is 1.5-2.5. Record reading.

10.2.5. Place sample in a 50 ml volumetric flask and bring to volume with deionized water. Pour back into original cup and swirl.

10.2.6. Let stand 5-10 minutes for full color development.

10.2.7. Read calibration standards, QC samples, and samples on spectrophotometer at 540 nm. Analyze the calibration check standard and calibration check blank immediately following the calibration standards.

10.2.8. Dilute samples that exceed calibration curve using deionized water. Recolorize and read again on spectrophotometer noting dilution factor.

10.2.9. Continue analyzing samples and quality control samples by first reading the sample followed by its background sample.

10.2.10. After every 10 samples and after reading the last sample in the batch, verify the calibration by reading Calibration Check Verification (CCV) and Continuing Calibration Blank (CCB).

11. Calculations / Data Reduction

11.1. Accuracy:

$$\text{ICV / CCV, LCS \% Recovery} = \frac{\text{observed concentration}}{\text{known concentration}} \times 100$$

11.2. Precision (RPD):

$$\text{Matrix Duplicate (MD)} = \frac{|\text{orig. sample value - dup. sample value}|}{[(\text{orig. sample value + dup. sample value})/2]} \times 100$$

11.3. Calculate the hexavalent chromium result for each aqueous sample as follows:

Hexavalent Chromium in ug/L = A x E

A = Concentration from the calibration curve in ug/L
E = Dilution (if necessary)

11.4. Trivalent Chromium Calculation: When required, the calculation for trivalent chromium is completed using the TALS method '7196a_CR3' which must be logged for the samples being processed along with methods for total chromium (metals) and hexavalent chromium. Upon completion of the total and hexavalent chromium analyses the analyst may process the trivalent chromium results as follows:

- To have TALs perform an automated trivalent chromium calculation: on the trivalent chromium batch information page enter '1' (for 'yes') in response to the

prompt to automatically perform the calculation. As long as both methods are at 2nd level review status in TALS the program will automatically pull in the metals results for chromium and the hexavalent chromium results to perform the automated calculation. TALS will display an 'ok' message on the worksheet tab if the Cr6 result is less than Total Cr result.

- If the analyst intends to manually enter trivalent chromium results an entry of '0' (for 'no') should be made the and the results entered manually.

11.5. Data Reduction

11.5.1. Record analytical data directly into TALS and in the 'Hexachrome Run Logbook.'

11.5.2. Record Reagent information on the "batch information" page.

11.5.3. Special comments or observations should be recorded on the "worksheet" tab. Record Sample absorbances and pH readings on the "worksheet" tab.

11.5.4. Attach the calibration curve plot and the logbook pages for the analysis to the analytical batch as pdf files.

11.5.5. Complete the Data Review Checker (DRC) in TALS: Prior to data submission the analyst must execute the DRC (Data Review Checker) program in the applicable analytical batch (TALS Analyst Desktop II module).

11.5.5.1 Open the analytical batch and click on the Edit tab above to enter the Edit Mode.

11.5.5.2 Press F8 command key on the computer keyboard or right click anywhere on the batch worksheet then click on 'Run checklist.'

11.5.5.3 Acknowledge by filling in responses to all unacknowledged findings. Highlight the checklist with findings, then highlight the associated list of findings; right click and choose 'Acknowledge Item.'

11.5.5.4 Fill in appropriate comments in the response box, then hit 'OK.' 'The column labeled 'unacknowledged findings' should show '0' for all questions once completed; then batch is ready for 2nd level review.

12. Method Performance

12.1. Method Detection Limit Study (MDL)

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure in Section 19 (Test Methods and Method Validation) of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM). MDLs reflect a calculated (statistical) value

determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method requirements require a greater frequency.

12.2. Demonstration of Capabilities

For DOC procedure refer to Section 19 in the most current revision of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

12.3. Training Requirements

Refer to Eurofins Edison SOP No. ED-GEN-022, Training, for the laboratory's training program.

13.0 Pollution Control

It is Eurofins 's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention."

14.0. Waste Management

14.1. Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to Eurofins Edison SOP No. ED-SPM-008 (Laboratory Waste Disposal Procedures).

14.2. The following waste streams are generated as a result of this analysis:

- Water Retain Samples -These materials are originally received aqueous samples. These solutions are then transferred into the first drum of the neutralization system and neutralized to a pH of 6 – 9 with sodium bicarbonate (Siedler Chemical SC-0219-25). This solution is discharged into the municipal sewer system.

15.0. References / Cross-References

15.1. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, 3rd ed., U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. U.S. Government Printing Office: Washington, DC, 1995; SW-846, Method 7196A.

15.2. TestAmerica Edison Document No. ED-QA-LQM, *Laboratory Quality Manual*, most current revision.

15.3. TestAmerica Edison SOP ED-GEN-022, *Training*, most current revision.

15.4. TestAmerica Edison SOP No. ED-SPM-008, *Laboratory Waste Disposal Procedures*, current revision.

15.5. TestAmerica Corporate Environmental Health and Safety Manual, Document No. CW-E-M-001, most current revision.

16.0. Method Modifications:

N/A

17.0. Attachments

N/A

18.0. Revision History

- Revision 12, 23 September 2024
  - Sec. 10.1.5: Added requirements and procedures to evaluate %RE in the calibration
- Revision 11, 10/01/2021
  - Sec. 9.2.4: Added criteria to analyze a Minimum Reporting Level (MRL) daily.
- Revision 10, 14 May 2020
  - Updated SOP header with Eurofins logo.
  - Sec 1.1: Clarified matrix applicability for this SOP.
  - Sec. 9.1: Revised the frequency of Matrix Duplicate from 1/20 samples to 1/10 samples.
- Revision 9, 12 February 2019
  - Sec. 9.1.4: Changed LCS source vendor from ERA to Phenova.
  - Sec. 11.5.5: Replaced Wetchemistry Data review checklist (EDS-WI-008) to TALS Data Review Checker (DRC); instructions added.
  - Deleted Sec 15.6, WI EDS-WI-008, not applicable; subsequent sections adjusted accordingly.
- Revision 8, 30 Nov 2016
  - Sec. 11.4: Added Cr3 calc procedure
- Revision 7, 26 November 2012
  - Section 9.1.2: Revised the minimum concentration for PS from 15 ug/L to 30 ug/L to comply with Method 7196A.
- Revision 6, 04 October 2012
  - Section 1&12: Updated LQM reference to reflect the most current LQM revision.
  - Sec 5: Updated to comply with TestAmerica Corporate Quality SOP No. CW-QS-002 (Rev 0) Writing a Standard Operating Procedure (SOP)

- Sec. 9.1.1: Revised to include corrective action procedure when MB is greater than the RL.
- Sec. 9.1.4: Changed limits from 85-115% to vendor specified QC limits.
- Sec. 9.2.2 & 9.2.3: Revised to include corrective action procedure when CCV and CCB are outside the acceptance limits.

- Revision 5, 7 September 2010
  - Section 2.0: Removed text 'Dissolved;' this SOP is only applicable to aqueous samples for method SW7196A which are not filtered.
  - Sec 3: Revised to update LQM reference for the list of definitions.
  - Section 6.2: Added graduated cylinders (class A) and transfer pipettes to the list of supplies.
  - Removed Nitric acid on list of reagents, not applicable for the analysis of Cr6+ waters.
  - Section 9.1.1: Revised method blank criteria from <MDL to <RL.
  - Section 9.1.4: Replaced LCS vendor specified limits to 85-115%.
  - Section 9.2.2: Removed text: "immediately after analyzing the calibration standards." Renamed CCS to CCV.
  - Section 9.2.3: Revised CCB criteria from <MDL to <RL.
  - Section 10.1.4: Revised the correlation coefficient criteria from ≥0.997 to ≥0.995.
  - Section 13 & 14: Revised to comply with the current Method SOP format (CW-QS-002, Writing a Standard Operating Procedure (SOP)).
  - Section 11.4: Revised Data Reduction section in accordance with TALS.
  - Section 15: Added applicable references.

- Revision 4, January 22, 2008
  - Updated to new format as per TestAmerica's SOP format.
  - Added the shelf-life and storage requirements to reagents in section 7, Reagents and standards.
  - Added J.T.Baker (Catalog Nos. 3090, 3093 or equivalent) as source of primary and secondary standards. Deleted reference to Inorganic Ventures as a source of the primary standard.
  - Replaced the source standard used for the preparation of 10 mg/L Cr+6 (primary and secondary spiking solution) from 100 mg/L Cr+6 to 1000 mg/L Cr+6.
  - Added the control limits for Post Verification Spike (PVS).
  - Added ICV as Instrument QC.
  - Added the preparation procedure and control limits for the Calibration Check Standard (CCS).
  - Deleted Matrix spike (matrix spike low and matrix spike high) as sample QC requirement.
  - Section 10.3.3: Revised pH range from 1.6-2.2 to 1.5-2.5 to reflect method requirements.
  - Standardized all analytical units to ug/L and mg/L.
  - Added the following to the References section: TestAmerica Edison SOP ED-GEN-022 (Training) and TestAmerica Laboratory Quality Manual (ED-QA-LQM).

Emerging Contaminants

Method Description	Matrix	Method Code	Prep Method	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
Per- and Polyfluoroalkyl Substances by LC/MS/MS	Solid	1633	1633_Shake	Perfluorobutanoic acid (PFBA)	375-22-4	0.800	0.200		ug/Kg	40	150	30	40	150	30		
				Perfluoropentanoic acid (PFPeA)	2706-90-3	0.400	0.100		ug/Kg	40	150	30	40	150	30		
				Perfluorohexanoic acid (PFHxA)	307-24-4	0.200	0.0500		ug/Kg	40	150	30	40	150	30		
				Perfluoroheptanoic acid (PFHpA)	375-85-9	0.200	0.0500		ug/Kg	40	150	30	40	150	30		
				Perfluorooctanoic acid (PFOA)	335-67-1	0.200	0.0500		ug/Kg	40	150	30	40	150	30		
				Perfluorononanoic acid (PFNA)	375-95-1	0.200	0.0500		ug/Kg	40	150	30	40	150	30		
				Perfluorodecanoic acid (PFDA)	335-76-2	0.200	0.0500		ug/Kg	40	150	30	40	150	30		
				Perfluoroundecanoic acid (PFUnA)	2058-94-8	0.200	0.0500		ug/Kg	40	150	30	40	150	30		
				Perfluorododecanoic acid (PFDoA)	307-55-1	0.200	0.0500		ug/Kg	40	150	30	40	150	30		
				Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.200	0.0500		ug/Kg	40	150	30	40	150	30		
				Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.200	0.0500		ug/Kg	40	150	30	40	150	30		
				Perfluorobutanesulfonic acid (PFBS)	375-73-5	0.200	0.0500		ug/Kg	40	150	30	40	150	30		
				Perfluoropentanesulfonic acid (PFPeS)	2706-91-4	0.200	0.0500		ug/Kg	40	150	30	40	150	30		
				Perfluorohexanesulfonic acid (PFHxS)	355-46-4	0.200	0.0500		ug/Kg	40	150	30	40	150	30		
				Perfluoroheptanesulfonic acid (PFHpS)	375-92-8	0.200	0.0500		ug/Kg	40	150	30	40	150	30		
				Perfluorooctanesulfonic acid (PFOS)	1763-23-1	0.200	0.0500		ug/Kg	40	150	30	40	150	30		
				Perfluorononanesulfonic acid (PFNS)	68259-12-1	0.200	0.0500		ug/Kg	40	150	30	40	150	30		
				Perfluorododecanesulfonic acid (PFDoS)	79780-39-5	0.200	0.0500		ug/Kg	40	150	30	40	150	30		
				1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2	757124-72-4	0.800	0.200		ug/Kg	40	150	30	40	150	30		
				1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 F	27619-97-2	0.800	0.200		ug/Kg	40	150	30	40	150	30		
				1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2	39108-34-4	0.800	0.200		ug/Kg	40	150	30	40	150	30		
				Perfluorooctanesulfonamide (PFOSA)	754-91-6	0.200	0.0500		ug/Kg	40	150	30	40	150	30		
				N-methylperfluorooctane sulfonamide (NMeFOS)	31506-32-8	0.200	0.0500		ug/Kg	40	150	30	40	150	30		
				N-ethylperfluorooctane sulfonamide (NEtFOSA)	4151-50-2	0.200	0.0500		ug/Kg	40	150	30	40	150	30		
				N-methylperfluorooctanesulfonamidoacetic acid (	2355-31-9	0.200	0.0500		ug/Kg	40	150	30	40	150	30		
				N-ethylperfluorooctanesulfonamidoacetic acid (N	2991-50-6	0.200	0.0500		ug/Kg	40	150	30	40	150	30		
				N-methylperfluorooctane sulfonamidoethanol (NM	24448-09-7	2.00	0.500		ug/Kg	40	150	30	40	150	30		
				N-ethylperfluorooctane sulfonamidoethanol (NEtF	1691-99-2	2.00	0.500		ug/Kg	40	150	30	40	150	30		
				Hexafluoropropylene Oxide Dimer Acid (HFPO-D	13252-13-6	0.800	0.200		ug/Kg	40	150	30	40	150	30		
				4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	919005-14-4	0.800	0.200		ug/Kg	40	150	30	40	150	30		
				Perfluoro-4-methoxybutanoic acid (PFMBA)	863090-89-5	0.400	0.100		ug/Kg	40	150	30	40	150	30		
				Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	151772-58-6	0.400	0.100		ug/Kg	40	150	30	40	150	30		
				9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic	756426-58-1	0.800	0.200		ug/Kg	40	150	30	40	150	30		
				11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic	763051-92-9	0.800	0.200		ug/Kg	40	150	30	40	150	30		
				Perfluoro (2-ethoxyethane) sulfonic acid (PFEES	113507-82-7	0.400	0.100		ug/Kg	40	150	30	40	150	30		
				3-Perfluoropropylpropanoic acid (3:3 FTCA)	356-02-5	1.00	0.250		ug/Kg	40	150	30	40	150	30		
				3-Perfluoropentylpropanoic acid (5:3 FTCA)	914637-49-3	5.00	1.25		ug/Kg	40	150	30	40	150	30		
				3-Perfluoroheptylpropanoic acid (7:3 FTCA)	812-70-4	5.00	1.25		ug/Kg	40	150	30	40	150	30		
				13C4 PFBA	STL00992	2.50			ug/Kg	20	150	30	20	150	30		
				13C5 PFPeA	STL01893	1.25			ug/Kg	20	150	30	20	150	30		
				13C5 PFHxA	STL02577	0.625			ug/Kg	20	150	30	20	150	30		
				13C4 PFHpA	STL01892	0.625			ug/Kg	20	150	30	20	150	30		
				13C8 PFOA	STL01052	0.625			ug/Kg	20	150	30	20	150	30		
				13C9 PFNA	STL02578	0.313			ug/Kg	20	150	30	20	150	30		
				13C6 PFDA	STL02579	0.313			ug/Kg	20	150	30	20	150	30		
				13C7 PFUnA	STL02580	0.313			ug/Kg	20	150	30	20	150	30		
				13C2 PFTeDA	STL02116	0.313			ug/Kg	20	150	30	20	150	30		
				13C3 PFBS	STL02337	0.583			ug/Kg	20	150	30	20	150	30		
				13C3 PFHxS	STL02581	0.593			ug/Kg	20	150	30	20	150	30		
				13C8 PFOS	STL01054	0.600			ug/Kg	20	150	30	20	150	30		
				13C8 FOSA	STL01056	0.625			ug/Kg	20	150	30	20	150	30		
				d3-NMeFOSAA	STL02118	1.25			ug/Kg	20	150	30	20	150	30		
				d5-NEtFOSAA	STL02117	1.25			ug/Kg	20	150	30	20	150	30		
				M2-4:2 FTS	STL02395	1.17			ug/Kg	20	150	30	20	150	30		
				M2-6:2 FTS	STL02279	1.19			ug/Kg	20	150	30	20	150	30		
				M2-8:2 FTS	STL02280	1.20			ug/Kg	20	150	30	20	150	30		
				13C3 HFPO-DA	STL02255	2.50			ug/Kg	20	150	30	20	150	30		
				d7-N-MeFOSE-M	STL02277	6.25			ug/Kg	20	150	30	20	150	30		
				d9-N-EtFOSE-M	STL02278	6.25			ug/Kg	20	150	30	20	150	30		
				d5-NEtPFOSA	STL02704	0.625			ug/Kg	20	150	30	20	150	30		
				d3-NMePFOSA	STL02705	0.625			ug/Kg	20	150	30	20	150	30		
				13C3-PFBA	STL02680	1.25			ug/Kg	30	200	30	30	200	30		
				13C4 PFOA	STL00990	0.625			ug/Kg	30	200	30	30	200	30		
				13C2 PFDA	STL00996	0.313			ug/Kg	30	200	30	30	200	30		
				13C4 PFOS	STL00991	0.600			ug/Kg	30	200	30	30	200	30		
				13C5 PFNA	STL00995	0.313			ug/Kg	30	200	30	30	200	30		
				13C2 PFHxA	STL00993	0.625			ug/Kg	30	200	30	30	200	30		
				18O2 PFHxS	STL00994	0.593			ug/Kg	30	200	30	30	200	30		
				Perfluorodecanesulfonic acid (PFDS)	335-77-3	0.200	0.0500		ug/Kg	40	150	30	40	150	30		
				Perfluoro-3-methoxypropanoic acid (PFMPA)	377-73-1	0.400	0.100		ug/Kg	40	150	30	40	150	30		
				13C2-PFDoDA	STL02703	0.313			ug/Kg	20	150	30	20	150	30		
Per- and Polyfluoroalkyl Substances by LC/MS/MS	NPW	1633	1633_SPE	Perfluorobutanoic acid (PFBA)	375-22-4	8.00	2.13		ng/L	58	148		58	148	30		
				Perfluoropentanoic acid (PFPeA)	2706-90-3	4.00	1.00		ng/L	54	152		54	152	30		

Emerging Contaminants

Method Description	Matrix	Method Code	Prep Method	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
				Perfluorohexanoic acid (PFHxA)	307-24-4	2.00	0.500		ng/L	55	152		55	152	30		
				Perfluoroheptanoic acid (PFHpA)	375-85-9	2.00	0.500		ng/L	54	154		54	154	30		
				Perfluorooctanoic acid (PFOA)	335-67-1	2.00	0.500		ng/L	52	161		52	161	30		
				Perfluorononanoic acid (PFNA)	375-95-1	2.00	0.500		ng/L	59	149		59	149	30		
				Perfluorodecanoic acid (PFDA)	335-76-2	2.00	0.500		ng/L	52	147		52	147	30		
				Perfluoroundecanoic acid (PFUnA)	2058-94-8	2.00	0.500		ng/L	48	159		48	159	30		
				Perfluorododecanoic acid (PFDoA)	307-55-1	2.00	0.500		ng/L	64	142		64	142	30		
				Perfluorotridecanoic acid (PFTrDA)	72629-94-8	2.00	0.500		ng/L	49	148		49	148	30		
				Perfluorotetradecanoic acid (PFTeDA)	376-06-7	2.00	0.500		ng/L	47	161		47	161	30		
				Perfluorobutanesulfonic acid (PFBS)	375-73-5	2.00	0.500		ng/L	62	144		62	144	30		
				Perfluoropentanesulfonic acid (PFPeS)	2706-91-4	2.00	0.500		ng/L	59	151		59	151	30		
				Perfluorohexanesulfonic acid (PFHxS)	355-46-4	2.00	0.517		ng/L	57	146		57	146	30		
				Perfluoroheptanesulfonic acid (PFHpS)	375-92-8	2.00	0.500		ng/L	55	152		55	152	30		
				Perfluorooctanesulfonic acid (PFOS)	1763-23-1	2.00	0.500		ng/L	58	149		58	149	30		
				Perfluorononanesulfonic acid (PFNS)	68259-12-1	2.00	0.500		ng/L	52	148		52	148	30		
				Perfluorododecanesulfonic acid (PFDoS)	79780-39-5	2.00	0.500		ng/L	36	145		36	145	30		
				1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2	757124-72-4	8.00	2.00		ng/L	67	146		67	146	30		
				1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2	27619-97-2	8.00	2.00		ng/L	61	151		61	151	30		
				1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2	39108-34-4	8.00	2.00		ng/L	63	152		63	152	30		
				Perfluorooctanesulfonamide (PFOSA)	754-91-6	2.00	0.500		ng/L	61	148		61	148	30		
				N-methylperfluorooctane sulfonamide (NMeFOS	31506-32-8	2.00	0.500		ng/L	63	145		63	145	30		
				N-ethylperfluorooctane sulfonamide (NEtFOSA)	4151-50-2	2.00	0.500		ng/L	65	139		65	139	30		
				N-methylperfluorooctanesulfonamidoacetic acid (	2355-31-9	2.00	0.620		ng/L	58	144		58	144	30		
				N-ethylperfluorooctanesulfonamidoacetic acid (N	2991-50-6	2.00	0.521		ng/L	59	146		59	146	30		
				N-methylperfluorooctane sulfonamidoethanol (NM	24448-09-7	20.0	5.00		ng/L	71	136		71	136	30		
				N-ethylperfluorooctane sulfonamidoethanol (NEtF	1691-99-2	20.0	5.00		ng/L	69	137		69	137	30		
				Hexafluoropropylene Oxide Dimer Acid (HFPO-D	13252-13-6	8.00	2.00		ng/L	63	144		63	144	30		
				4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	919005-14-4	8.00	2.00		ng/L	68	146		68	146	30		
				Perfluoro-4-methoxybutanoic acid (PFMBA)	863090-89-5	4.00	1.00		ng/L	55	148		55	148	30		
				Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	151772-58-6	4.00	1.22		ng/L	48	161		48	161	30		
				9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic	756426-58-1	8.00	2.00		ng/L	56	156		56	156	30		
				11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic	763051-92-9	8.00	2.00		ng/L	46	156		46	156	30		
				Perfluoro (2-ethoxyethane) sulfonic acid (PFEES	113507-82-7	4.00	1.00		ng/L	56	151		56	151	30		
				3-Perfluoropropylpropanoic acid (3:3 FTCA)	356-02-5	10.0	2.50		ng/L	62	129		62	129	30		
				3-Perfluoropentylpropanoic acid (5:3 FTCA)	914637-49-3	50.0	12.5		ng/L	63	134		63	134	30		
				3-Perfluoroheptylpropanoic acid (7:3 FTCA)	812-70-4	50.0	14.9		ng/L	50	138		50	138	30		
				13C4 PFBA	STL00992	100			ng/L	10	130		10	130	30		
				13C5 PFPeA	STL01893	5.00			ng/L	40	150		35	150	30		
				13C5 PFHxA	STL02577	25.0			ng/L	40	150		55	150	30		
				13C4 PFHpA	STL01892	25.0			ng/L	40	150		55	150	30		
				13C8 PFOA	STL01052	25.0			ng/L	30	140		60	140	30		
				13C9 PFNA	STL02578	12.5			ng/L	30	140		55	140	30		
				13C6 PFDA	STL02579	12.5			ng/L	20	140		50	140	30		
				13C7 PFUnA	STL02580	12.5			ng/L	20	140		30	140	30		
				13C2 PFTeDA	STL02116	12.5			ng/L	10	130		10	130	30		
				13C3 PFBS	STL02337	24.0			ng/L	25	150		55	150	30		
				13C3 PFHxS	STL02581	24.0			ng/L	25	150		55	150	30		
				13C8 PFOS	STL01054	25.0			ng/L	20	140		45	140	30		
				13C8 FOSA	STL01056	25.0			ng/L	10	130		30	130	30		
				d3-NMeFOSAA	STL02118	50.0			ng/L	10	200		45	200	30		
				d5-NEtFOSAA	STL02117	50.0			ng/L	10	200		10	200	30		
				M2-4:2 FTS	STL02395	50.0			ng/L	25	200		60	200	30		
				M2-6:2 FTS	STL02279	50.0			ng/L	25	200		60	200	30		
				M2-8:2 FTS	STL02280	50.0			ng/L	25	200		50	200	30		
				13C3 HFPO-DA	STL02255	100			ng/L	25	160		25	160	30		
				d7-N-MeFOSE-M	STL02277	250			ng/L	10	150		10	150	30		
				d9-N-EtFOSE-M	STL02278	250			ng/L	10	150		10	150	30		
				d5-NEtFOSA	STL02704	25.0			ng/L	10	130		10	130	30		
				d3-NMeFOSA	STL02705	25.0			ng/L	10	130		15	130	30		
				13C3-PFBA	STL02680	5.00			ng/L						30		
				13C4 PFOA	STL00990	25.0			ng/L						30		
				13C2 PFDA	STL00996	12.5			ng/L						30		
				13C4 PFOS	STL00991	24.0			ng/L						30		
				13C5 PFNA	STL00995	12.5			ng/L						30		
				13C2 PFHxA	STL00993	25.0			ng/L						30		
				18O2 PFHxS	STL00994	24.0			ng/L						30		
				Perfluorodecanesulfonic acid (PFDS)	335-77-3	2.00	0.500		ng/L	51	147		51	147	30		
				Perfluoro-3-methoxypropanoic acid (PFMPA)	377-73-1	4.00	1.00		ng/L	51	145		51	145	30		
				13C2-PFDoDA	STL02703	12.5			ng/L	10	150		10	150	30		
Semivolatile Organic Compounds (GC/MS)	Solid	8270E	3546	1,4-Dioxane	123-91-1	0.0330	0.0289		mg/Kg	30	120	30	30	120	30		
				2,4,6-Tribromophenol (Surr)	118-79-6				mg/Kg			30			30	24	137
				2-Fluorobiphenyl	321-60-8				mg/Kg			30			30	48	120
				2-Fluorophenol (Surr)	367-12-4				mg/Kg			30			30	31	120
				Nitrobenzene-d5 (Surr)	4165-60-0				mg/Kg			30			30	38	120
				Phenol-d5 (Surr)	4165-62-2				mg/Kg			30			30	39	120
				Terphenyl-d14 (Surr)	1718-51-0				mg/Kg			30			30	25	126
Semivolatile Organic Compounds (GC/MS SIM / Isotope Dilution)	NPW	8270E_SIM_MS_ID	3510C_LVI	1,4-Dioxane	123-91-1	0.200	0.0720		ug/L	50	142	20	50	142	20		
				1,4-Dioxane-d8	17647-74-4	0.400			ug/L			20			20	10	150

Title: Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), SW846 Methods 8270E

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Approvals (Signature/Date):

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1.0 Scope and Application

1.1 Analytes, Matrix(s), and Reporting Limits

USEPA Method 8270E is an analytical method which employs the use of GC/MS to determine the concentration of semivolatile organic compounds in extracts prepared from many types of solid waste matrices, soils, and water samples

Eurofins Edison has the capability to analyze and report the compounds listed in Table 1 via Method 8270E.

Table 1

Compound	CAS No.	Compound	CAS No.
1,1'-Biphenyl	92-52-4	Anthracene **(1)**	120-12-7
1,2,4,5-Tetrachlorobenzene	95-94-3	Atrazine	1912-24-9
1,2,4-Trichlorobenzene	120-82-1	Benzaldehyde	100-52-7
1,2-Dichlorobenzene	95-50-1	Benzidine	92-87-5
1,2-Diphenylhydrazine	122-66-7	Benzo[a]anthracene **(1)**	56-55-3
1,3-Dichlorobenzene	541-73-1	Benzo[a]pyrene **(1)**	50-32-8
1,3-Dimethylnaphthalene	575-41-7	Benzo[b]fluoranthene **(1)**	205-99-2
1,4-Dichlorobenzene	106-46-7	Benzo[g,h,i]perylene **(1)**	191-24-2
1,4-Dichlorobenzene-d4 **(ISTD)**	3855-82-1	Benzo[k]fluoranthene **(1)**	207-08-9
1,4-Dioxane **(1) (2)**	123-91-1	Benzoic acid	65-85-0
1-Methylnaphthalene	90-12-0	Benzyl alcohol	100-51-6
1-Naphthylamine	134-32-7	Bis(2-chloroethoxy)methane	111-91-1
2,2'-oxybis[1-chloropropane]	108-60-1	Bis(2-chloroethyl)ether **(1)**	111-44-4
2,3,4,6-Tetrachlorophenol	58-90-2	Bis(2-ethylhexyl) phthalate	117-81-7
2,3,7,8-TCDD	1746-01-6	Bisphenol-A	80-05-7
2,3-Dihydroindene	496-11-7	Butyl benzyl phthalate	85-68-7
2,3-Dimethylaniline	87-59-2	Caprolactam	105-60-2
2,4,5-Trichlorophenol	95-95-4	Carbamazepine	298-46-4
2,4,5-Trimethylaniline	137-17-7	Carbazole	86-74-8
2,4,6-Tribromophenol **(Surrogate)**	118-79-6	Chrysene **(1)**	218-01-9
2,4,6-Trichlorophenol	88-06-2	Chrysene-d12 **(ISTD)**	1719-03-5
2,4-Dichlorophenol	120-83-2	Coumarin	91-64-5
2,4-Dimethylphenol	105-67-9	Dibenz(a,h)anthracene **(1)**	53-70-3
2,4-Dinitrophenol	51-28-5	Dibenzofuran	132-64-9
2,4-Dinitrotoluene	121-14-2	Diethyl phthalate	84-66-2
2,4-Xylidine	95-68-1	Dimethyl phthalate	131-11-3
2,6-Dinitrotoluene	606-20-2	Di-n-butyl phthalate	84-74-2
2-Chloronaphthalene	91-58-7	Di-n-octyl phthalate	117-84-0
2-Chlorophenol	95-57-8	Fluoranthene **(1)**	206-44-0
2-Ethylaniline	578-54-1	Fluorene **(1)**	86-73-7
2-Fluorobiphenyl **(Surrogate)**	321-60-8	Hexachlorobenzene **(1)**	118-74-1
2-Fluorophenol **(Surrogate)**	367-12-4	Hexachlorobutadiene	87-68-3
2-Methylnaphthalene	91-57-6	Hexachlorocyclopentadiene	77-47-4
2-Methylphenol	95-48-7	Hexachloroethane	67-72-1
2-Naphthylamine	91-59-8	Indeno[1,2,3-cd]pyrene **(1)**	193-39-5
2-Nitroaniline	88-74-4	Isophorone	78-59-1
2-Nitrophenol	88-75-5	n,n'-Dimethylaniline	121-69-7
2-tertbutyl-4-methylphenol	2409-55-4	Naphthalene **(1)**	91-20-3
2-Toluidine	95-53-4	Naphthalene-d8 **(ISTD)**	1146-65-2

Table 1

Compound	CAS No.	Compound	CAS No.
3 & 4 Methylphenol	15831-10-4	n-Decane	124-18-5
3,3'-Dichlorobenzidine	91-94-1	Nitrobenzene	98-95-3
3,4-Dimethylaniline	95-64-7	Nitrobenzene-d5 **(Surrogate)**	4165-60-0
3,5-di-tert-butyl-4-hydroxytol	128-37-0	N-Nitrosodimethylamine **(1)**	62-75-9
3-Nitroaniline	99-09-2	N-Nitrosodi-n-propylamine	621-64-7
4,6-Dinitro-2-methylphenol **(1)**	534-52-1	N-Nitrosodiphenylamine	86-30-6
4-Bromophenyl phenyl ether	101-55-3	n-Octadecane	593-45-3
4-chloro-2-methylaniline	95-69-2	o-Toluidine-d9 **(Surrogate)**	194423-47-7
4-Chloro-3-methylphenol	59-50-7	Pentachloronitrobenzene	82-68-8
4-Chloroaniline	106-47-8	Pentachlorophenol **(1)**	87-86-5
4-Chloroaniline–d4 **(Surrogate)**	191656-33-4	Perylene-d12 **(ISTD)**	1520-96-3
4-Chlorophenyl phenyl ether	7005-72-3	Phenanthrene **(1)**	85-01-8
4-Methylphenol	106-44-5	Phenanthrene-d10 **(ISTD**)	1517-22-2
4-Nitroaniline	100-01-6	Phenol	108-95-2
4-Nitrophenol	100-02-7	Phenol-d5 **(Surrogate)**	4165-62-2
Acenaphthene **(1)**	83-32-9	Phenyl ether	101-84-8
Acenaphthene-d10 **(ISTD)**	15067-26-2	Pyrene **(1)**	129-00-0
Acenaphthylene **(1)**	208-96-8	Pyridine	110-86-1
Acetophenone	98-86-2	Terphenyl-d14 **(Surrogate)**	1718-51-0
Aniline	62-53-3	Total Cresols	STL00160
Aniline-d5 **(Surrogate)**	4165-61-1		

(1) Compound can be analyzed by full scan or Selected Ion Monitoring (SIM).
(2) Compound can also be analyzed by Isotope Dilution/SIM.

1.2 For a listing of method detection limits (MDLs) and Reporting Limits (RLs) please refer to the currently active Method 8270 Method Limit Groups in TALS (Eurofins LIMS).

1.3 On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in Section 7 (*Review of Work)*, and Section 19 (*Test Methods and Method Validation)* in Eurofins Edison's Quality Assurance Manual (Eurofins Edison Document No. ED-QA-LQM).

1.4 Any variation in procedure shall be completely documented using an NCM. The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The QA department also receives NCMs by e-mail for tracking and trending purposes. The NCM process is described in more detail in SOP ED-GEN-003. The NCM shall be filed in the project file and addressed in the case narrative. Any unauthorized deviations from this procedure must also be documented as a nonconformance, with a cause and corrective action described.

2.0 Summary of Method

2.1 This method is used for the analysis of aqueous and solid matrices for semi-volatile base, neutral and acid organic compounds that are extracted from the sample matrix with an organic solvent.

2.2 An aliquot of sample containing surrogate spiking compounds is extracted with an organic solvent. The extract is concentrated on a steam bath to a suitable volume. Internal standards are added to the extract.

2.3 Sample extraction techniques are specified for each matrix in the following Eurofins Edison SOPs:

- ED-ORP-002 (*Extraction of Semivolatile Organic Compounds in Water by Separatory Funnel, SW846 Method 3510C*);
- ED-ORP-043 (*SW846 Method 3580A - Waste Dilution Prep for Analysis of BNAs by SW846 Method 8270);*
- ED-ORP-0044 (*Microwave Extraction for Solids, SW846 Method 3546*);

2.4 A small aliquot of the extract is injected into a gas chromatograph (GC) equipped with a capillary column. The GC is temperature programmed to separate the compounds which were recovered during the extraction step by boiling point. The effluent of the gas chromatograph is interfaced to a mass spectrometer (MS) which is used to detect the compounds eluting from the GC. The detected compounds are fragmented with an electron beam to produce a mass spectrum which is characteristic of the compound introduced into the MS. Identification of target analytes is accomplished by comparing their mass spectra with the electron ionization spectra of authentic standards. Quantitation is accomplished by comparing the response of a major ion (quantitation ion) relative to an internal standard established through a five-point calibration (six points for second order regression). Specific calibration and quality control steps are included in the method that must be performed and must meet the specifications of SW846 Method 8270E as applicable.

2.5 The standard preparation procedure for aqueous samples involves use of a Reduced Volume Extraction (250 ml) (RVE) followed by analysis using a Large Volume Injection (LVI). Optionally, a full volume (1000 ml nominal) may be employed. The details of the extractions are outlined in the applicable prep SOPs while the analytical details for 8270E is presented in this SOP.

2.6 These methods are also applicable to the analysis of samples by Selected Ion Monitoring (SIM) for the purpose of obtaining lower reporting limits for the following compounds:

Table 2 – SIM Analytes

SIM Analytes	CAS #
1,4-Dioxane	123-91-1
4,6-Dinitro-2-methylphenol	534-52-1
Acenaphthene	83-32-9

Table 2 – SIM Analytes	
SIM Analytes	**CAS #**
Acenaphthylene	208-96-8
Anthracene	120-12-7
Benzo[a]anthracene	56-55-3
Benzo[a]pyrene	50-32-8
Benzo[b]fluoranthene	205-99-2
Benzo[g,h,i]perylene	191-24-2
Benzo[k]fluoranthene	207-08-9
Bis(2-chloroethyl)ether	111-44-4
Chrysene	218-01-9
Dibenz(a,h)anthracene	53-70-3
Fluoranthene	206-44-0
Fluorene	86-73-7
Hexachlorobenzene	118-74-1
Indeno[1,2,3-cd]pyrene	193-39-5
Naphthalene	91-20-3
N-Nitrosodimethylamine	62-75-9
Pentachlorophenol	87-86-5
Phenanthrene	85-01-8
Pyrene	129-00-0

2.7 An isotope dilution selected ion monitoring (SIM) technique for the analysis of 1,4-dioxane in water at a reporting level of 0.2 ug/l is also described in this SOP. Using this technique 1,4-dioxane-d8 is added prior to sample extraction and is used as an internal standard to calculate the concentration of 1,4-dioxane present. Additionally, 1,4-dichorobenzene-d4 is added to the extract prior to analysis to monitor the recovery of 1,4-dioxane-d8.

3.0 Definitions

For a complete list of definitions refer to Appendix 2 in the most current revision of the Quality Assurance Manual (ED-QA-LQM).

4.0 Interferences

4.1 GC/MS data from all blanks, samples, and spikes must be evaluated for interferences. Analysts must take steps to determine the source of the interference and take corrective action to eliminate the problem.

4.1.1 Contamination by carryover can occur whenever high-concentration and low-concentration samples are sequentially analyzed. To reduce

carryover, the sample syringe is automatically rinsed with solvent between sample injections. Whenever an unusually concentrated sample is encountered, it should be followed by the analysis of a solvent blank to check for cross-contamination. Alternately, verify that the sample analyzed after the high concentration sample does not show any carryover through inspection of chromatogram and target results.

4.1.2 Contaminants from the extraction process detected in the method blank should be evaluated to determine the impact on the analysis. Interferences from any target analyte must not be present in the method blank above the reporting limit for that compound. If these types of interferences occur, corrective action is required. The source should be identified and corrective action initiated to eliminate the interference from the extraction process. Affected samples must be re-extracted and re-analyzed.

4.1.3 The analyst must take precautions to make sure that contaminants do not enter the analytical system. These precautions include systematic procedures designed to eliminate interferences.

4.2 Some compounds analyzed by this method are unstable or sensitive to extraction and/or instrument conditions:

- Benzidine is easily oxidized during extraction. Neutral extraction may enhance the recovery of this compound.
- Hexachlorocyclopentadiene breaks down photochemically and can decompose from high temperatures, particularly in the injection port of the GC. This compound can also react with acetone in solution.
- 1,2-Diphenylhydrazine is unstable even at room temperature and readily converts to azobenzene.
- Phenols are sensitive to active sites and can give a low response or exhibit poor chromatography by tailing. Therefore, it is important the GC is maintained in the best possible condition. See Section 10.1 for proper daily maintenance.
- N-Nitrosodiphenylamine decomposes in the gas chromatographic inlet and cannot be distinguished from diphenylamine.
- 3-Methylphenol cannot be separated from 4-methylphenol by the conditions specified in this method. They are reported as 3 and 4-methylphenol.
- Pyridine may perform poorly at the GC injection port temperatures listed in this SOP. Lowering the injection port temperature may reduce the amount of degradation.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001) and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1. Specific Safety Concerns or Requirements

The gas chromatograph and mass spectrometer contain zones that have elevated temperatures. The analyst needs to be aware of the locations of those zones, and must cool them to room temperature prior to working on them.

The mass spectrometer is under deep vacuum. The mass spectrometer must be brought to atmospheric pressure prior to working on the source.

There are areas of high voltage in both the gas chromatograph and the mass spectrometer. Depending on the type of work involved, either turn the power to the instrument off, or disconnect it from its source of power.

5.2. Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Methanol	Flammable Poison Irritant	200 ppm-TWA	A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Symptoms of overexposure may include headache, drowsiness and dizziness. Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure. Irritant to the eyes.
Methylene Chloride	Carcinogen Irritant	25 ppm-TWA 125 ppm-STEL	Causes irritation to respiratory tract. Has a strong narcotic effect with symptoms of mental confusion, light-headedness, fatigue, nausea, vomiting and headache. Causes irritation, redness and pain to the skin and eyes. Prolonged contact can cause burns. Liquid degreases the skin. May be absorbed through skin.
Toluene	Flammable Poison Irritant	200 ppm-TWA 300 ppm-Ceiling	Inhalation may cause irritation of the upper respiratory tract. Symptoms of overexposure may include fatigue, confusion, headache, dizziness and drowsiness. Peculiar skin sensations (e. g. pins and needles) or numbness may be produced. Causes severe eye and skin irritation with redness and pain. May be absorbed through the skin.
Dimethyl-dichloro-silane	Flammable	none	Can be corrosive to the respiratory tract causing severe irritation and tissue damage. Harmful if absorbed through the skin. May cause severe irritation and systemic damage. Severely irritating to the skin and eyes. Harmful if swallowed. Can cause abdominal discomfort, nausea, vomiting, diarrhea, and irritation to the mouth, throat and stomach.
1 – Always add acid to water to prevent violent reactions.			
2 – Exposure limit refers to the OSHA regulatory exposure limit.			

6.0 Equipment and Supplies

6.1 Gas chromatograph/mass spectrometer system

6.1.1 Gas chromatograph: An Agilent/HP 6890/7890/900 Intuvo (or equivalent) houses the capillary column. The GC provides a splitless injection port and allows the column to be directly coupled to the mass spectrometer. The oven is temperature programmable to meet the requirements of the method. An HP/Agilent 7673/7683/7963 autosampler (or equivalent) with a 10 ul syringe provides automatic injection of sample extracts while the instrument is unattended.

6.1.2 Analytical Column: 30m x 0.25mm ID, 0.25 um film thickness, Restek Rxi-5Sil MS, Catalog #13623

6.1.3 Mass spectrometer: Agilent (HP) 5972, 5973, 5975 or 5977A Mass Selective Detector (MSD) Capable of scanning from 35 to 500 amu every 1 sec or less, using 70 volts electron energy in the electron ionization mode. The mass spectrometer must be capable of producing a mass spectrum for 50 ng of decafluorotriphenylphosphine (DFTPP) which meets the criteria in Section 9.2.1 when 2 ul of the 25 ug/ml GC/MS tuning standard is injected through the GC.

6.1.4 GC/MS interface: Any GC-to-MS interface may be used that gives acceptable calibration points at 50 ng per injection for each compound of interest and achieves acceptable tuning performance criteria.

6.1.5 Data system: The data system is interfaced to the mass spectrometer and accommodates continuous acquisition and storage of GC/MS data throughout the duration of the chromatographic program. The data system consists of a Hewlett-Packard Chemstation equipped with Mustang software used for instrument control and data acquisition. This, in turn, is interfaced to Eurofins's Chrom software for data processing. Data from sample extract analysis can be accessed in real-time, while sample data reports and library searches can be performed on data files from previously run samples. The software is also capable of searching any GC/MS data file for ions of a specific mass whose abundances can be plotted versus time or scan number which allows integration of abundances for any extracted ion between specified times or scan-number limits. Library searches utilize a NIST 02.1 Mass Spectral Library.

6.2 Bottles, glass with polytetrafluoroethylene (PTFE)-lined screw caps or crimp tops.

6.3 Injection port liners, splitless

6.4 Injection port septa

6.5 Injection port graphite seals

6.6 Pre-silanized glass wool (Supelco 2-0411 or equivalent)

6.7 Syringes, Assorted sizes 10ul - 1000ul; gas-tight

6.8 Bottles, 10 and 5ml amber screw cap with Teflon liner

6.9 Vials, 2ml amber screw cap with Teflon liner

6.10 Wheaton microvials 100ul (or equivalent)

6.11 Volumetric Flasks, Class A with ground glass stoppers (2ml - 100ml)

6.12 Analytical balance, ASP Model SP-180 (or equivalent), capable of accurately weighing to 0.0001 gr.

7.0 Reagents and Standards

The following items are recommended for performing this procedure. Equivalent items should only be used when they result in an improvement in quality, efficiency, productivity, or cost. An item can be considered equivalent if with its use, the analytical and QA/QC requirements in this SOP can be met. Please refer to the MSDS prior to the use of any reagent or standard.

The preparation of standards, surrogates and spiking solutions is documented in the TALS Reagent Module. Formulary reports can be generated upon request.

7.1. Reagents:

7.1.1. Methylene Chloride: J.T.Baker Resi-Analyzed, used for Organic Residue Analysis (P/N 9266-V8 or equivalent).

7.1.2. Methanol: J.T.Baker Purge and Trap Grade (P/N 9077-02 or equivalent).

7.1.3. Sylon-CT: Supelco (P/N 33065-U or equivalent). Sylon-CT is a highly reactive silanizing reagent consisting of 95% Toluene and 5% Dimethyldichlorosilane (DMDCS).

7.1.4. Each lot of solvent is screened for contaminants before being used for analysis as detailed in Eurofins Corporate Quality SOP No. CA-Q-S-001 (*Solvent & Acid Lot Testing & Approval*) and Eurofins Edison SOP No. ED-GEN-023 (*Bulk Solvent Testing and Approval*).

7.2. Standards:

7.2.1. **Calibration Standards (Full Scan Analysis)**: Stock analytical standard solutions are purchased mainly from Restek Corporation. Other standards are prepared in the laboratory as needed using neat compounds or prepared solutions purchased from Agilent, SPEX CertiPrep, Chem Service,

Accustandard, Supelco or other suppliers. Standards prep instructions are detailed for the following full scan analyte list options:

- Full Volume Aqueous Prep; and,
- Reduced Volume Aqueous Prep and Soils

Secondary dilutions are either made from purchased stock solutions as listed below or from prepared solutions as listed in the following table:

NOTE: Second sources (from certified separate lots) are used for ICV standards.

Table 3 – Full Scan Stock Standards			
Target Analyte Standard Name	**Conc. (PPM)**	**Vendor**	**Catalog #**
1,2,3,4-TCDD	50	SPEX	SVO-TANJ-12
Agilent Mix (contains compounds listed in Table 4 below)	2000 *	Agilent	Cus 0456
8270 List 1/ Std #1 Megamix	Varied	Restek	571995
8270 List 1/ Std#9	2000	Restek	569730
8270 List 1/ Std#11	2000	Restek	569732
8270 Surrogate Standard	5000*	Restek	567685
8270 Internal Standard	2000	Restek	567684
8270 List 1/ Std#10	2000	Restek	569731
Bisphenol-A	1000	Agilent	Cus-0457

*Agilent Mix, 8270 list1/std#9 and 8270 Surrogate standard are diluted to 100ppm prior to the preparation of the 1.0ppm and 0.5ppm standards.

Table 4	
Agilent Mix Catalog No. Cus-0456	
Analyte	**Concentration (PPM)**
Pentachloronitrobenzene	2000
2 -tert-butyl-4-Methylphenol	2000
2,6-Di-tert-butyl-4-Methylphenol	2000
Coumarin	2000
Phenyl ether	2000
N,N'-Dimethylaniline	2000
N-Methylaniline	2000
Carbamazepine	2000
Benzonitrile	2000
1,3-Dimethylnaphthalene	2000

7.2.1.1. Individual calibration standards for full scan analysis are prepared in one of several ways depending upon the technique (full volume aqueous prep, soils prep, reduced volume prep with LVI) as well as the target analyte list. The following tables detail the preparation of calibration standard solutions for each of these techniques and analyte lists. Prepare by combining the indicated volumes of each stock solution using volumetric flask. Dilute to the volume marker with methylene chloride.

Table 5
Full Volume Aqueous Prep and Soils
Working Standards Preparation

Solution Name	120 PPM	80 PPM	50 PPM	20 PPM	10 PPM	5 PPM	2 PPM	1 PPM	0.5 PPM
8270 List 1/ Std #1 Megamix	3000 ul	2000 ul	2500 ul	500ul	250ul	250ul	100ul	50ul	25ul
8270 List 1/ Std #9	1500 ul	1000 ul	1250 ul	250ul	125ul	125ul	50ul	500ul*	250ul *
8270 List 1/ Std #10	1500 ul	1000 ul	1250 ul	250ul	125ul	125ul	-	-	-
Agilent custom Mix	1500 ul	1000 ul	1250 ul	250ul	125ul	125ul	50ul	500ul*	250ul *
1,2,3,4-TCDD	-	-	500ul	-	-	-	-	-	-
8270 Surrogate Standard	600ul	400ul	500ul	100ul	50ul	50ul	20ul	500ul*	250ul *
8270 Internal Standard	500ul	500ul	1000 ul	500ul	500ul	1000 ul	1000 ul	1000 ul	1000 ul
Bisphenol-A	3000 ul	2000 ul	2500 ul	500ul	250ul	250ul	100ul	-	-
8270 List 1/ Std #11	400ul	300ul	500ul	200ul	125ul	125ul	50ul	25ul	-
Final Volume (ml)	**25**	**25**	**50**	**25**	**25**	**50**	**50**	**50**	**50**

Note: The 1.0ppm and 0.5pmm standards (above) are prepared using the 100ug/ml standard for Agilent custom Mix, 8270 List1/std#9 and 8270 Surrogate Standard.

Table 6
Reduced Volume Extraction/LVI
Working Standards Preparation

Solution Name	24 PPM	16 PPM	10 PPM	4 PPM	2 PPM	1 PPM	0.4 PPM	0.2 PPM	0.1 PPM
120 ppm (see Table 5)	2.0mL								
80 ppm (see Table 5)		2.0 mL							
50 ppm (see Table 5)			2.0 mL						
20 ppm (see Table 5)				2.0 mL					

Table 6 Reduced Volume Extraction/LVI Working Standards Preparation									
Solution Name	**24 PPM**	**16 PPM**	**10 PPM**	**4 PPM**	**2 PPM**	**1 PPM**	**0.4 PPM**	**0.2 PPM**	**0.1 PPM**
10 ppm (see Table 5)					2.0 mL				
5.0 ppm (see Table 5)						2.0 mL			
2.0 ppm (see Table 5)							2.0mL		
1.0 ppm (see Table 5)								2.0 mL	
0.5 ppm (see Table 5)									2.0mL
Final Volume (ml)	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**

7.2.1.2. **Initial Calibration Verification (full scan)**: Second source ICVs for full scan analysis are prepared in one of several ways depending upon the technique (full volume aqueous prep, soils prep, reduced volume prep with LVI) as well as the target analyte list. The following tables detail the preparation of ICVs for each of these techniques and analyte lists. Prepare by combining the indicated volumes of each stock solution using volumetric flask. Dilute to the volume marker with methylene chloride.

Table 7 8270/625 ICV Working Standards Preparation	
Solution Name	**25 PPM**
8270 List 1/ Std #1 Megamix (2nd Lot)	250ul
8270 List 1/ Std #9 (2nd Lot)	125ul
8270 List 1/ Std #10 (2nd Lot)	125ul
Agilent custom Mix (2nd Lot)	125ul
8270 Internal Standard	200ul
8270 List 1/ Std#11	125ul
Bisphenol-A (2nd Lot)	250ul
Final Volume (ml)	**10**

7.2.1.3. **Surrogate Standards (Full Scan Analysis):** A 5000ppm Surrogate Standard is purchased from Restek for use in spiking blanks, samples and associated QC prior to extraction (reference the applicable sample prep SOPs for spiking instructions).

Table 8 Full Scan Surrogate Standards Solution Restek Catalog No. 567685	
Surrogate Standard Compounds	**Concentration (PPM)**
Nitrobenzene-d5	5000
p-Terphenyl-d14	5000
2,4,6-Tribromophenol	5000
Phenol-d5	5000
2-Fluorobiphenyl	5000
2-Fluorophenol	5000

7.2.1.4. **Internal Standards** (**Full Scan Analysis**): The Internal Standards Solution at 2000ppm is purchased from Restek (Catalog # 567684). The Internal Standard solution is stored in 10ml amber screw cap bottles with Teflon liners in the dark at 4°C. The Internal standard solution is used in preparing all analytical standards. Inject 20ul of this solution (2000ppm) per ml of sample extract prior to analysis resulting in a concentration of 40ppm (ug/ml) in the extract.

Table 9 Full Scan Internal Standards Solution Restek Catalog No. 567684	
Internal Standard Compounds	**Concentration (PPM)**
1,4-Dichlorobenzene-d4	2000
Phenanthrene-d10	2000
Naphthalene-d8	2000
Chrysene-d12	2000
Acenaphthene-d10	2000
Perylene-d12	2000

7.2.2. **Calibration Standards (SIM analysis)**: The Edison lab currently analyzes only a select list of compounds by 8270E SIM (see Sections 1.0 and 2.0). Stock analytical SIM standard solutions are purchased mainly from Agilent. Working standards are prepared from these solutions as listed in the tables in Section 7.2.2.1:

Table 10 Stock SIM Standards			
Standard Name	**Concentration**	**Vendor**	**Catalog #**
Pentachlorophenol	1000ppm	AGILENT	PH-180-1
n-Nitrosodimethylamine	100ppm	AGILENT	NS-100-1
Hexachlorobenzene	100ppm*	AGILENT	CH-151-1
PAH Mix	100ppm	AGILENT	PAH-605-1
Bis(2-chloroethyl)ether	100ppm*	AGILENT	BEC-110-1
4,6-Dinitro-2-methylphenol	1000ppm**	AGILENT	PH-150
1,4-Dioxane	1000ppm**	AGILENT	NV-152-1

*Hexachlorobenzene and Bis(2-chloroethyl)ether are diluted to 10ppm prior to SIM Standards prep

** 4,6-Dinitro-2-methylphenol and 1,4-Dioxane is diluted (10x) to 100ppm prior to SIM Standards prep

NOTE: Second sources (from separate lots are used for ICV standards).

7.2.2.1 Individual calibration standards for SIM analysis are prepared in one of two ways depending upon the technique (full volume aqueous prep or reduced volume prep with LVI) as well as the target analyte list. The following tables detail the preparation of calibration standard solutions for each of these techniques and analyte lists. Prepare by combining the indicated volumes of each stock solution using volumetric flask. Dilute to the volume marker with methylene chloride.

Table 11
Full Volume Aqueous Prep – SIM
Working Standards Preparation

	0.025 PPM	0.05 PPM	0.1 PPM	0.5 PPM	1.0 PPM	5.0 PPM
Pentachlorophenol	2.5uL	2.5uL	12.5uL	10uL	20uL	50uL
n-Nitrosodimethylamine	25uL	25uL	125uL	100uL	200uL	500uL
PAH mix	6.25uL	5uL	25uL	50uL	100uL	200uL
Hexachlorobenzene	25uL	25uL	250uL	1000uL	2000uL	500uL*
Bis(2-chloroethyl)ether	25uL	25uL	250uL	1000uL	2000uL	500uL*
4,6-dinitro-2-methylphenol	50ul	50ul	250ul	200ul	400ul	1000ul
1,4-Dioxane	25ul	50ul	250ul	200ul	400ul	1000ul
ISTD	500uL	200uL	500uL	200uL	200uL	200uL
Final Volume (ml)	**25**	**10**	**25**	**10**	**10**	**10**

*For Hexachlorobenzene and Bis(2-chloroethyl)ether the 5.0 ppm level is prepared using the 100ppm standard.

Table 12
Reduced Volume Extraction/LVI – SIM
Working Standards Preparation

	0.005 PPM	0.01 PPM	0.02 PPM	0.10 PPM	0.20 PPM	1.0 PPM
0.025 PPM Std (see Table 11)	1.0 mL					
0.05 PPM Std (see Table 11)		1.0 mL				
0.1 PPM Std (see Table 11)			1.0 mL			
0.5 PPM Std (see Table 11)				1.0 mL		
1.0 PPM Std (see Table 11)					1.0 mL	
5.0 PPM Std (see Table 11)						1.0 mL
Final Volume (ml)	**5**	**5**	**5**	**5**	**5**	**5**

7.2.2.2 Initial Calibration Verification (SIM): A 0.1 ppm separate lot SIM ICV is prepared as detailed in Table 13 using the stock standards detailed in Section 7.2.2 (above)

Table 13 0.1ppm SIM ICV preparation	
Pentachlorophenol	25uL
n-Nitrosodimethylamine	25uL
PAH mix	5uL
Hexachlorobenzene	5uL
1,4-Dioxane	5ul
4,6-Dinitro-2-methylphenol	100ul
ISTD	**100uL**
Final Volume	**5 ml**

7.2.2.3 Internal Standard solution (SIM): A 50 ppm Internal Standard solution for SIM analysis is prepared by adding 125ul of the 2000ppm stock ISTD (see Section 7.2.1.4) and bringing to volume with Methylene Chloride in a 5ml volumetric flask.

7.2.2.3.1 For SIM analysis inject 20ul of this solution (50ppm) per ml of sample extract prior to analysis resulting in a concentration of 1ppm (ug/ml) in the extract.

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7.2.3. Calibration Standards (Isotope Dilution SIM – 1,4-Dioxane): The Edison lab currently analyzes only for 1,4-dioxane by 8270E isotope dilution SIM (see Sections 1.0 and 2.0). Stock analytical isotope dilution SIM standard solutions are purchased mainly from Accustandard and Restek. Working standards are prepared from these solutions as listed in the tables below.

Table 14 - Stock 1,4-Dioxane Isotope Dilution SIM Standards			
Standard Name	**Concentration**	**Vendor**	**Catalog #**
1,4-Dioxane	1000ppm*	Accustandard	APP-9-096

* 1,4-Dioxane is diluted (10x) to 100ppm prior to SIM Standards prep

Table 15 - Stock Labeled 1,4-Dioxane SIM Surrogate/Internal Standard (added at prep)			
Standard Name	**Concentration**	**Vendor**	**Catalog #**
1,4-Dioxane-d8	2000ppm	Restek	30614

Table 16 - Stock 1,4-Dioxane Isotope Dilution SIM Internal Standard (added to extract)			
Standard Name	**Concentration**	**Vendor**	**Catalog #**
1,4-Dichlorobenzene-d4	2000ppm	Accustandard	AZ-014J-3

7.2.3.1 Individual calibration standards for 1,4-dioxane isotope dilution SIM analysis are prepared at the concentrations detailed in the following tables. Prepare by combining the appropriate volumes of each stock solution using volumetric flask. Dilute to the volume marker with methylene chloride.

Table 17 Reduced Volume Extraction/LVI – 1,4-Dioxane Isotope Dilution SIM ICAL Standard Concentrations (ug/ml)									
	Lev 1	**Lev 2**	**Lev 3**	**Lev 4**	**Lev 5**	**Lev 6**	**Lev 7**	**Lev 8**	**ICV***
1,4-Dioxane	0.02	0.04	0.1	0.2	0.5	1	2	10	0.2
1,4-Dioxane-d8	4	4	4	4	4	4	4	4	4
1,4-Dichlorobenzene-d4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

***:** The ICV is prepared from the second source stock in Table 13.

7.2.4. GC/MS Instrument Performance Check (DFTPP): The DFTPP standard is prepared by is prepared at 25 ppm by adding 2.5ml of EPA 8270 GC/MS Tuning Solution II (Restek Catalog # 31615) to a 100ml volumetric flask and bringing to volume with Methylene Chloride.

7.2.5. Information on prepared standard solutions must be recorded in the TALS Reagent Module. Information such as standard supplier, lot number, original concentration, a description of how the standard was made, are required along with the laboratory lot number, analyst's initials, date prepared, expiration date and verification signature. Standards must be remade every 6 months, or sooner, if the standards expire or begin to show signs of unacceptable degradation. Class "A" volumetric must be used at all times and syringes, preferably gas-tight syringes when available, should be checked for accuracy using an analytical balance. Class "A" pipettes should also be used if volumes permit.

7.2.6. Please refer to Eurofins Edison SOP No. ED-GEN-008, Standard Operating Procedure for Preparation, Purity and storage of Reagents and Standards.

- Shelf Life of Standard: 1 year after preparation or stock standard manufacture expiration, whichever comes first;
- Storage Requirements: Stock standards are stored at 4°C and Working Standards stored at -10°C to -20°C.

8.0 Sample Collection, Preservation, Shipment and Storage

8.1 Samples from chlorinated water sources must be treated with sodium thiosulfate (0.008% solution) at the time of collection to remove chlorine. NOTE: containers pre-preserved with sodium thiosulfate must be requested in bottle orders for samples from chlorinated water sources.

8.2 All samples must be stored at 4ºC (± 2ºC) upon receipt.

8.3 Sample Extract Storage. Samples extracts must be protected from light and refrigerated at 4ºC (± 2ºC) from time of extraction until analysis.

8.4 Sample Extract Holding Time. All sample extracts must be analyzed within 40 days of extraction.

Matrix	Sample Container	Min. Sample Size	Preservation	Holding Time	Reference
Waters	Amber glass, 1L	1000 ml or 250 ml (1)	Cool 4 ± 2ºC	7 days to extraction; Analyze within 40 days of extraction	EPA Method SW846 8270E
Solids	Wide mouth glass, 8 or 16 oz.	50g	Cool 4 ± 2ºC	14 days to extraction; Analyze within 40 days of extraction	EPA Method SW846 8270E

(1) : Reduced volume extraction (RVE) LVI option

9.0 Quality Control

9.1. **Sample QC** - The following quality control samples are prepared with each batch of samples.

Quality Controls	Frequency	Control Limit
Method Blank (MB)	1 in 20 or fewer samples	< Rpt. Limit
Laboratory Control Sample (LCS)[1]	1 in 20 or fewer samples	Statistical Limits [4]
Matrix Spike (MS)[2]	1 in 20 or fewer samples	Statistical Limits [4]
MS Duplicate (MSD)[2]	1 in 20 or fewer samples	Statistical Limits [4]
Surrogates	every sample[3]	Statistical Limits [4]
Internal Standards	Every sample	Response within -50% to +100% of CCV

[1] LCS Duplicate (LCD) is performed only when insufficient sample is available for the MS/MSD or when requested by the client/project/contract.

[2] The sample selection for MS/MSD are randomly selected, unless specifically requested by a client….predetermined by the extraction lab.
[3] Analytical and QC samples (MB, LCS, MS/MSD, Method Blank)
[4] Statistical control limits are determined annually and are updated into TALS limit group..

9.1.1. Method blanks are extracted with every sample batch on each day that samples are extracted. To be considered acceptable, the method blank must contain less than the reporting limit of all target compounds except for phthalates, which can be present at up to 5x the MDL. For method 8270E the method blank is generally acceptable if target analyte concentrations are less than the one half the reporting limit.

If method blanks are unacceptably contaminated with target compounds that are also present in field samples, all affected samples must be re-extracted and re-analyzed. Corrective action must be taken to identify and eliminate the contamination source. Demonstrate that acceptable blanks can be obtained before continuing with sample extraction and analysis. Method blanks must be analyzed on each instrument on which the associated samples are analyzed.

9.1.1.1. Surrogate recoveries for the method blank are compared to laboratory generated limits. If two or more surrogates for any one fraction (base-neutral or acid) are outside of recovery limits or if any one surrogate recovers at <10%, the sample must be re-extracted and re-analyzed to confirm matrix interference.. If any surrogate is still outside limits, all samples and QC samples associated with that method blank must be re-extracted (volume permitting).

9.1.2. Matrix Spike (MS)/Matrix Spike Duplicate (MSD): A matrix spike/matrix spike duplicate (MS/MSD) pair is extracted and analyzed with every 20 environmental samples of a specific matrix (defined as a sample batch). Full compound list spiking is employed for MS/MSDs and LCSs. These spikes are prepared and extracted concurrent with sample preparation. MS and MSD recoveries are calculated and compared to lab generated acceptance criteria. See the current active TALS 8270 Method Limit Group for QC limits. The MS/MSD spiking solution should the same as used for the calibration standards.

9.1.2.1 A Laboratory Control Sample Duplicate (LCSD) is extracted and analyzed only when insufficient client sample is available for preparation of an MS/MSD pair. The LCS/LSCD is evaluated in the same manner as the MS/MSD (see Section 9.1.2)

9.1.2.2 An LCS/LCSD may be substituted for the MS/MSD if insufficient sample volume is available.

9.1.3. Laboratory Control Sample (LCS)/Laboratory Control Sample Duplicate (LCSD): A Laboratory Control Sample (LCS) (aka blank spike) must be extracted and analyzed with each batch of 20 environmental samples. The LCS data is used to assess method performance if the MS/MSD recoveries fall outside of the lab generated limits (See the current active TALS 8270 Method Limit Group for QC limits). If the LCS recovery is within the current lab generated limits, the MS/MSD recoveries are attributed to matrix interference.

9.1.3.1 A Laboratory Control Sample Duplicate (LCSD) is extracted and analyzed only when insufficient client sample is available for preparation of an MS/MSD pair. The LCS/LSCD is evaluated in the same manner as the MS/MSD (see Section 9.1.2)

9.1.3.2 Spike recovery limits are lab generated and are updated annually. Certain state regulatory programs have defined recovery limits which, where applicable, are used for spike recovery evaluations. The TALS Method Limit Groups detail these regulatory program criteria.

9.1.4. Surrogate Standards: All full scan samples, blanks and QC samples are spiked with a six (6) component surrogate standard mix (see Section 7.2.1.3). The percent recovery of the surrogate standards is calculated and compared to lab generated limits (See the current active TALS 8270 Method Limit Group for QC limits).

If any two or more surrogates for any one fraction (base-neutral or acid) are outside of recovery limits or if any one surrogate recovers at <10%, the sample must be re-extracted and re-analyzed to confirm matrix interference. If a surrogate is diluted to a concentration below that of the lowest calibration standard, no corrective action is necessary.

9.1.4.1 Surrogate recovery limits are lab generated and are updated annually. Certain state regulatory programs have defined recovery limits which, where applicable, are used for spike recovery evaluations. The TALS Method Limit Groups detail these regulatory program criteria.

9.1.5. Internal Standards: The response (area count) of each internal standard in the sample must be within -50 +100% of its corresponding internal standard in the CCV or, the ICAL midpoint for samples analyzed under the initial calibration range. Failure to meet these criteria is indicative of sample matrix effects. All samples failing these criteria must be reanalyzed to confirm matrix effects.

9.2. Instrument QC

9.2.1 GC/MS Instrument Performance Check (DFTPP): (**Note**: the DFTPP performance check applies only to full scan analyses and is not evaluated for SIM analysis). The GC/MS system is tuned using Perfluortributylamine

(PFTBA) such that an injection of 50ng of Decafluorotriphenylphosphine (DFTPP) meet the abundance criteria listed in the table below. Prior to the analysis of any calibration standards or samples, the GC/MS system must meet all DFTPP key ion abundance criteria. This analysis will verify proper tuning of the system for a period of 12 hours post-injection. After 12 hours, the instrument performance must again be verified prior to the analysis of standards, QC or samples. Daily tune verification is not required for 8270E CCV.

DFTPP Key Ions and Abundance Criteria	
Mass	**Ion Abundance Criteria**
51	30-60% of mass 198
68	<2% of mass 69
69	reference only
70	<2% of mass 69
127	40-60% of mass 198
197	<1% of mass 198
198	Base Peak, 100% relative abundance
199	5-9% of mass 198
275	10-30% of mass 198
365	>1% of mass 198
441	present but less than mass 443
442	>40% of mass 198
443	17-23% of mass 442

9.2.1.1. Evaluate DFTPP using three scan averaging and background subtraction techniques. Select the scan at the peak apex, add +1 scan from the apex and -1 scans from the apex.

9.2.1.2. The mass spectrum of DFTPP may be background subtracted to eliminate column bleed or instrument background ions. Background subtract DFTPP by selecting a scan for subtraction ≤20 scans before the apex scan of DFTPP.

9.2.1.3. Check column performance using pentachlorophenol and the benzidine peaks (these compounds are included in the DFTPP solution). Benzidine & Pentachlorophenol should respond normally without significant peak tailing (Tailing Factor should be <2 measured at 10% peak height). If responses are poor and excessive peak tailing is present, corrective action for the GC/MS instrument may be required. Corrective actions may include:

9.2.1.3.1 Retune the GC/MS;
9.2.1.3.2 Clip the injector end of the GC column;
9.2.1.3.3 Replace the septum and injection port liner;
9.2.1.3.4 Change the injection port seal;

9.2.1.3.5 Replace the GC column;
9.2.1.3.6 Clean the injection port with MeCl2
9.2.1.3.7 Clean the MS ion source;
9.2.1.3.8 Place a service call.

9.2.1.4. The breakdown of 4, 4-DDT into 4,4-DDD and 4,4'DDE may also be used to assess GC column performance and injection port inertness. If so evaluated the breakdown must be <20%.

9.2.1.5. DFTPP parameter settings are stored in a tune file, which will be used in all subsequent analysis of standards and sample extracts.

9.2.2 Initial Calibration Range and Initial Calibration Verification

9.2.2.1. Initial Calibration: The initial calibration range consists of a minimum of five concentration levels of analytical standards (six for second order regression) prepared as described in Section 7.2. and analyzed once the DFTPP instrument performance check has met the criteria in Section 9.2.1. .

9.2.2.2. Initial Calibration Verification (ICV): An Initial Calibration Verification (ICV) standard is analyzed immediately after the Initial Calibration Range and before any samples are analyzed. The ICV is prepared as detailed in Section 7.2. The ICV must be from a source (or lot) separate from the standards used in the Initial Calibration Range.

9.2.3 Continuing Calibration Verification (CCV) and Low Level Continuing Calibration Verification (LLCCV): A mid-point Continuing Calibration Verification (CCV) must be analyzed every 12 hours after the DFTPP instrument performance check (when applicable).. The CCV is prepared as detailed in Section 7.2. (typically, 50 ug/ml for full volume aqueous and soils, 10 ug/ml for LV, 0.02 ug/ml for LVI SIM) and 0.2 for isotope dilution SIM). Additionally a Low Level Continuing Calibration Verification (LLCCV) is analyzed after the CCV for full scan analysis. The LLCCV is the same as the lowest calibration level analyzed with the initial calibration range (See Section 7.2).

9.2.4 Calibration Acceptance Summary

9.2.4.1. Retention Time Windows: Retention time windows must be established to compensate for minor shifts in absolute retention times as a result of sample loading and normal chromatographic variability. Obtain the retention time for all compounds from the analysis of the midpoint standard for the calibration curve. Establish the center of the retention time window by using the absolute retention time for each analyte, internal standard and surrogate from the calibration verification standard at the beginning of the analytical shift. For samples run during the

same shift as an initial calibration, use the retention time of the mid-point standard of the initial calibration. For qualitative identification to be acceptable the retention time of the relative retention time (automatically calculated in Chrom) must be within 0.8 - 1.2 RRT units of its assigned internal standard. The relative retention times of each compound in the five calibration standards must agree within .06 relative retention time units.

9.2.4.2. Initial Calibration Range: Internal standard calibration is employed for this method. After the initial calibration range has been analyzed the relative response factor (RRF) for each target/surrogate compound at each concentration level is determined using the following equation.

$$RRF = \frac{A_x}{A_{is}} \times \frac{C_{is}}{C_x}$$

Where:
A_x = Area characteristic ion (see Table 21) for the compound
Ais = Area characteristic ion (see Table 21) of associated internal standard
Cis = Concentration of internal standard
Cx = Concentration of compound in standard

9.2.4.2.1. Determine the mean RRF for each compound. Minimum response factors must be met for each of the compounds listed in Table 18 (below). Any compound that fails the minimum response factor must be reported as estimated for detects and must have a demonstration of sensitivity in the analytical batch to report non-detects. To demonstrate adequate sensitivity for out of criterion compounds analyze the low level point of the calibration (LLCCV) in the analytical sequence. The criterion for the LLCCV is detection only but the standard qualitative identification criteria in the method must be met.

Table 18:
Minimum Response Factors

Compound	Minimum Response Factor
Benzaldehyde	0.010
Phenol	0.800
Bis(2-chloroethyl) ether	0.700
2-Chlorophenol	0.800
2-Methylphenol	0.700
2,2-Oxybis-(1-chloropropane)	0.010
Acetophenone	0.010
4-Methylphenol	0.600

Table 18: Minimum Response Factors	
Compound	**Minimum Response Factor**
N-Nitroso-di-n-propylamine	0.500
Hexachloroethane	0.300
Nitrobenzene	0.200
Isophorone	0.400
2-Nitrophenol	0.100
2,4-Dimethylphenol	0.200
Bis(2-chloroethoxy)methane	0.300
2,4-Dichlorophenol	0.200
Naphthalene	0.700
4-Chloroaniline	0.010
Hexachlorobutadiene	0.010
Caprolactam	0.010
4-chloro-3-methylphenol	0.200
2-Methylnaphthalene	0.400
Hexachlorocyclopentadiene	0.050
2,4,6-Trichlorophenol	0.200
2,4,5-Trichlorophenol	0.200
1,1'-Biphenyl	0.010
2-Chloronaphthalene	0.800
2-Nitroaniline	0.010
Dimethyl phthalene	0.010
2,6-Dinitrotoluene	0.200
Acenaphthylene	0.900
3-Nitroaniline	0.010
Acenaphthene	0.900
2,4-Dinitrophenol	0.010
4-Nitrophenol	0.010
Dibenzofuran	0.800
2,4-Dinitrotoluene	0.200
Diethyl phthalate	0.010
1,2,4,5-Tetrachlorobenzene	0.010
4-chlorophenyl-phenyl ether	0.400
Fluorene	0.900
4-Nitroanailine	0.010
4,6-Dinitro-2-methylphenol	0.010
4-Bromophenyl-phenyl ether	0.100
N-Nitrosodiphenylamine	0.010
Hexachlorobenzene	0.100
Atrazine	0.010
Pentachlorophenol	0.050
Phenanthrene	0.700
Anthracene	0.700
Carbazole	0.010
Di-n-butyl phthalene	0.010

Table 18: Minimum Response Factors	
Compound	**Minimum Response Factor**
Fluoranthene	0.600
Pyrene	0.600
Butyl benzyl phthalate	0.010
3,3'-Dichlorobenzidine	0.010
Benzo(a)anthracene	0.800
Chrysene	0.700
Bis-(2-ethylhexyl)phthalate	0.010
Di-n-octyl phthalate	0.010
Benzo(b)fluoranthene	0.700
Benzo(k)fluoranthene	0.700
Benzo(a)pyrene	0.700
Indeno(1,2,3-cd)pyrene	0.500
Dibenz(a,h)anthracene	0.400
Benzo(g,h,i)perylene	0.500
2,3,4,6-Tetrachlorophenol	0.010
Pentachloronitrobenzene	0.050

9.2.4.2.2. Calculate the Standard Deviation (SD) and Percent Relative Standard Deviation (% RSD) of the response factors for each compound:

$$\% \text{ RSD} = \frac{\text{Standard Deviation of RRFs}}{\text{Mean RRF}}$$

9.2.4.2.3. The % RSD of the RRF's must be ≤20% for each target analyte listed in Table 18. The % RSD of each target analytes must be ≤20% in order for the calibration range to be acceptable. Additionally for 8270E, the calculated concentration or amount of each analyte of interest in the CCV standard should fall within ±20%. If more than 10% of the compounds included with the initial calibration exceed the 20% RSD limit or do not meet the minimum correlation coefficient (0.99) or Relative Standard Error (≤20%) for alternate curve fits (see below) then appropriate corrective maintenance action must be performed. If more than 10% of the compounds included with the initial calibration exceed the 20% RSD limit **AND** do not meet the minimum correlation coefficient (0.99)) or Relative Standard Error (≤20%) then recalibration is necessary.

9.2.4.2.4. If the above listed criteria is met, the system can be assumed to be linear and sample analysis may begin and the average RF from the initial calibration range is used to quantitate all samples.

9.2.4.2.4.1 Certain state regulatory programs have defined calibration acceptance limits which, where applicable, are used for calibration evaluations. The TALS ICAL Limit Groups detail these regulatory program criteria.

9.2.4.2.5. An alternative calibration technique may be employed for those any compounds exceeding the 20% RSD criteria:

9.2.4.2.5.4 Calculate the first order linear regression for any compound which did not meet the 20% criteria. First order linear regression calibration may be employed if alternative average response calibration procedures were not applicable. The r value (Correlation Coefficient) of the equation must be ≥0.99 or the Relative Standard Error (RSE) (≤20%) for the calibration to be employed.

9.2.4.2.5.2 Second order regression calibration can be used for any compound that has an established history as a non-linear performer.

9.2.4.2.5.3 If second order regression calibration is used a minimum of six (6) calibration levels must be analyzed.

9.2.4.2.5.4 If second order regression calibration is used, the r^2 (Correlation Coefficient) value must be ≥ 0.99 or the Relative Standard Error (RSE) (≤20%) for the calibration to be employed.

9.2.4.2.5.5 Any compound that fails to meet the 20% RSD or 0.99 correlation coefficient or RSE (≤20%) criteria must be flagged as estimated for detects (or must be noted in the narrative). If there are non-detects the compounds may be reported if there is adequate sensitivity to detect at the quantitation limit. To demonstrate adequate sensitivity analyze the low level point of the initial calibration in each analytical batch (LLCCV) The criteria for demonstrating adequate sensitivity is detection in the LLCCV using the standard qualitative identification criteria.

9.2.4.2.5.6. When calculating the calibration curve using the linear calibration model a minimum quantitation check on the viability of the lowest calibration point should be performed by re-fitting the response from the low concentration back into the curve. The recalculated concentration of the low calibration point should be within ±50% of the

standard's concentration. This evaluation can be checked using the Initial Calibration %Drift Report in Chrom. Any detects for analytes calibrated using the linear model and failing this readback criterion must be flagged as estimated or detailed in the narrative.

9.2.4.3. **Calibration Point Read-back Criteria**: Whichever calibration model above is selected, it should be subjected to an additional check to establish the representativeness of the data that were used to produce it. This check is the refitting of each calibration point response back to the calibration model, or the comparison of the calculated amount of the standard against the expected amount.

- CHROM software provides an Initial Calibration %Drift report which shows the % Error for each calibration point. This report must be reviewed in addition to the %RSD / Linear Response Factor.

- The absolute value of the % Error for each calibration point should be < 30%. For the lowest calibration point, the % Error may be <50%.

- See Section 11.8 for the Calculation of Percent (%) Error.

9.2.4.4. **Initial Calibration Verification (ICV):**.Once the initial calibration has been analyzed and has met the above criteria, a second source Initial Calibration Verification (ICV) (as prepared in Section 7.2) must be analyzed and evaluated. The ICV must meet the criteria of 70-130% recovery for all compounds with the exception of the poor performing compounds listed in Attachment 1 which are allowed to be within 50-150% : An NCM must be initiated to denote any ICV non-conformances.

9.2.4.5. The ICV must meet the criteria of 70-130% recovery for all compounds however up to 10% of the compounds are allowed to exceed these criteria as long as their recoveries are within 65-135%. For the poor performers (see Attachment 1) the range is 50-150%. If the criterion is not met, a second ICV may be analyzed after corrective measures are taken. If a second ICV analysis fails to meet criteria proceed with corrective action and the analysis of a new initial calibration range. Flagging: If the ICV limits are outside of criteria (high) for an analyte and that analyte is undetected in the sample, no flagging or narration is required. If the ICV limits are outside of criteria (low) for an analyte and that analyte is undetected in a sample, narrate the non-conformance in an NCM. When that out of spec analyte is detected in a sample, describe the issue in the narrative, or flag as estimated.

9.2.4.6. Continuing Calibration Verification (CCV): A CCV consisting of a standard at or near the midpoint of the Initial Calibration Range is analyzed every 12 hours of instrument operation or at the beginning of an analytical sequence to verify the initial calibration. The calibration verification consists of a DFTPP instrument performance check (not required for 8270E), and analysis of a calibration verification standard. **Note:** Certain state regulatory programs have defined calibration acceptance limits which, where applicable, are used for calibration evaluations. The TALS ICAL Limit Groups detail these regulatory program criteria.

9.2.4.5.1 Tune Verification: Follow the procedure for verifying the instrument tune described in section 9.2.1 using a 50 ng injection of DFTPP. If the tune cannot be verified, analysis must be stopped, corrective action taken and a return to "control" demonstrated before continuing with the calibration verification process. For 8270E analysis only, tune verification is required just prior to ICAL.

9.2.4.5.2 Calibration Verification: Analyze the calibration verification standard immediately after a DFTPP that meets criteria. Daily analysis of the DFTPP is not required as part of the CCV for 8270E analysis. .When samples are analyzed after an ICAL the last ICAL standard may be used as the starting time reference for evaluation. Use the mid point calibration standard (approximately 50ug/l). NOTE: The calibration standard contains internal standards; Dichlorobenzene d_4, Naphthalene d_8, Acenaphthene d_{10}, Phenanthrene d_{10}, Chrysene d_{12}, and Perylene d_{12} at 40ug/l (0.1ug/L for SIM). The calibration check standard must also include all the target analytes from the original calibration.

9.2.4.5.3 The RFs must meet the criteria for the compounds in Table 18. Any compound that fails the minimum response factor must be reported as estimated for detects and must have a demonstration of sensitivity to report non-detects. To demonstrate adequate sensitivity for out of criterion compounds analyze the low level point of the calibration (LLCCV) in the analytical sequence. The criterion for the LLCCV is detection only but the standard qualitative identification criteria in the method must be met

9.2.4.5.4 The percent difference (when using average response factor) or percent drift (when using linear regression) of the compounds in Table 18 must be ≤20% for at least 80% of the total analyte list. If more than 20% of the compound list fail to 20% difference or drift criterion then appropriate corrective action must be taken prior to the analysis of the samples. Any individual compound that fails must be reported as estimated for detects and must have a demonstration of sensitivity to report non-detects. To demonstrate adequate sensitivity for out of criterion compounds analyze the low level point of the calibration (LLCCV) in the analytical sequence. The criterion for the LLCCV is detection only (%D criteria are not applied) but the standard qualitative identification criteria in the method must be met.

9.2.4.5.5 **CCV Poor Performers**: Refer to Attachment 1 for the identification of poor and/or erratic performing analytes. These analytes are allowed a %D >20% but must be <50 %D to be acceptable. If there are poor performers that exceed 50%D, the data may be reported provided results are noted as estimated. An NCM must be initiated to denote this situation.

9.2.4.5.6 The retention times of the internal standards from the calibration check must be within ±30 seconds of the internal standards from the mid point standard of the original calibration. If the retention time for any internal standard changes by more than 30 seconds from the latest daily (12 hour) calibration standard, the chromatographic system is inspected for malfunctions, and corrections made as required. If corrective action does not result in the retention time criteria being achieved, the system must be re-calibrated using four additional standards.

9.2.4.5.7 The response (area count) of each internal standard in the calibration verification standard must be within 50 - 100% of its corresponding internal standard in the mid-level calibration standard of the active calibration curve. If the EICP area for any internal standard changes by more than a factor of two (-50% +100%), the mass spectrometer system must be inspected for malfunction and corrections made as appropriate. When corrections are made, re-analysis of samples analyzed while the system was malfunctioning is required.

9.2.4.5.8 The relative retention times of each compound in the calibration verification standard must agree within .06 relative retention time units of its value in the initial calibration.

9.2.4.5.9 Use the average response factors from the original five-point calibration for quantitative analysis of target analytes identified in field samples.

9.2.4.5.10 Prepare a calibration summary or list indicating which compounds did not meet the 20% average percent difference criteria. Record this information in that run log.

9.2.4.7. Low Level Continuing Calibration Verification (LLCCV): An LLCCV consisting of the low level standard from the initial calibration range is analyzed every 12 hours of instrument operation after the CCV. The purpose and evaluation of the LLCCV is described in Section 9.2.4.4.4.

10.0 Procedure

10.1. Gas Chromatograph/Mass Spectrometer Operation

10.1.1. The sequence of events for GC/MS analysis involves many steps. First the injection system and column performance and calibration must be verified. Maintenance operations are performed as needed.

10.1.2. Preparation of the Injection Port Liner and Installation Procedure: Prior to the start of initial calibration and each daily analysis of sample extracts, a new liner for the injection port must be prepared. Once a liner has been used it is no longer inert and will cause serious chromatography problems with phenols and other compounds. When preparing the liner, proper laboratory protection must be worn and the liner must be prepared in a well-ventilated hood. When the procedure is completed all traces of toluene, Sylon-Ct and methanol will be removed immediately so that extraction solvents and preparation of sample extracts will not come into contact with these solvents and become contaminated.

10.1.2.1 Remove one liner from a 40ml VOA bottle containing other liners immersed in Sylon-Ct solution. Rinse off the liner with Toluene and wipe dry. Insert 1cm of pre-silanized glass wool partially into one end of the liner and trim neatly. Push the glass wool into the center of the liner so that it is 1 1/4" from the bottom. Do not use glass wool or solvents that are dirty (i.e. suspended particles) or use liners which are chipped on the ends, deformed or fractured. Inspect the glass wool for cleanliness after it has been inserted.

10.1.2.2 Using a Pasteur pipette flush out the interior of the liner containing the glass wool with Sylon-Ct. Rest the liner horizontally on a small beaker and allow the Sylon-Ct to re-deactivate the interior surfaces and the glass wool. There should be no air bubbles caught in the glass wool. After several

minutes flush out the Sylon-Ct with toluene and finally with methanol. Dry the outer surface of the liner and rest it on the injection port housing until the remaining methanol is boiled off

10.1.2.3 Insert the liner with the newly silanized glass wool plug into the injection port. Verify that the column extends up into the injection port and is perpendicular. Inspect the graphite seal and replace it if the edges are knife-shaped.

10.1.2.4 The septum is always replaced daily. Bake out the column at 300^{O}C for 15 minutes after the vacuum in the analyzer has returned to normal.

10.1.2.5 Performance may enhanced by clipping a small portion of the column at the injection port end. Document this activity in the maintenance record.

10.1.3. Prior to calibration or sample analysis always verify that the analyzer is under sufficient vacuum and that the column has proper carrier gas flow.

10.1.4. Establish the following GC/MS operating conditions:

10.1.4.1 Full Scan Operating Mode

Full Scan Mode – Standard Injection Volume
Mass Range: 35 to 500amu
Scan Time: 1 sec/scan
Transfer Line Temperature: 300^{O}C
Source Temperature: Preset by H.P. at 280^{O}C
Scan start time: 1.0 minutes
Initial Column Temperature and Hold Time: 45^{O}C for 0.5 minutes
Column Temperature Program: 20°C /min to 100°C 25°C/min to 270°C 10° C/min to 310°C
Final Column Temperature Hold: 310^{O}C for 5 minutes
Carrier Gas: Ultra High Purity Grade Helium at 1.3ml/min
Injector Temperature: 275^{O}C
Injector: Grob-type, pulse, splitless
Injection Volume: 1ul
Splitless Valve Time: 0.3 minutes

Full Scan Mode – Large Volume Injection (LVI)
Mass Range: 35 to 500amu
Scan Time: 1 sec/scan
Transfer Line Temperature: 300^{O}C
Source Temperature: Preset by H.P. at 280^{O}C
Scan start time: 1.0 minutes
Initial Column Temperature and Hold Time: 45^{O}C for 0.5 minutes
Column Temperature Program: 20°C /min to 100°C 25°C/min to 270°C 10° C/min to 310°C
Final Column Temperature Hold: 310^{O}C for 5 minutes
Carrier Gas: Ultra High Purity Grade Helium at 1.3ml/min
Injector Temperature: 275^{O}C
Injector: Grob-type, pulse, splitless
Injection Volume: 5ul
Splitless Valve Time: 0.3 minutes

10.1.4.2 SIM Operating Mode

SIM Mode
Mass Range: 35 to 500amu
Scan Time: 1 sec/scan
Transfer Line Temperature: 300^{O}C
Source Temperature: Preset by H.P. at 280^{O}C
Scan start time: 1.5 minutes
Initial Column Temperature and Hold Time: 40^{O}C for 0.5 minutes
Column Temperature Program: 20°C /min to 100°C 25°C/min to 270°C 10° C/min to 310°C
Final Column Temperature Hold: 310^{O}C for 3 minutes
Carrier Gas: Ultra High Purity Grade Helium at 1.3ml/min
Injector Temperature: 275^{O}C
Injector: Grob-type, pulse splitless
Injection Volume: 1ul
Splitless Valve Time: 0.3 minutes

10.1.4.3 Isotope Dilution Selected Ion Monitoring Mode :

SIM Parameters

Group 1
Plot 1 Ion: 74.0

Ions/Dwell in Group	(Mass Dwell)	(Mass Dwell)	(Mass Dwell)
	42.0 50	43. 0 50	68.0 50
	74.0 50	128.0 50	129.0 50
	136.0 50	150.0 50	152.0 50
	93.0 50	66.0 50	
	58.0 50		
	88.0 50		

Group 2
Group Start Time: 6.00
Plot 1 Ion: 152.0

Ions/Dwell in Group	(Mass Dwell)	(Mass Dwell)	(Mass Dwell)
	151.0 50	152.0 50	153.0 50
	154.0 50	162.0 50	164.0 50
	165.0 50	166.0 50	

Group 3
Group Start Time: 7.80
Plot 1 Ion: 188.0

Ions/Dwell in Group	(Mass Dwell)	(Mass Dwell)	(Mass Dwell)
	94.0 50	101.0 50	142.0 50
	178.0 50	179.0 50	188.0 50
	202.0 50	264.0 50	266.0 50
	284.0 50		

Group 4
Group Start Time: 10.50
Plot 1 Ion: 228

Ions/Dwell in Group	(Mass Dwell)	(Mass Dwell)	(Mass Dwell)
	120.0 50	228.0 50	229.0 50
	240.0 50		

Group 5
Group Start Time: 12.00
Plot 1 Ion: 252.0

Ions/Dwell in Group	(Mass Dwell)	(Mass Dwell)	(Mass Dwell)
	138.0 50	139.0 50	252.0 50
	253.0 50	260.0 50	264.0 50
	267.0 50	276.0 50	278.0 50

Table 19: Target Compound - Primary and Monitoring Ions

Compound	1	2	3

Compound	1	2	3
1,4-Dioxane-d8	96	64	62
1,4-Dioxane	88	58	57
1,4-Dichlorobenzene-d4	152	150	

10.1.5. The above listed instrument conditions are used for all analytical standards for calibration and for all sample extracts analyzed by this method.

10.1.5.1 The column conditions, scan start time, and splitless valve time for analysis of DFTPP only are as follows are as follows:

Initial Column Temperature and Hold Time: 140^{o}C for 0.5 minutes
Column Temperature Program: 140^{o} to 320^{o}C at 22^{o}C/minute
Final Column Temperature Hold: 320C for 0.5 minutes
Scan Start Time: approx. 5 minutes
Splitless Valve Time: 0.3 minutes
Injection Volume: 2 ul

10.2. Analytical Sequence

10.2.1. Dilutions are made based on initial GC/MS analysis. Dilutions are made in 1-ml vials using microsyringes. Calculate the dilution factor using the equation below:

DF= Ph / 5 x Is
Where:
DF = Dilution Factor
Ph = Sample Peak Height
Is = Internal Standard Peak Height

When DF >1 but <2, combine 500ul of sample extract with 500ul methylene chloride in a 1 ml amber vial, add20 ul internal standard and crimp seal

Use **Table 20** to determine dilution and internal standard amount.

Table 20 Dilution Factor Calculations			
DF Value	**Volume of Sample (ul)**	**Volume of Methylene Chloride (ul)**	**Volume of ISTD (ul)**
<1	1,000	None	None
>1, <2	500	500	10
>4, <5	200	800	16
>10, <20	100	900	36
>20	500*	500	10
*Prepare this dilution by serially diluting the >10, <20 dilution			

10.2.2. Instrument Performance and Calibration Sequence

10.2.2.1. Once the GC/MS instrument has been setup and maintained as detailed in Section 10.1, the first operations to be performed are the performance checks and calibration standards.

10.2.2.2. Analyze the Instrument Performance Check Standard (DFTPP) as discussed in Section 9.2.1.

10.2.2.3. Initially and as required, analyze the Initial Calibration Range (minimum 5 points, six points for second order regression) as detailed in Sections 7.2.1 and 9.2.4.2. Evaluate the acceptability of the Initial Calibration Range as detailed in Section 9.2.4.2.

10.2.2.4. Immediately after the Initial Calibration Range only, analyze the Initial Calibration Verification (ICV) as detailed in Sections 7.2. and 9.2.4.3. Evaluate the acceptability of the ICV as detailed in Section 9.2.4.3.

10.2.2.5. Every 12 hours, reanalyze and evaluate the Instrument Performance Check Standard (DFTPP), not required for 8270E followed by the Continuing Calibration Verification (CCV) and Low Level Continuing Calibration Verification (LLCCV) as detailed in Section 9.2.3, 9.2.4.4 and 9.2.4.5. Evaluate the acceptability of the CCV and LLCCV as detailed in Section 9.2.4.4

10.2.2.6. Client samples and QC samples are analyzed (as detailed in Section 10.2.3) after acceptable Instrument Performance and Calibration Checks and until the 12 hour clock expires. Repeat the sequence as required. The automation of GC/MS runs is accomplished via the “SEQUENCE” macro of the ChemStation.

10.2.3. Sample Analysis Sequence

10.2.3.1. Sample extracts are normally prepared on the same day as analysis. The GC/MS operator will prepare the extracts that will be run on his or her instrument. Volume adjustments to the extracts will be made at the discretion of the supervisor.

10.2.3.2. Prior to the start of sample analysis the GC/MS operator will generate a sequence program containing the list of the sample extracts to be analyzed, the position on the autosampler tray, and the proper acquisition and tune methods that are to be used. This sequence program contains all the necessary information on the samples to be analyzed and how the GC/MS system is to analyze them. The sample extracts are loaded onto the autosampler (ALS) tray. Their position is verified by checking them against the ALS number on the sequence. This batch analysis will be performed automatically over the 12-hour period.

10.2.3.3. The analytical run log is printed as a record of samples analyzed. The analyst will annotate the run log with any required information regarding anomalies or unusual events. The run log must be signed by the analyst and a reviewed and signed by a trained peer or manager

10.3. Data Processing

10.3.1. Prior to processing any standards or samples, target compound lists and sublists must be assembled. Chrom's auto-processing system queries TALS (LIMS) for each sample's processing parameters (including target compounds lists) and downloads the required processing methods from LIMS to analyze data. These lists are required for processing of all data files including calibration files. The data includes compound names, retention time data, quantitation ions, qualitative identification ions, and the assigned internal standard for qualitative and quantitative identification.

10.3.2. Key data is manually entered the first time a compound list is used for data processing. Processing data using a compound list automatically generates response factor data and updates retention information.

10.3.3. The characteristic ions for target compounds, surrogate compounds, and internal standards which can be determined using SW 8270E are listed in Table 21.

10.4. Interpretation and Qualitative Identification: Qualitative identification of target compounds is based on retention time and mass spectral comparison with characteristic ions in the target compound list. The reference mass spectrum is taken from a standard of the target compound analyzed by this method. The

characteristic ions are the three ions of greatest relative intensity or any ions over 30% relative intensity if less than three such ions occur in the reference spectrum. Compounds are identified as present when the following criteria are met:

10.4.1 Target Analytes: Qualitative identification of target compounds is based on retention time and mass spectral comparison with characteristic ions in the target compound list. The reference mass spectrum is taken from a standard of the target compound analyzed by this method. The characteristic ions are the three ions of greatest relative intensity or any ions over 30% relative intensity if less than three such ions occur in the reference spectrum. Compounds are identified as present when the following criteria are met:

10.4.1.1. Once the GC/MS instrument has been setup and maintained as detailed in Section 10.1, the first operations to be performed are the performance checks and calibration standards.

10.4.1.2. The intensities of the characteristic ions of a compound maximize in the same scan or within one scan of each other.

10.4.1.3. The relative retention time (RRT) of the sample component is within ± 0.06 RRT units of the RRT of the standard component.

10.4.1.4. The most abundant ion in the standard target spectrum that equals 100% MUST also be present in the sample target spectrum.

10.4.1.5. All other ions that are greater than 10% in the standard target spectra should also be present in the sample.

10.4.1.6. The relative intensities of the characteristic ions agree within 30% of the relative intensities of these ions in the reference spectrum. (Example: For an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%).

10.4.1.7. If the compound does not meet all of the criteria listed above, but is deemed a match in the technical judgment of the mass spectral interpretation specialist, the compound will be positively identified and reported with documentation of the identification noted in the raw data record.

10.4.2 Non-Target Analytes: Upon client request a library search to identify non-target Tentatively Identified Compounds (TIC) is performed. The NIST/EPA/NIH mass spectral library is used to identify non-target compounds (not including internal standard and surrogate compounds) of greatest apparent concentration by a forward search of the library. The following guidelines are used by the analyst when making TIC identifications:

10.4.2.1. Relative intensities of major ions in the reference spectrum (ions greater than 10% of the most abundant ion) should be present in the sample spectrum.

10.4.2.2. The relative intensities of the major ions should agree within ±20%. (Example: For an ion with an abundance of 50% in the standard spectrum, the corresponding sample ion abundance must be between 30 and 70%).

10.4.2.3. Molecular ions present in the reference spectrum should be present in the sample spectrum.

10.4.2.4. Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of co-eluting compounds.

10.4.2.5. Ions present in the reference spectrum but not in the sample spectrum should be reviewed for possible subtraction from the sample spectrum because of background contamination or co-eluting peaks. Data system library reduction programs can sometimes create these discrepancies.

10.4.2.6. If, in the technical judgement of the mass spectral interpretation specialist, no tentative identification can be made, the compound will be reported as 'Unknown'. If the compound can be further classified the analyst may do so (i.e, 'Unknown hydrocarbon', 'Unknown acid' , etc.).

10.5. Data Reporting

10.5.1. Final Report. The Chom data system automatically produces a data report consisting of hardcopy reports corresponding to specific data reporting requirements, which is uploaded to the TALS LIMS System for the report production group.

10.5.1.1. Total Ion Chromatogram. Full length chromatogram depicting the full length of the GC/MS acquisition.

10.5.1.2. Spectra of all detected target compounds. A page for each detected target compound spectra with a standard reference spectrum for comparison.

10.5.1.3. The calculations of the concentrations of each target compound in the sample, reported in units of ppb, ug/kg or ug/l.

10.5.1.4. Data summaries for each method blank indicating which samples were extracted with the indicated blank.

10.5.1.5. A copy of the initial calibration range together with the calibration verification report, and tune report.

10.5.1.6. Quality Control (QC) data report for each batch including surrogate recoveries, internal standard area summaries, LCS, MS/MSD and RPD summaries.

10.6. The low-level calibration standard establishes the reporting limit. All reported data must be at a concentration at or above the low concentration standard. Any quantitative values below the report limit must be qualified as estimated.

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11.0. Calculations/Data Reduction

11.1. Target Compounds: are quantitated using the internal standard method (see the formula in Section 11.3).

11.1.1. Identified target compounds are quantitated using the integrated abundance from the EICP of the primary characteristic ion. The internal standard used shall be the one nearest the retention time of the analyte).

11.1.2. The average response factor (RRF) from the initial calibration is used to calculate the target analyte concentration in client samples using the formula found in Section 11.3. See Section 9.2.4 for discussion of RRF.

11.1.3. Secondary ion quantitation is utilized only when there are sample interferences preventing use of the primary characteristic ion. If secondary ion quantitation is used an average relative response factor (RRF) must be calculated using that secondary ion.

11.2. Non-Target Compounds (Tentatively Identified Compounds): An estimated concentration for non-target (tentatively identified compounds) is calculated using the internal standard method (see formula in Section 11.3). For quantiation, the nearest eluting internal standard free of interferences is used. The procedure used for calculating the concentration of non-target compounds is the same as that used for target compounds (see Section 11.1) with the following revisions:

11.2.1. The total area count of the non-target compound is used for As (instead of the area of a characteristic ion).

11.2.2. The total area count of the chosen internal standard is used as Ais (instead of the area of a characteristic ion).

11.2.3. A RF on 1.0 is assumed.

11.2.4. The resulting concentration is qualified as estimated ('J') indicating the quantitative uncertainties of the reported concentration.

11.3. Internal Standard Calculation:

11.3.1. Aqueous Samples

$$\text{Concentration } (\mu g/L) = \frac{(As)(Cis)(D)}{(Ais)(RF)(Vs)\ (Vi)\ (1000)}$$

Where:

As	=	Area of the characteristic ion for the target analyte in the sample
Cis	=	Concentration of the internal standard (ug/L)
D	=	Dilution factor, if the sample or extract was diluted prior to analysis. If no dilution is performed, D = 1.
Vi	=	Volume of the extract injected (ul)
Ais	=	Area of the characteristic for the associated internal standard
RF	=	Average response factor from the initial calibration.
Vs	=	Volume of sample extracted (ml)

The 1000 in the denominator represents the number of ul in 1 ml.

11.3.2. Solid Samples

$$\text{Concentration } (\mu g/KG) = \frac{(As)(Cis)(D)(Vt)}{(Ais)(RF)(Ws)\ (Vi)\ (1000)}$$

Where:

As	=	Area of the characteristic ion for the target analyte in the sample
Cis	=	Concentration of the internal standard (ug/L)
D	=	Dilution factor, if the sample or extract was diluted prior to analysis. If no dilution is performed, D = 1.
Vi	=	Volume of the extract injected (ul)
Ais	=	Area of the characteristic for the associated internal standard
RF	=	Average response factor from the initial calibration.
Vt	=	Volume of concentrated extract (ul)
Ws	=	Weight of sample (g)

The 1000 in the denominator represents the number of ul in 1 ml.

11.4. Relative Response Factors

$$RRF = \frac{A_x}{A_{is}} \times \frac{C_{is}}{C_x}$$

Where:

A_x = Area characteristic ion for the compound (see Table 21)
Ais = Area characteristic ion of associated internal std (See Table 21)
Cis = Concentration of internal standard
Cx = Concentration of compound in standard

11.5. Percent Relative Standard Deviation (% RSD) : as discussed in Section 9.2.4.4 (Initial calibration):

$$\% \text{ RSD} = \frac{\text{Standard Deviation of RRFs}}{\text{Mean RRF}}$$

11.6. Percent Difference (% D):as discussed in Section 9.2.4.4 (Continuing calibration):

$$\% D = \frac{RRF_c - \overline{RRF_i}}{\overline{RRF_i}} \times 100$$

Where: RRFc = RRF from continuing calibration

$\overline{RRF_i}$ = Mean RRF from current initial calibration

11.7. Percent Recovery (% R): Surrogates and Spikes

$$\text{Recovery (\%)} = \frac{\text{Concentration (or amount) found}}{\text{Concentration (or amount) added}} \times 100$$

11.8. Calculation of Relative Standard Error (RSE)

$$\%\,RSE = 100\% \times \sqrt{\frac{\sum_{i=1}^{N}\left[\frac{C_i - PC_i}{C_i}\right]^2}{(N-P)}}$$

Where:

N = Number of points in the curve
P = Number of parameters in the curve (= 1 for average response factor, 2 for linear, 3 for quadratic)
CI = True concentration for level i
PCi = Predicted concentration for level

11.9. Calculation of Percent (%) Error

$$\%Error = \frac{x_i - x_i'}{x_i} x\,100$$

Where:

x_i ' = Measured amount of analyte at calibration level *i*, in mass or concentration units

x_i = True amount

11.10. Dry Weight Correction: All solid samples must be corrected for dry weight using the following formula for dry weight determination.

$$DW = \frac{Gd}{Gw} \times 100$$

Where:

DW	=	Percent % Dry Weight
Gd	=	Dry weight of selected sample aliquot
Gw	=	Wet weight of selected sample aliquot

Multiply the DW value times the wet weight of the sample extracted. NOTE: This calculation can also be performed automatically by the target system provided the DW value is available and entered into the system.

12.0. Method Performance

12.1. Method Detection Limit Study (MDL)

A Method Detection Limit (MDL) study, as described in the Eurofins corporate Detection and Quantitation Limits SOP, CA-Q-S-006, must be performed initially and whenever a significant change affecting sensitivity is made to the analytical system. The MDL must be re-evaluated from quarterly MDL points at least every 12 months.

12.2. Demonstration of Capabilities

For DOC procedure refer to Section 19 in the most current revision of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

12.3. Lower Limit of Quantitation Verification

The lowest calibration standard analyzed establishes the LLOQ or Reporting Limit. The capability to reliably detect this concentration through the preparation, clean-

up and analytical procedure is verified through the annual analysis of a standard at the LLOQ/RL. The LLOQ verification shall also be performed whenever significant changes are made to the preparation and/or analytical procedure.

12.3.1 The LLOQ verification standard shall be prepared at a concentration 0.5-2 times the LLOQ/RL, and be taken through all of the same preparation and clean-up methods as client samples.

12.3.2 The LLOQ verification standard for aqueous matrix shall be prepared using laboratory deionized water and for the solid matrix using clean Ottawa sand. Other clean matrices may be used in addition, for project specific requirements.

12.3.3 The annual LLOQ verification is completed and documented with the required annual MDL evaluation.

12.3.4 Recovery of each analyte must meet the laboratory established LCS recovery limits + 20%. (For example, if the LCS recovery limits are 70-130%, the LLOQ verification must meet recovery limits of 50-150%.) Once sufficient points have been generated, LLOQ based statistical limits may be used in place of limits based on LCS recovery.

NOTE: The lower recovery limit for the LLOQ can be no lower than 10%.

12.4. Training Requirements

Refer to Eurofins SOP No. ED-GEN-022, (*Training*), for the laboratory's training program.

13.0. Pollution Control

13.1 It is Eurofins's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention."

14.0. Waste Management

14.1 Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to Eurofins Edison SOPs Nos. ED-SPM-007 (*Disposal of Samples and Associated Laboratory Waste, current revision)* and ED-SPM-008 (*Laboratory Waste Disposal Procedures, current revision).* The following waste streams are produced when this method is carried out:

- Auto sampler vials and expired standards: These vials are collected in satellite accumulation within the instrument laboratory. The vials are then placed into a 55 steel open top drum in the waste room. When the drums are full, the drum will be collected by the waste vendor for disposal. This waste is treated for incineration.

  Teris Profile Number: 50016652
  Onyx Profile WIP Number: 282493

- Mixed Solvent Waste: Mixed solvent waste is collected in a small beaker inside the bench top hood. This waste is then transferred into the satellite accumulation container in the Organic Prep. Lab. on a daily basis. This material is transferred into 5 gallon solvent cans as satellite accumulation. These cans are emptied every 24 hours into a steel drum in the waste room. This drum is kept in the walk in hood until it is full. The full drum is then removed from the hood and placed on secondary containment in the waste room.

  Teris Profile Number: 50016624
  Onyx Profile WIP Number: 545240

14.1. Pollution Prevention

14.2.1. Pollution prevention encompasses any technique that reduces or eliminates the quantity or toxicity of waste at the point of generation. Numerous opportunities for pollution prevention exist in laboratory operation. The USEPA has established a prevention hierarchy of environmental management techniques that places pollution prevention as the management option of first choice. Whenever feasible, laboratory personnel should use pollution prevention techniques to address their waste generation. When wastes cannot be feasibly reduced at the source, the agency recommends recycling as the next best option.

14.2.2. The quantity of chemical purchased should be based on expected usage during its shelf life and disposal cost of unused material. Actual reagent preparation volumes should reflect anticipated usage and reagent stability.

15.0. References / Cross-References

15.1. United States Environmental Protection Agency, “Method SW8270D, Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry”, Test Methods for Evaluating Solid Wastes, SW846 Third Edition, Laboratory Manual, Physical/Chemical Methods, Revision 5, July 2014..

15.2. United States Environmental Protection Agency, “Method SW8270E, Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry”, Test Methods for Evaluating Solid Wastes, SW846 Update IV, Laboratory Manual, Physical/Chemical Methods, Revision 6, June 2018.

15.3. United States Environmental Protection Agency, "Method SW8000D: Determinative Chromatographic Separations", Test Methods for Evaluating Solid Wastes, SW846, Laboratory Manual, Physical/Chemical Methods, Update V, Revision 4, October 2012..

15.4. Eurofins Edison Document No. ED-QA-LQM, *Laboratory Quality Manual*, current revision.

15.5. Eurofins Edison SOP No. ED-ORP-002, *SW846 Method 3510C-Extraction of Semi-Volatile Organic Compounds in Water by Separatory Funnel,* current revision.

15.6. Eurofins Edison SOP No. ED-ORP-043, *SW846 Method 3580A - Waste Dilution Prep for Analysis of BNAs by SW846 Method 8270,* current revision.

15.7. Eurofins Edison SOP No. ED-ORP-044, *Procedure for the Microwave Extraction of Solids, SW3546, current revision.*

15.8. Eurofins Document No. CW-E-M-001, Corporate Environmental Health and *Safety Manual,* current revision.

15.9. Eurofins Corporate Quality SOP No. CA-Q-S-001, *Solvent & Acid Lot Testing & Approval*, current revision.

15.10. Eurofins Edison SOP No. ED-GEN-023 (*Bulk Solvent Testing and Approval*), current revision.

15.11. Eurofins Edison SOP No. ED-GCS-001, *Preparation and Screening of Semivolatile Organic Extracts for GC/MS Analysis*, current revision.

15.12. Eurofins Edison Work Instruction Document No. EDS-WI-012, *Client Complaint/Corrective Action Form,* current revision.

15.13. Eurofins Edison SOP No. ED-GEN-003, *Standard Operating Procedure for Control of Non-Conformances and Corrective Action,* current revision.

15.14. Eurofins Edison SOP No. ED-ORP-001, *Extraction of Semivolatile Organic Compounds in Water, EPA Method 625.1,* current revision.

15.15. Eurofins Edison SOP No. ED-GEN-022, *Training,* current revision.

15.16. Eurofins Corporate Quality Memorandum, CA-Q-QM-002, *GC/MS Tuning Policy*, current revision.

15.17. Eurofins Corporate Quality SOP No. CA-Q-S-006, *Detection and Quantitation Limits,* current revision.

16.0. Method Modifications:

Method 8270E requires the DFTPP tune standard to be analyzed once prior to an ICAL

and not daily prior to sample analysis. Until such time as 8270D is removed from lab capabilities and in order to satisfy both 8270D and 8270E The laboratory will analyze the DFTPP tune daily, prior to QC and sample analysis. The laboratory will use the tighter criteria from Methods 8270C/8270D for tune evaluation, rather than the criteria suggested in Table 3 of Method 8270E.

17.0. Attachments

Attachment 1 Poor Performing Analytes

18.0. Revision History

- Revision 10, date 10/18/2022
    - Updated to Eurofins branding throughout.
    - Section 8.1: updated to include procedure for sampling chlorinated water sources.
    - Section 9 updated throughout to include ICAL evaluation with Relative Standard Error (RSE).
    - Section 11.8: added formula for calculation of Relative Standard Error (RSE)

- Revision 9, date 03/15/2021
    - Updated as needed to reflect 1,4-dioxane RL of 0.2 ug/l.
    - Updated Tables 11 and 12 to reflect new low ICAL standard concentration of 1,4-dioxane..

- Revision 8, date 06/29/2020
    - Updated to Eurofins branding.
    - Updated throughout to include 8270E requirements.
    - Removed references to SW846 3550B/C prep methods (no longer in use for this method at Edison lab).
    - Update equipment listed in Section 6.0.Updated analytical column in Section 6.1.2.
    - Updated, deleted and renumbered tables as required.
    - Made extensive updates to Standards (sources and preparation) in Section 7.2.
    - Removed all references to Aromatic Amines. Deleted all tables specific to Aromatic Amine analysis. Renumbered remaining tables in document and updated text references.
    - Throughout document clarified tune requirements for 8270E.
    - Following added to Section 9.1.1: For method 8270E the method blank is generally acceptable if target analyte concentrations are less than the one half the reporting limit.
    - Calibration Point Read-back Criteria was added to Section 9.2.4.3. The calculation for percent error was added to Section 11.8.
    - Section 9.2.4.2.3: added following for 8270E: the calculated concentration or amount of each analyte of interest in the CCV standard should fall within ±20%.
    - Section 9.2.4.2.5.6: added ‘The recalculated concentration of the low calibration point should be within ±50% of the standard’s concentration.”

- Section 12.1 revised to reflect the updated MDL procedure.
- Added Section 12.3: annual Lower Limit of Quantitation Verification
- Added Corporate SOP CA-Q-S-006, Detection and Quantitation Limits to references.
- Section 16.0: added a Method Modification regarding tuning check requirements.

- Revision 7, date 06/08/2018

  - Section 2.3: revised to clarify that RVE/LVI is lab standard procedure.
  - Section 9.1.3: removed statement regarding allowance for up to five analytes to recover outside of lab acceptance limits in LCS/LCSD.
  - Section 9.2.4.3: Replace table 'ICV Poor Performers (50-150% Recovery) with expanded list of 'Poor Performing Analytes' in Attachment 1.
  - Added Section 9.2.4.4.5: CCV Poor Performers
  - Corrected number in section 9.2.4.5
  - Added Attachment 1 – Poor Performing Analytes

- Revision 6, date 01/12/2018:

  - Section 7.2.5 included to specify reagent and standard storage conditions.
  - Revised Section 9.1.3 to clarify requirements for specific LCS/LCSD evaluation criteria regarding the # of out of criteria analytes.
  - Revised Section 9.2.4.3 to add 2,4-Dimethylphenol as a poor performing analyte, increased the range for the poor performers to 50-150 and also expanded the guidelines for flagging the ICV outliers.

- Revision 5, dated 09/29/2017:
  - Revised Section 9.1.1 to clarify requirements for surrogate recovery in method blanks.

- Revision 4, dated 08/21/2017:
  - Updated throughout to add a procedure for the analysis of 1,4-dioxane by isotope dilution selected ion monitoring (SIM)
  - Added tables for isotope dilution SIM standards. Renumbered all tables as necessary.
  - Section 7.2.1: added a list of full scan calibration list options.
  - Table 3: Renamed 'Full Scan Stock Standards'.
  - Section 9.2.1: noted that DFTTP applies only to full scan analysis.
  - Section 9.2.3: updated CCV concentrations
  - Added reference to GC/MS Tuning Policy in Section 15.16.

- Revision 3, dated 01/07/2016:
  - Tables 1 and 2: added SIM as option for 1,4-Dioxane.
  - Section 2.3: removed SW3541 (Soxtherm) as option for soils prep (lab has discontinued use of this method). Also removed SW3541 SOP reference from Section 15.0.
  - Tables 19 and 20: added source and prep instructions for 1,4-Dioxane SIM standard. Updated source and prep instructions for 4,6-Dinitro-2-methylphenol.
  - Table 22: added prep instructions for 1,4-Dioxane and 4,6-Dinitro-2-methylphenol

SIM ICV standard.
- Corrected the information in the 'DFTPP Key Ions and Abundance Criteria' table in Section 9.2.1 to match the info found in SW846 8270C.
- Section 10.1.4.2: updated "SIM Parameters" to included ion masses/dwell times for 1,4-Dioxane.

- Revision 2, dated 01/28/2015:
  - Extensively reformatted the SOP. Placed tables that had been in rear of document into the body of the text. Renumbered tables as applicable and fixed text references to tables.
  - Section 1.1, Table 1: Revised table to include all current analytes. Also footnoted those compounds which are currently analyzed by SIM.
  - Section 2.3: added options for extraction of solids by SW846 3456 (Microwave Extraction) and by SW3580A (Waste Dilution) and added SOP references. Deleted reference to SOP ED-ORP-005 (SW3550B – Low Level); Updated Section 15 (References).
  - Section 2.5: added text detailing the RVE/LVI options.
  - Section 2.6: added table which includes all analytes routinely analyzed by SIM.
  - Section 6: updated to include newer GC, MS and autosampler models currently in use.
  - Section 6.1.3: added Zebron ZB column as an option.
  - Section 7.2: extensively revised standards information to reflect switch to Restek standards.
  - Table 3:Added Custom Aromatic Amine Surrogate Standard and revised Table 8 to include initial calibration prep instructions for the Aromatic Amine surrogates.
  - Throughout document: removed references to Target and replaced with Chrom.
  - Section 7.2.1: Added reference to section 10.2.1.2 for LVI.
  - Added Section 7.2.1.3.1 and Table 17A both of which discuss use of Aromatic Amine surrogates.
  - Section 7.2.1.2: Added reference to Tables 9,10 and 11 (ICV Preparation)
  - Section 8.0: Added Sample container and minimum sample size (250 ml) for Reduced volume extraction.
  - Sections 9.1.2, 9.1.3, 9.1.4 and 9.2.4: added statement that certain state regulatory programs have defined recovery limits which, where applicable, are used for spike and calibration evaluations.
  - Section 9.1.2: Deleted sentence "A minimum of 16 spiked analytes are reported to in client reports (the full list is reported at least once during each 2 year period because we employ full spiking list.
  - Section 9.1.4: Added note regarding use of Aromatic Amine Surrogates.
  - Section 9.2.2.2: Added reference to ICV Preparation tables in Section 7.2.
  - Section 9.2.3: added more specific info as to the concentration of the CCVs for all techniques.
  - Section 9.2.4.2.1: Changed to reflect that each analyte should meet minimum RF's, not the average across the calibration. Added LLCCV requirement.
  - Section 10.3.1: added explanation of Chrom's interaction with TALS. Removed references to Target.
  - Section 9.2.4.2.5.5: Added: (or can be noted in the narrative)
  - Section 9.2.4.2.5.6: Revised last sentence to read: "This evaluation can be checked using the Initial Calibration %Drift Report in Chrom."
  - Section 9.2.4.3: Removed 65-135% criteria and added "poor performing" analyte list and associated criteria of 60-140%.

- Section 9.2.4.4.3: Added LLCCV criterion for RFs
- Section 9.2.4.4.4: Added LLCCV criterion for %D
- Section 10.1.4: Updated GC/MS operating conditions for full scan, SIM and DFTPP.
- Section 10.1.4.1: added a table detailing operating conditions for LVI option.
- Table 2: Added 2-ethylaniline, 2,4-dimethylaniline, 3,4-dimethylaniline, 2,3-dimethylaniline, 2,4,5-trimethylaniline and 4-chloro-o-toluidine to Working Standards preparation information.
- Table 25: updated to include all current analytis/surrogates/internal standards and associated ions.
- Throughout document: updated LQM section references as appropriate as some have changed with the latest LQM revision.

- Revision 1, dated 11/07/2011

  - Section 1.1, Table 1: Added Pentachloronitrobenzene and associated CAS# to the analyte list.
  - Section 7.2.1: Added Pentachloronitrobenzene standard information.
  - Table 2: Added Pentachloronitrobenzene to Working Standards preparation information.
  - Table 4: Added Pentachloronitrobenzene and associated minimum RF.
  - Table 8: Added Pentachloronitrobenzene and associated ions.

- Revision 0, dated 02/22/2011: NEW

Table 21
Characteristic Ions Of Semi-Volatile Organic Compounds

Compound	Primary Ion	Secondary Ion(s)
1,1'-Biphenyl	154	153,76
1,2,4,5-Tetrachlorobenzene	216	214, 179
1,2,4-Trichlorobenzene	180	182, 145
1,2-Dichlorobenzene	146	148, 111
1,2-Diphenylhydrazine	77	105, 182
1,3-Dichlorobenzene	146	148, 111
1,3-Dimethylnaphthalene	156	141, 115
1,4-Dichlorobenzene	146	148, 111
1,4-Dichlorobenzene d4 **(ISTD)**	152	150, 115
1,4-Dioxane	88	58, 43
1-Methylnaphthalene	142	141, 115
1-Naphthylamine	143	115, 116
2,2'-oxybis[1-chloropropane]	45	77, 121
2,3,4,6-Tetrachlorophenol	232	131, 230
2,3,7,8-TCDD (screen)	320	322, 324
2,3-Dihydroindene		
2,3-Dimethylaniline	106	129

Table 21 Characteristic Ions Of Semi-Volatile Organic Compounds		
Compound	**Primary Ion**	**Secondary Ion(s)**
2,4,5-Trichlorophenol	196	198, 200
2,4,5-Trimethylaniline	102	55, 56
2,4,6-Tribromophenol **(Surrogate)**	330	132, 141
2,4,6-Trichlorophenol	196	198, 200
2,4-Dichlorophenol	162	164, 98
2,4-Xylidine	121	120, 106
2,4-Dimethylphenol	122	107, 121
2,4-Dinitrophenol	184	63, 154
2,4-Dinitrotoluene	165	63, 89
2,6-Dinitrotoluene	165	63, 89
2-Chloronaphthalene	162	127, 164
2-Chlorophenol	128	64, 130
2-Ethylaniline	106	122,104
2-Fluorobiphenyl **(Surrogate)**	172	171
2-Fluorophenol **(Surrogate)**	112	64
2-Methylnaphthalene	142	141
2-Methylphenol	108	107
2-Naphthylamine	143	115, 116
2-Nitroaniline	65	108, 138
2-Nitrophenol	139	109, 65
2-tert-butyl-4-Methylphenol	149	121, 91
2-Toluidine	107	106, 77
3,3'-Dichlorobenzidine	252	254, 126
3,4-Dimethylaniline	106	129, 127
3,5-Di-tert-butyl-4-Hydroxytol	205	220, 145
3-Nitroaniline	138	108, 65
4,6-Dinitro-2-methylphenol	198	51, 105
4-Bromophenyl phenyl ether	248	250, 141
4-chloro-2-methylaniline	106	144, 142
4-Chloro-3-methylphenol	107	144, 142
4-Chloroaniline	127	129
4-Chloroaniline-d4 **(Surrogate)**	131	133
4-Chlorophenyl phenyl ether	204	206, 141
4-Methylphenol	108	107
4-Nitroaniline	138	108, 65
4-Nitrophenol	139	109, 65
Acenaphthene	154	153, 152
Acenaphthene d10 **(ISTD)**	164	162, 160
Acenaphthylene	152	151, 153
Acetophenone	105	77, 51
Aniline	93	66
Aniline-d5 (**Surrogate**)	98	71,42
Anthracene	178	176, 179
Atrazine	200	173,215
Benzaldehyde	77	105,106
Benzidine	184	92, 185

Table 21 Characteristic Ions Of Semi-Volatile Organic Compounds		
Compound	**Primary Ion**	**Secondary Ion(s)**
Benzo(a)anthracene	228	229, 226
Benzo(a)pyrene	252	253, 125
Benzo(b)fluoranthene	252	253, 125
Benzo(g,h,i)perylene	276	138, 277
Benzo(k)fluoranthene	252	253, 125
Benzoic Acid	122	105, 77
Benzyl Alcohol	108	79, 77
Bis(2-chloroethoxy)methane	93	95, 123
Bis(2-chloroethyl)ether	93	63, 95
Bis(2-ethylhexyl)phthalate	149	167, 279
Bisphenol-A	213	228, 119
Butyl benzyl phthalate	149	91, 206
Caprolactam	113	55,56
Carbamazepine	193	236, 135
Carbazole	167	166, 139
Chrysene	228	226, 229
Chrysene d12 **(ISTD)**	240	120, 136
Coumarin	146	118, 63
Dibenz(a,h)anthracene	278	139, 279
Dibenzofuran	168	139
Diethylphthalate	149	177, 150
Dimethylphthalate	163	194, 164
Di-n-butylphthalate	149	150, 104
Di-n-octylphthalate	149	167, 43
Fluoranthene	202	101, 203
Fluorene	166	165, 167
Hexachlorobenzene	284	142, 249
Hexachlorobutadiene	225	223, 227
Hexachlorocyclopentadiene	237	235, 272
Hexachloroethane	117	201, 199
Indeno(1,2,3-cd)pyrene	276	138, 227
Isophorone	82	95,138
Kepone	272	237, 355
N,N-Dimethylaniline	120	122, 104
Naphthalene	128	129, 127
Naphthalene d8 **(ISTD)**	136	68
n-decane	43	57
Nitrobenzene	77	123, 65
Nitrobenzene-d5 **(Surrogate)**	82	128, 54
N-Nitrosodimethylamine	42	74, 44
N-Nitroso-di-n-propylamine	170	42,101,130
N-Nitrosodiphenylamine	169	168, 167
n-Octadecane	57	43, 85
o-Toluidine-d9 **(Surrogate)**	114	112, 42
Pentachloronitrobenzene	237	214,295
Pentachlorophenol	266	264, 268

Table 21 Characteristic Ions Of Semi-Volatile Organic Compounds		
Compound	**Primary Ion**	**Secondary Ion(s)**
Perylene d12 **(ISTD)**	264	260, 265
Phenanthrene	178	179, 176
Phenanthrene d10 **(ISTD)**	188	94, 80
Phenol	94	65, 66
Phenol-d5 **(Surrogate)**	99	42, 71
Phenyl ether	170	77, 115
Pyrene	202	200, 203
Pyridine	79	52, 51
Terphenyl-d14 **(Surrogate)**	244	122, 212

Attachment 1
Poor Performing Compounds

1,2,4,5-Tetrachlorobenzene
1,4-Dioxane
1-Naphthylamine
2,3,4,6-Tetrachlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2-Chloroaniline
2-Naphthylamine
3&4-Methylphenol
3'3-Dichlorobenzidine
4,6-Dinitro-2-methyl- phenol
4-Chloroaniline
4-Nitrophenol
Aniline
Atrazine
Benzaldehyde
Benzidine
Benzoic Acid
Benzyl Alcohol
Biphenyl
Caprolactam
Diphenylamine
Hexachlorocyclopentadiene
Hexachloroethane
n-Decane
n-Nitrosodimethylamine
o,o,o-Triethylphosphorothioate
o-Toluidine
Pentachloronitrobenzene
Pentachlorophenol
Phenol
Pyridine

These analytes are exempt from the ICV and CCV criteria as detailed in this SOP

eurofins	Always check on-line for validity.	Level:
Document number: **T-PFAS-WI69608**	**Aqueous PFAS Prep by SPE and Analysis by LC-MS-MS by EPA 1633 and EPA 1633A**	**Work Instruction**
Old Reference:		
Version: **5**		Organisation level: **5-Sub-BU**
Approved by: **TYZ8** Effective Date: **11-MAR-2025**	Document users: **5_EUUSLA_PFAS_Manager, 6_EUUSLA_PFAS_Analyst, 6_EUUSLA_PFAS_BKK_Data_Reviewers, 6_EUUSLA_PFAS_Data_Reviewers, 6_EUUSLA_PFAS_Management_Team, 6_EUUSLA_PFAS_Sample_Prep**	Responsible: **5_EUUSLA_PFAS_Manager**

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Revision Log

	Revision: 05	**Effective date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
References	Enhancement	Added Revision A
Cross Reference	Enhancement	Added Prescreen SOP QC Rotation form
Reagents and Standards	Enhancement	Added sand
Procedure	Enhancement	Added 5% solids visual standard prep instructions. Added reconstitution standard prep instructions. Added pre-prep dilution instruction section. Added data types. Clarified Manual SPE steps. Added requirement for to rotate QC.

	Revision: 04	**Effective date:** 31.OCT.2024
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Apparatus and Equipment	Enhancement	Added missing vendors. Standards are stored in the dark.
Calibration	Enhancement	CCVs are run every 10 injections of field sample extracts
Reagents and Standards	Enhancement	Added missing vendors.
Procedure A, B, C	Clarification	Clarified prep procedure
Procedure D	Clarification	removed references to Cal0. Added additional ICB in sequence. Rearranged section.
Procedure E	Enhancement	Added section to address dilutions
QA/QC	Clarification	IAR ratio is based off the mid-point CCV standard
Attachments	Clarification	Updates to Att 01, 02, 11,12, 16

Reference

1. USEPA Method 1633, Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS, January 2024.

2. USEPA Method 1633 Revision A, Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS, December 2024.

3. Chemical Hygiene Plan, current version.

Cross Reference

Document	Document Title
T-PEST-WI9847	Common Equations Used During Chromatographic Analyses
QA-SOP11178	Demonstrations of Capability
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation
G-DC-FRM23907	Redacted SOPs
T-PFAS-WI21568	Environmental Monitoring in the PFAS Lab
T-PFAS-WI23588	Preventative and Corrective Maintenance for the AB Sciex Liquid Chromatograph Mass Spectrometers (LC/MS/MS)
T-PFAS-WI50447	PFAS Prescreen Method in Water Samples Requesting PFAS by Isotope Dilution
T-PFAS-FRM80101	D4033 - QC Rotation Tracking

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Scope

This method is applicable for the determination of selected per- and polyfluorinated alkyl substances (PFAS) in aqueous samples to include non-potable waters and non-regulatory potable water when directed by the client. The compounds analyzed in this method are listed in the table below. The most current MDLs and LOQs are listed in the LIMS. Compounds other than those listed may be analyzed by client request.

Analyte	Acronym	CAS#
Perfluorobutanoic acid	PFBA	375-22-4
Perfluoropentanoic acid	PFPeA	2706-90-3
Perfluorohexanoic acid	PFHxA	307-24-4
Perfluoroheptanoic acid	PFHpA	375-85-9
Perfluorooctanoic acid	PFOA	335-67-1
Perfluorononanoic acid	PFNA	375-95-1
Perfluorodecanoic acid	PFDA	335-76-2
Perfluoroundecanoic acid	PFUnA	2058-94-8
Perfluorododecanoic acid	PFDoA	307-55-1
Perfluorotridecanoic acid	PFTrDA	72629-94-8
Perfluorotetradecanoic acid	PFTeDA	376-06-7
Perfluorobutanesulfonic acid	PFBS	375-73-5
Perfluoropentanesulfonic acid	PFPeS	2706-91-4
Perfluorohexanesulfonic acid	PFHxS	355-46-4
Perfluoroheptanesulfonic acid	PFHpS	375-92-8
Perfluorooctanesulfonic acid	PFOS	1763-23-1
Perfluorononanesulfonic acid	PFNS	68259-12-1
Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanesulfonic acid	PFDoS	79780-39-5
1H,1H,2H,2H-Perfluorohexane sulfonic acid	4:2 FTS	757124-72-4
1H,1H,2H,2H-Perfluorooctane sulfonic acid	6:2 FTS	27619-97-2
1H,1H,2H,2H-Perfluorodecane sulfonic acid	8:2 FTS	39108-34-4
Perfluorooctanesulfonamide	PFOSA	754-91-6
N-methylperfluorooctane sulfonamide	NMeFOSA, N-MePFOSA	31506-32-8
N-ethylperfluorooctane sulfonamide	NEtFOSA, N-EtPFOSA	4151-50-2
N-methylperfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9
N-ethylperfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6
N-methylperfluorooctane sulfonamidoethanol	NMeFOSE, NMePFOSAE	24448-09-7
N-ethylperfluorooctane sulfonamidoethanol	NEtFOSE, NEtFOSAE	1691-99-2

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Analyte	Acronym	CAS#
Hexafluoropropylene Oxide Dimer Acid	HFPO-DA, GenX	13252-13-6
4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4 *
Perfluoro-3-methoxypropanoic acid	PFMPA, PFECA F	377-73-1
Perfluoro-4-methoxybutanoic acid	PFMBA, PFECA A	863090-89-5
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA, PFECA B	151772-58-6
9-chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	9Cl-PF3ONS	756426-58-1
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9
3-Perfluoropropylpropanoic acid	3:3 FTCA	356-02-5
3-Perfluoropentylpropanoic acid	5:3 FTCA	914637-49-3
3-Perfluoroheptylpropanoic acid	7:3 FTCA	812-70-4
Perfluoro (2-ethoxyethane) sulfonic acid	PFEESA, PES	113507-82-7
Perfluoro-4-ethylcyclohexanesulfonic acid	PFECHS	133201-07-7
Perfluorobutylsulfonamide	FBSA	30334-69-1
Perfluorohexanesulfonamide	FHxSA	41997-13-1

*CAS# for the free acid form of the analyte

Basic Principles

An aqueous sample is fortified with isotopically-labeled extraction standards and is passed through a solid phase extraction (SPE) cartridge to extract the analytes. The compounds are eluted from the solid phase with a combination of solvents. Carbon cleanup is performed during SPE. The extract is fortified with Isotopically-labeled injection internal standards. It is then analyzed by LC/MS/MS operated in negative electrospray ionization (ESI) mode for detection and quantification of the analytes. Quantitative analysis is performed using isotope dilution.

Reference Modifications

This method is "performance-based," which means that modifications may be made without additional EPA review to improve performance (e.g., overcome interferences, or improve the sensitivity, accuracy, or precision of the results) provided that all performance criteria in this method are met. These options include alternative extraction, concentration, and cleanup procedures, and changes in sample volumes, columns, and detectors. Changes in performance, sensitivity, selectivity, precision, recovery, etc., that result from modifications must be documented, as well as how these modifications compare to the specifications in this method.

Interferences

Compounds which have similar structures to the compounds of interest and similar molecular weights would potentially interfere. Method interferences may be caused by contaminants in solvents, reagents (including reagent water), sample bottles and caps, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in the chromatograms. The analytes in this method can also be found in many common laboratory supplies and equipment, such as PTFE (polytetrafluoroethylene) products, LC solvent lines, methanol, aluminum foil, etc. A laboratory blank is performed with each batch of samples to demonstrate that the extraction system is free of contaminants.

Precaution to Minimize Method Interference

1. LC system components contain many of the target analytes. To minimize the background PFAS peaks, PTFE solvent frits and tubing are replaced by PEEK™ solvent frits and tubing where

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possible.

2. A precolumn, Proprietary Content, is installed before the injection valve to separate PFAS in standards/samples from those from the LC system and mobile phases.

3. All part of the SPE manifold must be cleaned as per *T-PFAS-WI21568*.

Safety Precautions and Waste Handling

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. PFOA has been described as "likely to be carcinogenic to humans". Each chemical should be treated as a potential health hazard and exposure to these chemicals should be minimized.

Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves. Gloves, lab coats, and safety glasses should be worn when preparing standards and handling samples. Avoid inhaling solvents and chemicals and getting them on the skin. Wear gloves when handling neat materials. When working with acids and bases, take care not to come in contact and to wipe any spills. Always add acid to water when preparing reagents containing concentrated acids.

All laboratory waste is accumulated, managed, and disposed of in accordance with all Federal, State, and local laws and regulations. All solvent waste and extracts are collected in approved solvent waste containers in the laboratory and subsequently emptied by personnel trained in hazardous waste disposal into the lab-wide disposal facility. HPLC vials are disposed of in the lab container for waste vials, and subsequently lab packed. Any solid waste material (disposable pipettes and broken glassware, etc.) may be disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC).

Each chemist performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Also, several batches of sample extractions must be performed under the direct observation of another experienced chemist to assure the trainee is capable of independent preparation. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

Each LC/MS/MS analyst must work with an experienced employee for a period of time until they can independently calibrate the LC/MS/MS, review and process data, and perform maintenance procedures. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

The IPR (IDOC) and the DOC consist of 4 laboratory control samples (or alternatively, one blind sample for the DOC) that are spiked at the LCS level and carried through all steps of the extraction and analysis. Using results of the set of four analyses, compute the average percent recovery and the relative standard deviation (RSD) of the concentration for each analyte.

- For each target, the RSD and percent recovery must meet the criteria in Table 5. If any individual RSD exceeds the precision limit or any individual percent recovery falls outside the range for recovery for a target, system performance is unacceptable for that compound. Correct the problem and repeat the test.

- For each EIS and NIS, the percent recovery must meet the criteria defined in Table 6. There are is no RSD criteria for the EIS or NIS. If any individual percent recovery falls outside the range for an EIS or NIS, system performance is unacceptable for that compound. Correct the problem and repeat the test.

See *QA-SOP11178* for additional information on IDOC and DOC.

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Sample Collection, Preservation, and Handling

A. Sample Collection

The samples are collected in 125-mL HDPE containers. All sample containers must have linerless HDPE or polypropylene caps. Keep the sample sealed from time of collection until extraction. The entire aqueous sample that is collected must be prepared and analyzed, and subsampling must be avoided whenever possible.

NOTE: PFAS contamination during sampling can occur from a number of common sources, such as food packaging and certain foods and beverages. Proper hand washing and wearing nitrile gloves will aid in minimizing this type of accidental contamination of the samples.

B. Sample Storage and Shipment

1. Samples must be chilled during shipment and must not exceed 6°C during the first 48 hours after collection. Sample temperature must be confirmed to be at 0° to 6°C when the samples are received at the laboratory.

2. Samples stored in the lab must be held at a temperature of 0° to 6°C, not frozen, and protected from light until extraction. Alternatively, to meet project requirements, samples may be stored at less than or equal to -20°C and protected from light until extraction.

3. Water samples must be extracted within 28 days when stored at a temperature of 0° to 6°C, not frozen, and protected from light. Water samples must be extracted within 90 days when stored at a temperature less than or equal to -20°C and protected from light.

4. Extracts must be analyzed within 28 days after extraction when stored at a temperature of 0° to 6°C, not frozen, and protected from light. Extracts must be analyzed within 90 days after extraction when stored at a temperature less than or equal to -20°C and protected from light.

Apparatus and Equipment

A. Apparatus

1. 125-mL HDPE bottles. CapSure Leak-Proof bottles, Catalog No. 0125-1060-QC or equivalent.

   Note: One bottle per lot must be tested and demonstrated to be PFAS-free at or below the laboratory's MDLs for all target analytes. See *T-PFAS-WI21568* for additional details.

2. Centrifuge tubes, 15-mL conical polypropylene with polypropylene screw caps. Fisher Scientific, Catalog No. 05-539-5 or equivalent.

3. HDPE bottles for extraction fluid storage, 1L. Environmental Sampling Supply, Catalog No. 1000-1902-PC or equivalent.

4. Analytical Balance – Capable of weighing to 0.0001 g

5. Top-Loading Balance – Capable of weighing to 0.01 g

6. Solid phase extraction (SPE) Proprietary Content.

7. GCB filter cartridge, Proprietary Content

8. Large-volume SPE Reservoir, 25-mL. Millipore-Sigma, Product No. 54258-U or equivalent.

9. SPE Tube Adapter. Millipore-Sigma, Catalog No. 57020-U or equivalent.

10. SPE vacuum extraction manifold – "Resprep" 24-port manifold. Restek, Catalog No. 26080 or equivalent.

11. Polypropylene SPE delivery needles. Agilent, Catalog No. 12234511 or equivalent.

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12. Centrifuge, capable of a minimum rotational force of 3500 rcf, rotor radius 19.5 cm. Sorvall ST4 Plus-MD; Fisher Scientific, Catalog No. 75009510 or equivalent.

13. Auto Pipettes, Eppendorf Repeater, capable of accurately dispensing 10- to 1000-µL. Fisher Scientific, Catalog No. 14-287-150 or equivalent.

14. Polypropylene pipette tips, 0.1-200 µL. Fisher Scientific, Catalog No. 02-681-135 or equivalent.

15. Polypropylene pipette tips, 100-1000 µL. Fisher Scientific, Catalog No. 02-707-507 or equivalent.

16. Polypropylene pipette tips, 1 – 10 mL. Eppendorf, Catalog No. 022492098 or equivalent.

17. Pipettes, disposable transfer. Fisher Scientific, Catalog No. 13-711-7M or equivalent.

18. Vortex mixer, variable speed. Fisher Scientific or equivalent.

19. N-Evap sample extract concentrator with N_2 supply and water bath for temperature control. Organomation, Inc., Catalog No. 11250 or equivalent.

20. Reagent Water Purification System: Capable of producing ultrapure "Type 1/Milli-Q"-grade water from in-house deionized water system. Millipore SAS, Catalog No. FTPF08831.

21. SureStart Polyspring inserts. Fisher Scientific, Catalog No. 03452340 or equivalent.

22. Short-Cap Vial with Grad Marking Spot, 9-425 Screw-Thread, 2.0 mL, 9 mm, Clear. Restek, Catalog No. 21141 or equivalent.

23. Short Screw Caps, Polypropylene, Screw-Thread, PTFE/Silicone Septa, Blue, Preassembled, 2.0 mL, 9 mm. Restek, Catalog No. 24485 or equivalent.

24. Centrifuge tubes, 50-mL conical polypropylene with polypropylene screw caps. Fisher Scientific, Catalog No. 06-443-21 or equivalent.

25. Polypropylene bottles for standard storage, 4-mL. Fisher Scientific, Catalog No. 02-923-11E or equivalent.

26. Stainless steel spatula/scoop set. Bel-Art SP Scienceware, Product No. 11-865-130 or equivalent.

27. pH paper, Hydrion, range 5.5-8.0. Fisher Scientific, Catalog No. 14-853-275 or equivalent.

28. Disposable syringe filter, 25-mm, 0.2µm Nylon membrane, PALL/Acrodisc or equivalent.

29. Wheaton Bottle, 15-mL, narrow mouth, HDPE, Leak resistant; DWK Life Sciences, Catalog No. 209044SP or equivalent.

30. Graduated Medicine Cups, Plastic, 30-mL. Medline Industries, Catalog No. DYND8000 or equivalent.

31. Mobile phase bottles, 5 L. Fisher Scientific, Catalog No. 064141F or equivalent.

B. Equipment

1. AB Sciex Triple Quad 5500/5500+ Turbo V Ion Source or equivalent.

   ExionLC Controller
   ExionLC AC Pump
   ExionLC AC Autosampler
   Exion AC Column Oven
   Data system – Analyst 1.6.3

2. AB Sciex Triple Quad 7500 QTRAP Ready or equivalent.

   Shimadzu DGU-405 Degasser
   Shimadzu LC-40D XR Pump A
   Shimadzu LC-40D XR Pump B
   Shimadzu SIL-40C XR Autosampler

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Shimadzu CBM-40 Controller
Shimadzu CTO-40C Column Oven
Data system – Sciex OS (Version 3.1.6.44)

3. Automated extractor, Proprietary Content or equivalent

4. HPLC columns

   a. Analytical column: Proprietary Content Catalog No. 00B-4439-Y0 or equivalent.
   b. Pre-column: Proprietary Content Catalog No. 00D-4435-Y0 or equivalent.

Reagents and Standards

All solvents, acids, and bases are stored in glass bottles in flammable proof cabinets or pressure resistant steel drums. Solvents, acids, and bases are stored at ambient temperature for up to 1 year. All non-solvents are stored according to manufacturer's storage conditions.

A. Reagents

1. Methanol (MeOH), "Chromasolv LC-MS" grade. Honeywell, Catalog No. 34966-4X4L or equivalent.

2. Acetonitrile (ACN). J.T. Baker, Catalog No. 9012-03 or equivalent.

3. Ammonium acetate. Sigma Aldrich, Catalog No. 431311-250G or equivalent. Store at 0-6°C.

4. Proprietary Content.

   a. Proprietary Content.

   b. Proprietary content.

   c. Proprietary Content.

5. 30:70 (v/v) Methanol:Water – Add methanol (300 mL) to water (700 mL). Store at room temperature. Replace after 1 month.

6. Methanol with 5% water - Add reagent water (50 mL) to methanol (950 mL). Store at room temperature. Replace after 1 month.

7. Formic Acid, ACS-grade. Sigma, Catalog No. 33015-1L or equivalent.

   a. Formic acid (aqueous, 0.1 M) - Dissolve formic acid (4.6 g or 3.8 mL) in reagent water (1 L). Store at room temperature. Replace after 2 years.

   b. Formic acid (aqueous, 0.3 M) - Dissolve formic acid (13.8 g or 11.3 mL) in reagent water (1 L). Store at room temperature. Replace after 2 years.

   c. Formic acid (aqueous, 5% v/v) - Mix 5 mL formic acid with 95 mL reagent water. store at room temperature. Replace after 2 years.

   d. Formic acid (aqueous, 50% v/v) - Mix 50 mL formic acid with 50 mL reagent water. Store at room temperature. Replace after 2 years.

8. Mobile Phase A: Proprietary Content. Store at room temperature for up to 2 months. Different volumes can be prepared as long as final concentrations are equivalent.

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9. Mobile Phase B: Proprietary Content into a 2-L glass mobile phase bottle. Store at room temperature for up to 2 months.

10. Sand - Sigma-Aldrich, Part No. 274739-5Kg or equivalent.

B. Standards

Standards are prepared using calibrated pipettes, polypropylene microcentrifuge tubes, and polypropylene bottles to create solutions at desired concentrations. The concentrated solution is injected below the surface of the diluting solvent. After preparation is completed, standards should be vortexed to ensure complete mixing. Measurement of volumes less than 5 µl should be avoided in routine production operations.

All stock, intermediate and spiking solutions are prepared using methanol. All initial calibration, initial calibration verification, and linear branched working standard solutions are prepared using Proprietary Content.

All diluted solutions must be stored in HDPE containers that have been thoroughly rinsed with methanol.

Stock standard and intermediate standard solutions are stored in the dark in the refrigerator in labeled polypropylene screw-top vials, polypropylene bottles, or polypropylene centrifuge tubes.

Expiration dates are managed through LIMS Reagent module. Solutions transferred from sealed glass ampules to screw-capped vials are given expiration dates of 1 year from the date opened or the expiration date provided by the vendor, whichever occurs sooner. Intermediate solutions are given an expiration date of 6 months from the preparation date, or the expiration date from the ampule provided by the vendor, whichever occurs sooner. The ampules and transferred solutions are stored in the refrigerator in the dark.

Working native and labeled (extraction surrogate and internal standard) compound spiking solutions are given an expiration date of 6 months, or the expiration date of the solutions used to prepare the working solution, whichever occurs sooner. The solutions are stored in labeled polypropylene screw-top vials in the refrigerator in the dark. When these solutions are prepared they must be tested prior to use in the PFAS extraction lab and verified monthly until they are consumed by operations or expire. Records of the standard verification are maintained by the laboratory. Prior to use, the working spiking solution should be evaluated against recovery windows of 85-115% for all compounds that will be analyzed using that solution. Should a standard fail to meet these criteria, the data must be reviewed by departmental management for acceptability and/or corrective action.

Working initial calibration solutions are given an expiration date of 6 months, or the expiration date of the solutions used to prepare the working initial calibration solution, whichever occurs sooner.

The primary/preferred standard vendor is Wellington Laboratories, Inc. Ontario, Canada. Listed catalog numbers are taken from Wellington product lists. Equivalent standards may be substituted, if the listed standards are unavailable.

The solution concentration listed is as presented on the certificate of analysis and includes adjustment for purity and the salt form of the compound used.

The concentrations referenced for the sulfonate salts, (for example PFBS, PFHxS and PFOS) have already been corrected to the acid form by the standards supplier as noted in the example Certificate of analysis (CofA). See *Attachment 04*. If the compound purity is assayed to be 98% or greater, weight can be used without correction to calculate concentrations.

Log purchased standards into LIMS Reagent. Select the solution category SOURCE for purchased mixes and/or single-compound ampules. LIMS Reagent system will assign formatted names to the purchased standard solutions. The automatically-generated name can be overwritten with a manually created name if desired. Use labels printed through the LIMS Reagent to identify and track standard solutions after transfer from original ampule to storage vial. The CofA for the ampulated stock standard is attached in LIMS Reagent for reference.

Standards are prepared by transferring a known quantity of Standard to a final volume of solvent. Standard Preparation is documented in LIMS Reagent. Solutions are stored by Type in LIMS Reagent,

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i.e., INTERMEDIATE=working solutions and intermediate standards and SOURCE=stocks (ampulated solutions). Each Standard is given a unique name.

The following attachments provide examples of standard preparation and purchasing information. Refer to the documentation in LIMS Reagent for standards preparation information.

Attachment 05 - 1633 Native PFAS Intermediate A
Attachment 06 - 1633 Native PFAS Intermediate B
Attachment 07 - 1633 Native PFAS CAL8 Intermediate
Attachment 08 - 1633 Extracted Internal Standard Intermediate
Attachment 09 - 1633 Non-Extracted Internal Standard Intermediate
Attachment 10 - 1633 TOP Surrogate Intermediate
Attachment 11 - 1633 ICAL Standard Preparation Scheme
Attachment 12 - 1633 Initial Calibration Standard Concentrations
Attachment 13 - Bile Salts Stock Solution
Attachment 14 - Bile Salts Intermediate
Attachment 15 - Bile Salts Working Solution
Attachment 16 - 1633 WDM Standard
Attachment 17 - 1633 Native Mid-Level Spike
Attachment 18 - 1633 Native Low-Level Spike
Attachment 19 - 1633 ICV Working Standard
Attachment 20 - 1633 Purchased/Ampulated Standards

Calibration

A. Mass Calibration

Frequency	Acceptance Criteria	Corrective Action
Calibration - at least annually or as recommended by the instrument manufacturer, whichever is more frequent, to maintain instrument sensitivity and stability.	Per manufacturer recommendations. Optimize the precursor and product ions in *Attachment 01*	Repeat as needed.
Verification - on an as-needed basis (e.g., QC failures, ion masses fall outside of the required mass window, major instrument maintenance, or if the instrument is moved) prior to the analysis of any standards and samples and after each subsequent mass calibration.	Resolution must meet manufacturer recommendations. The mass assignments must be within ±0.2 amu of the values shown in *Attachment 01*.	Recalibrate as needed. Otherwise, proceed to ICAL.

B. Chromatographic conditions

The mass spectral acquisition rate must include a minimum of 10 spectra scans across each chromatographic peak. See the AB Sciex (5500/5500 Plus/7500) Acquisition, Quantitation, Gradient, and Detector Condition files for the most up to date chromatographic conditions. An example acquisition method and chromatographic conditions are shown in *Proprietary* Content. Modifications to these conditions can be made at the discretion of the analyst to improve resolution or the chromatographic process. All injections must use the same parameters as used in the ICAL.

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C. Retention Time Calibration

Frequency	Acceptance Criteria	Corrective Action
once per ICAL and at the beginning of the analytical sequence	The position of all target, EIS, and NIS peaks shall be set using the midpoint standard of the ICAL curve when ICAL is performed. When an ICAL is not performed, the initial CV retention times or the midpoint standard of the ICAL curve can be used to establish the RT window position. The RTs for the target analytes, EIS, and NIS compounds must fall within 0.4 minutes of the predicted retention times from the midpoint standard of the ICAL or initial CV, whichever was used to establish the RT window position for the analytical batch. All branched isomer peaks identified in either the calibration standard or the qualitative (technical grade) standard also must fall within 0.4 minutes of the predicted retention times from the midpoint standard of the ICAL or initial CV. For all target analytes with exact corresponding isotopically labeled analogs, target analytes must elute within 0.1 minutes of the associated EIS compound.	Recalibrate

D. Initial Calibration

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Frequency	Acceptance Criteria	Corrective Action
Prior to the analysis of samples, and after the mass calibration verification has met all criteria whenever the laboratory takes an action that changes the chromatographic conditions or might change or affect the initial calibration criteria when either the CV or Instrument Sensitivity Check (ISC) acceptance criteria have not been met.	A minimum of six calibration standards are required when using an average or linear curve fit. A minimum of seven calibration standards are required for a second-order curve fit (quadratic). The lowest standard must be at or below the RL. In general, Cal1 (at the RL), Cal2, Cal3, Cal4, Cal5, Cal6, Cal7, and Cal8 are included in the initial calibration. S/N ratio for the lowest standard within the quantitation range must be greater than or equal to 3:1 for quantification ions and the confirmation ions, or greater than or equal to 10:1 if the analyte only has a quantification ion. To use Average Response Factor: • %RSD for the response factors is less than or equal to 20% • if greater than 20%, try a Linear Regression. To use Linear Regression with a concentration weighing factor of 1/x: • The %RSE for all method analytes must be less than or equal to 20%. • if greater than 20%, try a Quadratic fit. To use Quadratic fit with a concentration weighing factor of $1/x^2$: • The %RSE for all method analytes must be less than or equal to 20%. For all curve fits, each calibration point is calculated back against the curve. The back calculated concentration for each calibration point must be within ±30% of its true value.	If the criteria are not met, the source of the problem must be determined and corrected. Situations may exist where the initial calibration can be used. In those cases, the data will be reported with a qualifying comment.

E. Initial Calibration Verification (ICV)

Frequency	Acceptance Criteria	Corrective Action
After ICAL prior to analyzing samples	ICV must be prepared from a second source. If a second source is not available, a separate preparation from the same stock (including intermediates) by a second analyst may be used. The calculated amount for each analyte must be within ±30% of the true value.	If this criteria is not met, re-inject or remake the standard. If the criteria is still not met, recalibration is necessary. Instrument maintenance may be needed prior to recalibrating.

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F. Calibration Verification (CV)

Frequency	Acceptance Criteria	Corrective Action
Once the calibration curve has been established, the continuing accuracy must be verified by analysis of a continuing calibration verification (CCV) standard at the beginning of each analytical sequence, every ten injections of a field sample extract, and at the end of the analytical sequence.	The calculated amount for each native in the CCV standard must be within ±30% of the true value. The absolute areas of the injection internal standard must be greater than 30% of the average areas measured during the initial calibration.	Samples that are not bracketed by acceptable CCV analyses must be reanalyzed. The exception to this would be if the CCV recoveries are high, indicating increased sensitivity, and there are no positive detections in the associated samples, the data may be reported with a qualifying comment. The source of the problem must be determined and the system recalibrated before continuing sample analysis.

Procedure

Data Types are included in brackets. If a Data Type is not needed (for example, no reagents were needed for pH adjustment), "NA" may be used.

A) Sample Preparation and Prescreen

1. Bring all samples to room temperature and vortex prior to starting. Thaw frozen samples in room temperature water. Weigh sample container with contents on a calibrated top loading balance to 0.1g and record the first reading in the automated prep entry system [*Gross Weight*].

2. Sample Volume:

    a. For all samples, the full bottle must be extracted. The sample must remain in the original sample container until after spiking solutions have been added.

    b. If a limited sample volume is submitted, spike sample in original container, then add Milli-Q water to bring to final volume of 125 mL prior to SPE extraction (see Procedure A.7 for spiking details).

    c. All water samples should be evaluated for Total Suspended Solids (TSS) by visual inspection. Although the full container volume of sample should be extracted, this method is applicable to aqueous samples containing up to 50 mg of suspended solids. For samples containing > 50 mg of suspended solids, or when unavoidable due to high levels of PFAS, smaller samples volumes may be analyzed. However, ultimately, visual inspection and analyst experience are all used to determine the volume to be used to extract the sample.

    d. TSS above 400 mg/L will likely require sample manipulation to effectively mitigate impacts on the solid phase extraction process and there may be impacts on data quality objectives. Every effort should be made in the field to properly collect samples with less than 50 mg of suspended solids. If sample dilution is required, this will result in elevated final reporting limits.

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In most cases a dilution factor less than 5X is sufficient which would result in RLs being elevated by up to 5X. Eurofins analyst will conduct a visual inspection of the sample and use professional judgement to determine the necessary dilution. If sample dilution is not acceptable for the project DQOs or significantly high TSS is anticipated e.g. >2,000 mg/L in a 125mL sample, the laboratory will centrifuge the sample according to the following procedure. This approach must be agreed to as part of the project DQOs up front and the analyst will proceed accordingly without further client consultation. Centrifugation can only be performed if the solids have high enough density to form a pellet or mass at the bottom of the bottle. Please note, not all samples will form such a mass, and the solids will not be extracted as a separate sample. With the use of isotope dilution, once labeled surrogates (EIS) are added to the sample, they distribute between all phases of the sample system (solid fraction, aqueous fraction, air/water interface, and water/container interface). These surrogates (EIS) are then used for recovery correction and the total PFAS concentration can be accurately reported for the whole sample, provided surrogate (EIS) recoveries are acceptable. A potential outcome of this approach is poor recoveries of the labeled surrogates (EIS) that will preferentially sorb to the particulates leading to qualified QC in the final results.

Note: Fill a 125-mL HDPE bottle with 125 mL of Milli-Q water. Using a calibrated balance, add 6.25 g of sand to the bottle to create a 5% (w/v) standard. Record the preparation of this standard in the reagent prep logbook and replace annually.

e. All attempts will be made to use the full volume of sample. If multiple bottles sizes were sent from the field, the appropriate sample volume will be processed. In cases where this is not possible, the sample is first gently swirled and then subsampled for pre-dilution. The sample aliquot is placed into a clean 125-mL HDPE container, brought up to 125 mL with Milli-Q water, and vortexed for 30 seconds to mix. Continue the extraction process with Procedure A.4. Clients will be notified, and the laboratory will proceed with the pre-dilution as necessary.

3. Use a 125-mL HDPE bottle [*QCBottleLotID*] for the Method Blank (MB), the Laboratory Control Sample (LCS), and the Low-level Laboratory Control Sample (LLCS). If the client has not requested an MS/MSD, an LCSD must be prepared as well. Fill each bottle with 125 mL of Milli-Q water. Record "150.0 g" as the gross weight and "25.0 g" as the tare weight for the batch QC samples.

4. Check that the pH is 6.0 ± 0.5. If necessary, adjust the pH with 50% formic acid or 30% ammonium hydroxide (or with 5% formic acid or 3% aqueous ammonium hydroxide). **NOTE: Never put pH test strips into the sample.** Record the acid or base lot number [*RgtID*] and amount used [*Amt*]. Use a disposable pipette [*TranferPipID*] to place a few drops of sample onto the pH paper [*pHIndID*].

5. If a client requests centrifugation, see T-PFAS-FRM74046.

6. Bring all spike solutions to room temperature and vortex for 30 seconds prior to use.

7. Spike QC and all samples with 25 µL of 1633_125 EIS Intermediate (1633_125_SS_#####). Spike LCS/LCSD/MS/MSD with 50 µL of 1633_125 Native Spike Mid (1633_125_MS_M_#####). Spike LLCS with 40 µL of 1633_125 Native Spike Low (1633_125_MS_L_#####). Vortex/Shake containers to mix thoroughly. Let samples equilibrate for 30 minutes after spiking. Document the technician who spike the sample [*Analyst ID - Reagent Drop*] as well as the spike witness [*Analyst ID - Reagent Drop Witness*].

8. Continue to either Manual SPE (Procedure B) or Automated SPE (Procedure C.)

B) Manual Solid Phase Extraction (SPE)

1. Before use, rinse each port of the SPE manifold [*ManifoldID*] with several milliliters of the following solvents in order:

- Proprietary
- Proprietary
- Proprietary
- Proprietary

2. Label each SPE cartridge [*SPECartType*] and *SPECartLot#*] to correspond with each associated sample/QC piece and attach to a rinsed SPE port. Record the SPE port number for each sample/QC piece on the batchlog.

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3. Condition each SPE cartridge with the following reagents in the following order without allowing the cartridges to go dry. Do not use vacuum during this step.

   a. Proprietary Content
   b. Proprietary Content
   c. Proprietary Content
   d. Proprietary Content

4. Label each sample bottle, cap, 15-mL centrifuge tube, and reservoir with the same number to ensure samples are not inadvertently switched during the extraction procedure (i.e.; 1,1,1; 2,2,2; 3,3,3; etc.).

5. Attach the labeled 25-mL SPE reservoir to each cartridge. Load the QC and samples to their respective cartridges. Allow sample to pass through. The drip rate should be approximately 3-5 drops per second.

6. After sample/QC has passed through, rinse the walls of the sample bottle with 5 mL reagent water. Add to cartridge and allow to pass through using vacuum. Then repeat.

7. After Milli-Q water has passed through, rinse the walls of the sample/QC bottle with 5 mL 30:70 (v/v) methanol:water [*RinseSolventName* and *RinseSolventLot*]. Add to cartridge and allow to pass through using vacuum. Then repeat.

8. Apply full vacuum to dry the cartridges until visibly dry (at least 10 minutes). Discard the rinse solution.

   NOTE: If a given sample is too problematic to extract using one cartridge with full vacuum, a second cartridge is created following Procedure B.2-4 above.

9. Place each empty sample bottle on the top-loading balance and weigh. Record the second reading in the automated prep entry system. The prep entry system will calculate the sample weight to 0.1g. Record the calculated weight as the sample volume on the batchlog.

10. Proprietary Content to the bottom of each SPE cartridge.

11. Place labeled 15-mL polypropylene centrifuge collection tubes [*CentrifugeTube*]under each respective SPE cartridge ensuring the delivery needles to do not touch the sides of the tubes.

12. Rinse the inside of each empty sample/QC bottle with Proprietary Content. Add to reservoir and cartridge.

13. Apply a slight vacuum to the manifold in order to reclaim as much solvent as possible from the SPE cartridges.

14. Disconnect the cartridge/adapter from the manifold. Remove the collection tubes.

    Note: If a second cartridge was required, the eluent from the second cartridge is added to the first cartridge eluent with a methanol rinse and then blown down to 5 mL on an N-EVAP prior to step 16 below.

15. Bring each sample extract to final volume 5 mL using methanol with Proprietary Content. Cap and vortex for 30 seconds to mix.

16. Proceed to Procedure D - Vialing and Addition of Internal Standard

C) Automated Solid Phase Extraction (SPE) by Proprietary

This procedure can be used in place of the manual extraction described in Procedure B.

Note: all samples must be prescreened prior to use of the Proprietary to avoid carryover and contamination.

1. Label each SPE cartridge [*SPECartType* and *SPECartLot#*] to correspond with each associated sample/QC piece and attach to a rinsed SPE port. Record the SPE port number for each sample/QC piece on the batchlog.

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2. Check to make sure all reagent bottles are filled and that reagents are not expired. Record Proprietary ID and reagent lot numbers. [*ManifoldID*, *SPE_Cond#1ID*, *SPE_Cond#2ID*, *RinseSolventName*, *RinseSolventLot*, *SolventName*, and *SolventLot*]

3. Label each sample bottle, cap, and Proprietary cartridge with the same number to ensure samples are not inadvertently switched during the extraction procedure (i.e.; 1,1,1; 2,2,2; 3,3,3; etc.).

4. Select "Proprietary" from the drop down menu to start the cleaning cycle prior to SPE. Make sure the "Clean" cartridges and bottles are attached for this cycle.

5. Remove "Clean" cartridges and attach the labeled cartridges that will be used when running the samples when the system cleaning is complete. Disconnect the "Clean" bottles. Attach the labeled sample bottles by twisting the bottles and not the cap. Attach a filter [*FilterEXPID*] to each cap. Place sample bottles upside down in corresponding numbered location on shaker. Poke two holes into the lip of each bottle. Load labeled centrifuge tubes [*CentrifugeTube*] in the moving tray beneath the cartridges.

6. Select "Proprietary" from the drop down menu and press the green check mark to start the procedure. The Proprietary program is described in *Proprietary*.

7. When the cycle pauses after cartridge drying, attach Proprietary to the bottom of each SPE cartridge and uncapped tubes in the moving tray.

8. Once the cycle is complete, remove centrifuge tubes and discard the used cartridges and bottles. Reattach "Clean" bottles and cartridges, select "Proprietary" from menu, select "start". This must be done between each batch and at the beginning and the end of the day. At the end of the day, run the "Proprietary" clean cycle.

9. Place each empty sample bottle on the top-loading balance and weigh. Record the second reading in the automated prep entry system [*TareWeight*]. The prep entry system will calculate the sample weight to 0.1g. Record the calculated weight as the sample volume on the batchlog.

10. The batch QC must be rotated among the Proprietary ports so that all the ports are covered over the course of a quarter. Use form *T-PFAS-FRM80101* for tracking.

11. Bring each sample extract to final volume 5 mL using methanol with Proprietary. Cap and vortex for 30 seconds to mix.

12. Proceed to Procedure D - Vialing and Addition of Internal Standard

D) Vialing and Addition of Internal Standard

Note: The instrument lab chemist performs these steps.

1. Determine the sample aliquot to use for analysis. Add Internal Standard Spike Solution (1633_125_IS_V_#####) to the corresponding labeled autosampler vial [*VialLot#*].

    - 10 µL IS into a 190 µL aliquot of sample (final volume = 200 µL)
    - 25 µL IS into a 475 µL aliquot of sample (final volume = 500 µL)
    - 50 µL IS into a 950 µL aliquot of sample (final volume = 1000 µL)

2. Transfer an aliquot of the final extract (as determined in Step 1 above) to the corresponding labeled auto-sampler vial.

3. Cap the auto-sampler vial [*Caps*] and vortex for 30 seconds. Samples are now ready for analysis.

4. Cap the centrifuge tube. The remaining centrifuged extracts are stored in the refrigerator for dilution or reinjection if needed.

E) LC/MS/MS Analysis

1. Load sample vials containing calibration standards, quality control samples, and sample extracts into the autosampler tray. Allow the instrument adequate time to equilibrate to ensure the mass

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spec and LC have reached operating conditions (approximately 5 minutes) before the first injection. Analyze several solvent blanks to clean the instrument prior to sample acquisition.

2. Bring standards to room temperature and vortex before calibrating. To eliminate the need for a qualitative identification standard, the calibration standards contain the branched isomers for PFHxS, PFOS, NMeFOSAA, NEtFOSAA, PFNA, PFOA, PFOSA, NEtFOSE, NMeFOSE, NEtFOSA, and NMeFOSA. Mass Transitions are defined in *Attachment 01*.

Example Initial Calibration Sequence (LIMS ID):

Instrument Blank to clean instrument (at least 3)
1. CAL 1 (IC)
2. CAL 2 (IC)
3. CAL 3 (IC)
4. CAL 4 (IC)
5. CAL 5 (ICISAV)
6. CAL 6 (IC)
7. CAL 7 (IC)
8. CAL 8 (IC)
9. Instrument Blank (ICB)
10. Initial Calibration Verification (ICV)
11. Bile Salts Standard (WDM)

3. Isotopically-labeled compounds are not available for some compounds. See below for compounds without labeled isotopes and their referenced extraction standards. See *Attachment 02* shows the full list of analytes and their EIS and NIS.

Note: For better accuracy, PFTrDA is quantitated using the average of the areas of labeled compounds 13C2-PFTeDA and 13C2-PFDoA.

Native	Extracted Internal Standard
3:3FTCA	13C5-PFPeA
PFMPA	
PFMBA	
NFDHA	13C5-PFHxA
5:3FTCA	
7:3FTCA	
PFEESA	
DONA	13C3-HFPO-DA
9Cl-PF3ONS	
11Cl-PF3OUdS	
PFTrDA	Avg 13C2-PFTeDA and 13C2-PFDoA
PFHpS	13C8-PFOS
PFNS	
PFDS	
PFDoS	
PFPeS	13C3-PFHxS
TFSI	
FHxSA	
PFECHS	
PFODA	13C2-PFTeDA

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Native	Extracted Internal Standard
FBSA	13C3-PFBS

Example Sample Sequence (LIMS ID):

Instrument Blanks to clean instrument if needed (at least 3)
1. Instrument Sensitivity Check at CAL1 (CCVO)
2. Calibration Verification at CAL4 (CCV)
3. Instrument Blank (CCB)
4. Bile Salts marker (WDM)
5. Method Blank (MB)
6. On-going Precision and Recovery (LCS)
7. Low-level OPR (LLCS)
8. On-going Precision and Recovery Duplicate (LCSD)
9. Samples (10 or less)
10. Calibration Verification at CAL4 (CCV)
11. Instrument Blank (CCB)

4. Instrument Blank (ICB, CCB) - Instrument Blanks need to be analyzed immediately following the highest standard analyzed and daily at the start of a sequence. The concentration of all analytes must be less than the MDL. If acceptance criteria are not met, the calibration must be performed using a lower concentration standard for the high standard until the criteria are met.

5. Instrument Sensitivity Check (CCVO) - Prior to sample analysis, an Instrument Sensitivity Check (ISC) must be performed. The ISC standard concentration must be at the LOQ. The CAL1 standard's concentration is at the LOQ, so the CAL1 standard will be analyzed. All analyte concentrations must be within ±30% of their true values. The signal-to-noise ratio must be greater than or equal to 3:1 for the quantitation ions and confirmation ions, and 10:1 for quantitation ions that have no confirmation ion. If the criteria are not met, correct problem and rerun ISC. If a target analyte (or EIS) reads back high with no detection (or in-spec recoveries) in the samples, data may be reported. If problem persists, repeat the ICAL. No samples can be analyzed until the ISC meets acceptance criteria.

6. Bile Salt Interference Check (WDM) - Analyze a Window-Defining Matrix (WDM) standard containing 100 ppb of Taurodeoxycholic Acid (TDCA), Taurochenodeoxycholic Acid (TCDCA), and Tauroursodeoxycholic Acid (TUDCA). The laboratory must establish chromatographic conditions to ensure the bile salt (TDCA) does not cause interference during the analysis of samples. To demonstrate successful separation the retention time of TDCA must be at least 1 minute outside the retention time window of PFOS. This is demonstrated as a comparison of the RT of TDCA (measured at the apex of the TCDA peak) separated by at least 1.4 minutes from the RT of the linear isomer of PFOS (measured at the apex of the peak of the linear isomer of PFOS). If the mobile phase does not contain acetonitrile, this check must include all three bile salts (TDCA, TCDCA, and TUDCA). If adequate separation is not achieved, adjust the chromatographic conditions and reevaluate the separation of TDCA from PFOS.

7. After injections are completed, check all CCV recoveries and absolute areas to make sure they are within method control limits. See Calibration F for acceptance criteria. Process each chromatogram and closely evaluate all integrations, baseline anomalies, and retention time differences. If manual integrations are performed, they must be documented and a reason given for the change in integrations. The manual integrations are documented during data processing and all original integrations are reported at the end of the sample PDF file with the reason for manual integration clearly listed.

8. Quantitate results for the Method Blank (MB). Calculate the recoveries of spiked analytes for the LCS and its duplicate (LCSD, if needed), Low-Level LCS, Matrix Spike and Matrix Spike Duplicate (MS/MSD) by comparing concentrations observed to the true values. Calculate the relative percent difference (RPD) between the duplicates.

9. Isotopically-labeled Extraction Standards (EIS) are added to all samples, MB, LLCS, LCS/LCSD, and MS/MSD prior to extraction. Isotopically-labeled Injection Standards (NIS) are added to each QC and field sample extract prior to analysis. Quantitation by isotope dilution generally precludes any adverse effect on data quality due to EIS recoveries being outside of the acceptance limits as long as the signal-to-noise ratio is greater than 10:1.

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10. To identify a target or EIS:

    a. Peak responses of quantitation and confirmation ions must have S/N of at least 3:1. If there is no confirmation ion, the quantitation ion must have S/N of at least 10:1. If the S/N ratio is not met, the analyte is considered to be ND.

    b. The retention times should not vary by more than 0.4 minutes from the expected retention time from the midpoint of the ICAL or initial CV. Furthermore, native compounds with an exact isotopically-labeled analogue must elute within 0.1 minutes from their associated analog. If the retention time is outside of the criteria, the compound is considered a false positive unless it is a compound with branched isomers. Compounds with branched isomers can vary in intensity of the individual isomers that are used for reporting and must be reviewed and compared to the preceding CCV to determine if it should be reported.

    c. For concentrations at or above the LOQ, the Ion Abundance Ratio (IAR) must fall within ±50% of the IAR observed in the mid-point initial calibration standard. The total response of all isomers (branched and linear) in the quantitative standards must be used to define the IAR. In samples, the total response should include only the branched isomer peaks that have been identified in either the quantitative or qualitative standard.

11. Two ion transitions and the ion transition ratio per analyte shall be monitored and documented with the exception of PFBA, PFECA F (PFMPA), PFECA A (PFMBA), NMeFOSE, NEtFOSE, FBSA, and FHxSA. The expected ion ratio for each compound is calculated by using the average of ion ratios of each compound from initial calibration standards. When an ion ratio for a compound differs from the expected ion ratio by more than 50%, see QA/QC section for Corrective Action.

F) Dilutions

Aqueous samples are prescreened prior to extraction to ensure concentrations do not exceed the range of the method and will not contaminate the laboratory or instrumentation. Samples with high concentrations of target PFAS which have the potential to contaminate the laboratory or the instrument will be extracted at a lower volume to mitigate those risks. Samples determined to be at or above 100x the level of the high standard will be diluted to mitigate the need for dilutions of the sample extract above 10x. For example, prescreen results at 125x the high standard would require that the sample prior to extraction be diluted by a factor of 12.5x (125/10 = 12.5). This would be done by using a 10mL portion of the sample (125/12.5 = 10) and bringing to a final volume of 125mL for extraction.

All attempts will be made to use the full volume of sample if multiple bottles sizes were sent from the field. In cases where this is not possible, the sample is first shaken, then subsampled for pre-dilution. Clients will be notified, and the laboratory will proceed with the pre-dilution as necessary. Samples requiring dilution due to high concentrations will be noted in the case narrative. Note that results based solely off the pre-dilution of a sample DO NOT have a dilution factor as dilution factors are only applied to extract dilutions.

When the area of the primary transition of a target analyte is above the area of the highest calibration point a sample dilution is required. Dilute the extract as follows:

1. Remove extracts from storage and allow to come to room temperature for approximately 60-90 minutes.
2. Vortex the extract for one minute.
3. Using a pipette or syringe, remove an aliquot of the extract, this extract should target a dilution equivalent to the mid-level concentration of the calibration curve to avoid over diluting the extract.
4. Dilute the aliquot to volume using Proprietary Content.
5. Fortify with additional NIS to achieve the same concentration of NIS in the original extract.
6. Vortex an aliquot for analysis.

If the S/N of EIS associated with the analyte requiring dilution in the extract meets the S/N requirement for EIS and the recovery of the associated EIS meet the method criteria, the results from the dilution can be reported. If these criteria are not met and additional sample is available, a smaller volume/mass of sample should be extracted.

Calculations

1. Peak Area Ratio

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$$\text{Peak Area Ratio} = \frac{\text{Analyte Response}}{\text{Labeled Analyte Response}}$$

2. On-Column Analyte Concentration using average RRF

   On-column Concentration = peak area ratio ÷ AVE RRF

3. On-Column Analyte Concentration using linear curve

   On-column Concentration = (peak area ratio - intercept) ÷ slope

4. Sample Concentration

   Sample concentration (ng/l) = (On-column concentration x Final Sample Volume x DF) ÷ Initial Sample Volume

5. Ion Abundance Ratio (IAR)

   Ion Abundance Ratio (IAR) = (peak area or height of quantifier)/(peak area or height of qualifier)

6. See *T-PEST-WI9847* for additional calculations used to evaluate the calibrations and quality control samples.

Statistical Information/Method Performance

Historical data for LCS/Ds, LLCSs, MS/Ds, and EIS is reviewed at least annually. However, all samples are reported using the limits in EPA 1633 Tables 5 and 6. When target analytes not on these tables are requested, statistical limits are used for LCS/MS. (Preliminary limits of 70-130% Recovery and <20% RPD can be used until enough data points are generated.) Reporting limits including method detection limits (MDLs) and limits of quantitation (LOQs) are set according to EPA method requirements and are evaluated annually. Refer to *QA-SOP11892* for specific guidelines and procedures. Updates to the LIMS are made as needed by the QA Department and only as directed by the supervisor.

As MDL studies are run on clean laboratory matrices, statistically derived MDL values could be artificially lower than achievable limits in real world samples. Nominal MDL values, set at no lower than 1/4 the calculated and verified Reporting Limit (or Limit of Quantitation) will be used as a method to avoid artificially low bias in MDL studies.

Quality Assurance/Quality Control

For each batch of samples extracted, a method blank, an LCS, and an LLCS must be extracted and analyzed. An MS/MSD are extracted only if requested and submitted by the client. If no MS/MSD is provided, an LCS/LCSD must be extracted and analyzed instead. A batch is defined as the samples to be extracted on any given day, but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared. If any client, state, or agency has more stringent QC or batching requirements, these must be followed.

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QC Item	Frequency	Acceptance Criteria	Corrective Action
Method Blank (MB)	One per extraction batch of no more than 20 field samples	No target analytes greater than RL, or greater than 1/10 the amount measured in any sample, or 1/10 the regulatory limit (whichever is greater).	Verify instrument clean (evaluate calibration blank & samples prior to method blank), then reanalyze. Evaluate to determine if systematic issue within laboratory, correct, then re-prepare and reanalyze the method blank and all samples processed with the contaminated blank.
Low-Level On-going Precision and Recovery (LLCS)	One per extraction batch of no more than 20 field samples	Acceptance criteria defined in *Attachment 22* (Tables 5 and 6 of Method 1633)	Reanalyze LLCS once. If acceptable, report. Evaluate samples for detections, and LLCS for high bias. If LLCS has high bias, and samples non-detect, report and narrate. If LLCS has low bias, or if there are detections for critical chemicals of concern, evaluate and reprep and reanalyze the LLCS and all samples in the associated prep batch for failed analytes, if sufficient sample material is available.
On-going Precision and Recovery and its Duplicate (LCS)	One per extraction batch of no more than 20 field samples	Acceptance criteria defined in *Attachment 22* (Tables 5 and 6 of Method 1633)	Reanalyze LCS once. If acceptable, report. Evaluate samples for detections, and LCS for high bias. If LCS has high bias, and samples non-detect, report and narrate. If LCS has low bias, or if there are detections for critical chemicals of concern, evaluate and re-prep and reanalyze the LCS and all samples in the associated prep batch for failed analytes, if sufficient sample material is available.
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	*at client request*, one per extraction batch of no more than 20 field samples	Acceptance criteria defined in *Attachment 22* (Tables 5 and 6 of Method 1633) RPD less than 30%	If outside the acceptance windows, consult a supervisor to determine the appropriate course of action based on batch and sample results.

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QC Item	Frequency	Acceptance Criteria	Corrective Action
Extracted Internal Standards (EIS) or Isotope Dilution Analyte (IDA), added prior to extraction	per sample (including MB, LCS, LCSD, LLCS, MS, MSD) during preparation	Acceptance criteria defined in *Attachment 22* (Table 6 of Method 1633)	1. If EIS outside windows, check for errors and correct. Re-analyze sample, if needed. 2. If EIS out high and samples are non-detect, report and narrate. If EIS out high with detections, but EIS <200% (FTS <350%), report and narrate. If EIS out high with detections and EIS >200% (FTS >350%), dilute 10X, re-analyze, report, and narrate. 3. If EIS low but > 5% and S/N > 10:1, narrate and report. If EIS <5% then contact client to re-extract at smaller aliquot.
Non-extracted Internal Standards (NIS) added following extraction and prior to analysis	per sample (including MB, LCS, LCSD, LLCS, MS, MSD) during preparation	NIS areas 50-200% of the mean area of the most recent ICAL in undiluted sample extracts and sample extracts that require NIS to be added.	If fails high, check for errors and report. If fails low, re-analyze fresh aliquot of sample. If in control, report. If the failure confirms report the initial analysis and narrate.
Ion Abundance Ratio (IAR)	Each detected analyte (except PFBA, PFPeA, NMeFOSE, NEtFOSE, PFMPA, PFMBA, FBSA, FHxSA)	Acceptance window of 50-150% of the ratio in the mid-point CCV standard.	Check for error, if none found report as outlined below. 1. If outside limits and value is less than the RL, report as ND at RL. 2. If outside limits, but within 2X rule* flag, report and narrate. 3. If ratio outside 2X rule* then report as ND at elevated RL, apply G flag and narrate. 4. If ratio out due to branched isomer contribution, report as positive with narration. 5. If outside limits (and RT window) due to matrix, report as ND at elevated RL, apply G flag and narrate.
E-flagged data	NA	NA	Dilute sample extract. If still E-flagged after dilution, consult the client for course of action.

*2X Rule: If the ion ratio <0.5X the lower control limit or >2X the upper control limit, then do not report the analyte. It should be either Non-Detect at the RL or elevate the RL as needed (G flag). As an example if the target ion ratio is 4.00. The Chrom-determined limits are 2.00-6.00. If the ratio is <1.00 (2.00 X 0.5) or >12.00 (6.00 X 2) follow the specifications above.

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Attachment:
Attachment 01 - Mass Transitions (.pdf)
Attachment 02 - Standard Relationships (.pdf)
Attachment 03 – Proprietary Content
Attachment 04 - Example CoA (.pdf)
Attachment 05 - Native PFAS Intermediate A (.pdf)
Attachment 06 - Native PFAS Intermediate B (.pdf)
Attachment 07 - Native PFAS CAL8 Intermediate (.pdf)
Attachment 08 - 1633 EIS Intermediate (.pdf)
Attachment 09 - 1633 NIS Intermediate (.pdf)
Attachment 10 - 1633 TOP SS Intermediate (.pdf)
Attachment 11 - Initial Calibration Standards Preparation (.pdf)
Attachment 12 - ICAL Standard Concentration (.pdf)
Attachment 13 - Bile Salts Stock Solutions (.pdf)
Attachment 14 - Bile Salts Intermediate (.pdf)
Attachment 15 - Bile Salts Working Solution (.pdf)
Attachment 16 - 1633 WDM (.pdf)
Attachment 17 - Native Mid Level Spike (.pdf)
Attachment 18 - Native Low Level Spike (.pdf)
Attachment 19 - ICV Working Standard (.pdf)
Attachment 20 - Purchased Standards (.pdf)
Attachment 21 – Proprietary Content
Attachment 22 - Tables 5-6 (EPA 1633) (.docx)

G-DC-FRM23907 Redacted SOPs
QA-SOP11178 Demonstrations of Capability
QA-SOP11892 Determining Method Detection Limits and Limits of Quantitation
T-PEST-WI9847 Common Equations Used During Chromatographic Analyses
T-PFAS-FRM80101 D4033 - QC Rotation Tracking Form
T-PFAS-WI21568 Environmental Monitoring in the PFAS Lab
T-PFAS-WI23588 Preventative and Corrective Maintenance for the AB Sciex Liquid Chromatograph Mass Spectrometers (LC/MS/MS)
T-PFAS-WI50447 PFAS Prescreen Method in Water Samples Requesting PFAS by Isotope Dilution
T-WC-WI53304 Total Suspended Solids (TSS Gravimetric) Prescreen for PFAS by EPA Draft Methods in Aqueous Samples
Attachment: Attachment 01 - Mass Transitions (pdf)
Attachment: Attachment 02 - Standard Relationships (pdf)
Attachment: Attachment 03 – Proprietary Content Attachment:
Attachment 04 - Example CoA (pdf)
Attachment: Attachment 05 - Native PFAS Intermediate A (pdf)
Attachment: Attachment 06 - Native PFAS Intermediate B (pdf)
Attachment: Attachment 07 - Native PFAS CAL8 Intermediate (pdf)
Attachment: Attachment 08 - 1633 EIS Intermediate (pdf)
Attachment: Attachment 09 - 1633 NIS Intermediate (pdf)
Attachment: Attachment 10 - 1633 TOP SS Intermediate (pdf)
Attachment: Attachment 11 - Initial Calibration Standards Preparation (pdf)
Attachment: Attachment 12 - ICAL Standard Concentration (pdf)
Attachment: Attachment 13 - Bile Salts Stock Solutions (pdf)
Attachment: Attachment 14 - Bile Salts Intermediate (pdf)
Attachment: Attachment 15 - Bile Salts Working Solution (pdf)
Attachment: Attachment 16 - 1633 WDM (pdf)
Attachment: Attachment 17 - Native Mid Level Spike (pdf)
Attachment: Attachment 18 - Native Low Level Spike (pdf)
Attachment: Attachment 19 - ICV Working Standard (pdf)
Attachment: Attachment 20 - Purchased Standards (pdf)
Attachment: Attachment 21 – Proprietary Content
Attachment: Attachment 22 - Tables 5-6 (EPA 1633) (docx)

End of document

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Version history

Version	Approval	Revision information	
3.1	27.AUG.2024		
4	31.OCT.2024		
5	11.MAR.2025		

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Attachment 1 – Mass Transitions

CAS#	Compound	Parent Ion	Daughter Ion
422-64-0	PFPrA	163.00	119.00
STL03194	13C3-PFPrA	166.00	121.00
STL02680	13C3-PFBA	216.00	172.00
STL00992	13C4-PFBA	216.80	171.90
375-22-4	PFBA	212.80	168.90
377-73-1	PFECA F (PFMPA)	229.00	84.90
356-02-5	3:3 FTCA	241.00	177.00
	3:3 FTCA (2)	241.00	117.00
2706-90-3	PFPeA	263.00	219.00
STL01893	13C5-PFPeA	268.30	223.00
863090-89-5	PFECA A (PFMBA)	279.00	85.10
82113-65-3	TFSI	280.00	147.00
	TFSI (2)	280.00	78.00
13252-13-6	HFPODA	284.90	168.90
	HFPODA (2)	284.90	184.90
STL02255	13C3-HFPODA	286.90	168.90
	13C3-HFPODA (2)	286.90	184.90
151772-58-6	PFECA B (NFDHA)	295.00	201.00
	PFECA B (NFDHA) (2)	295.00	84.90
375-73-5	PFBS	298.70	79.90
	PFBS (2)	298.70	98.80
STL02337	13C3-PFBS	302.10	79.90
307-24-4	PFHxA	313.00	269.00
	PFHxA (2)	313.00	118.90
113507-82-7	PFEESA (PES)	314.80	134.90
	PFEESA (PES) (2)	314.80	82.90
STL00993	13C2-PFHxA	315.10	270.00
STL02577	13C5-PFHxA	318.00	273.00
757124-72-4	4:2-FTS	327.10	307.00
	4:2-FTS (2)	327.10	80.90
914637-49-3	5:3 FTCA	341.00	237.10
	5:3 FTCA (2)	341.00	217.00
2706-91-4	PFPeS	349.10	79.90
	PFPeS (2)	349.10	98.90
375-85-9	PFHpA	363.10	319.00
	PFHpA (2)	363.10	169.00
STL01892	13C4-PFHpA	367.10	322.00
919005-14-4	DONA	376.90	250.90
	DONA (2)	376.90	84.80
41997-13-1	FHxSA	397.90	78.00

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Attachment 1 – Mass Transitions

CAS#	Compound	Parent Ion	Daughter Ion
355-46-4	PFHxS	398.70	79.90
	PFHxS (2)	398.70	98.90
STL02581	13C3-PFHxS	402.10	79.90
STL00994	18O2-PFHxS	403.00	83.90
335-67-1	PFOA	413.00	369.00
	PFOA (2)	413.00	169.00
STL00623	13C2-PFOA	415.00	370.00
STL00990	13C4-PFOA	417.10	372.00
STL01054	13C8-PFOA	421.10	376.00
27619-97-2	6:2-FTS	427.10	407.00
	6:2-FTS (2)	427.10	80.90
STL02279	13C2-6:2-FTS	429.10	80.90
812-70-4	7:3 FTCA	441.00	316.90
	7:3 FTCA (2)	441.00	336.90
375-92-8	PFHpS	449.00	79.90
	PFHpS (2)	449.00	98.80
133201-07-7	PFECHS	461.00	381.00
	PFECHS (2)	461.00	99.00
375-95-1	PFNA	463.00	419.00
	PFNA (2)	463.00	219.00
STL00995	13C5-PFNA	468.00	423.00
STL02578	13C9-PFNA	472.10	427.00
516-50-7	TDCA	498.00	80.00
754-91-6	PFOSA	498.10	77.90
	PFOSA (2)	498.10	478.00
516-35-8	TCDCA	498.10	80.00
14605-22-2	TUDCA	498.20	80.00
1763-23-1	PFOS	498.90	79.90
	PFOS (2)	498.90	98.80
STL00991	13C4-PFOS	502.80	79.90
STL01056	13C8-PFOSA	506.10	77.80
STL01054	13C8-PFOS	507.10	79.90
31506-32-8	NMeFOSA	511.90	219.00
	NMeFOSA (2)	511.90	169.00
335-76-2	PFDA	512.90	469.00
	PFDA (2)	512.90	219.00
STL02705	d3-NMeFOSA	515.00	219.00
STL00996	13C2-PFDA	515.10	470.10
STL02579	13C6-PFDA	519.10	474.10
4151-50-2	NEtFOSA	526.00	219.00
	NEtFOSA (2)	526.00	169.00
39108-34-4	8:2-FTS	527.10	507.00
	8:2-FTS (2)	527.10	80.80

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Attachment 1 – Mass Transitions

CAS#	Compound	Parent Ion	Daughter Ion
STL02280	13C2-8:2-FTS	529.10	80.90
756426-58-1	9Cl-PF3ONS	530.80	351.00
	9Cl-PF3ONS (2)	532.80	353.00
STL02704	d5-NEtFOSA	531.10	219.00
68259-12-1	PFNS	548.80	79.90
	PFNS (2)	548.80	98.80
2058-94-8	PFUnA	563.10	519.00
	PFUnA (2)	563.10	269.10
STL00997	13C2-PFUnA	565.00	520.00
STL02580	13C7-PFUnA	570.00	525.10
2355-31-9	NMeFOSAA	570.10	419.00
	NMeFOSAA (2)	570.10	483.00
STL02118	d3-NMeFOSAA	573.20	419.00
2991-50-6	NEtFOSAA	584.20	419.10
	NEtFOSAA (2)	584.20	526.00
STL02117	d5-NEtFOSAA	589.20	419.00
335-77-3	PFDS	599.00	79.90
	PFDS (2)	599.00	98.80
307-55-1	PFDoDA	613.10	569.00
	PFDoDA (2)	613.10	319.00
STL00998	13C2-PFDoDA	615.10	570.00
24448-09-7	NMeFOSE	616.10	58.90
STL02277	d7-NMeFOSE	623.20	58.90
1691-99-2	NEtFOSE	630.00	58.90
763051-92-9	11Cl-PF3OUdS	630.90	450.90
	11Cl-PF3OUdS (2)	632.90	452.90
STL02278	d9-NEtFOSE	639.20	58.90
72629-94-8	PFTrDA	663.00	619.00
	PFTrDA (2)	663.00	168.90
79780-39-5	PFDoS	699.10	79.90
	PFDoS (2)	699.10	98.80
376-06-7	PFTeDA	713.10	168.90
	PFTeDA (2)	713.10	219.00
STL02116	13C2-PFTeDA	715.20	670.00
16517-11-6	PFODA	913.00	869.00
	PFODA (2)	913.00	169.00

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Attachment 2 - PFAS Injection Standards/Extraction Standards/Native Compounds

Native	Extraction Standard	Internal Standard
PFBA	13C4-PFBA	13C3-PFBA
PFPrA	13C3-PFPrA	
PFPeA	13C5-PFPeA	13C2-PFHxA
3:3FTCA		
PFMPA		
PFMBA		
PFHxA	13C5-PFHxA	
NFDHA		
5:3FTCA		
7:3FTCA		
PFEESA		
PFHpA	13C4-PFHpA	
HFPO-DA	13C3-HFPO-DA	
ADONA		
9Cl-PF3ONS		
11Cl-PF3OUdS		
PFOA	13C8-PFOA	13C4-PFOA
PFNA	13C9-PFNA	13C5-PFNA
PFDA	13C6-PFDA	13C2-PFDA
PFUnA	13C7-PFUnA	
PFDoA	13C2-PFDoA	
PFTeDA	13C2-PFTeDA	
PFODA		
PFTrDA	Avg 13C2-PFTeDA and 13C2-PFDoA	
PFBS	13C3-PFBS	18O2-PFHxS
FBSA		
PFPeS	13C3-PFHxS	
PFHxS		
FHxSA		
PFECHS		
TFSI		
4:2-FTS	13C2-4:2-FTS	
6:2-FTS	13C2-6:2-FTS	
8:2-FTS	13C2-8:2-FTS	
PFHpS	13C8-PFOS	13C4-PFOS
PFOS		

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Attachment 2 - PFAS Injection Standards/Extraction Standards/Native Compounds

Native	Extraction Standard	Internal Standard
PFNS		
PFDS		
PFDoS		
PFOSA	13C8-PFOSA	
NMeFOSA	d3-NMeFOSA	
NEtFOSA	d5-NEtFOSA	
NMeFOSAA	d3-NMeFOSAA	
NEtFOSAA	d5-NEtFOSAA	
NMeFOSE	d7-N-MeFOSE-M	
NEtFOSE	d9-N-EtFOSE-M	

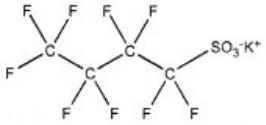
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Attachment 4 – Example CoA

WELLINGTON LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

PRODUCT CODE:	L-PFBS	**LOT NUMBER:**	LPFBS1022
COMPOUND:	Potassium perfluoro-1-butanesulfonate		
STRUCTURE:		**CAS #:**	29420-49-3



MOLECULAR FORMULA:	$C_4F_9SO_3K$	**MOLECULAR WEIGHT:**	338.19
CONCENTRATION:	50.0 ± 2.5 µg/mL (K salt) 44.4 ± 2.2 µg/mL (PFBS acid) 44.2 ± 2.2 µg/mL (PFBS anion)	**SOLVENT(S):**	Methanol
CHEMICAL PURITY:	>98%		
LAST TESTED: (mm/dd/yyyy)	10/04/2022		
EXPIRY DATE: (mm/dd/yyyy)	10/04/2027		
RECOMMENDED STORAGE:	Store ampoule in a cool, dark place		

DOCUMENTATION/ DATA ATTACHED:

Figure 1: LC/MS Data (Full Scan and Mass Spectrum)
Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Certified By: _____ **Date:** 10/14/2022 (mm/dd/yyyy)
B.G. Chittim, General Manager

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

Form#:27, Issued 2004-11-10
Revision#:9, Revised 2020-12-23

INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compound it contains.

HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products are compared to older lots in the same manner, which further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters x_1, x_2,...x_n on which it depends is:

$$u_c(y(x_1, x_2, \ldots x_n)) = \sqrt{\sum_{i=1}^{n} u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A1226), and ISO 17034 by ANSI National Accreditation Board (ANAB; AR-1523).

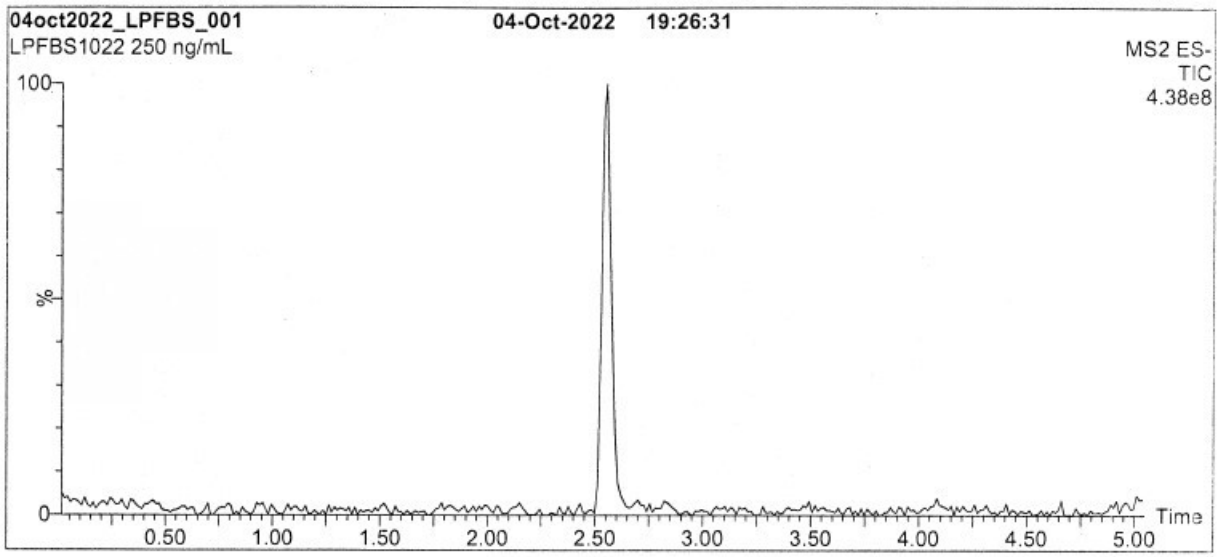
CALA Testing Accreditation No. A1226

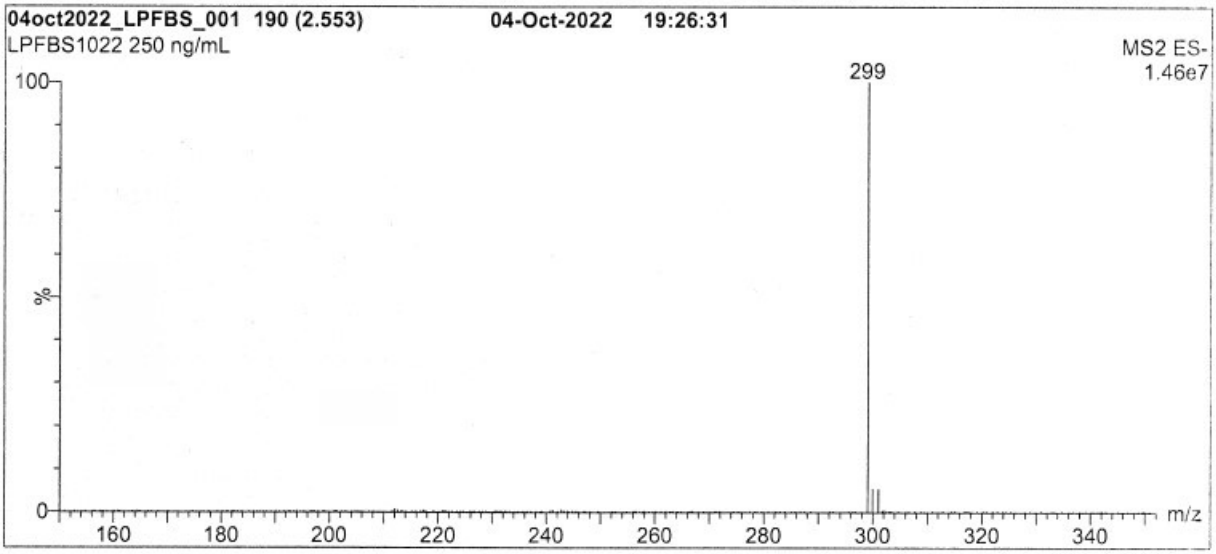
ANAB ANSI National Accreditation Board ACCREDITED ISO 17034 REFERENCE MATERIAL PRODUCER

For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at www.well-labs.com or contact us directly at info@well-labs.com

Attachment 4 – Example CoA

Figure 1: **L-PFBS; LC/MS Data (Full Scan and Mass Spectrum)**





Conditions for Figure 1:

Waters Acquity Ultra Performance LC
Waters Xevo TQ-S micro MS

Chromatographic Conditions:

Column: Acquity UPLC BEH Shield RP_{18}
1.7 µm, 2.1 x 100 mm

Mobile phase: Gradient
Start: 60% H_2O / 40% (80:20 MeOH:ACN)
(both with 10 mM NH_4OAc buffer)
Ramp to 90% organic over 8 min and hold for 2 min
before returning to initial conditions over 0.75 min.
Time: 12 min

Flow: 300 µL/min

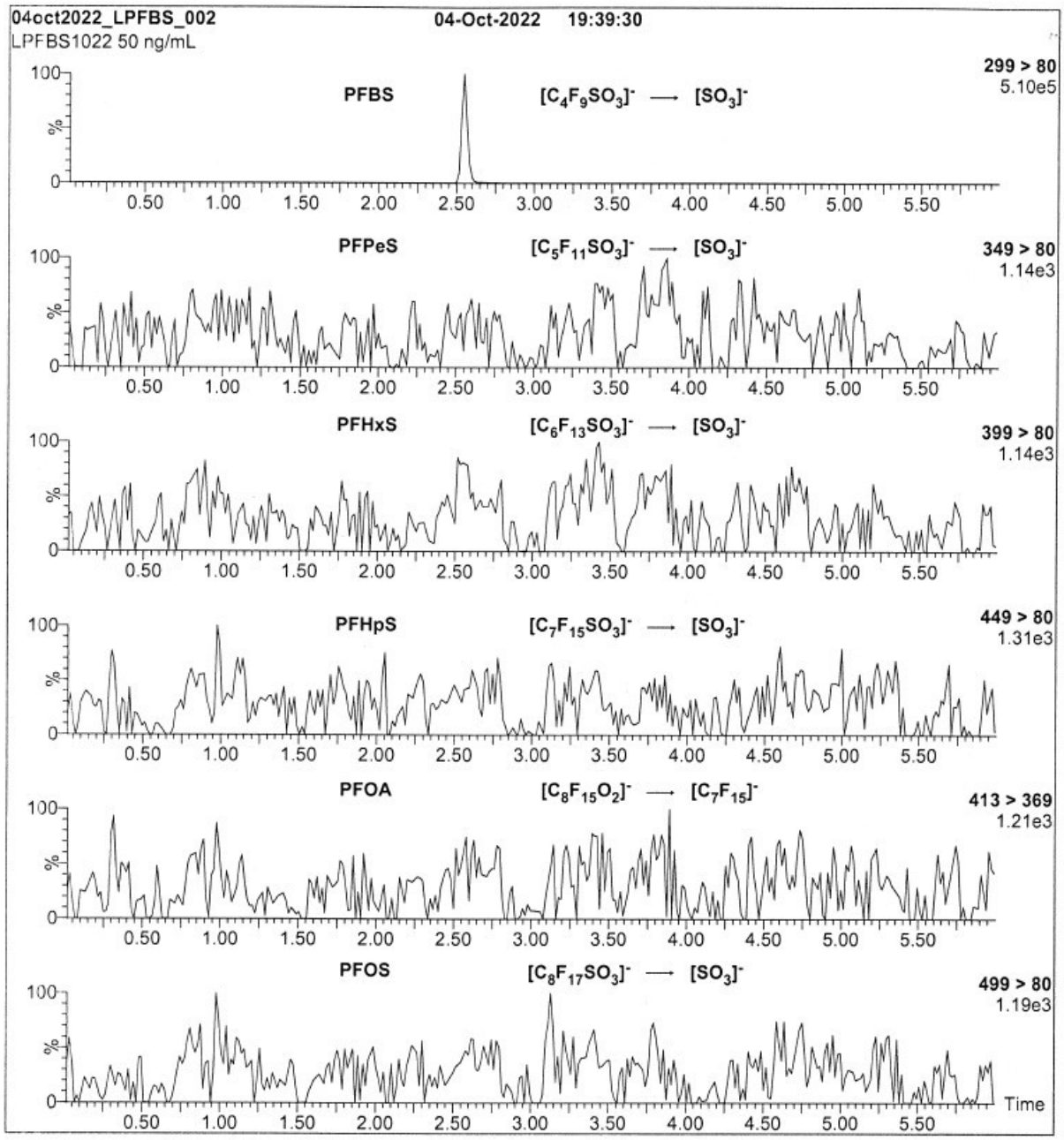
MS Parameters:

Experiment: Full Scan (150 - 850 amu)

Source: Electrospray (negative)
Capillary Voltage (kV) = 2.00
Cone Voltage (V) = 10.00
Desolvation Temperature (°C) = 500
Desolvation Gas Flow (L/hr) = 1000

Attachment 4 – Example CoA

Figure 2: **L-PFBS; LC/MS/MS Data (Selected MRM Transitions)**



Conditions for Figure 2:

Injection:	On-column (L-PFBS)
Mobile phase:	Same as Figure 1
Flow:	300 µL/min

MS Parameters:

Collision Gas (mbar) = 3.29e-3
Collision Energy (eV) = 30

Form#:27, Issued 2004-11-10
Revision#:9, Revised 2020-12-23

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rev0

Attachment 05 - Native PFAS Intermediate A								
Vendor	Catalog Number	Analyte	CAS#	Acronym	Conc. (ng/mL)	Aliquot (mL)	Final Volume (mL) in MeOH	Final Conc. (ng/mL)
Wellington	PFBA	Perfluorobutanoic acid	375-22-4	PFBA	50000	0.100	10	500
Wellington	PFPeA	Perfluoropentanoic acid	2706-90-3	PFPeA	50000	0.050		250
Wellington	PFHxA	Perfluorohexanoic acid	307-24-4	PFHxA	50000	0.050		250
Wellington	PFHpA	Perfluoroheptanoic acid	375-85-9	PFHpA	50000	0.050		250
Wellington	br-PFOA	Perfluorooctanoic acid	335-67-1	PFOA	50000	0.050		250
Wellington	br-PFNA	Perfluorononanoic acid	375-95-1	PFNA	50000	0.050		250
Wellington	PFDA	Perfluorodecanoic acid	335-76-2	PFDA	50000	0.050		250
Wellington	PFUdA	Perfluoroundecanoic acid	2058-94-8	PFUnA	50000	0.050		250
Wellington	MPFDOA	Perfluorododecanoic acid	307-55-1	PFDoA	50000	0.050		250
Wellington	PFTrDA	Perfluorotridecanoic acid	72629-94-8	PFTrDA	50000	0.050		250
Wellington	PFTeDA	Perfluorotetradecanoic acid	376-06-7	PFTeDA	50000	0.050		250
Wellington	L-PFBS	Perfluorobutanesulfonic acid	375-73-5	PFBS	44200	0.050		221
Wellington	L-PFPeS	Perfluoropentansulfonic acid	2706-91-4	PFPeS	46900	0.050		235
Wellington	br-PFHxSK	Perfluorohexanesulfonic acid	355-46-4	PFHxS	45500	0.050		228
Wellington	L-PFHpS	Perfluoroheptanesulfonic acid	375-92-8	PFHpS	47600	0.050		238
Wellington	br-PFOSK	Perfluorooctanesulfonic acid	1763-23-1	PFOS	46600	0.050		233
Wellington	L-PFNS	Perfluorononanesulfonic acid	68259-12-1	PFNS	48000	0.050		240
Wellington	L-PFDS	Perfluorodecanesulfonic acid	335-77-3	PFDS	48200	0.050		241
Wellington	L-PFDoS	Perfluorododecanesulfonic acid	79780-39-5	PFDoS	48400	0.050		242
Wellington	4;2 FTS	1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	757124-72-4	4:2-FTS	46700	0.100		467
Wellington	6;2 FTS	1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	27619-97-2	6:2-FTS	47400	0.100		474
Wellington	8;2 FTS	1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	39108-34-4	8:2-FTS	47900	0.100		479
Wellington	br-FOSA	Perfluorooctanesulfonamide	754-91-6	PFOSA	50000	0.050		250
Wellington	br-NMeFOSA	N-methyl perfluorooctanesulfonamide	31506-32-8	NMeFOSA / N-MePFOSA	50000	0.050		250
Wellington	br-NEtFOSA	N-ethyl perfluorooctanesulfonamide	4151-50-2	NEtFOSA / N-EtPFOSA	50000	0.050		250
Wellington	br-NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid	2355-31-9	NMeFOSAA	50000	0.050		250
Wellington	br-NEtFOSAA	N-ethyl perfluorooctanesulfonamidoacetic acid	2991-50-6	NEtFOSAA	50000	0.050		250
Wellington	br-NMeFOSE	N-methyl perfluorooctanesulfonamidoethanol	24448-09-7	NMePFOSAE / NMeFOSE	50000	0.250		1250
Wellington	br-NMeFOSE	N-ethyl perfluorooctanesulfonamidoethanol	1691-99-2	NEtPFOSAE / NEtFOSE	50000	0.250		1250
Wellington	HFPO-DA	Hexafluoropropylene oxide dimer acid	13252-13-6	HFPO-DA / GenX	50000	0.0375		187.5
Wellington	NaDONA	4,8-Dioxa-3H-perfluorononanoic acid	919005-14-4	ADONA	47100	0.050		236
Wellington	PFEESA	Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	PFEESA / PES	44500	0.050		223
Wellington	PF4OPeA	Perfluoro-3-methoxypropanoic acid	377-73-1	PFMPA / PFECA F	50000	0.050		250
Wellington	PF5OHxA	Perfluoro-4-methoxybutanoic acid	863090-89-5	PFMBA / PFECA A	50000	0.050		250
Wellington	3,6-OPFHpA	Nonafluoro-3,6-dioxaheptanoic acid	151772-58-6	NFDHA / PFECA B	50000	0.050		250
Wellington	9Cl-PF3ONS	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	756426-58-1	9Cl-PF3ONS	46600	0.050		233
Wellington	11Cl-PF3OUdS	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	763051-92-9	11Cl-PF3OUdS	47100	0.050		236
Wellington	FPrPA	3-Perfluoropropyl propanoic acid	356-02-5	3:3 FTCA	50000	0.100		500
Wellington	FPePA	2H,2H,3H,3H-Perfluorooctanoic acid	914637-49-3	5:3 FTCA	50000	0.250		1250
Wellington	FHpPA	3-Perfluoroheptyl propanoic acid	812-70-4	7:3 FTCA	50000	0.250		1250
Wellington	PFECHS	Perfluoro-4-ethylcyclohexanesulfonate	335-24-0	PFECHS	46100	0.050		231
Wellington	FBSA-I	Perfluoro-1-butanesulfonamide	30334-69-1	FBSA	50000	0.050		250
Wellington	FHxSA-I	Perlfuoro-1-hexanesulfonamide	41997-13-1	FHxSA	50000	0.050		250
Wellington	PFPrA	Perfluoropropanoic acid	422-64-0	PFPrA / PPF Acid	50000	0.250		1250
Wellington	PFODA	Perfluoro-n-octadecanoic acid	16517-11-6	PFODA	50000	0.050		250
AccuStandard	PFOS-030S	Bis(trifluoromethylsulfonyl)amine	82113-65-3	TFSI	97900	0.0250		245

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Attachment 06 - Native PFAS Intermediate B							
Source Rgt Name	Analyte	CAS#	Acronym	Conc. (ng/mL)	Aliquot (mL)	Final Volume (mL) in MeOH	Final Conc. (ng/mL)
Native PFAS Intermediate A	Perfluorobutanoic acid	375-22-4	PFBA	500	0.1	10	5
	Perfluoropentanoic acid	2706-90-3	PFPeA	250			2.5
	Perfluorohexanoic acid	307-24-4	PFHxA	250			2.5
	Perfluoroheptanoic acid	375-85-9	PFHpA	250			2.5
	Perfluorooctanoic acid	335-67-1	PFOA	250			2.5
	Perfluorononanoic acid	375-95-1	PFNA	250			2.5
	Perfluorodecanoic acid	335-76-2	PFDA	250			2.5
	Perfluoroundecanoic acid	2058-94-8	PFUnA	250			2.5
	Perfluorododecanoic acid	307-55-1	PFDoA	250			2.5
	Perfluorotridecanoic acid	72629-94-8	PFTrDA	250			2.5
	Perfluorotetradecanoic acid	376-06-7	PFTeDA	250			2.5
	Perfluorobutanesulfonic acid	375-73-5	PFBS	221			2.21
	Perfluoropentansulfonic acid	2706-91-4	PFPeS	235			2.35
	Perfluorohexanesulfonic acid	355-46-4	PFHxS	228			2.28
	Perfluoroheptanesulfonic acid	375-92-8	PFHpS	238			2.38
	Perfluorooctanesulfonic acid	1763-23-1	PFOS	233			2.33
	Perfluorononanesulfonic acid	68259-12-1	PFNS	240			2.4
	Perfluorodecanesulfonic acid	335-77-3	PFDS	241			2.41
	Perfluorododecanesulfonic acid	79780-39-5	PFDoS	242			2.42
	1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	757124-72-4	4:2-FTS	467			4.67
	1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	27619-97-2	6:2-FTS	474			4.74
	1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	39108-34-4	8:2-FTS	479			4.79
	Perfluorooctanesulfonamide	754-91-6	PFOSA	250			2.5
	N-methyl perfluorooctanesulfonamide	31506-32-8	NMeFOSA / N-MePFOSA	250			2.5
	N-ethyl perfluorooctanesulfonamide	4151-50-2	NEtFOSA / N-EtPFOSA	250			2.5
	N-methyl perfluorooctanesulfonamidoacetic acid	2355-31-9	NMeFOSAA	250			2.5
	N-ethyl perfluorooctanesulfonamidoacetic acid	2991-50-6	NEtFOSAA	250			2.5
	N-methyl perfluorooctanesulfonamidoethanol	24448-09-7	NMePFOSAE / NMeFOSE	1250			12.5
	N-ethyl perfluorooctanesulfonamidoethanol	1691-99-2	NEtPFOSAE / NEtFOSE	1250			12.5
	Hexafluoropropylene oxide dimer acid	13252-13-6	HFPO-DA / GenX	187.5			1.875
	4,8-Dioxa-3H-perfluorononanoic acid	919005-14-4	ADONA	236			2.36
	Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	PFEESA / PES	223			2.23
	Perfluoro-3-methoxypropanoic acid	377-73-1	PFMPA / PFECA F	250			2.5
	Perfluoro-4-methoxybutanoic acid	863090-89-5	PFMBA / PFECA A	250			2.5
	Nonafluoro-3,6-dioxaheptanoic acid	151772-58-6	NFDHA / PFECA B	250			2.5
	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	756426-58-1	9Cl-PF3ONS	233			2.33
	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	763051-92-9	11Cl-PF3OUdS	236			2.36
	3-Perfluoropropyl propanoic acid	356-02-5	3:3 FTCA	500			5
	2H,2H,3H,3H-Perfluorooctanoic acid	914637-49-3	5:3 FTCA	1250			12.5
	3-Perfluoroheptyl propanoic acid	812-70-4	7:3 FTCA	1250			12.5
	Perfluoro-4-ethylcyclohexanesulfonate	335-24-0	PFECHS	231			2.31
	Perfluoro-1-butanesulfonamide	30334-69-1	FBSA	250			2.5
	Perlfuoro-1-hexanesulfonamide	41997-13-1	FHxSA	250			2.5
	Perfluoropropanoic acid	422-64-0	PFPrA / PPF Acid	1250			12.5
	Perfluoro-n-octadecanoic acid	16517-11-6	PFODA	250			2.5
	Bis(trifluoromethylsulfonyl)amine	82113-65-3	TFSI	245			2.45

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Attachment 07 - Native PFAS CAL8 Intermediate								
Vendor	**Catalog Number**	**Analyte**	**CAS#**	**Acronym**	**Conc. (ng/mL)**	**Aliquot (mL)**	**Final Volume (mL) in MeOH**	**Final Conc. (ng/mL)**
Wellington	PFBA	Perfluorobutanoic acid	375-22-4	PFBA	50000	0.100	10	500
Wellington	PFPeA	Perfluoropentanoic acid	2706-90-3	PFPeA	50000	0.050		250
Wellington	PFHxA	Perfluorohexanoic acid	307-24-4	PFHxA	50000	0.050		250
Wellington	PFHpA	Perfluoroheptanoic acid	375-85-9	PFHpA	50000	0.050		250
Wellington	br-PFOA	Perfluorooctanoic acid	335-67-1	PFOA	50000	0.050		250
Wellington	br-PFNA	Perfluorononanoic acid	375-95-1	PFNA	50000	0.050		250
Wellington	L-PFBS	Perfluorobutanesulfonic acid	375-73-5	PFBS	44200	0.050		221
Wellington	L-PFPeS	Perfluoropentansulfonic acid	2706-91-4	PFPeS	46900	0.050		235
Wellington	br-PFHxSK	Perfluorohexanesulfonic acid	355-46-4	PFHxS	45500	0.050		228
Wellington	L-PFHpS	Perfluoroheptanesulfonic acid	375-92-8	PFHpS	47600	0.050		238
Wellington	br-PFOSK	Perfluorooctanesulfonic acid	1763-23-1	PFOS	46600	0.050		233
Wellington	HFPO-DA	Hexafluoropropylene oxide dimer acid	13252-13-6	HFPO-DA / GenX	50000	0.0375		187.5

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Attachment 08 - 1633 EIS Intermediate								
Vendor	**Catalog Number**	**Analyte**	**CAS#**	**Acronym**	**Conc. (ng/mL)**	**Aliquot (mL)**	**Final Volume (mL in MeOH)**	**Final Conc. (ng/mL)**
Wellington	MPFBA	Perfluoro-n-[13C4]butanoic acid	STL00992	$^{13}C_4$-PFBA	50000	0.08	10	400
Wellington	M5PFPeA	Perfluoro-n-[13C5]pentanoic acid	STL01893	$^{13}C_5$-PFPeA	50000	0.08		400
Wellington	M5PFHxA	Perfluoro-n-[1,2,3,4,6-13C5]hexanoic acid	STL02577	$^{13}C_5$-PFHxA	50000	0.08		400
Wellington	M4PFHpA	Perfluoro-n-[1,2,3,4-13C4]heptanoic acid	STL01892	$^{13}C_4$-PFHpA	50000	0.08		400
Wellington	M8PFOA	Perfluoro-n-[13C8]octanoic acid	STL01052	$^{13}C_8$-PFOA	50000	0.08		400
Wellington	M9PFNA	Perfluoro-n-[13C9]nonanoic acid	STL02578	$^{13}C_9$-PFNA	50000	0.08		400
Wellington	M6PFDA	Perfluoro-n-[1,2,3,4,5,6-13C6]decanoic acid	STL02579	$^{13}C_6$-PFDA	50000	0.08		400
Wellington	M7PFUdA	Perfluoro-n-[1,2,3,4,5,6,7-13C7]undecanoic acid	STL02580	$^{13}C_7$-PFUnA	50000	0.08		400
Wellington	MPFDoA	Perfluoro-n-[1,2-13C2]dodecanoic acid	STL00998	$^{13}C_2$-PFDoA	50000	0.08		400
Wellington	M2PFTeDA	Perfluoro-n-[1,2-13C2]tetradecanoic acid	STL02116	$^{13}C_2$-PFTeDA	50000	0.08		400
Wellington	M3PFBS	Perfluoro-1-[2,3,4-13C3]butanesulfonic acid	STL02337	$^{13}C_3$-PFBS	46500	0.08		372
Wellington	M3PFHxS	Perfluoro-1-[1,2,3-13C3]hexanesulfonic acid	STL02581	$^{13}C_3$-PFHxS	47300	0.08		378
Wellington	M8PFOS	Perfluoro-1-[13C8]octanesulfonic acid	STL01054	$^{13}C_8$-PFOS	47800	0.08		382
Wellington	M8FOSA-I	Perfluoro-1-[13C8]octanesulfonamide	STL01056	$^{13}C_8$-PFOSA	50000	0.08		400
Wellington	d3-N-MeFOSAA	N-methyl-d3-perfluoro-1-octanesulfonamidoacetic acid	STL02118	d_3-NMeFOSAA	50000	0.2		1000
Wellington	d5-N-EtFOSAA	N-ethyl-d5-perfluoro-1-octanesulfonamidoacetic acid	STL02117	d_5-NEtFOSAA	50000	0.2		1000
Wellington	M2-4;2FTS	1H,1H,2H,2H-Perfluoro-1-[1,2-13C2]hexane sulfonic acid	STL02395	$^{13}C_2$-4:2FTS	46700	0.2		934
Wellington	M2-6;2FTS	1H,1H,2H,2H-Perfluoro-1-[1,2-13C2]octane sulfonic acid	STL02279	$^{13}C_2$-6:2FTS	47500	0.2		950
Wellington	M2-8;2FTS	1H,1H,2H,2H-Perfluoro-1-[1,2-13C2]decane sulfonic acid	STL02280	$^{13}C_2$-8:2FTS	47900	0.2		958
Wellington	M3HFPO-DA	Tetrafluoro-2-heptafluoropropoxy-13C3-propanoic acid	STL02255	$^{13}C_3$-HFPO-DA	50000	0.08		400
Wellington	d7-N-MeFOSE-M	N-methyl-d7-perfluorooctanesulfonamidoethanol	STL02277	d_7-N-MeFOSE-M	50000	0.2		1000
Wellington	d9-N-EtFOSE-M	N-ethyl-d9-perfluorooctanesulfonamidoethanol	STL02278	d_9-N-EtFOSE-M	50000	0.2		1000
Wellington	d-N-MeFOSA-M	N-ethyl-d5-perfluoro-1-octanesulfonamide	STL02704	d_5-NEtPFOSA	50000	0.08		400
Wellington	d-N-EtFOSA-M	N-methyl-d3-perfluoro-1-octanesulfonamide	STL02705	d_3-NMePFOSA	50000	0.08		400
Cambridge Isotope	CLM-11324-A-1.2	Perfluoropropanoic acid (PFPrA) ($^{13}C_3$)	STL03194	$^{13}C_3$-PFPrA	50000	0.08		400

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Attachment 09 - 1633 NIS Intermediate								
Vendor	**Catalog Number**	**Analyte**	**CAS#**	**Acronym**	**Conc. (ng/mL)**	**Aliquot (mL)**	**Final Volume (mL) in MeOH**	**Final Conc. (ng/mL)**
Wellington	M3PFBA	Perfluoro-n-[2,3,4-13C3]butanoic acid	STL02680	$^{13}C_3$-PFBA	50000	0.08	10	400
Wellington	MPFOA	Perfluoro-n-[1,2,3,4-13C4]octanoic acid	STL00990	$^{13}C_4$-PFOA	50000	0.2		1000
Wellington	MPFDA	Perfluoro-n-[1,2-13C2]decanoic acid	STL00996	$^{13}C_2$-PFDA	50000	0.08		400
Wellington	MPFOS	Perfluoro-n-[1,2,3,4-13C4]octanesulfonic acid	STL00991	$^{13}C_4$-PFOS	47800	0.08		382.4
Wellington	MPFNA	Perfluoro-n-[1,2,3,4,5-13C5] nonanoic acid	STL00995	$^{13}C_5$-PFNA	50000	0.08		400
Wellington	MPFHxA	Perfluoro-n-[1,2-13C2]hexanoic acid	STL00993	$^{13}C_2$-PFHxA	50000	0.2		1000
Wellington	MPFHxS	Perfluoro-1-hexane[18O2]sulfonic acid	STL00994	$^{18}O_2$-PFHxS	47300	0.08		378.4

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Attachment 10 - 1633 TOP SS Intermediate								
Vendor	**Catalog Number**	**Analyte**	**CAS#**	**Acronym**	**Conc. (ng/mL)**	**Aliquot (mL)**	**Final Volume (mL in MeOH)**	**Final Conc. (ng/mL)**
Wellington	M2PFOA	Perfluoro-n-(1,2-13C2)octanoic acid	STL00623	$^{13}C_2$-PFOA	50000	0.025	10	125
Wellington	MPFUdA	Perfluoro-n-(1,2-13C2)undecanoic acid	STL00997	$^{13}C_2$-PFUnA	50000	0.025		125
Wellington	M3PFPeA	Perfluoro-n-(3,4,5-13C3)pentanoic acid	STL03269	$^{13}C_3$-PFPeA	50000	0.025		125

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Attachment 11 - 1633 Initial Calibration Standards Preparation								
Solution Name	**CAL1**	**CAL2**	**CAL3**	**CAL4**	**CAL5**	**CAL6**	**CAL7**	**CAL8**
Native PFAS CAL8 Intermediate (mL)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.0
Native PFAS Intermediate A (mL)	N/A	N/A	0.02	0.04	0.1	0.2	0.4	N/A
Native PFAS Intermediate B (mL)	0.2	0.5	N/A	N/A	N/A	N/A	N/A	N/A
1633 TOP SS Intermediate (mL)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
1633 EIS Intermediate (mL)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
1633 NIS Intermediate (mL)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Final Volume (mL)	10	10	10	10	10	10	10	10

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Attachment 12 - 1633 Initial Calibration Standard Concentrations								
	CAL1	CAL2	CAL3	CAL4	CAL5	CAL6	CAL7	CAL8
Analyte Name	Conc. (ng/ml)	Conc. (ng/ml)	Conc. (ng/ml)	Conc. (ng/ml)	Conc. (ng/ml)	Conc. (ng/ml)	Conc. (ng/ml)	Conc. (ng/ml)
PFBA	0.100	0.250	1.00	2.00	5.00	10.0	20.0	100
PFPeA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	50.0
PFHxA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	50.0
PFHpA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	50.0
PFOA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	50.0
PFNA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	50.0
PFDA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
PFUnA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
PFDoA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
PFTrDA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
PFTeDA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
PFBS	0.044	0.111	0.442	0.884	2.21	4.42	8.84	44.2
PFPeS	0.047	0.117	0.469	0.938	2.35	4.69	9.38	46.9
PFHxS	0.046	0.114	0.455	0.910	2.28	4.55	9.10	45.5
PFHpS	0.048	0.119	0.476	0.952	2.38	4.76	9.52	47.6
PFOS	0.047	0.117	0.466	0.932	2.33	4.66	9.32	46.6
PFNS	0.048	0.120	0.480	0.960	2.40	4.80	9.60	N/A
PFDS	0.048	0.121	0.482	0.964	2.41	4.82	9.64	N/A
PFDoS	0.048	0.121	0.484	0.968	2.42	4.84	9.68	N/A
4:2-FTS	0.093	0.234	0.934	1.87	4.67	9.34	18.7	N/A
6:2-FTS	0.095	0.237	0.948	1.90	4.74	9.48	19.0	N/A
8:2-FTS	0.096	0.240	0.958	1.92	4.79	9.58	19.2	N/A
PFOSA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
NMeFOSA / N-MePFOSA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
NEtFOSA / N-EtPFOSA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
NMeFOSAA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
NEtFOSAA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
NMePFOSAE / NMeFOSE	0.250	0.625	2.50	5.00	12.5	25.0	50.0	N/A
NEtPFOSAE / NEtFOSE	0.250	0.625	2.50	5.00	12.5	25.0	50.0	N/A
HFPO-DA / GenX	0.038	0.094	0.38	0.750	1.88	3.75	7.50	37.5
ADONA	0.047	0.118	0.471	0.942	2.36	4.71	9.42	N/A
PFEESA / PES	0.045	0.111	0.445	0.890	2.23	4.45	8.90	N/A
PFMPA / PFECA F	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
PFMBA / PFECA A	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
NFDHA / PFECA B	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
9Cl-PF3ONS	0.047	0.117	0.466	0.93	2.33	4.66	9.32	N/A
11Cl-PF3OUdS	0.047	0.118	0.471	0.94	2.36	4.71	9.42	N/A
3:3 FTCA	0.100	0.250	1.00	2.00	5.00	10.0	20.0	N/A
5:3 FTCA	0.250	0.625	2.50	5.00	12.5	25.0	50.0	N/A
7:3 FTCA	0.250	0.625	2.50	5.00	12.5	25.0	50.0	N/A
PFECHS	0.046	0.116	0.462	0.92	2.31	4.62	9.24	N/A
FBSA	0.050	0.125	0.500	1.00	2.50	5.00	10.0	N/A
FHxSA	0.050	0.125	0.500	1.00	2.50	5.00	10.0	N/A
PFPrA / PPF Acid	0.250	0.625	2.500	5.00	12.5	25.0	50.0	N/A
PFODA	0.050	0.125	0.500	1.00	2.50	5.00	10.0	N/A
TFSI	0.049	0.122	0.490	0.98	2.45	4.90	9.79	N/A
$^{13}C_3$-PFPrA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_4$-PFBA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_5$-PFPeA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_5$-PFHxA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_4$-PFHpA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_8$-PFOA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_9$-PFNA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_6$-PFDA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_7$-PFUnA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_2$-PFDoA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_2$-PFTeDA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_3$-PFBS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_3$-PFHxS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_8$-PFOS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_8$-PFOSA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
d_3-NMeFOSAA	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
d_5-NEtFOSAA	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
$^{13}C_2$-4:2FTS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
$^{13}C_2$-6:2FTS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
$^{13}C_2$-8:2FTS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
$^{13}C_3$-HFPO-DA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
d_7-N-MeFOSE-M	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
d_9-N-EtFOSE-M	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
d_5-NEtPFOSA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
d_3-NMePFOSA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_3$-PFBA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_4$-PFOA	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
$^{13}C_2$-PFDA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_4$-PFOS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_5$-PFNA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_2$-PFHxA	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
$^{18}O_2$-PFHxS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_2$-PFOA	0.625	0.625	0.625	0.625	0.625	0.625	0.625	0.625
$^{13}C_2$-PFUnA	0.625	0.625	0.625	0.625	0.625	0.625	0.625	0.625
$^{13}C_3$-PFPeA	0.625	0.625	0.625	0.625	0.625	0.625	0.625	0.625

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Attachment 13 - Bile Salts Stock Solution							
Vendor	**Catalog Number**	**Analyte**	**CAS#**	**Acronym**	**Aliquot (g)**	**Final Volume (mL of MeOH)**	**Final Conc. (ng/mL)**
Sigma Aldrich	T0557-500MG	Taurodeoxycholic acid	516-50-7	TDCA	0.05	50	1000000
Sigma Aldrich	T6260-1G	Taurochenodeoxycholic acid	516-35-8	TCDCA	0.05		950000
Calbiochem	580549-1GM	Tauroursodeoxycholic acid	14605-22-2	TUDCA	0.05		1000000

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Attachment 14 - Bile Salts Intermediate							
Source Rgt Name	**Analyte**	**CAS#**	**Acronym**	**Conc. (ng/mL)**	**Aliquot (mL)**	**Final Volume (mL of MeOH)**	**Final Conc. (ng/mL)**
Bile Salts Stock Solution	Taurodeoxycholic acid	516-50-7	TDCA	1000000	1	4	250000
	Taurochenodeoxycholic acid	516-35-8	TCDCA	950000			237500
	Tauroursodeoxycholic acid	14605-22-2	TUDCA	1000000			250000

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Attachment 15 - Bile Salts Working Solution							
Source Rgt Name	**Analyte**	**CAS#**	**Acronym**	**Conc. (ng/mL)**	**Aliquot (mL)**	**Final Volume (mL of MeOH)**	**Final Conc. (ng/mL)**
Bile Salts Intermediate	Taurodeoxycholic acid	516-50-7	TDCA	250000	0.1	5	5000
	Taurochenodeoxycholic acid	516-35-8	TCDCA	237500			4750
	Tauroursodeoxycholic acid	14605-22-2	TUDCA	250000			5000

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Attachment 16 - 1633 Window-Defining Matrix Standard							
Source Rgt. Name	**Analyte**	**CAS#**	**Acronym**	**Conc. (ng/mL)**	**Aliquot (mL)**	**Final Volume* (mL)**	**Final Conc. (ng/mL)**
Bile Salts Working Solution	Taurodeoxycholic acid	516-50-7	TDCA	5000	0.05	10	25
	Taurochenodeoxycholic acid	516-35-8	TCDCA	4750			23.8
	Tauroursodeoxycholic acid	14605-22-2	TUDCA	5000			25

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Attachment 17 - Native 1633 Mid-Level Spike							
Source Rgt. Name	Analyte	CAS#	Acronym	Conc. (ng/mL)	Aliquot (mL)	Final Volume (mL in MeOH)	Final Conc. (ng/mL)
Native PFAS Intermediate A	Perfluorobutanoic acid	375-22-4	PFBA	500	4	10	200
	Perfluoropentanoic acid	2706-90-3	PFPeA	250			100
	Perfluorohexanoic acid	307-24-4	PFHxA	250			100
	Perfluoroheptanoic acid	375-85-9	PFHpA	250			100
	Perfluorooctanoic acid	335-67-1	PFOA	250			100
	Perfluorononanoic acid	375-95-1	PFNA	250			100
	Perfluorodecanoic acid	335-76-2	PFDA	250			100
	Perfluoroundecanoic acid	2058-94-8	PFUnA	250			100
	Perfluorododecanoic acid	307-55-1	PFDoA	250			100
	Perfluorotridecanoic acid	72629-94-8	PFTrDA	250			100
	Perfluorotetradecanoic acid	376-06-7	PFTeDA	250			100
	Perfluorobutanesulfonic acid	375-73-5	PFBS	221			88.4
	Perfluoropentansulfonic acid	2706-91-4	PFPeS	235			93.8
	Perfluorohexanesulfonic acid	355-46-4	PFHxS	228			91.0
	Perfluoroheptanesulfonic acid	375-92-8	PFHpS	238			95.2
	Perfluorooctanesulfonic acid	1763-23-1	PFOS	233			93.2
	Perfluorononanesulfonic acid	68259-12-1	PFNS	240			96.0
	Perfluorodecanesulfonic acid	335-77-3	PFDS	241			96.4
	Perfluorododecanesulfonic acid	79780-39-5	PFDoS	242			96.8
	1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	757124-72-4	4:2-FTS	467			187
	1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	27619-97-2	6:2-FTS	474			190
	1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	39108-34-4	8:2-FTS	479			192
	Perfluorooctanesulfonamide	754-91-6	PFOSA	250			100
	N-methyl perfluorooctanesulfonamide	31506-32-8	NMeFOSA / N-MePFOSA	250			100
	N-ethyl perfluorooctanesulfonamide	4151-50-2	NEtFOSA / N-EtPFOSA	250			100
	N-methyl perfluorooctanesulfonamidoacetic acid	2355-31-9	NMeFOSAA	250			100
	N-ethyl perfluorooctanesulfonamidoacetic acid	2991-50-6	NEtFOSAA	250			100
	N-methyl perfluorooctanesulfonamidoethanol	24448-09-7	NMePFOSAE / NMeFOSE	1250			500
	N-ethyl perfluorooctanesulfonamidoethanol	1691-99-2	NEtPFOSAE / NEtFOSE	1250			500
	Hexafluoropropylene oxide dimer acid	13252-13-6	HFPO-DA / GenX	187.5			75.0
	4,8-Dioxa-3H-perfluorononanoic acid	919005-14-4	ADONA	236			94.2
	Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	PFEESA / PES	223			89.0
	Perfluoro-3-methoxypropanoic acid	377-73-1	PFMPA / PFECA F	250			100
	Perfluoro-4-methoxybutanoic acid	863090-89-5	PFMBA / PFECA A	250			100
	Nonafluoro-3,6-dioxaheptanoic acid	151772-58-6	NFDHA / PFECA B	250			100
	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	756426-58-1	9Cl-PF3ONS	233			93.2
	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	763051-92-9	11Cl-PF3OUdS	236			94.2
	3-Perfluoropropyl propanoic acid	356-02-5	3:3 FTCA	500			200
	2H,2H,3H,3H-Perfluorooctanoic acid	914637-49-3	5:3 FTCA	1250			500
	3-Perfluoroheptyl propanoic acid	812-70-4	7:3 FTCA	1250			500
	Perfluoro-4-ethylcyclohexanesulfonate	335-24-0	PFECHS	231			92.2
	Perfluoro-1-butanesulfonamide	30334-69-1	FBSA	250			100
	Perlfuoro-1-hexanesulfonamide	41997-13-1	FHxSA	250			100
	Perfluoropropanoic acid	422-64-0	PFPrA / PPF Acid	1250			500
	Perfluoro-n-octadecanoic acid	16517-11-6	PFODA	250			100
	Bis(trifluoromethylsulfonyl)amine	82113-65-3	TFSI	245			97.9

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Attachment 18 - Native 1633 Low-Level Spike							
Source Rgt. Name	**Analyte**	**CAS#**	**Acronym**	**Conc. (ng/mL)**	**Aliquot (mL)**	**Final Volume (mL in MeOH)**	**Final Conc. (ng/mL)**
Native PFAS Intermediate A	Perfluorobutanoic acid	375-22-4	PFBA	500	0.5	10	25.00
	Perfluoropentanoic acid	2706-90-3	PFPeA	250			12.50
	Perfluorohexanoic acid	307-24-4	PFHxA	250			12.50
	Perfluoroheptanoic acid	375-85-9	PFHpA	250			12.50
	Perfluorooctanoic acid	335-67-1	PFOA	250			12.50
	Perfluorononanoic acid	375-95-1	PFNA	250			12.50
	Perfluorodecanoic acid	335-76-2	PFDA	250			12.50
	Perfluoroundecanoic acid	2058-94-8	PFUnA	250			12.50
	Perfluorododecanoic acid	307-55-1	PFDoA	250			12.50
	Perfluorotridecanoic acid	72629-94-8	PFTrDA	250			12.50
	Perfluorotetradecanoic acid	376-06-7	PFTeDA	250			12.50
	Perfluorobutanesulfonic acid	375-73-5	PFBS	221			11.05
	Perfluoropentansulfonic acid	2706-91-4	PFPeS	235			11.73
	Perfluorohexanesulfonic acid	355-46-4	PFHxS	228			11.38
	Perfluoroheptanesulfonic acid	375-92-8	PFHpS	238			11.90
	Perfluorooctanesulfonic acid	1763-23-1	PFOS	233			11.65
	Perfluorononanesulfonic acid	68259-12-1	PFNS	240			12.00
	Perfluorodecanesulfonic acid	335-77-3	PFDS	241			12.05
	Perfluorododecanesulfonic acid	79780-39-5	PFDoS	242			12.10
	1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	757124-72-4	4:2-FTS	467			23.35
	1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	27619-97-2	6:2-FTS	474			23.70
	1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	39108-34-4	8:2-FTS	479			23.95
	Perfluorooctanesulfonamide	754-91-6	PFOSA	250			12.50
	N-methyl perfluorooctanesulfonamide	31506-32-8	NMeFOSA / N-MePFOSA	250			12.50
	N-ethyl perfluorooctanesulfonamide	4151-50-2	NEtFOSA / N-EtPFOSA	250			12.50
	N-methyl perfluorooctanesulfonamidoacetic acid	2355-31-9	NMeFOSAA	250			12.50
	N-ethyl perfluorooctanesulfonamidoacetic acid	2991-50-6	NEtFOSAA	250			12.50
	N-methyl perfluorooctanesulfonamidoethanol	24448-09-7	NMePFOSAE / NMeFOSE	1250			62.50
	N-ethyl perfluorooctanesulfonamidoethanol	1691-99-2	NEtPFOSAE / NEtFOSE	1250			62.50
	Hexafluoropropylene oxide dimer acid	13252-13-6	HFPO-DA / GenX	187.5			9.38
	4,8-Dioxa-3H-perfluorononanoic acid	919005-14-4	ADONA	235.5			11.78
	Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	PFEESA / PES	223			11.13
	Perfluoro-3-methoxypropanoic acid	377-73-1	PFMPA / PFECA F	250			12.50
	Perfluoro-4-methoxybutanoic acid	863090-89-5	PFMBA / PFECA A	250			12.50
	Nonafluoro-3,6-dioxaheptanoic acid	151772-58-6	NFDHA / PFECA B	250			12.50
	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	756426-58-1	9Cl-PF3ONS	233			11.65
	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	763051-92-9	11Cl-PF3OUdS	235.5			11.78
	3-Perfluoropropyl propanoic acid	356-02-5	3:3 FTCA	500			25.00
	2H,2H,3H,3H-Perfluorooctanoic acid	914637-49-3	5:3 FTCA	1250			62.50
	3-Perfluoroheptyl propanoic acid	812-70-4	7:3 FTCA	1250			62.50
	Perfluoro-4-ethylcyclohexanesulfonate	335-24-0	PFECHS	230.5			11.53
	Perfluoro-1-butanesulfonamide	30334-69-1	FBSA	250			12.50
	Perlfuoro-1-hexanesulfonamide	41997-13-1	FHxSA	250			12.50
	Perfluoropropanoic acid	422-64-0	PFPrA / PPF Acid	1250			62.50
	Perfluoro-n-octadecanoic acid	16517-11-6	PFODA	250			12.50
	Bis(trifluoromethylsulfonyl)amine	82113-65-3	TFSI	244.75			12.24

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Attachment 19 - 1633 ICV Working Standard							
Source Rgt. Name	Analyte	CAS#	Acronym	Conc. (ng/mL)	Aliquot (mL)	Final Volume (mL	Final Conc. (ng/mL)
Native PFAS Intermediate A	Perfluorobutanoic acid	375-22-4	PFBA	500	0.050	10	2.50
	Perfluoropentanoic acid	2706-90-3	PFPeA	250			1.25
	Perfluorohexanoic acid	307-24-4	PFHxA	250			1.25
	Perfluoroheptanoic acid	375-85-9	PFHpA	250			1.25
	Perfluorooctanoic acid	335-67-1	PFOA	250			1.25
	Perfluorononanoic acid	375-95-1	PFNA	250			1.25
	Perfluorodecanoic acid	335-76-2	PFDA	250			1.25
	Perfluoroundecanoic acid	2058-94-8	PFUnA	250			1.25
	Perfluorododecanoic acid	307-55-1	PFDoA	250			1.25
	Perfluorotridecanoic acid	72629-94-8	PFTrDA	250			1.25
	Perfluorotetradecanoic acid	376-06-7	PFTeDA	250			1.25
	Perfluorobutanesulfonic acid	375-73-5	PFBS	221			1.105
	Perfluoropentansulfonic acid	2706-91-4	PFPeS	235			1.173
	Perfluorohexanesulfonic acid	355-46-4	PFHxS	228			1.138
	Perfluoroheptanesulfonic acid	375-92-8	PFHpS	238			1.190
	Perfluorooctanesulfonic acid	1763-23-1	PFOS	233			1.165
	Perfluorononanesulfonic acid	68259-12-1	PFNS	240			1.200
	Perfluorodecanesulfonic acid	335-77-3	PFDS	241			1.205
	Perfluorododecanesulfonic acid	79780-39-5	PFDoS	242			1.210
	1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	757124-72-4	4:2-FTS	467			2.34
	1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	27619-97-2	6:2-FTS	474			2.37
	1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	39108-34-4	8:2-FTS	479			2.40
	Perfluorooctanesulfonamide	754-91-6	PFOSA	250			1.25
	N-methyl perfluorooctanesulfonamide	31506-32-8	NMeFOSA / N-MePFOSA	250			1.25
	N-ethyl perfluorooctanesulfonamide	4151-50-2	NEtFOSA / N-EtPFOSA	250			1.25
	N-methyl perfluorooctanesulfonamidoacetic acid	2355-31-9	NMeFOSAA	250			1.25
	N-ethyl perfluorooctanesulfonamidoacetic acid	2991-50-6	NEtFOSAA	250			1.25
	N-methyl perfluorooctanesulfonamidoethanol	24448-09-7	NMePFOSAE / NMeFOSE	1250			6.25
	N-ethyl perfluorooctanesulfonamidoethanol	1691-99-2	NEtPFOSAE / NEtFOSE	1250			6.25
	Hexafluoropropylene oxide dimer acid	13252-13-6	HFPO-DA / GenX	187.5			0.938
	4,8-Dioxa-3H-perfluorononanoic acid	919005-14-4	ADONA	236			1.178
	Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	PFEESA / PES	223			1.113
	Perfluoro-3-methoxypropanoic acid	377-73-1	PFMPA / PFECA F	250			1.25
	Perfluoro-4-methoxybutanoic acid	863090-89-6	PFMBA / PFECA A	250			1.25
	Nonafluoro-3,6-dioxaheptanoic acid	151772-58-6	NFDHA / PFECA B	250			1.25
	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	756426-58-1	9Cl-PF3ONS	233			1.165
	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	763051-92-9	11Cl-PF3OUdS	236			1.178
	3-Perfluoropropyl propanoic acid	356-02-5	3:3 FTCA	500			2.50
	2H,2H,3H,3H-Perfluorooctanoic acid	914637-49-3	5:3 FTCA	1250			6.25
	3-Perfluoroheptyl propanoic acid	812-70-4	7:3 FTCA	1250			6.25
	Perfluoro-4-ethylcyclohexanesulfonate	335-24-0	PFECHS	231			1.153
	Perfluoro-1-butanesulfonamide	30334-69-1	FBSA	250			1.25
	Perlfuoro-1-hexanesulfonamide	41997-13-1	FHxSA	250			1.25
	Perfluoropropanoic acid	422-64-0	PFPrA / PPF Acid	1250			6.25
	Perfluoro-n-octadecanoic acid	16517-11-6	PFODA	250			1.25
	Bis(trifluoromethylsulfonyl)amine	82113-65-3	TFSI	245			1.224
1633 TOP SS Intermediate	Perfluoro-n-(1,2-13C2)octanoic acid	STL00623	$^{13}C_2$-PFOA	125	0.050		0.625
	Perfluoro-n-(1,2-13C2)undecanoic acid	STL00997	$^{13}C_2$-PFUnA	125			0.625
	Perfluoro-n-(3,4,5-13C3)pentanoic acid	STL03269	$^{13}C_3$-PFPeA	125			0.625
1633 EIS Intermediate	Perfluoro-n-[13C4]butanoic acid	STL00992	$^{13}C_4$-PFBA	400	0.050		2.00
	Perfluoro-n-[13C5]pentanoic acid	STL01893	$^{13}C_5$-PFPeA	400			2.00
	Perfluoro-n-[1,2,3,4,6-13C5]hexanoic acid	STL02577	$^{13}C_5$-PFHxA	400			2.00
	Perfluoro-n-[1,2,3,4-13C4]heptanoic acid	STL01892	$^{13}C_4$-PFHpA	400			2.00
	Perfluoro-n-[13C8]octanoic acid	STL01052	$^{13}C_8$-PFOA	400			2.00
	Perfluoro-n-[13C9]nonanoic acid	STL02578	$^{13}C_9$-PFNA	400			2.00
	Perfluoro-n-[1,2,3,4,5,6-13C6]decanoic acid	STL02579	$^{13}C_6$-PFDA	400			2.00
	Perfluoro-n-[1,2,3,4,5,6,7-13C7]undecanoic acid	STL02580	$^{13}C_7$-PFUnA	400			2.00
	Perfluoro-n-[1,2-13C2]dodecanoic acid	STL00998	$^{13}C_2$-PFDoA	400			2.00
	Perfluoro-n-[1,2-13C2]tetradecanoic acid	STL02116	$^{13}C_2$-PFTeDA	400			2.00
	Perfluoro-1-[2,3,4-13C3]butanesulfonic acid	STL02337	$^{13}C_3$-PFBS	372			1.86
	Perfluoro-1-[1,2,3-13C3]hexanesulfonic acid	STL02581	$^{13}C_3$-PFHxS	378			1.89
	Perfluoro-1-[13C8]octanesulfonic acid	STL01054	$^{13}C_8$-PFOS	382			1.91
	Perfluoro-1-[13C8]octanesulfonamide	STL01056	$^{13}C_8$-PFOSA	400			2.00
	N-methyl-d3-perfluoro-1-octanesulfonamidoacetic acid	STL02118	d_3-NMeFOSAA	1000			5.00
	N-ethyl-d5-perfluoro-1-octanesulfonamidoacetic acid	STL02117	d_5-NEtFOSAA	1000			5.00
	1H,1H,2H,2H-Perfluoro-1-[1,2-13C2]hexane sulfonic acid	STL02395	$^{13}C_2$-4:2FTS	934			4.67
	1H,1H,2H,2H-Perfluoro-1-[1,2-13C2]octane sulfonic acid	STL02279	$^{13}C_2$-6:2FTS	950			4.75
	1H,1H,2H,2H-Perfluoro-1-[1,2-13C2]decane sulfonic acid	STL02280	$^{13}C_2$-8:2FTS	958			4.79
	Tetrafluoro-2-heptafluoropropoxy-13C3-propanoic acid	STL02255	$^{13}C_3$-HFPO-DA	400			2.00
	N-methyl-d7-perfluorooctanesulfonamidoethanol	STL02277	d_7-N-MeFOSE-M	1000			5.00
	N-ethyl-d9-perfluorooctanesulfonamidoethanol	STL02278	d_9-N-EtFOSE-M	1000			5.00
	N-ethyl-d5-perfluoro-1-octanesulfonamide	STL02704	d_5-NEtPFOSA	400			2.00
	N-methyl-d3-perfluoro-1-octanesulfonamide	STL02705	d_3-NMePFOSA	400			2.00
	Perfluoropropanoic acid (PFPrA) ($^{13}C_3$)	STL03194	$^{13}C_3$-PFPrA	400			2.00
1633 NIS Intermediate	Perfluoro-n-[2,3,4-13C3]butanoic acid	STL02680	$^{13}C_3$-PFBA	400	0.050		2.00
	Perfluoro-n-[1,2,3,4-13C4]octanoic acid	STL00990	$^{13}C_4$-PFOA	1000			5.00
	Perfluoro-n-[1,2-13C2]decanoic acid	STL00996	$^{13}C_2$-PFDA	400			2.00
	Perfluoro-n-[1,2,3,4-13C4]octanesulfonic acid	STL00991	$^{13}C_4$-PFOS	382			1.91
	Perfluoro-n-[1,2,3,4,5-13C5] nonanoic acid	STL00995	$^{13}C_5$-PFNA	400			2.00
	Perfluoro-n-[1,2-13C2]hexanoic acid	STL00993	$^{13}C_2$-PFHxA	1000			5.00
	Perfluoro-1-hexane[18O2]sulfonic acid	STL00994	$^{18}O_2$-PFHxS	378			1.89

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Attachment 20 - Purchased Standards					
Vendor	Cat. No.	Analyte	CAS#	Acronym	Conc. (ng/ml)
Wellington	PFBA	Perfluorobutanoic acid	375-22-4	PFBA	50000
Wellington	PFPeA	Perfluoropentanoic acid	2706-90-3	PFPeA	50000
Wellington	PFHxA	Perfluorohexanoic acid	307-24-4	PFHxA	50000
Wellington	PFHpA	Perfluoroheptanoic acid	375-85-9	PFHpA	50000
Wellington	br-PFOA	Perfluorooctanoic acid	335-67-1	PFOA	50000
Wellington	br-PFNA	Perfluorononanoic acid	375-95-1	PFNA	50000
Wellington	PFDA	Perfluorodecanoic acid	335-76-2	PFDA	50000
Wellington	PFUdA	Perfluoroundecanoic acid	2058-94-8	PFUnA	50000
Wellington	MPFDOA	Perfluorododecanoic acid	307-55-1	PFDoA	50000
Wellington	PFTrDA	Perfluorotridecanoic acid	72629-94-8	PFTrDA	50000
Wellington	PFTeDA	Perfluorotetradecanoic acid	376-06-7	PFTeDA	50000
Wellington	L-PFBS	Perfluorobutanesulfonic acid	375-73-5	PFBS	44200
Wellington	L-PFPeS	Perfluoropentansulfonic acid	2706-91-4	PFPeS	46900
Wellington	br-PFHxSK	Perfluorohexanesulfonic acid	355-46-4	PFHxS	45500
Wellington	L-PFHpS	Perfluoroheptanesulfonic acid	375-92-8	PFHpS	47600
Wellington	br-PFOSK	Perfluorooctanesulfonic acid	1763-23-1	PFOS	46600
Wellington	L-PFNS	Perfluorononanesulfonic acid	68259-12-1	PFNS	48000
Wellington	L-PFDS	Perfluorodecanesulfonic acid	335-77-3	PFDS	48200
Wellington	L-PFDoS	Perfluorododecanesulfonic acid	79780-39-5	PFDoS	48400
Wellington	4;2 FTS	1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	757124-72-4	4:2-FTS	46700
Wellington	6;2 FTS	1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	27619-97-2	6:2-FTS	47400
Wellington	8;2 FTS	1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	39108-34-4	8:2-FTS	47900
Wellington	br-FOSA	Perfluorooctanesulfonamide	754-91-6	PFOSA	50000
Wellington	br-NMeFOSA	N-methyl perfluorooctanesulfonamide	31506-32-8	NMeFOSA / N-MePFOSA	50000
Wellington	br-NEtFOSA	N-ethyl perfluorooctanesulfonamide	4151-50-2	NEtFOSA / N-EtPFOSA	50000
Wellington	br-NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid	2355-31-9	NMeFOSAA	50000
Wellington	br-NEtFOSAA	N-ethyl perfluorooctanesulfonamidoacetic acid	2991-50-6	NEtFOSAA	50000
Wellington	br-NMeFOSE	N-methyl perfluorooctanesulfonamidoethanol	24448-09-7	NMePFOSAE / NMeFOSE	50000
Wellington	br-NEtFOSE	N-ethyl perfluorooctanesulfonamidoethanol	1691-99-2	NEtPFOSAE / NEtFOSE	50000
Wellington	HFPO-DA	Hexafluoropropylene oxide dimer acid	13252-13-6	HFPO-DA / GenX	50000
Wellington	NaDONA	4,8-Dioxa-3H-perfluorononanoic acid	919005-14-4	ADONA	47100
Wellington	PFEESA	Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	PFEESA / PES	44500
Wellington	PF4OPeA	Perfluoro-3-methoxypropanoic acid	377-73-1	PFMPA / PFECA F	50000
Wellington	PF5OHxA	Perfluoro-4-methoxybutanoic acid	863090-89-5	PFMBA / PFECA A	50000
Wellington	3,6-OPFHpA	Nonafluoro-3,6-dioxaheptanoic acid	151772-58-6	NFDHA / PFECA B	50000
Wellington	9Cl-PF3ONS	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	756426-58-1	9Cl-PF3ONS	46600
Wellington	11Cl-PF3OUdS	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	763051-92-9	11Cl-PF3OUdS	47100
Wellington	FPrPA	3-Perfluoropropyl propanoic acid	356-02-5	3:3 FTCA	50000
Wellington	FPePA	2H,2H,3H,3H-Perfluorooctanoic acid	914637-49-3	5:3 FTCA	50000
Wellington	FHpPA	3-Perfluoroheptyl propanoic acid	812-70-4	7:3 FTCA	50000
Wellington	PFECHS	Perfluoro-4-ethylcyclohexanesulfonate	335-24-0	PFECHS	46100
Wellington	FBSA-I	Perfluoro-1-butanesulfonamide	30334-69-1	FBSA	50000
Wellington	FHxSA-I	Perlfuoro-1-hexanesulfonamide	41997-13-1	FHxSA	50000
Wellington	PFPrA	Perfluoropropanoic acid	422-64-0	PFPrA / PPF Acid	50000
Wellington	PFODA	Perfluoro-n-octadecanoic acid	16517-11-6	PFODA	50000
AccuStandard	PFOS-030S	Bis(trifluoromethylsulfonyl)amine	82113-65-3	TFSI	97900
Wellington	MPFBA	Perfluoro-n-[13C4]butanoic acid	STL00992	$^{13}C_4$-PFBA	50000
Wellington	M5PFPeA	Perfluoro-n-[13C5]pentanoic acid	STL01893	$^{13}C_5$-PFPeA	50000
Wellington	M5PFHxA	Perfluoro-n-[1,2,3,4,6-13C5]hexanoic acid	STL02577	$^{13}C_5$-PFHxA	50000
Wellington	M4PFHpA	Perfluoro-n-[1,2,3,4-13C4]heptanoic acid	STL01892	$^{13}C_4$-PFHpA	50000
Wellington	M8PFOA	Perfluoro-n-[13C8]octanoic acid	STL01052	$^{13}C_8$-PFOA	50000
Wellington	M9PFNA	Perfluoro-n-[13C9]nonanoic acid	STL02578	$^{13}C_9$-PFNA	50000
Wellington	M6PFDA	Perfluoro-n-[1,2,3,4,5,6-13C6]decanoic acid	STL02579	$^{13}C_6$-PFDA	50000
Wellington	M7PFUdA	Perfluoro-n-[1,2,3,4,5,6,7-13C7]undecanoic acid	STL02580	$^{13}C_7$-PFUnA	50000
Wellington	MPFDoA	Perfluoro-n-[1,2-13C2]dodecanoic acid	STL00998	$^{13}C_2$-PFDoA	50000
Wellington	M2PFTeDA	Perfluoro-n-[1,2-13C2]tetradecanoic acid	STL02116	$^{13}C_2$-PFTeDA	50000
Wellington	M3PFBS	Perfluoro-1-[2,3,4-13C3]butanesulfonic acid	STL02337	$^{13}C_3$-PFBS	46500
Wellington	M3PFHxS	Perfluoro-1-[1,2,3-13C3]hexanesulfonic acid	STL02581	$^{13}C_3$-PFHxS	47300
Wellington	M8PFOS	Perfluoro-1-[13C8]octanesulfonic acid	STL01054	$^{13}C_8$-PFOS	47800
Wellington	M8FOSA-I	Perfluoro-1-[13C8]octanesulfonamide	STL01056	$^{13}C_8$-PFOSA	50000
Wellington	d3-N-MeFOSAA	N-methyl-d3-perfluoro-1-octanesulfonamidoacetic acid	STL02118	d_3-NMeFOSAA	50000
Wellington	d5-N-EtFOSAA	N-ethyl-d5-perfluoro-1-octanesulfonamidoacetic acid	STL02117	d_5-NEtFOSAA	50000
Wellington	M2-4;2FTS	1H,1H,2H,2H-Perfluoro-1-[1,2-13C2]hexane sulfonic acid	STL02395	$^{13}C_2$-4:2FTS	46700
Wellington	M2-6;2FTS	1H,1H,2H,2H-Perfluoro-1-[1,2-13C2]octane sulfonic acid	STL02279	$^{13}C_2$-6:2FTS	47500
Wellington	M2-8;2FTS	1H,1H,2H,2H-Perfluoro-1-[1,2-13C2]decane sulfonic acid	STL02280	$^{13}C_2$-8:2FTS	47900
Wellington	M3HFPO-DA	Tetrafluoro-2-heptafluoropropoxy-13C3-propanoic acid	STL02255	$^{13}C_3$-HFPO-DA	50000
Wellington	d7-N-MeFOSE-M	N-methyl-d7-perfluorooctanesulfonamidoethanol	STL02277	d_7-N-MeFOSE-M	50000
Wellington	d9-N-EtFOSE-M	N-ethyl-d9-perfluorooctanesulfonamidoethanol	STL02278	d_9-N-EtFOSE-M	50000
Wellington	d-N-MeFOSA-M	N-ethyl-d5-perfluoro-1-octanesulfonamide	STL02704	d_5-NEtPFOSA	50000
Wellington	d-N-EtFOSA-M	N-methyl-d3-perfluoro-1-octanesulfonamide	STL02705	d_3-NMePFOSA	50000
Cambridge Isotope	CLM-11324-A-1.2	Perfluoropropanoic acid (PFPrA) ($^{13}C_3$)	STL03194	$^{13}C_3$-PFPrA	50000
Wellington	M3PFBA	Perfluoro-n-[2,3,4-13C3]butanoic acid	STL02680	$^{13}C_3$-PFBA	50000
Wellington	MPFOA	Perfluoro-n-[1,2,3,4-13C4]octanoic acid	STL00990	$^{13}C_4$-PFOA	50000
Wellington	MPFDA	Perfluoro-n-[1,2-13C2]decanoic acid	STL00996	$^{13}C_2$-PFDA	50000
Wellington	MPFOS	Perfluoro-n-[1,2,3,4-13C4]octanesulfonic acid	STL00991	$^{13}C_4$-PFOS	47800
Wellington	MPFNA	Perfluoro-n-[1,2,3,4,5-13C5] nonanoic acid	STL00995	$^{13}C_5$-PFNA	50000
Wellington	MPFHxA	Perfluoro-n-[1,2-13C2]hexanoic acid	STL00993	$^{13}C_2$-PFHxA	50000
Wellington	MPFHxS	Perfluoro-1-hexane[18O2]sulfonic acid	STL00994	$^{18}O_2$-PFHxS	47300
Wellington	M2PFOA	Perfluoro-n-(1,2-13C2)octanoic acid	STL00623	$^{13}C_2$-PFOA	50000
Wellington	MPFUdA	Perfluoro-n-(1,2-13C2)undecanoic acid	STL00997	$^{13}C_2$-PFUnA	50000
Wellington	M3PFPeA	Perfluoro-n-(3,4,5-13C3)pentanoic acid	STL03269	$^{13}C_3$-PFPeA	50000
Sigma Aldrich	T0557-500MG	Taurodeoxycholic acid	516-50-7	TDCA	neat
Sigma Aldrich	T6260-1G	Taurochenodeoxycholic acid	516-35-8	TCDCA	neat
Calbiochem	580549-1GM	Tauroursodeoxycholic acid	14605-22-2	TUDCA	neat

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Table 5. IPR/OPR/LLOPR Acceptance Limits for Target Analytes in Aqueous Matrices[1]

Target Analyte	IPR[2]		OPR/LLOPR Recovery (%)[2]
	Mean Recovery (%)	RSD (%)	
PFBA	70 - 135	21	70 - 140
PFPeA	70 - 135	23	65 - 135
PFHxA	70 - 135	24	70 - 145
PFHpA	70 - 135	28	70 - 150
PFOA	65 - 155	27	70 - 150
PFNA	70 - 140	28	70 - 150
PFDA	65 - 140	26	70 - 140
PFUnA	70 - 135	29	70 - 145
PFDoA	70 - 130	21	70 - 140
PFTrDA	60 - 145	29	65 - 140
PFTeDA	70 - 145	27	60 - 140
PFBS	70 - 140	23	60 - 145
PFPeS	70 - 135	25	65 - 140
PFHxS	70 - 135	27	65 - 145
PFHpS	70 - 140	30	70 - 150
PFOS	70 - 140	29	55 - 150
PFNS	70 - 135	29	65 - 145
PFDS	70 - 135	30	60 - 145
PFDoS	45 - 135	35	50 - 145
4:2FTS	70 - 135	27	70 - 145
6:2FTS	70 - 135	32	65 - 155
8:2FTS	70 - 140	33	60 - 150
PFOSA	70 - 135	22	70 - 145
NMeFOSA	70 - 135	30	60 - 150
NEtFOSA	70 - 130	26	65 - 145
NMeFOSAA	65 - 140	32	50 - 140
NEtFOSAA	70 - 135	28	70 - 145
NMeFOSE	70 - 135	29	70 - 145
NEtFOSE	70 - 130	21	70 - 135
HFPO-DA	70 - 135	23	70 - 140
ADONA	70 - 135	23	65 - 145
PFMPA	60 - 140	23	55 - 140
PFMBA	65 - 145	27	60 - 150
NFDHA	65 - 140	37	50 - 150
9Cl-PF3ONS	70 - 145	30	70 - 155
11Cl-PF3OUdS	50 - 150	35	55 - 160
PFEESA	70 - 135	25	70 - 140
3:3FTCA	70 - 130	23	65 - 130
5:3FTCA	70 - 130	24	70 - 135
7:3FTCA	55 - 130	34	50 - 145

[1] Limits apply to the IPR, OPR, and LLOPR analyses associated with all aqueous matrices, including wastewater, surface water, groundwater, and landfill leachates.

[2] The recovery and RSD limits apply to the target analyte results for IPR, OPR, and LLOPR samples associated with all aqueous matrices. Data were derived from the multi-laboratory validation study and are therefore the limits required for this method.

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Table 6. Acceptance Limits for EIS and NIS Compounds in All Aqueous Matrices and Associated QC Samples		
	Aqueous Matrices Other Than Leachates[2]	Landfill Leachates[3]
EIS Compound[1]	Recovery (%)	Recovery (%)
$^{13}C_4$-PFBA	5[4] - 130	5[4] - 130
$^{13}C_5$-PFPeA	40 - 130	40 - 130
$^{13}C_5$-PFHxA	40 - 130	40 - 130
$^{13}C_4$-PFHpA	40 - 130	40 - 130
$^{13}C_8$-PFOA	40 - 130	40 - 130
$^{13}C_9$-PFNA	40 - 130	40 - 130
$^{13}C_6$-PFDA	40 - 130	40 - 130
$^{13}C_7$-PFUnA	30 - 130	40 - 130
$^{13}C_2$-PFDoA	10 - 130	35 – 130
$^{13}C_2$-PFTeDA	10 - 130	25 – 130
$^{13}C_3$-PFBS	40 - 135	40 - 130
$^{13}C_3$-PFHxS	40 - 130	40 - 130
$^{13}C_8$-PFOS	40 - 130	40 - 130
$^{13}C_2$-4:2FTS	40 - 200	40 – 220
$^{13}C_2$-6:2FTS	40 - 200	40 – 170
$^{13}C_2$-8:2FTS	40 - 300	40 – 145
$^{13}C_8$-PFOSA	40 - 130	40 – 130
D_3-NMeFOSA	10 - 130	40 – 130
D_5-NEtFOSA	10 - 130	35 - 130
D_3-NMeFOSAA	40 - 170	35 - 130
D_5-NEtFOSAA	25 - 135	30 - 130
D_7-NMeFOSE	10 - 130	20 - 130
D_9-NEtFOSE	10 - 130	20 - 130
$^{13}C_3$-HFPO-DA	40 - 130	40 - 130
$^{13}C_3$-PFBA	50 - 200	50 - 200
$^{13}C_2$-PFHxA		
$^{13}C_4$-PFOA		
$^{13}C_5$-PFNA		
$^{13}C_2$-PFDA		
$^{18}O_2$-PFHxS		
$^{13}C_4$-PFOS		

[1] The recovery limits for the EIS compounds were derived by EPA from the data from multi-laboratory validation study. To simplify laboratory operations, EPA has applied the same EIS recovery limits used for field sample analyses to the EIS recoveries in the method blank, IPR, OPR, and LLOPR samples. There are no IPR mean or RSD criteria for the EIS compounds.

[2] Limits apply to the EIS and NIS recoveries from samples of aqueous matrices, including wastewater, surface water, and groundwater, but **not** landfill leachates.

[3] Limits apply to the EIS and NIS recoveries from samples of landfill leachates, **not** other aqueous matrices.

[4] Recovery of $^{13}C_4$-PFBA can be problematic in some field samples. Although the lower limit for recovery for this EIS is set below 10%, laboratories should routinely track recovery of this EIS and take reasonable steps to ensure that recovery is at least 10% in the majority of samples.

eurofins	Always check on-line for validity. **Solid PFAS Prep by Sonication and Analysis by LC-MS-MS by EPA 1633 and EPA 1633A**	Level: **Work Instruction**
Document number: **T-PFAS-WI72213**		
Old Reference:		
Version: **5**		Organisation level: **5-Sub-BU**
Approved by: **TYZ8** Effective Date: **11-MAR-2025**	Document users: **5_EUUSLA_PFAS_Manager, 6_EUUSLA_PFAS_Analyst, 6_EUUSLA_PFAS_BKK_Data_Reviewers, 6_EUUSLA_PFAS_Data_Reviewers, 6_EUUSLA_PFAS_Management_Team, 6_EUUSLA_PFAS_Sample_Prep**	Responsible: **5_EUUSLA_PFAS_Manager**

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Revision Log

	Revision: 05	**Effective date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Cross Reference	Enhancement	Added Moisture form, QC rotation form
Sample Collection, Preservation, and Handling	Clarification	Clarified sample container
Reagents and Standards	Enhancement	Added sand
Procedure A	Enhancement	Added an additional centrifugation step. Added Data Types. Added uncertainty to biosolid weights. Added requirement to check sonicator water level. Added solvents to clean manifold ports. Added drip rate.

	Revision: 04	**Effective date:** 31.OCT.2024
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Apparatus and Equipment	Enhancement	Added missing vendors. Standards are stored in the dark.
Calibration	Enhancement	CCVs are run every 10 injections of field sample extracts
Reagents and Standards	Enhancement	Added missing vendors.
Procedure A, B, C	Clarification	Clarified prep procedure
Procedure D	Clarification	removed references to Cal0. Added additional ICB in sequence. Rearranged section.
Procedure E	Enhancement	Added section to address dilutions
QA/QC	Clarification	IAR ratio is based off the mid-point CCV standard
Attachments	Clarification	Updates to Att 01, 02, 11,12, 16

Reference

1. USEPA Method 1633, Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS, January 2024.

2. USEPA Method 1633 Revision A, Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS, December 2024.

3. Chemical Hygiene Plan, current version.

Cross Reference

Document	Document Title
T-PFAS-WI21568	Environmental Monitoring in the PFAS Lab
T-PEST-WI9847	Common Equations Used During Chromatographic Analyses
QA-SOP11178	Demonstrations of Capability
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation
T-PFAS-WI23588	Preventative and Corrective Maintenance for the AB Sciex Liquid Chromatograph Mass Spectrometers (LC-MS/MS)
G-DC-FRM23907	Redacted SOPs
T-PFAS-FRM74731	D4033 - Moisture Calculation

Scope

This method is applicable for the determination of selected per- and polyfluorinated alkyl substances (PFAS) in solid samples to include solids and biosolids. The compounds analyzed in this method are

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listed in the table below. The most current MDLs and LOQs are listed in the LIMS. Compounds other than those listed may be analyzed by client request.

Analyte	Acronym	CAS#
Perfluorobutanoic acid	PFBA	375-22-4
Perfluoropentanoic acid	PFPeA	2706-90-3
Perfluorohexanoic acid	PFHxA	307-24-4
Perfluoroheptanoic acid	PFHpA	375-85-9
Perfluorooctanoic acid	PFOA	335-67-1
Perfluorononanoic acid	PFNA	375-95-1
Perfluorodecanoic acid	PFDA	335-76-2
Perfluoroundecanoic acid	PFUnA	2058-94-8
Perfluorododecanoic acid	PFDoA	307-55-1
Perfluorotridecanoic acid	PFTrDA	72629-94-8
Perfluorotetradecanoic acid	PFTeDA	376-06-7
Perfluorobutanesulfonic acid	PFBS	375-73-5
Perfluoropentanesulfonic acid	PFPeS	2706-91-4
Perfluorohexanesulfonic acid	PFHxS	355-46-4
Perfluoroheptanesulfonic acid	PFHpS	375-92-8
Perfluorooctanesulfonic acid	PFOS	1763-23-1
Perfluorononanesulfonic acid	PFNS	68259-12-1
Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanesulfonic acid	PFDoS	79780-39-5
1H,1H,2H,2H-Perfluorohexane sulfonic acid	4:2 FTS	757124-72-4
1H,1H,2H,2H-Perfluorooctane sulfonic acid	6:2 FTS	27619-97-2
1H,1H,2H,2H-Perfluorodecane sulfonic acid	8:2 FTS	39108-34-4
Perfluorooctanesulfonamide	PFOSA	754-91-6
N-methylperfluorooctane sulfonamide	NMeFOSA, N-MePFOSA	31506-32-8
N-ethylperfluorooctane sulfonamide	NEtFOSA, N-EtPFOSA	4151-50-2
N-methylperfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9
N-ethylperfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6
N-methylperfluorooctane sulfonamidoethanol	NMeFOSE, NMePFOSAE	24448-09-7
N-ethylperfluorooctane sulfonamidoethanol	NEtFOSE, NEtFOSAE	1691-99-2
Hexafluoropropylene Oxide Dimer Acid	HFPO-DA, GenX	13252-13-6
4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4 *
Perfluoro-3-methoxypropanoic acid	PFMPA, PFECA F	377-73-1

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Analyte	Acronym	CAS#
Perfluoro-4-methoxybutanoic acid	PFMBA, PFECA A	863090-89-5
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA, PFECA B	151772-58-6
9-chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	9Cl-PF3ONS	756426-58-1
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9
3-Perfluoropropylpropanoic acid	3:3 FTCA	356-02-5
3-Perfluoropentylpropanoic acid	5:3 FTCA	914637-49-3
3-Perfluoroheptylpropanoic acid	7:3 FTCA	812-70-4
Perfluoro (2-ethoxyethane) sulfonic acid	PFEESA, PES	113507-82-7
Perfluoro-4-ethylcyclohexanesulfonic acid	PFECHS	133201-07-7
Perfluorobutylsulfonamide	FBSA	30334-69-1
Perfluorohexanesulfonamide	FHxSA	41997-13-1

*CAS# for the free acid form of the analyte

Basic Principles

A solid sample is fortified with isotopically-labeled extraction standards. The sample is sonicated, centrifuged, and the supernatant decanted. Carbon cleanup is performed on each sample extract. Sample extract is diluted to volume and then concentrated. The sample is then passed through a solid phase extraction (SPE) cartridge to extract the analytes. The compounds are eluted from the solid phase with a combination of solvents. The extract is fortified with Isotopically-labeled injection internal standards. It is then analyzed by LC/MS/MS operated in negative electrospray ionization (ESI) mode for detection and quantification of the analytes. Quantitative analysis is performed using isotope dilution.

Interferences

Compounds which have similar structures to the compounds of interest and similar molecular weights would potentially interfere. Method interferences may be caused by contaminants in solvents, reagents (including reagent water), sample bottles and caps, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in the chromatograms. The analytes in this method can also be found in many common laboratory supplies and equipment, such as PTFE (polytetrafluoroethylene) products, LC solvent lines, methanol, aluminum foil, etc. A laboratory blank is performed with each batch of samples to demonstrate that the extraction system is free of contaminants.

Precaution to Minimize Method Interference

1. LC system components contain many of the target analytes. To minimize the background PFAS peaks, PTFE solvent frits and tubing are replaced by PEEK™ solvent frits and tubing where possible.

2. A precolumn, Proprietary Content, is installed before the injection valve to separate PFAS in standards/samples from those from the LC system and mobile phases.

3. All parts of the SPE manifold must be cleaned as per *T-PFAS-WI21568*.

Safety Precautions and Waste Handling

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. PFOA has been described as "likely to be carcinogenic to humans". Each chemical should be treated as a potential health hazard and exposure to these chemicals should be minimized.

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Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves. Gloves, lab coats, and safety glasses should be worn when preparing standards and handling samples. Avoid inhaling solvents and chemicals and getting them on the skin. Wear gloves when handling neat materials. When working with acids and bases, take care not to come in contact and to wipe any spills. Always add acid to water when preparing reagents containing concentrated acids.

All laboratory waste is accumulated, managed, and disposed of in accordance with all Federal, State, and local laws and regulations. All solvent waste and extracts are collected in approved solvent waste containers in the laboratory and subsequently emptied by personnel trained in hazardous waste disposal into the lab-wide disposal facility. HPLC vials are disposed of in the lab container for waste vials, and subsequently lab packed. Any solid waste material (disposable pipettes and broken glassware, etc.) may be disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC).

Each chemist performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Also, several batches of sample extractions must be performed under the direct observation of another experienced chemist to assure the trainee is capable of independent preparation. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

Each LC/MS/MS analyst must work with an experienced employee for a period of time until they can independently calibrate the LC/MS/MS, review and process data, and perform maintenance procedures. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

The IPR (IDOC) and the DOC consist of 4 laboratory control samples (or alternatively, one blind sample for the DOC) that are spiked at the LCS level and carried through all steps of the extraction and analysis. Using results of the set of four analyses, compute the average percent recovery and the relative standard deviation (RSD) of the concentration for each analyte.

- For each target, the RSD and percent recovery must meet the criteria in Table 7. If any individual RSD exceeds the precision limit or any individual percent recovery falls outside the range for recovery for a target, system performance is unacceptable for that compound. Correct the problem and repeat the test.

- For each EIS and NIS, the percent recovery must meet the criteria defined in Table 8. There are is no RSD criteria for the EIS or NIS. If any individual percent recovery falls outside the range for an EIS or NIS, system performance is unacceptable for that compound. Correct the problem and repeat the test.

See *QA-SOP11178* for additional information on IDOC and DOC.

Sample Collection, Preservation, and Handling

A. Sample Collection

The samples are collected in 4-oz HDPE specimen containers with polyethylene screw caps. Keep the sample sealed from time of collection until extraction.

NOTE: PFAS contamination during sampling can occur from a number of common sources, such as food packaging and certain foods and beverages. Proper hand washing and wearing nitrile gloves will aid in minimizing this type of accidental contamination of the samples.

B. Sample Storage and Shipment

1. Solid and Biosolid samples must be chilled during shipment and must not exceed 6°C during the first 48 hours after collection. Sample temperature must be confirmed to be at 0° to 6°C when the samples are received at the laboratory.

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2. Solid and Biosolid samples stored in the lab must be protected from light and held at a temperature of 0° to 6°C, or less than or equal to -20°C, until extraction.

3. Solid and Biosolid samples must be extracted within 90 days.

NOTE: Biosolid samples stored under refrigeration may produce gases that may cause sample to be expelled from the container when opened. This may produce noxious odors. It is recommended to store frozen if extraction will not occur for a few days.

4. Extracts must be analyzed within 28 days after extraction when stored at a temperature of 0° to 6°C, not frozen, and protected from light. Extracts must be analyzed within 90 days after extraction when stored at a temperature less than or equal to -20°C and protected from light.

Apparatus and Equipment

A. Apparatus

1. Specimen container; PP; natural; graduated; non-sterile; separate 1/4-turn red screwcap; 4 oz. Greenwood Products, Inc., Part No. HP30011 or equivalent

Note: One bottle per lot must be tested and demonstrated to be PFAS-free at or below the laboratory's MDLs for all target analytes. See *T-PFAS-WI21568* for additional details.

2. Centrifuge tubes, 15-mL conical polypropylene with polypropylene screw caps. Fisher Scientific, Catalog No. 05-539-5 or equivalent.

3. HDPE bottles for extraction fluid storage, 1L. Environmental Sampling Supply, Catalog No. 1000-1902-PC or equivalent.

4. Analytical Balance – Capable of weighing to 0.0001 g

5. Top-Loading Balance – Capable of weighing to 0.01 g

6. Solid phase extraction (SPE) Cartridge; Proprietary Content or equivalent.

7. GCB filter cartridge, Proprietary Content or equivalent.

8. Large-volume SPE Reservoir, 25-mL. Millipore-Sigma, Product No. 54258-U or equivalent.

9. SPE Tube Adapter. Millipore-Sigma, Catalog No. 57020-U or equivalent.

10. SPE vacuum extraction manifold – "Resprep" 24-port manifold. Restek, Catalog No. 26080 or equivalent.

11. Polypropylene SPE delivery needles. Agilent, Catalog No. 12234511 or equivalent.

12. Centrifuge, capable of a minimum rotational force of 3500 rcf, rotor radius 19.5 cm. Sorvall ST4 Plus-MD; Fisher Scientific, Catalog No. 75009510 or equivalent.

13. Auto Pipettes, Eppendorf Repeater, capable of accurately dispensing 10- to 1000-µL. Fisher Scientific, Catalog No. 14-287-150 or equivalent.

14. Polypropylene pipette tips, 0.1-200 µL. Fisher Scientific, Catalog No. 02-681-135 or equivalent.

15. Polypropylene pipette tips, 101-1000 µL. Fisher Scientific, Catalog No. 02-707-507 or equivalent.

16. Polypropylene pipette tips, 1 – 10 mL. Eppendorf, Catalog No. 022492098 or equivalent.

17. Pipettes, disposable transfer. Fisher Scientific, Catalog No. 13-711-7M or equivalent.

18. Vortex mixer, variable speed, Fisher Scientific or equivalent.

19. N-Evap sample extract concentrator with N_2 supply and water bath for temperature control. Organomation, Inc., Catalog No. 11250, or equivalent.

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20. Reagent Water Purification System: Capable of producing ultrapure "Type 1/Milli-Q"-grade water from in-house deionized water system. Millipore SAS, Catalog No. FTPF08831.

21. SureStart Polyspring inserts. Fisher Scientific, Catalog No. 03452340 or equivalent.

22. Short-Cap Vial with Grad Marking Spot, 9-425 Screw-Thread, 2.0 mL, 9 mm, Clear. Restek, Catalog No. 21141 or equivalent.

23. Short Screw Caps, Polypropylene, Screw-Thread, PTFE/Silicone Septa, Blue, Preassembled, 2.0 mL, 9 mm. Restek, Catalog No. 24485 or equivalent.

24. Centrifuge tubes, 50-mL conical polypropylene with polypropylene screw caps. Fisher Scientific, Catalog No. 06-443-21 or equivalent.

25. Polypropylene bottles for standard storage, 4 mL. Fisher Scientific, Catalog No. 2006-9125 or equivalent.

26. Stainless steel spatula/scoop set. Bel-Art SP Scienceware, Product No. 11-865-130 or equivalent.

27. pH paper, Hydrion, range 5.5-8.0. Fisher Scientific, Catalog No. 14-853-275 or equivalent.

28. Syringe filter, 25 mm Syringe Filter, 0.22 um, 100-pk. Restek, Catalog No. 26148 or equivalent.

29. Sonicator bath - Branson 3800 or equivalent.

30. Wooden Tongue Depressors. Fisher Scientific, Catalog No. 11-700-555 or equivalent.

31. Mobile phase bottles, 5 L. Fisher Scientific, Catalog No. 064141F or equivalent.

B. Equipment

1. AB Sciex Triple Quad 5500/5500+ Turbo V Ion Source or equivalent.

   ExionLC Controller
   ExionLC AC Pump
   ExionLC AC Autosampler
   Exion AC Column Oven
   Data system – Analyst 1.6.3

2. AB Sciex Triple Quad 7500 QTRAP Ready or equivalent.

   Shimadzu DGU-405 Degasser
   Shimadzu LC-40D XR Pump A
   Shimadzu LC-40D XR Pump B
   Shimadzu SIL-40C XR Autosampler
   Shimadzu CBM-40 Controller
   Shimadzu CTO-40C Column Oven
   Data system – Sciex OS (Version 3.1.6.44)

3. Automated extractor, Proprietary Content or equivalent

4. HPLC columns

   a. Analytical column: Proprietary Content or equivalent.
   b. Pre-column: Proprietary Content or equivalent.

Reagents and Standards

All solvents, acids, and bases are stored in glass bottles in flammable proof cabinets or pressure resistant steel drums. Solvents, acids, and bases are stored at ambient temperature for up to 1 year. All non-solvents are stored according to manufacturer's storage conditions.

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A. Reagents

1. Methanol (MeOH), "Chromasolv LC-MS" grade. Honeywell, Catalog No. 34966-4X4L or equivalent.
2. Acetonitrile (ACN). J.T. Baker, Catalog No. 9012-03 or equivalent.
3. Ammonium acetate. Sigma Aldrich, Catalog No. 431311-250G or equivalent. Store at 0-6°C.
4. Proprietary Content or equivalent. Store at room temperature.
    a. Proprietary Content Store at room temperature. Replace after 3 months.
    b. Proprietary Content Store at room temperature. Replace after 1 month.
    c. Proprietary Content. Store at room temperature. Replace after 1 month.
5. 30:70 (v/v) Methanol:Water – Add methanol (300 mL) to water (700 mL). Store at room temperature. Replace after 1 month.
6. Methanol with 5% water - Add reagent water (50 mL) to methanol (950 mL). Store at room temperature. Replace after 1 month.
7. Acetic Acid, ACS grade. Sigma Aldrich, Catalog No. 695092-100mL or equivalent. Store at room temperature.
    a. Acetic Acid (0.1% v/v) – Dissolve acetic acid (1 mL) in reagent water (1 L). Store at room temperature. Replace after 3 months.
8. Formic Acid, ACS-grade. Sigma, Catalog No. 33015-1L or equivalent.
    a. Formic acid (aqueous, 0.1 M) - Dissolve formic acid (4.6 g or 3.8 mL) in reagent water (1 L). Store at room temperature. Replace after 2 years
    b. Formic acid (aqueous, 0.3 M) - Dissolve formic acid (13.8 g or 11.3 mL) in reagent water (1 L). Store at room temperature. Replace after 2 years
    c. Formic acid (aqueous, 5% v/v) - Mix 5 mL formic acid with 95 mL reagent water. store at room temperature. Replace after 2 years
    d. Formic acid (aqueous, 50% v/v) - Mix 50 mL formic acid with 50 mL reagent water. Store at room temperature. Replace after 2 years.
9. Proprietary Content or equivalent. Store at room temperature. Replace 1 year after opening.
    a. Proprietary Content. Store at room temperature. Expires 1 month after preparation.
10. Sand - Sigma-Aldrich, Part No. 274739-5Kg or equivalent.
11. Mobile Phase A: Proprietary Content. Store at room temperature for up to 2 months. Different volumes can be prepared as long as final concentrations are equivalent.
12. Mobile Phase B: 100% acetonitrile into a 2-L glass mobile phase bottle. Store at room temperature for up to 2 months.

B. Standards

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Standards are prepared using calibrated pipettes, polypropylene microcentrifuge tubes, and polypropylene bottles to create solutions at desired concentrations. The concentrated solution is injected below the surface of the diluting solvent. After preparation is completed, standards should be vortexed to ensure complete mixing. Measurement of volumes less than 5 µl should be avoided in routine production operations.

All stock, intermediate and spiking solutions are prepared using methanol. All initial calibration, initial calibration verification, and linear branched working standard solutions are prepared using Proprietary Content.

All diluted solutions must be stored in HDPE containers that have been thoroughly rinsed with methanol.

Stock standard and intermediate standard solutions are stored in the dark in the refrigerator in labeled polypropylene screw-top vials, polypropylene bottles, or polypropylene centrifuge tubes.

Expiration dates are managed through LIMS Reagent module. Solutions transferred from sealed glass ampules to screw-capped vials are given expiration dates of 1 year from the date opened or the expiration date provided by the vendor, whichever occurs sooner. Intermediate solutions are given an expiration date of 6 months from the preparation date, or the expiration date from the ampule provided by the vendor, whichever occurs sooner. The ampules and transferred solutions are stored in the refrigerator in the dark.

Working native and labeled (extraction surrogate and internal standard) compound spiking solutions are given an expiration date of 6 months, or the expiration date of the solutions used to prepare the working solution, whichever occurs sooner. The solutions are stored in labeled polypropylene screw-top vials in the refrigerator in the dark. When these solutions are prepared they must be tested prior to use in the PFAS extraction lab and verified monthly until they are consumed by operations or expire. Records of the standard verification are maintained by the laboratory. Prior to use, the working spiking solution should be evaluated against recovery windows of 85-115% for all compounds that will be analyzed using that solution. Should a standard fail to meet these criteria, the data must be reviewed by departmental management for acceptability and/or corrective action.

Working initial calibration solutions are given an expiration date of 6 months, or the expiration date of the solutions used to prepare the working initial calibration solution, whichever occurs sooner.

The primary/preferred standard vendor is Wellington Laboratories, Inc. Ontario, Canada. Listed catalog numbers are taken from Wellington product lists. Equivalent standards may be substituted, if the listed standards are unavailable.

The solution concentration listed is as presented on the certificate of analysis and includes adjustment for purity and the salt form of the compound used.

The concentrations referenced for the sulfonate salts, (for example PFBS, PFHxS and PFOS) have already been corrected to the acid form by the standards supplier as noted in the example Certificate of analysis (CofA). See Attachment 4. If the compound purity is assayed to be 98% or greater, weight can be used without correction to calculate concentrations.

Log purchased standards into LIMS Reagent. Select the solution category SOURCE for purchased mixes and/or single-compound ampules. LIMS Reagent system will assign formatted names to the purchased standard solutions. The automatically-generated name can be overwritten with a manually created name if desired. Use labels printed through the LIMS Reagent to identify and track standard solutions after transfer from original ampule to storage vial. The CofA for the ampulated stock standard is attached in LIMS Reagent for reference.

Standards are prepared by transferring a known quantity of Standard to a final volume of solvent. Standard Preparation is documented in LIMS Reagent. Solutions are stored by Type in LIMS Reagent, i.e., INTERMEDIATE=working solutions and intermediate standards and SOURCE=stocks (ampulated solutions). Each Standard is given a unique name.

The following attachments provide examples of standard preparation and purchasing information. Refer to the documentation in LIMS Reagent for standards preparation information.

Attachment 05 - 1633 Native PFAS Intermediate A
Attachment 06 - 1633 Native PFAS Intermediate B
Attachment 07 - 1633 Native PFAS CAL8 Intermediate
Attachment 08 - 1633 Extracted Internal Standard Intermediate

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Attachment 09 - 1633 Non-Extracted Internal Standard Intermediate
Attachment 10 - 1633 TOP Surrogate Intermediate
Attachment 11 - 1633 ICAL Standard Preparation Scheme
Attachment 12 - 1633 Initial Calibration Standard Concentrations
Attachment 13 - Bile Salts Stock Solution
Attachment 14 - Bile Salts Intermediate
Attachment 15 - Bile Salts Working Solution
Attachment 16 - 1633 WDM Standard
Attachment 17 - 1633 Native Mid-Level Spike
Attachment 18 - 1633 Native Low-Level Spike
Attachment 19 - 1633 ICV Working Standard
Attachment 20 - 1633 Purchased/Ampulated Standards

Calibration

A. Mass Calibration

Frequency	Acceptance Criteria	Corrective Action
Calibration - at least annually or as recommended by the instrument manufacturer, whichever is more frequent, to maintain instrument sensitivity and stability.	Per manufacturer recommendations. Optimize the precursor and product ions in *Attachment 01*	Repeat as needed.
Verification - on an as-needed basis (e.g., QC failures, ion masses fall outside of the required mass window, major instrument maintenance, or if the instrument is moved) prior to the analysis of any standards and samples and after each subsequent mass calibration.	Resolution must meet manufacturer recommendations. The mass assignments must be within ±0.2 amu of the values shown in *Attachment 01*.	Recalibrate as needed. Otherwise, proceed to ICAL.

B. Chromatographic conditions

The mass spectral acquisition rate must include a minimum of 10 spectra scans across each chromatographic peak. See the AB Sciex (5500/5500 Plus/7500) Acquisition, Quantitation, Gradient, and Detector Condition files for the most up to date chromatographic conditions. An example acquisition method and chromatographic conditions are shown in *Proprietary* . Modifications to these conditions can be made at the discretion of the analyst to improve resolution or the chromatographic process. All injections must use the same parameters as used in the ICAL.

C. Retention Time Calibration

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Frequency	Acceptance Criteria	Corrective Action
once per ICAL and at the beginning of the analytical sequence	EIS, and NIS peaks shall be set using the midpoint standard of the ICAL curve when ICAL is performed. When an ICAL is not performed, the initial CV retention times or the midpoint standard of the ICAL curve can be used to establish the RT window position. The RTs for the target analytes, EIS, and NIS compounds must fall within 0.4 minutes of the predicted retention times from the midpoint standard of the ICAL or initial CV, whichever was used to establish the RT window position for the analytical batch. All branched isomer peaks identified in either the calibration standard or the qualitative (technical grade) standard also must fall within 0.4 minutes of the predicted retention times from the midpoint standard of the ICAL or initial CV. For all target analytes with exact corresponding isotopically labeled analogs, target analytes must elute within 0.1 minutes of the associated EIS compound.	Recalibrate.

D. Initial Calibration

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Frequency	Acceptance Criteria	Corrective Action
Prior to the analysis of samples, and after the mass calibration verification has met all criteria whenever the laboratory takes an action that changes the chromatographic conditions or might change or affect the initial calibration criteria when either the CV or Instrument Sensitivity Check (ISC) acceptance criteria have not been met.	A minimum of six calibration standards are required when using an average or linear curve fit. A minimum of seven calibration standards are required for a second-order curve fit (quadratic). The lowest standard must be at or below the RL. In general, Cal1 (at the RL), Cal2, Cal3, Cal4, Cal5, Cal6, Cal7, and Cal8 are included in the initial calibration. S/N ratio for the lowest standard within the quantitation range must be greater than or equal to 3:1 for quantification ions and the confirmation ions, or greater than or equal to 10:1 if the analyte only has a quantification ion. To use Average Response Factor: • %RSD for the response factors is less than or equal to 20% • if greater than 20%, try a Linear Regression. To use Linear Regression with a concentration weighing factor of 1/x: • The %RSE for all method analytes must be less than or equal to 20%. • if greater than 20%, try a Quadratic fit. To use Quadratic fit with a concentration weighing factor of $1/x^2$: • The %RSE for all method analytes must be less than or equal to 20%. For all curve fits, each calibration point is calculated back against the curve. The back calculated concentration for each calibration point must be within ±30% of its true value.	If the criteria are not met, the source of the problem must be determined and corrected. Situations may exist where the initial calibration can be used. In those cases, the data will be reported with a qualifying comment.

E. Initial Calibration Verification (ICV)

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Frequency	Acceptance Criteria	Corrective Action
After ICAL prior to analyzing samples	ICV must be prepared from a second source. If a second source is not available, a separate preparation from the same stock (including intermediates) by a second analyst may be used. The calculated amount for each analyte must be within ±30% of the true value.	If this criteria is not met, re-inject or remake the standard. If the criteria is still not met, recalibration is necessary. Instrument maintenance may be needed prior to recalibrating.

F. Calibration Verification (CV)

Frequency	Acceptance Criteria	Corrective Action
Once the calibration curve has been established, the continuing accuracy must be verified by analysis of a continuing calibration verification (CCV) standard at the beginning of each analytical sequence, every ten injections of a field sample extract, and at the end of the analytical sequence.	The calculated amount for each native in the CCV standard must be within ±30% of the true value. The absolute areas of the injection internal standard must be greater than 30% of the average areas measured during the initial calibration.	Samples that are not bracketed by acceptable CCV analyses must be reanalyzed. The exception to this would be if the CCV recoveries are high, indicating increased sensitivity, and there are no positive detections in the associated samples, the data may be reported with a qualifying comment. The source of the problem must be determined and the system recalibrated before continuing sample analysis.

Procedure

Data Types are included in brackets. If a Data Type is not needed (for example, no reagents were needed for pH adjustment), "NA" may be used.

A) Solid Sample Preparation

NOTE: Prior to weighing out samples, thoroughly mix each sample using a separate wooden tongue depressor or stainless steel spoon to ensure a homogeneous sample matrix. Stir from the bottom to the top in a circular motion along the sides of the jar, breaking particles to less than 1 mm by pressing against the side of the container. Remove rocks, invertebrates, and foreign objects. Vegetation can either be removed or cut into smaller pieces based on project requirements.

1. On a calibrated, top-loading balance [*BalanceID*], accurately weigh:

    - 2.0 ± 0.10g for solids (dry weight; note: maximum 4.0g sample aliquot)
    - 0.5 ± 0.025g for biosolids (dry weight; note: maximum 1.0g sample aliquot)

    into a tared, labeled 50-mL centrifuge tube [*TubeLotID*] using a disposable polypropylene spatula [*SpatulaID*]. Record sample weight in the prep entry system to 2 decimal places [*InitialAmount*]. These weights are based on dry weights. Use T-PFAS-FRM74731 to calculate dry weight based on the percent moisture.

2. For each batch of no more than 20 field samples include the following quality control samples:

    a. Method Blank, LCS, LCSD, and LLCS: Weigh 2.0 ± 0.10g (0.5 ± 0.025g for biosolids) of sand [*BlankMtrxID, BlkMatLot, QCBottleLotID*] wetted with 1.0g (0.25g for biosolids) of reagent water. Record "2.00g" as the Initial Amount.

    b. Matrix Spike/Matrix Spike Duplicate (MS/MSD): Weigh 2.0g ± 0.10g (dry weight; note: maximum 2.5g sample aliquot) (0.5g for biosolids (dry weight; note: maximum 1g sample

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aliquot)) of sample as specified in sample preparation log. **Note**: if not enough sample to prepare an MS/MSD, an LCS/LCSD must be prepared instead.

3. Bring all spike solutions to room temperature and vortex for 30 seconds prior to use.

4. Spike QC and all samples with 25 µL of 1633_125 EIS (1633_125_SS_#####). Spike LCS/LCSD/MS/MSD with 50 µL of 1633_125 Native Spike Mid (1633_125_MS_M_#####). Spike LLCS with 40 µL of 1633_125 Native Spike Low (1633_125_MS_L_#####). Vortex/Shake containers to mix thoroughly. Let samples equilibrate for 30 minutes after spiking. Document the technician who spike the sample [*Analyst ID - Reagent Drop*] as well as the spike witness [*Analyst ID - Reagent Drop Witness*].

5. Cap and vortex for 30 seconds.

6. Allow samples/QC to equilibrate for at least 30 minutes.

7. Add 10 mL of Proprietary Content to each centrifuge tube.

8. Cap and vortex for 30 seconds.

9. Sonicate in an ultrasonic bath [*SonicatorID*] for 1 hour. Record start and stop times. [S*onicationStart* and *SonicationStop]* Ensure the bath is filled with water to the optimal water level mark inside the tank.

10. Centrifuge [*CentrifugeID*] at 3500 rcf for 5 minutes and transfer supernatant to a clean 50-mL centrifuge tube.

11. Add 4 mL of 0.4% (w/v) methanolic potassium hydroxide to the remaining solid sample in each centrifuge tube. Cap and vortex for 30 seconds.

12. Centrifuge at 3500 rcf for 5 minutes and decant the supernatant from the second extraction into the 50-mL centrifuge tube with the supernatant from the first extraction.

13. Centrifuge the combined extracts at 3500 rcf for 5 minutes and decant the supernatant from the 50-mL centrifuge tube to a clean 125-mL HDPE bottle.

14. Bring the 125-mL HDPE container up to 125 mL with Milli-Q water.

15. Check that the pH is 6.0 ± 0.5 and adjust as necessary with 50% formic acid or 30% ammonium hydroxide (or with 5% formic acid and 3% aqueous ammonium hydroxide). **NOTE: Never put pH test strips into the sample.** Record the acid or base lot number [*RgtID*] and amount used [*Amt*]. Use a disposable pipette [*TranferPipID*] to place a few drops of sample onto the pH paper [*pHIndID*].

16. Invert container to thoroughly mix.

17. Continue to either Manual SPE (Procedure B) or Automated SPE (Procedure C.)

B) Manual Sample Phase Extraction

1. Before use, rinse each port of the SPE manifold [*ManifoldID*] with several milliliters of the following solvents in order:

   Proprietary
   Proprietary
   Proprietary
   Proprietary

2. Label each SPE cartridge [*SPECartType*] and *SPECartLot#*] to correspond with each associated sample/QC piece and attach to a rinsed SPE port. Record the SPE port number for each sample/QC piece on the batchlog.

3. Condition each SPE cartridge with the following reagents in the following order:

   a. Proprietary Content
   b. Proprietary Content
   c. Proprietary Content

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d. Proprietary Content

4. Label each sample bottle, cap, 15-mL centrifuge tube, and reservoir with the same number to ensure samples are not inadvertently switched during the extraction procedure (i.e.; 1,1,1; 2,2,2; 3,3,3; etc.).

5. Attach the labeled 25-mL SPE reservoir [*SPEResID*] to each cartridge. Load the QC and samples to their respective cartridges. Allow full volume to pass through each cartridge by gravity, if possible. Allow sample to pass through. The drip rate should be approximately 3-5 drops per second.

6. After sample/QC has passed through, rinse the walls of the sample/QC bottle with 5 mL reagent water. Add to cartridge and allow to pass through using vacuum. Then repeat.

7. After Milli-Q water has passed through, rinse the walls of the sample/QC bottle with 5 mL 30:70 (v/v) methanol:water [*RinseSolventName* and *RinseSolventLot*]. Add to cartridge and allow to pass through using vacuum. Then repeat.

8. Apply full vacuum to dry the cartridges until they are visually similar to an unused cartridge. This may take up to 10 minutes for some cartridges.

9. Discard the waste and rinse the waste reservoir with isopropyl alcohol. Wipe each needle with a Kim-wipe/methanol.

10. Attach Proprietary Content to the bottom of each SPE cartridge.

11. Place labeled 15-mL polypropylene centrifuge collection tubes [*CentrifugeTube*] under each respective SPE cartridge.

12. Rinse the inside of each empty sample/QC bottle with 5 mL of Proprietary Content. Add to reservoir and cartridge.

13. Apply a slight vacuum to the manifold in order to reclaim as much solvent as possible from the SPE cartridges.

14. Disconnect the cartridge/adapter from the manifold. Remove the collection tubes.

15. Bring each sample extract to final volume 5 mL using methanol with Proprietary Content. Cap and vortex for 30 seconds to mix.

16. Proceed to Procedure D - Vialing and Addition of Internal Standard

C) Automated Solid Phase Extraction (SPE) by Proprietary

This procedure can be used in place of the manual extraction described above.

1. Label each SPE cartridge [*SPECartType* and *SPECartLot#*] to correspond with each associated sample/QC piece and attach to a rinsed SPE port. Record the SPE port number for each sample/QC piece on the batchlog.

2. Check to make sure all reagent bottles are filled and that reagents are not expired. Record Proprietary Content ID and reagent lot numbers. [*ManifoldID*, *SPE_Cond#1ID*, *SPE_Cond#2ID*, *RinseSolventName*, *RinseSolventLot*, *SolventName*, and *SolventLot*]

3. Label each sample bottle, cap, and Proprietary Content cartridge with the same number to ensure samples are not inadvertently switched during the extraction procedure (i.e.; 1,1,1; 2,2,2; 3,3,3; etc.).

4. Select "Proprietary Content" from the drop down menu to start the cleaning cycle prior to SPE. Make sure the "Clean" cartridges and bottles are attached for this cycle.

5. Remove "Clean" cartridges and attach the labeled cartridges that will be used when running the samples. Disconnect the "Clean" bottles. Attach the sample bottle by twisting the bottle and not the cap. Place sample bottle upside down in corresponding numbered location on shaker. Attach a filter [*FilterEXPID*] to each cap. Poke two holes into the lip of each bottle. Load labeled centrifuge tubes [*CentrifugeTube*] in the moving tray beneath the cartridges.

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6. Select “Proprietary Content” from the drop down menu and press the green check mark to start the procedure. The Proprietary Content program is described in *Proprietary* .

7. When the cycle pauses after cartridge drying, attach Proprietary Content to the bottom of each SPE cartridge and uncapped tubes in the moving tray.

8. Once the cycle is complete, remove centrifuge tubes and discard the used cartridges and bottles. Reattach “Clean” bottles and cartridges, select "Proprietary Content" from menu, select “start”. This must be done between each batch and at the beginning and the end of the day. At the end of the day, run the "Proprietary Content" clean cycle.

9. The batch QC must be rotated among the Proprietary Content ports so that all the ports are covered over the course of a quarter. Use form T-PFAS-FRM80101 for tracking.

10. Bring each sample extract to final volume 5 mL using Proprietary Content. Cap and vortex for 30 seconds to mix.

11. Proceed to Procedure D - Vialing and Addition of Internal Standard

D) Vialing and Addition of Internal standard

Note: The instrument lab chemist performs these steps.

1. Determine the sample aliquot to use for analysis. Add Internal Standard Spike Solution (1633_125_IS_V_#####) to the corresponding labeled autosampler vial [*VialLot#*].

    - 10 µL IS into a 190 µL aliquot of sample (final volume = 200 µL)
    - 25 µL IS into a 475 µL aliquot of sample (final volume = 500 µL)
    - 50 µL IS into a 950 µL aliquot of sample (final volume = 1000 µL)

2. Transfer an aliquot of the final extract (as determined in Step 1 above) to the corresponding labeled auto-sampler vial.

3. Cap the auto-sampler vial [*Caps*] and vortex for 30 seconds. Samples are now ready for analysis.

4. Cap the centrifuge tube. The remaining centrifuged extracts are stored in the refrigerator for dilution or reinjection if needed.

E) LC/MS/MS Analysis

1. Load sample vials containing calibration standards, quality control samples, and sample extracts into the autosampler tray. Allow the instrument adequate time to equilibrate to ensure the mass spec and LC have reached operating conditions (approximately 5 minutes) before the first injection. Analyze several solvent blanks to clean the instrument prior to sample acquisition.

2. Bring standards to room temperature and vortex before calibrating. To eliminate the need for a qualitative identification standard, the calibration standards contain the branched isomers for PFHxS, PFOS, NMeFOSAA, NEtFOSAA, PFNA, PFOA, PFOSA, NEtFOSE, NMeFOSE, NEtFOSA, and NMeFOSA. Mass Transitions are defined in *Attachment 01*.

Example Initial Calibration Sequence (LIMS ID) (Example instrument method is in *Attachment 03*.):

Instrument Blank to clean instrument (at least 3)

1. CAL 1 (IC)
2. CAL 2 (IC)
3. CAL 3 (IC)
4. CAL 4 (IC)
5. CAL 5 (ICISAV)
6. CAL 6 (IC)
7. CAL 7 (IC)
8. CAL 8 (IC)
9. Instrument Blank (ICB)
10. Initial Calibration Verification (ICV)
11. Bile Salts Standard (WDM)

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3. Isotopically-labeled compounds are not available for some compounds. See below for compounds without labeled isotopes and their referenced extraction standards. See *Attachment 02* shows the full list of analytes and their EIS and NIS.

Note: For better accuracy, PFTrDA is quantitated using the average of the areas of labeled compounds 13C2-PFTeDA and 13C2-PFDoA.

Native	Extracted Internal Standard
3:3FTCA	13C5-PFPeA
PFMPA	
PFMBA	
NFDHA	13C5-PFHxA
5:3FTCA	
7:3FTCA	
PFEESA	
DONA	13C3-HFPO-DA
9Cl-PF3ONS	
11Cl-PF3OUdS	
PFTrDA	Avg 13C2-PFTeDA and 13C2-PFDoA
PFHpS	13C8-PFOS
PFNS	
PFDS	
PFDoS	
PFPeS	13C3-PFHxS
TFSI	
FHxSA	
PFECHS	
PFODA	13C2-PFTeDA
FBSA	13C3-PFBS

Example Sample Sequence (LIMS ID):

Instrument Blanks to clean instrument if needed (at least 3)
1. Instrument Sensitivity Check at CAL1 (CCVO)
2. Calibration Verification at CAL4 (CCV)
3. Instrument Blank (CCB)
4. Bile Salts marker (WDM)
5. Method Blank (MB)
6. On-going Precision and Recovery (LCS)
7. Low-level OPR (LLCS)
8. On-going Precision and Recovery Duplicate (LCSD)
9. Samples (10 or less)
10. Calibration Verification at CAL4 (CCV)
11. Instrument Blank (CCB)

4. Instrument Blank (ICB, CCB) - Instrument Blanks need to be analyzed immediately following the highest standard analyzed and daily at the start of a sequence. The concentration of all analytes

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must be less than the MDL. If acceptance criteria are not met, the calibration must be performed using a lower concentration standard for the high standard until the criteria are met.

5. Instrument Sensitivity Check (CCVO) - Prior to sample analysis, an Instrument Sensitivity Check (ISC) must be performed. The ISC standard concentration must be at the LOQ. The CAL1 standard's concentration is at the LOQ, so the CAL1 standard will be analyzed. All analyte concentrations must be within ±30% of their true values. The signal-to-noise ratio must be greater than or equal to 3:1 for the quantitation ions and confirmation ions, and 10:1 for quantitation ions that have no confirmation ion. If the criteria are not met, correct problem and rerun ISC. If a target analyte (or EIS) reads back high with no detection (or in-spec recoveries) in the samples, data may be reported. If problem persists, repeat the ICAL. No samples can be analyzed until the ISC meets acceptance criteria.

6. Bile Salt Interference Check (WDM) - Analyze a Window-Defining Matrix (WDM) standard containing 100 ppb of Taurodeoxycholic Acid (TDCA), Taurochenodeoxycholic Acid (TCDCA), and Tauroursodeoxycholic Acid (TUDCA). The laboratory must establish chromatographic conditions to ensure the bile salt (TDCA) does not cause interference during the analysis of samples. To demonstrate successful separation the retention time of TDCA must be at least 1 minute outside the retention time window of PFOS. This is demonstrated as a comparison of the RT of TDCA (measured at the apex of the TCDA peak) separated by at least 1.4 minutes from the RT of the linear isomer of PFOS (measured at the apex of the peak of the linear isomer of PFOS). If the mobile phase does not contain acetonitrile, this check must include all three bile salts (TDCA, TCDCA, and TUDCA). If adequate separation is not achieved, adjust the chromatographic conditions and reevaluate the separation of TDCA from PFOS.

7. After injections are completed, check all CCV recoveries and absolute areas to make sure they are within method control limits. See Calibration F for acceptance criteria. Process each chromatogram and closely evaluate all integrations, baseline anomalies, and retention time differences. If manual integrations are performed, they must be documented and a reason given for the change in integrations. The manual integrations are documented during data processing and all original integrations are reported at the end of the sample PDF file with the reason for manual integration clearly listed.

8. Quantitate results for the Method Blank (MB). Calculate the recoveries of spiked analytes for the LCS and its duplicate (LCSD, if needed), Low-Level LCS, Matrix Spike and Matrix Spike Duplicate (MS/MSD) by comparing concentrations observed to the true values. Calculate the relative percent difference (RPD) between the duplicates.

9. Isotopically-labeled Extraction Standards (EIS) are added to all samples, MB, LLCS, LCS/LCSD, and MS/MSD prior to extraction. Isotopically-labeled Injection Standards (NIS) are added to each QC and field sample extract prior to analysis. Quantitation by isotope dilution generally precludes any adverse effect on data quality due to EIS recoveries being outside of the acceptance limits as long as the signal-to-noise ratio is greater than 10:1.

10. To identify a target or EIS:

    a. Peak responses of quantitation and confirmation ions must have S/N of at least 3:1. If there is no confirmation ion, the quantitation ion must have S/N of at least 10:1. If the S/N ratio is not met, the analyte is considered to be ND.

    b. The retention times should not vary by more than 0.4 minutes from the expected retention time from the midpoint of the ICAL or initial CV. Furthermore, native compounds with an exact isotopically-labeled analogue must elute within 0.1 minutes from their associated analog. If the retention time is outside of the criteria, the compound is considered a false positive unless it is a compound with branched isomers. Compounds with branched isomers can vary in intensity of the individual isomers that are used for reporting and must be reviewed and compared to the preceding CCV to determine if it should be reported.

    c. For concentrations at or above the LOQ, the Ion Abundance Ratio (IAR) must fall within ±50% of the IAR observed in the mid-point initial calibration standard. The total response of all isomers (branched and linear) in the quantitative standards must be used to define the IAR. In samples, the total response should include only the branched isomer peaks that have been identified in either the quantitative or qualitative standard.

11. Two ion transitions and the ion transition ratio per analyte shall be monitored and documented with the exception of PFBA, PFECA F (PFMPA), PFECA A (PFMBA), NMeFOSE, NEtFOSE, FBSA, and FHxSA. The expected ion ratio for each compound is calculated by using the average of ion ratios

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of each compound from initial calibration standards. When an ion ratio for a compound differs from the expected ion ratio by more than 50%, see QA/QC section for Corrective Action.

F) Dilution

When the area of the primary transition of a target analyte is above the area of the highest calibration point a sample dilution is required. Dilute the extract as follows:

1. Remove extracts from storage and allow to come to room temperature for approximately 60-90 minutes.
2. Vortex the extract for one minute.
3. Using a pipette or syringe, remove an aliquot of the extract, this extract should target a dilution equivalent to the mid-level concentration of the calibration curve to avoid over diluting the extract.
4. Dilute the aliquot to volume using Proprietary Content.
5. Fortify with additional NIS to achieve the same concentration of NIS in the original extract.
6. Vortex an aliquot for analysis.

If the S/N of EIS associated with the analyte requiring dilution in the extract meets the S/N requirement for EIS and the recovery of the associated EIS meet the method criteria, the results from the dilution can be reported. If these criteria are not met and additional sample is available, a smaller volume/mass of sample should be extracted.

Calculations

1. Peak Area Ratio

$$\text{Peak Area Ratio} = \frac{\text{Analyte Response}}{\text{Labeled Analyte Response}}$$

2. On-Column Analyte Concentration using average RRF

On-column Concentration = peak area ratio ÷ AVE RRF

3. On-Column Analyte Concentration using linear curve

On-column Concentration = (peak area ratio - intercept) ÷ slope

4. Sample Concentration

Sample concentration (ng/g) = (On-column concentration x Final Sample Volume x DF) ÷ Initial Sample Volume

5. Ion Abundance Ratio (IAR)

ion abundance ratio = (peak area or height of quantifier)/(peak area or height of qualifier)

6. See *T-PEST-WI9847* for additional calculations used to evaluate the calibrations and quality control samples.

Statistical Information/Method Performance

Historical data for LCS/Ds, LLCSs, MS/Ds, and EIS is reviewed at least annually. However, all samples are reported using the limits in EPA 1633 Tables 7 and 8. When target analytes not on these tables are requested, statistical limits are used for LCS/MS. (Preliminary limits of 70-130% Recovery and <20%

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RPD can be used until enough data points are generated.) Reporting limits including method detection limits (MDLs) and limits of quantitation (LOQs) are set according to EPA method requirements and are evaluated annually. Refer to *QA-SOP11892* for specific guidelines and procedures. Updates to the LIMS are made as needed by the QA Department and only as directed by the supervisor.

As MDL studies are run on clean laboratory matrices, statistically derived MDL values could be artificially lower than achievable limits in real world samples. Nominal MDL values, set at no lower than 1/4 the calculated and verified Reporting Limit (or Limit of Quantitation) will be used as a method to avoid artificially low bias in MDL studies.

Quality Assurance/Quality Control

For each batch of samples extracted, a method blank, an LCS, and an LLCS must be extracted and analyzed. An MS/MSD are extracted only if requested and submitted by the client. If no MS/MSD is provided, an LCS/LCSD must be extracted and analyzed instead. A batch is defined as the samples to be extracted on any given day, but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared. If any client, state, or agency has more stringent QC or batching requirements, these must be followed.

QC Item	Frequency	Acceptance Criteria	Corrective Action
Method Blank (MB)	One per extraction batch of no more than 20 field samples	No target analytes greater than RL, or greater than 1/10 the amount measured in any sample, or 1/10 the regulatory limit (whichever is greater).	Verify instrument clean (evaluate calibration blank & samples prior to method blank), then reanalyze. Evaluate to determine if systematic issue within laboratory, correct, then re-prepare and reanalyze the method blank and all samples processed with the contaminated blank.
Low-Level On-going Precision and Recovery (LLCS)	One per extraction batch of no more than 20 field samples	Acceptance criteria defined in *Attachment 22* (Tables 7 and 8 of Method 1633)	Reanalyze LLCS once. If acceptable, report. Evaluate samples for detections, and LLCS for high bias. If LLCS has high bias, and samples non-detect, report and narrate. If LLCS has low bias, or if there are detections for critical chemicals of concern, evaluate and reprep and reanalyze the LLCS and all samples in the associated prep batch for failed analytes, if sufficient sample material is available.
On-going Precision and Recovery and its Duplicate (LCS)	One per extraction batch of no more than 20 field samples	Acceptance criteria defined in *Attachment 22* (Tables 7 and 8 of Method 1633)	Reanalyze LCS once. If acceptable, report. Evaluate samples for detections, and LCS for high bias. If LCS has high bias, and samples non-detect, report and narrate. If LCS has low bias, or if there are detections for critical chemicals of concern, evaluate and re-prep and reanalyze the LCS and all samples in the associated prep batch for failed analytes, if sufficient sample material is available.

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QC Item	Frequency	Acceptance Criteria	Corrective Action
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	*at client request*, one per extraction batch of no more than 20 field samples	Acceptance criteria defined in *Attachment 22* (Tables 7 and 8 of Method 1633) RPD less than 30%	If outside the acceptance windows, consult a supervisor to determine the appropriate course of action based on batch and sample results.
Extracted Internal Standards (EIS) or Isotope Dilution Analyte (IDA), added prior to extraction	per sample (including MB, LCS, LCSD, LLCS, MS, MSD) during preparation	Acceptance criteria defined in *Attachment 22* (Table 8 of Method 1633)	1. If EIS outside windows, check for errors and correct. Re-analyze sample, if needed. 2. If EIS out high and samples are non-detect, report and narrate. If EIS out high with detections, but EIS <200% (FTS <350%), report and narrate. If EIS out high with detections and EIS >200% (FTS >350%), dilute 10X, re-analyze, report, and narrate. 3. If EIS low but > 5% and S/N > 10:1, narrate and report. If EIS <5% then contact client to re-extract at smaller aliquot.
Non-extracted Internal Standards (NIS) added following extraction and prior to analysis	per sample (including MB, LCS, LCSD, LLCS, MS, MSD) during preparation	NIS areas 50-200% of the mean area of the most recent ICAL in undiluted sample extracts and sample extracts that require NIS to be added.	If fails high, check for errors and report. If fails low, re-analyze fresh aliquot of sample. If in control, report. If the failure confirms report the initial analysis and narrate.
Ion Abundance Ratio (IAR)	Each detected analyte (except PFBA, PFPeA, NMeFOSE, NEtFOSE, PFMPA, PFMBA, FBSA, FHxSA)	Acceptance window of 50-150% of the ratio in the mid-point CCV standard.	Check for error, if none found report as outlined below. 1. If outside limits and value is less than the RL, report as ND at RL. 2. If outside limits, but within 2X rule* flag, report and narrate. 3. If ratio outside 2X rule* then report as ND at elevated RL, apply G flag and narrate. 4. If ratio out due to branched isomer contribution, report as positive with narration. 5. If outside limits (and RT window) due to matrix, report as ND at elevated RL, apply G flag and narrate.
E-flagged data	NA	NA	Dilute sample extract. If still E-flagged after dilution, consult the client for course of action.

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*2X Rule: If the ion ratio <0.5X the lower control limit or >2X the upper control limit, then do not report the analyte. It should be either Non-Detect at the RL or elevate the RL as needed (G flag). As an example if the target ion ratio is 4.00. The Chrom-determined limits are 2.00-6.00. If the ratio is <1.00 (2.00 X 0.5) or >12.00 (6.00 X 2) follow the specifications above.

Attachment:
Attachment 01 - Mass Transitions (.pdf)
Attachment 02 - Standard Relationships (.pdf)
Attachment 03 – Proprietary Content
Attachment 04 - Example CoA (.pdf)
Attachment 05 - Native PFAS Intermediate A (.pdf)
Attachment 06 - Native PFAS Intermediate B (.pdf)
Attachment 07 - Native PFAS CAL8 Intermediate (.pdf)
Attachment 08 - 1633 EIS Intermediate (.pdf)
Attachment 09 - 1633 NIS Intermediate (.pdf)
Attachment 10 - 1633 TOP SS Intermediate (.pdf)
Attachment 11 - Initial Calibration Standards Preparation (.pdf)
Attachment 12 - Initial Calibration Standard Concentrations (.pdf)
Attachment 13 - Bile Salts Stock Solutions (.pdf)
Attachment 14 - Bile Salts Intermediate (.pdf)
Attachment 15 - Bile Salts Working Solution (.pdf)
Attachment 16 - 1633 WDM (.pdf)
Attachment 17 - Native Mid Level Spike (.pdf)
Attachment 18 - Native Low Level Spike (.pdf)
Attachment 19 - ICV Working Standard (.pdf)
Attachment 20 - Purchased Standards (.pdf)
Attachment 21 – Proprietary Content
Attachment 22 - Tables 7-8 (EPA 1633) (.docx)

G-DC-FRM23907 Redacted SOPs
QA-SOP11178 Demonstrations of Capability
QA-SOP11892 Determining Method Detection Limits and Limits of Quantitation
T-PEST-WI9847 Common Equations Used During Chromatographic Analyses
T-PFAS-FRM74731 D4033 - Moisture Calculation
T-PFAS-WI21568 Environmental Monitoring in the PFAS Lab
T-PFAS-WI23588 Preventative and Corrective Maintenance for the AB Sciex Liquid Chromatograph Mass Spectrometers (LC/MS/MS)
Attachment: Attachment 01 - Mass Transitions (pdf)
Attachment: Attachment 02 - Standard Relationships (pdf)
Attachment: Attachment 03 – Proprietary Content
Attachment: Attachment 04 - Example CoA (pdf)
Attachment: Attachment 05 - Native PFAS Intermediate A (pdf)
Attachment: Attachment 06 - Native PFAS Intermediate B (pdf)
Attachment: Attachment 07 - Native PFAS CAL8 Intermediate (pdf)
Attachment: Attachment 08 - 1633 EIS Intermediate (pdf)
Attachment: Attachment 09 - 1633 NIS Intermediate (pdf)
Attachment: Attachment 10 - 1633 TOP SS Intermediate (pdf)
Attachment: Attachment 11 - Initial Calibration Standards Preparation (pdf)
Attachment: Attachment 12 - Initial Calibration Standard Concentrations (pdf)
Attachment: Attachment 13 - Bile Salts Stock Solutions (pdf)
Attachment: Attachment 14 - Bile Salts Intermediate (pdf)
Attachment: Attachment 15 - Bile Salts Working Solution (pdf)
Attachment: Attachment 16 - 1633 WDM (pdf)
Attachment: Attachment 17 - Native Mid Level Spike (pdf)
Attachment: Attachment 18 - Native Low Level Spike (pdf)
Attachment: Attachment 19 - ICV Working Standard (pdf)
Attachment: Attachment 20 - Purchased Standards (pdf)
Attachment: Attachment 21 – Proprietary Content
Attachment: Attachment 22 - Tables 7-8 (EPA 1633) (docx)

End of document

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Version history

Version	Approval	Revision information	
3.1	27.AUG.2024		
4	31.OCT.2024		
5	11.MAR.2025		

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Attachment 1 – Mass Transitions

CAS#	Compound	Parent Ion	Daughter Ion
422-64-0	PFPrA	163.00	119.00
STL03194	13C3-PFPrA	166.00	121.00
STL02680	13C3-PFBA	216.00	172.00
STL00992	13C4-PFBA	216.80	171.90
375-22-4	PFBA	212.80	168.90
377-73-1	PFECA F (PFMPA)	229.00	84.90
356-02-5	3:3 FTCA	241.00	177.00
	3:3 FTCA (2)	241.00	117.00
2706-90-3	PFPeA	263.00	219.00
STL01893	13C5-PFPeA	268.30	223.00
863090-89-5	PFECA A (PFMBA)	279.00	85.10
82113-65-3	TFSI	280.00	147.00
	TFSI (2)	280.00	78.00
13252-13-6	HFPODA	284.90	168.90
	HFPODA (2)	284.90	184.90
STL02255	13C3-HFPODA	286.90	168.90
	13C3-HFPODA (2)	286.90	184.90
151772-58-6	PFECA B (NFDHA)	295.00	201.00
	PFECA B (NFDHA) (2)	295.00	84.90
375-73-5	PFBS	298.70	79.90
	PFBS (2)	298.70	98.80
STL02337	13C3-PFBS	302.10	79.90
307-24-4	PFHxA	313.00	269.00
	PFHxA (2)	313.00	118.90
113507-82-7	PFEESA (PES)	314.80	134.90
	PFEESA (PES) (2)	314.80	82.90
STL00993	13C2-PFHxA	315.10	270.00
STL02577	13C5-PFHxA	318.00	273.00
757124-72-4	4:2-FTS	327.10	307.00
	4:2-FTS (2)	327.10	80.90
914637-49-3	5:3 FTCA	341.00	237.10
	5:3 FTCA (2)	341.00	217.00
2706-91-4	PFPeS	349.10	79.90
	PFPeS (2)	349.10	98.90
375-85-9	PFHpA	363.10	319.00
	PFHpA (2)	363.10	169.00
STL01892	13C4-PFHpA	367.10	322.00
919005-14-4	DONA	376.90	250.90
	DONA (2)	376.90	84.80
41997-13-1	FHxSA	397.90	78.00

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Attachment 1 – Mass Transitions

CAS#	Compound	Parent Ion	Daughter Ion
355-46-4	PFHxS	398.70	79.90
	PFHxS (2)	398.70	98.90
STL02581	13C3-PFHxS	402.10	79.90
STL00994	18O2-PFHxS	403.00	83.90
335-67-1	PFOA	413.00	369.00
	PFOA (2)	413.00	169.00
STL00623	13C2-PFOA	415.00	370.00
STL00990	13C4-PFOA	417.10	372.00
STL01054	13C8-PFOA	421.10	376.00
27619-97-2	6:2-FTS	427.10	407.00
	6:2-FTS (2)	427.10	80.90
STL02279	13C2-6:2-FTS	429.10	80.90
812-70-4	7:3 FTCA	441.00	316.90
	7:3 FTCA (2)	441.00	336.90
375-92-8	PFHpS	449.00	79.90
	PFHpS (2)	449.00	98.80
133201-07-7	PFECHS	461.00	381.00
	PFECHS (2)	461.00	99.00
375-95-1	PFNA	463.00	419.00
	PFNA (2)	463.00	219.00
STL00995	13C5-PFNA	468.00	423.00
STL02578	13C9-PFNA	472.10	427.00
516-50-7	TDCA	498.00	80.00
754-91-6	PFOSA	498.10	77.90
	PFOSA (2)	498.10	478.00
516-35-8	TCDCA	498.10	80.00
14605-22-2	TUDCA	498.20	80.00
1763-23-1	PFOS	498.90	79.90
	PFOS (2)	498.90	98.80
STL00991	13C4-PFOS	502.80	79.90
STL01056	13C8-PFOSA	506.10	77.80
STL01054	13C8-PFOS	507.10	79.90
31506-32-8	NMeFOSA	511.90	219.00
	NMeFOSA (2)	511.90	169.00
335-76-2	PFDA	512.90	469.00
	PFDA (2)	512.90	219.00
STL02705	d3-NMeFOSA	515.00	219.00
STL00996	13C2-PFDA	515.10	470.10
STL02579	13C6-PFDA	519.10	474.10
4151-50-2	NEtFOSA	526.00	219.00
	NEtFOSA (2)	526.00	169.00
39108-34-4	8:2-FTS	527.10	507.00
	8:2-FTS (2)	527.10	80.80

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Attachment 1 – Mass Transitions

CAS#	Compound	Parent Ion	Daughter Ion
STL02280	13C2-8:2-FTS	529.10	80.90
756426-58-1	9Cl-PF3ONS	530.80	351.00
	9Cl-PF3ONS (2)	532.80	353.00
STL02704	d5-NEtFOSA	531.10	219.00
68259-12-1	PFNS	548.80	79.90
	PFNS (2)	548.80	98.80
2058-94-8	PFUnA	563.10	519.00
	PFUnA (2)	563.10	269.10
STL00997	13C2-PFUnA	565.00	520.00
STL02580	13C7-PFUnA	570.00	525.10
2355-31-9	NMeFOSAA	570.10	419.00
	NMeFOSAA (2)	570.10	483.00
STL02118	d3-NMeFOSAA	573.20	419.00
2991-50-6	NEtFOSAA	584.20	419.10
	NEtFOSAA (2)	584.20	526.00
STL02117	d5-NEtFOSAA	589.20	419.00
335-77-3	PFDS	599.00	79.90
	PFDS (2)	599.00	98.80
307-55-1	PFDoDA	613.10	569.00
	PFDoDA (2)	613.10	319.00
STL00998	13C2-PFDoDA	615.10	570.00
24448-09-7	NMeFOSE	616.10	58.90
STL02277	d7-NMeFOSE	623.20	58.90
1691-99-2	NEtFOSE	630.00	58.90
763051-92-9	11Cl-PF3OUdS	630.90	450.90
	11Cl-PF3OUdS (2)	632.90	452.90
STL02278	d9-NEtFOSE	639.20	58.90
72629-94-8	PFTrDA	663.00	619.00
	PFTrDA (2)	663.00	168.90
79780-39-5	PFDoS	699.10	79.90
	PFDoS (2)	699.10	98.80
376-06-7	PFTeDA	713.10	168.90
	PFTeDA (2)	713.10	219.00
STL02116	13C2-PFTeDA	715.20	670.00
16517-11-6	PFODA	913.00	869.00
	PFODA (2)	913.00	169.00

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Attachment 2 - PFAS Injection Standards/Extraction Standards/Native Compounds

Native	Extraction Standard	Internal Standard
PFBA	13C4-PFBA	13C3-PFBA
PFPrA	13C3-PFPrA	
PFPeA	13C5-PFPeA	13C2-PFHxA
3:3FTCA		
PFMPA		
PFMBA		
PFHxA	13C5-PFHxA	
NFDHA		
5:3FTCA		
7:3FTCA		
PFEESA		
PFHpA	13C4-PFHpA	
HFPO-DA	13C3-HFPO-DA	
ADONA		
9Cl-PF3ONS		
11Cl-PF3OUdS		
PFOA	13C8-PFOA	13C4-PFOA
PFNA	13C9-PFNA	13C5-PFNA
PFDA	13C6-PFDA	13C2-PFDA
PFUnA	13C7-PFUnA	
PFDoA	13C2-PFDoA	
PFTeDA	13C2-PFTeDA	
PFODA		
PFTrDA	Avg 13C2-PFTeDA and 13C2-PFDoA	
PFBS	13C3-PFBS	18O2-PFHxS
FBSA		
PFPeS	13C3-PFHxS	
PFHxS		
FHxSA		
PFECHS		
TFSI		
4:2-FTS	13C2-4:2-FTS	
6:2-FTS	13C2-6:2-FTS	
8:2-FTS	13C2-8:2-FTS	
PFHpS	13C8-PFOS	13C4-PFOS
PFOS		

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Attachment 2 - PFAS Injection Standards/Extraction Standards/Native Compounds

Native	Extraction Standard	Internal Standard
PFNS		
PFDS		
PFDoS		
PFOSA	13C8-PFOSA	
NMeFOSA	d3-NMeFOSA	
NEtFOSA	d5-NEtFOSA	
NMeFOSAA	d3-NMeFOSAA	
NEtFOSAA	d5-NEtFOSAA	
NMeFOSE	d7-N-MeFOSE-M	
NEtFOSE	d9-N-EtFOSE-M	

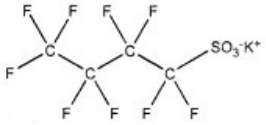
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Attachment 4 – Example CoA

WELLINGTON LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

PRODUCT CODE:	L-PFBS	**LOT NUMBER:**	LPFBS1022
COMPOUND:	Potassium perfluoro-1-butanesulfonate		
STRUCTURE:		**CAS #:**	29420-49-3



MOLECULAR FORMULA:	$C_4F_9SO_3K$	**MOLECULAR WEIGHT:**	338.19
CONCENTRATION:	50.0 ± 2.5 µg/mL (K salt)	**SOLVENT(S):**	Methanol
	44.4 ± 2.2 µg/mL (PFBS acid)		
	44.2 ± 2.2 µg/mL (PFBS anion)		
CHEMICAL PURITY:	>98%		
LAST TESTED: (mm/dd/yyyy)	10/04/2022		
EXPIRY DATE: (mm/dd/yyyy)	10/04/2027		
RECOMMENDED STORAGE:	Store ampoule in a cool, dark place		

DOCUMENTATION/ DATA ATTACHED:

Figure 1: LC/MS Data (Full Scan and Mass Spectrum)
Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Certified By: _____ **Date:** 10/14/2022 (mm/dd/yyyy)
B.G. Chittim, General Manager

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

Form#:27, Issued 2004-11-10
Revision#:9, Revised 2020-12-23

INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compound it contains.

HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products are compared to older lots in the same manner, which further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters $x_1, x_2, \ldots x_n$ on which it depends is:

$$u_c(y(x_1, x_2, \ldots x_n)) = \sqrt{\sum_{i=1}^{n} u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A1226), and ISO 17034 by ANSI National Accreditation Board (ANAB; AR-1523).

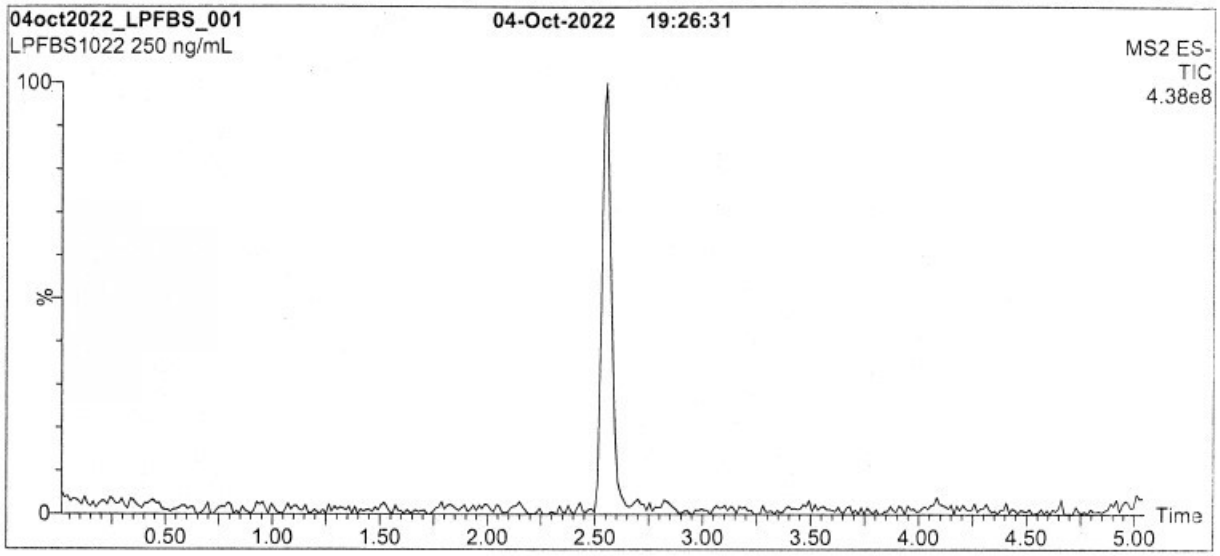
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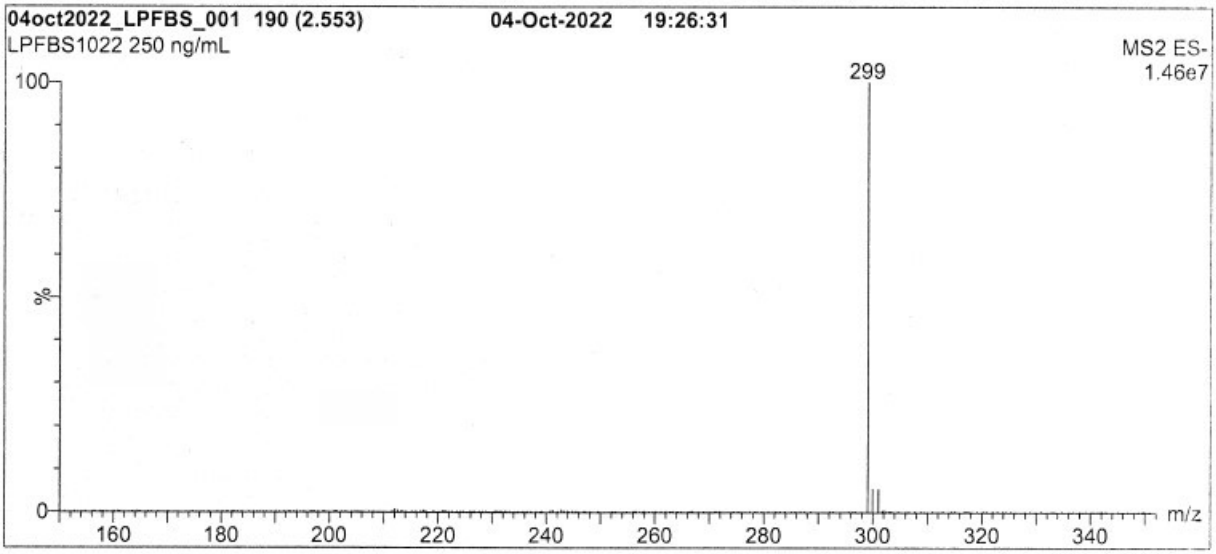
ANAB ANSI National Accreditation Board ACCREDITED ISO 17034 REFERENCE MATERIAL PRODUCER

For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at www.well-labs.com or contact us directly at info@well-labs.com

Attachment 4 – Example CoA

Figure 1: **L-PFBS; LC/MS Data (Full Scan and Mass Spectrum)**





Conditions for Figure 1:

Waters Acquity Ultra Performance LC
Waters Xevo TQ-S micro MS

Chromatographic Conditions:

Column: Acquity UPLC BEH Shield RP_{18}
1.7 µm, 2.1 x 100 mm

Mobile phase: Gradient
Start: 60% H_2O / 40% (80:20 MeOH:ACN)
(both with 10 mM NH_4OAc buffer)
Ramp to 90% organic over 8 min and hold for 2 min
before returning to initial conditions over 0.75 min.
Time: 12 min

Flow: 300 µL/min

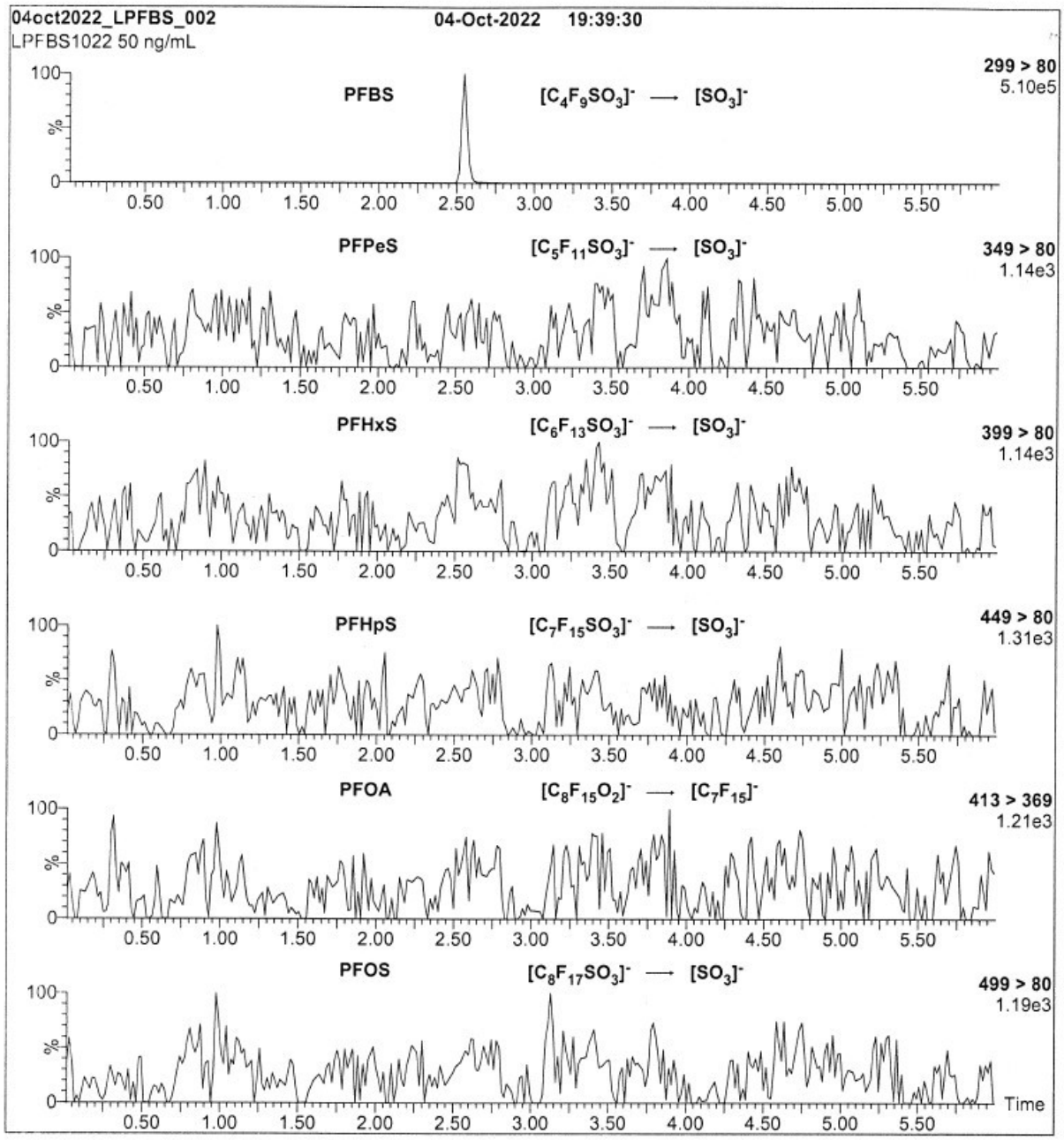
MS Parameters:

Experiment: Full Scan (150 - 850 amu)

Source: Electrospray (negative)
Capillary Voltage (kV) = 2.00
Cone Voltage (V) = 10.00
Desolvation Temperature (°C) = 500
Desolvation Gas Flow (L/hr) = 1000

Attachment 4 – Example CoA

Figure 2: **L-PFBS; LC/MS/MS Data (Selected MRM Transitions)**



Conditions for Figure 2:

Injection:	On-column (L-PFBS)
Mobile phase:	Same as Figure 1
Flow:	300 µL/min

MS Parameters:

Collision Gas (mbar) = 3.29e-3
Collision Energy (eV) = 30

Form#:27, Issued 2004-11-10
Revision#:9, Revised 2020-12-23

LPFBS1022 (4 of 4)
rev0

Attachment 05 - Native PFAS Intermediate A								
Vendor	Catalog Number	Analyte	CAS#	Acronym	Conc. (ng/mL)	Aliquot (mL)	Final Volume (mL)	Final Conc. (ng/mL)
Wellington	PFBA	Perfluorobutanoic acid	375-22-4	PFBA	50000	0.100	10	500
Wellington	PFPeA	Perfluoropentanoic acid	2706-90-3	PFPeA	50000	0.050		250
Wellington	PFHxA	Perfluorohexanoic acid	307-24-4	PFHxA	50000	0.050		250
Wellington	PFHpA	Perfluoroheptanoic acid	375-85-9	PFHpA	50000	0.050		250
Wellington	br-PFOA	Perfluorooctanoic acid	335-67-1	PFOA	50000	0.050		250
Wellington	br-PFNA	Perfluorononanoic acid	375-95-1	PFNA	50000	0.050		250
Wellington	PFDA	Perfluorodecanoic acid	335-76-2	PFDA	50000	0.050		250
Wellington	PFUdA	Perfluoroundecanoic acid	2058-94-8	PFUnA	50000	0.050		250
Wellington	MPFDOA	Perfluorododecanoic acid	307-55-1	PFDoA	50000	0.050		250
Wellington	PFTrDA	Perfluorotridecanoic acid	72629-94-8	PFTrDA	50000	0.050		250
Wellington	PFTeDA	Perfluorotetradecanoic acid	376-06-7	PFTeDA	50000	0.050		250
Wellington	L-PFBS	Perfluorobutanesulfonic acid	375-73-5	PFBS	44200	0.050		221
Wellington	L-PFPeS	Perfluoropentansulfonic acid	2706-91-4	PFPeS	46900	0.050		235
Wellington	br-PFHxSK	Perfluorohexanesulfonic acid	355-46-4	PFHxS	45500	0.050		228
Wellington	L-PFHpS	Perfluoroheptanesulfonic acid	375-92-8	PFHpS	47600	0.050		238
Wellington	br-PFOSK	Perfluorooctanesulfonic acid	1763-23-1	PFOS	46600	0.050		233
Wellington	L-PFNS	Perfluorononanesulfonic acid	68259-12-1	PFNS	48000	0.050		240
Wellington	L-PFDS	Perfluorodecanesulfonic acid	335-77-3	PFDS	48200	0.050		241
Wellington	L-PFDoS	Perfluorododecanesulfonic acid	79780-39-5	PFDoS	48400	0.050		242
Wellington	4;2 FTS	1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	757124-72-4	4:2-FTS	46700	0.100		467
Wellington	6;2 FTS	1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	27619-97-2	6:2-FTS	47400	0.100		474
Wellington	8;2 FTS	1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	39108-34-4	8:2-FTS	47900	0.100		479
Wellington	br-FOSA	Perfluorooctanesulfonamide	754-91-6	PFOSA	50000	0.050		250
Wellington	br-NMeFOSA	N-methyl perfluorooctanesulfonamide	31506-32-8	NMeFOSA / N-MePFOSA	50000	0.050		250
Wellington	br-NEtFOSA	N-ethyl perfluorooctanesulfonamide	4151-50-2	NEtFOSA / N-EtPFOSA	50000	0.050		250
Wellington	br-NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid	2355-31-9	NMeFOSAA	50000	0.050		250
Wellington	br-NEtFOSAA	N-ethyl perfluorooctanesulfonamidoacetic acid	2991-50-6	NEtFOSAA	50000	0.050		250
Wellington	br-NMeFOSE	N-methyl perfluorooctanesulfonamidoethanol	24448-09-7	NMePFOSAE / NMeFOSE	50000	0.250		1250
Wellington	br-NMeFOSE	N-ethyl perfluorooctanesulfonamidoethanol	1691-99-2	NEtPFOSAE / NEtFOSE	50000	0.250		1250
Wellington	HFPO-DA	Hexafluoropropylene oxide dimer acid	13252-13-6	HFPO-DA / GenX	50000	0.0375		187.5
Wellington	NaDONA	4,8-Dioxa-3H-perfluorononanoic acid	919005-14-4	ADONA	47100	0.050		236
Wellington	PFEESA	Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	PFEESA / PES	44500	0.050		223
Wellington	PF4OPeA	Perfluoro-3-methoxypropanoic acid	377-73-1	PFMPA / PFECA F	50000	0.050		250
Wellington	PF5OHxA	Perfluoro-4-methoxybutanoic acid	863090-89-5	PFMBA / PFECA A	50000	0.050		250
Wellington	3,6-OPFHpA	Nonafluoro-3,6-dioxaheptanoic acid	151772-58-6	NFDHA / PFECA B	50000	0.050		250
Wellington	9Cl-PF3ONS	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	756426-58-1	9Cl-PF3ONS	46600	0.050		233
Wellington	11Cl-PF3OUdS	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	763051-92-9	11Cl-PF3OUdS	47100	0.050		236
Wellington	FPrPA	3-Perfluoropropyl propanoic acid	356-02-5	3:3 FTCA	50000	0.100		500
Wellington	FPePA	2H,2H,3H,3H-Perfluorooctanoic acid	914637-49-3	5:3 FTCA	50000	0.250		1250
Wellington	FHpPA	3-Perfluoroheptyl propanoic acid	812-70-4	7:3 FTCA	50000	0.250		1250
Wellington	PFECHS	Perfluoro-4-ethylcyclohexanesulfonate	335-24-0	PFECHS	46100	0.050		231
Wellington	FBSA-I	Perfluoro-1-butanesulfonamide	30334-69-1	FBSA	50000	0.050		250
Wellington	FHxSA-I	Perlfuoro-1-hexanesulfonamide	41997-13-1	FHxSA	50000	0.050		250
Wellington	PFPrA	Perfluoropropanoic acid	422-64-0	PFPrA / PPF Acid	50000	0.250		1250
Wellington	PFODA	Perfluoro-n-octadecanoic acid	16517-11-6	PFODA	50000	0.050		250
AccuStandard	PFOS-030S	Bis(trifluoromethylsulfonyl)amine	82113-65-3	TFSI	97900	0.0250		245

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Attachment 06 - Native PFAS Intermediate B							
Source Rgt Name	**Analyte**	**CAS#**	**Acronym**	**Conc. (ng/mL)**	**Aliquot (mL)**	**Final Volume (mL**	**Final Conc. (ng/mL)**
Native PFAS Intermediate A	Perfluorobutanoic acid	375-22-4	PFBA	500	0.1	10	5
	Perfluoropentanoic acid	2706-90-3	PFPeA	250			2.5
	Perfluorohexanoic acid	307-24-4	PFHxA	250			2.5
	Perfluoroheptanoic acid	375-85-9	PFHpA	250			2.5
	Perfluorooctanoic acid	335-67-1	PFOA	250			2.5
	Perfluorononanoic acid	375-95-1	PFNA	250			2.5
	Perfluorodecanoic acid	335-76-2	PFDA	250			2.5
	Perfluoroundecanoic acid	2058-94-8	PFUnA	250			2.5
	Perfluorododecanoic acid	307-55-1	PFDoA	250			2.5
	Perfluorotridecanoic acid	72629-94-8	PFTrDA	250			2.5
	Perfluorotetradecanoic acid	376-06-7	PFTeDA	250			2.5
	Perfluorobutanesulfonic acid	375-73-5	PFBS	221			2.21
	Perfluoropentansulfonic acid	2706-91-4	PFPeS	235			2.35
	Perfluorohexanesulfonic acid	355-46-4	PFHxS	228			2.28
	Perfluoroheptanesulfonic acid	375-92-8	PFHpS	238			2.38
	Perfluorooctanesulfonic acid	1763-23-1	PFOS	233			2.33
	Perfluorononanesulfonic acid	68259-12-1	PFNS	240			2.4
	Perfluorodecanesulfonic acid	335-77-3	PFDS	241			2.41
	Perfluorododecanesulfonic acid	79780-39-5	PFDoS	242			2.42
	1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	757124-72-4	4:2-FTS	467			4.67
	1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	27619-97-2	6:2-FTS	474			4.74
	1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	39108-34-4	8:2-FTS	479			4.79
	Perfluorooctanesulfonamide	754-91-6	PFOSA	250			2.5
	N-methyl perfluorooctanesulfonamide	31506-32-8	NMeFOSA / N-MePFOSA	250			2.5
	N-ethyl perfluorooctanesulfonamide	4151-50-2	NEtFOSA / N-EtPFOSA	250			2.5
	N-methyl perfluorooctanesulfonamidoacetic acid	2355-31-9	NMeFOSAA	250			2.5
	N-ethyl perfluorooctanesulfonamidoacetic acid	2991-50-6	NEtFOSAA	250			2.5
	N-methyl perfluorooctanesulfonamidoethanol	24448-09-7	NMePFOSAE / NMeFOSE	1250			12.5
	N-ethyl perfluorooctanesulfonamidoethanol	1691-99-2	NEtPFOSAE / NEtFOSE	1250			12.5
	Hexafluoropropylene oxide dimer acid	13252-13-6	HFPO-DA / GenX	187.5			1.875
	4,8-Dioxa-3H-perfluorononanoic acid	919005-14-4	ADONA	236			2.36
	Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	PFEESA / PES	223			2.23
	Perfluoro-3-methoxypropanoic acid	377-73-1	PFMPA / PFECA F	250			2.5
	Perfluoro-4-methoxybutanoic acid	863090-89-5	PFMBA / PFECA A	250			2.5
	Nonafluoro-3,6-dioxaheptanoic acid	151772-58-6	NFDHA / PFECA B	250			2.5
	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	756426-58-1	9Cl-PF3ONS	233			2.33
	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	763051-92-9	11Cl-PF3OUdS	236			2.36
	3-Perfluoropropyl propanoic acid	356-02-5	3:3 FTCA	500			5
	2H,2H,3H,3H-Perfluorooctanoic acid	914637-49-3	5:3 FTCA	1250			12.5
	3-Perfluoroheptyl propanoic acid	812-70-4	7:3 FTCA	1250			12.5
	Perfluoro-4-ethylcyclohexanesulfonate	335-24-0	PFECHS	231			2.31
	Perfluoro-1-butanesulfonamide	30334-69-1	FBSA	250			2.5
	Perlfuoro-1-hexanesulfonamide	41997-13-1	FHxSA	250			2.5
	Perfluoropropanoic acid	422-64-0	PFPrA / PPF Acid	1250			12.5
	Perfluoro-n-octadecanoic acid	16517-11-6	PFODA	250			2.5
	Bis(trifluoromethylsulfonyl)amine	82113-65-3	TFSI	245			2.45

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Attachment 07 - Native PFAS CAL8 Intermediate								
Vendor	**Catalog Number**	**Analyte**	**CAS#**	**Acronym**	**Conc. (ng/mL)**	**Aliquot (mL)**	**Final Volume (mL)**	**Final Conc. (ng/mL)**
Wellington	PFBA	Perfluorobutanoic acid	375-22-4	PFBA	50000	0.100	10	500
Wellington	PFPeA	Perfluoropentanoic acid	2706-90-3	PFPeA	50000	0.050		250
Wellington	PFHxA	Perfluorohexanoic acid	307-24-4	PFHxA	50000	0.050		250
Wellington	PFHpA	Perfluoroheptanoic acid	375-85-9	PFHpA	50000	0.050		250
Wellington	br-PFOA	Perfluorooctanoic acid	335-67-1	PFOA	50000	0.050		250
Wellington	br-PFNA	Perfluorononanoic acid	375-95-1	PFNA	50000	0.050		250
Wellington	L-PFBS	Perfluorobutanesulfonic acid	375-73-5	PFBS	44200	0.050		221
Wellington	L-PFPeS	Perfluoropentansulfonic acid	2706-91-4	PFPeS	46900	0.050		235
Wellington	br-PFHxSK	Perfluorohexanesulfonic acid	355-46-4	PFHxS	45500	0.050		228
Wellington	L-PFHpS	Perfluoroheptanesulfonic acid	375-92-8	PFHpS	47600	0.050		238
Wellington	br-PFOSK	Perfluorooctanesulfonic acid	1763-23-1	PFOS	46600	0.050		233
Wellington	HFPO-DA	Hexafluoropropylene oxide dimer acid	13252-13-6	HFPO-DA / GenX	50000	0.0375		187.5

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Attachment 08 - 1633 EIS Intermediate								
Vendor	**Catalog Number**	**Analyte**	**CAS#**	**Acronym**	**Conc. (ng/mL)**	**Aliquot (mL)**	**Final Volume**	**Final Conc. (ng/mL)**
Wellington	MPFBA	Perfluoro-n-[13C4]butanoic acid	STL00992	$^{13}C_4$-PFBA	50000	0.08	10	400
Wellington	M5PFPeA	Perfluoro-n-[13C5]pentanoic acid	STL01893	$^{13}C_5$-PFPeA	50000	0.08		400
Wellington	M5PFHxA	Perfluoro-n-[1,2,3,4,6-13C5]hexanoic acid	STL02577	$^{13}C_5$-PFHxA	50000	0.08		400
Wellington	M4PFHpA	Perfluoro-n-[1,2,3,4-13C4]heptanoic acid	STL01892	$^{13}C_4$-PFHpA	50000	0.08		400
Wellington	M8PFOA	Perfluoro-n-[13C8]octanoic acid	STL01052	$^{13}C_8$-PFOA	50000	0.08		400
Wellington	M9PFNA	Perfluoro-n-[13C9]nonanoic acid	STL02578	$^{13}C_9$-PFNA	50000	0.08		400
Wellington	M6PFDA	Perfluoro-n-[1,2,3,4,5,6-13C6]decanoic acid	STL02579	$^{13}C_6$-PFDA	50000	0.08		400
Wellington	M7PFUdA	Perfluoro-n-[1,2,3,4,5,6,7-13C7]undecanoic acid	STL02580	$^{13}C_7$-PFUnA	50000	0.08		400
Wellington	MPFDoA	Perfluoro-n-[1,2-13C2]dodecanoic acid	STL00998	$^{13}C_2$-PFDoA	50000	0.08		400
Wellington	M2PFTeDA	Perfluoro-n-[1,2-13C2]tetradecanoic acid	STL02116	$^{13}C_2$-PFTeDA	50000	0.08		400
Wellington	M3PFBS	Perfluoro-1-[2,3,4-13C3]butanesulfonic acid	STL02337	$^{13}C_3$-PFBS	46500	0.08		372
Wellington	M3PFHxS	Perfluoro-1-[1,2,3-13C3]hexanesulfonic acid	STL02581	$^{13}C_3$-PFHxS	47300	0.08		378
Wellington	M8PFOS	Perfluoro-1-[13C8]octanesulfonic acid	STL01054	$^{13}C_8$-PFOS	47800	0.08		382
Wellington	M8FOSA-I	Perfluoro-1-[13C8]octanesulfonamide	STL01056	$^{13}C_8$-PFOSA	50000	0.08		400
Wellington	d3-N-MeFOSAA	N-methyl-d3-perfluoro-1-octanesulfonamidoacetic acid	STL02118	d_3-NMeFOSAA	50000	0.2		1000
Wellington	d5-N-EtFOSAA	N-ethyl-d5-perfluoro-1-octanesulfonamidoacetic acid	STL02117	d_5-NEtFOSAA	50000	0.2		1000
Wellington	M2-4;2FTS	1H,1H,2H,2H-Perfluoro-1-[1,2-13C2]hexane sulfonic acid	STL02395	$^{13}C_2$-4:2FTS	46700	0.2		934
Wellington	M2-6;2FTS	1H,1H,2H,2H-Perfluoro-1-[1,2-13C2]octane sulfonic acid	STL02279	$^{13}C_2$-6:2FTS	47500	0.2		950
Wellington	M2-8;2FTS	1H,1H,2H,2H-Perfluoro-1-[1,2-13C2]decane sulfonic acid	STL02280	$^{13}C_2$-8:2FTS	47900	0.2		958
Wellington	M3HFPO-DA	Tetrafluoro-2-heptafluoropropoxy-13C3-propanoic acid	STL02255	$^{13}C_3$-HFPO-DA	50000	0.08		400
Wellington	d7-N-MeFOSE-M	N-methyl-d7-perfluorooctanesulfonamidoethanol	STL02277	d_7-N-MeFOSE-M	50000	0.2		1000
Wellington	d9-N-EtFOSE-M	N-ethyl-d9-perfluorooctanesulfonamidoethanol	STL02278	d_9-N-EtFOSE-M	50000	0.2		1000
Wellington	d-N-MeFOSA-M	N-ethyl-d5-perfluoro-1-octanesulfonamide	STL02704	d_5-NEtPFOSA	50000	0.08		400
Wellington	d-N-EtFOSA-M	N-methyl-d3-perfluoro-1-octanesulfonamide	STL02705	d_3-NMePFOSA	50000	0.08		400
Cambridge Isotope	CLM-11324-A-1.2	Perfluoropropanoic acid (PFPrA) ($^{13}C_3$)	STL03194	$^{13}C_3$-PFPrA	50000	0.08		400

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Attachment 09 - 1633 NIS Intermediate								
Vendor	**Catalog Number**	**Analyte**	**CAS#**	**Acronym**	**Conc. (ng/mL)**	**Aliquot (mL)**	**Final Volume (mL)**	**Final Conc. (ng/mL)**
Wellington	M3PFBA	Perfluoro-n-[2,3,4-13C3]butanoic acid	STL02680	$^{13}C_3$-PFBA	50000	0.08	10	400
Wellington	MPFOA	Perfluoro-n-[1,2,3,4-13C4]octanoic acid	STL00990	$^{13}C_4$-PFOA	50000	0.2		1000
Wellington	MPFDA	Perfluoro-n-[1,2-13C2]decanoic acid	STL00996	$^{13}C_2$-PFDA	50000	0.08		400
Wellington	MPFOS	Perfluoro-n-[1,2,3,4-13C4]octanesulfonic acid	STL00991	$^{13}C_4$-PFOS	47800	0.08		382.4
Wellington	MPFNA	Perfluoro-n-[1,2,3,4,5-13C5] nonanoic acid	STL00995	$^{13}C_5$-PFNA	50000	0.08		400
Wellington	MPFHxA	Perfluoro-n-[1,2-13C2]hexanoic acid	STL00993	$^{13}C_2$-PFHxA	50000	0.2		1000
Wellington	MPFHxS	Perfluoro-1-hexane[18O2]sulfonic acid	STL00994	$^{18}O_2$-PFHxS	47300	0.08		378.4

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Attachment 10 - 1633 TOP SS Intermediate								
Vendor	**Catalog Number**	**Analyte**	**CAS#**	**Acronym**	**Conc. (ng/mL)**	**Aliquot (mL)**	**Final Volume**	**Final Conc. (ng/mL)**
Wellington	M2PFOA	Perfluoro-n-(1,2-13C2)octanoic acid	STL00623	$^{13}C_2$-PFOA	50000	0.025	10	125
Wellington	MPFUdA	Perfluoro-n-(1,2-13C2)undecanoic acid	STL00997	$^{13}C_2$-PFUnA	50000	0.025		125
Wellington	M3PFPeA	Perfluoro-n-(3,4,5-13C3)pentanoic acid	STL03269	$^{13}C_3$-PFPeA	50000	0.025		125

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Attachment 11 - 1633 Initial Calibration Standards Preparation								
Solution Name	**CAL1**	**CAL2**	**CAL3**	**CAL4**	**CAL5**	**CAL6**	**CAL7**	**CAL8**
Native PFAS CAL8 Intermediate (mL)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.0
Native PFAS Intermediate A (mL)	N/A	N/A	0.02	0.04	0.1	0.2	0.4	N/A
Native PFAS Intermediate B (mL)	0.2	0.5	N/A	N/A	N/A	N/A	N/A	N/A
1633 TOP SS Intermediate (mL)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
1633 EIS Intermediate (mL)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
1633 NIS Intermediate (mL)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Final Volume (mL)	10	10	10	10	10	10	10	10

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Attachment 12 - 1633 Initial Calibration Standard Concentrations								
	CAL1	CAL2	CAL3	CAL4	CAL5	CAL6	CAL7	CAL8
Analyte Name	Conc. (ng/ml)	Conc. (ng/ml)	Conc. (ng/ml)	Conc. (ng/ml)	Conc. (ng/ml)	Conc. (ng/ml)	Conc. (ng/ml)	Conc. (ng/ml)
PFBA	0.100	0.250	1.00	2.00	5.00	10.0	20.0	100
PFPeA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	50.0
PFHxA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	50.0
PFHpA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	50.0
PFOA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	50.0
PFNA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	50.0
PFDA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
PFUnA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
PFDoA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
PFTrDA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
PFTeDA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
PFBS	0.044	0.111	0.442	0.884	2.21	4.42	8.84	44.2
PFPeS	0.047	0.117	0.469	0.938	2.35	4.69	9.38	46.9
PFHxS	0.046	0.114	0.455	0.910	2.28	4.55	9.10	45.5
PFHpS	0.048	0.119	0.476	0.952	2.38	4.76	9.52	47.6
PFOS	0.047	0.117	0.466	0.932	2.33	4.66	9.32	46.6
PFNS	0.048	0.120	0.480	0.960	2.40	4.80	9.60	N/A
PFDS	0.048	0.121	0.482	0.964	2.41	4.82	9.64	N/A
PFDoS	0.048	0.121	0.484	0.968	2.42	4.84	9.68	N/A
4:2-FTS	0.093	0.234	0.934	1.87	4.67	9.34	18.7	N/A
6:2-FTS	0.095	0.237	0.948	1.90	4.74	9.48	19.0	N/A
8:2-FTS	0.096	0.240	0.958	1.92	4.79	9.58	19.2	N/A
PFOSA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
NMeFOSA / N-MePFOSA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
NEtFOSA / N-EtPFOSA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
NMeFOSAA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
NEtFOSAA	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
NMePFOSAE / NMeFOSE	0.250	0.625	2.50	5.00	12.5	25.0	50.0	N/A
NEtPFOSAE / NEtFOSE	0.250	0.625	2.50	5.00	12.5	25.0	50.0	N/A
HFPO-DA / GenX	0.038	0.094	0.38	0.750	1.88	3.75	7.50	37.5
ADONA	0.047	0.118	0.471	0.942	2.36	4.71	9.42	N/A
PFEESA / PES	0.045	0.111	0.445	0.890	2.23	4.45	8.90	N/A
PFMPA / PFECA F	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
PFMBA / PFECA A	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
NFDHA / PFECA B	0.050	0.125	0.50	1.00	2.50	5.00	10.0	N/A
9Cl-PF3ONS	0.047	0.117	0.466	0.93	2.33	4.66	9.32	N/A
11Cl-PF3OUdS	0.047	0.118	0.471	0.94	2.36	4.71	9.42	N/A
3:3 FTCA	0.100	0.250	1.00	2.00	5.00	10.0	20.0	N/A
5:3 FTCA	0.250	0.625	2.50	5.00	12.5	25.0	50.0	N/A
7:3 FTCA	0.250	0.625	2.50	5.00	12.5	25.0	50.0	N/A
PFECHS	0.046	0.116	0.462	0.92	2.31	4.62	9.24	N/A
FBSA	0.050	0.125	0.500	1.00	2.50	5.00	10.0	N/A
FHxSA	0.050	0.125	0.500	1.00	2.50	5.00	10.0	N/A
PFPrA / PPF Acid	0.250	0.625	2.500	5.00	12.5	25.0	50.0	N/A
PFODA	0.050	0.125	0.500	1.00	2.50	5.00	10.0	N/A
TFSI	0.049	0.122	0.490	0.98	2.45	4.90	9.79	N/A
$^{13}C_3$-PFPrA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_4$-PFBA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_5$-PFPeA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_5$-PFHxA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_4$-PFHpA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_8$-PFOA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_9$-PFNA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_6$-PFDA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_7$-PFUnA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_2$-PFDoA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_2$-PFTeDA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_3$-PFBS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_3$-PFHxS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_8$-PFOS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_8$-PFOSA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
d_3-NMeFOSAA	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
d_5-NEtFOSAA	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
$^{13}C_2$-4:2FTS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
$^{13}C_2$-6:2FTS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
$^{13}C_2$-8:2FTS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
$^{13}C_3$-HFPO-DA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
d_7-N-MeFOSE-M	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
d_9-N-EtFOSE-M	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
d_5-NEtPFOSA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
d_3-NMePFOSA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_3$-PFBA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_4$-PFOA	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
$^{13}C_2$-PFDA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_4$-PFOS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_5$-PFNA	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_2$-PFHxA	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
$^{18}O_2$-PFHxS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
$^{13}C_2$-PFOA	0.625	0.625	0.625	0.625	0.625	0.625	0.625	0.625
$^{13}C_2$-PFUnA	0.625	0.625	0.625	0.625	0.625	0.625	0.625	0.625
$^{13}C_3$-PFPeA	0.625	0.625	0.625	0.625	0.625	0.625	0.625	0.625

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Attachment 13 - Bile Salts Stock Solution							
Vendor	**Catalog Number**	**Analyte**	**CAS#**	**Acronym**	**Aliquot (g)**	**Final Volume**	**Final Conc. (ng/mL)**
Sigma Aldrich	T0557-500MG	Taurodeoxycholic acid	516-50-7	TDCA	0.05	50	1000000
Sigma Aldrich	T6260-1G	Taurochenodeoxycholic acid	516-35-8	TCDCA	0.05		950000
Calbiochem	580549-1GM	Tauroursodeoxycholic acid	14605-22-2	TUDCA	0.05		1000000

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Attachment 14 - Bile Salts Intermediate							
Source Rgt Name	**Analyte**	**CAS#**	**Acronym**	**Conc. (ng/mL)**	**Aliquot (mL)**	**Final Volume**	**Final Conc. (ng/mL)**
Bile Salts Stock Solution	Taurodeoxycholic acid	516-50-7	TDCA	1000000	1	4	250000
	Taurochenodeoxycholic acid	516-35-8	TCDCA	950000			237500
	Tauroursodeoxycholic acid	14605-22-2	TUDCA	1000000			250000

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Attachment 15 - Bile Salts Working Solution							
Source Rgt Name	**Analyte**	**CAS#**	**Acronym**	**Conc. (ng/mL)**	**Aliquot (mL)**	**Final Volume**	**Final Conc. (ng/mL)**
Bile Salts Intermediate	Taurodeoxycholic acid	516-50-7	TDCA	250000	0.1	5	5000
	Taurochenodeoxycholic acid	516-35-8	TCDCA	237500			4750
	Tauroursodeoxycholic acid	14605-22-2	TUDCA	250000			5000

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Attachment 16 - 1633 Window-Defining Matrix Standard							
Source Rgt. Name	**Analyte**	**CAS#**	**Acronym**	**Conc. (ng/mL)**	**Aliquot (mL)**	**Final Volume* (mL)**	**Final Conc. (ng/mL)**
Bile Salts Working Solution	Taurodeoxycholic acid	516-50-7	TDCA	5000	0.05	10	25
	Taurochenodeoxycholic acid	516-35-8	TCDCA	4750			23.8
	Tauroursodeoxycholic acid	14605-22-2	TUDCA	5000			25

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Attachment 17 - Native 1633 Mid-Level Spike							
Source Rgt. Name	Analyte	CAS#	Acronym	Conc. (ng/mL)	Aliquot (mL)	Final Volume	Final Conc. (ng/mL)
Native PFAS Intermediate A	Perfluorobutanoic acid	375-22-4	PFBA	500	4	10	200
	Perfluoropentanoic acid	2706-90-3	PFPeA	250			100
	Perfluorohexanoic acid	307-24-4	PFHxA	250			100
	Perfluoroheptanoic acid	375-85-9	PFHpA	250			100
	Perfluorooctanoic acid	335-67-1	PFOA	250			100
	Perfluorononanoic acid	375-95-1	PFNA	250			100
	Perfluorodecanoic acid	335-76-2	PFDA	250			100
	Perfluoroundecanoic acid	2058-94-8	PFUnA	250			100
	Perfluorododecanoic acid	307-55-1	PFDoA	250			100
	Perfluorotridecanoic acid	72629-94-8	PFTrDA	250			100
	Perfluorotetradecanoic acid	376-06-7	PFTeDA	250			100
	Perfluorobutanesulfonic acid	375-73-5	PFBS	221			88.4
	Perfluoropentansulfonic acid	2706-91-4	PFPeS	235			93.8
	Perfluorohexanesulfonic acid	355-46-4	PFHxS	228			91.0
	Perfluoroheptanesulfonic acid	375-92-8	PFHpS	238			95.2
	Perfluorooctanesulfonic acid	1763-23-1	PFOS	233			93.2
	Perfluorononanesulfonic acid	68259-12-1	PFNS	240			96.0
	Perfluorodecanesulfonic acid	335-77-3	PFDS	241			96.4
	Perfluorododecanesulfonic acid	79780-39-5	PFDoS	242			96.8
	1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	757124-72-4	4:2-FTS	467			187
	1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	27619-97-2	6:2-FTS	474			190
	1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	39108-34-4	8:2-FTS	479			192
	Perfluorooctanesulfonamide	754-91-6	PFOSA	250			100
	N-methyl perfluorooctanesulfonamide	31506-32-8	NMeFOSA / N-MePFOSA	250			100
	N-ethyl perfluorooctanesulfonamide	4151-50-2	NEtFOSA / N-EtPFOSA	250			100
	N-methyl perfluorooctanesulfonamidoacetic acid	2355-31-9	NMeFOSAA	250			100
	N-ethyl perfluorooctanesulfonamidoacetic acid	2991-50-6	NEtFOSAA	250			100
	N-methyl perfluorooctanesulfonamidoethanol	24448-09-7	NMePFOSAE / NMeFOSE	1250			500
	N-ethyl perfluorooctanesulfonamidoethanol	1691-99-2	NEtPFOSAE / NEtFOSE	1250			500
	Hexafluoropropylene oxide dimer acid	13252-13-6	HFPO-DA / GenX	187.5			75.0
	4,8-Dioxa-3H-perfluorononanoic acid	919005-14-4	ADONA	236			94.2
	Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	PFEESA / PES	223			89.0
	Perfluoro-3-methoxypropanoic acid	377-73-1	PFMPA / PFECA F	250			100
	Perfluoro-4-methoxybutanoic acid	863090-89-5	PFMBA / PFECA A	250			100
	Nonafluoro-3,6-dioxaheptanoic acid	151772-58-6	NFDHA / PFECA B	250			100
	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	756426-58-1	9Cl-PF3ONS	233			93.2
	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	763051-92-9	11Cl-PF3OUdS	236			94.2
	3-Perfluoropropyl propanoic acid	356-02-5	3:3 FTCA	500			200
	2H,2H,3H,3H-Perfluorooctanoic acid	914637-49-3	5:3 FTCA	1250			500
	3-Perfluoroheptyl propanoic acid	812-70-4	7:3 FTCA	1250			500
	Perfluoro-4-ethylcyclohexanesulfonate	335-24-0	PFECHS	231			92.2
	Perfluoro-1-butanesulfonamide	30334-69-1	FBSA	250			100
	Perlfuoro-1-hexanesulfonamide	41997-13-1	FHxSA	250			100
	Perfluoropropanoic acid	422-64-0	PFPrA / PPF Acid	1250			500
	Perfluoro-n-octadecanoic acid	16517-11-6	PFODA	250			100
	Bis(trifluoromethylsulfonyl)amine	82113-65-3	TFSI	245			97.9

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Attachment 18 - Native 1633 Low-Level Spike							
Source Rgt. Name	**Analyte**	**CAS#**	**Acronym**	**Conc. (ng/mL)**	**Aliquot (mL)**	**Final Volume**	**Final Conc. (ng/mL)**
Native PFAS Intermediate A	Perfluorobutanoic acid	375-22-4	PFBA	500	0.5	10	25.00
	Perfluoropentanoic acid	2706-90-3	PFPeA	250			12.50
	Perfluorohexanoic acid	307-24-4	PFHxA	250			12.50
	Perfluoroheptanoic acid	375-85-9	PFHpA	250			12.50
	Perfluorooctanoic acid	335-67-1	PFOA	250			12.50
	Perfluorononanoic acid	375-95-1	PFNA	250			12.50
	Perfluorodecanoic acid	335-76-2	PFDA	250			12.50
	Perfluoroundecanoic acid	2058-94-8	PFUnA	250			12.50
	Perfluorododecanoic acid	307-55-1	PFDoA	250			12.50
	Perfluorotridecanoic acid	72629-94-8	PFTrDA	250			12.50
	Perfluorotetradecanoic acid	376-06-7	PFTeDA	250			12.50
	Perfluorobutanesulfonic acid	375-73-5	PFBS	221			11.05
	Perfluoropentansulfonic acid	2706-91-4	PFPeS	235			11.73
	Perfluorohexanesulfonic acid	355-46-4	PFHxS	228			11.38
	Perfluoroheptanesulfonic acid	375-92-8	PFHpS	238			11.90
	Perfluorooctanesulfonic acid	1763-23-1	PFOS	233			11.65
	Perfluorononanesulfonic acid	68259-12-1	PFNS	240			12.00
	Perfluorodecanesulfonic acid	335-77-3	PFDS	241			12.05
	Perfluorododecanesulfonic acid	79780-39-5	PFDoS	242			12.10
	1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	757124-72-4	4:2-FTS	467			23.35
	1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	27619-97-2	6:2-FTS	474			23.70
	1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	39108-34-4	8:2-FTS	479			23.95
	Perfluorooctanesulfonamide	754-91-6	PFOSA	250			12.50
	N-methyl perfluorooctanesulfonamide	31506-32-8	NMeFOSA / N-MePFOSA	250			12.50
	N-ethyl perfluorooctanesulfonamide	4151-50-2	NEtFOSA / N-EtPFOSA	250			12.50
	N-methyl perfluorooctanesulfonamidoacetic acid	2355-31-9	NMeFOSAA	250			12.50
	N-ethyl perfluorooctanesulfonamidoacetic acid	2991-50-6	NEtFOSAA	250			12.50
	N-methyl perfluorooctanesulfonamidoethanol	24448-09-7	NMePFOSAE / NMeFOSE	1250			62.50
	N-ethyl perfluorooctanesulfonamidoethanol	1691-99-2	NEtPFOSAE / NEtFOSE	1250			62.50
	Hexafluoropropylene oxide dimer acid	13252-13-6	HFPO-DA / GenX	187.5			9.38
	4,8-Dioxa-3H-perfluorononanoic acid	919005-14-4	ADONA	235.5			11.78
	Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	PFEESA / PES	223			11.13
	Perfluoro-3-methoxypropanoic acid	377-73-1	PFMPA / PFECA F	250			12.50
	Perfluoro-4-methoxybutanoic acid	863090-89-5	PFMBA / PFECA A	250			12.50
	Nonafluoro-3,6-dioxaheptanoic acid	151772-58-6	NFDHA / PFECA B	250			12.50
	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	756426-58-1	9Cl-PF3ONS	233			11.65
	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	763051-92-9	11Cl-PF3OUdS	235.5			11.78
	3-Perfluoropropyl propanoic acid	356-02-5	3:3 FTCA	500			25.00
	2H,2H,3H,3H-Perfluorooctanoic acid	914637-49-3	5:3 FTCA	1250			62.50
	3-Perfluoroheptyl propanoic acid	812-70-4	7:3 FTCA	1250			62.50
	Perfluoro-4-ethylcyclohexanesulfonate	335-24-0	PFECHS	230.5			11.53
	Perfluoro-1-butanesulfonamide	30334-69-1	FBSA	250			12.50
	Perlfuoro-1-hexanesulfonamide	41997-13-1	FHxSA	250			12.50
	Perfluoropropanoic acid	422-64-0	PFPrA / PPF Acid	1250			62.50
	Perfluoro-n-octadecanoic acid	16517-11-6	PFODA	250			12.50
	Bis(trifluoromethylsulfonyl)amine	82113-65-3	TFSI	244.75			12.24

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Attachment 19 - 1633 ICV Working Standard							
Source Rgt. Name	Analyte	CAS#	Acronym	Conc. (ng/mL)	Aliquot (mL)	Final Volume	Final Conc. (ng/mL)
Native PFAS Intermediate A	Perfluorobutanoic acid	375-22-4	PFBA	500	0.050	10	2.50
	Perfluoropentanoic acid	2706-90-3	PFPeA	250			1.25
	Perfluorohexanoic acid	307-24-4	PFHxA	250			1.25
	Perfluoroheptanoic acid	375-85-9	PFHpA	250			1.25
	Perfluorooctanoic acid	335-67-1	PFOA	250			1.25
	Perfluorononanoic acid	375-95-1	PFNA	250			1.25
	Perfluorodecanoic acid	335-76-2	PFDA	250			1.25
	Perfluoroundecanoic acid	2058-94-8	PFUnA	250			1.25
	Perfluorododecanoic acid	307-55-1	PFDoA	250			1.25
	Perfluorotridecanoic acid	72629-94-8	PFTrDA	250			1.25
	Perfluorotetradecanoic acid	376-06-7	PFTeDA	250			1.25
	Perfluorobutanesulfonic acid	375-73-5	PFBS	221			1.105
	Perfluoropentansulfonic acid	2706-91-4	PFPeS	235			1.173
	Perfluorohexanesulfonic acid	355-46-4	PFHxS	228			1.138
	Perfluoroheptanesulfonic acid	375-92-8	PFHpS	238			1.190
	Perfluorooctanesulfonic acid	1763-23-1	PFOS	233			1.165
	Perfluorononanesulfonic acid	68259-12-1	PFNS	240			1.200
	Perfluorodecanesulfonic acid	335-77-3	PFDS	241			1.205
	Perfluorododecanesulfonic acid	79780-39-5	PFDoS	242			1.210
	1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	757124-72-4	4:2-FTS	467			2.34
	1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	27619-97-2	6:2-FTS	474			2.37
	1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	39108-34-4	8:2-FTS	479			2.40
	Perfluorooctanesulfonamide	754-91-6	PFOSA	250			1.25
	N-methyl perfluorooctanesulfonamide	31506-32-8	NMeFOSA / N-MePFOSA	250			1.25
	N-ethyl perfluorooctanesulfonamide	4151-50-2	NEtFOSA / N-EtPFOSA	250			1.25
	N-methyl perfluorooctanesulfonamidoacetic acid	2355-31-9	NMeFOSAA	250			1.25
	N-ethyl perfluorooctanesulfonamidoacetic acid	2991-50-6	NEtFOSAA	250			1.25
	N-methyl perfluorooctanesulfonamidoethanol	24448-09-7	NMePFOSAE / NMeFOSE	1250			6.25
	N-ethyl perfluorooctanesulfonamidoethanol	1691-99-2	NEtPFOSAE / NEtFOSE	1250			6.25
	Hexafluoropropylene oxide dimer acid	13252-13-6	HFPO-DA / GenX	187.5			0.938
	4,8-Dioxa-3H-perfluorononanoic acid	919005-14-4	ADONA	236			1.178
	Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	PFEESA / PES	223			1.113
	Perfluoro-3-methoxypropanoic acid	377-73-1	PFMPA / PFECA F	250			1.25
	Perfluoro-4-methoxybutanoic acid	863090-89-5	PFMBA / PFECA A	250			1.25
	Nonafluoro-3,6-dioxaheptanoic acid	151772-58-6	NFDHA / PFECA B	250			1.25
	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	756426-58-1	9Cl-PF3ONS	233			1.165
	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	763051-92-9	11Cl-PF3OUdS	236			1.178
	3-Perfluoropropyl propanoic acid	356-02-5	3:3 FTCA	500			2.50
	2H,2H,3H,3H-Perfluorooctanoic acid	914637-49-3	5:3 FTCA	1250			6.25
	3-Perfluoroheptyl propanoic acid	812-70-4	7:3 FTCA	1250			6.25
	Perfluoro-4-ethylcyclohexanesulfonate	335-24-0	PFECHS	231			1.153
	Perfluoro-1-butanesulfonamide	30334-69-1	FBSA	250			1.25
	Perlfuoro-1-hexanesulfonamide	41997-13-1	FHxSA	250			1.25
	Perfluoropropanoic acid	422-64-0	PFPrA / PPF Acid	1250			6.25
	Perfluoro-n-octadecanoic acid	16517-11-6	PFODA	250			1.25
	Bis(trifluoromethylsulfonyl)amine	82113-65-3	TFSI	245			1.224
1633 TOP SS Intermediate	Perfluoro-n-(1,2-13C2)octanoic acid	STL00623	$^{13}C_2$-PFOA	125	0.050		0.625
	Perfluoro-n-(1,2-13C2)undecanoic acid	STL00997	$^{13}C_2$-PFUnA	125			0.625
	Perfluoro-n-(3,4,5-13C3)pentanoic acid	STL03269	$^{13}C_3$-PFPeA	125			0.625
1633 EIS Intermediate	Perfluoro-n-[13C4]butanoic acid	STL00992	$^{13}C_4$-PFBA	400	0.050		2.00
	Perfluoro-n-[13C5]pentanoic acid	STL01893	$^{13}C_5$-PFPeA	400			2.00
	Perfluoro-n-[1,2,3,4,6-13C5]hexanoic acid	STL02577	$^{13}C_5$-PFHxA	400			2.00
	Perfluoro-n-[1,2,3,4-13C4]heptanoic acid	STL01892	$^{13}C_4$-PFHpA	400			2.00
	Perfluoro-n-[13C8]octanoic acid	STL01052	$^{13}C_8$-PFOA	400			2.00
	Perfluoro-n-[13C9]nonanoic acid	STL02578	$^{13}C_9$-PFNA	400			2.00
	Perfluoro-n-[1,2,3,4,5,6-13C6]decanoic acid	STL02579	$^{13}C_6$-PFDA	400			2.00
	Perfluoro-n-[1,2,3,4,5,6,7-13C7]undecanoic acid	STL02580	$^{13}C_7$-PFUnA	400			2.00
	Perfluoro-n-[1,2-13C2]dodecanoic acid	STL00998	$^{13}C_2$-PFDoA	400			2.00
	Perfluoro-n-[1,2-13C2]tetradecanoic acid	STL02116	$^{13}C_2$-PFTeDA	400			2.00
	Perfluoro-1-[2,3,4-13C3]butanesulfonic acid	STL02337	$^{13}C_3$-PFBS	372			1.86
	Perfluoro-1-[1,2,3-13C3]hexanesulfonic acid	STL02581	$^{13}C_3$-PFHxS	378			1.89
	Perfluoro-1-[13C8]octanesulfonic acid	STL01054	$^{13}C_8$-PFOS	382			1.91
	Perfluoro-1-[13C8]octanesulfonamide	STL01056	$^{13}C_8$-PFOSA	400			2.00
	N-methyl-d3-perfluoro-1-octanesulfonamidoacetic acid	STL02118	d_3-NMeFOSAA	1000			5.00
	N-ethyl-d5-perfluoro-1-octanesulfonamidoacetic acid	STL02117	d_5-NEtFOSAA	1000			5.00
	1H,1H,2H,2H-Perfluoro-1-[1,2-13C2]hexane sulfonic acid	STL02395	$^{13}C_2$-4:2FTS	934			4.67
	1H,1H,2H,2H-Perfluoro-1-[1,2-13C2]octane sulfonic acid	STL02279	$^{13}C_2$-6:2FTS	950			4.75
	1H,1H,2H,2H-Perfluoro-1-[1,2-13C2]decane sulfonic acid	STL02280	$^{13}C_2$-8:2FTS	958			4.79
	Tetrafluoro-2-heptafluoropropoxy-13C3-propanoic acid	STL02255	$^{13}C_3$-HFPO-DA	400			2.00
	N-methyl-d7-perfluorooctanesulfonamidoethanol	STL02277	d_7-N-MeFOSE-M	1000			5.00
	N-ethyl-d9-perfluorooctanesulfonamidoethanol	STL02278	d_9-N-EtFOSE-M	1000			5.00
	N-ethyl-d5-perfluoro-1-octanesulfonamide	STL02704	d_5-NEtPFOSA	400			2.00
	N-methyl-d3-perfluoro-1-octanesulfonamide	STL02705	d_3-NMePFOSA	400			2.00
	Perfluoropropanoic acid (PFPrA) ($^{13}C_3$)	STL03194	$^{13}C_3$-PFPrA	400			2.00
1633 NIS Intermediate	Perfluoro-n-[2,3,4-13C3]butanoic acid	STL02680	$^{13}C_3$-PFBA	400	0.050		2.00
	Perfluoro-n-[1,2,3,4-13C4]octanoic acid	STL00990	$^{13}C_4$-PFOA	1000			5.00
	Perfluoro-n-[1,2-13C2]decanoic acid	STL00996	$^{13}C_2$-PFDA	400			2.00
	Perfluoro-n-[1,2,3,4-13C4]octanesulfonic acid	STL00991	$^{13}C_4$-PFOS	382			1.91
	Perfluoro-n-[1,2,3,4,5-13C5] nonanoic acid	STL00995	$^{13}C_5$-PFNA	400			2.00
	Perfluoro-n-[1,2-13C2]hexanoic acid	STL00993	$^{13}C_2$-PFHxA	1000			5.00
	Perfluoro-1-hexane[18O2]sulfonic acid	STL00994	$^{18}O_2$-PFHxS	378			1.89

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Attachment 20 - Purchased Standards					
Vendor	Cat. No.	Analyte	CAS#	Acronym	Conc. (ng/ml)
Wellington	PFBA	Perfluorobutanoic acid	375-22-4	PFBA	50000
Wellington	PFPeA	Perfluoropentanoic acid	2706-90-3	PFPeA	50000
Wellington	PFHxA	Perfluorohexanoic acid	307-24-4	PFHxA	50000
Wellington	PFHpA	Perfluoroheptanoic acid	375-85-9	PFHpA	50000
Wellington	br-PFOA	Perfluorooctanoic acid	335-67-1	PFOA	50000
Wellington	br-PFNA	Perfluorononanoic acid	375-95-1	PFNA	50000
Wellington	PFDA	Perfluorodecanoic acid	335-76-2	PFDA	50000
Wellington	PFUdA	Perfluoroundecanoic acid	2058-94-8	PFUnA	50000
Wellington	MPFDOA	Perfluorododecanoic acid	307-55-1	PFDoA	50000
Wellington	PFTrDA	Perfluorotridecanoic acid	72629-94-8	PFTrDA	50000
Wellington	PFTeDA	Perfluorotetradecanoic acid	376-06-7	PFTeDA	50000
Wellington	L-PFBS	Perfluorobutanesulfonic acid	375-73-5	PFBS	44200
Wellington	L-PFPeS	Perfluoropentansulfonic acid	2706-91-4	PFPeS	46900
Wellington	br-PFHxSK	Perfluorohexanesulfonic acid	355-46-4	PFHxS	45500
Wellington	L-PFHpS	Perfluoroheptanesulfonic acid	375-92-8	PFHpS	47600
Wellington	br-PFOSK	Perfluorooctanesulfonic acid	1763-23-1	PFOS	46600
Wellington	L-PFNS	Perfluorononanesulfonic acid	68259-12-1	PFNS	48000
Wellington	L-PFDS	Perfluorodecanesulfonic acid	335-77-3	PFDS	48200
Wellington	L-PFDoS	Perfluorododecanesulfonic acid	79780-39-5	PFDoS	48400
Wellington	4;2 FTS	1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	757124-72-4	4:2-FTS	46700
Wellington	6;2 FTS	1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	27619-97-2	6:2-FTS	47400
Wellington	8;2 FTS	1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	39108-34-4	8:2-FTS	47900
Wellington	br-FOSA	Perfluorooctanesulfonamide	754-91-6	PFOSA	50000
Wellington	br-NMeFOSA	N-methyl perfluorooctanesulfonamide	31506-32-8	NMeFOSA / N-MePFOSA	50000
Wellington	br-NEtFOSA	N-ethyl perfluorooctanesulfonamide	4151-50-2	NEtFOSA / N-EtPFOSA	50000
Wellington	br-NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid	2355-31-9	NMeFOSAA	50000
Wellington	br-NEtFOSAA	N-ethyl perfluorooctanesulfonamidoacetic acid	2991-50-6	NEtFOSAA	50000
Wellington	br-NMeFOSE	N-methyl perfluorooctanesulfonamidoethanol	24448-09-7	NMePFOSAE / NMeFOSE	50000
Wellington	br-NEtFOSE	N-ethyl perfluorooctanesulfonamidoethanol	1691-99-2	NEtPFOSAE / NEtFOSE	50000
Wellington	HFPO-DA	Hexafluoropropylene oxide dimer acid	13252-13-6	HFPO-DA / GenX	50000
Wellington	NaDONA	4,8-Dioxa-3H-perfluorononanoic acid	919005-14-4	ADONA	47100
Wellington	PFEESA	Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	PFEESA / PES	44500
Wellington	PF4OPeA	Perfluoro-3-methoxypropanoic acid	377-73-1	PFMPA / PFECA F	50000
Wellington	PF5OHxA	Perfluoro-4-methoxybutanoic acid	863090-89-5	PFMBA / PFECA A	50000
Wellington	3,6-OPFHpA	Nonafluoro-3,6-dioxaheptanoic acid	151772-58-6	NFDHA / PFECA B	50000
Wellington	9Cl-PF3ONS	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	756426-58-1	9Cl-PF3ONS	46600
Wellington	11Cl-PF3OUdS	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	763051-92-9	11Cl-PF3OUdS	47100
Wellington	FPrPA	3-Perfluoropropyl propanoic acid	356-02-5	3:3 FTCA	50000
Wellington	FPePA	2H,2H,3H,3H-Perfluorooctanoic acid	914637-49-3	5:3 FTCA	50000
Wellington	FHpPA	3-Perfluoroheptyl propanoic acid	812-70-4	7:3 FTCA	50000
Wellington	PFECHS	Perfluoro-4-ethylcyclohexanesulfonate	335-24-0	PFECHS	46100
Wellington	FBSA-I	Perfluoro-1-butanesulfonamide	30334-69-1	FBSA	50000
Wellington	FHxSA-I	Perlfuoro-1-hexanesulfonamide	41997-13-1	FHxSA	50000
Wellington	PFPrA	Perfluoropropanoic acid	422-64-0	PFPrA / PPF Acid	50000
Wellington	PFODA	Perfluoro-n-octadecanoic acid	16517-11-6	PFODA	50000
AccuStandard	PFOS-030S	Bis(trifluoromethylsulfonyl)amine	82113-65-3	TFSI	97900
Wellington	MPFBA	Perfluoro-n-[13C4]butanoic acid	STL00992	$^{13}C_4$-PFBA	50000
Wellington	M5PFPeA	Perfluoro-n-[13C5]pentanoic acid	STL01893	$^{13}C_5$-PFPeA	50000
Wellington	M5PFHxA	Perfluoro-n-[1,2,3,4,6-13C5]hexanoic acid	STL02577	$^{13}C_5$-PFHxA	50000
Wellington	M4PFHpA	Perfluoro-n-[1,2,3,4-13C4]heptanoic acid	STL01892	$^{13}C_4$-PFHpA	50000
Wellington	M8PFOA	Perfluoro-n-[13C8]octanoic acid	STL01052	$^{13}C_8$-PFOA	50000
Wellington	M9PFNA	Perfluoro-n-[13C9]nonanoic acid	STL02578	$^{13}C_9$-PFNA	50000
Wellington	M6PFDA	Perfluoro-n-[1,2,3,4,5,6-13C6]decanoic acid	STL02579	$^{13}C_6$-PFDA	50000
Wellington	M7PFUdA	Perfluoro-n-[1,2,3,4,5,6,7-13C7]undecanoic acid	STL02580	$^{13}C_7$-PFUnA	50000
Wellington	MPFDoA	Perfluoro-n-[1,2-13C2]dodecanoic acid	STL00998	$^{13}C_2$-PFDoA	50000
Wellington	M2PFTeDA	Perfluoro-n-[1,2-13C2]tetradecanoic acid	STL02116	$^{13}C_2$-PFTeDA	50000
Wellington	M3PFBS	Perfluoro-1-[2,3,4-13C3]butanesulfonic acid	STL02337	$^{13}C_3$-PFBS	46500
Wellington	M3PFHxS	Perfluoro-1-[1,2,3-13C3]hexanesulfonic acid	STL02581	$^{13}C_3$-PFHxS	47300
Wellington	M8PFOS	Perfluoro-1-[13C8]octanesulfonic acid	STL01054	$^{13}C_8$-PFOS	47800
Wellington	M8FOSA-I	Perfluoro-1-[13C8]octanesulfonamide	STL01056	$^{13}C_8$-PFOSA	50000
Wellington	d3-N-MeFOSAA	N-methyl-d3-perfluoro-1-octanesulfonamidoacetic acid	STL02118	d_3-NMeFOSAA	50000
Wellington	d5-N-EtFOSAA	N-ethyl-d5-perfluoro-1-octanesulfonamidoacetic acid	STL02117	d_5-NEtFOSAA	50000
Wellington	M2-4;2FTS	1H,1H,2H,2H-Perfluoro-1-[1,2-13C2]hexane sulfonic acid	STL02395	$^{13}C_2$-4:2FTS	46700
Wellington	M2-6;2FTS	1H,1H,2H,2H-Perfluoro-1-[1,2-13C2]octane sulfonic acid	STL02279	$^{13}C_2$-6:2FTS	47500
Wellington	M2-8;2FTS	1H,1H,2H,2H-Perfluoro-1-[1,2-13C2]decane sulfonic acid	STL02280	$^{13}C_2$-8:2FTS	47900
Wellington	M3HFPO-DA	Tetrafluoro-2-heptafluoropropoxy-13C3-propanoic acid	STL02255	$^{13}C_3$-HFPO-DA	50000
Wellington	d7-N-MeFOSE-M	N-methyl-d7-perfluorooctanesulfonamidoethanol	STL02277	d_7-N-MeFOSE-M	50000
Wellington	d9-N-EtFOSE-M	N-ethyl-d9-perfluorooctanesulfonamidoethanol	STL02278	d_9-N-EtFOSE-M	50000
Wellington	d-N-MeFOSA-M	N-ethyl-d5-perfluoro-1-octanesulfonamide	STL02704	d_5-NEtPFOSA	50000
Wellington	d-N-EtFOSA-M	N-methyl-d3-perfluoro-1-octanesulfonamide	STL02705	d_3-NMePFOSA	50000
Cambridge Isotope	CLM-11324-A-1.2	Perfluoropropanoic acid (PFPrA) ($^{13}C_3$)	STL03194	$^{13}C_3$-PFPrA	50000
Wellington	M3PFBA	Perfluoro-n-[2,3,4-13C3]butanoic acid	STL02680	$^{13}C_3$-PFBA	50000
Wellington	MPFOA	Perfluoro-n-[1,2,3,4-13C4]octanoic acid	STL00990	$^{13}C_4$-PFOA	50000
Wellington	MPFDA	Perfluoro-n-[1,2-13C2]decanoic acid	STL00996	$^{13}C_2$-PFDA	50000
Wellington	MPFOS	Perfluoro-n-[1,2,3,4-13C4]octanesulfonic acid	STL00991	$^{13}C_4$-PFOS	47800
Wellington	MPFNA	Perfluoro-n-[1,2,3,4,5-13C5] nonanoic acid	STL00995	$^{13}C_5$-PFNA	50000
Wellington	MPFHxA	Perfluoro-n-[1,2-13C2]hexanoic acid	STL00993	$^{13}C_2$-PFHxA	50000
Wellington	MPFHxS	Perfluoro-1-hexane[18O2]sulfonic acid	STL00994	$^{18}O_2$-PFHxS	47300
Wellington	M2PFOA	Perfluoro-n-(1,2-13C2)octanoic acid	STL00623	$^{13}C_2$-PFOA	50000
Wellington	MPFUdA	Perfluoro-n-(1,2-13C2)undecanoic acid	STL00997	$^{13}C_2$-PFUnA	50000
Wellington	M3PFPeA	Perfluoro-n-(3,4,5-13C3)pentanoic acid	STL03269	$^{13}C_3$-PFPeA	50000
Sigma Aldrich	T0557-500MG	Taurodeoxycholic acid	516-50-7	TDCA	neat
Sigma Aldrich	T6260-1G	Taurochenodeoxycholic acid	516-35-8	TCDCA	neat
Calbiochem	580549-1GM	Tauroursodeoxycholic acid	14605-22-2	TUDCA	neat

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Table 7. IPR/OPR/LLOPR Acceptance Limits for Target Analytes in Solid, Biosolid, and Tissue Matrices

	Solid and Biosolid Matrices[1]			Tissue Matrix[1]		
	IPR			IPR		
Compound	Mean Recovery (%)	RSD (%)	OPR/LLOPR Recovery (%)	Mean Recovery (%)	RSD (%)	OPR/LLOPR Recovery (%)
PFBA	70 - 140	17	70 - 140	70 - 135	20	60 - 140
PFPeA	70 - 140	26	60 - 150	70 - 130	20	60 - 145
PFHxA	70 - 135	23	65 - 140	70 - 140	20	60 - 160
PFHpA	70 - 140	21	65 - 145	70 - 140	20	60 - 145
PFOA	70 - 140	23	70 - 150	70 - 130	25	60 - 150
PFNA	65 - 145	24	70 - 155	70 - 140	20	60 - 145
PFDA	70 - 145	26	70 - 155	70 - 135	20	60 - 150
PFUnA	70 - 145	26	70 - 155	70 - 135	20	60 - 155
PFDoA	70 - 145	25	70 - 150	70 - 135	20	60 - 140
PFTrDA	55 - 160	26	65 - 150	55 - 160	20	60 - 150
PFTeDA	70 - 145	24	65 - 150	70 - 140	25	60 - 140
PFBS	60 - 145	25	65 - 145	70 - 145	20	60 - 150
PFPeS	65 - 140	29	55 - 160	70 - 150	20	60 - 145
PFHxS	65 - 145	28	60 - 150	70 - 140	25	60 - 155
PFHpS	70 - 140	27	65 - 155	70 - 145	20	60 - 140
PFOS	70 - 135	27	65 - 160	70 - 135	30	60 - 160
PFNS	70 - 140	27	55 - 140	60 - 130	20	45 - 140
PFDS	50 - 150	31	40 - 155	55 - 135	20	50 - 140
PFDoS	40 - 140	40	25 - 160	25 - 145	45	25 - 140
4:2FTS	70 - 135	27	60 - 150	65 - 140	30	55 - 150
6:2FTS	60 - 160	50	55 - 200	70 - 140	25	60 - 150
8:2FTS	70 - 140	27	70 - 150	70 - 150	25	60 - 170
PFOSA	70 - 140	19	70 - 140	70 - 140	20	60 - 150
NMeFOSA	65 - 145	26	70 - 155	70 - 140	30	60 - 160
NEtFOSA	70 - 135	19	70 - 140	70 - 140	40	60 - 150
NMeFOSAA	65 - 145	31	65 - 155	70 - 140	20	60 - 145
NEtFOSAA	60 - 150	31	65 - 165	70 - 140	25	60 - 145
NMeFOSE	70 - 140	19	70 - 140	60 - 150	20	40 - 180
NEtFOSE	70 - 135	17	70 - 135	70 - 145	40	60 - 205
HFPO-DA	70 - 140	25	70 - 145	70 - 140	25	60 - 145
ADONA	70 - 155	26	70 - 160	70 - 145	20	55 - 165
PFMPA	70 - 140	25	30 - 140	70 - 145	40	25 - 145
PFMBA	55 - 145	33	60 - 150	70 - 140	20	60 - 150
NFDHA	45 - 145	27	60 - 155	70 - 155	30	60 - 180
9Cl-PF3ONS	65 - 135	23	70 - 150	70 - 140	20	60 - 170
11Cl-PF3OUdS	50 - 135	31	45 - 160	65 - 140	20	50 - 170
PFEESA	70 - 140	20	70 - 140	70 - 145	25	50 - 150
3:3FTCA	45 - 155	32	45 - 130	55 - 130	25	30 - 140
5:3FTCA	70 - 135	28	60 - 130	70 - 145	20	60 - 160
7:3FTCA	70 - 145	39	60 - 150	70 - 155	20	60 - 200

[1] The recovery limits apply to the target analyte results for IPR, OPR, and LLOPR samples for solid, biosolids, and tissue matrices. Data were derived from the multi-laboratory validation study and are therefore the limits required for this method.

Table 8. Acceptance Limits for EIS and NIS Compounds in Soil-Sediment, Tissue, and Biosolid Matrices and Associated QC Samples

EIS Compound[1]	Soil/Sediment Samples[2] Recovery (%)	Tissue Samples[2] Recovery (%)	Biosolid Samples[2] Recovery (%)
$^{13}C_4$-PFBA	8[3] - 130	5[3] - 130	5[3] - 130
$^{13}C_5$-PFPeA	35 - 130	10 - 185	35 - 130
$^{13}C_5$-PFHxA	40 - 130	25 - 170	40 – 130
$^{13}C_4$-PFHpA	40 - 130	25 - 150	40 – 130
$^{13}C_8$-PFOA	40 - 130	25 - 150	40 – 130
$^{13}C_9$-PFNA	40 - 130	35 - 185	40 – 145
$^{13}C_6$-PFDA	40 - 130	30 - 150	40 – 130
$^{13}C_7$-PFUnA	40 - 130	30 - 180	40 – 130
$^{13}C_2$-PFDoA	40 - 130	35 - 180	40 – 130
$^{13}C_2$-PFTeDA	20 - 130	20 - 160	10 - 160
$^{13}C_3$-PFBS	40 - 135	25 - 190	40 - 150
$^{13}C_3$-PFHxS	40 - 130	35 - 175	40 - 140
$^{13}C_8$-PFOS	40 - 130	40 - 160	40 - 130
$^{13}C_2$-4:2FTS	40 - 165	30 - 300	40 - 300
$^{13}C_2$-6:2FTS	40 - 215	35 - 300	40 - 300
$^{13}C_2$-8:2FTS	40 - 275	40 - 365	40 - 300
$^{13}C_8$-PFOSA	40 - 130	25 - 180	20 - 140
D_3-NMeFOSA	10 - 130	5[4] - 130	20 - 130
D_5-NEtFOSA	10 - 130	5[4]- 130	20 - 130
D_3-NMeFOSAA	40 - 135	30 - 250	30 – 150
D_5-NEtFOSAA	40 - 150	30 - 235	20 - 140
D_7-NMeFOSE	20 - 130	5[4] - 160	25 - 130
D_9-NEtFOSE	15 - 130	5[4] - 130	20 - 130
$^{13}C_3$-HFPO-DA	40 - 130	20 - 185	40 - 130
$^{13}C_3$-PFBA	50 - 200	50 - 200	50 - 200
$^{13}C_2$-PFHxA			
$^{13}C_4$-PFOA			
$^{13}C_5$-PFNA			
$^{13}C_2$-PFDA			
$^{18}O_2$-PFHxS			
$^{13}C_4$-PFOS			

[1] Limits apply to the EIS and NIS recoveries from samples of all solid, biosolid, and tissue matrices.

[2] The recovery limits for the EIS compounds were derived by EPA from the solid, tissue, and biosolids sample data from multi-laboratory validation study. To simplify laboratory operations, EPA has applied the same EIS recovery limits used for field sample analyses to the EIS recoveries in the method blank, IPR, OPR, and LLOPR samples. There are no IPR mean or RSD criteria for the EIS compounds.

[3] Recovery of $^{13}C_4$-PFBA, can be problematic in some soil, tissue, and biosolids samples. Although the lower limits for recovery for these EISs are set below 10%, laboratories should routinely track recoveries of these EISs and take reasonable steps to ensure that recoveries are at least 10% in the majority of samples.

[4] Recoveries of D_3-NMeFOSA, D_5-NEtFOSA, D_7-NMeFOSE, and D_9-NEtFOSE can be problematic in tissue samples. The 5% the lower limit for recovery for these EISs may not be achievable for all laboratories in tissue samples. Any result associated with an EIS recovery below 5% should be considered estimated.

Title: Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) by SW846 Method 8260D

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Approvals (Signature/Date):

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1.0 Scope and Application

1.1 Analytes, Matrix(s), and Reporting Limits

1.1.1 USEPA SW846 Method 8260D is used for the determination of volatile organic compounds in a variety of aqueous and solid matrices by purge and trap gas chromatography (GC)/mass spectrometery (MS). The methods are applicable to the compounds listed in Table 1 (below). Actual target compound lists are determined through regulatory or project specifications. Method performance criteria for each target analyte will be determined prior to sample analysis.

1.1.2 This SOP also describes the optional procedure for analyses of compounds using 8260D Selected Ion Monitoring (SIM). SIM analyses is specific to target compounds: 1,2-dibromoethane, 1,2-dibromo-3-chloropropane, 1,2,3-Trichloropropane and 1,4-Dioxane. Benzene and Chloroform if needed.

Table 1: Method Analytes

Compound	CAS #	Compound	CAS #
1,1,1,2-Tetrachloroethane	630-20-6	cis-1,2-Dichloroethene	156-59-2
1,1,1-Trichloroethane	71-55-6	cis-1,3-Dichloropropene	10061-01-5
1,1,1-Trifluoro-2,2-dichloroethane	306-83-2	Cyclohexane	110-82-7
1,1,2,2-Tetrachloroethane	79-34-5	Cyclopentene	142-29-0
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	Dibromomethane	74-95-3
1,1,2-Trichloroethane	79-00-5	Dichlorobromomethane	75-27-4
1,1-Dichloroethane	75-34-3	Dichlorodifluoromethane	75-71-8
1,1-Dichloroethene	75-35-4	Dichlorofluoromethane	75-43-4
1,1-Dichloropropene	563-58-6	Dimethylnaphthalene (total)	28804-88-8
1,1-Difluoroethane	75-37-6	Epichlorohydrin	106-89-8
1,2,3-Trichlorobenzene	87-61-6	Ethanol	64-17-5
1,2,3-Trichloropropane **(1)**	96-18-4	Ethyl acetate	141-78-6
1,2,3-Trimethylbenzene	526-73-8	Ethyl acrylate	140-88-5
1,2,4,5-Tetramethylbenzene	95-93-2	Ethyl ether	60-29-7
1,2,4-Trichlorobenzene	120-82-1	Ethyl methacrylate	97-63-2
1,2,4-Trimethylbenzene	95-63-6	Ethylbenzene	100-41-4
1,2-Dibromo-3-Chloropropane **(1)**	96-12-8	Ethylene Dibromide **(1)**	106-93-4
1,2-Dichloro-1,1,2,2-tetrafluoroethane	76-14-2	Hexachlorobutadiene	87-68-3
1,2-Dichloro-1,1,2-trifluoroethane	354-23-4	Hexane	110-54-3
1,2-Dichlorobenzene	95-50-1	Indan	496-11-7
1,2-Dichloroethane	107-06-2	Iodomethane	74-88-4
1,2-Dichloroethene, Total	540-59-0	Isobutyl alcohol	78-83-1
1,2-Dichloropropane	78-87-5	Isopropyl acetate	108-21-4
1,3,5-Trichlorobenzene	108-70-3	Isopropyl alcohol	67-63-0
1,3,5-Trimethylbenzene	108-67-8	Isopropyl ether	108-20-3
1,3-Dichlorobenzene	541-73-1	Isopropylbenzene	98-82-8
1,3-Dichloropropane	142-28-9	Methacrylonitrile	126-98-7
1,3-Dichloropropene, Total	542-75-6	Methyl acetate	79-20-9

Compound	CAS #	Compound	CAS #
1,4-Dichlorobenzene	106-46-7	Methyl acrylate	96-33-3
1,4-Dioxane **(1)**	123-91-1	Methyl methacrylate	80-62-6
1-Chloropropane	540-54-5	Methyl tert-butyl ether	1634-04-4
2,2,4-Trimethylpentane	540-84-1	Methylcyclohexane	108-87-2
2,2-Dichloropropane	594-20-7	Methylene Chloride	75-09-2
2,4,4-Trimethyl-1-pentene	107-39-1	Methylnaphthalene (total)	1321-94-4
2-Butanone (MEK)	78-93-3	Monochloropentafluoroethane	76-15-3
2-Chloro-1,3-butadiene	126-99-8	m-Xylene & p-Xylene	179601-23-1
2-Chloroethyl vinyl ether	110-75-8	Naphthalene	91-20-3
2-Chloropropane	75-29-6	n-Butanol	71-36-3
2-Chlorotoluene	95-49-8	n-Butyl acetate	123-86-4
2-Hexanone	591-78-6	n-Butyl acrylate	141-32-2
2-Methyl-1,3-butadiene	78-79-5	n-Butylbenzene	104-51-8
2-Methyl-2-propanol	75-65-0	n-Heptane	142-82-5
2-Nitropropane	79-46-9	n-Propyl acetate	109-60-4
2-Octanol	123-96-6	N-Propylbenzene	103-65-1
2-Octanone	111-13-7	o-Xylene	95-47-6
4-Chlorotoluene	106-43-4	p-Diethylbenzene	105-05-5
4-Ethyltoluene	622-96-8	Pentane	109-66-0
4-Isopropyltoluene	99-87-6	Propene	115-07-1
4-Methyl-2-pentanone (MIBK)	108-10-1	Propionitrile	107-12-0
Acetaldehyde	75-07-0	sec-Butylbenzene	135-98-8
Acetone	67-64-1	Styrene	100-42-5
Acetonitrile	75-05-8	Tert-amyl methyl ether	994-05-8
Acrolein	107-02-8	Tert-butyl ethyl ether	637-92-3
Acrylonitrile	107-13-1	tert-Butylbenzene	98-06-6
Allyl chloride	107-05-1	Tetrachloroethene	127-18-4
Amyl acetate (mixed isomers)	628-63-7	Tetrahydrofuran	109-99-9
Benzene **(1)**	71-43-2	Toluene	108-88-3
Benzyl chloride	100-44-7	Total BTEX	STL00431
Bromobenzene	108-86-1	trans-1,2-Dichloroethene	156-60-5
Bromoform	75-25-2	trans-1,3-Dichloropropene	10061-02-6
Bromomethane	74-83-9	trans-1,4-Dichloro-2-butene	110-57-6
Butadiene	106-99-0	Trichloroethene	79-01-6
Butyl Methacrylate	97-88-1	Trichlorofluoromethane	75-69-4
Camphene	79-92-5	Vinyl acetate	108-05-4
Camphor	76-22-2	Vinyl chloride	75-01-4
Carbon disulfide	75-15-0	Xylenes, Total	1330-20-7
Carbon tetrachloride	56-23-5	1,4-Dichlorobenzene-d4 **(ISTD)**	3855-82-1
Chlorobenzene	108-90-7	1,4-Dioxane-d8 **(ISTD)**	17647-74-4
Chlorobromomethane	74-97-5	2-Butanone-d5 **(ISTD)**	24313-50-6
Chlorodibromomethane	124-48-1	Chlorobenzene-d5 **(ISTD)**	3114-55-4
Chlorodifluoromethane	75-45-6	Fluorobenzene **(ISTD)**	462-06-6
Chloroethane	75-00-3	TBA-d9 **(ISTD)**	25725-11-5
Chloroform **(1)**	67-66-3	1,2-Dichloroethane-d4 **(Surrogate)**	17060-07-0
Chloromethane	74-87-3	4-Bromofluorobenzene **(Surrogate)**	460-00-4

Compound	CAS #	Compound	CAS #
Chlorotrifluoroethene	79-38-9	Dibromofluoromethane **(Surrogate)**	1868-53-7
Chlorotrifluoromethane	75-72-9	Toluene-d8 **(Surrogate)**	2037-26-5
2-ethylhexyl acrylate	103-11-7		

(1) Compound can be analyzed by full scan or Selected Ion Monitoring (SIM).

1.1.3 Method 8260D can be used to quantitate most volatile organic compounds that have boiling points below 200°C, and that are insoluble or slightly soluble in water. Water-soluble compounds can be included in this method, but quantitation limits will be higher due to poor purging efficiency.

1.1.4 The standard reporting limit (RL) is established at or above the low-level standard in the calibration curve (1 ug/l for most compounds). For a complete list of method detection limits (MDLs) and RLs, please see reference the current TALS (LIMS) active Method Limit Group database.

1.1.5 On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in Sections 7 (*Review of Work Request*) and 20 (*Test Methods and Method Validation*) of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

1.1.6 Any variation in procedure shall be completely documented using an NCM. The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The QA department also receives NCMs by e-mail for tracking and trending purposes. The NCM process is described in more detail in Eurofins Edison SOP No. ED-GEN-003, *Standard Operating Procedure for Control of Non-Conformances and Corrective Action,* current revision NCM shall be filed in the project file and addressed in the case narrative. Any unauthorized deviations from this procedure must also be documented as a nonconformance, with a cause and corrective action described.

2.0 Summary of Method

2.1 Method 8260D is used to determine volatile organic compounds in aqueous, non-aqueous and solid matrices. Sample preparation techniques vary, depending on the matrix and the level of contamination expected. Purge and trap techniques are used to introduce the sample to the GC/MS system. Refer to Eurofins Edison SOP Nos. ED-MSV-001*, Purge and Trap for Aqueous Samples, SW846 Method 5030*, current revision and ED-MSV-002, *Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples, SW846 Method 5035A,* current revision.

2.2 All soil samples are screened by GC/FID static headspace or MS analysis to provide the analyst with appropriate initial dilution factors. Aqueous samples without historical results are also screened. For additional details see Eurofins Edison SOP No. ED-GCV-001, *Screening for Volatile Organics, Static Headspace with GC FID, SW846 Method 5021*, current revision.

2.3 An aliquot of sample containing internal standard and surrogate spiking solution is purged with nitrogen in a closed sparging vessel. The volatile compounds are transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbent column where the volatiles are trapped. After purging is complete, the sorbent column is heated and backflushed with helium to desorb the volatiles onto a gas chromatograph column.

2.4 Analytes eluted from the capillary chromatograhy column are introduced into the mass spectrometer via a direct connection. Identification of target analytes is accomplished by comparing their mass spectra with the electron impact spectra of authentic standards. Quantitation is accomplished by comparing the response of a major (quantitation) ion relative to an internal standard using a minimum of a five-point calibration curve.

2.5 For aqueous VOA samples submitted for New Jersey Groundwater Quality Standard (NJ GWQS) evaluation, a full scan analysis is initially performed using the 8260 methodology No further analysis by SIM is required if all of the following compounds are present above the full scan RL: 1,2-dibromoethane, 1,2-dibromo-3-chloropropane, 1,2,3-Trichloropropane and 1,4-dioxane, chloroform, vinyl chloride and benzene. If any of these compounds are undetected in the undiluted, full scan analysis, the sample must be analyzed via 8260D SIM for those compounds.

2.6 In order to meet lower reporting limits of 0.5ug/L for most analytes, 2.5 ug/L for ketones and generally lower limits for other non-routine analytical compounds, samples must be analyzed against an initial calibration with a low point at those levels. The corresponding TALS login method for low level aqueous analysis is 8260_LL. See Table 3b for initial calibration levels and spike amounts.

3.0 Definitions

3.1 For a complete list of definitions refer to Appendix 2 in the most current revision of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

4.0 Interferences

4.1 This method is susceptible to contamination from a number of sources, including organic solvents used in other laboratory procedures, impurities in the purge gas, improper cleaning of syringes or purge vessels, and carryover from high level samples. Samples can be contaminated by the diffusion of volatile organics through the septum during shipment or storage. Steps have been taken to ensure that these potential problems are eliminated from the laboratory.

4.2 The volatiles analytical laboratory is housed in a separate building, away from the organic extraction lab area where large quantities of organic solvents are used. No organic solvents are used or stored in the volatiles laboratory.

4.3 The nitrogen used as purge gas passes through a solvent trap prior to its inlet into the purge and trap units.

4.4 Trip Blanks are shipped to clients with aqueous bottle ware as requested. The purpose of the trip blank is to detect and identify any VOC contamination of the samples while in transit to and from the lab. The blank is created at the laboratory by completely filling the volatile vial container with lab grade organic free deionized water and sealing the container Trip Blanks accompany bottle ware and samples through the sampling, storage and analysis stages as a check on contamination that may occur at these points.

4.5 Individual samples are each handled with a unique syringe that has been baked in a drying oven at 105°C to ensure the absence of volatile compounds.

4.6 Carryover can occur anytime a high level sample is analyzed. Screening procedures are employed to ensure that a sample is analyzed at an appropriate dilution to minimize potential carryover. When a high level sample is analyzed, it is followed by the analysis of a reagent water blank. If another sample was analyzed after the high level sample, this sample is inspected carefully for signs of carryover. If this sample does not contain any of the compounds found in the high level sample, the system can be considered contamination free.

4.7 The analytical system is checked daily with the analysis of a method blank. This blank must meet all quality control criteria for the method before sample analysis may take place.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001) and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

Any questions pertaining to safety issues or procedures should be brought to the department manager or Edison Safety Officer.

5.1 Specific Safety Concerns or Requirements

5.1.1 Latex, nitrile and vinyl gloves all provide adequate protection against the methanol used in this method.

5.1.2 Purge vessels on purge-and-trap instruments can be pressurized by the time analysis is completed. Vent the pressure prior to removal of these vessels to prevent the contents from spraying out.

5.1.3 The gas chromatograph and mass spectrometer contain zones that have elevated temperatures. The analyst needs to be aware of the locations of those zones, and must cool them to room temperature prior to working on them.

5.1.4 The mass spectrometer is under deep vacuum. The mass spectrometer must be brought to atmospheric pressure prior to working on the source.

5.1.5 There are areas of high voltage in both the gas chromatograph and the mass spectrometer. Depending on the type of work involved, either turn the power to the instrument off, or disconnect it from its source of power.

5.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Methanol (MeOH)	Flammable Poison Irritant	200 ppm-TWA	A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Symptoms of overexposure may include headache, drowsiness and dizziness. Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure. Irritant to the eyes.
1 – Always add acid to water to prevent violent reactions.			
2 – Exposure limit refers to the OSHA regulatory exposure limit.			

6.0 Equipment and Supplies

6.1 Instrumentation

6.1.1 Purge and trap units from several different manufacturers are used, depending upon the sample matrix and preparatory technique required. A purge and trap unit consists of three parts: the sample purge unit, the trap, and the concentrator. Unit configurations currently in use are:

- OI Analytical 4551, 4100 Automatic Sampler/4660,4760 concentrator;
- Archon 5100A Automatic sampler/ OI Analytical 4660,4760 concentrator;
- EST Centurion Autosampler/ EST Encon concentrator;
- Archon Autosampler/EST Encon concentrator.
- Archon/EST Evolution

6.1.2 A VOCARB 3000 trap from Supelco is used in the Encon concentrator. The trap is 25cm long with an inside diameter of 0.105 inches. The trap is packed with 10.0cm Carbopack B, 6.0 cm Carboxin 1000, and 1cm Carboxin 1001.

6.1.3 An OI analytical purge trap #10 is used for the OI 4560,4660 and 4760 concentrator. The trap is 25cm long with an inside diameter of 0.105 inches. The trap is packed to contain the following absorbents: Tenax/silica gel/carbon molecular sieve.

6.1.4 Alternate traps may be used provided the adsorption and desorption characteristics are equivalent to those of the trap recommended by the method.

6.1.5 Both the Encon and OI concentrators are capable of rapidly heating the trap to 260°C and holding at that temperature for the duration of the desorb time.

6.1.6 Gas chromatograph: HP Agilent 6890/7890 equipped with temperature programming capability.

6.1.7 GC column: 30M long x 0.25mm ID, 1.4um film thickness, 20M x 0.18mm x 1um DB-624 and 20M long x 0.18 mm ID Restek Rtx-VMS capillary column with 1um film thickness or similar phase.

6.1.8 Mass Spectrometer (Agilent 5973/5975/5977): scanning from 35-260 amu every 0.9 seconds, utilizing 70 volts (nominal) electron energy in the electron ionization mode and producing a mass spectrum which meets all EPA performance criteria when 50 ng of 4-Bromofluorobenzene (BFB) is injected through the gas chromatograph inlet.

6.1.9 GC/MS Interface: transfer lines heated to 180°C .

6.1.10 Data system: HP Chemstation II for data acquisition and Eurofins Chrom for data processing.

6.2 Supplies

- Microsyringes: 10 ul to 1000 ul.
- Syringes: 5 ml to 25 ml gas-tight.

- Injection port liners: HP 18740-80200 or equivalent
- Volumetric flasks: Class "A" glassware, 5 ml to 500 ml.
- VOA vials: 20-ml and 40-ml glass with PTFE – faced septum.
- Vials: 2-ml amber glass with screw cap with Teflon-faced septa.
- Top loading analytical balance.
- Spatula: Narrow, stainless steel.
- Stir bars: PTFE coated, small enough to spin freely inside a VOA vial.

7.0 Reagents and Standards

7.1 Reagents

7.1.1 Organic free reagent water: High purity water that meets the requirements for a method blank when analyzed. (See section 9.1.1) Reagent water is obtained from Millipore system. Other methods of preparing reagent water are acceptable, provided that the water produced meets method blank criteria.

7.1.2 Methanol: Ultra Resi-Analyzed, purge and trap grade, purchased from JT Baker or equivalent. (Cat # 9077-02)

7.1.2.1 Each lot of methanol is screened for contaminants before being used for analysis as detailed in Eurofins Corporate Quality SOP No. CA-Q-S-001 (*Solvent & Acid Lot Testing & Approval*) and Eurofins Edison SOP No. ED-GEN-023 (*Bulk Solvent Testing and Approval*).

7.2 Standards

7.2.1 **Calibration Standards** Stock target compound analytical standard solutions are purchased mainly from Restek, Supelco, Inc, Absolute Standards and Spex although standards of similar quality from other suppliers may be substituted as required. Standards noted with an asterisk (*) are custom mixes made especially for Eurofins Edison.

Target Analyte Standard Name	Concentration	Vendor	Catalog #
8260 List 1 / Std #3 Gases*	2500 ppm	Restek	569722
8260 List 1 / Std #3 Gases – (SS)*	2500 ppm	Restek	569722 sec
8260 List 1 / Std #1 MegaMix*	1250-62500 ppm	Restek	569720
8260 List 1 / Std #1 MegaMix (SS)*	1250-62500 ppm	Restek	569720 sec
8260 List 1 / Std #2 Ketones *	12500 ppm	Restek	569721
8260 List 1 / Std #2 Ketones * (SS)	12500 ppm	Restek	569721 sec
8260 List 1 / Std #5 Acrolein *	20,000 ppm	Restek	568720
8260 List 1 / Std #5 Acrolein (SS)	20,000 ppm	Restek	568720 sec
8260 List 1 /Std #4 2 CEVE *	2500 ppm	Restek	569723

Target Analyte Standard Name	Concentration	Vendor	Catalog #
8260 List 1 /Std #4 2 CEVE (SS) *	2500 ppm	Restek	569723 sec
8260 List 1 /Std #6 Vinyl Acetate *	5000 ppm	Restek	569724
8260 List 1 /Std #6 Vinyl Acetate (SS) *	5000 ppm	Restek	569724 sec
8260 List 2 / Std #1 Additions *	2500-62500ppm	Restek	568725
8260 List 2 / Std #1 Additions (SS) *	2500-62500 ppm	Restek	568725 sec
8260 List 3 / Std #1 Polar Additions *	2500-100000ppm	Restek	568728
8260 List 3 / Std #1 Polar Additions (SS) *	2500-100000 ppm	Restek	568728 sec
VOC Extra Standard 2015 *	2500-5000 ppm	Absolute	98593
VOC Extra Standard 2015 * (SS)	2500-5000 ppm	Absolute	98593
Epichlorohydrin	1000 ppm	Absolute	70377
Acrolein	5000 ppm	Restek	91980
Acrolein *	Neat	Sigma	110221
2-Freon Mix quote # 12258 *	2500ppm	Absolute	12258
2-Freon Mix quote # 12258 * (SS)	2500ppm	Absolute	12258
1,4-Dioxane	Neat	Sigma	360481
Epichlorohydrin	Neat	Sigma	45340
2-Chloroethylvinyl ether	Neat	Sigma	109983
1,4-Dioxane	1000 ppm	Absolute	70373
1,4-Dioxane	10000 ppm	Absolute	92785
Benzene	1000 ppm	Absolute	70025
Chloroform	1000 ppm	Absolute	70076

(1): The separate source for this material is not available as a distinct catalog number. Analyst must ensure that a separate lot of the material is selected and used as required.

An asterisk (*) indicates a custom standard mix.

7.2.1.1. Prepare stock solutions at volumes and concentrations indicated in Table 2 (Working Standards Preparation) by combining the indicated volumes of each stock solution into a volumetric flask corresponding to the total final volume. Dilute to the volume marker with methanol.

7.2.1.2. Prepare individual calibration standards as applicable per Section 9.2.2.1, Table 3, Initial Calibration Standards Preparation, Low Level Soil, Table 3a, Initial Calibration Standards Preparation (Low Level), Aqueous or Table 3B Initial Calibration Standards Preparation, Aqueous.

7.2.1.3. The 'Second Source' standards listed are used in the preparation of the Initial Calibration Verification (ICV) standard (see Tables 4 and 4a for ICV preparation instructions) and the Laboratory Control Standard (LCS) (see Section 9.1.3 and Tables 4 and 4a).

7.2.2 **Surrogate Standards:** Surrogate standard solutions are prepared from the stock solution (2500ppm)

Surrogate Standard Name	Concentration	Vendor	Catalog #
4-Bromofluorobenzene	2500ppm	Restek	567650
Toluene-d8			
1,2-Dichloroethane-d4			
Dibromofluoromethane			

7.2.2.1 A primary surrogate stock solution (2500 ppm each) is prepared from the neat standards as follows:

7.2.2.2 Secondary surrogate standard solutions are prepared at two (2) levels using the 2500 ppm primary stock solution as detailed in the table below:

Standard Name	Vendor	Catalog #	Volume added	Concentration of Stock Std.	Concentration of Standard	Total Volume Volume in MeOH/Total volume of MeOH
8260 Surrogate Mix: 4-Bromofluorobenzene Toluene-d8 1,2-Dichloroethane-d4 Dibromofluoromethane	Restek	567650	1ml	2500ppm	250ppm	10mL 9.0mL TV/M
8260 Surrogate Mix: 4-Bromofluorobenzene Toluene-d8 1,2-Dichloroethane-d4 Dibromofluoromethane	Restek	567650	1ml	2500ppm	50ppm	50mL 9.0mL TV/M

7.2.2.3 Methanol/Surrogate solution (2.5ug/mL): For methanol sampling field kits. Prepared by adding 1mL of 2500 ug/ml primary surrogate stock solution (see Section 7.2.2.1) to 1 L purge and trap grade methanol.

7.2.3 **Internal Standards:** Internal Standards Solutions are purchased from Restek:

Standard Name	Concentration	Vendor	Catalog #
8260 Internal Standard Mix: *Chlorobenzene-d5 *1,4-Dichlorobenzene-d4 *Fluorobenzene *1,4-Dioxane-d8 *TBA-d9	250-5000ppm	Restek	567649

7.2.4 **Internal Standard/Surrogate Mix (125 ppm each):** A solution containing both Internal Standards and Surrogates at 125 ppm is prepared in a 10ml volumetric flask as detailed below using the 2500

ppm surrogate stock solution prepared in Section 7.2.2.1 and the 2500 ppm internal standard mix detailed in Section 7.2.3:

Standard Name	Concentration of Stock Std.	Volume added to final volume of 20ml MeOH	Final Concentration of Standard
8260 Internal Standard/Surrogate Mix (125 ppm) For Aquatek Autosampler	2500 ppm Surrogate Mix	1.0ml	125 ppm each component
	250 Internal Std Mix	10 ml	

7.2.5 **Internal Standard/Surrogate Mix (SIM) (2.5/50 ppm each):** A solution containing both Internal Standards and Surrogates at 25 ppm is prepared in a 10ml volumetric flask as detailed below using the 2500 ppm surrogate stock solution prepared in Section 7.2.2.1 and the 250 ppm internal standard mix detailed in Section 7.2.3:

Standard Name	Concentration of Stock Std.	Volume added to final volume of 10ml MeOH	Final Concentration of Standard
8260 Internal Standard/Surrogate Mix (25 ppm) (SIM)	2500 ppm Surrogate Mix	10ul	2.5/50 ppm each component
	250 Internal Std Mix (Restek)	10ul	
1,4-Dioxane-d8	10000 ppm	50ul	

7.2.6 **GC/MS Instrument Performance Check (BFB):** The instrument performance check solution consists of 4-Bromofluorobenzene in addition to the other three surrogates in methanol. Prepare the solution at **50ppm as specified in section 7.2.2.2**. Assign an expiration date of 6 months.

7.2.7 All standards preparation information must be logged into the TALS Reagent Module. All pertinent information must be entered: Date prepared, Lot #'s, Expiration dates, Solvents used, Lab Lot # (expiration date), Manufacturer and Verification signature. Additionally, all prepped standards are typically given a unique Lot# and all information pertaining to standard preparation is entered into the GC/MS VOA Standard Preparation Log Book. Information such as standard supplier, lot number, original concentration, a description of how the standard was made, are required along with the laboratory lot number, analyst's initials, date prepared, expiration date and verification signature. Class "A" volumetric must be used at all times and syringes, preferably gas-tight syringes when available, should be checked for accuracy using an analytical balance. Class "A" pipettes should also be used if volumes permit.

7.2.8 Please refer to Eurofins Edison SOP No. ED-GEN-008, *Standard Operating Procedure for Preparation, Purity and Storage of Reagents and Standards*, current revision. For Method 8260D:

- Shelf Life of Standard:
  - Stock standards (Non-gases) - 6 months after opening vendor stock of up to 2000ppm, 3 years for 10,000ppm, 5 years for over 50,000ppm, or manufacturer's expiration date whichever comes first.
  - Stock Standards (Gases) - 2 months after opening vendor stock, or manufacturer's expiration date whichever comes first.
  - Working/Secondary dilution Standards (Non-gases) – 6 months after preparation, or manufacturer's expiration date whichever comes first.
  - Working/Secondary dilution Standards (Gases) – 1 week from the date of preparation for 50ppm and 2 weeks for 500ppm, or manufacturer's expiration date whichever comes first.
  - Daily Calibration Standards – 24 hours after preparation.

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- Storage Requirements:
  Aqueous standards are stored at 4°C and Methanol standards are stored at -10°C to -20°C.

8.0 Sample Collection, Preservation, Shipment and Storage

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client requests. Listed below are the holding times and the references that include preservation requirements.

Matrix	Sample Container	Min. Sample Size	Preservation	Holding Time	Reference
Waters	Glass 40 ml vials	40 mLs	HCl, pH < 2; Cool 4 °C ± 2°C	14 Days / preserved 7 Days / unpreserved	SW846 Method 5030
Waters	Glass 40 ml vials	40mLs	TSP,pH>11 Cool 4 °C ± 2°C	14 Days / preserved	SW846 Method 5030
Soils (Low)	Encore or Terracore (40 ml vials)	5 grams in 5 mls DI H_2O	Frozen Stored -7°C to -20°C	14 Days	SW846 Method 5035A

Matrix	Sample Container	Min. Sample Size	Preservation	Holding Time	Reference
Soils (Med)	Encore or Terracore (40 ml vials)	5 grams in 10 mls MeOH	Cool 4 °C ± 2°C	14 Days	SW846 Method 5030
Soils (High)	Glass (Lab Prepared Kits)	10 grams in 25 mls MeOH	Cool 4 °C ± 2°C	14 Days	SW846 Method 5030

8.1.1 There are several methods of sampling soil. The recommended method is to take samples using an EnCore™ sampler or using a Terra Core™ sampling kit. At specific client request, unpreserved soil samples in 4oz jars may be accepted. For EnCore and Terra Core sampling, a separate jar is required for percent solids/moisture determination, unless one is supplied for another analysis.

8.1.2 For EnCore™ samplers, the 5g sample is extruded into a pre-weighed 40mL vial containing 5mL of methanol (medium level analysis) or reagent water (for low level, <50 µg/kg, analysis). The exact samples weight is determined as the difference between the vial + preservative weight and weight after the sample is added.

- Samples must be transferred (extruded from the sampler) and preserved within 48 hours of sampling.
- Water preserved samples are then frozen at <10°C. Methanol preserved samples may be stored at > 0.0 °C but < 6° °C or frozen.
- Methanol preserved samples are shaken for at least 2 minutes, and a portion of the methanol extract after settling may be transferred to a smaller Teflon-lined capped vial for storage below 6 °C
- Normally one (1) medium level and two (2) low-level samples are taken and preserved.
- One vial with a clean matrix of each preservation type is prepared at the same time as samples, to be used for LCS analysis. Spikes are not added until the time of analysis.
- Samples are spiked with internal standards and surrogates at the time of analysis.

8.1.3 Terra Core™ sampling kits are pre-preserved for use and immediate samples preservation in the field. Kits are shipped that include one (1) methanol preserved and two (2) reagent water preserved vials, along with a 4oz jar for solids/moisture analysis volume.

- Terra Core™ vials are immediately placed in the freezer (<-10°C) upon receipt at the lab. Methanol preserved vials are shaken for at least two (2) minutes to break up the solid and create the methanol extract.
- Terra Core™ vials are labeled with the weight of the vial and preservative. The vials are re-weighed prior to analysis to determine the weight of the solid sample added. It is important that labels NOT

be added to these vials prior to weighing, because the weight of the label will add to the sample weight. Vials may be marked with indelible marker, or placed in a labeled, sectioned box until ID labels can be added after weighing.

8.2 Unpreserved soils - At client request, unpreserved soils packed into glass jars or brass tubes may be accepted and subsampled in the lab. A 5g portion of the sample is transferred to a 40mL vial and mixed with reagent water and/or methanol for analysis. Since this procedure is not compliant with SW5035A an NCM and case narrative statement describing the non-conformance must be included with any resulting data reported to the client.

8.3 Aqueous samples are stored in 40mL glass vials with Teflon lined septa at >0 and ≤ 6.0°C. Vials are required to have no headspace larger than a small pea.

8.3.1 Samples from chlorinated water sources must be treated with sodium thiosulfate (0.008% solution) at the time of collection to remove chlorine. NOTE: containers pre-preserved with sodium thiosulfate must be requested in bottle orders for samples from chlorinated water sources

8.3.2 Regulatory requirements for 2-Chloroethyl vinyl ether:

- 2-Chloroethyl vinyl ether: The stability of this compound is reduced when subjected to low pH, therefore samples for analysis to include 2-CEVE must be taken without acid preservation. Unpreserved samples must be analyzed within 7 days.

- SW846 Update V removed special preservation requirements for Acolein and Acylonitrile. These compounds may be analyzed for using a preserved sample vial.

8.4 Soil samples and water samples preserved to pH <2 with HCl have a maximum holding time is 14 days from sampling until the sample is analyzed. If water samples are known to be unpreserved, the holding time is 7 days from sampling to analysis.

8.4.1 Preserved water samples are checked to confirm the preservation pH AFTER analysis because the vials must not be opened prior to analysis. If the pH is found to be >2, this must be addressed in the case narrative.

8.5 Medium level solid methanol extracts, if taken at the time of preservation, are aliquoted into 4 mL glass vials with Teflon lined caps and stored at > 0.0 °C but ≤6.0°C or frozen. The extracts are stored with minimum headspace.

8.6 Storage blanks are prepared by filling 40 mL VOA vials with reagent water and placing one in each refrigerator. After 1-2 weeks, the storage blanks are removed and analyzed. Additional details can be found in Eurofins Edison SOP No. ED-SPM-004, *Sample Storage & Handling Procedures for Mitigation of Sample and Laboratory Contamination,* current revision.

9.0 Quality Control

9.1 **Sample QC** - The following quality control samples are prepared with each batch of samples:

Quality Controls	Frequency	Control Limit
Method Blank (MB)	1 in 20 or fewer samples	< Rpt. Limit
Laboratory Control Sample (LCS)[1]	1 in 20 or fewer samples	Statistical Limits [4]
Matrix Spike (MS)[2]	1 in 20 or fewer samples	Statistical Limits [4]
MS Duplicate (MSD)[2]	1 in 20 or fewer samples	Statistical Limits [4]
Surrogates	every sample[3]	Statistical Limits [4]
Internal Standards	Every samples	Response within -50% to +100% of CCV

[1] LCS Duplicate (LCD) is performed only when insufficient sample is available for the MS/MSD or when requested by the client/project/contract.
[2] The sample selection for MS/MSD are randomly selected, unless specifically requested by a client….predetermined by the extraction lab.
[3] Analytical and QC samples (MB, LCS, MS/MSD)
[4] Statistical control limits are updated annually and are updated into LIMS.

9.1.1. **Method blanks** are analyzed every 12 hours immediately after successful calibration verification (ICV and CCV) and before any samples are analyzed during the 12 hour clock. Analyze the blank in the same manner as the associated samples.

9.1.1.1. Prepare an aqueous blank by filling a 40 mL vial with reagent water and placing it in the autosampler. The autosampler will add the internal standard and/or surrogate standard.

9.1.1.2. Prepare a medium or high level blank in a 50 mL volumetric flask by adding 1.0 mL of purge and trap grade methanol to reagent water and bringing up to volume with the reagent water. The appropriate volume of this mix is added to the purge vessel. The autosampler will automatically internal standard and/or surrogate standard.

9.1.1.3. Prepare a low- level soil blank in a 40 ml VOA vial by adding a magnetic stir bar and 5 ml of reagent water and placing the vial in the autosampler tray. An additional 5mL of reagent water plus 1uL of 250ppm Internal Standard/Surrogate Mix (see Section 7.2.4) will be added by the Archon prior to purging.

9.1.1.4. To be considered acceptable, the method blank must not have any target analytes above the reporting limit. For method 8260D method blank is acceptable when target analyte concentrations are less than one-half of the reporting limit. Method blanks may contain analyte concentrations greater than acceptance limits if the associated samples in the batch are unaffected or sample

concentrations/responses are >10x the blank If method blanks are unacceptably contaminated with target compounds that are also present in field samples, all affected samples must be re-extracted and re-analyzed. Re-analysis is not necessary if the analyte concentration falls well below the action or regulatory limit or if the analyte is deemed not important for the project. Corrective action must be taken to identify and eliminate the contamination source. Demonstrate that acceptable blanks can be obtained before continuing with sample extraction and analysis. Method blanks must be analyzed on each instrument on which the associated samples are analyzed. Method blanks, trip blanks and other field blanks must be carried out through all stages of sample preparation and analysis.

9.1.1.5. Surrogate recoveries for the method blank must be within the laboratory generated limits. (Method 8260D requires the use of a minimum of three (3) surrogates. Since we are spiking with four (4) surrogates, either 1,2-Dichloroethane-d4 or dibromofluoromethane can be recovered outside of control limits without corrective action) .Internal standard area counts in the method blank must be within method specified limits. If any surrogate or internal standard is outside the limits, the method blank must re-analyzed.

9.1.2. Matrix Spike (MS)/Matrix Spike Duplicate (MSD): A matrix spike/matrix spike duplicate (MS/MSD) pair is extracted and analyzed with every 20 environmental samples of a specific matrix (defined as a sample batch which may contain up to 20 samples, and additional samples can be added to the batch for 14 days after the first sample was analyzed). Full compound list spiking is employed for MS/MSDs and LCSs. These spikes are prepared (as described in Section 9.1.2.1) concurrent with sample preparation. MS and MSD recoveries are calculated and compared to lab generated acceptance criteria which are updated annually. For acceptance limits, reference the current TALS (LIMS) active Method Limit Group database.

9.1.2.1. Prepare the MS/MSD as follows:

9.1.2.1.1 Low Level Soil: The low level soil MS/MSD is prepared as detailed in the following table. This is prepared in duplicate (one for the MS, the other for the MSD) in a 5 ml syringe filled with reagent water. Once prepped the solution is added to separate 40 ml vials each containing 5 gram aliquots of the sample to be spiked :

Standard Solution (Reference Table 2, Lab Names)	Concentration	Volume of Standard (ul) Added to 5.0 ml of Reagent Water	Final Concentration (ug/kg)
Gas Mix Li	50ppm	2	20

Standard Solution (Reference Table 2, Lab Names)	Concentration	Volume of Standard (ul) Added to 5.0 ml of Reagent Water	Final Concentration (ug/kg)
8260 combined	50ppm	2	20
Acrolein	500 ppm	3	300
Propenes	50ppm (varied)	2	20 (varied)
Freons	50 ppm	2	20

9.1.2.1.2 Aqueous Samples: The MS/MSD for aqueous samples is prepared as detailed in the following table. This is prepared in duplicate (one for MS, the other for MSD) in 50 ml volumetric flasks filled with an aliquot of sample to be spiked. Once prepped the solution is poured into a 40 ml VOA vial and loaded onto the purge and trap autosampler:

Standard Solution (Reference Table 2, Lab Names)	Concentration	Volume of Standard (ul) Added to 50 ml of Sample	Final Concentration(ug/L)
Gas Mix Li	50ppm	20	20
8260 combined	50ppm	20	20
Acrolein	500 ppm	4	40
Propenes	50ppm (varied)	20	20 (varied)
Freons	50	20	20

9.1.2.1.3 Medium & High Level Soils: The MS/MSD for medium/high level soils is prepared as detailed in the following table. This is prepared in duplicate (one for MS, the other for MSD) in 50 ml volumetric flasks filled with reagent water which has been previously spiked with the methanol sample extract. Once prepped the solution is poured into a 40 ml VOA vial, the and loaded onto the purge and trap autosampler:

Standard Solution (Reference Table 2, Lab Names)	Concentration	Volume of Standard (ul) Added to 50 ml of Reagent Water containing sample methanol extract	Final Concentration (ug/L)
Gas Mix Li	50ppm	20	20
8260 conbined	50ppm	20	20
Acrolein	500ppm	4	40
Propenes	50ppm (varied)	20	20 (varied)
Freons	50 ppm	20	20

9.1.2.1.4 SIM: The MS/MSD for SIM samples is prepared as detailed in the following table. This is prepared in duplicate (one for MS, the other for MSD) in 100 ml

volumetric flasks filled with an aliquot of sample to be spiked. Once prepped, two separate 10ml solution is poured into 40 ml VOA vials, 2ul of SIM IS/S is then added to each vial and loaded onto the purge and trap autosampler:

Standard Solution	Concentration	Volume of Standard Added to 100 ml of Sample (ul)	Final Concentration (ug/L)
8260SIM Mix1	10ppm	0.5	0.05
1,4-Dioxane	50ppm (varied)	10	5
Benzene/Chloroform	10ppm	0.5	0.05

9.1.2.2. An Laboratory Control Sample (LCS) /Laboratory Control Sample Duplicate (LCSD) may be substituted for the MS/MSD if insufficient sample volume is available (see Section 9.1.3).

9.1.3. Laboratory Control Sample (LCS)/Laboratory Control Sample Duplicate (LCSD): A Laboratory Control Sample (LCS) (aka blank spike) must be prepared analyzed with each batch of 20 environmental samples. The LCS data is used to assess method performance if the MS/MSD recoveries fall outside of the lab generated limits (see For acceptance limits, reference the current TALS (LIMS) active Method Limit Group database). If the LCS recovery is within the current lab generated limits, the MS/MSD recoveries are attributed to matrix interference. If the LCS recovery results are outside the method specified, the LCS is reanalyzed. If, upon reanalysis, the LCS is it is still outside of limits the entire batch must be reanalyzed. For 8260D, when an LCS is prepared in the same manner as CCV, the same standard can be used as both the LCS and CCV.

9.1.3.1 For LCS preparation instructions please refer to Section 9.1.2.1 for low level soil introduction technique (note: use reagent water only, no solid matrix is used when preparing the LCS) and Sections 9.1.2.1.2 and 9.1.2.1.3 as applicable for aqueous/medium or high level solids introduction (note: use reagent water only, no sample or sample extract is used when preparing the LCS).

9.1.3.2 The LCS for SIM samples is prepared as detailed in the following table. This is prepared in a 200 ml volumetric flasks filled with organic free reagent water. Once prepped, 10ml of the solution is poured into a 40 ml VOA vial and 2ul IS/SS added manually and loaded onto the purge and trap autosampler

Standard Solution	Concentration	Volume of Standard Added to 200 ml of Reagent Water (ul)	Final Concentration (ug/L)
8260 Mix1	10ppm	1	0.05
1,4-Dioxane	50ppm	20	5
Benzene/Chloroform	10ppm	1	0.05

9.1.3.3 A Laboratory Control Sample Duplicate (LCSD) is analyzed only when insufficient client sample is available for preparation of an MS/MSD pair. The LCS/LSCD is evaluated in the same manner as the MS/MSD (see Section 9.1.2)

9.1.4. Surrogate Standards: All samples, blanks and QC samples are spiked with a four (4) component surrogate standard mix (see Section 7.2.2). The percent recovery of the surrogate standards is calculated and compared to lab generated limits (For acceptance limits, reference the current TALS (LIMS) active Method Limit Group database).

9.1.4.1. Surrogate recovery limits are lab generated and are updated annually.

9.1.4.2. Surrogate recoveries are calculated for the blank, samples, and QC samples. Surrogate recovery is calculated as:

$$\frac{\text{Concentration found}}{\text{Concentration added}} \times 100 = \%\ \text{RECOVERY}$$

9.1.4.3. If the surrogate recoveries of any blank, sample, or QC sample fails to meet the current recovery criteria, the sample must be re-analyzed. If a surrogate is diluted to a concentration below that of the lowest calibration standard, no corrective action is necessary. Method 8260D requires the use of a minimum of three (3) surrogates. As we spike with four (4) surrogates, one can be recovered outside of control limits without corrective action.

9.1.5. Internal Standards: All samples, blanks, standards and QC samples are spiked with a five (5) component internal standard mix (See Section 7.2.3). The response (area count) and retention time of each internal standard in all samples, standards, blanks and QC samples are monitored.

9.1.5.1. The internal standard responses must be within -50 +100% of its corresponding internal standard in the mid-level calibration standard or the active calibration curve. Failure to meet these criteria is indicative of sample matrix effects. All samples failing these criteria must be reanalyzed to confirm matrix effects.

9.1.5.2. Internal standard retention time is evaluated immediately after acquisition. The retention times of the internal standards must be within ±30 seconds of the internal standards from the mid point standard of the initial calibration or the calibration verification standard. Any blank, sample, or QC sample that fails to meet these criteria must be re-analyzed.

9.2 Instrument QC

9.2.1 GC/MS Instrument Performance Check (BFB): The GC/MS system is tuned using Perfluortributylamine (PFTBA) such that an injection or purging of 50ng of 4-Bromofluorobenzene (BFB) meets the abundance criteria listed in the table below. Prior to the analysis of any calibration standards or samples, the GC/MS system must meet all BFB key ion abundance criteria. This analysis will verify proper tuning of the system for a period of 12 hours post-injection. After 12 hours, the instrument performance must again be verified prior to the analysis of standards, QC or samples. For method 8260D tune checks are only required prior to initial calibration. (**NOTE**: see Method Modifications in Section 16.0).

BFB Key Ions and Abundance Criteria	
Mass	**Ion Abundance Criteria**
50	15.0-40.0 percent of the base peak
75	30.0-60.0 percent of the base peak
95	Base peak, 100% relative abundance
96	5.0-9.0 percent of the base peak
173	Less than 2.0% of mass 174
174	Greater than 50% of the base peak
175	5.0-9.0 percent of mass 174
176	Greater than 95.0% but less than 101% of mass174
177	5.0-9.0 percent of mass 176

9.2.1.1. The BFB mass spectrum may be evaluated using one of the procedures listed below. The spectrum may be background subtracted using a single peak no more than 20 scans before the peak apex. The BFB spectrum must meet the technical acceptance criteria listed in the table above:

- A single scan on the peak;
- An average of the peak;
- Use of three scan averaging and background subtraction techniques. Select the scan at the BFB peak apex, add +1 scan from the apex and -1 scans from the apex;

9.2.1.2. BFB parameter settings are stored in a tune file, which ill be used in all subsequent analysis of standards and samples.

9.2.2 Initial Calibration Range and Initial Calibration Verification

9.2.2.1. **Initial Calibration:** The initial calibration range consists of a five-point concentrations (six points for second order regression) of analytical standards prepared as described in Tables 3, 3A and 3B as applicable (attached). The initial calibration range must be analyzed only after the BFB instrument performance check has met the criteria in Section 9.2.1. A separate initial calibration range is analyzed for each sample introduction technique. The last initial calibration standard may be used to be the start of the 12 hour clock for samples analyzed after initial calibration. Verify closely eluting isomers resolution in the mid-point concentration of the ICAL. Isomers are considered resolved if the peaks are at least 50% resolved (i.e., the height of the valley between two isomer peaks is less than or equal to 50% of the average of the two peak heights. This should also be checked in the daily CC's.

9.2.2.2. If analysis by the SIM technique is required, prepare calibration standards for, Vinyl Chloride, Chloroform, Benzene 1,2-dibromoethane, 1,2,3-Trichloropropane and 1,2-dibromo-3-chloropropane at concentrations of 0.02, 0.04, .05, 0.10, 0.20, 0.50, 1.0 and 2.0 ppb; 1,4-Dioxane at 0.4, 1, 5, 10, 20, 30, 40 and 50ppb. See Table 5 that summarizes the preparation information.

9.2.2.3. **Initial Calibration Verification (ICV):** An Initial Calibration Verification (ICV) standard is analyzed immediately after the Initial Calibration Range and before any samples are analyzed. The ICV is prepared as detailed in Section 7.2.1.3 and Tables 4 and 4a (full scan) and Table 6 (SIM) (attached). The ICV must be from a source separate from the standards used in the Initial Calibration Range.

9.2.3 **Continuing Calibration Verification (CCV):** A approximately mid-point (20ug/ml and 0.050/5ug/ml for SIM) Continuing Calibration Verification (CCV) must be analyzed every 12 hours after the BFB instrument performance check. BFB is not a requirement for 8260D CCV verification. The CCV is prepared as detailed in Section 7.2.1.1 and Table 3 (attached).

9.2.4 **Calibration Acceptance Summary**

9.2.4.1. **Retention Time:** The relative retention times of each compound in the five calibration standards must agree within 0.06 relative retention time units.

9.2.4.2. **Initial Calibration Range:** Internal standard calibration is employed for this method. After the initial calibration range has been analyzed as detailed in Section 10.3.3 the relative response factor (RRF) for each target/surrogate compound at each concentration level is determined using the following equation.

$$RRF = \frac{A_x}{A_{is}} \times \frac{C_{is}}{C_x}$$

Where:
A_x = Area characteristic ion for the compound (see attached Table 7)
Ais = Area characteristic ion of internal standard (see attached Table 7)
Cis = Concentration of internal standard
Cx = Concentration of compound in standard

9.2.4.2.1. Determine the mean RRF for each compound using the five or six RFs from the initial calibration range.

9.2.4.2.2. The average RFs of the target analytes listed in the table below must meet the indicated minimum RF criteria:

Minimum Relative Response Factor	
Common Target Analytes	**Minimum RF**
Dichlorodifluoromethane	0.100
Chloromethane	0.100
Vinyl Chloride	0.100
Bromomethane	0.100
Chloroethane	0.100
Trichlorofluoromethane	0.100
1,1-Dichloroethene	0.100
1,1,2-Trichloro-1,2,2-trifluoroethane	0.100
Acetone *	0.050
Carbon disulfide	0.100
Methyl Acetate *	0.005
Methylene chloride	0.100
trans-1,2-Dichloroethene	0.100
cis-1,2-Dichloroethene	0.100
Methyl tert-Butyl Ether	0.100
1,1-Dichloroethane	0.200
2-Butanone *	0.050
Chloroform	0.200
1,1,1-Trichloroethane	0.100
Cyclohexane	0.100
Carbon tetrachloride	0.100
Benzene	0.500
1,2-Dichloroethane	0.100
Trichloroethene	0.200
Methylcyclohexane	0.100
1,2-Dichloropropane	0.100
Bromodichloromethane	0.200
cis-1,3-Dichloropropene	0.200
trans-1,3-Dichloropropene	0.100
4-Methyl-2-pentanone *	0.050
Toluene	0.400

Minimum Relative Response Factor	
Common Target Analytes	**Minimum RF**
1,1,2-Trichloroethane	0.100
Tetrachloroethene	0.200
2-Hexanone*	0.050
Dibromochloromethane	0.100
1,2-Dibromoethane	0.100
Chlorobenzene	0.500
Ethylbenzene	0.100
meta-/para-Xylene	0.100
ortho-Xylene	0.300
Styrene	0.300
Bromoform	0.100
Isopropylbenzene	0.100
1,1,2,2-Tetrachloroethane	0.300
1,3-Dichlorobenzene	0.600
1,4-Dichlorobenzene	0.500
1,2-Dichlorobenzene	0.400
1,2-Dibromo-3-chloropropane	0.050
1,2,4-Trichlorobenzene	0.200

Note: Alternate ions chosen for the analytes in the table above may result in lower than recommended value

* These values are lower than method recommended values.

9.2.4.2.3. Any individual analyte that fails the minimum response factor above must have a demonstration of sensitivity in the analytical batch to report non-detects. The demonstration of sensitivity is analysis of a low level CCV (at or below the reporting limit). The criterion for a passing LLCCV is detection only, and a passing LLCCV allows non-detects to be reported without flagging. The low level CCV would normally be analyzed immediately after the mid-level CCV

9.2.4.2.4. Calculate the Standard Deviation (SD) and Percent Relative Standard Deviation (% RSD) of the response factors for each compound:

$$\% \text{ RSD} = \frac{\text{Standard Deviation of RRFs}}{\text{Mean RRF}}$$

The % RSD of the common target compounds listed above must be ≤20% for average RF in order for the calibration range to be acceptable. If more than 10% of the compounds exceed the 20%RSD limit and do not meet the minimum correlation coefficient (0.99) or Relative Standard Error (RSE) of ≤20% for alternative curve fits, appropriate instrument maintenance like source cleaning should be performed. Any compound that do not meet the 20%

RSD or 0.99 correlation coefficient/RSE criteria must be flagged as estimated for detects.

9.2.4.2.5. For all compounds (including those analyzed by SIM): in order to assume linearity, the % RSD of the RRF's for each target analyte must be ≤20%.

9.2.4.2.6. If the above listed criteria is met, the system can be assumed to be linear, sample analysis may begin and the average RF from the initial calibration range may be used to quantitate all samples.

9.2.4.2.7. An alternative calibration technique may be employed for those any compounds exceeding the 20% RSD criteria:

9.2.4.2.5.4 Linear regression: Calculate the first order linear regression for any compound which did not meet the 20% RSD criteria the r^2 (Correlation Coefficient) value must be $\geq$ 0.99 or the Relative Standard Error (RSE) (≤20%) for the calibration to be employed.

9.2.4.2.5.4 Quadratic (or second order) regression: may be used if the linear regression correlation coefficient exceeds criteria. Quadratic regression requires the use of a minimum six calibration points. If second order regression calibration is used, , the r^2 (Correlation Coefficient) value must be $\geq$ 0.99 or the Relative Standard Error (RSE) (≤20%) for the calibration to be employed.

9.2.4.2.8. If neither of the alternative calibration techniques meets acceptance criteria i.e for more than 10% of the analytes fail both 20%RSE and 0.990 the calibration is not valid. Corrective action must be taken and the initial calibration range reanalyzed.

9.2.4.2.9. Non-detect results for any analyte that fails both 20%RSD/RSE and 0.990 correlation coefficient may be reported without flagging if (and only if) there has been a successful analysis of a LLCCV (CCV at the reporting limit) in the same analytical batch. The criterion for the LLCCV is detection only (%D criteria are not applied) but the standard qualitative criteria in the method must be met. Flagging of detected analytes results as estimated is discouraged when the 20%RSD/RSE and 0.990 criteria fails. In general no more than one or two of the poorest performing analytes should fail both criteria.

9.2.4.2.10. Due to significant bias to the lower portion of a calibration curve using the linear regression fit model a quantitation check on the viability of the lowest calibration point should be performed by re-fitting the response from the low concentration calibration standard back into the curve as if it were an unknown sample (rename the lower point calibration file as a separate data file before re-processing). The results should be within ±30% of the standard's true concentration. This is not required for average RF or quadratic fits. Additionally forcing a linear regression through zero will meet the requirement of not re-fitting. Analytes which do not meet the minimum quantitation calibration re-fitting criteria should be considered 'out of control'. Report those target analyte outliers as estimated when the concentration is at or near the lowest calibration point and/or report to the next reporting level (i.e., the next higher calibration point for the analyte).

9.2.4.2.11. For additional detail refer to Eurofins Edison Work Instruction No. EDS-WI-096, *8260C ICAL Procedure*, latest revision.

9.2.4.3. Calibration Point Read-back Criteria: Whichever calibration model above is selected, it should be subjected to an additional check to establish the representativeness of the data that were used to produce it. This check is the refitting of each calibration point response back to the calibration model, or the comparison of the calculated amount of the standard against the expected amount.

- CHROM software provides an Initial Calibration %Drift report which shows the % Error for each calibration point. This report must be reviewed in addition to the %RSD Linear Response Factor.

- The absolute value of the % Error for each calibration point should be < 30%. For the lowest calibration point, the % Error may be < 50%. Relative standard error (RSE) can also be used and must be ≤ 20% for each calibration point. See section 11.10 for the Calculation of the %Error.

9.2.4.4. Initial Calibration Verification (ICV): Once the initial calibration has been analyzed and has met the above criteria, a second source Initial Calibration Verification (ICV) (as prepared in Section 9.2.2.2) must be analyzed and evaluated. The ICV must meet the criteria of 70-130% recovery for all compounds however up to 10% of the compounds are allowed to exceed

this criteria as long as their recoveries are within 65-135%. For the poor performers the range is 50-150%. If the criterion is not met, a second ICV may be analyzed after corrective measures are taken. If a second ICV analysis fails to meet criteria proceed with corrective action and the analysis of a new initial calibration range. Flagging: If the ICV limits are outside of criteria (high) for an analyte and that analyte is undetected in the sample, no flagging or narration is required. If the ICV limits are outside of criteria (low) for an analyte and that analyte is undetected in a sample, narrate the non-conformance in an NCM. When that out of spec analyte is detected in a sample, describe the issue in the narrative, or flag as estimated.

9.2.4.5. Continuing Calibration Verification (CCV): A CCV consisting of a standard at or near the midpoint of the Initial Calibration Range is analyzed every 12 hours of instrument operation or at the beginning of an analytical sequence to verify the initial calibration. The calibration verification consists of a BFB instrument performance check, and analysis of a calibration verification standard.

9.2.4.4.1 Tune Verification: Follow the procedure for verifying the instrument tune described in section 9.2.1 using a 50 ng injection of BFB. If the tune cannot be verified, analysis must be stopped, corrective action taken and a return to "control" demonstrated before continuing with the calibration verification process. For method 8260D, tune verification is not required for daily CCV.

9.2.4.4.1.1 Calibration Verification: Analyze the calibration verification standard immediately after a BFB that meets criteria. For method 8260D, BFB is not needed. Use the mid point calibration standard (20ug/L). **NOTE:** The same sample introduction technique employed for the initial six-point calibration must be used for the calibration verification.

9.2.4.4.1.2 Calculate response factors (RF) for each compound using the internal standard method.

9.2.4.4.1.3 The RFs must meet the minimum RF criteria listed in the table in Section 9.2.4.2.2.

9.2.4.4.1.4 Calculate the % Difference for each response factor in the calibration check standard vs. the response factors from the initial calibration.

9.2.4.4.1.5 If the percent difference/drift (%D) for the compounds listed in the table in Section 9.2.4.2.2 is ≤20%, the initial calibration is assumed to be valid. If the ≤20% D criteria is not met for more than 20% of the compounds in the initial calibration, corrective action/ investigation may be taken. After corrective action, another calibration verification standard may be injected. If the response for the analyte is still not ≤20%, a new initial calibration range must be generated.

9.2.4.4.1.6 For the poor performing compounds listed below that fail the 20%D or 50%D criteria adequate sensitivity may be demonstrated by including a low level standard (LLCCV) in the analytical batch.

Poor Performers	
Acetone	Acrolein
Carbon disulfide	1,4-Dioxane
2-Butanone	Cyclohexane
2-Hexanone	Methyl cyclohexane
4-Methyl-2-pentanone	Benzyl chloride
Chlorodibromomethane	Naphthalene
1,2-Dibromo-3-chloropropane	Cis-Dichloropropene
Bromomethane	Trans-Dichloropropene
Chloroethane	All Alcohols

When samples have non-detects for an analyte that fails the SOP criteria with low recovery a low level CCV must be analyzed in the batch as a demonstration of adequate sensitivity. The criterion for a passing LLCCV is detection only, and a passing LLCCV allows non-detects to be reported without flagging. Any sample detects for an analyte that fails the SOP criteria must be flagged as estimated, or detailed in the case narrative. In all cases every effort should be made to re-analyze on an instrument with a passing CCV.

9.2.4.4.1.7 Percent drift is used instead of percent difference in calibrations employing either the linear or second order regression modes.

9.2.4.4.1.8 For the compounds not listed in the table in Section 9.2.4.2.2: No one individual compound of interest may exceed 50%D. For SIM analysis the %D is 20%.

9.2.4.4.1.9 The retention times of the internal standards from the calibration check must be within ±30 seconds of the internal standards from the mid point standard of the original calibration. If the retention time for any internal standard changes by more than 30 seconds from the latest daily (12 hour) calibration standard, the chromatographic system is inspected for malfunctions, and corrections made as required. If corrective action does not result in the retention time criteria being achieved, the system must be re-calibrated using four additional standards.

9.2.4.4.1.10 Internal standard area response is also evaluated immediately after acquisition. The response (area count) of each internal standard in the calibration verification standard must be within 50% - 100% of its corresponding internal standard in the mid-level calibration standard of the initial calibration curve. If the EICP area for any internal standard changes by more than a factor of two (-50% to +100%), the mass spectrometer system must be inspected for malfunction and corrections made as appropriate. When corrections are made, re-analysis of samples analyzed while the system was malfunctioning is required.

10.0 Procedure

10.1. Gas Chromatograph/Mass Spectrometer Operation

10.1.1. The instrument operating parameters are set as follows at the beginning of a method of analysis and remain constant throughout the entire analytical procedure

10.1.1.1 Full Scan Operating Mode

Purge and trap unit

Purge Time:	11 minutes
Dry Purge:	1 Minutes
Purge Gas:	Nitrogen
Purge Flow:	40-45 ml/min
Purge Temp:	Water: Ambient; Solids: 40°C
Trapping Temp:	Ambient, <30°C

Desorb Time:	1 Minute
Desorb Temp:	VOCARB: 260°C, #10: 190°C

Gas chromatograph

Injector:	180°C
Carrier Gas:	Helium
Carrier Flow:	6 ml/min, 6890: 0.8 ml/min
Oven Program:	40°C for 1 min, 8°C/min to 90°C, 20°C/ min to 250°C for 3 min; 6890: 40°C for 1 min, 8°C/min to 100°C, 24°C/min to 220°C for 2 min
Run Time:	15 - 20 Minutes

Mass Spectrometer

Electron Energy:	70 volts (nominal)
Mass range:	35-260 AMU
Scan time:	0.9 sec./scan
Source Temp:	200°C
Separator Temp:	180°C

10.1.1.2 SIM Operating Mode

Purge and trap unit

Purge Time:	11 minutes
Dry Purge:	1 Minutes
Purge Gas:	Nitrogen
Purge Flow:	40-45 ml/min
Purge Temp:	Water: Ambient; Solids: 40°C
Trapping Temp:	Ambient, <30°C
Desorb Time:	1 Minute
Desorb Temp:	VOCARB: 260°C, #10: 190°C

Gas chromatograph

Injector:	180°C
Carrier Gas:	Helium
Carrier Flow:	6 ml/min, 6890: 0.8 ml/min
Oven Program:	40°C for 1 min, 8°C/min to 90°C, 20°C/ min to 250°C for 3 min; 6890: 40°C for 1 min, 8°C/min to 100°C, 24°C/min to 220°C for 2 min
Run Time:	15 - 20 Minutes

Mass Spectrometer

Electron Energy:	70 volts (nominal)
Mass range:	35-260 AMU
Scan time:	0.9 sec./scan
Source Temp:	200°C
Separator Temp:	180°C

SIM Parameters:

Group 1
Plot 1 Ion: 51.0/96

Ions/Dwell in Group	(Mass	Dwell)	(Mass	Dwell)	(Mass	Dwell)
	51.0	100	58.0	100	65.0	100
	67.0	100	70.0	100	88.0	100
	96.0	100	78.0	100	83.0	100
	85.0	100	62.0	100	64.0	100

Group 2
Group Start Time: 6.20
Plot 1 Ion: 82/117

Ions/Dwell in Group	(Mass	Dwell)	(Mass	Dwell)	(Mass	Dwell)
	82.0	100	107.0	100	109.0	100
	117.0	100				

Group 3
Group Start Time: 8.50
Plot 1 Ion: 75/157

Ions/Dwell in Group	(Mass	Dwell)	(Mass	Dwell)	(Mass	Dwell)
	75.0	100	95.0	100	150.0	100
	152.0	100	152.0	100	157.0	100
	174.0	100				

10.2. Sample Preparation

10.2.1. Screening: All soil samples extracts must be screened by GC/FID static headspace or MS analysis to provide the analyst with appropriate initial dilution factors. Aqueous samples without historical results are also screened. For additional details see Eurofins Edison SOP No. ED-GCV-001, *Screening for Volatile Organics, Static Headspace with GC FID, SW846 Method 5021*, current revision.

10.2.2. Aqueous Samples: Unopened 40 mls vials with aqueous samples are placed in an Archon autosampler. 1 uL of Internal Standard/Surrogate Mix (see Section 7.2.4) is added by the Archon as the 5 mL of the sample passes through the sample loop.

10.2.3. **Medium or high level soils:** Medium or high level extracts that will be run on an Archon autosampler are prepared in 50mL volumetric flasks. The Archon can be set up to add 1uL of 250ppm Internal Standard/Surrogate separately (see Section 7.2.3 and 7.2.2.2) to each sample as the 5mL portion passes through the sample loop.

10.2.4. **Low level soils:** Low level soils must be run on an Archon autosampler. 1uL of 250ppm Internal Standard/Surrogate separately (see Section 7.2.3 and 7.2.2.2) and 5mL reagent water is added to each sample vial by the Archon immediately before the sample is purged.

10.2.5. **SIM analysis:** Aliquot 10ml of sample and manually add 2ul of 2.5/50ppm of internal standard/surrogate mix. Load to soil section of the autosampler for heated purge.

10.3. Instrument Performance and Calibration Sequence

10.3.1. Once the GC/MS instrument has been setup and maintained as detailed in Section 10.1, the first operations to be performed are the performance checks and calibration standards.

10.3.2. Analyze the Instrument Performance Check Standard (BFB) as discussed in Section 9.2.1.

10.3.3. A unique initial calibration is then prepared for each sample introduction technique.:

10.3.3.1 **40 ml VOA Vial (Aqueous/Medium-High Level Soils):** Prepare aqueous calibration standards at six concentration levels for each parameter by adding the volumes of working standards listed in Table 3 to a 50mL volumetric flask of reagent water. Pour the calibration standards into 40mL VOA vials and load into the autosampler tray. If the internal standard is to be added by the Archon/OI autosamplers the addition of internal standard into the 50ml volumetric flaks may be omitted.

10.3.3.2 **40 ml VOA Vial (Low Level Soils):** If the calibration is for low-level soils prepared according to Method 5035AA, the calibration standards must be prepared by adding the volumes of working standards listed in Table 3 into a 5 mL syringe filled with reagent water and pouring the prepared standards into 40 mL VOA vials containing a magnetic stir bar.

10.3.4. Purge the standard for 11 minutes.

10.3.5. After purging is complete, desorb the sample onto the GC column by rapidly heating the trap to 260°C for VOCARB, 190°C for #10 and backflushing it with helium.

10.3.6. Begin the GC temperature program and data acquisition.

10.3.7. Re-condition the trap by baking for 12 minutes at 260°C for VOCARB, 210°C for #10.

10.3.8. Cool the trap to (<31°C). The trap is now ready for the next sample.

10.3.9. Transfer data to network, and process using CHROM software.

10.4. Sample Analysis Sequence

10.4.1. Once the initial calibration has been verified by successful analysis of an ICV and Method Blank, analysis of samples may begin.

10.4.2. Samples must be analyzed under the same instrument conditions and using the same injection volume as the calibration standards.

10.4.3. Equilibrate all samples to room temperature prior to analysis.

10.4.4. If the sample concentration exceeds that of the range, the sample must be diluted and re-analyzed.

10.4.5. The analytical run log is printed as a record of samples analyzed. The analyst will annotate the run log with any required information regarding anomalies or unusual events. The run log must be signed by the analyst and a reviewed and signed by a trained peer or manager

10.5. Data Processing

10.5.1. Prior to processing any standards or samples, target compound lists and sublists must be assembled in the Chrom system. These lists are required for processing of all data files including calibration files. The data includes compound names, retention time data, quantitation ions, qualitative identification ions, and the assigned internal standard for qualitative and quantitative identification.

10.5.2. Key data is manually entered the first time a compound list is used for data processing. Processing data using a compound list automatically generates response factor data and updates retention information.

10.5.3. Data is transferred from the acquisition PC to the network for auto-processing with CHROM software.

10.5.4. Each data file is checked for correct information including sample number, job number, QA batch, dilution factor, initial volume, final volume, and % moisture.

10.5.5. The data processing service from Chrom queries LIMS for the sample processing parameters.

10.5.6. Each data file is processed using calibration factors from the most recent initial calibration, quantitation from the daily calibration verification standard is not permitted.

10.5.7. The characteristic ions for target compounds, surrogate compounds, and internal standards which can be determined using SW8260D are listed in Table 7.

10.6. Interpretation and Qualitative Identification:

10.6.1 Target Analytes: Qualitative identification of target compounds is based on retention time and mass spectral comparison with characteristic ions in the target compound list. The reference mass spectrum is taken from a standard of the target compound analyzed by this method. The characteristic ions are the three ions of greatest relative intensity or any ions over 30% relative intensity if less than three such ions occur in the reference spectrum. Compounds are identified as present when the following criteria are met:

10.6.1.1. Once the GC/MS instrument has been setup and maintained as detailed in Section 10.1, the first operations to be performed are the performance checks and calibration standards.

10.6.1.2. The intensities of the characteristic ions of a compound maximize in the same scan or within one scan of each other.

10.6.1.3. The relative retention time (RRT) of the sample component is within ± 0.06 RRT units of the RRT of the standard component.

10.6.1.4. The most abundant ion in the standard target spectrum that equals 100% MUST also be present in the sample target spectrum.

10.6.1.5. All other ions that are greater than 10% in the standard target spectra should also be present in the sample.

10.6.1.6. The relative intensities of the characteristic ions agree within 30% of the relative intensities of these ions in the reference spectrum. (Example: For an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%).

10.6.1.7. Structural isomers that produce very similar mass spectra should be identified as individual isomers if they have sufficiently different GC retention times. Otherwise, structural isomers are identified as isomeric pairs.

10.6.1.8. If the compound does not meet all of the criteria listed above, but is deemed a match in the technical judgment of the mass spectral interpretation specialist, the compound will be positively identified and reported with documentation of the identification noted in the raw data record.

10.6.2 Non-Target Analytes: Upon client request a library search to identify non-target Tentatively Identified Compounds (TIC) is performed. The NIST/EPA/NIH mass spectral library is used to identify non-target compounds (not including internal standard and surrogate compounds) of greatest apparent concentration by a forward search of the library. The following guidelines are used by the analyst when making TIC identifications:

10.6.2.1 Relative intensities of major ions in the reference spectrum (ions greater than 10% of the most abundant ion) should be present in the sample spectrum.

10.6.2.2 The relative intensities of the major ions should agree within ±20%. (Example: For an ion with an abundance of 50% in the standard spectrum, the corresponding sample ion abundance must be between 30 and 70%).

10.6.2.3 Molecular ions present in the reference spectrum should be present in the sample spectrum.

10.6.2.4 Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of co-eluting compounds.

10.6.2.5 Ions present in the reference spectrum but not in the sample spectrum should be reviewed for possible subtraction from the sample spectrum because of background contamination or co-eluting peaks. Data system library reduction programs can sometimes create these discrepancies.

10.6.2.6 If, in the technical judgement of the mass spectral interpretation specialist, no tentative identification can be made, the compound will be reported as 'Unknown'. If the compound can be further classified the analyst may do so (i.e, 'Unknown hydrocarbon', 'Unknown acid' , etc..).

10.7. Data Reporting

10.7.1. Final Report. LIMS TALS system automatically produces a data report consisting of key, hardcopy reports corresponding to specific data reporting requirements.

10.7.1.1. Total Ion Chromatogram. Full length chromatogram depicting the full length of the GC/MS acquisition.

10.7.1.2. Spectra of all detected target compounds. A page for each detected target compound spectra with a standard reference spectrum for comparison.

10.7.1.3. The calculations of the concentrations of each target compound in the sample, reported in units of ppb, ug/kg or ug/l.

10.7.1.4. Data summaries for each method blank indicating which samples were extracted with the indicated blank.

10.7.1.5. A copy of the initial calibration range together with the calibration verification report, and tune report.

10.7.1.6. Quality Control (QC) data report for each batch including surrogate recoveries, internal standard area summaries, LCS, MS/MSD and RPD summaries.

11.0. Calculations / Data Reduction

11.1. Target Compounds: are quantitated using the internal standard method.

11.1.1. Identified target compounds are quantitated using the integrated abundance from the EICP of the primary characteristic ion. The internal standard used shall be the one nearest the retention time of the analyte).

11.1.2. The average response factor (RRF) from the initial calibration is used to calculate the target analyte concentration in client samples using the formula found in Section 11.3.. See Section 9.2.4.2 for discussion of RRF.

11.1.3. Secondary ion quantitation is utilized only when there are sample interferences preventing use of the primary characteristic ion. If secondary ion quantitation is used an average relative response factor (RRF) must be calculated using that secondary ion.

11.1.4. Aqueous Samples

$$\text{Concentration } (\mu g/L) = \frac{(As)(Cis)(D)}{(Ais)(RRF)(Vs)}$$

Where:

As = Area of the characteristic ion for the target analyte in the sample

Cis = Concentration of the internal standard (ug/L)

D = Dilution factor, if the sample or extract was diluted prior to analysis. If no dilution is performed, D = 1.

Ais = Area of the characteristic for the associated internal standard

RRF = Average relative response factor from the initial calibration.

Vs = Volume of sample purged (ml)

11.1.5. Low Level Solid Samples

$$\text{Concentration (µg/Kg) (dry wt)} = \frac{(As)(Cis)}{(Ais)(RRF)(Ws)\,(DW)}$$

Where:

As = Area of the characteristic ion for the target analyte in the sample

Cis = Concentration of the internal standard (ug/L)

DW = Dry wt correction = $\frac{100 - \%\ \text{moisture}}{100}$

Ais = Area of the characteristic for the associated internal standard

RRF = Average relative response factor from the initial calibration.

Ws = Weight of sample purged (g)

11.1.6. Medium Level Solid Samples

$$\text{Concentration (µg/Kg) (dry wt)} = \frac{(As)(Cis)(Vt)(1000)(D)}{(Ais)(RRF)(Va)(Ws)(DW)}$$

Where:

As = Area of the characteristic ion for the target analyte in the sample

Cis = Concentration of the internal standard (ug/L)

D = Dilution factor, if the sample or extract was diluted prior to analysis. If no dilution is performed, D = 1

DW = Dry wt correction = $\frac{100 - \% \text{ moisture}}{100}$

Ais = Area of the characteristic for the associated internal standard

RRF = Average relative response factor from the initial calibration.

Va = Volume of the aliquot of sample methanol extract added to reagent water for purging in ul

Vt = Total volume of methanol extract in milliliters

Ws = Weight of sample purged (g)

11.2. Non-Target Compounds (Tentatively Identified Compounds): An estimated concentration for non-target (tentatively identified compounds) is calculated using the internal standard method . For quantiation, the nearest eluting internal standard free of interferences is used. The procedure used for calculating the concentration of non-target compounds is the same as that used for target compounds (see Section 11.1) with the following revisions:

11.2.1. The total area count of the non-target compound is used for As (instead of the area of a characteristic ion).

11.2.2. The total area count of the chosen internal standard is used as Ais (instead of the area of a characteristic ion).

11.2.3. A RF on 1.0 is assumed.

11.2.4. The resulting concentration is qualified as estimated ('J') indicating the quantitative uncertainties of the reported concentration.

11.3. Relative Response Factors

$$RRF = \frac{A_x}{A_{is}} \times \frac{C_{is}}{C_x}$$

Where:

A_x = Area characteristic ion for the compound (see Table 7)
Ais = Area characteristic ion of associated internal standard (See Table 7)
Cis = Concentration of internal standard
Cx = Concentration of compound in standard

11.4. Percent Relative Standard Deviation (% RSD) : as discussed in Section 9.2.4.2. (Initial calibration):

$$\% \text{ RSD} = \frac{\text{Standard Deviation of RRFs}}{\text{Mean RRF}}$$

11.5. Percent Difference (% D):as discussed in Section 9.2.4.4 (Continuing calibration):

$$\% \text{ D} = \frac{RRF_c - \overline{RRF_i}}{\overline{RRF_i}} \times 100$$

Where: RRFc = RRF from continuing calibration

$\overline{RRF_i}$ = Mean RRF from current initial calibration

11.6. Percent Recovery (% R): Surrogates and Spikes

$$\text{Recovery (\%)} = \frac{\text{Concentration (or amount) found}}{\text{Concentration (or amount) added}} \times 100$$

11.7. Dry Weight Correction: All solid samples must be corrected for dry weight using the following formula for dry weight determination.

$$DW = \frac{Gd}{Gw} \times 100$$

Where:

DW	=	Percent % Dry Weight
Gd	=	Dry weight of selected sample aliquot
Gw	=	Wet weight of selected sample aliquot

Multiply the DW value times the wet weight of the sample extracted. NOTE: This calculation can also be performed automatically by the target system provided the DW value is available and entered into the system.

11.8. Accuracy:

$$\text{ICV , CCV and LCS \% Recovery} = \frac{\text{observed concentration}}{\text{known concentration}} \times 100$$

$$\text{MS \% Recovery} = \frac{\text{(spiked sample) - (unspiked sample)}}{\text{spiked concentration}} \times 100$$

11.9. Precision (RPD):

$$\text{Matrix Duplicate (MD)} = \frac{|\text{orig. sample value - dup. sample value}|}{[(\text{orig. sample value + dup. sample value})/2]} \times 100$$

11.10. Calculation of Percent (%) Error:

$$\%Error = \frac{x_i - x_i'}{x_i} x\,100$$

Where:

x_i ' = Measured amount of analyte at calibration level *i*, in mass or concentration units
x_i = True amount

11.11. Relative Standard Error (RSE):

$$\%\,RSE = 100\% \times \sqrt{\frac{\sum_{i=1}^{N}\left[\frac{C_i - PC_i}{C_i}\right]^2}{(N-P)}}$$

Where:

N = Number of points in the curve
P = Number of parameters in the curve (= 1 for average response factor, 2 for linear, 3 for quadratic)
CI = True concentration for level i
PCi = Predicted concentration for level

12.0 Method Performance

12.1. Method Detection Limit Study (MDL)

A Method Detection Limit (MDL) study, as described in the Eurofins corporate Detection and Quantitation Limits SOP, CA-Q-S-006, must be performed initially and whenever a significant change affecting sensitivity is made to the analytical system. The MDL must be re-evaluated from quarterly MDL points at least every 12 months.

12.2. Demonstration of Capabilities

For DOC procedure refer to Section 19 in the most current revision of Eurofins Edison's Quality Assurance Manual (ED-QA-LQM).

12.3. Lower Limit of Quantitation Verification

The lowest calibration standard analyzed establishes the LLOQ or Reporting Limit. The capability to reliably detect this concentration through the preparation, clean-

up and analytical procedure is verified through the annual analysis of a standard at the LLOQ/RL. The LLOQ verification shall also be performed whenever significant changes are made to the preparation and/or analytical procedure. The annual LLOQ verification is completed and documented with the required annual MDL evaluation

12.3.1 The LLOQ verification standard shall be prepared at a concentration 0.5-2 times the LLOQ/RL, and be taken through all of the same preparation and clean-up methods as client samples.

12.3.2 The LLOQ verification standard for aqueous matrix shall be prepared using laboratory deionized water and for the solid matrix using clean Ottawa sand. Other clean matrices may be used in addition, for project specific requirements.

12.3.3 The LLOQ shall be verified annually on each instrument used for client sample analysis.

12.3.4 Recovery of each analyte must meet the laboratory established LCS recovery limits + 20%. (For example, if the LCS recovery limits are 70-130%, the LLOQ verification must meet recovery limits of 50-150%.) Once sufficient points have been generated, LLOQ based statistical limits may be used in place of limits based on LCS recovery.

NOTE: The lower recovery limit for the LLOQ can be no lower than 10%.

12.4. Training Requirements

Refer to Eurofins SOP No. ED-GEN-022, (*Training*), for the laboratory's training program.

13.0 Pollution Control

13.1. It is Eurofins's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention."

14.0 Waste Management

14.1. Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to Eurofins Edison SOP No. ED-SPM-008, *Laboratory Waste Disposal Practices*, current revision. The following waste streams are produced when this method is carried out.

- Laboratory Generated Aqueous Waste (aqueous VOA vials – used and unused). This waste may have a pH of less than 2.0. These vials are collected in satellite accumulation. The vials are then transferred to the waste room. These vials are passed through a vial crusher and the liquid portion is separated from the solid portion. The solid is dumped into the municipal garbage. The liquid is pumped into the neutralization system where it is neutralized to a pH of 6 to 9 with sodium bicarbonate (Seidler Chemical SC-0219-25). When neutralization is complete, the material is transferred to the municipal sewer system**.**

- Expired Standards – The vials are collected in a 1 gallon polyethylene bucket. These vials are then transferred to an open top 55 gallon steel or polyethylene waste drum. These drums are transported to a waste facility for proper disposal.

- Soil Retain Samples - These samples if not flagged in the system for any hazardous constituents are transferred to poly-lined cubic yard boxes. These boxes when full are sent to stabilization or incineration. These materials are sent out as hazardous for lead and chromium

  Teris Profile Number (incineration): 50016710
  Onyx Profile Number: (stabilization) 402535

- Methanol Preserved Samples/Returned Methanol Preservative - Methanol preserved sample vials are collected in satellite accumulation and then transferred to a 55 gallon open top steel waste drum in the waste room. This drum is then removed by a waste vendor for incineration.

  Teris Profile Number: 50016652
  Onyx Profile Number: 282493

15.0 References / Cross-References

15.2. .United States Environmental Protection Agency, “Method 8260D, Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)”, Test Methods for Evaluating Solid Waste, SW846, Update VI, Revision 4, June 2018.

15.3. United States Environmental Protection Agency, “Method SW8000D: Determinative Chromatographic Separations”, Test Methods for Evaluating Solid Wastes, SW846, Laboratory Manual, Physical/Chemical Methods, Update V, Revision 4, October 2012.

15.4. U.S. EPA. 2003. "Method 5030C (SW-846): Purge-and-Trap for Aqueous Samples," Revision 3. Washington, DC.

15.5. U.S. EPA. 2002. "Method 5035A (SW-846): Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples," Draft Revision 1. Washington, DC.

15.6. Eurofins Edison Document No. ED-QA-LQM, *Laboratory Quality Manual*, most current revision.

15.7. Eurofins Document No. CW-E-M-001, Corporate Environmental Health and *Safety Manual,* current revision.

15.8. Eurofins Edison SOP Nos. ED-MSV-001*, Purge and Trap for Aqueous Samples, SW846 Method 5030*, current revision.

15.9. Eurofins Edison ED-MSV-002, *Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples, SW846 Method 5035A,* current revision.

15.10. Eurofins Edison SOP No. ED-GCV-001, *Screening for Volatile Organics, Static Headspace with GC FID, SW846 Method 5021*, current revision.

15.11. Eurofins Corporate Quality SOP No. CA-Q-S-001, *Solvent & Acid Lot Testing & Approval*, current revision.

15.12. Eurofins Edison SOP No. ED-GEN-023, *Bulk Solvent Testing and Approval*, current revision.

15.13. Eurofins Edison SOP No. ED-GEN-008, *Standard Operating Procedure for Preparation, Purity and Storage of Reagents and Standards*, current revision

15.14. Eurofins Edison SOP No. ED-SPM-004, *Sample Storage & Handling Procedures for Mitigation of Sample and Laboratory Contamination,* current revision

15.15. Eurofins Edison Work Instruction No. EDS-WI-096, *8260C ICAL Procedure*, current revision.

15.16. Eurofins Edison SOP No. ED-GEN-022, *Training*, current revision.

15.17. Eurofins Edison SOP No. ED-SPM-008, *Laboratory Waste Disposal Practices*, current revision

15.18. Eurofins Edison Work Instruction Document No. EDS-WI-012, *Client Complaint/Corrective Action Form,* current revision.

15.19. Eurofins Corporate Quality Memorandum, CA-Q-QM-002, *GC/MS Tuning Policy*, current revision.

15.20. Eurofins Edison SOP No. ED-GEN-003, *Standard Operating Procedure for Control of Non-Conformances and Corrective Action,* current revision

16.0 Method Modifications:

16.1 Method 8260D requires the BFB tune standard to be analyzed once prior to an ICAL and not daily after that prior to sample analysis. The laboratory will analyze the BFB tune daily, prior to QC and sample analysis. The laboratory will use the

tighter criteria from Methods 8260B/8260C for tune evaluation, rather than the criteria suggested in Table 3 of Method 8260D.

17.0 Attachments

N/A

18.0 Revision History

- Revision 10, dated 08/09/2023
    - Throughout: added analyte 2-ethylhexyl acrylate
    - Sections 2.3 and 10.2.1: Screening clarified to indicate which samples are screened and samples that derive their dilutions from historical data.

- Revision 9, dated 10/17/2022
    - Updated throughout to Eurofins branding throughout the document.
    - Removed all references to 8260C
    - Section 8.3.1: added requirements for handing aqueous samples from chlorinated sources.
    - Section 9.2.2: updated throughout to detail requirements for Relative Standard Error (RSE) evaluation if ICAL.
    - Section 11.11: added formula for calculation of RSE.

- Revision 8, dated 07/16//2020
    - Updated throughout to include requirements of SW 8260D and 8000D.
    - Updated Table 1 with full current analyte list.
    - Add text to Section 1.1.6 detailing procedures for documenting method variations via NCMs.
    - Section 2.6: clarified text regrading lower than standard RLs.
    - Section 4.4: clarified text regarding trip blanks.
    - Section 7.1.1: revised source and details of organic free water.
    - Section 8.0: added handling and preservation details for various soil and aqueous sample types.
    - Section 9.1.1.4: Added that concentrations allowed in blanks (one half of RL), how blank concentration relates to sample concentration (<1/10) and some guidance on re-analysis when concentration exceeds criteria.
    - Section 9.1.3: added that CCV/LCS can be the same run.
    - Tune verifications as not required for daily CCV updated throughout.
    - Section 9.2.2.1.: Allowance for last calibration standard to be the start of 12-hour clock for samples analyzed after initial calibration. Calculations for verifying peak resolution
    - New Section 9.2.4.2 added: Calibration Point Read Back Criteria
    - Section 11.10: added formula for calculation of Percent Error.

- Section 12 (Method Performance) updated to include new MDL procedure and annual LLOQ procedure.
- Updated references in Section 15 as necessary.

- Revision 7, dated 04/01/2020:

  - Updated formatting and branding to Eurofins
  - Sec 7.2.8: Revised Expiration dates based on concentration level and corrected storage requirements.
  - Sec 8.1: Changed Storage Blanks storage period from 1 week to 1-2 weeks.

- Revision 6, dated 01/17/2018:

  - Revised Table 5 and 6: revised to add additional levels plus Benzene and chloroform and to updated concentration level of ICV to current level.

  - 7.2.1 and Table 2: Table in Section 7.2.1 and Table 2 updated to include complete list of standards currently in use as well as to update vendor catalog number for several items.

  - Section 7.2.5: SIM IS/SS mix corrected to reflect lower concentration of IS mix .

  - Section 9.1.2.1.4: SIM MS/MSD preparation revised.

  - Section 9.1.3.2: SIM LCS/LCSD preparation revised.

  - Section 9.2.2.2: additional SIM levels added.

  - Section 9.2.3: SIM CCV level concentration revised to reflect lower concentration.

  - Section 10.2.5: New SIM analysis preparation narrative added

  - Section: 6.1: New instrumentation added.

  - Section: Section: 9.1.4.3: Revised to have any one surrogate out without the need for corrective action. This corrects previous narrative of one surrogate out of two.

- Revision 5, dated 12/11//2015:

  - Revised Table 5: new concentration of low standard (1,4-dioxane only).

- Revision 4, dated 12/08//2014:

  - Section 9.2.4.2.2: Table revised to reflect minimum RF of 0.050 for following compounds: acetone, 2-butanone, 4-methyl-2-pentanone, 2-hexanone.

  - Section 9.2.4.3: added statement ‘for poor performers the range is 50-150%’.

- Revision 3, dated 11/10/2014:

- Tables 1 and 7: added 1,2,4,5-Trimethylbenzene, 1,4-Diethylbenzene, Butadiene, 1,4-Difluorobenzene, 1-Chlorohexane, Freon 114, Freon 123a, Isooctane, 4-Ethyltoluene, t-Amyl Alcohol, Chlorofluoroethylene to list of target compounds and list of standard sources.

- Section 2.5: added chloroform, vinyl chloride and benzene to the list of SIM analytes addressed in this section.

- Section 2.6: revised the concentration of the low ketone standard to 2.5 ug/l.

- 7.2.1 and Table 2: Table in Section 7.2.1 and Table 2 updated to include complete list of standards currently in use as well as to update vendor catalog number for several items. All standards prep tables revised to reflect current standard prep instructions.

- Section 8. Preservation by TSP and holding time is added.

- Section 9.1.2.1: updated source of standards used in various spiking solutions.

- Section 9.1.3: LCS/MS/MSD. Preparation tables now indicate using calibration mix and not the second source mix.

- Sections 9.1.4.3 and 9.1.1 : Revised to indicate that we are now spiking with 4 surrogates instead of the method required 3. One surrogate is now allowed to be out of limit criteria for either 1,2-Dichloroethane-d4 and Dibromofluoromethane.

- Section 9.2.2: Chloroform, Vinyl Chloride and Benzene added as SIM compounds.

- Section 9.2.4.2.3.1. A list of 'poor performing compounds' is added with a ICAL RSD criteria of 50%.

- Section 9.2.4.3: now specifies that up to 10% of the compounds are allowed to exceed the 70-130% ICV recovery criteria as long as their recoveries are within 65-135%..

- Section 9.2.4.4.1.6: Added the following to the first sentence: '…or 50%D for the poor performing compounds'.

- Section 10.1.1.2: updated masses/dwell time for Group 1 under SIM Parameters.

- Throughout document as appropriate: Replaced references to Target with references to CHROM

- Added Section 10.5.5: "The data processing service from Chrom queries LIMS for the sample processing parameters."

- Revision 2, dated 11/04/2013:

- Tables 1 and 7: added methyl acrylate, 1-methylnaphthalene and 2-methylnapthalene.

- Revision 1, dated 09/16/2011:

  - Tables 1 and 7: added cyclopentene, 2-chloro-1,3-butadiene, methacrylonitrile, propionitrile, ethyl methacrylate, 2-nitropropane, indan and isobutyl alcohol to list of target compounds and list of standards sources.

  - Section 7.2.1 and Table 2: Table in Section 7.2.1 and Table 2 updated to include complete list of standards currently in use as well as to update vendor catalog number for several items.

  - Table 3: Initial Calibration Standards Preparation: is now split into three tables to include aqueous low level analysis.

  - Table 5: added following footnote:
    Levels 1 and 2 respectively are prepared in 500ml and 100ml final volumes
    [1]This level is also used as the Continuing Calibration Verification.

- Revision 0, dated 02/15/2011: New

Table 2: Working Standards Preparation							
Target Compound Standard Name	**Lab Name**	**Vendor**	**Cat. #**	**Vol. Std. Added**	**Conc. of Stock Std.**	**Concentration of Standard**	**Final Vol/ Total vol of MeOH**
Gas Mix Hi	Gas (Hi)	Restek	567645	5ml mL	2000 ppm	500 ppm	20mL 15mL TV/M
Gas Mix Li	Gas (Li)	Restek	567645	500 uL	2000 ppm	50 ppm	20mL 19.5mL TV/M
8260Mix 1	Mix 1 (Hi)	Restek	567641 567646 567642 568022	2.5ml 2.5 ml 2.5 ml 2.5 ml	2000 ppm	500 ppm	10ml
8260 combined	Mix 1 (Li)	Restek	567641 567646 567642 568022 567643 568018 568713 568722 568723	1.0ml 1.0ml 1.0ml 1.0ml 1.0ml 1.0ml 1.0ml 1.0ml 1.0ml	2000 ppm	50 ppm	40ml 31ml TV/M
Acrolein	AC	Restek	82402	1.0ml	20000 ppm	500 ppm	40ml 39ml TV/M
8260 Mix 2	Mix 2 (Hi)	Restek	567643 568722 568019-fl 568713-fl	2.5ml 2.5 ml 2.5 ml 2.5 ml	2000 ppm	500 ppm	10mL
8260 Mix 3	Mix 3 (Hi)	Restek	568723 568021-fl	2.5ml 2.5ml	2000 ppm	500 ppm	10ml 5ml TV/M
1,4-Dioxane	1,4-Dioxane	Supelco	360481	483.6ul	Neat	50000 ppm	10ml/9.52TVM
1,4-Dioxane	1,4-Dioxane	Supelco	NA	100ul	50000 ppm	500 ppm	10ml/9.90TVM
Propenes*	Propenes	Supelco	21240202	NA	1000/2000 ppm	NA	NA
Propenes*	Propenes	Supelco	21240202	1ml	1000/2000 ppm	50 ppm (varied)	20ml/ 19ml
Gas SS	Gas SS	Restek	567645.sec	1ml	2000ppm	50 ppm	40ml 39ml/TV/M
8260 Mix 1 SIM	8260 Mix 1 SIM	Supelco	5-02111	50 ul	2000ppm	10 ppm	10ml 9.95 TV/M
1,4-Dioxane SIM	1,4-Dioxane	Supelco	NA	100 ul	50000 ppm	500 ppm	10ml/9.90TVM

Table 2: Working Standards Preparation

Target Compound Standard Name	Lab Name	Vendor	Cat. #	Vol. Std. Added	Conc. of Stock Std.	Concentration of Standard	Final Vol/ Total vol of MeOH
8260 SS	8260 SS	Restek	567641.sec 567646.sec 567642.sec 568022- sl 567643.sec 568019- sl 568713- sl 568722.sec 568723.sec 568021- sl	1 ml 1 ml 1 ml 1 ml 1 ml 1 ml 1 ml 1 ml 1 ml 1 ml	2000 ppm	50 ppm	40 ml 30 ml TV/M
Acrolein SS	AC SS	Restek	568720.sec	1 ml	20000 ppm	500 ppm	40 ml 39 ml TV/M
Propenes SS	Propenes SS	Supelco		1 ml	1000/2000 ppm	50/100 ppm	40 ml 39 ml TV/M
8260Mix 1 SIM SS	SIM MIX1 SS	Supelco	5S-02111	50ul	2000 ppm	10 ppm	10ml 9.95 TV/M
Benzene/ Chloroform	Ben/chl	Absolute	70025/ 70076	100ul each	1000ppm	10ppm	10ml 9.90 TV/M
1,4-Dioxane (SS)	1,4-Dioxane	Absolute	70373	1ml	1000 ppm	500 ppm	2ml/1ml TV/M

Asterisk (*) indicates a custom standard mix.

Table 3: Initial Calibration Standards Preparation, Low Level Soil

Standard Solution	Final Volume Reagent Water (ml)	Volume of Standard Added to Reagent Water (ul)					
		1ppb *	5ppb*	20ppb[1]	50ppb	200ppb	500ppb
Gas Mix (50ppm)	5	-	-	2.0	5	-	-
	50	1.0	5.0			-	-
Gas Mix (500ppm)	5	-	-	-		2.0	5.0
		-	-	-			
Mix 1 (combined) (50ppm)	5	-	-	2.0	5	-	-
	50	1.0	5.0			-	-
Mix 1 (Hi) (500ppm)	5	-	-	-	-	2.0	5.0
		-	-	-	-	-	-
Freon Mix							
AC (500ppm)	5	-	-	3.0	4.0	5.0	6.0
	50	10	20			-	-
Mix 2 (Hi) (500ppm)	5	-	-	-	-	2.0	5.0
		-	-	-	-		
Mix 3 (500ppm)	5					2.0	5
Propenes (50ppm)	-	-	-	-	-	-	-
	50	10.0	20.0		-	-	-
Propenes (Hi)(500ppm)	5	-	-	2.0	5.0	20	50
	-	-	-	-	-	-	-

[1]**This level is also used as the Continuing Calibration Verification.**

Table 3a: Initial Calibration Standards Preparation, Aqueous (LOW LEVEL)

Standard Solution	Volume of Standard Added to Reagent Water (ul)						
	0.5ppb*	1ppb*	5ppb*	20ppb[1]	50ppb	200ppb	500ppb
Gas Mix (500ppm)	0.5	1	1	2	5	20	50
Mix 1 (Hi) (500ppm)	0.5	1	1	2	5	20	50
Mix 2 (Hi) (500ppm)	0.5	1	1	2	5	20	50
Mix 3 (varied)	0.5	1	1	2	5	20	50
AC (500ppm)	2	4	4	4	10	20	40
1,4-Dioxane (500ppm)	15	30	-	-	-	-	-
Freons mix	0.5	1	1	2	5	20	50
Propenes (1000/2000ppm)	0.5	0.5	0.5	1	2.5	10	25
Methanol Compensate	3000	2800	610	300	280	190	0
Final vol. (reagent water)	500ml	500 ml	100ml	50 ml	50ml	50ml	50ml

[1]This level is also used as the Continuing Calibration Verification.

Table 3b: Initial Calibration Standards Preparation, Aqueous

Standard Solution	Volume of Standard Added to Reagent Water (ul)					
	1.0ppb*	5ppb*	20ppb[1]	50ppb	200ppb	500ppb
Gas Mix (500ppm)	1	1	2	5	20	50
Mix 1 (Hi) (500ppm)	1	1	2	5	20	50
Mix 2 (Hi) (500ppm)	1	1	2	5	20	50
Mix 3 (varied)	1	1	2	5	20	50
AC (500ppm)	4	4	4	10	20	40
1,4-Dioxane (500ppm)	30	-	-	-	-	-
Freons Mix	1	1	2	5	20	50
Propenes (1000/2000ppm)	0.25	0.5	1	2.5	10	25
Methanol Compensate	2800	610	300	280	190	0
Final vol. (reagent water)	500 ml	100ml	50 ml	50ml	50ml	50ml

[1]This level is also used as the Continuing Calibration Verification.

Table 4 : ICV Standard Preparation, Low Level Soil

Standard Solution	Concentration	Volume of Standard Added to 5.0 ml of Reagent Water (ul)	Final Concentration (ug/L)
GAS SS (Separate lot)	50ppm	2	20
8260 SS (Separate lot)	50ppm (+varied)	2	20
AC SS (separate lot)	500ppm	3	300
Freon SS (Separate lot)	50ppm	2	20
Propenes SS(separate lot)	50ppm (varied)	2	20 (varied)

Table 4a: ICV Standard Preparation, Aqueous

Standard Solution	Concentration	Volume of Standard Added to 50 ml of Reagent Water (ul)	Final Concentration (ug/L)
GAS SS (Separate lot)	50ppm	20	20
8260 SS (Separate lot)	5000ppm (varied)	20	20
AC SS (separate lot)	500ppm	4	400
Freons SS (Separate lot)	50ppm	20	20
Propenes (second source)	50ppm (varied)	20	20 (varied)

Table 5: SIM Initial Calibration Standards Preparation

Standard Solutions	Volume Standard Solution Added to Reagent Water (Final Concentration)							
8260 Mix 1 SIM (10ppm)	1 ul (0.02 ppb)	2 ul (0.04 ppb)	1 ul (0.05 ppb)	1 ul (0.1 ppb)	1 ul (0.2 ppb)	2.5 ul (0.5 ppb)	5 ul (1 .0 ppb)	10 ul (2.0 ppb)
1,4-Dioxane (500ppm)	4 ul (0.4 ppb)	2 ul (1.0 ppb)	1 ul (5.0 ppb)	1 ul (10 ppb)	1 ul (20 ppb)	2.5 ul (30 ppb)	5 ul (40 ppb)	10 ul (50 ppb)
SIM (ben/chl) 10ppm	1 ul (0.02 ppb)	1 ul (0.02 ppb)	1 ul (0.05 ppb	1 ul (0.1 ppb)	1 ul (0.2 ppb)	2.5 ul (0.5 ppb)	5 ul (1.0 ppb)	10 ul (2.0 ppb)
Final Vol. (reagent water)	**500ml**	**500ml**	**200ml**	**100ml**	**50ml**	**50ml**	**50ml**	**50ml**

levels 1 and 2 are respectively prepared in 500ml and 100ml final volumes
[1]**This level is also used as the Continuing Calibration Verification.**

Table 6 : SIM ICV Standard Preparation

Standard Solution	Concentration	Volume of Standard Added to 200 ml of Reagent Water (ul)	Final Concentration (ug/L)
SIM MIX1 SS (Second source)	10ppm	1	0.05
1,4-Dioxane SS	50ppm	20	5

TABLE 7
Characteristic Ions of Volatile Organic Compounds

Parameter	Primary ion	Secondary ion
1,1,1-Trichloroethane	97	99,117,119
1,1,2,2-Tetrachloroethane	83	85,131,133,166
1,1,2-Trichloroethane	97	83,85,99,132,134
1,1-Dichloroethane	63	65,83,85,98,100
1,1-Dichloroethene	96	61,98
1,1-Dichloropropene	75	110. 77
1,2,3-Trichlorobenzene	180	182
1,2,3-Trichloropropane	110	75
1,2,4-Trichlorobenzene	180	182, 145
1,2,4-Trimethylbenzene	105	120
1,2-Dibromo-3-Chloropropane	75	155, 157
1,2-Dibromomethane	107	109
1,2-Dichloroethane	62	64,100,98
1,2-Dichloroethene	96	61,98
1,2-Dichloropropane	63	65,114
1,2-Dichlorotrifluoroethene	67	117
1,2-Difluorotetrachloroethene	101	103, 167
1,3,5-Trimethylbenzene	105	120
1,3-Dichlorobenzene	146	148, 111
1,4-Dichlorobenzene	146	148, 111
1,4-Dioxane	88	58
1-Chloropropane	63	78
1-Methylnaphthalene	142	141
1-Propene	41	42
2,2-Dichloropropane	77	97

TABLE 7 Characteristic Ions of Volatile Organic Compounds		
2,4,4-trimethyl-1-pentene	41	57, 97
2-Butanone	72	57
2-Chloroethyl vinyl ether	63	65, 106
2-Chloropropane	78	63
2-Chlorotoluene	91	126
2-Chloro-1,3-butadiene	88	53
2-Hexanone	43	58,100
2-Methylnaphthalene	142	141, 115
2-Nitropropane	39	42, 44
2-Octane	43	58
2-Octanol	45	55
4-Chlorotoluene	91	126
4-Methyl-2-Pentanone	43	58,100
Methacrylonitrile	67	41
Acetone	43	58
Acetonitrile	39	40, 41
Acrolein	56	55
Acrylonitrile	53	52
Allyl Alcohol	57	40, 39
Allyl Chloride	76	41
Amyl Acetate	43	70, 61
Benzene	78	--
Benzyl Chloride	91	126, 65
Bromobenzene	156	77, 158
Bromochloromethane	129	49, 130
Bromodichloromethane	83	85
Bromoform	173	171,175,
Bromomethane	94	96
Butyl Acetate	73	56, 43
Butyl Acrylate	73	56, 55
Butyl methacrylate	87	69
Camphene	93	121
Camphor	95	81
Carbon disulfide	76	78
Carbon tetrachloride	117	119,121
Chlorobenzene	112	114
Chloroethane	64	66
Chloroform	83	85
Chloromethane	50	52
Chlortrifluoroethene	116	118
cis-1,3-Dichloropropene	75	77

TABLE 7 Characteristic Ions of Volatile Organic Compounds		
Cyclohexane	56	84, 69
Cyclopentene	67	68, 68, 53
Dibromochloromethane	129	208,206
Dibromomethane	93	95, 174
Dichlorodifluoromethane	85	87
Dimethylnaphthalene (total)	141	156, 155
Epichlorohydrin	57	62, 49
Ethanol	46	45
Ethyl Acetate	70	61, 43
Ethyl Acrylate	55	56
Ethyl Ether	59	74, 75
Ethylbenzene	106	91,
Ethyl methacrylate	69	41, 99
Freon TF	101	103, 151, 85
Hexachlorobutadiene	225	223
Hexane	56	57, 86
Indan	117	118, 58
Iodomethane (methyl iodide)	142	127
Isobutyl Alcohol (Isobutanol)	43	41, 42
Isoprene	67	53, 59
Isopropanol	45	59
Isopropyl Acetate	43	61, 87
Isopropyl Ether (DIPE)	45	87
Isopropylbenzene	105	120
Methyl Acetate	43	74
Methyl Acrylate	55	85, 42
Methyl cyclohexane	83	55, 98
Methyl Methacrylate	100	69
Methyl tert-butyl ether (MTBE)	73	57
Methylene chloride	84	49,51,86
Methylnaphthalene (total)	142	141, 115
Naphthalene	128	--
n-Butanol	56	41, 43
n-Butylbenzene	91	92, 134
n-Heptane	57	43, 71
n-Pentane	72	57
N-Propanol	60	59
n-Propylbenzene	91	120
P-Isopropyltoluene`	119	134, 91
Propyl Acetate	43	61, 73
Propionitrile	54	52, 54

TABLE 7 Characteristic Ions of Volatile Organic Compounds		
sec-Butylbenzene	105	134
Styrene	104	78,103
Tert-Amyl Methyl Ether	73	55, 87
Tert-butyl Alcohol	59	--
Tert-Butyl Ethyl Ether	59	87
Tert-Butylbenzene	119	91, 134
Tetrachloroethene	164	129,131,166
Tetrahydrofuran	42	72, 71
Toluene	92	91
Total Xylenes	106	91
trans,-1,3-Dichloropropene	75	77
Trans-1,4-dichloro-2-butene	53	75
Trichloroethene	130	95,97,132
Trichlorofluoromethane	101	103
Vinyl acetate	43	86
Dichlorofluoromethane	67	69
Chlorotrifluoroethene	116	118
1,2-tetrachlorodifluoroethane	101	103,167
1,2-Dichlorotrifluoroethane	67	117
Vinyl chloride	62	64
Isooctane	57	41, 56
1- Chlorohexane	91	93, 55, 56
1,2,4,5-Tetramethylbenzene	119	134, 91
4-EthylToluene	105	120, 77
Chlorotrifluoroethylene	66	116,118,85
Freon 114	85	87,135,137
t-Amyl Alcohol	59	55, 73, 43
1,4-Difluorobenzene	114	63
1,4-Diethylbenzene	119	105,134
Freon 123a	67	69, 117, 119
Butadiene	54	53, 39
4-Bromofluorobenzene (sur)	95	174,176
1,2-Dichloroethane-d4 (sur)	65	102, 104
Toluene-d8 (sur)	98	70,100
Fluorobenzene (istd)	96	77
Chlorobenzene-d5 (istd)	117	82,119
1,4-Dichlorobenzene-d4 (istd)	152	115,150

APPENDIX I

Site Management Forms

SSDS Operations, Maintenance, and Monitoring Tracking Sheet

Date	Name / Company Completing Work	Associated Suction Pit/ Blower Unit	Photos or Sketches included with Event (Yes or No)	List of other Documents/ Forms / Receipts included with the Work	Summary of Activites/Maintenance/Adjustments

MONTHLY SSDS INSPECTION CHECKLIST

Site Name:	Greenpoint Ferry Site (BCP Site No. C224272)	Inspection Date:	
Street Address:	127-141 West Street (1 Java Street)		
Location:	Brooklyn, New York 11222	Inspection Personnel:	
System:	Active Sub-Slab Depressurization System		
Blower:	Obar GBR76UD		
Blower Range:	0-40 iwc vacuum, ~195 CFM max flow rate		

INSPECTION ITEM DESCRIPTION	Yes	No	Comments/ Actions Taken (list actions taken if "No" is checked)
Is the system operating normally?	___	___	_____
Are any warning lights on? (Please list those that are on)	___	___	_____
If there is an alarm condition, was it fixed and the system restarted?	___	___	_____
Are the blower enclosures in good condition?	___	___	_____
Are the valves (at blowers and aboveground piping) in good condition?	___	___	_____
Are vacuum/pressure gauges at blower operating properly?	___	___	_____
Is exterior piping free of cracks, leaks, and support issues?	___	___	_____
Is interior piping free of cracks, leaks, and support issues?	___	___	_____

List maintenance activities that were performed or other comments about the system: _____

Blower Influent*	Vacuum (iwc)	Comments
INF-1		
INF-2		
INF-3		
INF-4		
INF-5		

Blower Effluent*	Pressure (iwc)	Comments
EFF-1		
EFF-2		
EFF-3		
EFF-4		
EFF-5		

iwc - inches of water
* Refer to figure for locations of noted items

ANNUAL SITE INSPECTION CHECKLIST

Site Name:	Greenpoint Ferry Site (BCP Site No. C224272)	Inspection Date:	
Street Address:	127-141 West Street (1 Java Street)		
Location:	Brooklyn, New York 11222	Inspection Personnel:	
System:	Active Sub-Slab Depressurization System		
Blower:	Obar GBR76UD		
Blower Range:	0-40 iwc vacuum, ~195 CFM max flow rate		

INSPECTION ITEM DESCRIPTION	Yes	No	Comments/ Actions Taken (list actions taken if "No" is checked)
Is the system operating normally?	___	___	
Are any warning lights on? (Please list those that are on)	___	___	
If there is an alarm condition, was it fixed and the system restarted?	___	___	
Is the blower enclosure in good condition?	___	___	
Are the valves (at blower and aboveground piping) in good condition?	___	___	
Is the vacuum filter in good condition?	___	___	
Does the knock-out tank need to be drained? (Record amount drained)	___	___	
Are vacuum/pressure gauges at blower operating properly?	___	___	
Is exterior piping free of cracks, leaks, and support issues?	___	___	
Is interior piping free of cracks, leaks, and support issues?	___	___	

List maintenance activities that were performed or other comments about the system: _____

Blower Influent*	Vacuum (iwc)	Comments
INF-1		
INF-2		
INF-3		
INF-4		
INF-5		

ANNUAL SITE INSPECTION CHECKLIST		
Blower Effluent	**Pressure (iwc)**	**Comments**
EFF-1		
EFF-2		
EFF-3		
EFF-4		
EFF-5		
Soil Vapor Monitoring Point*	**Vacuum (iwc)**	**Comments**
SVMP-1		
SVMP-2		
SVMP-3		
SVMP-4		
SVMP-5		
SVMP-6		
SVMP-7		
SVMP-8		

iwc - inches of water
* Refer to figure for locations of noted items

BUILDING SLAB INSPECTION	**Comments / Actions Taken**
Describe General Condition of Slab	
Describe any Cracks or New Penetrations	
Describe any Patching	

ANNUAL SITE INSPECTION CHECKLIST	
REAR WATERFRONT INSPECTION	**Comments / Actions Taken**
Describe General Condition of Waterfront Area	
Describe any Cracks in Paved Areas, New Penetrations, Excavation, or Signs of Erosion	
INSTITUTIONAL CONTROLS	**Comments / Actions Taken**
Confirm Site Usage is Compliant with Recorded Institutional Controls	
SITE RECORDS	**Comments / Actions Taken**
Inspect On-Site Records and Confirm Records are Up To Date (e.g. Site Inspection Checklists, Sampling Logs etc.)	

Indoor Air / Soil Vapor Sampling Form

Date: _____ **Time:** _____

Weather : _____

Temperature: _____ Humidity: _____

Wind Magnitude: _____ Wind Direction: _____

Barometric Pressure: _____ Precipitation: _____

Sampling Team: _____

Sampling Location: _____

Site Condition (i.e. any adjacent questionable facilities, vent pipes, tanks, etc. and what type of basements are present)

_____

_____

_____

Prior to commencing the sampling activity, remove the brass cap from the end of the sample tubing and fit a new brass hose barb fitting onto the sample tubing.

Calibrate the Helium detection meter

Utility Clearance Completed: _____

Sampling Depth: _____ feet below land surface (If ambient air sample, elevate can to approx. 3 ft - 5 ft above land surface)

Sealed with bentonite: _____

Apparent Moisture Content: _____

Purge Rate: _____ Must be less than 0.2 L/min (200 mL/min)

Purge Time: _____

Helium Rate at enclosure: _____

Helium Rate from sample tubing: _____ Is this rate <10% of the rate at the enclosure **Yes / No**

If the Helium readings have a greater ratio than 10% the seals should be rechecked and the tracer gas should be reapplied.

Once the tracer gas screening procedures are completed and no short-circuiting is determined to be present at the location the soil vapor sample can be collected in a lab certified clean summa canister at a rate less than 0.2 L/min.

Is the Summa Canister Certified Clean and within the proper holding time ? Yes

Starting Pressure: _____ in. of Hg

Starting Time: _____

Ending Time: _____

Ending Pressure: _____ in. of Hg

Summa Canister Identification #: _____

Flow Regulator ID # _____

Sample ID # _____

Time _____

Analysis _____

Laboratory _____

ROUX

Well Sampling Data Form

Client: _____ **Project Number:** _____

Site Location: _____

Well No: _____ Weather: _____

Date: _____ Purge Water Disposal: _____

Sampled By: _____ Well Diameter / Type: _____

Depth of Well (ft): _____ Water Column (ft): _____

Depth to Water(ft): _____ Volume of Water in Well (gal) _____

Depth to Product (ft): _____ Volume of Water to Remove (gal): _____

well diameter:	1 in	2 in	4 in	6 in	8 in
gallons per foot:	0.041	0.163	0.653	1.469	2.611

Start Purging: _____ Purge Rate: _____

End Purging: _____ Volume of Water Removed (gal): _____

Method of Purge: _____ Method of Sampling: _____

Physical Appearance/ Comments: _____

Samples Collected: (analyses / no. bottles) _____

Time: _____ Laboratory : _____

Field Measurements:

Time	DTW ft	Flow Rate ml/min	ORP mV (+/- 10 mV)	Conductivity mS/m - S/m (w/in 3%)	Turbidity NTU (w/in %10)	pH SU (+/- 0.1)	Temperature C^o - F^o (w/in 3%)	Dissolved O_2 mg/L (w/in 10%)

ROUX

Summary of Green Remediation Metrics for Site Management

Site Name: _____ Site Code: _____
Address: _____ City: _____
State: _____ Zip Code: _____ County: _____

Initial Report Period (Start Date of period covered by the Initial Report submittal)
Start Date: _____

Current Reporting Period
Reporting Period From: _____ To: _____

Contact Information
Preparer's Name: _____ Phone No.: _____
Preparer's Affiliation: _____

I. Energy Usage: Quantify the amount of energy used directly on-site and the portion of that derived from renewable energy sources.

	Current Reporting Period	**Total to Date**
Fuel Type 1 (e.g. natural gas (cf))		
Fuel Type 2 (e.g. fuel oil, propane (gals))		
Electricity (kWh)		
Of that Electric usage, provide quantity:		
Derived from renewable sources (e.g. solar, wind)		
Other energy sources (e.g. geothermal, solar thermal (Btu))		

Provide a description of all energy usage reduction programs for the site in the space provided on Page 3.

II. Solid Waste Generation: Quantify the management of solid waste generated on-site.

	Current Reporting Period (tons)	**Total to Date (tons)**
Total waste generated on-site		
OM&M generated waste		
Of that total amount, provide quantity:		
Transported off-site to landfills		
Transported off-site to other disposal facilities		
Transported off-site for recycling/reuse		
Reused on-site		

Provide a description of any implemented waste reduction programs for the site in the space provided on Page 3.

III. Transportation/Shipping: Quantify the distances travelled for delivery of supplies and lab-supplied bottles, shipping of laboratory samples, and the removal of waste.

	Current Reporting Period (miles)	Total to Date (miles)
Standby Engineer/Contractor		
Laboratory Courier/Delivery Service (bottle and sample delivery)		
Waste Removal/Hauling		

Provide a description of all mileage reduction programs for the site in the space provided on Page 3. Include specifically any local vendor/services utilized that are within 50 miles of the site.

IV. Water Usage: Quantify the volume of water used on-site from various sources.

	Current Reporting Period (gallons)	Total to Date (gallons)
Total quantity of water used on-site (not including treated water)		
Of that total amount, provide quantity:		
Public potable water supply usage		
Surface water usage		
On-site groundwater usage		
Collected or diverted storm water usage		

Provide a description of any implemented water consumption reduction programs for the site in the space provided on Page 3.

V. Land Use and Ecosystems: Quantify the amount of land and/or ecosystems disturbed and the area of land and/or ecosystems restored to a pre-development condition (i.e. Green Infrastructure).

	Current Reporting Period (acres)	Total to Date (acres)
Land disturbed		
Land restored		

Provide a description of any implemented land restoration/green infrastructure programs for the site in the space provided on Page 3.

Description of green remediation programs reported above (Attach additional sheets if needed)
Energy Usage:
Waste Generation:
Transportation/Shipping:
Water usage:
Land Use and Ecosystems:
Recommendations/Other:

CONTRACTOR CERTIFICATION

I, _____ (**Name**) do hereby certify that I am _____ (**Title**) of _____ (**Contractor Name**), which is responsible for the work documented on this form. According to my knowledge and belief, all of the information provided in this form is accurate and the site management program complies with the DER-10, DER-31, and CP-49 policies.

_____

Date **Contractor**

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Request to Import/Reuse Fill or Soil

This form is based on the information required by DER-10, Section 5.4(e) and 6NYCRR Part 360.13. Use of this form is not a substitute for reading the applicable regulations and Technical Guidance document.

SECTION 1 – SITE BACKGROUND

Site Name:

Site Number:

The allowable site use is: Choose an item

Have Ecological Resources been identified? Choose an item

Is this soil originating from the site? Choose an item

How many cubic yards of soil will be imported/reused? Choose an item

If greater than 1000 cubic yards will be imported, enter volume to be imported:

SECTION 2 – MATERIAL OTHER THAN SOIL

Is the material to be imported gravel, rock or stone? Choose an item

Does it contain less than 10%, by weight, material that passes a size 100 sieve? Choose an item

Is this virgin material from a permitted mine or quarry? Choose an item

Is this material recycled concrete or brick from a DEC registered processing facility? Choose an item

SECTION 3 - SAMPLING

Provide a brief description of the number and type of samples collected in the space below:

Example Text: 5 discrete samples were collected and analyzed for VOCs. 2 composite samples were collected and analyzed for SVOCs, Inorganics & PCBs/Pesticides.

If the material meets requirements of DER-10 section 5.4(e)5 (other material), no chemical testing needed.

SECTION 3 CONT'D - SAMPLING

Provide a brief written summary of the sampling results or attach evaluation tables (compare to DER-10, Appendix 5):

Example Text: Arsenic was detected up to 17 ppm in 1 (of 5) samples; the allowable level is 16 ppm.

If Ecological Resources have been identified use the "If Ecological Resources are Present" column in Appendix 5.

SECTION 4 – SOURCE OF FILL

Name of person providing fill and relationship to the source:

Name and address of fill source:

Location where fill was obtained:

Identification of any state or local approvals as a fill source:

If no approvals are available, provide a brief history of the use of the property that is the fill source:

Provide a list of supporting documentation included with this request:

The information provided on this form is accurate and complete.

_____ _____

Signature Date

_____

Print Name

_____

Firm

APPENDIX J

Remedial System Optimization Table of Contents

APPENDIX [x]

REMEDIAL SYSTEM OPTIMIZATION TABLE OF CONTENTS

REMEDIAL SYSTEM OPTIMIZATION FOR [Site Name]

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