REMEDIAL INVESTIGATION WORK PLAN

2409 JEROME AVENUE
BRONX, NEW YORK
NYSDEC BCP Site No. C203087

Prepared For:

2409 Jerome, Inc.
29 East Fordham Road
Bronx, NY 10468

Prepared By:

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Langan Project No. 170390601

LANGAN

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CERTIFICATION

I, Michael D. Burke, certify that I am currently a Qualified Environmental Professional as defined in 6 New York Codes, Rules, and Regulations (NYCRR) Part 375 and that this Remedial Investigation Work Plan (RIWP) was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation (DER)-10 Technical Guidance for Site Investigation and Remediation.

Michael D. Burke, CHMM

1.0 INTRODUCTION

This Remedial Investigation Work Plan (RIWP) was prepared on behalf of 2409 Jerome, Inc. (the Applicant) for the property located at 2409 Jerome Avenue in the Fordham Heights neighborhood of the Bronx, New York (the site). The Applicant will implement the RIWP for New York State Brownfield Cleanup Program (BCP) Site No. C203087 pursuant to a Brownfield Cleanup Agreement (BCA) with the New York State Department of Environmental Conservation (NYSDEC) executed on April 3, 2017.

The objective of the scope of work defined in the RIWP is to investigate and characterize the nature and extent of environmental impacts at and emanating from the site and to provide sufficient information to evaluate remedial alternatives, as required. This RIWP was developed in accordance with the process and requirements identified in the NYSDEC Division of Environmental Remediation (DER)-10 *Technical Guidance for Site Investigation and Remediation* (May 2010) and the New York State Department of Health (NYSDOH) *Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (October 2006).

2.0 SITE BACKGROUND

2.1 Site Description

The site is located at 2409 Jerome Avenue in the Fordham Heights neighborhood of the Bronx, New York and is identified as Block 3199, Lots 106 and 113, on the Bronx Tax Map. A site location map is provided as Figure 1. The rectangular-shaped site encompasses an area of about 25,200 square feet (0.58 acres) and is occupied by an asphalt-paved parking lot (Lot 113) and two one-story structures used for automotive repair (Lot 106). One of the structures (the auto garage) is in use and it is expected to be in use during their regular business hours. The site is bound by a two-story commercial building (2415 Jerome Ave) followed by West Fordham Road to the north, Jerome Avenue to the east, a two-story academic facility (2375 Jerome Avenue) followed by West 184th Street to the south, and five-story multi-family residential buildings (2390-2410 Davidson Avenue) followed by Davidson Avenue to the west. A site plan is provided as Figure 2.

2.2 Surrounding Property Land Use

The site is located in a mixed-use area with commercial, residential, and industrial uses nearby. The following is a summary of surrounding property usage:

Direction	Adjoining and Adjacent Properties			Surrounding Properties
	Block No.	Lot No.	Description	
North	3199	105	Two-story commercial building (2415 Jerome Avenue)	Commercial and industrial buildings
East	3188	7	Jerome Avenue and an elevated "No. 4" train subway line followed by a three-story medical center (2386 Jerome Avenue)	Multi-family residential buildings
		8	Jerome Avenue and an elevated "No. 4" train subway line followed by a one-story school office building (2392 Jerome Avenue)	
		14	Jerome Avenue and an elevated "No. 4" train subway line followed by a playground (2400 Jerome Avenue)	
		20	Jerome Avenue and an elevated "No. 4" train subway line followed by a three-story elementary school (2418 Jerome Avenue)	
South	3199	118	Two-story Monroe College building (Ustin Hall) (2375 Jerome Avenue)	West 184th Street followed by commercial and residential buildings
West	3199	59	Five-story multi-family residential building (2390 Davidson Avenue)	Davidson Avenue followed by multi-

Direction	Adjoining and Adjacent Properties			Surrounding Properties
	Block No.	Lot No.	Description	
		62	Five-story multi-family residential building (2400 Davidson Avenue)	family residential buildings
		66	Five-story multi-family residential building (2410 Davidson Avenue)	

Public infrastructure (storm drains, sewers, and underground utility lines) exists within the streets surrounding the site.

Land use within a half-mile radius is urban and includes residential, industrial, and commercial buildings, public parks, and school facilities. The nearest ecological receptors are the Harlem River, located about 3,000 feet northwest of the site, and the Jerome Park Reservoir, located about 4,000 feet north of the site. Sensitive receptors, as defined in DER-10, located within a half mile of the site include those listed below:

Number	Name (Approximate distance from site)	Address
1	PS 033 Timothy Dwight (about 0.1 mile east of the site)	2424 Jerome Avenue Bronx, NY 10468
2	Paul T. Matson Head Start (about 0.1 mi east of the site)	2341 Morris Avenue Bronx, NY 10468
3	Academy for Personal Leadership and Excellence (approximately 0.2 miles southeast)	100 East 184th Street (about 0.1 mile southeast of the site)
4	Tolentine Zeiser Community Life Senior Center and Headstart (about 0.1 mile west of the site)	2435 University Avenue Bronx, NY 10468
5	J.A.D.S. Children Center Inc. (about 0.1 mile southeast of the site)	2403 Grand Concourse Bronx, NY 10468
6	La Casita Group Family Day Care (approximately 0.1 miles northwest)	2424 Davidson Avenue Bronx, NY 10468
7	ABC Training Center (approximately 0.1 miles northeast)	2471 Morris Avenue 2nd Floor Bronx, NY 10468
8	My Little Life Day Care (approximately 0.1 miles north)	2460 Grand Ave. Bronx, NY 10468
9	3 A's Family Daycare	2361 Morris Ave Bronx, NY 10468

Number	Name (Approximate distance from site)	Address
10	Monroe College (approximately 0.2 miles north)	2501 Jerome Avenue Bronx, NY 10468
11	East Fordham Academy for the Arts (approximately 0.2 miles southeast)	120 E 184th St. Bronx, NY 10468
12	Academy for Personal Leadership and Excellence (approximately 0.2 miles southeast)	100 East 184th Street (about 0.1 mile southeast of the site)
13	Saint Dominic's Home (approximately 0.2 miles west)	2341 Dr. Martin Luther King Jr. Blvd Bronx, NY 10468
14	New York Language Center – Bronx (approximately 0.3 miles east)	2450 Grand Concourse Bronx, NY 10458
15	Cribs to Crayons Group Daycare Inc. (approximately 0.2 miles north)	30 W 190th St Bronx, NY 10468
16	Educating Young One's Daycare (approximately 0.2 miles north)	30 W 190th St Bronx, NY 10468
17	Brittany Beauty School (approximately 0.3 miles east)	210 E 188th St. #2 Bronx, NY 10458
18	I.S. 206 Ann Mersereau (approximately 0.3 miles southwest)	2280 Aqueduct Avenue Bronx, NY 10468
19	P.S. 315 Lab School (approximately 0.3 miles south)	2246 Jerome Avenue Bronx, NY 10468
20	Lion of Judah Academy (approximately 0.3 miles west)	2336 Andrews Ave N Bronx, NY 10468
21	Sweet Baby Day Care (approximately 0.3 miles west)	2272 University Ave Bronx, NY 10468
22	Lil Inventors Child Care (approximately 0.3 miles west)	2260 Andrews Ave N Bronx, NY 10468
23	P.S. 091 Bronx (approximately 0.4 miles southwest)	2170 Aqueduct Avenue Bronx, NY 10453
24	Bronx Day Care Center (approximately 0.4 miles east)	331 E 187th St Bronx, NY 10458
25	Rising Stars Daycare / After School Program (approximately 0.4 miles southwest)	2170 University Avenue Bronx, NY 10453
26	Round the Clock Nursery (approximately 0.4 miles southeast)	2380 Marion Ave Bronx, NY 10458

Number	Name (Approximate distance from site)	Address
27	Arcadia Children's Daycare (approximately 0.4 miles south)	2195 Grand Concourse Bronx, NY 10453
28	A Better Start (approximately 0.4 miles southeast)	2339 Tiebout Ave Bronx, NY 10458
29	PS X015 Institute for Environmental Learning (approximately 0.5 miles southwest)	2195 Andrews Avenue Bronx, NY 10453
30	P.S. 291 (approximately 0.5 miles southwest)	2195 Andrews Avenue Bronx, NY 10453
31	P.S. 9 Ryer Avenue Elementary School (approximately 0.5 miles southeast)	230 East 183rd Street Bronx, NY 10458
32	P.S. 85 (approximately 0.5 miles southeast)	2400 Marion Avenue Bronx, NY 10458
33	P.S. 209 Margaret Mead (approximately 0.5 miles southeast)	313 E 183rd St Bronx, NY 10458
34	Creston Academy (approximately 0.5 miles south)	125 E 181st St Bronx, NY 10453
35	Elementary School for Math, Science, and Technology (approximately 0.5 miles south)	125 E 181st St Bronx, NY 10453
36	School for Environmental Citizenship (approximately 0.5 miles south)	125 E 181st St Bronx, NY 10453
37	Aileen Family Daycare Inc. (approximately 0.5 miles south)	212 E 182nd St #2F Bronx, NY 10457
38	Miss Francine Day School II (approximately 0.5 miles south)	2169 Grand Concourse Bronx, NY 10453

2.3 Site Physical Conditions

2.3.1 Topography

According to a survey prepared by Langan, dated December 17, 2015, surface elevations range from about 111.5 to 115 feet.[1] The topography of the site is generally level.

[1] Elevations in this RIWP refer to North American Vertical Datum of 1998 (NAVD88), which is about 1.1 feet above mean sea level at Sandy Hook, NJ.

2.3.2 Site Geology

Based on borings advanced by Langan during environmental and geotechnical investigations in December 2015 and January 2016, the stratigraphy underlying the site consists of a layer of historic fill material that extends to depths of up to about 9 feet below grade surface (bgs), followed by native soil and bedrock. The historic fill consists of brown-black, fine to medium sand with varying amounts of silt, clay, gravel, and anthropogenic material (brick, concrete, asphalt, glass, and coal). Native soil (till) underneath historic fill material consists of a layer of gray-brown clay with varying amounts of sand and silt, followed by a layer of brown-black, medium to fine sand with varying amounts of gravel, silt, and clay. Bedrock, consisting of fine-grained biotite-quartz gneiss, was encountered at about 15 to 18 feet bgs; bedrock is weathered near the contact with the overburden soil in isolated locations.

2.3.3 Hydrogeology

Groundwater flow is typically topographically influenced, as shallow groundwater tends to originate in areas of topographic highs and flows toward areas of topographic lows, such as rivers, stream valleys, ponds, and wetlands. A broader, interconnected hydrogeologic network often governs groundwater flow at depth or in the bedrock aquifer. Groundwater depth and flow direction are also subject to hydrogeologic and anthropogenic variables such as precipitation, evaporation, extent of vegetation cover, coverage by impervious surfaces, and subsurface structures. Other factors influencing groundwater include depth to bedrock, the presence of anthropogenic fill, and variability in local geology and groundwater sources or sinks.

Infiltration of precipitation to the water table is likely minimal due to the presence of impervious or semi-impervious surfaces throughout the site, including a concrete building slab and asphalt-paved parking lot. The majority of runoff drains to city sewers and then to one of the several wastewater treatment plants that serve the city. Groundwater in New York City is not used as a potable water source. Potable water provided to the City of New York is derived from surface impoundments in the Croton, Catskill, and Delaware watersheds.

Based on a synoptic gauging event of two monitoring wells on December 21, 2015, depth to groundwater ranges from about 9.63 feet bgs (about el. 103 feet) to 10.00 feet bgs (about el. 102 feet). Poor recharge experienced during previous groundwater sampling indicates shallow groundwater is likely perched on the bedrock surface. Groundwater within bedrock is expected at about 100 feet bgs given the site's elevation and regional hydrology and is expected to flow to the west towards the Harlem River, which is located about 3,000 feet west of the site.

2.3.4 Wetlands

Wetlands on or near the site were evaluated by reviewing the National Wetlands Inventory and NYSDEC regulated wetlands map. There are no wetlands on or adjacent to the site. The nearest wetland to the site is the Jerome Park Reservoir, which is located about 4,000 feet north of the site.

2.4 Summary of Previous Environmental Investigations

Previous environmental reports were reviewed as part of this RIWP. These reports are summarized below and are included in Appendix A.

- *Phase I Environmental Site Assessment (ESA), prepared by Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C. (Langan), dated May 11, 2016*
- *Phase II Environmental Site Investigation (ESI), prepared by Langan, dated May 11, 2016*

Phase I ESA, prepared by Langan, dated May 11, 2016

The Phase I ESA was prepared in accordance with the ASTM International Standard E1527-13 and the United States Environmental Protection Agency (USEPA) All Appropriate Inquiry Rule (40 Code of Federal Regulations [CFR] Part 312) and included a site reconnaissance, a review of environmental databases, a review of historical maps, and an interview with the property owner's representative. The following recognized environmental conditions (RECs) were identified:

- The former and current tenants of Lot 106 include a "greasing and auto laundry" facility, a term formerly used to describe auto repair facilities (circa 1945 to 1989), auto repair and gasoline filling stations (circa 1927 to 1989) with thirteen closed/removed 550-gallon gasoline underground storage tanks (USTs) and one closed/removed 4,000-gallon gasoline UST, and auto repair facilities (circa 1989 to the present). Lot 113 was used as a parking lot from circa 1945 to the present.
- A NYSDEC petroleum spill case (#97-00644) was associated with a former BP Amoco station at 2350 Jerome Avenue, which is about 400 feet south and hydraulically cross-gradient of the site. This site was investigated and subject to multiple remediation efforts by various consultants since 1997. Although petroleum-contaminated soil was removed to bedrock and efforts were made to employ different remedial technologies to address persistent groundwater contamination, at the time the Phase I ESA was issued, groundwater (in particular bedrock groundwater) appeared to still be impacted

by gasoline constituents, including benzene, toluene, ethyl benzene and xylene (BTEX) and methyl-tert-butyl ether (MTBE). The spill case was subsequently closed on September 14, 2016, about four months after the Phase I ESA was issued.

- The historical use of the adjoining properties included a paint company, battery and ignition service station, laundromat, manufacturing facility, auto parts and repair companies, and a filling station.

Phase II ESI, prepared by Langan, dated May 11, 2016

Langan completed a Phase II ESI to evaluate potential subsurface impacts associated with the RECs identified in the Phase I ESA. The investigation consisted of a geophysical survey, completion of eight soil borings, installation of three groundwater monitoring wells and three soil vapor points, and collection and laboratory analysis of soil, groundwater, and soil vapor samples. The findings of the investigation include:

- The geophysical survey identified multiple utility lines, including water, sewer, gas, and electric. Several scattered and minor anomalies were identified with the highest density near the northern half of the site. Subsurface anomalies with reflections or signatures consistent with USTs were not identified. The geophysical survey did not cover the existing building/structures at the site.
- A historic fill layer (up to 9 feet thick) composed of brown-black, fine to medium sand and varying amounts of silt, clay, gravel, and anthropogenic material (brick, concrete, asphalt, glass, and coal) was encountered beneath the asphalt pavement.
- Polycyclic aromatic hydrocarbons (PAHs) and metals typically found in historic fill in urban environments were identified at concentrations above the Title 6 New York Codes Rules and Regulations (NYCRR) Part 375-6.8(a,b) Unrestricted Use and/or Restricted Use-Commercial Soil Cleanup Objectives (SCOs). The fill material is underlain by till (glacial deposits) followed by bedrock.
- Several petroleum-related volatile organic compounds (VOCs) were detected at concentrations above the Unrestricted Use and Protection of Groundwater SCOs in five borings.
- Visual, olfactory, and photoionization detector (PID) evidence of residual petroleum impacts were apparent in several borings, and petroleum-like staining, odors, and elevated PID readings were generally observed from below surface cover to about 16 feet bgs (i.e., at the boring completion depth). Petroleum non-aqueous phase liquid (NAPL) was apparent at Lot 106. The petroleum NAPL present in soil is consistent with gasoline based on a fingerprint analysis.

- The depth to groundwater ranged from about 9.63 feet bgs (about el. 103 feet) to 10.00 feet bgs (about el. 102 feet).
- Several petroleum-related VOCs (e.g. benzene, toluene, ethylbenzene, xylene [BTEX]) were detected at concentrations exceeding the 6 NYCRR Part 703.5 Water Quality Standards for Class GA waters and the NYSDEC Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values (SGVs) for Class GA water (collectively referred to as the "NYSDEC SGVs"). Several SVOCs and metals were also detected at concentrations exceeding the NYSDEC SGVs.
- Several petroleum-related VOCs were detected in one or more of the soil vapor samples. Tetrachloroethylene (PCE) was detected in the soil vapor sample, SV03.

Based on the field observations and detections of VOCs in soil, groundwater, and soil vapor indicate a petroleum release in the central and northern portions of the property near the closed and removed USTs locations. In accordance with Article 12 of New York State Navigation Law, a petroleum spill was reported to the NYSDEC Spills Hotline and NYSDEC Spill No. 1509511 was assigned to the incident.

The soil, groundwater, and soil vapor results are presented in Figures 3, 4, and 5, respectively. The full laboratory analytical data reports for soil, groundwater, and soil vapor are included in Appendix G of the Phase II ESI report, which is included in Appendix A.

2.5 Areas of Concern

Based on the history of the site and the findings of the previous studies, the areas of concern (AOCs) to be further investigated by the RI, shown on Figure 6, are as follows:

AOC 1: Site Use

The site has operated as an auto repair business and a parking lot since at least 1989. Petroleum bulk storage associated with site use includes an out-of-service 550-gallon waste oil UST located in the main auto garage and a 50-gallon transmission fluid AST located in the single car garage. Releases of petroleum products or solvents associated with current operations and petroleum bulk storage may have adversely impacted soil, soil vapor, and/or groundwater.

AOC 2: Petroleum-Impacted Soil, Groundwater, and Soil Vapor

The 2015 Phase II ESI identified residual petroleum-impacted soil (including NAPL), groundwater, and soil vapor in the northeastern part of the site. The residual petroleum-impacted material is likely related to releases associated with historical site use and petroleum bulk storage and is associated with NYSDEC Spill No. 1509511. The site was historically used as a greasing and auto laundry facility (circa 1945 to 1989) and filling station (circa 1927 to 1989)

with thirteen closed 550-gallon USTs and one closed 4,000-gallon gasoline UST (PBS Facility No. 2-188492). The thirteen 550-gallon gasoline USTs and the one 4,000-gallon gasoline UST associated with the former gasoline filling station were decommissioned and removed in 1989 after title of the property was transferred to the current owner.

AOC 3: Historical Use of Adjoining Properties

Historical uses of adjoining properties include a paint company and battery and ignition service station adjoining to the north, a paint company and a manufacturing facility adjoining to the east, and an auto parts company, a glass company, and a filling station and auto repair business adjoining to the south. Historical releases of petroleum, solvents, and/or other chemicals from these properties may have migrated to and adversely impacted groundwater and/or soil vapor at the site.

AOC 4: Historic Fill

Historic fill material from an unknown source was used as backfill during various phases of the site development history. Historic fill was identified up to 9 feet bgs and is composed of brown-black, fine to medium sand with varying amounts of silt, clay, gravel, and anthropogenic material (brick, concrete, asphalt, glass, and coal). Contaminants associated with historic fill were identified in surficial soil samples, including concentrations of PAHs and metals exceeding the Unrestricted Use and/or Commercial SCOs.

3.0 SCOPE OF WORK

The objective of this RIWP is to investigate and characterize "the nature and extent of the contamination at and/or emanating from a brownfield site," per Environmental Conservation Law Article 27, Title 14 (Brownfield Cleanup Program). The field investigation will include the tasks summarized below to supplement the data and findings of the previous environmental investigation. The rationale for each sampling location in relation to the AOCs and analytical parameters for each proposed sample are provided in Table 1. These tasks are discussed in more detail in the following sections.

Geophysical Survey

- The survey will attempt to locate any unidentified USTs and underground structures and identify utilities in the vicinity of proposed sampling locations.

Soil Borings and Sampling

- Advance nine soil borings to bedrock
- Collect up to six soil samples from each soil boring location for a total of up to 54 soil samples (plus quality assurance/quality control [QA/QC] samples) for laboratory analysis

Monitoring Well Installation and Sampling

- Install and develop ten permanent monitoring wells and one bedrock well
- Collect one groundwater sample from the three existing monitoring wells[2] for laboratory analysis
- Collect one groundwater sample from each newly-installed monitoring well (plus QA/QC samples) for laboratory analysis
- Survey and gauge existing and newly-installed monitoring wells to evaluate groundwater elevations and flow direction

Soil Vapor, Sub-slab Vapor, and Indoor and Ambient Air Sampling

- Install one sub-slab vapor point in the one-story auto garage and five new soil vapor points (including duplicate QA/QC point) across the exterior areas of the site
- Collect one vapor sample from each vapor point and one indoor air sample

[2] Existing monitoring wells include MW01, MW02, and MW03.

- Collect QA/QC samples (duplicate and outdoor ambient air) for laboratory analysis

Off-site Soil Vapor Intrusion Investigation

- Install up to two sub-slab vapor points at each of the five adjoining buildings to the west and south
- Collect sub-slab vapor samples, each with a concurrent indoor air sample and QA/QC samples for laboratory analysis

This RIWP was designed to allow for real-time decision making in the field and additional soil, groundwater and/or soil vapor samples may be required: (1) in the event unexpected contamination is encountered in the field or exhibited by lab data; (2) due to site operations, equipment or restrictions; and (3) to adequately characterize and delineate impacts related to AOCs in compliance with the Brownfield Cleanup Program legislation, regulations and applicable investigation guidance documents (e.g., DER-10). Decisions to collect additional data may be based on field observations and/or preliminary laboratory data received during the investigation. The NYSDEC Project Manager will be consulted, as reasonable, to inform this decision making process. In addition, modifications to the scope of work presented above may be required because of site operations, equipment or restrictions.

The field investigation will be completed in accordance with the procedures specified in the Health and Safety Plan (HASP) and Quality Assurance Project Plan (QAPP) included as Appendices B and C, respectively. A Community Air Monitoring Plan will be implemented during this investigation (see Section 3.8.2).

The names, contact information and roles of the principal personnel who will participate in the investigation, including NYSDEC/NYSDOH personnel, project managers, and subcontractors are listed below. Resumes for Langan employees involved in the project are included in the QAPP (Appendix C).

Personnel	Investigation Role	Contact Information
Michael Burke, CHMM Langan Engineering	Qualified Environmental Professional	Phone – 212-479-5413 Email – mburke@langan.com
Jason Hayes, P.E. Langan Engineering	Project Engineer	Phone – 212-479-5427 Email – jhayes@langan.com
Ilkay Cam-Spanos Langan Engineering	Senior Project Manager	Phone – 212-479-5410 Email – icam@Langan.com
Greg Wyka Langan Engineering	Project Manager	Phone – 212-479-5476 Email – gwyka@langan.com
Tony Moffa, CHMM Langan Engineering	Langan Health & Safety Officer	Phone – 215-491-6500 Email – tmoffa@langan.com
Bill Bohrer	Field Safety Officer	Phone – 410-984-3068

Personnel	Investigation Role	Contact Information
Langan Engineering		Email – wbohrer@langan.com
Shana Holberton Langan Engineering	Quality Assurance Officer	Phone – 212-479-5499x5750 Email – sholberton@langan.com
Monika Boguszewski Langan Engineering	Field Team Leader	Phone – 212-479-5527 Email – mboguszewski@langan.com
Steve Plofker AARCO Environmental	Drilling Contractor	Phone – 631-586-5900 Email – splofker@aarcoenvironmental.com
Ben Rao Alpha Analytical	Laboratory Contractor	Phone – 201-847-9100 Email – brao@alphalab.com
Emily Strake Langan Engineering	Program Quality Assurance Monitor/ Data Validator	Phone – 215-491-6526 Email – estrake@langan.com

3.1 Geophysical Survey

We will coordinate with a geophysical contractor to clear subsurface testing locations of potential subsurface utilities and to locate any USTs. The geophysical survey will be completed using a collection of geophysical instruments, including electromagnetic and utility line locator instruments and ground-penetrating radar (GPR). The results of the survey may require relocating subsurface testing locations.

3.2 Soil Investigation

Soil Boring Installation

A drilling subcontractor will advance at least nine soil borings (designated SB09 through SB17) to further investigate the AOCs identified in Section 2.5 and supplement the subsurface investigation performed by Langan in December 2015. Two of these borings will be installed off-site to support an off-site exposure assessment. Each soil boring will terminate at the bedrock surface. A plan showing the proposed boring locations is included as Figure 7. Table 1 indicates the borings that are intended to investigate each AOC.

The soil borings will be advanced using direct-push drilling technology by an experienced environmental driller. The direct-push drill rig will be equipped with a closed-point MacroCore sampler or dual-tube sampling system to prevent the collapse of sidewall material as the borings. A Langan field engineer, scientist or geologist will document the work, screen soil samples for environmental impacts, and collect representative environmental soil samples for laboratory analyses. Soil will be screened continuously to the boring termination depth for organic vapors with a PID equipped with a 10.6 electron volt (eV) bulb and for visual and olfactory evidence of environmental impacts (e.g., NAPL, staining and/or odor). Soil will be visually classified for color, grain size, texture, and moisture content, and will be recorded in a field log. Work will comply with the safety guidelines outlined in the HASP in Appendix B.

Non-disposable, down-hole drilling equipment and sampling apparatus will be decontaminated between locations with Alconox® and water.

Soil Sampling and Analysis

Up to six grab soil samples will be collected for laboratory analysis from each boring location.

- One sample will be collected from the upper 6 inches of soil recovered from the boring.
- One to two samples will be collected between 6 and 24 inches below grade, based on recovery at each boring location.
- One sample will be collected from the historic fill layer above the bedrock and below 24 inches below grade.
- One sample will be collected from the capillary fringe above the groundwater interface or from the interval immediately above bedrock, if groundwater is not encountered.
- One sample will be collected from the interval exhibiting the greatest degree of contamination, where observed (based on the presence of staining, odor, and/or PID readings above background).

The proposed soil samples are summarized in Table 1. Depending on the site conditions (e.g., shallower-than-expected bedrock, historic fill depth, absence of impacts, etc.), the number of samples collected at each boring may vary.

The samples will be collected in laboratory-supplied containers and will be sealed, labeled, and placed in an ice-chilled cooler (to maintain a temperature of about 4°C) for delivery to a NYSDOH Environmental Laboratory Approval Program (ELAP)-certified laboratory. Soil samples will be analyzed using the latest USEPA methods as follows:

- Target Compound List (TCL) VOCs by USEPA methods 8260C/5035
- TCL SVOCs by USEPA method 8270D
- Polychlorinated biphenyls (PCBs) by USEPA method 8082A
- Target Analyte List (TAL)/Part 375 List metals (including cyanide and hexavalent and trivalent chromium) by USEPA Methods 6010C/7471B/9010C/7196A.
- Pesticides and herbicides by USEPA methods 8081B and 8151A, respectively

Relevant QA/QC procedures to be followed are described in the QAPP in Appendix C.

3.3 Groundwater Investigation

Monitoring Well Installation

Ten permanent groundwater monitoring wells will be installed during the investigation. A plan showing the proposed well locations is included as Figure 7. Table 1 indicates the wells that are intended to investigate each AOC. Seven of the nine soil borings will be converted into monitoring wells, two of which will be installed off-site. Four additional permanent groundwater monitoring wells will be installed, one of which will be installed as a bedrock well. Soil samples will not be collected during installation of these four monitoring wells because they will be located in the vicinity of areas where samples were collected during previous locations. Monitoring well locations will be numbered in conjunction with their respective soil boring numbers, and prefixed with "MW." Soil conditions will be screened and logged as described in Section 3.2. Wells will be constructed across the observed water table. The wells will be constructed with 2-inch diameter, threaded, flush-joint, polyvinyl chloride (PVC) casing and 0.01-inch slot well screens. Clean sand (e.g., No. 1 or No. 2) will be used to fill the annulus around the screen up to about two feet above the top of the screened interval. A two-foot bentonite seal will be installed above the sand and the borehole annulus will be grouted to the surface with bentonite/cement slurry.

The bedrock well will be installed into bedrock using an appropriate drill rig by advancing steel protective casing at least 5 feet into bedrock, grouting the annulus outside the casing within the borehole up to the ground surface, and coring another 5 feet into rock starting at the bottom of the casing. The targeted depth of the well will be about 10 feet below the bedrock surface. A 5-foot 0.01-inch slot PVC well screen will be placed within the cored bedrock interval and will be connected to a solid PVC riser. Clean sand (e.g., No. 1 or No. 2) will be used to fill the inner annulus around the PVC well screen and riser. The bedrock monitoring well will be designated BRW01.

After installation, the new and existing wells will be developed by surging either a weighted bailer or surge block across the well screen/casing to agitate and remove fines. The bailer or surge block will be surged across the well screen in two to three foot increments for about two minutes per increment. After surging, the well will be purged via pumping until the water becomes visually clear. The well will then be allowed to stabilize for a minimum of one week. The bedrock well will be developed by surging with a surge block.

Groundwater Sampling and Analysis

Before sampling, the headspace of each well will be monitored with a PID and the wells will be gauged and purged. Each well will be gauged with an interface probe to determine the depth to groundwater and thickness of any NAPL (light non-aqueous phase liquid [LNAPL] or dense non-aqueous phase liquid [DNAPL]). If NAPL is encountered, representative samples of the product will be collected for laboratory fingerprint analysis.

One groundwater sample will be collected from each existing and newly-installed well in general accordance with NYSDEC DER-10 and USEPA's *Low Flow Purging and Sampling Procedures for the Collection of Groundwater Samples from Monitoring Wells*. The proposed groundwater samples are summarized in Table 1. Groundwater samples will be collected about one week after new wells are installed. No groundwater samples will be collected from monitoring wells containing NAPL. Before the groundwater samples are collected, wells will be gauged and then, provided no NAPL is present, continuously purged until groundwater quality parameters (pH, conductivity, turbidity, dissolved oxygen, temperature, and oxidation-reduction potential) stabilize, to the extent practical, in accordance with the USEPA low-flow guidance. A multi-parameter water quality system will be used to monitor the groundwater quality parameters during sampling. Samples will be collected with a submersible pump or equivalent and dedicated polyethylene tubing. The pump will be decontaminated with Alconox® and water between each sample location. Development and purge water will be containerized into United Nations/Department of Transportation (UN/DOT)-approved 55-gallon drums, labeled, and staged for off-site disposal.

The groundwater samples will be collected in laboratory-supplied containers and will be sealed, labeled, and placed in an ice-chilled cooler (to maintain a temperature of about 4°C) for delivery to the laboratory. Groundwater samples will be analyzed using the latest USEPA methods as follows:

- TCL VOCs by USEPA method 8260C
- TCL SVOCs by USEPA method 8270D (1,4-dioxane by 8270 SIM isotope dilution)
- PCBs by USEPA method 8082A
- Metals (filtered and unfiltered) by USEPA method 6010C/7470
- Pesticides and herbicides by USEPA methods 8081B and 8151A, respectively
- Per- and poly-fluoroalkyl substances (PFAS) by USEPA method 537 Rev 1.15[3]

QA/QC procedures to be followed are described in the QAPP in Appendix C.

3.4 Soil Vapor and Sub-slab Vapor Investigation

Soil Vapor and Sub-slab Vapor Point Installation

[3] Groundwater samples from eight monitoring wells, including MW01, MW04, MW09, MW10, MW12, MW13, MW14 and MW15, will be analyzed for PFAS.

Five soil vapor points and one sub-slab vapor point will be installed using direct-push technology in accordance with the NYSDOH's *Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (October 2006). A plan showing the proposed soil vapor and sub-slab vapor locations is included as Figure 7. Table 1 indicates the vapor points that are intended to investigate each AOC. The sub-slab vapor point will be installed 2 inches below the auto garage's building slab using a concrete core or hammer drill. Soil vapor points will be installed by advancing a probe/implant to the anticipated depth of proposed foundation footings, if known at the time of the investigation, or to about 2 feet above the groundwater table.

The soil vapor and sub-slab vapor collection points will consist of a 1.875-inch polyethylene implant with inert sample tubing (i.e., polyethylene or Teflon) and inert sample tubing only, respectively. The annulus (i.e., the sampling zone) around the soil vapor implant and tubing will be filled with a clean, coarse sand pack followed by a hydrated bentonite seal to surface grade. Hydrated bentonite will also be used to create a seal around the tubing at the surface of the sub-slab vapor point.

Soil Vapor and Sub-slab Vapor Sampling and Analysis

Samples will be collected in general accordance with the NYSDOH guidance. The proposed vapor samples are summarized in Table 1. Before collecting vapor samples, a minimum of three vapor probe volumes (i.e., the volume of the sample implant and tubing) will be purged from each sample point at a rate of less than 0.2 liters per minute using a RAE Systems MultiRAE® meter. The purged soil vapor will be monitored for VOCs and methane with the MultiRAE® during purging.

A helium tracer gas will be used in accordance with the NYSDOH protocols to serve as a QA/QC technique to document the integrity of each soil vapor and sub-slab vapor sampling point seal before and after sampling. The tracer gas will be introduced into a container, which will shroud the vapor point and seal. Helium will be measured from the sampling tube and inside the container. If the sample tubing contains more than 10% of the tracer gas concentration that was introduced into the container, then the seal is considered compromised and should be enhanced or reconstructed to reduce outdoor air infiltration.

A log sheet for each soil vapor sample will be completed to record sample identification, date and time of sample collection, sampling depth, name of the field engineer responsible for sampling, sampling methods and equipment, vapor purge volumes, volume of vapor extracted, flow rate; and vacuum of canisters before and after sample collection.

After integrity of each seal is confirmed, soil vapor samples will be collected into laboratory-supplied batch-certified clean 2.7- or 6-liter Summa® canisters with calibrated flow controllers.

Sub-slab vapor and soil vapor samples will be collected over an 8-hour sampling period and analyzed for VOCs by USEPA Method TO-15.

Indoor and Ambient Air Sampling

An indoor air sample and ambient air sample will be collected at a height above the ground to represent the breathing zone (about 3 to 5 feet). The indoor air sample will be co-located with the sub-slab vapor sample within the auto garage. The air samples will be collected over an 8-hour sampling period (concurrently with the soil vapor and sub-slab vapor samples) and analyzed for VOCs by USEPA TO-15 to evaluate potential outdoor air interferences with the sampling apparatus.

QA/QC procedures to be followed are described in the QAPP in Appendix C.

3.5 Off-site Vapor Intrusion Investigation

Sub-slab Vapor Point Installation

An off-site vapor intrusion investigation will be performed at five adjoining properties to the south and west, contingent on site access. Up to two sub-slab vapor points will be installed in the adjoining building to the south and each of the four adjoining buildings to the west. The sub-slab soil vapor points will be installed to about 2 inches beneath the base of the building slab using a concrete core or hammer drill in accordance with the NYSDOH's *Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (October 2006). The sub-slab vapor collection points will consist of inert sample tubing (i.e., polyethylene or Teflon). Hydrated bentonite will be used to create a seal around the tubing at the surface of the sub-slab vapor point. A plan showing the proposed sampling areas is included as Figure 8. Sampling locations will be determined in the field after inspections of the properties have been conducted.

Sub-Slab Vapor Sampling and Analysis

Samples will be collected in general accordance with the NYSDOH guidance. The proposed sub-slab vapor samples are summarized in Table 1. Before collecting vapor samples, a minimum of three vapor probe volumes (i.e., the volume of the tubing) will be purged from each sample point at a rate of less than 0.2 liters per minute using a RAE Systems MultiRAE® meter. The purged vapor will be monitored for VOCs with the MultiRAE® during purging.

A helium tracer gas will be used in accordance with the NYSDOH protocols to serve as a QA/QC technique to document the integrity of each sub-slab vapor sampling point seal before and after sampling. The tracer gas will be introduced into a container, which will shroud the vapor point and seal. Helium will be measured from the sampling tube and inside the

container. If the sample tubing contains more than 10% of the tracer gas concentration that was introduced into the container, then the seal is considered compromised and should be enhanced or reconstructed to reduce outdoor air infiltration.

A log sheet for each sub-slab vapor sample will be completed to record sample identification, date and time of sample collection, sampling depth, name of the field engineer responsible for sampling, sampling methods and equipment, vapor purge volumes, volume of vapor extracted, flow rate; and vacuum of canisters before and after sample collection.

After integrity of each seal is confirmed, sub-slab vapor samples will be collected into laboratory-supplied batch-certified clean 2.7- or 6-liter Summa® canisters with calibrated flow controllers. Sub-slab vapor samples will be collected over a 24-hour sampling period and analyzed for VOCs by USEPA Method TO-15.

Indoor and Ambient Air Sampling

Indoor and ambient air samples will be collected at a height above the ground to represent the breathing zone (about 3 to 5 feet). An indoor air sample will be co-located with each sub-slab vapor sample. One ambient air sample will be collected west of the site along Davidson Avenue, and one ambient air sample will be collected south of the site along Jerome Avenue. The indoor and ambient air samples will be collected over a 24-hour sampling period (concurrently with the sub-slab vapor samples) and analyzed for VOCs by USEPA TO-15. The ambient air samples will be used to evaluate potential outdoor air interferences.

QA/QC procedures to be followed are described in the QAPP in Appendix C.

3.6 Sampling Contingency

Additional soil, groundwater, and soil vapor sampling locations may be completed, as needed, to evaluate unanticipated contamination and to horizontally and vertically delineate identified contamination (i.e., NAPL, VOCs, PAHs, metals, or other analytes) based on field observations and analytical results. The objective of sampling contingency is to provide adequate delineation of AOCs during a single mobilization event, if possible. The decision to complete additional sampling and delineation (including step-out distances and target depth intervals) based on field observations will be made by Langan field staff in consultation with the Langan, NYSDEC, and NYSDOH Project Managers. The location of any step-out soil borings and additional monitoring wells will be based on field observations and analytical data from adjacent borings and wells as well as site access and drilling ability considerations. Sampling depths and analyses will be contingent on findings.

3.7 Monitoring Well Survey

The location and elevation of the groundwater monitoring wells (top of casing) will be surveyed. This data will be used in conjunction with synoptic groundwater well gauging data to prepare a groundwater elevation contour map and evaluate the direction of groundwater flow. The survey will be conducted relative to the North American Vertical Datum of 1988 (NAVD88) by a NYS-licensed land surveyor. Elevations of the top of monitoring well casings and protective well covers will be surveyed to the nearest 0.01-foot.

3.8 Data Management and Validation

Laboratory analyses of soil, groundwater, vapor, and air samples will be conducted by a NYSDOH ELAP-approved laboratory in accordance with USEPA SW-846 methods and NYSDEC Analytical Services Protocol (ASP) Category B deliverable format. Environmental data will be reported electronically using the database software application EQuIS as part of NYSDEC's Environmental Information Management System (EIMS).

Table 1 summarizes the proposed samples and laboratory analyses. QA/QC procedures required by the NYSDEC ASP and SW-846 methods, including initial and continuing instrument calibrations, standard compound spikes, surrogate compound spikes, and analysis of other samples (blanks, laboratory control samples, and matrix spikes/matrix spike duplicates), will be followed. The laboratory will provide sample bottles, which will be pre-cleaned and preserved in accordance with the SW-846 methods. Where there are differences in the SW-846 and NYSDEC ASP requirements, the NYSDEC ASP shall take precedence.

Data validation will be performed in accordance with the USEPA validation guidelines for organic and inorganic data review. Validation will include the following:

- Verification of QC sample results (both qualitative and quantitative).
- Verification of sample results (both positive hits and non-detects).
- Recalculation of 10 percent of all investigative sample results.
- Preparation of Data Usability Summary Reports (DUSRs).

The DUSRs will be prepared and reviewed by the Program Quality Assurance Monitor (PQAM). The DUSRs will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and COC procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method. A detailed assessment of each sample delivery group (SDG) will follow. Additional details on the DUSRs are provided in the QAPP in Appendix C.

Laboratory analytical results from the December 2015 Phase II ESI were reported in NYSDEC ASP Category B deliverable format and validated by the Data Validator identified in the QAPP. The results from the Phase II ESI and the RI will be reported to the NYSDEC using EQuIS. DUSRs for the previous results will be included in the remedial investigation report (RIR).

3.9 Management of Investigation-Derived Waste

Soil cuttings will be returned to the borehole unless:

- Free product or grossly-contaminated soil is present in the cuttings;
- The borehole has penetrated a confining layer;
- Backfilling the borehole with cuttings will create a significant path for vertical movement of contaminants. Soil additives (bentonite) may be added to the cuttings to reduce permeability; and
- The soil cannot fit into the borehole.

Boreholes requiring disposal of drill cuttings will be filled with hydrated bentonite chips or clean sand and capped with asphalt or concrete. Soil cuttings, groundwater investigation-derived wastes (IDW), decontamination and well development/purging fluids will be containerized in properly-labeled and sealed UN/DOT-approved 55-gallon drums and staged for future waste characterization and off-site disposal at a facility permitted to accept the waste. The drums will be staged in a secure area on-site, pending receipt of laboratory data and off-site disposal to an appropriate facility. Spent disposable sampling equipment, including spoons, gloves, bags, and paper towels, will be double-bagged and disposed as municipal trash in a dumpster or garbage can.

3.10 Air Monitoring

Air monitoring will be conducted for site workers and the community (CAMP) during field activities. We will record air monitoring results in the field book during the investigation. Fugitive particulate (dust) generation that could affect site workers or the community is not expected for the following reasons:

- Most of the work area and the boring locations are paved with asphalt or concrete; therefore, vehicle movement will not generate dust.
- Intrusive work is limited to boring, soil vapor point and well installation, which does not generate large volumes of soil cuttings or dust.

3.10.1 Worker Air Monitoring

Air monitoring of the breathing zone will be performed periodically during drilling and sampling activities to document health and safety protection for the work team. We will monitor VOCs with a PID in accordance with the HASP. If air monitoring during intrusive operations identifies the presence of VOCs, we will follow the guidelines outlined in the HASP regarding action levels, permissible exposure, engineering controls, and personal protective equipment. If the VOCs action level is exceeded, work will cease and the work location will be evacuated. Monitoring will continue until the levels drops to permissible limits, at which point, work will resume with continued monitoring. If high levels persist, field activities will be halted and the work relocated to another area. If dust emissions are observed, work will stop and dust suppression measures (i.e., water spray) will be implemented.

3.10.2 Community Air Monitoring Plan

In addition to air monitoring in the worker breathing zone, we will conduct community air monitoring in compliance with the NYSDOH Generic CAMP. The CAMP is included in the HASP (see Appendix B). Additional monitoring requirements for work within 20 feet of potentially-exposed individuals or structures or indoor work with co-located residences or facilities are provided in this section.

The CAMP will consist of continuous monitoring for VOCs and dust emissions during ground intrusive activities (i.e., soil boring and monitoring well installation). Upwind concentrations will be measured at the start of each workday, and periodically thereafter, to establish background concentrations. VOCs and dust emissions will be monitored at the downwind perimeter of the work zone, which will be established at a point on the site where the general public or site employees may be present. VOC Monitoring will be conducted with a PID equipped with a 10.6 eV lamp. VOC community air monitoring requirements will be conducted until it is determined that the site is not a source of organic vapors. Dust emissions will be monitored using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM10) and capable of averaging a period of 15 minutes (or less) for comparison to the airborne particulate action level (e.g., DustTrak). If dust emissions are observed, work will stop and dust suppression measures will be used.

Periodic monitoring for VOCs will be conducted during non-intrusive activities such as the collection of groundwater samples. Periodic monitoring may include obtaining measurements upon arrival at a location, when opening a monitoring well cap, when bailing/purging a well, as well as upon departure from the location.

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 take into consideration 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. The special requirements may apply when work is conducted near the auto garage or the adjoining properties to the north, south, and west of the site.

- If total VOC concentrations near the walls of the adjacent occupied structures or next to intake vents exceed 1 part per million (ppm), VOC monitoring should occur within the occupied structure(s). Background readings in the occupied spaces will 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 near the walls of the adjacent occupied structures or next to intake vents exceed 150 micrograms per cubic meter (μ/m^3), work activities will be suspended until controls are implemented and are successful in reducing the total particulate concentration to 150 μ/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 interior areas where 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. The special requirements may apply when work is conducted inside the one-story auto garage.

3.11 Qualitative Human Health Exposure Assessment

A Qualitative Human Health Exposure Assessment will be conducted in accordance with Appendix 3B of the NYSDEC DER-10, *Technical Guidance for Site Investigation and Remediation*. The assessment will be submitted in the RIR.

4.0 REMEDIAL INVESTIGATION REPORT

Following completion of the RI and receipt of analytical data, an RIR will be prepared. The report will include: 1) a summary of the site history and previous investigations; 2) description of site conditions and the remedial investigation; 3) sampling methodology and field observations; 4) evaluation of the results and findings; and 5) conclusions, recommendations for any further assessment, if warranted, and remedial action objectives. The report will summarize the nature and extent of contamination at each area of concern and identify unacceptable exposure pathways (as determined through a Qualitative Human Health Exposure Assessment).

The report will include soil boring and well construction logs, sampling logs, tabulated analytical results, figures, and laboratory data packages. The tabulated analytical results will be organized in table format and include sample location, media sampled, sample depth, field/laboratory identification numbers, analytical results and the applicable Standards, Criteria, and Guidance (SCGs) pertaining to the site and contaminants of concern for comparison. The soil and groundwater analytical results will be compared to the 6 NYCRR Part 375-6.8(a,b) Unrestricted Use, Restricted-Residential, and Commercial Use SCOs and NYSDEC SGVs for Class GA water, respectively. Soil vapor and sub-slab vapor results will be evaluated using the NYSDOH Decision Matrices. The report will include scaled figures showing the locations of soil borings, monitoring wells, and sub-slab and soil vapor points, sample concentrations above SCGs for each media, groundwater elevation contours and flow direction, and, if appropriate, groundwater contaminant concentration contours.

5.0 SCHEDULE

The table below presents an anticipated schedule for the proposed remedial investigation and reporting. If the scheduled changes, it will be updated and submitted to the NYSDEC.

Milestone	Weeks from NYSDEC Approval of RIWP	Estimated Duration (weeks)
RI Mobilization and Field Work	12	4
Laboratory Analysis	14	2
Remedial Investigation Report Preparation and Submission to the NYSDEC	20	6

TABLES

Table 1
Proposed Sample Summary

Remedial Investigation Work Plan
2409 Jerome Avenue, Bronx, NY
BCP Site No. C203087
Langan Project No. 170390601

No.	Sample Name	Type	Location	Rationale	Depth[1]	Analysis[2]
SOIL						
1	SB09_depth	Grab	SB09	Investigate AOCs 1, 2, 3 & 4	0-6 inches below grade	TCL VOCs, TCL SVOCs, pesticides, herbicides, PCBs, TAL metals including hexavalent and trivalent chromium, cyanide
2	SB09_depth				6-12 inches below grade	
3	SB09_depth				12-24 inches below grade	
4	SB09_depth				historic fill interval below 24 inches and above bedrock	
5	SB09_depth				greatest degree of impacts, if encountered	
6	SB09_depth				groundwater interface or interval immediately above bedrock	
7	SB10_depth	Grab	SB10	Investigate AOCs 1, 2, 3 & 4	0-6 inches below grade	TCL VOCs, TCL SVOCs, pesticides, herbicides, PCBs, TAL metals including hexavalent and trivalent chromium, cyanide
8	SB10_depth				6-12 inches below grade	
9	SB10_depth				12-24 inches below grade	
10	SB10_depth				historic fill interval below 24 inches and above bedrock	
11	SB10_depth				greatest degree of impacts, if encountered	
12	SB10_depth				groundwater interface or interval immediately above bedrock	
13	SB11_depth	Grab	SB11	Investigate AOCs 1, 2, & 4	0-6 inches below grade	TCL VOCs, TCL SVOCs, pesticides, herbicides, PCBs, TAL metals including hexavalent and trivalent chromium, cyanide
14	SB11_depth				6-12 inches below grade	
15	SB11_depth				12-24 inches below grade	
16	SB11_depth				historic fill interval below 24 inches and above bedrock	
17	SB11_depth				greatest degree of impacts, if encountered	
18	SB11_depth				groundwater interface or interval immediately above bedrock	
19	SB12_depth	Grab	SB12	Investigate AOCs 1, 2, 3 & 4	0-6 inches below grade	TCL VOCs, TCL SVOCs, pesticides, herbicides, PCBs, TAL metals including hexavalent and trivalent chromium, cyanide
20	SB12_depth				6-12 inches below grade	
21	SB12_depth				12-24 inches below grade	
22	SB12_depth				historic fill interval below 24 inches and above bedrock	
23	SB12_depth				greatest degree of impacts, if encountered	
24	SB12_depth				groundwater interface or interval immediately above bedrock	
25	SB13_depth	Grab	SB13	Investigate AOCs 1, 2 & 4	0-6 inches below grade	TCL VOCs, TCL SVOCs, pesticides, herbicides, PCBs, TAL metals including hexavalent and trivalent chromium, cyanide
26	SB13_depth				6-12 inches below grade	
27	SB13_depth				12-24 inches below grade	
28	SB13_depth				historic fill interval below 24 inches and above bedrock	
29	SB13_depth				greatest degree of impacts, if encountered	
30	SB13_depth				groundwater interface or interval immediately above bedrock	

Table 1
Proposed Sample Summary

Remedial Investigation Work Plan
2409 Jerome Avenue, Bronx, NY
BCP Site No. C203087
Langan Project No. 170390601

No.	Sample Name	Type	Location	Rationale	Depth[1]	Analysis[2]
31	SB14_depth	Grab	SB14	Investigate AOCs 1, 3 & 4	0-6 inches below grade	TCL VOCs, TCL SVOCs, pesticides, herbicides, PCBs, TAL metals including hexavalent and trivalent chromium, cyanide
32	SB14_depth				6-12 inches below grade	
33	SB14_depth				12-24 inches below grade	
34	SB14_depth				historic fill interval below 24 inches and above bedrock	
35	SB14_depth				greatest degree of impacts, if encountered	
36	SB14_depth				groundwater interface or interval immediately above bedrock	
37	SB15_depth	Grab	SB15	Investigate AOCs 1, 2, 3 & 4	0-6 inches below grade	TCL VOCs, TCL SVOCs, pesticides, herbicides, PCBs, TAL metals including hexavalent and trivalent chromium, cyanide
38	SB15_depth				6-12 inches below grade	
39	SB15_depth				12-24 inches below grade	
40	SB15_depth				historic fill interval below 24 inches and above bedrock	
41	SB15_depth				greatest degree of impacts, if encountered	
42	SB15_depth				groundwater interface or interval immediately above bedrock	
43	SB16_depth	Grab	SB16	Investigate AOCs 1, 2, 3 & 4	0-6 inches below grade	TCL VOCs, TCL SVOCs, pesticides, herbicides, PCBs, TAL metals including hexavalent and trivalent chromium, cyanide
44	SB16_depth				6-12 inches below grade	
45	SB16_depth				12-24 inches below grade	
46	SB16_depth				historic fill interval below 24 inches and above bedrock	
47	SB16_depth				greatest degree of impacts, if encountered	
48	SB16_depth				groundwater interface or interval immediately above bedrock	
49	SB17_depth	Grab	SB17	Investigate AOCs 1, 2, 3 & 4	0-6 inches below grade	TCL VOCs, TCL SVOCs, pesticides, herbicides, PCBs, TAL metals including hexavalent and trivalent chromium, cyanide
50	SB17_depth				6-12 inches below grade	
51	SB17_depth				12-24 inches below grade	
52	SB17_depth				historic fill interval below 24 inches and above bedrock	
53	SB17_depth				greatest degree of impacts, if encountered	
54	SB17_depth				groundwater interface or interval immediately above bedrock	
55	SBDUP01_date	Duplicate	TBD	QA/QC	TBD	same analysis as parent sample
56	SBDUP02_date	Duplicate	TBD		TBD	
57	SBDUP03_date	Duplicate	TBD		TBD	
58	MS/MSD-SS01_date	MS/MSD	TBD		TBD	
59	MS/MSD-SS02_date	MS/MSD	TBD		TBD	
60	MS/MSD-SS03_date	MS/MSD	TBD		TBD	
61	SBEB01_date	Equipment Blank	TBD		NA	TCL VOCs, TCL SVOCs, pesticides, herbicides, PCBs, cyanide, TAL metals including hexavalent and trivalent chromium
62	SBEB02_date	Equipment Blank	TBD		NA	
63	SBEB03_date	Equipment Blank	TBD		NA	

Table 1
Proposed Sample Summary

Remedial Investigation Work Plan
2409 Jerome Avenue, Bronx, NY
BCP Site No. C203087
Langan Project No. 170390601

No.	Sample Name	Type	Location	Rationale	Depth[1]	Analysis[2]
GROUNDWATER						
1	MW01_date	Grab	MW01	Investigate AOCs 1, 2, 3 & 4	middle of observed water column	TCL VOCs, TCL SVOCs, 1,4 Dioxane, Pesticides, Herbicides, PCBs, Cyanide, TAL Metals including hexavalent and trivalent chromium (total and dissolved [field filtered]), and PFAS
2	MW02_date		MW02	Investigate AOCs 1, 2, 3 & 4	middle of observed water column	TCL VOCs, TCL SVOCs, 1,4 Dioxane, Pesticides, Herbicides, PCBs, Cyanide, TAL Metals including hexavalent and trivalent chromium (total and dissolved [field filtered]).
3	MW03_date		MW03	Investigate AOCs 1, 2, 3 & 4		
4	MW04_date		MW04	Investigate AOCs 1, 2 & 4	middle of observed water column	TCL VOCs, TCL SVOCs, 1,4 Dioxane, Pesticides, Herbicides, PCBs, Cyanide, TAL Metals including hexavalent and trivalent chromium (total and dissolved [field filtered]), and PFAS
5	MW05_date		MW05	Investigate AOCs 1, 2 & 4	middle of observed water column	TCL VOCs, TCL SVOCs, 1,4 Dioxane, Pesticides, Herbicides, PCBs, Cyanide, TAL Metals including hexavalent and trivalent chromium (total and dissolved [field filtered]).
6	MW06_date		MW06	Investigate AOCs 1, 2, 3 & 4	middle of observed water column	
7	MW09_date		MW09	Investigate AOCs 1, 2, 3 & 4	middle of observed water column	TCL VOCs, TCL SVOCs, 1,4 Dioxane, Pesticides, Herbicides, PCBs, Cyanide, TAL Metals including hexavalent and trivalent chromium (total and dissolved [field filtered]), and PFAS
8	MW10_date		MW10	Investigate AOCs 1, 2 & 3		
9	MW11_date		MW11	Investigate AOCs 1, 3 & 4	middle of observed water column	TCL VOCs, TCL SVOCs, 1,4 Dioxane, Pesticides, Herbicides, PCBs, Cyanide, TAL Metals including hexavalent and trivalent chromium (total and dissolved [field filtered]).
10	MW12_date		MW12	Investigate AOCs 1, 2 & 4	middle of observed water column	TCL VOCs, TCL SVOCs, 1,4 Dioxane, Pesticides, Herbicides, PCBs, Cyanide, TAL Metals including hexavalent and trivalent chromium (total and dissolved [field filtered]), and PFAS
11	MW13_date		MW13	Investigate AOCs 1, 2, 3 & 4	middle of observed water column	
12	MW14_date		MW14	Investigate AOCs 1, 3 & 4	middle of observed water column	
13	MW15_date		MW15	Investigate AOCs 1, 2 & 3	middle of observed water column	
14	BRW01_date		BRW01	Investigate AOCs 1, 2 & 3	middle of observed water column	TCL VOCs, TCL SVOCs, 1,4 Dioxane, Pesticides, Herbicides, PCBs, Cyanide, TAL Metals including hexavalent and trivalent chromium (total and dissolved [field filtered]).
15	GWDUP01_date	Duplicate	TBD	QA/QC	middle of observed water column	same analysis as parent sample
16	MS/MSD-GW01_date	MS/MSD	TBD		middle of observed water column	
17	GWEB01_date	Equipment Blank	TBD		NA	TCL VOCs, TCL SVOCs, 1,4 Dioxane, Pesticides, Herbicides, PCBs, Cyanide, TAL Metals including hexavalent and trivalent chromium (total and dissolved [field filtered]).
18	GWTB01_date	Trip Blank	NA			TCL VOC
19	GWTB02_date	Trip Blank				
20	GWTB03_date	Trip Blank	NA			
21	GWTB04_date	Trip Blank	NA			

Table 1
Proposed Sample Summary

Remedial Investigation Work Plan
2409 Jerome Avenue, Bronx, NY
BCP Site No. C203087
Langan Project No. 170390601

No.	Sample Name	Type	Location	Rationale	Depth[1]	Analysis[2]
AIR						
1	SV04_date	Grab	SV04	On-site soil vapor intrusion investigation for AOCs 1, 2, 3 & 4	anticipated depth of proposed foundation footings, if known at the time of the investigation, or to about 2 feet above the groundwater table	TO-15
2	SV05_date		SV05			
3	SV06_date		SV06			
4	SV07_date		SV07			
5	SV08_date		SV08			
6	SSV01_date		SSV01		2 inches below concrete slab	
7	IA01_date		IA01		NA	
8	SSV01_off_date		SSV01_off	Off-site soil vapor intrusion investigation	2 inches below concrete slab	
9	SSV02_off_date		SSV02_off			
10	SSV03_off_date		SSV03_off			
11	SSV04_off_date		SSV04_off			
12	SSV05_off_date		SSV05_off			
13	SSV06_off_date		SSV06_off			
14	SSV07_off_date		SSV07_off			
15	SSV08_off_date		SSV08_off			
16	SSV09_off_date		SSV09_off			
17	SSV10_off_date		SSV10_off			
18	IA01_off_date		to be co-located and collected concurrently with the off-site sub-slab vapor sample of same number			
19	IA02_off_date					
20	IA03_off_date					
21	IA04_off_date					
22	IA05_off_date					
23	IA06_off_date				NA	
24	IA07_off_date					
25	IA08_off_date					
26	IA09_off_date					
27	IA010_off_date					
28	SVDUP01	Duplicate	TBD	QA/QC	TBD	
29	SVDUP01_off_date	Duplicate	TBD		2 inches below concrete slab	
30	IADUP01_off_date	Duplicate	TBD		NA	
31	AA02_date	Field Blank	TBD		NA	
32	AA01_off_date	Field Blank	TBD		NA	
33	AA02_off_date	Field Blank	TBD		NA	

Notes:
Area of concern (AOC) 1 - Site Use
AOC 2 - Petroleum-Impacted, Soil, Groundwater, and Soil Vapor
AOC 3 - Historical Use of Adjoining Properties
AOC 4 - Historic Fill

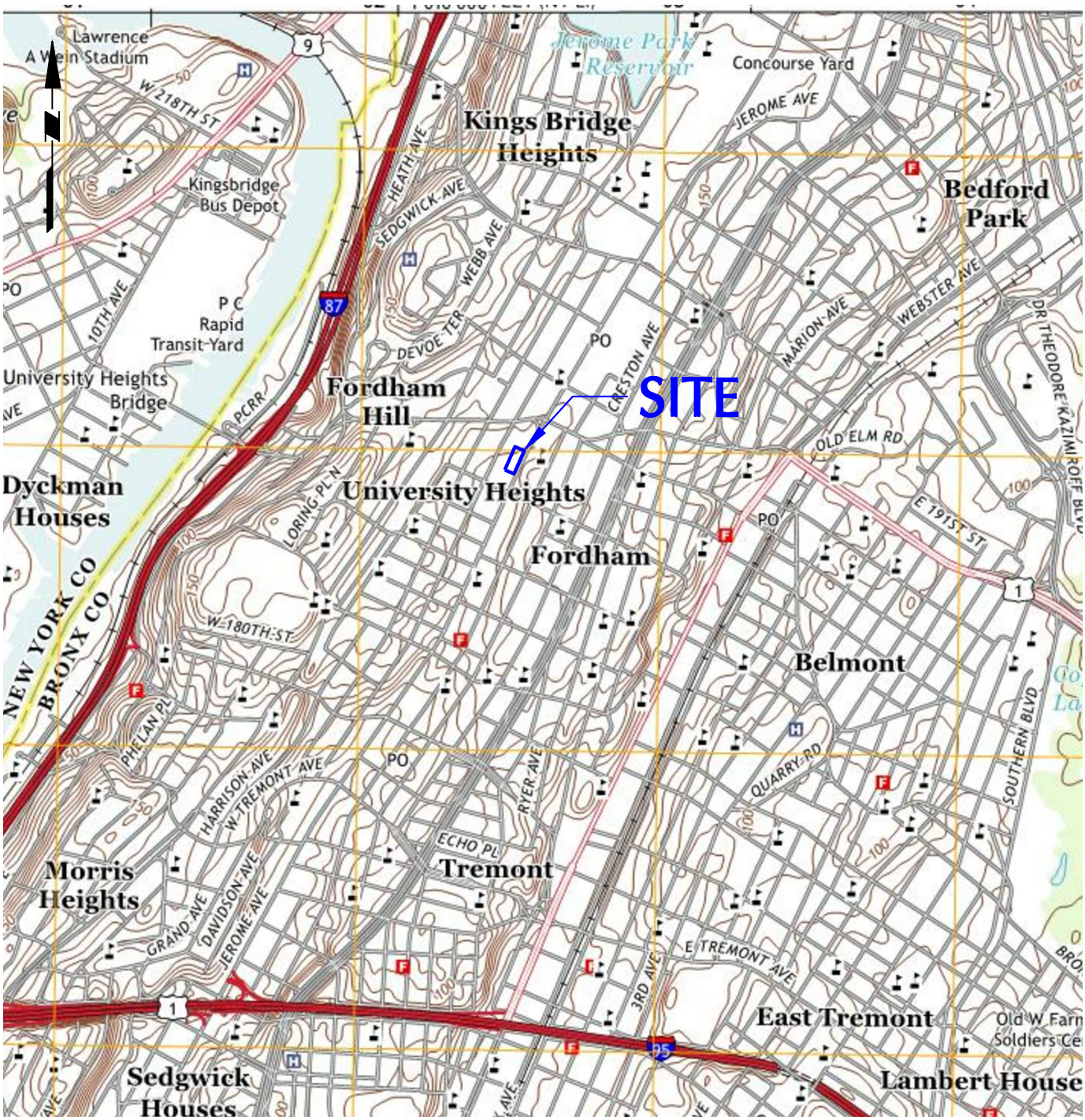
1. Depending on the depth and thickness of the site cover (i.e., asphalt, concrete, subbase), sample collection from the 0-6-inch interval may not be practical. Sampling depth intervals will be determined in the field based on subsurface conditions and sample recovery. The samples from the historic fill interval below 24 inches and above bedrock is intended to better characterize the historic fill layer across the site and understand the quality of historic fill material. Samples from this interval may not be collected at all boring locations depending on the depth to bedrock encountered at each location and the proximity of adjacent borings with similar historic fill intervals and composition.

2. Soil and groundwater samples to be analyzed for analytes listed in the New York State Department of Environmental Conservation (NYSDEC) Title 6 of the Official Compilation of New York Codes, Rules and Regulations (6 NYCRR) Part 375 and NYSDEC Commissioner's Policy CP-51.

3. A soil vapor intrusion investigation will be performed off-site at four buildings immediately west of the property and one building immediately south of the property. Up to two sub-slab vapor samples with co-located indoor air samples (one indoor air sample per sub-slab vapor sample) will be collected in each building. One duplicate sub-slab vapor sample and two ambient air samples (one west of the site and one south of the site) will also be collected. Off-site vapor intrusion samples are designated with the suffix _off in the table.

3. TBD = To be determined in the field
4. VOC = volatile organic compounds
5. SVOC = semivolatile organic compounds
6. PCBs = polychlorinated biphenyls
7. TCL = target compound list
8. TAL = target analyte list
9. PFAS = per- and poly-fluoroalkyl substances (PFAS)
10. QA/QC = quality assurance/quality control
11. NA = not applicable

FIGURES



LEGEND

APPROXIMATE SITE BOUNDARY

NOTES:

1. BASE MAP SOURCE: USGS CENTRAL PARK QUADRANGLE MAP (2013).

LANGAN
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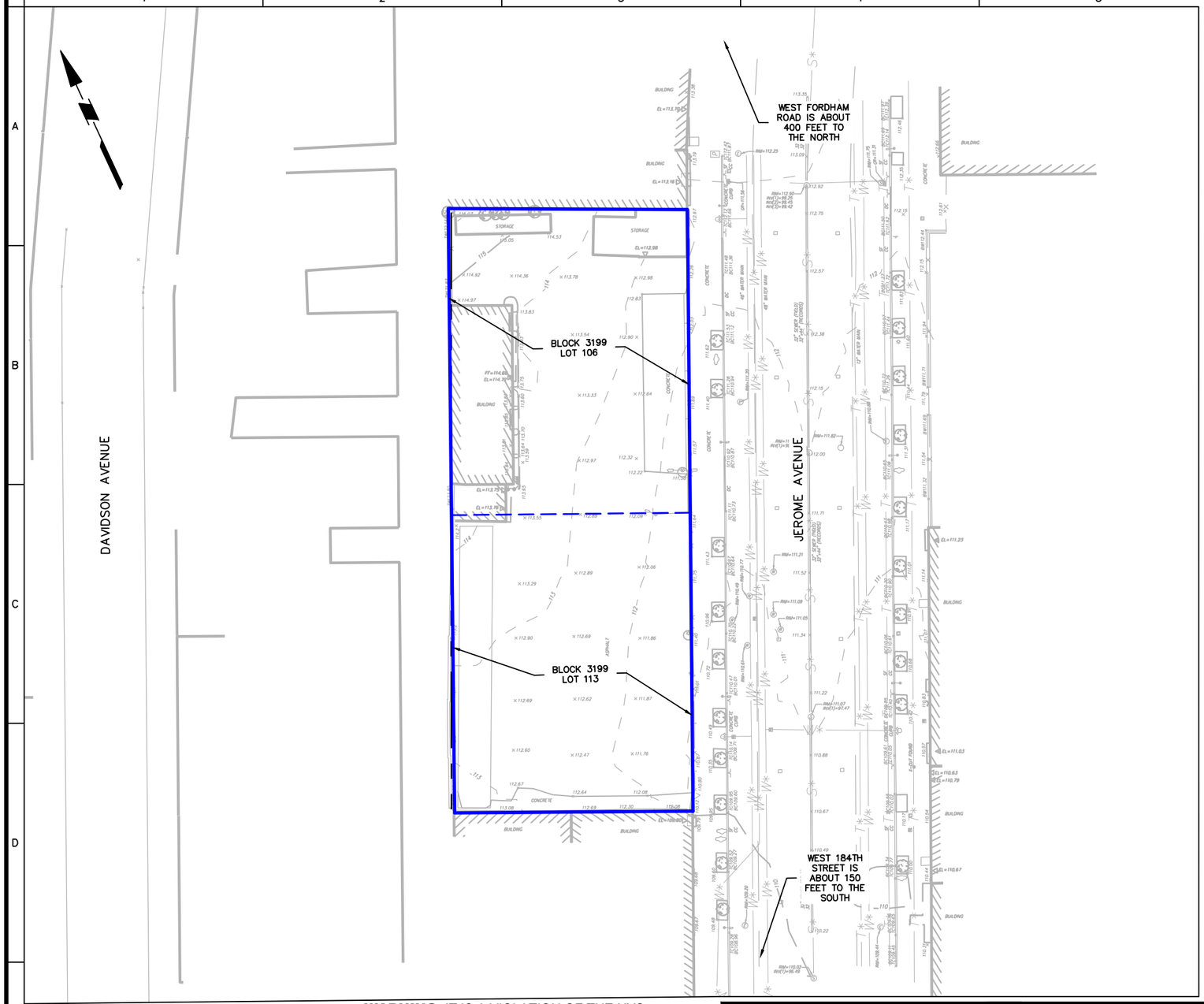
Collectively known as Langan

Project
2409 JEROME AVENUE
BLOCK No. 3199, LOT Nos. 106 AND 113
BRONX NEW YORK

Figure Title
SITE LOCATION MAP

Project No. 170390601	Figure No. 1
Date 5/23/2017	
Scale NTS	
Drawn By SH / Checked By GCW	
Submission Date	Sheet 1 of 8

Filename: \\langan.com\data\NYC\data6\170390601\Cadd Data - 170390601\2D-DesignFiles\Environmental\RIWP\Figure 1 - Site Location Map.dwg Date: 8/29/2017 Time: 18:13 User: sholberton Style Table: Langan.stb Layout: ANSIA-BP



LEGEND:

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE LOT BOUNDARY

GENERAL NOTES:

1. BASE PLAN IS TAKEN FROM SITE SURVEY COMPLETED IN DECEMBER 2015 BY LANGAN.
2. ELEVATIONS ON THE BACKGROUND SURVEY ARE IN NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88). NAVD88 IS APPROXIMATELY 1.1 FEET ABOVE MEAN SEA LEVEL DATUM AT SANDY HOOK, NEW JERSEY, AS DEFINED BY THE UNITED STATES GEOLOGICAL SURVEY (USGS NGVD 1929).

50 0 25 50

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Project

2409 JEROME AVENUE

BLOCK No. 3199, LOT Nos. 106 and 113
BRONX

BRONX **NEW YORK**

Figure Title

SITE PLAN

Project No. 170390601	Figure No. 2
Date 5/2/2017	
Scale 1" = 50'	
Drawn By SH / Checked By GCW	
Submission Date	Sheet 2 of 8

Filename: \\langan.com\data\NYC\data6\170390601\Cadd Data - 170390601\2D-DesignFiles\Environmental\RIWP\Figure 2 - Site Plan_v2.dwg Date: 8/29/2017 Time: 18:15 User: sholberton Style Table: Langan.stb Layout: Fig 2 Site Plan

SB04		
Sample ID	**SB04_0-2**	**SB04_10-11**
Lab Sample ID	**L1533709-15**	**L1533709-07**
Sampling Date	**12/18/2015**	**12/18/2015**
VOC (mg/kg)		
1,2,4-Trimethylbenzene	NE	3.7
Benzene	0.2	0.068
cis-1,2-Dichloroethene	0.3	ND
Methylene chloride	ND	0.18 J
Total Xylenes	NE	5.1
SVOC (mg/kg)		
Total SVOCs	NE	NE
PCB (mg/kg)		
Total PCBs	ND	ND
Pesticides (mg/kg)		
Total Pesticides	ND	ND
Herbicides (mg/kg)		
Total Herbicides	ND	ND
Metals (mg/kg)		
Chromium, Trivalent	NE	34 J
Lead	89	ND
Mercury	0.4	NE
Zinc	140	NE

SB05		
Sample ID	**SB05_1-2**	
Lab Sample ID	**L1533709-08**	
Sampling Date	**12/18/2015**	
VOC (mg/kg)		
Total VOCs	NE	
SVOC (mg/kg)		
Total SVOCs	NE	
PCB (mg/kg)		
Total PCBs	ND	
Pesticides (mg/kg)		
Total Pesticides	ND	
Herbicides (mg/kg)		
Total Herbicides	ND	
Metals (mg/kg)		
Lead	220	
Mercury	0.25	
Zinc	250	

SB06		
Sample ID	**SB06_2-3**	**SB06_11-12**
Lab Sample ID	**L1533709-09**	**L1533709-10**
Sampling Date	**12/18/2015**	**12/18/2015**
VOC (mg/kg)		
1,2,4-Trimethylbenzene	ND	15
Benzene	ND	0.28
Ethylbenzene	ND	5.2
Total Xylenes	ND	16.6
SVOC (mg/kg)		
Total SVOCs	ND	NE
PCB (mg/kg)		
Total PCBs	ND	ND
Pesticides (mg/kg)		
Total Pesticides	ND	ND
Herbicides (mg/kg)		
Total Herbicides	ND	ND
Metals (mg/kg)		
Total Metals	NE	NE

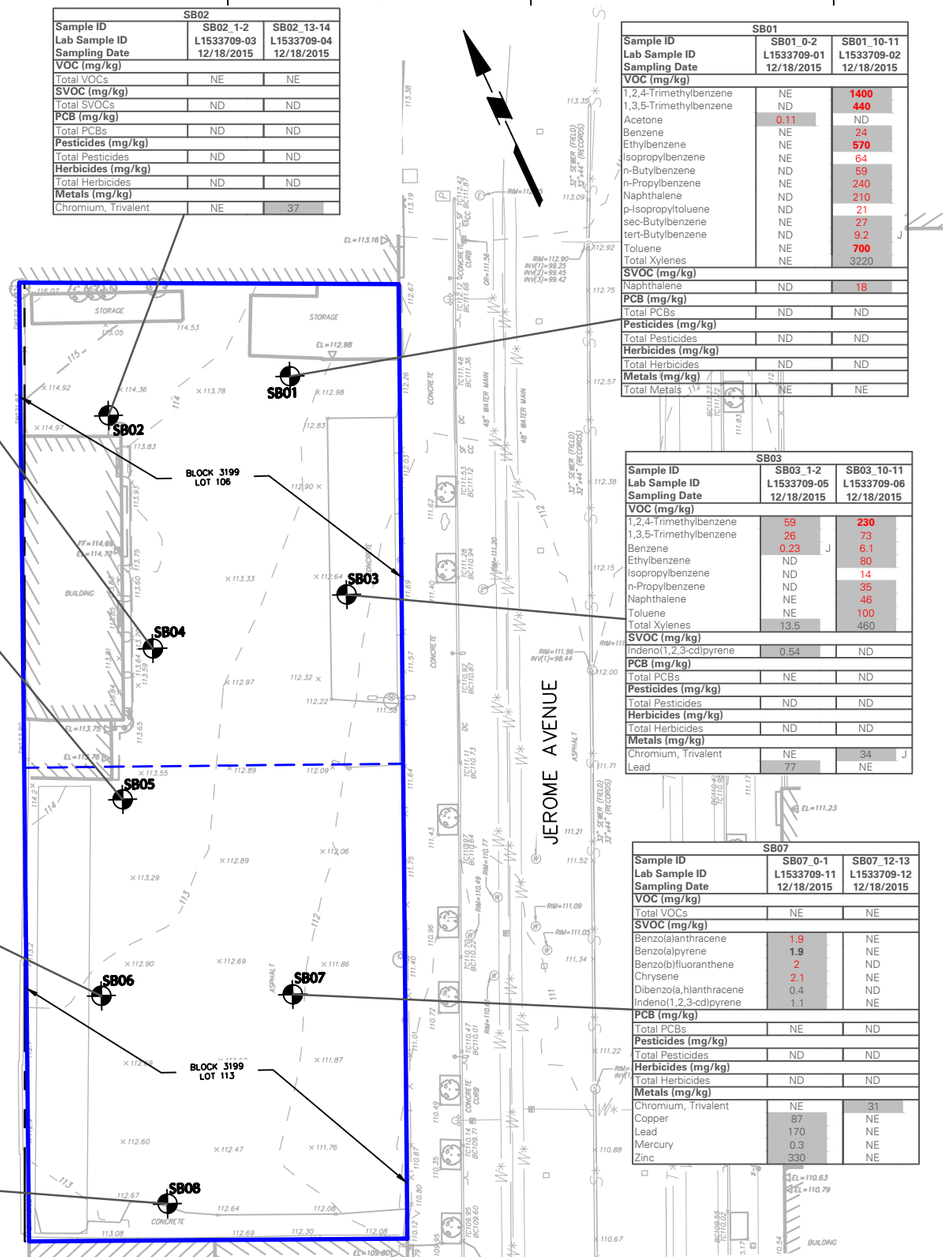
SB08		
Sample ID	**SB08_0-2**	**SB08_12-13**
Lab Sample ID	**L1533709-13**	**L1533709-14**
Sampling Date	**12/18/2015**	**12/18/2015**
VOC (mg/kg)		
Benzene	0.11	ND
Methylene chloride	0.4 J	NE
Toluene	1.9	NE
Total Xylenes	2.83	NE
SVOC (mg/kg)		
Benzo(a)anthracene	1.7	ND
Benzo(a)pyrene	**1.4**	ND
Benzo(b)fluoranthene	2	ND
Chrysene	1.8	ND
Indeno(1,2,3-cd)pyrene	0.93	ND
PCB (mg/kg)		
Total PCBs	ND	ND
Pesticides (mg/kg)		
4,4'-DDT	0.0135	ND
Herbicides (mg/kg)		
Total Herbicides	ND	ND
Metals (mg/kg)		
Barium	380	NE
Copper	**24000**	NE
Lead	540	ND
Mercury	0.64	ND
Nickel	35	NE
Silver	4.6	ND
Zinc	1700	NE

SB02		
Sample ID	**SB02_1-2**	**SB02_13-14**
Lab Sample ID	**L1533709-03**	**L1533709-04**
Sampling Date	**12/18/2015**	**12/18/2015**
VOC (mg/kg)		
Total VOCs	NE	NE
SVOC (mg/kg)		
Total SVOCs	ND	ND
PCB (mg/kg)		
Total PCBs	ND	ND
Pesticides (mg/kg)		
Total Pesticides	ND	ND
Herbicides (mg/kg)		
Total Herbicides	ND	ND
Metals (mg/kg)		
Chromium, Trivalent	NE	37

SB01		
Sample ID	**SB01_0-2**	**SB01_10-11**
Lab Sample ID	**L1533709-01**	**L1533709-02**
Sampling Date	**12/18/2015**	**12/18/2015**
VOC (mg/kg)		
1,2,4-Trimethylbenzene	NE	**1400**
1,3,5-Trimethylbenzene	ND	**440**
Acetone	0.11	ND
Benzene	NE	24
Ethylbenzene	NE	**570**
Isopropylbenzene	NE	64
n-Butylbenzene	ND	59
n-Propylbenzene	NE	240
Naphthalene	ND	210
p-Isopropyltoluene	ND	21
sec-Butylbenzene	NE	27
tert-Butylbenzene	ND	9.2 J
Toluene	NE	**700**
Total Xylenes	NE	3220
SVOC (mg/kg)		
Naphthalene	ND	18
PCB (mg/kg)		
Total PCBs	ND	ND
Pesticides (mg/kg)		
Total Pesticides	ND	ND
Herbicides (mg/kg)		
Total Herbicides	ND	ND
Metals (mg/kg)		
Total Metals	NE	NE

SB03		
Sample ID	**SB03_1-2**	**SB03_10-11**
Lab Sample ID	**L1533709-05**	**L1533709-06**
Sampling Date	**12/18/2015**	**12/18/2015**
VOC (mg/kg)		
1,2,4-Trimethylbenzene	59	**230**
1,3,5-Trimethylbenzene	26	73
Benzene	0.23 J	6.1
Ethylbenzene	ND	80
Isopropylbenzene	ND	14
n-Propylbenzene	ND	35
Naphthalene	NE	46
Toluene	NE	100
Total Xylenes	13.5	460
SVOC (mg/kg)		
Indeno(1,2,3-cd)pyrene	0.54	ND
PCB (mg/kg)		
Total PCBs	NE	ND
Pesticides (mg/kg)		
Total Pesticides	ND	ND
Herbicides (mg/kg)		
Total Herbicides	ND	ND
Metals (mg/kg)		
Chromium, Trivalent	NE	34 J
Lead	77	NE

SB07		
Sample ID	**SB07_0-1**	**SB07_12-13**
Lab Sample ID	**L1533709-11**	**L1533709-12**
Sampling Date	**12/18/2015**	**12/18/2015**
VOC (mg/kg)		
Total VOCs	NE	NE
SVOC (mg/kg)		
Benzo(a)anthracene	1.9	NE
Benzo(a)pyrene	**1.9**	NE
Benzo(b)fluoranthene	2	ND
Chrysene	2.1	NE
Dibenzo(a,h)anthracene	0.4	ND
Indeno(1,2,3-cd)pyrene	1.1	NE
PCB (mg/kg)		
Total PCBs	NE	ND
Pesticides (mg/kg)		
Total Pesticides	ND	ND
Herbicides (mg/kg)		
Total Herbicides	ND	ND
Metals (mg/kg)		
Chromium, Trivalent	NE	31
Copper	87	NE
Lead	170	NE
Mercury	0.3	NE
Zinc	330	NE



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LEGEND:

- APPROXIMATE SITE BOUNDARY
- SB01 APPROXIMATE SOIL BORING LOCATION AND ID
- APPROXIMATE LOT BOUNDARY

GENERAL NOTES:

1. BASE PLAN IS TAKEN FROM SITE SURVEY COMPLETED IN DECEMBER 2015 BY LANGAN.
2. ELEVATIONS ON THE BACKGROUND SURVEY ARE IN NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88). NAVD88 IS APPROXIMATELY 1.1 FEET ABOVE MEAN SEA LEVEL DATUM AT SANDY HOOK, NEW JERSEY, AS DEFINED BY THE UNITED STATES GEOLOGICAL SURVEY (USGS NGVD 1929).
3. SOIL ANALYTICAL RESULTS ARE COMPARED TO THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC) TITLE 6 OF THE OFFICIAL COMPILATION OF NEW YORK CODES, RULES, AND REGULATIONS (NYCRR) PART 375 UNRESTRICTED USE, RESTRICTED USE COMMERICAL, PROTECTION OF GROUNDWATER AND CP-51 SUPPLEMENTAL SOIL CLEANUP OBJECTIVES (SCOs) (SEE TABLE BELOW).
4. ONLY ANALYTES EXCEEDING CRITERIA ARE SHOWN IN THE FIGURE.
5. RESULTS ABOVE NYSDEC UNRESTRICTED USE SCOs ARE SHADED.
6. RESULTS ABOVE NYSDEC RESTRICTED-COMMERCIAL USE SCOs ARE SHADED AND BOLDED.
7. RESULTS ABOVE NYSDEC PROTECTION OF GROUNDWATER SCOs ARE IN RED.
8. VOC = VOLATILE ORGANIC COMPOUND
9. SVOC = SEMIVOLATILE ORGANIC COMPOUND
10. PCB = POLYCHLORINATED BIPHENYL
11. mg/kg = MILLIGRAMS PER KILOGRAM
12. ~ = CRITERION DOES NOT EXIST
13. ND = NOT DETECTED
14. NE = NO EXCEEDANCES
15. J = THE ANALYTE WAS DETECTED ABOVE THE METHOD DETECTION LIMIT (MDL), BUT BELOW THE REPORTING LIMIT (RL), THEREFORE , THE RESULT IS AN ESTIMATED CONCENTRATION.

Analyte	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Use Restricted-Commercial SCO	NYSDEC Part 375 Protection of Groundwater SCO
VOC (mg/kg)			
1,2,4-Trimethylbenzene	3.6	190	3.6
1,3,5-Trimethylbenzene	8.4	190	8.4
Acetone	0.05	500	0.05
Benzene	0.06	44	0.06
cis-1,2-Dichloroethene	0.25	500	0.25
Ethylbenzene	1	390	1
Isopropylbenzene	~	~	2.3
n-Butylbenzene	12	500	12
n-Propylbenzene	3.9	500	3.9
Methylene chloride	0.05	500	0.05
Naphthalene	12	500	12
p-Isopropyltoluene	~	~	10
sec-Butylbenzene	11	500	11
tert-Butylbenzene	5.9	500	5.9
Toluene	0.7	500	0.7
Total Xylenes	0.26	500	~
SVOC (mg/kg)			
Benzo(a)anthracene	1	5.6	1
Benzo(a)pyrene	1	1	22
Benzo(b)fluoranthene	1	5.6	1.7
Chrysene	1	56	1
Dibenzo(a,h)anthracene	0.33	0.56	1000
Indeno(1,2,3-cd)pyrene	0.5	5.6	8.2
Naphthalene	12	500	12
PCB (mg/kg)			
Total PCBs	0.1	1	~
Pesticides (mg/kg)			
4,4'-DDT	0.0033	47	136
Herbicides (mg/kg)			
Total Herbicides	~	~	~
Metals (mg/kg)			
Barium	350	400	820
Chromium, Trivalent	30	1500	~
Copper	50	270	1720
Lead	63	1000	450
Mercury	0.18	2.8	0.73
Nickel	30	310	130
Silver	2	1500	8.3
Zinc	109	10000	2480

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BLOCK No. 3199, LOT Nos.106 and 113
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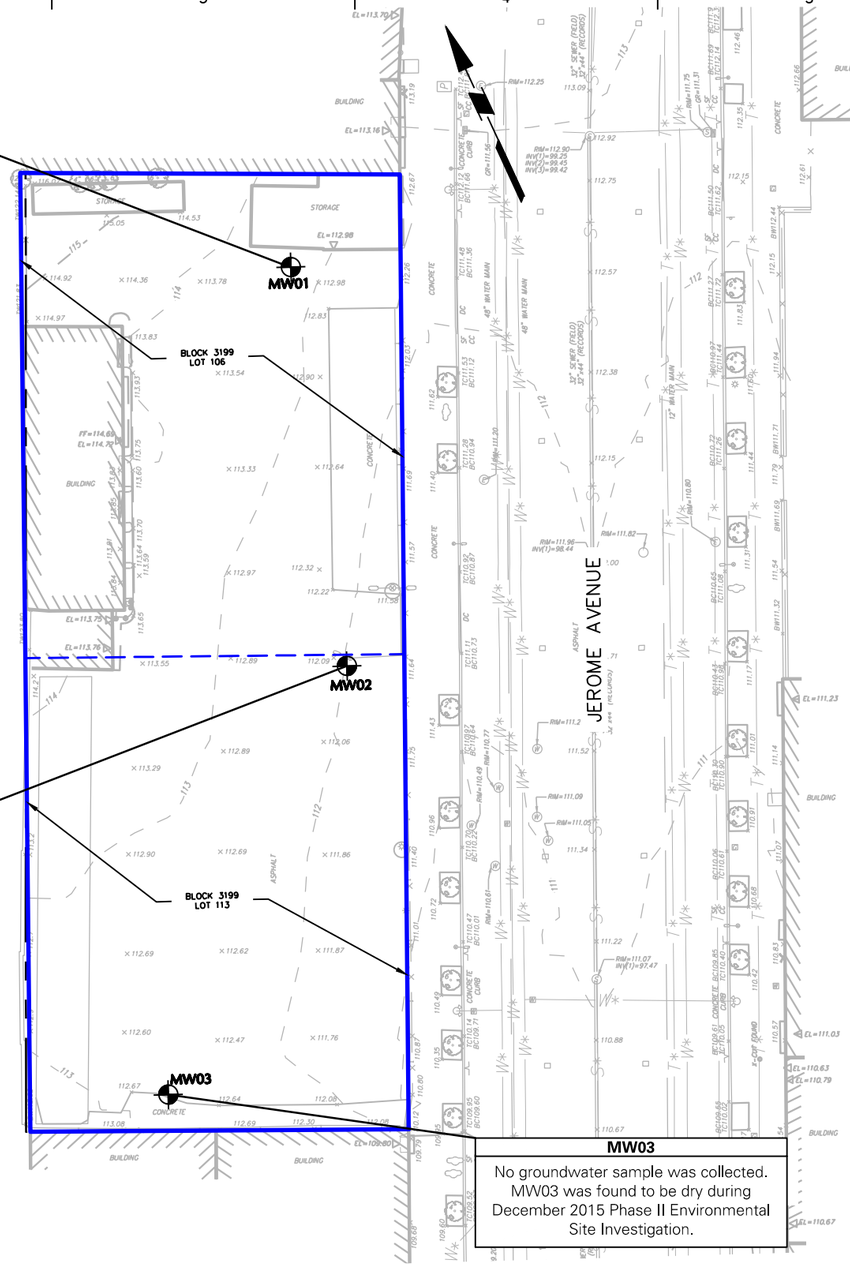
Figure Title
PREVIOUS SOIL SAMPLE LOCATIONS AND ANALYTICAL RESULTS MAP

Project No. 170390601
Date 5/2/2017
Scale 1" = 40'
Drawn By MB | Checked By GW
Submission Date

Figure No. 3
Sheet 3 of 8

MW01		
Sample ID	**MW01_122115**	
Lab Sample ID	**L1533806-01**	
Sampling Date	**12/21/2015**	
VOC (µg/l)		
1,2,4-Trimethylbenzene	**1700**	
1,3,5-Trimethylbenzene	**440**	J
Benzene	**4200**	
Ethylbenzene	**2900**	
n-Propylbenzene	**240**	J
Naphthalene	**320**	J
o-Xylene	**4600**	
p/m-Xylene	**11000**	
Toluene	**18000**	
SVOC (µg/l)		
2,4-Dimethylphenol	**87**	
Naphthalene	**280**	
PCB (µg/l)		
Total PCBs	ND	
Pesticides (µg/l)		
Total Pesticides	ND	
Herbicides (µg/l)		
Total Herbicides	ND	
Total Metals (µg/l)		
Barium	**1688**	
Iron	**4090**	
Magnesium	**208000**	
Manganese	**4963**	
Sodium	**646000**	
Dissolved Metals (µg/l)		
Barium	**1818**	
Iron	**1070**	
Magnesium	**211000**	
Manganese	**4582**	
Sodium	**608000**	

MW02	
Sample ID	**MW02_122115**
Lab Sample ID	**L1533806-02**
Sampling Date	**12/21/2015**
VOC (µg/l)	
1,2,4-Trimethylbenzene	**19**
Benzene	**50**
Ethylbenzene	**23**
o-Xylene	**7.1**
p/m-Xylene	**47**
Toluene	**14**
SVOC (µg/l)	
Total SVOCs	NE
PCB (µg/l)	
Total PCBs	ND
Pesticides (µg/l)	
Total Pesticides	NA
Herbicides (µg/l)	
Total Herbicides	NA
Total Metals (µg/l)	
Lead	**328.2**
Dissolved Metals (µg/l)	
Dissolved Metals	NA



MW03

No groundwater sample was collected. MW03 was found to be dry during December 2015 Phase II Environmental Site Investigation.

LEGEND:

- APPROXIMATE SITE BOUNDARY
- MW01 — MONITORING WELL LOCATION AND ID
- APPROXIMATE LOT BOUNDARY

GENERAL NOTES:

1. BASE PLAN IS TAKEN FROM SITE SURVEY COMPLETED IN DECEMBER 2015 BY LANGAN.
2. ELEVATIONS ON THE BACKGROUND SURVEY ARE IN NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88). NAVD88 IS APPROXIMATELY 1.1 FEET ABOVE MEAN SEA LEVEL DATUM AT SANDY HOOK, NEW JERSEY, AS DEFINED BY THE UNITED STATES GEOLOGICAL SURVEY (USGS NGVD 1929).
3. MW03 WAS GAUGED AND FOUND TO BE DRY DURING THE DECEMBER 2015 PHASE II ENVIRONMENTAL SITE INVESTIGATION (ESI); NO GROUNDWATER SAMPLE WAS COLLECTED.
4. GROUNDWATER SAMPLE ANALYTICAL RESULTS ARE COMPARED TO THE TITLE 6 NEW YORK CODES RULES AND REGULATIONS (NYCRR) PART 703.5 GUIDANCE VALUES FOR CLASS GA WATER AND THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC) TECHNICAL AND OPERATIONAL GUIDANCE SERIES (TOGS) 1.1.1 AMBIENT WATER QUALITY STANDARDS (AWQS).
5. ONLY ANALYTES EXCEEDING CRITERIA ARE SHOWN IN THIS FIGURE.
6. RESULTS ABOVE 6NYCRR PART 703.5 GUIDANCE VALUES ARE HIGHLIGHTED AND BOLDED.
7. VOC = VOLATILE ORGANIC COMPOUND
8. SVOC = SEMIVOLATILE ORGANIC COMPOUND
9. PCB = POLYCHLORINATED BIPHENYL
10. µg/l = MICROGRAMS PER LITER
11. NA = NOT ANALYZED
12. ND = NO DETECTIONS
13. NE = NO EXCEEDANCES
13. J = THE ANALYTE WAS DETECTED ABOVE THE METHOD DETECTION LIMIT (MDL), BUT BELOW THE REPORTING LIMIT (RL), THEREFORE, THE RESULT IS AN ESTIMATED CONCENTRATION.

Analyte	NYSDEC Water Quality Standard and Guidance Values
VOC (µg/l)	
1,2,4-Trimethylbenzene	5
1,3,5-Trimethylbenzene	5
Benzene	1
Ethylbenzene	5
n-Propylbenzene	5
Naphthalene	10
o-Xylene	5
p/m-Xylene	5
Toluene	5
SVOC (µg/l)	
2,4-Dimethylphenol	1
Naphthalene	10
PCB (µg/l)	
Total PCBs	~
Pesticides (µg/l)	
Total Pesticides	~
Herbicides (µg/l)	
Total Herbicides	~
Total Metals (µg/l)	
Barium	1000
Iron	300
Lead	25
Magnesium	35000
Manganese	300
Sodium	20000
Dissolved Metals (µg/l)	
Barium	1000
Iron	300
Lead	25
Magnesium	35000
Manganese	300
Sodium	20000

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40 0 10 25 40
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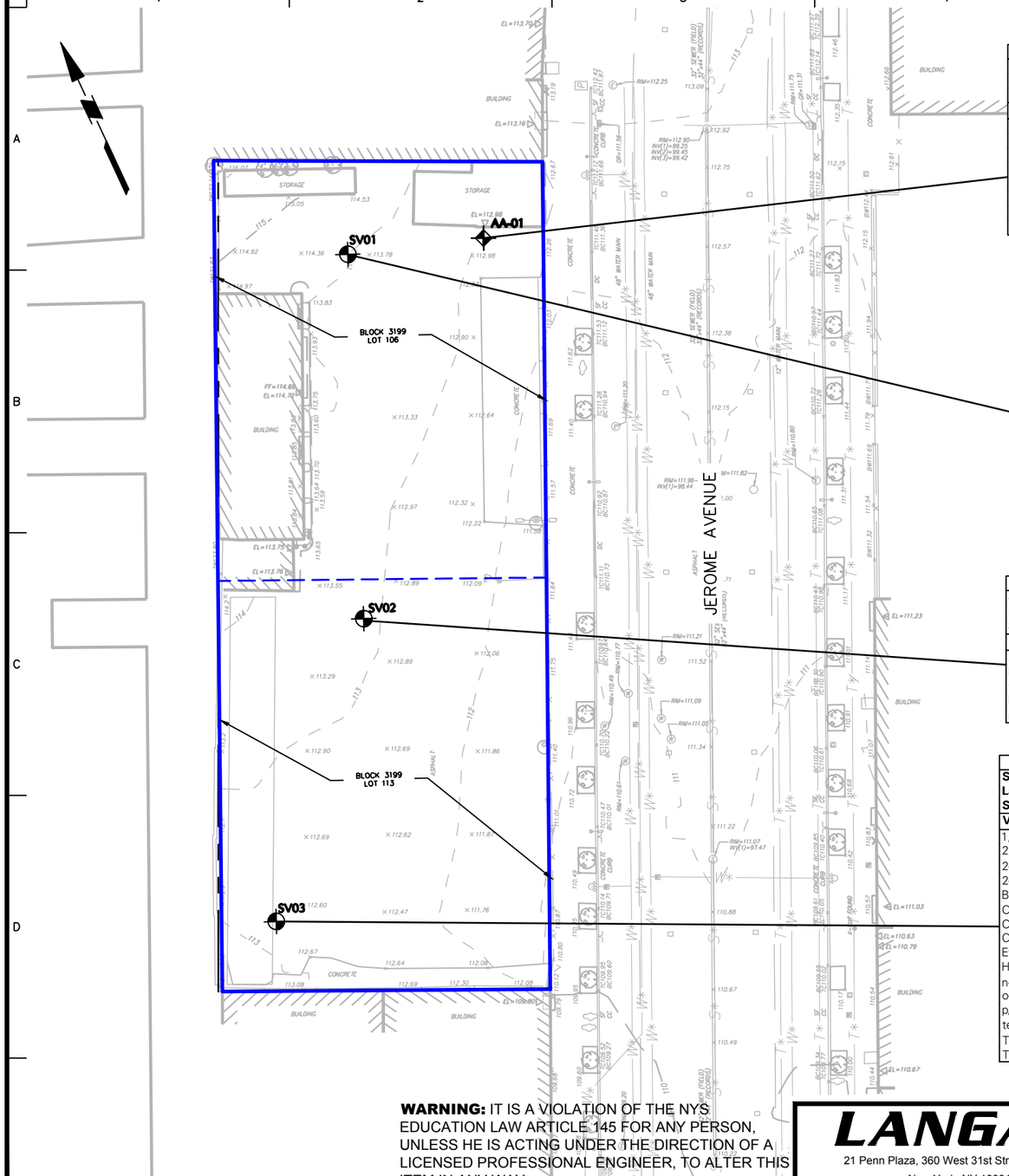
Figure Title
PREVIOUS GROUNDWATER SAMPLE LOCATIONS AND ANALYTICAL RESULTS MAP

Project No. 170390601	Figure No. 4
Date 5/2/2017	
Scale 1" = 40'	
Drawn By MB / Checked By GW	
Submission Date	Sheet 4 of 8

Filename: \\langan.com\data\NYC\data6\170390601\Cadd Data - 170390601\2D-DesignFiles\Environmental\RIWP\Figure 4 - Groundwater Analytical Results.dwg Date: 8/29/2017 Time: 18:17 User: sholberton Style Table: Langan.stb Layout: Fig 4 GW Analytical Results



AA01	
Sample ID	**AA01_121815**
Lab Sample ID	**L1533739-02**
Sampling Date	**12/18/2015**
VOC (ug/m³)	
Acetone	6.96
Benzene	1.29
Chloromethane	1.21
Ethyl Alcohol	12.2
iso-Propyl Alcohol	1.76
n-Hexane	0.747
Toluene	1.66
Trichlorofluoromethane	1.15

SV01	
Sample ID	**SV01_121815**
Lab Sample ID	**L1533739-01**
Sampling Date	**12/18/2015**
VOC (ug/m³)	
2,2,4-Trimethylpentane	69100
2-Butanone	552
Benzene	5560
Cyclohexane	2130
Ethylbenzene	695
Heptane	4010
Methyl tert butyl ether	999
n-Hexane	3910
o-Xylene	669
p/m-Xylene	1780
tert-Butyl Alcohol	476
Toluene	8630

SV02	
Sample ID	**SV02_121815**
Lab Sample ID	**L1533739-03**
Sampling Date	**12/18/2015**
VOC (ug/m³)	
2,2,4-Trimethylpentane	962000
Benzene	18800
Cyclohexane	406000
Heptane	308000
n-Hexane	1270000

SV03	
Sample ID	**SV03_121815**
Lab Sample ID	**L1533739-04**
Sampling Date	**12/18/2015**
VOC (ug/m³)	
1,3-Butadiene	118
2,2,4-Trimethylpentane	333
2-Butanone	543
2-Hexanone	62.3
Benzene	32.6
Carbon disulfide	48.3
Chloromethane	4.83
Cyclohexane	111
Ethylbenzene	21.2
Heptane	340
n-Hexane	226
o-Xylene	22.1
p/m-Xylene	63
tert-Butyl Alcohol	31.8
Tetrachloroethene	**63.7**
Toluene	34.7

LEGEND:

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE LOT BOUNDARY
- SB01 — APPROXIMATE SOIL VAPOR SAMPLE LOCATION AND ID
- AA-01 — APPROXIMATE AMBIENT AIR SAMPLE LOCATION AND ID

Analyte	Minimum Soil Vapor Concentrations Requiring Mitigation (NYSDOH Decision Matrices)
VOC (ug/m³)	
Carbon tetrachloride	5
1,1-Dichloroethene	100
cis-1,2-Dichloroethene	100
Tetrachloroethene	30
1,1,1-Trichloroethane	100
Trichloroethene	2
Vinyl chloride	5

GENERAL NOTES:

1. BASE PLAN IS TAKEN FROM SITE SURVEY COMPLETED IN DECEMBER 2015 BY LANGAN.
2. ELEVATIONS ON THE BACKGROUND SURVEY ARE IN NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88). NAVD88 IS APPROXIMATELY 1.1 FEET ABOVE MEAN SEA LEVEL DATUM AT SANDY HOOK, NEW JERSEY, AS DEFINED BY THE UNITED STATES GEOLOGICAL SURVEY (USGS NGVD 1929).
3. ONLY DETECTED ANALYTES IN SOIL VAPOR AND AMBIENT AIR ARE SHOWN IN THIS FIGURE.
4. SOIL VAPOR ANALYTICAL RESULTS ARE COMPARED TO THE MINIMUM CONCENTRATION REQUIRING MITIGATION ON THE NEW YORK STATE DEPARTMENT OF HEALTH (NYSDOH) DECISION MATRICES. THE MATRICES VALUES USED FOR TETRACHLOROETHENE AND TRICHLOROETHENE WERE REDUCTED TO CORRESPOND TO THE UPDATED AIR GUIDANCE VALUES FOR THESE COMPOUNDS DATED SEPTEMBER 2013 AND AUGUST 2015, RESPECTIVELY.
5. RESULTS ABOVE THE CRITERION ARE HIGHLIGHTED AND BOLDED.
6. VOC = VOLATILE ORGANIC COMPOUND
7. ug/m3 = MICROGRAMS PER CUBIC METER

WARNING: IT IS A VIOLATION OF THE NYS EDUCATION LAW ARTICLE 145 FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS ITEM IN ANY WAY.

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Langan CT, Inc.
Langan International LLC
Collectively known as Langan

Project
2409 JEROME AVENUE
BLOCK No. 3199, LOT Nos.106 AND 113
BRONX
BRONX NEW YORK

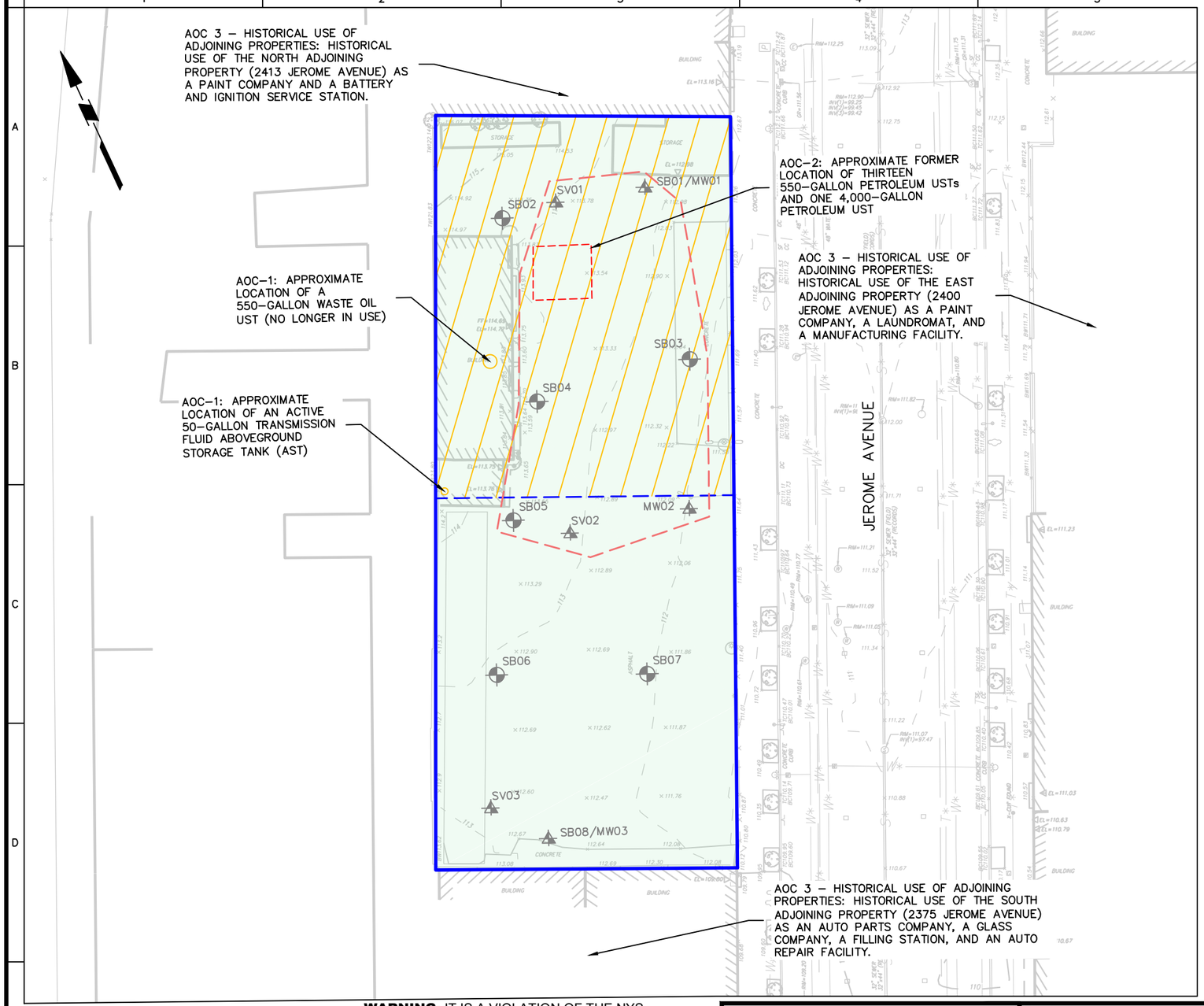
Figure Title
PREVIOUS SOIL VAPOR AND AIR SAMPLE LOCATIONS AND ANALYTICAL RESULTS MAP

Project No. 170390601
Date 5/2/2017
Scale 1" = 30'
Drawn By MB | Checked By GW
Submission Date

Figure No. 5

Sheet 5 of 8

Filename: \\langan.com\data\NYC\data6\170390601\Cadd Data - 170390601\2D-DesignFiles\Environmental\RIWP\Figure 5 - Soil Vapor and AA Analytical Results.dwg Date: 8/29/2017 Time: 18:20 User: sholberton Style Table: Langan.stb Layout: Fig 5 SV Analytical Results



LEGEND:

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE LOT BOUNDARY
- APPROXIMATE LOCATION OF HISTORICAL CLOSED/REMOVED UNDERGROUND STORAGE TANKS (USTs)
- APPROXIMATE LOCATION OF CURRENT PETROLEUM BULK STORAGE TANK
- SB01/MW01 — PREVIOUS SOIL BORING AND MONITORING WELL LOCATION
- MW02 — PREVIOUS MONITORING WELL LOCATION
- SB03 — PREVIOUS SOIL BORING LOCATION
- SV01 — PREVIOUS SOIL VAPOR SAMPLE LOCATION
- AOC 1 – SITE USE
- AOC 2 – PETROLEUM–IMPACTED SOIL, GROUNDWATER AND SOIL VAPOR
- AOC 4 – HISTORIC FILL

GENERAL NOTES:

1. BASE PLAN IS TAKEN FROM SITE SURVEY COMPLETED IN DECEMBER 2015 BY LANGAN.
2. ELEVATIONS ON THE BACKGROUND SURVEY ARE IN NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88). NAVD88 IS APPROXIMATELY 1.1 FEET ABOVE MEAN SEA LEVEL DATUM AT SANDY HOOK, NEW JERSEY, AS DEFINED BY THE UNITED STATES GEOLOGICAL SURVEY (USGS NGVD 1929).
3. AOC = AREA OF CONCERN

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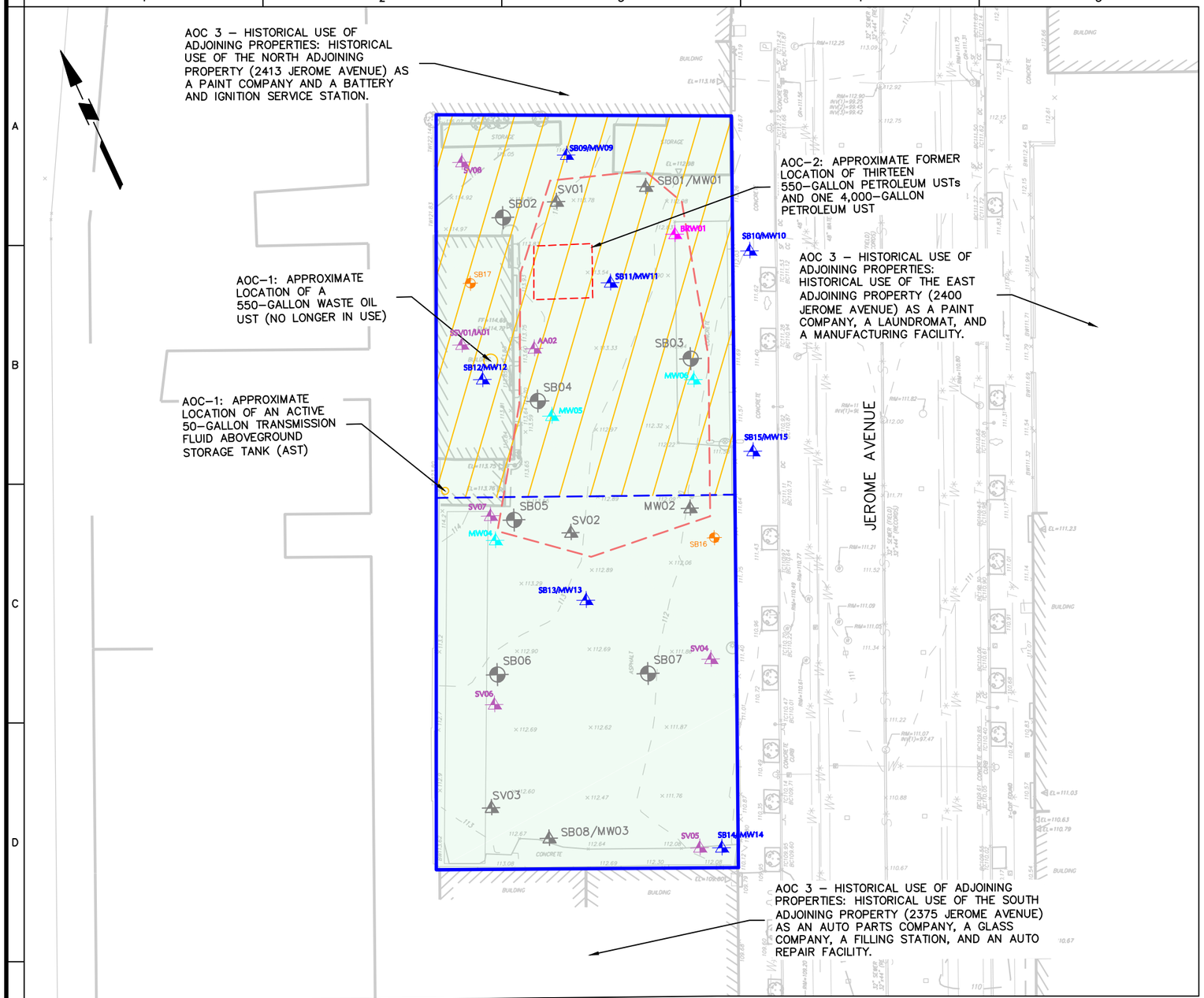
BLOCK No. 3199, LOT Nos. 106 and 113
BRONX
BRONX NEW YORK

Figure Title
AREA OF CONCERN MAP

Project No. 170390601	Figure No. 6
Date 5/2/2017	
Scale 1" = 40'	
Drawn By SH / Checked By GCW	
Submission Date	Sheet 6 of 8

Filename: \\langan.com\data\NYC\data6\170390601\Cadd Data - 170390601\2D-DesignFiles\Environmental\RIWP\Figure 6 - Area of Concern Map.dwg Date: 8/29/2017 Time: 18:21 User: sholberton Style Table: Langan.stb Layout: Figure



LEGEND:

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE LOT BOUNDARY
- APPROXIMATE LOCATION OF HISTORICAL UNDERGROUND STORAGE TANKS (UST)
- APPROXIMATE LOCATION OF EXISTING PETROLEUM BULK STORAGE TANK
- SB01/MW01 — PREVIOUS SOIL BORING AND MONITORING WELL LOCATION
- MW02 — PREVIOUS MONITORING WELL LOCATION
- SB03 — PREVIOUS SOIL BORING LOCATION
- SV01 — PREVIOUS SOIL VAPOR SAMPLE LOCATION
- SB09/MW09 — PROPOSED SOIL BORING AND MONITORING WELL LOCATION
- MW04 — PROPOSED MONITORING WELL
- SB15 — PROPOSED SOIL BORING
- SV04 — PROPOSED SOIL VAPOR SAMPLE
- SSV01/IA01 — PROPOSED SUB–SLAB SOIL VAPOR/INDOOR AIR SAMPLE LOCATION
- AA02 — PROPOSED AMBIENT AIR SAMPLE
- BRW01 — PROPOSED BEDROCK WELL LOCATION
- AOC 1 – SITE USE
- AOC 2 – PETROLEUM–IMPACTED SOIL, GROUNDWATER AND SOIL VAPOR
- AOC 4 – HISTORIC FILL

GENERAL NOTES:

1. BASE PLAN IS TAKEN FROM SITE SURVEY COMPLETED IN DECEMBER 2015 BY LANGAN.
2. ELEVATIONS ON THE BACKGROUND SURVEY ARE IN NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88). NAVD88 IS APPROXIMATELY 1.1 FEET ABOVE MEAN SEA LEVEL DATUM AT SANDY HOOK, NEW JERSEY, AS DEFINED BY THE UNITED STATES GEOLOGICAL SURVEY (USGS NGVD 1929).
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BLOCK No. 3199, LOT Nos. 106 and 113
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BRONX NEW YORK

Figure Title
PROPOSED REMEDIAL INVESTIGATION SAMPLE LOCATION MAP

Project No. 170390601	Figure No. 7
Date 5/2/2017	
Scale 1" = 40'	
Drawn By SH / Checked By GCW	
Submission Date	Sheet 7 of 8

Filename: \\langan.com\data\NYC\data6\170390601\Cadd Data - 170390601\2D-DesignFiles\Environmental\RIWP\Figure 7 - Proposed RI Sampling Location Map.dwg Date: 8/29/2017 Time: 17:43 User: sholberton Style Table: Langan.stb Layout: Figure

LEGEND:

APPROXIMATE SITE BOUNDARY

APPROXIMATE ADJOINING LOT BOUNDARY

GENERAL NOTES:

1. BASE PLAN IS TAKEN FROM NEARMAPS AERIAL IMAGE ACCESSED ON JULY 28, 2017 BY LANGAN.
2. UP TO TWO SUB-SLAB SOIL VAPOR SAMPLES AND ONE INDOOR AIR SAMPLE WILL BE COLLECTED WITHIN THE BUILDING SOUTH OF THE SITE AND EACH OF THE FOUR BUILDINGS WEST OF THE SITE. LOCATIONS WILL BE DETERMINED AFTER INSPECTIONS OF THE PROPERTIES HAVE BEEN CONDUCTED. AMBIENT AIR SAMPLES WILL BE COLLECTED CONCURRENTLY WITH THE SOIL VAPOR AND INDOOR AIR SAMPLES.

60 0 30 60

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Project

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BCP SITE NO. C203087
BLOCK No. 3199, LOT No.106 AND 113
BRONX
BRONX NEW YORK

Figure Title

PROPOSED OFF-SITE SOIL VAPOR INVESTIGATION SAMPLE LOCATION MAP

Project No. 170390601	Figure No. 8
Date 7/28/2017	
Scale 1" – 60'	
Drawn By CA / Checked By SH	
Submission Date	Sheet 8 of 8

Filename: \\Langan.com\data\NYC\data6\170390601\Cadd Data - 170390601\2D-DesignFiles\Environmental\RIWP\Figure 8 - Proposed Offsite Investigation Samples.dwg Date: 8/30/2017 Time: 10:54 User: gwyka Style Table: Langan.stb Layout: ANSIB-BL

APPENDIX A

PREVIOUS ENVIRONMENTAL REPORTS (ON CD)

1. *Phase I Environmental Site Assessment (ESA), prepared by Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C. (Langan), dated May 11, 2016*
2. *Phase II Environmental Site Investigation (ESI), prepared by Langan, dated May 11, 2016*

APPENDIX B

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

FOR

2409 JEROME AVENUE
BRONX, NEW YORK
NYSDEC BCP Site No. C203087

Prepared For

2409 Jerome, Inc.
29 East Fordham Road
Bronx, NY 10468

Prepared By:

Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C.
21 Penn Plaza
360 West 31st Street, 8th Floor
New York, New York 10001

May 2017
Langan Project No. 170390601

LANGAN

TABLE OF CONTENTS

Page No.

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

***** Items to be posted prominently on site, or made readily available to personnel.

1.0 INTRODUCTION

1.1 General

This Health And Safety Plan (HASP) was developed to address disturbance of known and reasonably anticipated subsurface contaminants and comply with Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1910.120(b) (4), *Hazardous Waste Operations and Emergency Response* during anticipated site work at the 2409 Jerome Avenue in the Fordham Heights neighborhood of the Bronx, New York (Tax Block 3199, Lots 106 and 113) ("the Site"). This HASP provides the minimum requirements for implementing site operations during remedial investigation activities. All contractors performing work on this Site shall implement their own Health and Safety Plans that, at a minimum, adhere to this HASP. The contractor is solely responsible for their own health and safety and that of their subcontractors. Langan personnel will implement this HASP while on-site.

The management of the day-to-day site activities and implementation of this HASP in the field is the responsibility of the site Langan Field Team Leader (FTL). Assistance in the implementation of this HASP can also be obtained from the site Langan Health and Safety Officer (HSO) and the Langan Health and Safety Manager (HSM). Contractors operating on the Site shall designate their own FTL, HSO and HSM. The content of this HASP may change or undergo revision based upon additional information made available to health and safety personnel, monitoring results, or changes in the work plan.

1.2 Site Location and Background

The Site is located at 2409 Jerome Avenue in the Fordham Heights neighborhood of the Bronx and is identified as New York City Tax Block 3199, Lots 106 and 113. A site location map is provided as Figure 1. The Site is rectangular and encompasses an area of about 25,200 square feet (0.58 acres). The Site is occupied by an asphalt-paved parking lot (Lot 113) and two one-story structures used for automotive repair (Lot 106). The site is bound by a two-story commercial building (2415 Jerome Ave) followed by West Fordham Road to the north, Jerome Avenue to the east, a two-story academic facility (2375 Jerome Avenue) followed by West 184th Street to the south, and five-story multi-family residential buildings (2390-2410 Davidson Avenue) followed by Davidson Avenue to the west.

1.3 Summary of Work Tasks

The general categories of work tasks being performed during implementation of the work plan include:

1.3.1 Geophysical Investigation

Prior to the commencement of intrusive field activities (i.e., soil borings); a geophysical consultant will conduct a geophysical survey using ground penetrating radar (GPR) and electromagnetic detection equipment. Langan personnel will coordinate the geophysical survey. The objective of the survey will be to identify any underground storage tank (UST) structures and/or associated piping and subsurface utilities that may be encountered during the investigation. During this time Langan personnel will inspect the Site and confirm sample locations.

1.3.2 Soil Investigation and Sampling

Langan will retain a drilling contractor to advance soil borings to a depth below grade surface (bgs) specified in the work plan. Borings locations will be based on the results of the geophysical survey and the site inspection and document review. The drilling contractor will contact the appropriate utility mark-out authority and make available to their drilling staff the verification number and effective dates. The borings will be filled with clean soil cuttings after samples are collected.

Langan personnel will screen soil for visual, olfactory, and instrumental indicators suggestive of a potential petroleum release. Instrument screening for the presence of volatile organic compounds (VOCs) may be performed with a calibrated photoionization detector (PID). Langan personnel will collect soil samples from the two-foot interval exhibiting the greatest degree of visual, olfactory, instrumental impact, or as otherwise specified in the work plan for lead delineation. Soil samples will be submitted to a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified laboratory and analyzed in accordance with work plan specifications.

1.3.3 Groundwater Investigation and Sampling

One or more soil borings will be converted into groundwater monitoring wells and sampled to evaluate groundwater quality. The wells will be developed in accordance with the Langan Well Development Standard Operating Procedure (SOP #07) by surging and pumping the well until the purged water is visibly clear. Groundwater samples will then be collected from one or more of the monitoring wells in accordance with the Langan Low Flow Groundwater Sampling SOP (SOP #12). Groundwater samples will be submitted to an NYSDOH ELAP-certified laboratory and analyzed for constituents as specified in the work plan. Langan personnel may survey the location and elevations of the newly completed wells.

1.3.4 Soil Vapor Point Installation and Sampling

The drilling contractor will install soil vapor points to a depth specified by the work plan. Vapor samples will be collected in accordance with the Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York (New York State Department of Health [NYSDOH] October

2006) and Langan's Soil Vapor Sampling SOP (SOP #13). Conditions in the field may require adjustment of sampling locations.

An ambient air sample may be collected for use as a comparison sample. The subsurface soil vapor samples will be collected using a polyethylene or stainless steel soil vapor implant and tubing or similar method. The annulus around the probe and tubing will be filled with sand to two inches above the probe. Bentonite slurry will be applied to the top of the sand up to seal the sampling points.

1.3.5 Drum Sampling

Excess or impacted soil and water drummed during the remedial action activities must be labeled in accordance with the Langan Drum Labeling Standard Operating Procedure (SOP-#9). Langan personnel will collect drum samples, as required, prior to off-site drum disposal. Samples will be placed into laboratory-supplied batch-certified clean glassware and submitted to a NYSDOH ELAP-certified laboratory.

2.0 IDENTIFICATION OF KEY PERSONNEL/HEALTH AND SAFETY PERSONNEL

The following briefly describes the health and safety (H&S) designations and general responsibilities that may be employed for this site. The titles have been established to accommodate the project needs and requirements and ensure the safe conduct of site activities. The H&S personnel requirements for a given work location are based upon the proposed site activities.

2.1 Langan Project Manager

The Langan Project Manager (PM) is Greg Wyka. His responsibilities include:

- Ensuring that this HASP is developed and approved prior to on-site activities.
- Ensuring that all the tasks in the project are performed in a manner consistent with Langan's comprehensive *Health and Safety Program for Hazardous Waste Operations* and this HASP.

2.2 Langan Corporate Health and Safety Manager

The Langan Corporate Health and Safety Manager (HSM) is Tony Moffa. His responsibilities include:

- Updating the *Health and Safety Program for Hazardous Waste Operations*.
- Assisting the site Health and Safety Officer (HSO) with development of the HASP, updating HASP as dictated by changing conditions, jobsite inspection results, etc. and approving changes to this HASP.
- Assisting the HSO in the implementation of this HASP and conducting Jobsite Safety

Inspections and assisting with communication of results and correction of shortcomings found.

- Maintaining records on personnel (medical evaluation results, training and certifications, accident investigation results, etc.).

2.3 Langan Site Health & Safety Officer

The Langan site HSO is William Bohrer. His responsibilities include:

- Participating in the development and implementation of this HASP.
- When on-site, assisting the Langan Field Team Leader in conducting Tailgate Safety Meetings and Jobsite Safety Inspections and correcting any shortcomings in a timely manner.
- Ensuring that proper PPE is available, worn by employees and properly stored and maintained.
- Controlling entry into and exit from the site contaminated areas or zones.
- Monitoring employees for signs of stress, such as heat stress, fatigue, and cold exposure.
- Monitoring site hazards and conditions.
- Knowing (and ensuring that all site personnel also know) emergency procedures, evacuation routes, and the telephone numbers of the ambulance, local hospital, poison control center, fire department, and police department.
- Resolving conflicts that may arise concerning safety requirements and working conditions.
- Reporting all incidents, injuries and near misses to the Langan Incident/Injury Hotline immediately and the client representative.

2.4 Langan Field Team Leader Responsibilities

The Langan Field Team Leader (FTL) is to be determined prior to the start of site activities. The Field Team Leader's responsibilities include:

- The management of the day-to-day site activities and implementation of this HASP in the field.
- Participating in and/or conducting Tailgate Safety Meetings and Jobsite Safety Inspections and correcting any shortcomings in a timely manner.
- When a Community Air Monitoring Operating Program (CAMP) is part of the scope, the FTL will set up and maintaining community air monitoring activities and instructing the responsible contractor to implement organic vapor or dust mitigation when necessary.
- Overseeing the implementation of activities specified in the work plan.

2.5 Contractor Responsibilities

The contractor shall develop and implement their own HASP for their employees, lower-tier subcontractors, and consultants. The contractor is solely responsible for their own health and safety and that of their subcontractors. Contractors operating on the Site shall designate their own FTL, HSO and HSM. The contractor's HASP will be at least as stringent as this Langan HASP. The contractor must be familiar with and abide by the requirements outlined in their own HASP. A contractor may elect to adopt Langan's HASP as its own provided that it has given written notification to Langan, but where Langan's HASP excludes provisions pertinent to the contractor's work (i.e., confined space entry); the contractor must provide written addendums to this HASP. Additionally, the contractor must:

- Ensure their employees are trained in the use of all appropriate PPE for the tasks involved;
- Notify Langan of any hazardous material brought onto the job site or site related area, the hazards associated with the material, and must provide a material safety data sheet (MSDS) or safety data sheet (SDS) for the material;
- Have knowledge of, understand, and abide by all current federal, state, and local health and safety regulations pertinent to the work;
- Ensure their employees handling hazardous materials, if identified at the Site, have received current training in the appropriate levels of 29 CFR 1910.120, *Hazardous Waste Operations and Emergency Response* (HAZWOPER) if hazardous waste is identified at the Site;
- Ensure their employees handling hazardous materials, if identified at the Site, have been fit-tested within the year on the type respirator they will wear;
- Ensure all air monitoring is in place pertaining to the health and safety of their employees as required by OSHA 1910.120; and
- All contractors must adherer to all federal, state, and local regulatory requirements.

3.0 TASK/OPERATION SAFETY AND HEALTH RISK ANALYSES

A Task-Hazard Analysis (Table 1) was completed for general construction hazards that may be encountered at the Site. Known and suspected chemical contaminant hazards that could be encountered during site operations are included in Table 2. A complete inventory of MSDS/SDS for chemical products used on site is included as Attachment E.

3.1 Specific Task Safety Analysis

3.1.1 Geophysical Survey

Langan personnel are not permitted to operate or otherwise handle the geophysical equipment including any downhole geophysical equipment subsequently used to survey boreholes. When

soil, groundwater or soil vapor points are surveyed with surface geophysical equipment, the locations of the point as well as possible utilities and other artifacts that may interfere with the subsurface investigation are to be marked with indelible paint, flags, or color tape (when marking indoor locations that the client has specifically requested not be marked with indelible paint). When applying paint, proper PPE including at a minimum hand protections should be used.

3.1.2 Soil Investigation and Sampling

Sampling the soil requires the donning of chemical resistant gloves in addition to the standard PPE. Langan personnel are not to operate drilling or excavation equipment nor open sampling devices (acetate liners, sonic sample bags, etc.). These tasks are to be completed by the driller or excavation contractor.

3.1.3 Groundwater Investigation and Sampling

Sampling groundwater requires the donning of chemical resistant gloves in addition to the standard PPE and cut resistant gloves when cutting sampling-tubing to length. Langan personnel are not to operate drilling equipment nor assemble or install monitoring well equipment. These tasks are to be completed by the driller contractor.

3.1.4 Soil Vapor Investigation and Sampling

Sampling soil vapor requires the donning of work gloves in addition to the standard PPE when assembling the Summa™ canister with the regulator and cut resistant gloves when cutting sampling- or silicone-tubing to length. Langan personnel are not to operate drilling equipment nor assemble or install soil vapor point equipment. These tasks are to be completed by the driller contractor.

3.1.5 Drum Sampling

Drilling fluid, rinse water, grossly-contaminated soil samples and cuttings will be containerized in 55-gallon drums for disposed off-site. Each drum must be labeled in accordance with the Langan Drum Labeling Standard Operating Procedure (SOP-#9). Sampling drums requires the donning of work gloves when opening the drums and chemical resistant gloves when sampling in addition to standard PPE.

Langan personnel and contractors are not to move or opened any orphaned (unlabeled) drum found on the site without approval of the project manager.

3.2 Radiation Hazards

No radiation hazards are known or expected at the site.

3.3 Physical Hazards

Physical hazards, which may be encountered during site operations for this project, are detailed in Table 1.

3.3.1 Explosion

No explosion hazards are expected for the scope of work at this site.

3.3.2 Heat Stress

The use of Level C protective equipment, or greater, may create heat stress. Monitoring of personnel wearing personal protective clothing should commence when the ambient temperature is 72^{O}F or above. Table 6 presents the suggested frequency for such monitoring. Monitoring frequency should increase as ambient temperature increases or as slow recovery rates are observed. Refer to the Table 7 to assist in assessing when the risk for heat related illness is likely. To use this table, the ambient temperature and relative humidity must be obtained (a regional weather report should suffice). Heat stress monitoring should be performed by the HSO or the FTL, who shall be able to recognize symptoms related to heat stress.

To monitor the workers, be familiar with the following heat-related disorders and their symptoms:

- **Heat Cramps:** Painful spasm of arm, leg or abdominal muscles, during or after work
- **Heat Exhaustion:** Headache, nausea, dizziness; cool, clammy, moist skin; heavy sweating; weak, fast pulse; shallow respiration, normal temperature
- **Heat Stroke**: Headache, nausea, weakness, hot dry skin, fever, rapid strong pulse, rapid deep respirations, loss of consciousness, convulsions, coma. *This is a life threatening condition***.**

Do not permit a worker to wear a semi-permeable or impermeable garment when they are showing signs or symptoms of heat-related illness.

To monitor the worker, measure:

- **Heart rate:** Count the radial pulse during a 30-second period as early as possible in the rest period. If the heart rate exceeds 100 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same. If the heart rate still exceeds 100 beats per minute at the next rest period, shorten the following work cycle by one-third. A worker cannot return to work after a rest period until their heart rate is below 100 beats per minute.
- **Oral temperature:** Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking).

If oral temperature exceeds 99.6°F (37.6°C), shorten the next work cycle by one-third without changing the rest period. A worker cannot return to work after a rest period until their oral temperature is below 99.6°F. If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, shorten the following cycle by one-third. Do not permit a worker to wear a semi-permeable or impermeable garment when oral temperature exceeds 100.6°F (38.1°C).

Prevention of Heat Stress - Proper training and preventative measures will aid in averting loss of worker productivity and serious illness. Heat stress prevention is particularly important because once a person suffers from heat stroke or heat exhaustion, that person may be predisposed to additional heat related illness. To avoid heat stress the following steps should be taken:

- Adjust work schedules.
- Mandate work slowdowns as needed.
- Perform work during cooler hours of the day if possible or at night if adequate lighting can be provided.
- Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.
- Maintain worker's body fluids at normal levels. This is necessary to ensure that the cardiovascular system functions adequately. Daily fluid intake must approximately equal the amount of water lost in sweat, id., eight fluid ounces (0.23 liters) of water must be ingested for approximately every eight ounces (0.23 kg) of weight lost. The normal thirst mechanism is not sensitive enough to ensure that enough water will be drunk to replace lost sweat. When heavy sweating occurs, encourage the worker to drink more. The following strategies may be useful:
    - Maintain water temperature 50° to 60°F (10° to 16.6°C).
    - Provide small disposal cups that hold about four ounces (0.1 liter).
    - Have workers drink 16 ounces (0.5 liters) of fluid (preferably water or dilute drinks) before beginning work.
    - Urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid per day are recommended, but more may be necessary to maintain body weight.
    - Train workers to recognize the symptoms of heat related illness.

3.3.3 Cold-Related Illness

If work on this project begins in the winter months, thermal injury due to cold exposure can become a problem for field personnel. Systemic cold exposure is referred to as hypothermia. Local cold exposure is generally called frostbite.

- **Hypothermia -** Hypothermia is defined as a decrease in the patient core temperature below 96^{O}F. The body temperature is normally maintained by a combination of central (brain and spinal cord) and peripheral (skin and muscle) activity. Interference with any of these mechanisms can result in hypothermia, even in the absence of what normally is considered a "cold" ambient temperature. Symptoms of hypothermia include: shivering, apathy, listlessness, sleepiness, and unconsciousness.
- **Frostbite -** Frostbite is both a general and medical term given to areas of local cold injury. Unlike systemic hypothermia, frostbite rarely occurs unless the ambient temperatures are less than freezing and usually less than 20^{O}F. Symptoms of frostbite are: a sudden blanching or whitening of the skin; the skin has a waxy or white appearance and is firm to the touch; tissues are cold, pale, and solid.

Prevention of Cold-Related Illness - To prevent cold-related illness:

- Educate workers to recognize the symptoms of frostbite and hypothermia
- Identify and limit known risk factors:
- Assure the availability of enclosed, heated environment on or adjacent to the site.
- Assure the availability of dry changes of clothing.
- Assure the availability of warm drinks.
- Start (oral) temperature recording at the job site:
- At the FSO or Field Team Leader's discretion when suspicion is based on changes in a worker's performance or mental status.
- At a worker's request.
- As a screening measure, two times per shift, under unusually hazardous conditions (e.g., wind-chill less than 20^{O}F, or wind-chill less than 30^{O}F with precipitation).
- As a screening measure whenever anyone worker on the site develops hypothermia.

Any person developing moderate hypothermia (a core temperature of 92^{O}F) cannot return to work for 48 hours.

3.3.4 Noise

Work activities during the proposed activities may be conducted at locations with high noise levels from the operation of equipment. Hearing protection will be used as necessary.

3.3.5 Hand and Power Tools

The use of hand and power tools can present a variety of hazards, including physical harm from being struck by flying objects, being cut or struck by the tool, fire, and electrocution. All hand and power tools should be inspected for health and safety hazards prior to use. If deemed unserviceable/un-operable, notify supervisor and tag equipment out of service. Ground Fault Circuit Interrupters (GFCIs) are required for all power tools requiring direct electrical service.

3.3.6 Slips, Trips and Fall Hazards

Care should be exercised when walking at the site, especially when carrying equipment. The presence of surface debris, uneven surfaces, pits, facility equipment, and soil piles contribute to tripping hazards and fall hazards. To the extent possible, all hazards should be identified and marked on the Site, with hazards communicated to all workers in the area.

3.3.7 Utilities (Electrocution and Fire Hazards)

The possibility of encountering underground utilities poses fire, explosion, and electrocution hazards. All excavation work will be preceded by review of available utility drawings and by notification of the subsurface work to the N.Y. One –Call–Center. Potential adverse effects of electrical hazards include burns and electrocution, which could result in death.

3.4 Biological Hazards

3.4.1 Animals

No animals are expected to be encountered during site operations.

3.4.2 Insects

Insects are not expected to be encountered during site operations.

3.5 Additional Safety Analysis

3.5.1 Presence of Non-Aqueous Phase Liquids (NAPL)

There is potential for exposure to NAPL at this site. Special care and PPE should be considered when NAPL is observed as NAPL is a typically flammable fluid and releases VOCs known to be toxic and/or carcinogenic. If NAPL is present in a monitoring well, vapors from the well casing may contaminate the work area breathing zone with concentrations of VOCs potentially exceeding health and safety action levels. In addition, all equipment used to monitor or sample NAPL (or groundwater from wells containing NAPL) must be intrinsically safe. Equipment that directly contacts NAPL must also be resistant to organic solvents.

At a minimum, a PID should be used to monitor for VOCs when NAPL is observed. If NAPL is expected to be observed in an excavation or enclosed area, air monitoring must be started using calibrated air monitoring equipment designed to sound an audio alarm when atmospheric concentrations of VOC are within 10% of the LEL. In normal atmospheric oxygen concentrations, the LEL monitoring may be done with a Wheatstone bridge/catalytic bead type sensor (i.e. MultiRAE). However in oxygen depleted atmospheres (confined space), only an LEL designed to work in low oxygen environments may be used. Best practices require that the LEL monitoring unit be equipped with a long sniffer tube to allow the LEL unit to remain

outside the UST excavation.

When NAPL is present, Langan personnel are required to use disposable nitrile gloves at all times to prevent skin contact with contaminated materials. They should also consider having available a respirator and protective clothing (Tyvek® overalls), especially if NAPL is in abundance and there are high concentrations of VOCs.

All contaminated disposables including PPE and sampling equipment must be properly disposed of in labeled 55-gallon drums.

3.6 Job Safety Analysis

A Job Safety Analysis (JSA) is a process to identify existing and potential hazards associated with each job or task so these hazards can be eliminated, controlled or minimized. A JSA will be performed at the beginning of each work day, and additionally whenever an employee begins a new task or moves to a new location. All JSAs must be developed and reviewed by all parties involved. A blank JSA form and documentation of completed JSAs are in Attachment G.

4.0 PERSONNEL TRAINING

4.1 Basic Training

Completion of an initial 40-hour HAZWOPER training program as detailed in OSHA's 29 CFR 1910.120(e) is required for all employees working on a site engaged in hazardous substance removal or other activities which expose or potentially expose workers to hazardous substances, health hazards, or safety hazards as defined by 29 CFR 1910.120(a). Annual 8-hour refresher training is also required to maintain competencies to ensure a safe work environment. In addition to these training requirements, all employees must complete the OSHA 10 hour Construction Safety and Health training and supervisory personnel must also receive eight additional hours of specialized management training. Training records are maintained by the HSM.

4.2 Initial Site-Specific Training

Training will be provided to specifically address the activities, procedures, monitoring, and equipment for site operations at the beginning of each field mobilization and the beginning of each discrete phase of work. The training will include the site and facility layout, hazards, and emergency services at the site, and will detail all the provisions contained within this HASP. For a HAZWOPER operation, training on the site must be for a minimum of 3 days. Specific issues that will be addressed include the hazards described in Section 3.0.

4.3 Tailgate Safety Briefings

Before starting work each day or as needed, the Langan HSO will conduct a brief tailgate safety meeting to assist site personnel in conducting their activities safely. Tailgate meetings will be documented in Attachment H. Briefings will include the following:

- Work plan for the day;
- Review of safety information relevant to planned tasks and environmental conditions;
- New activities/task being conducted;
- Results of Jobsite Safety Inspection Checklist;
- Changes in work practices;
- Safe work practices; and
- Discussion and remedies for noted or observed deficiencies.

5.0 MEDICAL SURVEILLANCE

All personnel who will be performing field work involving potential exposure to toxic and hazardous substances (defined by 29 CFR 1910.120(a)) will be required to have passed an initial baseline medical examination, with follow-up medical exams thereafter, consistent with 29 CFR 1910.120(f). Medical evaluations will be performed by, or under the direction of, a physician board-certified in occupational medicine.

Additionally, personnel who may be required to perform work while wearing a respirator must receive medical clearance as required under CFR 1910.134(e), *Respiratory Protection*. Medical evaluations will be performed by, or under the direction of, a physician board-certified in occupational medicine. Results of medical evaluations are maintained by the HSM.

6.0 COMMUNITY AIR MONITORING PROGRAM

Community air monitoring may be conducted in compliance with the NYSDOH Generic CAMP outlined below:

Monitoring for dust and odors will be conducted during all ground intrusive activities by the FTL. Continuous monitoring on the perimeter of the work zones for odor, VOCs, and dust may be required for all ground intrusive activities such as soil excavation and handling activities. The work zone is defined as the general area in which machinery is operating in support of remediation activities. A portable PID will be used to monitor the work zone and for periodic monitoring for VOCs during activities such as soil and groundwater sampling and .soil excavation. The site perimeter will be monitored for fugitive dust emissions by visual observations as well as instrumentation measurements (if required). When required, particulate or dust will be monitored continuously with real-time field instrumentation that will meet, at a minimum, the performance standards from DER-10 Appendix 1B.

If VOC monitoring is required, the following actions will be taken based on VOC levels

measured:

- If total VOC levels exceed 5 ppm above background for the 15-minute average at the perimeter, work activities will be temporarily halted and monitoring continued. If levels readily decrease (per instantaneous readings) below 5 ppm above background, work activities will resume with continued monitoring.
- If total VOC levels at the downwind perimeter of the hot zone persist at levels in excess of 5 ppm above background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps work activities will resume provided that the total organic vapor level 200 feet downwind of the hot zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less – but in no case less than 20 feet, is below 5 ppm above background for the 15-minute average.
- If the total VOC level is above 25 ppm at the perimeter of the hot zone, activities will be shutdown.

If dust monitoring with field instrumentation is required, the following actions will be taken based on instrumentation measurements:

- If the downwind particulate level is 100 micrograms per cubic meter (µg/m³) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression must be employed. Work may continue with dust suppression techniques provided that downwind PM10 levels do not exceed 150 µg/m³ above the background level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM10 levels are greater than 150 µg/m³ above the background level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM10 concentration to within 150 µg/m³ of the upwind level and in preventing visible dust migration.

6.1 Vapor Emission Response Plan

This section applies if VOC monitoring is required. If the ambient air concentration of organic vapors exceeds 5 ppm above background at the perimeter of the hot zone, boring and well installation, and excavation activities will be halted or odor controls will be employed, and monitoring continued. When work shut-down occurs, downwind air monitoring as directed by the HSO or FTL will be implemented to ensure that vapor emission does not impact the nearest residential or commercial structure at levels exceeding those specified in the Major Vapor Emission section.

If the organic vapor level decreases below 5 ppm above background, sampling and boring and well installation can resume, provided:

- The organic vapor level 200 feet downwind of the hot zone or half the distance to the nearest residential or commercial structure, whichever is less, is below 1 ppm over background, and
- More frequent intervals of monitoring, as directed by the HSO or FTL, are conducted.

6.2 Major Vapor Emission

This section applies if VOC monitoring is required. If any organic levels greater than 5 ppm over background are identified 200 feet downwind from the work site, or half the distance to the nearest residential or commercial property, whichever is less, all work activities must be halted or odor controls must be implemented.

If, following the cessation of the work activities, or as the result of an emergency, organic levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the hot zone, then the air quality must be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20 Foot Zone).

If either of the following criteria is exceeded in the 20 Foot Zone, then the Major Vapor Emission Response Plan shall automatically be implemented.

- Sustained organic vapor levels approaching 5 ppm above background for a period of more than 30 minutes, or
- Organic vapor levels greater than 5 ppm above background for any time period.

6.3 Major Vapor Emission Response Plan

Upon activation, the following activities will be undertaken:

- The local police authorities will immediately be contacted by the HSO or FTL and advised of the situation;
- Frequent air monitoring will be conducted at 30-minute intervals within the 20 Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the HSO or FTL; and
- All Emergency contacts will go into effect as appropriate.

6.4 Dust Suppression Techniques

Preventative measures for dust generation may include wetting site fill and soil, construction of an engineered construction entrance with gravel pad, a truck wash area, covering soils with tarps, and limiting vehicle speeds to five miles per hour.

Work practices to minimize odors and vapors include limiting the time that the excavations

remain open, minimizing stockpiling of contaminated-source soil, and minimizing the handling of contaminated material. Offending odor and organic vapor controls may include the application of foam suppressants or tarps over the odor or VOC source areas. Foam suppressants may include biodegradable foams applied over the source material for short-term control of the odor and VOCs.

If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: direct load-out of soils to trucks for off-Site disposal; use of chemical odorants in spray or misting systems; and, use of staff to monitor odors in surrounding neighborhoods.

Where odor nuisances have developed during remedial work and cannot be corrected, or where the release of nuisance odors cannot otherwise be avoided due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering excavation and handling areas under tented containment structures equipped with appropriate air venting/filtering systems.

7.0 PERSONAL PROTECTIVE EQUIPMENT

7.1 Levels of Protection

Langan will provide PPE to Langan employees to protect them from the specific hazards they are likely to encounter on-site. Direct hired contractors will provide their employees with equivalent PPE to protect them from the specific hazards likely to be encountered on-site. Selection of the appropriate PPE must take into consideration: (1) identification of the hazards or suspected hazards; (2) potential exposure routes; and, (3) the performance of the PPE construction (materials and seams) in providing a barrier to these hazards.

Based on anticipated site conditions and the proposed work activities to be performed at the site, Level D protection will be used. The upgrading/downgrading of the level of protection will be based on continuous air monitoring results as described in Section 6.0 (when applicable). The decision to modify standard PPE will be made by the site HSO or FTL after conferring with the PM. The levels of protection are described below.

Level D Protection (as needed)

- Safety glasses with side shields or chemical splash goggles
- Safety boots/shoes
- Coveralls (Tyvek® or equivalent)
- Hard hat
- Long sleeve work shirt and work pants
- Nitrile gloves
- Hearing protection

- Reflective safety vest

Level C Protection (as needed)

- Full or Half face, air-purifying respirator, with NIOSH approved HEPA filter
- Inner (latex) and outer (nitrile) chemical-resistant gloves
- Safety glasses with side shields or chemical splash goggles
- Chemical-resistant safety boots/shoes
- Hard hat
- Long sleeve work shirt and work pants
- Coveralls (Tyvek® or equivalent)
- Hearing protection (as needed)
- Reflective safety vest

The action levels used in determining the necessary levels of respiratory protection and upgrading to Level C are summarized in Table 4. The written Respiratory Protection Program is maintained by the HSM and is available if needed. The monitoring procedures and equipment are outlined in Section 6.0 (when applicable).

7.2 Respirator Fit-Test

All Langan employees who may be exposed to hazardous substances at the work site are in possession of a full or half face-piece, air-purifying respirator and have been successfully fit-tested within the past year. Fit-test records are maintained by the HSM.

8.0 SITE CONTROL

8.1 Site Communications Plan

Verbal communications will be the primary method of communication used at the site during the remedial action/remedial investigation and routine groundwater monitoring work. Cell phones shall be used to the extent practical. In the instances where verbal communication cannot be used, such as when working in respiratory protective equipment, hand signals will be used. Hand signals will be covered during site-specific training. Hand signals and their messages:

Hand Signal	Meaning
Hand gripping throat	Out of air; cannot breathe
Grip partners wrists or place both hands around waist	Leave immediately without debate
Hands on top of head	Need assistance
Thumbs up	OK; I'm alright; I understand
Thumbs down	No; negative
Simulated "stick" break with fists	Take a break; stop work

8.2 Work Zones

The need to formally establish specific work zones (Support, Contamination Reduction, and Exclusion Zones) during site activities will be determined by the HSO or FTL. It is important for the safety of all concerned that appropriate barriers (cones, wooden horses, plastic fencing etc.) are in place to keep vehicles and pedestrians away from the Work Zone.

8.2.1 Exclusion Zone

Exclusion zones or hot zones will be established within a 25 foot radius around drilling and sampling activities involving hazardous materials, where applicable and feasible. All personnel within the hot zone must don the appropriate levels of personal protection as set forth by the HSO. It is not anticipated that Level C or higher will be required for this site.

All personnel within the hot zone will be required to use the specified level of protection. No food, drink, or smoking will be allowed in the hot or warm zones.

8.2.2 Contamination Reduction Zone

If PID VOC concentration action levels are exceeded or obvious indications of contamination (by sight or odor) are encountered, a contamination reduction zone or warm zone will be established and utilized during the field activities. This zone will be established between the hot zone and the cold zone (discussed below), and will include the personnel and equipment necessary for decontamination of equipment and personnel exiting the hot zone. Personnel and equipment in the hot zone must pass through this zone before entering the cold zone. This zone should always be located upwind of the hot zone.

8.2.3 Support Zone

The support zone or cold zone will include the remaining areas of the job site. Break areas and support facilities (include equipment storage and maintenance areas) will be located in this zone. No equipment or personnel will be permitted to enter the cold zone from the hot zone without passing through the decontamination station in the warm zone (if necessitated). Eating, smoking, and drinking will be allowed only in this area.

8.3 The Buddy System

When working in teams of two or more, workers will use the "buddy system" for all work activities to ensure that rapid assistance can be provided in the event of an emergency. This requires work groups to be organized such that workers can remain close together and maintain visual contact with one another. Workers using the "buddy system" have the following responsibilities:

- Provide his/her partner with assistance.
- Observe his/her partner for signs of chemical or heat exposure.

- Periodically check the integrity of his/her partner's PPE.
- Notify the HSO or other site personnel if emergency service is needed.

9.0 NEAREST MEDICAL ASSISTANCE

The address and telephone number of the nearest hospital:

North Central Bronx Hospital
3424 Kossuth Avenue
Bronx, NY
718-519-3500

Map with directions to the hospital are shown in Figure 2. This information will either be posted prominently at the site or will be available to all personnel all of the time. Further, all field personnel, including the HSO & FTL, will know the directions to the hospital.

10.0 STANDING ORDERS/SAFE WORK PRACTICES

The standing orders, which consist of a description of safe work practices that must always be followed while on-site by Langan employees and contractors, are shown in Attachment A. The site HSO and FTL each have the responsibility for enforcing these practices. The standing orders will be posted prominently at the site, or are made available to all personnel at all times. Those who do not abide by these safe work practices will be removed from the site.

11.0 SITE SECURITY

No unauthorized personnel shall be permitted access to the work areas.

12.0 UNDERGROUND UTILITIES

As provided in Langan's Underground Utility Clearance Guidelines, the following safe work practices should be followed by Langan personnel and the contractor before and during subsurface work in accordance with federal, state and local regulations:

- Obtain available utility drawings from the property owner/client or operator.
- Provide utility drawings to the project team.
- In the field, mark the proposed area of subsurface disturbance (when possible).
- Ensure that the utility clearance system has been notified.
- Ensure that utilities are marked before beginning subsurface work.
- Discuss subsurface work locations with the owner/client and contractors.
- Obtain approval from the owner/client and operators for proposed subsurface work locations.
- Use safe digging procedures when applicable.
- Stay at least 10 feet from all equipment performing subsurface work.

13.0 SITE SAFETY INSPECTION

The Langan HSO or alternate will check the work area daily, at the beginning and end of each work shift or more frequently to ensure safe work conditions. The HSO or alternate must complete the Jobsite Safety Inspection Checklist, found in Attachment F. Any deficiencies shall be shared with the FTL, HSM and PM and will be discussed at the daily tailgate meeting.

14.0 HAND AND POWER TOOLS

All hand- and electric-power tools and similar equipment shall be maintained in a safe operating condition. All electric-power tools must be inspected before initial use. Damaged tools shall be removed immediately from service or repaired. Tools shall be used only for the purpose for which they were designed. All users must be properly trained in their safe operation.

15.0 DECONTAMINATION PLAN

15.1 General

All personnel, equipment, and samples leaving the contaminated area of the site must be decontaminated. Decontamination for this operation is achieved through physical removal and chemical detoxification/disinfection/sterilization. The first step in decontamination, however, is prevention and standard operating procedures have been established meant to minimize contact with wastes:

- Work habits that minimize contact with wastes are stressed.
- Disposable equipment, where appropriate, will be used.

15.2 Decontamination Procedures

Standard decontamination procedures will be used as described in Attachment B.

15.3 Disposal of Decontamination Wastes

Waste solutions generated during decontamination procedures shall be contained, collected, and stored in drums or other appropriate containers and labeled for proper off-site disposal.

16.0 EMERGENCY RESPONSE

16.1 General

Due to hazards that may be present at the site and the conditions under which operations are conducted, it is possible that an emergency situation may develop. Emergency situations can be characterized as injury or acute chemical exposure to personnel, fire or explosion, environmental release, or hazardous weather conditions.

16.2 Responsibilities

Site Emergency Coordinator - The HSO, or his/her alternate, will serve as the Site Emergency Coordinator and shall implement emergency procedures whenever conditions warrant such action. The Site Emergency Coordinator will be responsible for assuring the evacuation, emergency treatment, emergency transport of site personnel, and notification of emergency units and the appropriate management staff. Emergency response instructions will be provided by the HSO as part of every employee's training prior to the start of work.

Employees - All employees at the site will be familiar with emergency response procedures for this work location.

16.3 Evacuation

In the event of an emergency situation, an air horn or vehicle horn will be sounded three times indicating the initiation of evacuation procedures. Loud voice command, if appropriate, can be used. All personnel will evacuate and assemble at the site entrance. No one, except the emergency responders, will be allowed to proceed into the area once the emergency signal has been given. The Site Emergency Coordinator will ensure that access for emergency equipment is provided and that all sources of combustion (e.g., operating machinery, etc.) have been shut down once the alarm has been sounded. Wind direction will be taken into consideration for evacuation plans. Evacuation plans will be discussed at the initial Site-Specific Training and as needed at the regular safety briefings.

In all situations, when an on-site emergency results in an evacuation, personnel shall not re-enter until:

- The conditions resulting in the emergency have been corrected.
- The hazards have been reassessed.
- This HASP has been reviewed.
- Site personnel have been briefed on any changes to this HASP.

16.4 Emergency Contacts/Notification System

The fire department and other emergency response groups will be notified by telephone of the emergency as soon as possible. An emergency telephone numbers list is presented as Table 5 in this HASP. This list will either be posted prominently at the site or will be made readily available to all personnel all of the time.

16.5 Emergency Medical Treatment

Personnel Injury - In case of injury to personnel, the HSO or his/her alternate will immediately administer emergency first aid. The ambulance/rescue squad will also be contacted as necessary. Some situations may require transport of the injured parties by automobile.

Therefore, maps/directions to the nearest hospital are provided as Figure 2. Figure 2 will either be posted at the site, or will be made readily available to all personnel all of the time.

Personnel Exposure – Emergency first aid procedures to be followed are:

- **Skin Contact:** Use copious amounts of soap and water. Wash/rinse affected areas thoroughly, and then provide appropriate medical attention. Rinse eyes with water for at least 15 minutes.
- **Inhalation:** Move to fresh air and/or, if necessary decontaminate and transport to emergency medical facility.
- **Ingestion:** Decontaminate and transport to emergency medical facility.
- **Puncture/Laceration**: Decontaminate, if possible, and transport to emergency medical facility.

16.6 Fire or Explosion

Appropriate fire extinguishers will be made available at the site for trained personnel to use on insipient stage fires without endangering the safety and health of those nearby. If the use of fire extinguishers will not extinguish the fire, immediately notify the fire department, sound the evacuation signal, and then evacuate the area, assembling at the site entrance to be accounted for and to receive further instruction.

16.7 Spills/Leaks

Control or stop the spread of minor chemical spills or contamination by utilizing the appropriate materials (absorbents, etc.), if possible. If the release is significant, or highly hazardous, immediately notify the appropriate response groups, sound the evacuation signal, evacuate the area, and assemble at the site entrance to be accounted for and to receive further instruction.

16.8 Adverse Weather Conditions

In the event of severe weather (rain, snow, sleet, heat, etc.), conditions will be assessed on site to determine if the work can proceed safely. If it is determined that the weather poses a significant hazard, site operations will be stopped and rescheduled. Some of the items 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 working conditions including thunder storms. When thunderstorms do occur, work is to cease immediately while personnel seek shelter. Work cannot resume until 30 minutes after the last thunder clap.
- Limited visibility.

16.9 Underground Utilities

In the event a utility is encountered or disturbed during subsurface work, follow these procedures:

- Immediately stop work;
- Leave the work area and retreat to a safe area;
- Call 911, if necessary;
- Contact the client representative and owner and operator of the property; and
- Immediately notify the Langan PM, HSC and Langan Incident/Injury Hotline.

16.10 Documentation

Immediately following an incident or near miss, unless emergency medical treatment is required, either the employee or a coworker must contact the Langan Incident/Injury Hotline at 1-(800)-9-LANGAN (ext. #4699) and the client representative to report the incident or near miss. For emergencies involving personnel injury and/or exposure, the HSO and affected employee will complete and submit an Employee Exposure/Injury Incident Report (Attachment C) to the Langan Corporate Health and Safety Manager as soon as possible following the incident.

17.0 CONFINED SPACE ENTRY

Confined spaces are not anticipated at the Site during planned construction activities. If confined spaces are identified, the contractor must implement their own confined space program that all applicable federal, state and local regulations. Confined spaces **will not** be entered by Langan personnel.

18.0 HASP ACKNOWLEDGEMENT FORM

All Langan personnel and contractors will sign this HASP Compliance Agreement indicating that they have become familiar with this HASP and that they understand it and agree to abide by it.

Printed Name	Signature	Company	Date

TABLES

TABLE 1
TASK HAZARD ANALYSES

Task	Hazard	Description	Control Measures	First Aid
1.3.1 – 1.3.5	Contaminated Soil or Groundwater-Dermal Contact	Contaminated water spills on skin, splashes in eyes; contact with contaminated soil/fill during construction activities or sampling.	Wear proper PPE; follow safe practices, maintain safe distance from construction activities	See Table 2, seek medical attention as required
1.3.1 – 1.3.5	Lacerations, abrasions, punctures	Cutting bailer twine, pump tubing, acetate liners, etc. with knife; cuts from sharp site objects or previously cut piles, tanks, etc.; Using tools in tight spaces	Wear proper PPE; follow safe practices	Clean wound, apply pressure and/or bandages; seek medical attention as required.
1.3.1 – 1.3.5	Contaminated Media Inhalation	Opening drums, tanks, wells; vapors for non-aqueous phase liquids or other contaminated site media; dust inhalation during excavation; vapor accumulation in excavation	Follow air monitoring plan; have quick access to respirator, do not move or open unlabeled drums found at the site, maintain safe distance from construction activities	See Table 2, seek medical attention as required
1.3.1 – 1.3.5	Lifting	Improper lifting/carrying of equipment and materials causing strains	Follow safe lifting techniques; Langan employees are not to carry contractor equipment or materials	Rest, ice, compression, elevation; seek medical attention as required
1.3.1 – 1.3.5	Slips, trips, and falls	Slips, trips and falls due to uneven surfaces, cords, steep slopes, debris and equipment in work areas	Good housekeeping at site; constant awareness and focus on the task; avoid climbing on stockpiles; maintain safe distance from construction activities and excavations; avoid elevated areas over six feet unless fully accredited in fall protection and wearing an approved fall protection safety apparatus	Rest, ice, compression, elevation; seek medical attention as required
1.3.1 – 1.3.5	Noise	Excavation equipment, hand tools, drilling equipment.	Wear hearing protection; maintain safe distance from construction activities	Seek medical attention as required
1.3.1 – 1.3.5	Falling objects	Soil material, tools, etc. dropping from drill rigs, front-end loaders, etc.	Hard hats to be worn at all times while in work zones; maintain safe distance from construction activities and excavations	Seek medical attention as required
1.3.1 – 1.3.5	Underground/ overhead utilities	Excavation equipment, drill rig auger makes contact with underground object; boom touches overhead utility	"One Call" before dig; follow safe practices; confirm utility locations with contractor; wear proper PPE; maintain safe distance from construction activities and excavations	Seek medical attention as required
1.3.1 – 1.3.5	Insects (bees, wasps, hornet, mosquitoes, and spider)	Sings, bites	Insect Repellent; wear proper protective clothing (work boots, socks and light colored pants);field personnel who may have insect allergies (e.g., bee sting) should provide this information to the HSO or FSO prior to commencing work, and will have allergy medication on Site.	Seek medical attention as required
1.3.1 – 1.3.5	Vehicle traffic / Heavy Equipment Operation	Vehicles unable to see workers on site, operation of heavy equipment in tight spaces, equipment failure, malfunctioning alarms	Wear proper PPE, especially visibility vest; use a buddy system to look for traffic; rope off area of work with cones and caution tape or devices at points of hazard, maintain safe distance from construction activities and equipment	Seek medical attention as required

TABLE 2
CONTAMINANT HAZARDS OF CONCERN

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	1,2,4,5-Tetramethylbenzene	95-93-2	NA	None None	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	1,2,4-Trimethylbenzene	95-63-6	PID	None None	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	1,3,5-Trimethylbenzene Mesitylene sym-Trimethylbenzene	108-67-8	PID	None None	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	2,2,4-Trimethylpentane	540-84-1	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	1,3-Butadiene Biethylene Bivinyl Butadiene Divinyl Erythrene Vinylethylene	106-99-0	PID	1 ppm 2000 ppm	Vapor	inhalation, skin and/or eye contact (liquid)	irritation to the eyes, nose, throat; drowsiness, dizziness; liquid: frostbite; teratogenic, reproductive effects; [potential occupational carcinogen]	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support
1.3.1 – 1.3.5	p-Diethylbenzene 1,4-Diethyl benzene	105-05-5	PID	None None	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, respiratory system; skin burns; in animals: central nervous system depression	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	2-Butanone, Ethyl methyl ketone MEK Methyl acetone Methyl ethyl ketone	78-93-3	PID	200 ppm 3000 ppm	Soil Groundwater Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose; headache; dizziness; vomiting; dermatitis	Eye: Irrigate immediately Skin: Water wash immediately Breathing: Fresh air Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	2-Hexanone Butyl methyl ketone MBK Methyl butyl ketone Methyl n-butyl ketone	591-78-6	PID	100 ppm 1600 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose; peripheral neuropathy: lassitude (weakness, exhaustion), paresthesia; dermatitis; headache, drowsiness	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	2,4-Dimethylphenol 2,4-Xylenol m-Xylenol 1-Hydroxy-2,4-dimethylbenzene 2,4-Dimethylphenol 4-Hydroxy-1,3-dimethylbenzene 4,6-Dimethylphenol 1,3-Dimethyl-4-hydroxybenze	105-67-9	None	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; headache, narcosis, coma; dermatitis; in animals: liver, kidney damage	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	4-Isopropyltoulene 1-Methyl-4-(1-methylethyl)benzene 4-Isopropyltoluene; 4-Methylcumene; Paracymene p-Cymene p-Isopropyltoluene	99-87-6	PID	NA NA	Soil Groundwater Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; dermatitis; headache, narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	2-Methylnaphthalene β-methylnaphthalene	91-57-6	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion or skin absorption, eye contact	irritation to the skin, eyes, mucous membranes and upper respiratory tract. It may also cause headaches, nausea, vomiting, diarrhea, anemia, jaundice, euphoria, dermatitis, visual disturbances, convulsions and comatose	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Acenaphthene 1,2-Dihydroacenaphthylene 1,8-Ethylenenaphthalene peri-Ethylenenaphthalene Naphthyleneethylene Tricyclododecapentaene	83-32-9	PID	NA NA	Soil	inhalation, ingestion, skin and/or eye contact,	irritation to the skin, eyes, mucous membranes and upper respiratory tract; If ingested, it can cause vomiting	Eye: Irrigate immediately Skin: Soap wash immediately, if redness or irritation develop, seek medical attention immediately Breathing: Move to fresh air Swallow: do not induce vomiting, seek medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	Acetophenone 1-phenylethanone Methyl phenyl ketone Phenylethanone	98-86-2	None	NA NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the skin, eyes, mucous membranes and upper respiratory tract	Eye: Irrigate immediately, seek medical attention immediately, Skin: Soap wash immediately, if redness or irritation develop, seek medical attention immediately Breathing: Move to fresh air Swallow: do not induce vomiting, seek medical attention immediately
1.3.1 – 1.3.5	Acetone Dimethyl ketone Ketone propane 2-Propanone	67-64-1	PID	1000 ppm 2500 ppm	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; headache, dizziness, central nervous system depression; dermatitis	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Anthracene	120-12-7	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	irritation to the skin, eyes, mucous membranes and upper respiratory tract, abdominal pain if ingested.	Eye: Irrigate immediately, seek medical attention immediately, Skin: Soap wash immediately, Breathing: Move to fresh air, refer to medical attention; Swallow: refer to medical attention

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	Benzene Benzol Phenyl hydride	71-43-2	PID	3.19 mg/m^3 1,595 mg/mg^3	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; lassitude (weakness, exhaustion) [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Benzo(a)anthracene Benzanthracene Benzanthrene 1,2-Benzanthracene Benzo[b]phenanthrene Tetraphene	56-55-3	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, skin or eye contact, ingestion	dermatitis, bronchitis, [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Benzo(a)pyrene	50-32-8	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	dermatitis, bronchitis, [potential occupational carcinogen]	Eye: Irrigate immediately, seek medical attention Skin: Soap wash immediately; Breathing: move to fresh air; Swallow: Induce vomiting if conscious, seek medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	Benzo(b)fluoranthene	205-99-2	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.5	Benzo(g,h,i)perylene	191-24-2	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	NA	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.5	Benzo(k)fluoranthene	207-08-9	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	Benzyl butyl phthalate Butyl benzyl phthalate	86-66-7	None	NA NA	Groundwater Soil Vapor	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.5	Carbazole 9-azafluorene Dibenzopyrrole Diphenylenimine diphenyleneimide	86-74-8	None	NA NA	Soil	inhalation, skin absorption (liquid), skin and/or eye contact	irritation to eyes and skin, respiratory irritation	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.5	Carbon disulfide	75-15-0	PID	20 ppm 500 ppm	Soil Groundwater Vapor	inhalation, skin or eye contact, ingestion	irritation to the eyes, skin, respiratory system	Eye: Irrigate immediately (liquid) Skin: Water flush immediately (liquid) Breathing: Respiratory support

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	Methyl Chloride Chloromethane Monochloromethane	74-87-3	NA	100 ppm 2000 ppm	Groundwater Soil	inhalation, skin and/or eye contact	dizziness, nausea, vomiting; visual disturbance, stagger, slurred speech, convulsions, coma; liver, kidney damage; liquid: frostbite; reproductive, teratogenic effects; [potential occupational carcinogen]	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support
1.3.1 – 1.3.5	Chrysene Benzo[a]phenanthrene 1,2-Benzphenanthrene	218-01-9	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, absorption, ingestion, consumption	irritation to eye, skin, and respiratory, gastrointestinal irritation nausea, vomit, diarrhea [potential occupational carcinogen]	Eyes: Irrigate immediately Skin: Soap wash promptly. Breath: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Diethyl phthalate DEP Diethyl ester of phthalic acid Ethyl phthalate Diethylphthalate	84-66-2	PID	NA NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation eyes, skin, nose, throat; headache, dizziness, nausea; lacrimation (discharge of tears); possible polyneuropathy, vestibular dysfunc; pain, numb, lassitude (weakness, exhaustion), spasms in arms & legs; In Animals: reproductive effects	Eye: Irrigate immediately Skin: Wash regularly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	1,2-Dichloroethylene 1,2-DCE cis-1,2-Dichloroethylene mixture of cis and trans Acetylene dichloride cis-Acetylene dichloride trans-Acetylene dichloride sym-Dichloroethylene cis- 1,2-Dichloroethene Trans-1,2-Dichloroethylene, tDCE cDCE cis-1,2-Dichloroethene	540-59-0	PID	200 ppm 1000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, respiratory system; central nervous system depression	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	m-Cresol 3-methylphenol meta-Cresol 3-Cresol m-Cresylic acid 1-Hydroxy-3-methylbenzene 3-Hydroxytoluene 3-Methylphenol	108-39-4	PID	5 ppm 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; central nervous system effects: confusion, depression, resp failure; dyspnea (breathing difficulty), irreg rapid resp, weak pulse; eye, skin burns; dermatitis; lung, liver, kidney, pancreas damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	o-Cresol ortho-Cresol 2-Cresol o-Cresylic acid 1-Hydroxy-2-methylbenzene 2-Hydroxytoluene 2-Methyl phenol 2-Metyhlphenol	95-48-7	PID	5 ppm 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; central nervous system effects: confusion, depression, resp failure; dyspnea (breathing difficulty), irreg rapid resp, weak pulse; eye, skin burns; dermatitis; lung, liver, kidney, pancreas damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	p-Cresol para-Cresol 4-Cresol p-Cresylic acid 1-Hydroxy-4-methylbenzene 4-Hydroxytoluene 4-Methylphenol	106-44-5	PID	5 ppm 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; central nervous system effects: confusion, depression, resp failure; dyspnea (breathing difficulty), irreg rapid resp, weak pulse; eye, skin burns; dermatitis; lung, liver, kidney, pancreas damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Cumene Cumol Isopropylbenzene 2-Phenyl propane	98-82-8	PID	50 ppm 900 ppm	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; dermatitis; headache, narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Cyclohexane Benzene hexahydride Hexahydrobenzene Hexamethylene Hexanaphthene	110-82-7	PID	300 ppm 1300 ppm	Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, respiratory system; drowsiness; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	Dibenzo(a,h)anthracene	53-70-3	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, absorption, ingestion, consumption	irritation to eyes, skin, respiratory, and digestion [potential occupational carcinogen]	Eyes: Irrigate immediately Skin: Soap wash promptly. Breath: Respiratory support PID Swallow: Medical attention immediately
1.3.1 – 1.3.5	Bis(2-ethylhexyl)phthalate Di-sec octyl phthalate DEHP Di(2-ethylhexyl)phthalate Octyl phthalate	117-81-7	None	5 mg/m^3 5000 mg/m^3	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, mucous membrane; in animals: liver damage; teratogenic effects; [potential occupational carcinogen	Eye: Irrigate immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Ethanol Absolute alcohol Alcohol cologne spirit drinking alcohol ethane monoxide ethylic alcohol EtOH ethyl alcohol ethyl hydrate ethyl hydroxide ethylol grain alcohol hydroxyethane methylcarbinol	64-17-5	PID	1000 ppm 3300 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose; headache, drowsiness, lassitude (weakness, exhaustion), narcosis; cough; liver damage; anemia; reproductive, teratogenic effects	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Fresh air Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	Ethyl benzene Ethylbenzene Ethylbenzol Phenylethane	100-40-4	PID	435 mg/m^3 3,472 mg/m^3	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	p-Ethyltoluene 4-Ethyltoluene 1-ethyl-4-methyl-benzene	622-96-8	NA	NA NA	Soil	ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Fluoranthene Benzo(j, k)fluorene	206-44-0	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	Fluorene	86-73-7	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.5	Heptane n-Heptane	142-82-5	PID	500 ppm 750 ppm	Goundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	dizziness, stupor, incoordination; loss of appetite, nausea; dermatitis; chemical pneumonitis (aspiration liquid); unconsciousness	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Indeno(1,2,3-cd)pyrene	193-39-5	None	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, absorption, ingestion, consumption	irritation to eyes, skin, respiratory, and digestion [potential occupational carcinogen]	Eyes: Irrigate immediately Skin: Soap wash promptly. Breath: Respiratory support Swallow: Medical attention immediately, wash mouth with water

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	Isopropyl alcohol Iso-Propyl Alcohol Carbinol IPA Isopropanol 2-Propanol sec-Propyl alcohol Rubbing alcohol	67-63-0	PID	400 ppm 2000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; drowsiness, dizziness, headache; dry cracking skin; in animals: narcosis	Eye: Irrigate immediately Skin: Water flush Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Methylcyclohexane Methyl cyclohexane Hexahydrotoluene Cyclohexylmethane Toluene hexahydride	108-87-2	PID	500 ppm 1200 ppm	Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, drowsiness; in animals: narcosis	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Methyl *tert*-butyl ether MTBE Methyl tertiary-butyl ether Methyl t-butyl ether tert-Butyl methyl ether tBME tert-BuOMe	1634-04-4	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	Methylene Chloride Dichloromethane Methylene dichloride	75-09-2	PID	25 ppm 2300 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; lassitude (weakness, exhaustion), drowsiness, dizziness; numb, tingle limbs; nausea; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Naphthalene Naphthalin Tar camphor White tar	91-20-3	PID	50 mg/m^3 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; hematuria (blood in the urine); dermatitis, optical neuritis	Eye: Irrigate immediately Skin: Molten flush immediately/solid-liquid soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	n-Butylbenzene	104-51-8	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin; dry nose, throat; headache; low blood pressure, tachycardia, abnormal cardiovascular system stress; central nervous system, hematopoietic depression; metallic taste; liver, kidney injury	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	tert-Butylbenzene *t*-Butylbenzene 2-Methyl-2-phenylpropane Pseudobutylbenzene	98-06-6	PID	10 ppm NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	eye, skin irritation; dry nose, throat; headaches; low blood pressure, tachycardia; abnormal cardiovascular system; central nervous system depression; hematopoietic depression	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	n-Hexane Hexane, Hexyl hydride, normal-Hexane	110-54-3	PID	500 ppm 1100 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose; nausea, headache; peripheral neuropathy: numb extremities, muscle weak; dermatitis; dizziness; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	n-Propylbenzene Isocumene Propylbenzene 1-Phenylpropane 1-Propylbenzene Phenylpropane	103-65-1	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin; dry nose, throat; headache; low blood pressure, tachycardia, abnormal cardiovascular system stress; central nervous system, hematopoietic depression; metallic taste; liver, kidney injury	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	Phenanthrene	85-01-8	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.5	Pyrene benzo[def]phenanthrene	129-00-0	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.5	1,1′-Biphenyl Biphenyl Phenyl benzene Diphenyl	92-52-4	None	1 mg/m^3 100 mg/m^3	Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, throat; headache, nausea, lassitude (weakness, exhaustion), numb limbs; liver damage	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	sec-Butylbenzene	135-98-8	PID	10 ppm 100 ppm	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; inhalation: nausea or vomiting	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Tert-Butyl Alcohol Tertiary Butyl Alcohol 2-Methyl-2-propanol Trimethyl carbinol TBA	75-65-0	PID	100 ppm 1600 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; drowsiness, narcosis	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Tetrachloroethylene Perchlorethylene Perchloroethylene PCE Perk Tetrachlorethylene Tetrachloroethene	127-18-4	PID	100 ppm 150 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Toluene Methyl benzene Methyl benzol Phenyl methane Toluol	108-88-3	PID	200 ppm 500 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, paresthesia; dermatitis	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	Trichloroethylene Ethylene trichloride TCE Trichloroethene Trilene	79-01-6	PID	100 ppm 1000 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Trichlorofluoromethane Fluorotrichloromethane Freon® 11 Monofluorotrichloromethane Refrigerant 11 Trichloromonofluoromethane	75-69-4	PID	1000 ppm 2000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	incoordination, tremor; dermatitis; cardiac arrhythmias, cardiac arrest; asphyxia; liquid: frostbite	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Total PCBs Chlorodiphenyl (42% chlorine) Aroclor® 1242 PCB Polychlorinated biphenyl	53469-21-9	None	0.5 mg/m^3 5 mg/m^3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, chloracne	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	o-Xylenes 1,2-Dimethylbenzene ortho-Xylene o-Xylol	95-47-6	PID	100 ppm 900 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	m-Xylenes 1,3-Dimethylbenzene m-Xylol Metaxylene	108-38-3	PID	100 ppm 900 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	p-Xylenes 1,4-Dimethylbenzene para-Xylene p-Xylol	106-42-3	PID	100 ppm 900 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Total Xylenes Dimethylbenzene Xylol	1330-20-7	PID	100 ppm 900 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	Gasoline	8006-61-9	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; dermatitis; headache, lassitude (weakness, exhaustion), blurred vision, dizziness, slurred speech, confusion, convulsions; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Fuel Oil No. 2	68476-30-2	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Diesel Fuel automotive diesel fuel oil No. 2 distillate diesoline diesel oil diesel oil light diesel oil No. 1-D summer diesel	68334-30-5	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	Aluminum	7429-90-5	None	0.5 mg/m3 50 mg/m3	Soil	inhalation, skin and/or eye contact	irritation to the eyes, skin, respiratory system	Eye: Irrigate immediately Breathing: Fresh air
1.3.1 – 1.3.5	Antimony	7440-36-0	None	0.5 mg/m^3 50 mg/m^3	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation skin, possible dermatitis; resp distress; diarrhea; muscle tremor, convulsions; possible gastrointestinal tract	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Arsenic	NA	None	0.5 mg/m^3 NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation skin, possible dermatitis; resp distress; diarrhea; muscle tremor, convulsions; possible gastrointestinal tract	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Barium	10022-31-8	None	0.5 mg/m^3 50 mg/m^3	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, upper respiratory system; skin burns; gastroenteritis; muscle spasm; slow pulse	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	Beryllium	7440-41-7	None	0.002 mg/m^3 4 mg/m^3	Soil	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 to the eyes; dermatitis; [potential occupational carcinogen]	Eye: Irrigate immediately Breathing: Fresh air
1.3.1 – 1.3.5	Cadmium	7440-43-9	None	0.005 mg/m^3 9 mg/m^3	Soil	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]	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Calcium	7440-70-2	None	NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, upper resp tract; ulcer, perforation nasal septum; pneumonitis; dermatitis	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	Chromium Hexavalent- Trivalent-	7440-47-3	None	1.0 mg/m^3 250 mg/m^3	Groundwater Soil	inhalation absorption ingestion	irritation to eye, skin, and respiratory	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Cobalt	7440-48-4	None	0.1mg/m^3 20 mg/m^3	Soil	inhalation, ingestion, skin and/or eye contact	Cough, dyspnea (breathing difficulty), wheezing, decreased pulmonary function; weight loss; dermatitis; diffuse nodular fibrosis; resp hypersensitivity, asthma	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Copper	7440-50-8	None	1.0 mg/m^3 100 mg/m^3	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose, metallic taste; dermatitis; anemia	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	Cyanide	57-12-5	None	5 mg/m^3 25 mg/m^3	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	Exposure to cyanide can cause weakness, headaches, confusion, dizziness, fatigue, anxiety, sleepiness, nausea and vomiting. Breathing can speed up then become slow and gasping. Coma and convulsions also occur. If large amounts of cyanide have been absorbed by the body, the person usually collapses and death can occur very quickly. Long-term exposure to lower levels of cyanide can cause skin and nose irritation, itching, rashes and thyroid changes.	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Iron	7439-89-6	None	10 mg/m^3 NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; abdominal pain, diarrhea, vomiting	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	Lead	7439-92-1	None	0.050 mg/m^3 100 mg/m^3	Groundwater Soil	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 to the eyes; hypertension	Eye: Irrigate immediately Skin: Soap flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Manganese	7439-96-5	None	5 mg/m^3 500 mg/m^3	Groundwater Soil	inhalation, ingestion	aerosol is irritating to the respiratory tract	Eye: Irrigate immediately Skin: Soap flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Magnesium	7439-95-4	None	15 mg/m^3 NA	Soil	inhalation, skin and/or eye contact	irritation to the eyes, skin, respiratory system; cough	Eye: Irrigate immediately Breathing: Fresh air
1.3.1 – 1.3.5	Mercury	7439-97-6	None	0.1 mg/m^3 10 mg/m^3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	Nickel	7440-02-0	None	NA 10 mg/m³	Groundwater Soil	ion, ingestion, skin and/or eye contact	sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]	Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Potassium	7440-09-7	None	NA NA	Soil	inhalation, skin absorption, ingestion, skin and/or eye contact inhalation, ingestion, skin and/or eye contact	eye: Causes eye burns. Skin: Causes skin burns. Reacts with moisture in the skin to form potassium hydroxide and hydrogen with much heat. ingestion: Causes gastrointestinal tract burns. inhalation: May cause irritation of the respiratory tract with burning pain in the nose and throat, coughing, wheezing, shortness of breath and pulmonary edema. Causes chemical burns to the respiratory tract. inhalation may be fatal as a result of spasm, inflammation, edema of the larynx and bronchi, chemical pneumonitis and pulmonary edema.	Eyes: Get medical aid immediately Skin: Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. ingestion: If victim is conscious and alert, give 2-4 full cups of milk or water. Get medical aid immediately. inhalation: Get medical aid immediately.

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	Selenium	7782-49-2	None	1 mg/m^3 0.2 mg/m^3	Soil	inhalation, ingestion, skin and/or eye contact	irritation to the 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	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Sodium	7440-23-5	None	NA NA	Groundwater Soil	ion, ingestion, skin and/or eye contact	sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]	Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Vanadium	7440-62-2	None	0.1 mg/m3 15 mg/m3	Groundwater Soil	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	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.5	Zinc	7440-62-2	None	15 mg/m^3 500 mg/m^3	Groundwater Soil	inhalation	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	Breathing: Respiratory support
1.3.1 – 1.3.5	Non-Flammable Gas Mixture CALGAS (Equipment Calibration Gas : Oxygen Methane Hydrogen Sulfide Carbon Monoxide Nitrogen	 7782-44-7 74-82-8 7783-08-4 830-08-0 7727-37-9	Multi-Gas PID	 NA/NA NA/NA 10/100 ppm 50/1200 ppm NA/NA	NA	inhalation	dizziness, headache, and nausea	Breathing: Respiratory support
1.3.1 – 1.3.5	Helium	7440-59-7	Helium Detector	NA NA	NA	inhalation	dizziness, headache, and nausea	Breathing: Respiratory support
1.3.1 – 1.3.5	Potassium hydrogen phthalate	877-24-7	NA	NA NA	NA	skin absorption, ingestion, skin and/or eye contact	nausea, diarrhea, abdominal pain, vomiting;	Skin: Water flush promptly Swallow: Medical attention immediately
1.3.1 – 1.3.5	Non-Flammable Gas Mixture CALGAS (Equipment Calibration Gas : Oxygen Isobutylene Nitrogen	 7782-44-7 115-11-7 7727-37-9	PID	 NA/NA NA/NA NA/NA	NA	inhalation	dizziness, headache, and nausea	Breathing: Respiratory support

EXPLANATION OF ABBREVIATIONS

PID = Photoionization Detector
PEL = Permissible Exposure Limit (8-hour Time Weighted Average
IDLH = Immediately Dangerous to Life and Health
ppm = part per million
mg/m^3 = milligrams per cubic meter
500 mg/m3

TABLE 3
Summary of Monitoring Equipment

Instrument	Operation Parameters
Photoionization Detector (PID)	**Hazard Monitored:** Many organic and some inorganic gases and vapors. **Application:** Detects total concentration of many organic and some inorganic gases and vapors. Some identification of compounds is possible if more than one probe is measured. **Detection Method:** Ionizes molecules using UV radiation; produces a current that is proportional to the number of ions. **General Care/Maintenance:** Recharge or replace battery. Regularly clean lamp window. Regularly clean and maintain the instrument and accessories. **Typical Operating Time:** 10 hours. 5 hours with strip chart recorder.
Oxygen Meter	**Hazard Monitored:** Oxygen (O_2). **Application:** Measures the percentage of O_2 in the air. **Detection Method:** Uses an electrochemical sensor to measure the partial pressure of O_2 in the air, and converts the reading to O_2 concentration. **General Care/Maintenance:** Replace detector cell according to manufacturer's recommendations. Recharge or replace batteries prior to explanation of the specified interval. If the ambient air is less than 0.5% C O_2, replace the detector cell frequently. **Typical Operating Time:** 8 – 12 hours.
Additional equipment (if needed, based on site conditions)	
Combustible Gas Indicator (CGI)	**Hazard Monitored:** Combustible gases and vapors. **Application:** Measures the concentration of combustible gas or vapor. **Detection Method:** A filament, usually made of platinum, is heated by burning the combustible gas or vapor. The increase in heat is measured. Gases and vapors are ionized in a flame. A current is produced in proportion to the number of carbon atoms present. **General Care/Maintenance:** Recharge or replace battery. Calibrate immediately before use. **Typical Operating Time:** Can be used for as long as the battery lasts, or for the recommended interval between calibrations, whichever is less.
Flame Ionization Detector (FID) with Gas Chromatography Option *(i.e., Foxboro Organic Vapor Analyzer (OVA))*	**Hazard Monitored:** Many organic gases and vapors (approved areas only). **Application:** In survey mode, detects the concentration of many organic gases and vapors. In gas chromatography (GC) mode, identifies and measures specific compounds. In survey mode, all the organic compounds are ionized and detected at the same time. In GC mode, volatile species are separated. **General Care/Maintenance:** Recharge or replace battery. Monitor fuel and/or combustion air supply gauges. Perform routine maintenance as described in the manual. Check for leaks. **Typical Operating Time:** 8 hours; 3 hours with strip chart recorder.
Potable Infrared (IR) Spectrophotometer	**Hazard Monitored:** Many gases and vapors. **Application:** Measures concentration of many gases and vapors in air. Designed to quantify one or two component mixtures. **Detection Method:** Passes different frequencies of IR through the sample. The frequencies absorbed are specific for each compound. **General Care/Maintenance:** As specified by the manufacturer.

Instrument	Operation Parameters
Direct Reading Colorimetric Indicator Tube	**Hazard Monitored:** Specific gas and vapors. **Application:** Measures concentration of specific gases and vapors. **Detection Method:** The compound reacts with the indicator chemical in the tube, producing a stain whose length or color change is proportional to the compound's concentration. **General Care/Maintenance:** Do not use a previously opened tube even if the indicator chemical is not stained. Check pump for leaks before and after use. Refrigerate before use to maintain a shelf life of about 2 years. Check expiration dates of tubes. Calibrate pump volume at least quarterly. Avoid rough handling which may cause channeling.
Aerosol Monitor	**Hazard Monitored:** Airborne particulate (dust, mist, fume) concentrations **Application:** Measures total concentration of semi-volatile organic compounds, PCBs, and metals. **Detection Method:** Based on light-scattering properties of particulate matter. Using an internal pump, air sample is drawn into the sensing volume where near infrared light scattering is used to detect particles. **General Care/Maintenance:** As specified by the mfr. Also, the instrument must be calibrated with particulates of a size and refractive index similar to those to be measured in the ambient air.
Monitox	**Hazard Monitored:** Gases and vapors. **Application:** Measures specific gases and vapors. **Detection Method:** Electrochemical sensor relatively specific for the chemical species in question. **General Care/Maintenance:** Moisten sponge before use; check the function switch; change the battery when needed.
Gamma Radiation Survey Instrument	**Hazard Monitored:** Gamma Radiation. **Application:** Environmental radiation monitor. **Detection Method:** Scintillation detector. **General Care/Maintenance:** Must be calibrated annually at a specialized facility. **Typical Operating Time:** Can be used for as long as the battery lasts, or for the recommended interval between calibrations, whichever is less.

TABLE 4
INSTRUMENTATION ACTION LEVELS

Photoionization Detector Action Levels	**Action Required**
Background to 5 ppm	No respirator; no further action required
> 1 ppm but < 5 ppm for > 5 minutes	1. Temporarily discontinue all activities and evaluate potential causes of the excessive readings. If these levels persist and cannot be mitigated (i.e., by slowing drilling or excavation activities), contact HSO to review conditions and determine source and appropriate response action. 2. If PID readings remain above 1 ppm, temporarily discontinue work and upgrade to Level C protection. 3. If sustained PID readings fall below 1 ppm, downgrading to Level D protection may be permitted.
> 5 ppm but < 150 ppm for > 5 minutes	1. Discontinue all work; all workers shall move to an area upwind of the jobsite. 2. Evaluate potential causes of the excessive readings and allow work area to vent until VOC concentrations fall below 5 ppm. 3. Level C protection will continue to be used until PID readings fall below 1 ppm.
> 150 ppm	Evacuate the work area

Notes:
1. 1 ppm level based on OSHA Permissible Exposure Limit (PEL) for benzene.
2. 5 ppm level based on OSHA Short Term Exposure Limit (STEL) maximum exposure for benzene for any 15 minute period.
3. 150 ppm level based on NIOSH Immediately Dangerous to Life and Health (IDLH) for tetrachloroethylene.

TABLE 5
EMERGENCY NOTIFICATION LIST

ORGANIZATION	CONTACT	TELEPHONE
Local Police Department	NYPD	911
Local Fire Department	NYFD	911
Ambulance/Rescue Squad	NYFD	911
Hospital	North Central Bronx Hospital	911 or 718-519-3500
Langan Incident / Injury Hotline		800-952-6426 ex 4699
Langan Project Manager	Greg Wyka	347-267-2679 (cell)
Langan Health and Safety Manager (HSM)	Tony Moffa	215-756-2523 (cell)
Langan Health & Safety Officer (HSO)	William Bohrer	410-984-3068 (cell)
Langan Field Team Leader (FTL)	To Be Determined	
Client's Representative	David Dimond	914-740-6436
National Response Center (NRC)		800-424-8802
Chemical Transportation Emergency Center (Chemtrec)		800-424-9300
Center for Disease Control (CDC)		404-639-3534
EPA (RCRA Superfund Hotline)		800-424-9346
TSCA Hotline		202-554-1404
Poison Control Center		800-222-1222

Immediately following an incident or near miss, unless emergency medical treatment is required, either the employee or a coworker must contact the Langan Incident/Injury Hotline at 1-(800)-9-LANGAN (ext. #4699).

TABLE 6
SUGGESTED FREQUENCY OF PHYSIOLOGICAL MONITORING FOR FIT AND ACCLIMATED WORKERS[A]

Adjusted Temperature[b]	Normal Work Ensemble[c]	Impermeable Ensemble
90°F or above (32.2°C) or above	After each 45 min. of work	After each 15 min. of work
87.5°F (30.8°-32.2°C)	After each 60 min. of work	After each 30 min. of work
82.5°-87.5°F (28.1°-30.8°C)	After each 90 min. of work	After each 60 min. of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 min. of work	After each 90 min. of work
72.5°-77.5°F (22.5°-25.3°C)	After each 150 min. of work	After each 120 min. of work

a For work levels of 250 kilocalories/hour.

b Calculate the adjusted air temperature (ta adj) by using this equation: ta adj ^{o}F = ta ^{o}F + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)

c A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

TABLE 7

HEAT INDEX

	ENVIRONMENTAL TEMPERATURE (Fahrenheit)										
	70	**75**	**80**	**85**	**90**	**95**	**100**	**105**	**110**	**115**	**120**
RELATIVE HUMIDITY	**APPARENT TEMPERATURE***										
0%	64	69	73	78	83	87	91	95	99	103	107
10%	65	70	75	80	85	90	95	100	105	111	116
20%	66	72	77	82	87	93	99	105	112	120	**130**
30%	67	73	78	84	90	96	104	113	123	**135**	**148**
40%	68	74	79	86	93	101	110	123	**137**	**151**	
50%	69	75	81	88	96	107	120	**135**	**150**		
60%	70	76	82	90	100	114	**132**	**149**			
70%	70	77	85	93	106	124	**144**				
80%	71	78	86	97	113	**136**					
90%	71	79	88	102	122						
100%	72	80	91	108							

*Combined Index of Heat and Humidity...what it "feels like" to the body
Source: National Oceanic and Atmospheric Administration

How to use Heat Index:
1. Across top locate Environmental Temperature
2. Down left side locate Relative Humidity
3. Follow across and down to find Apparent Temperature
4. Determine Heat Stress Risk on chart at right

Note: Exposure to full sunshine can increase Heat Index values by up to 15 degrees F.

Apparent Temperature	**Heat Stress Risk with Physical Activity and/or Prolonged Exposure**
90-105	Heat Cramps or Heat Exhaustion Possible
105-130	Heat Cramps or Heat Exhaustion Likely, Heat Stroke Possible
>130	Heatstroke Highly Likely

FIGURES

FIGURE 1

Site Location Map

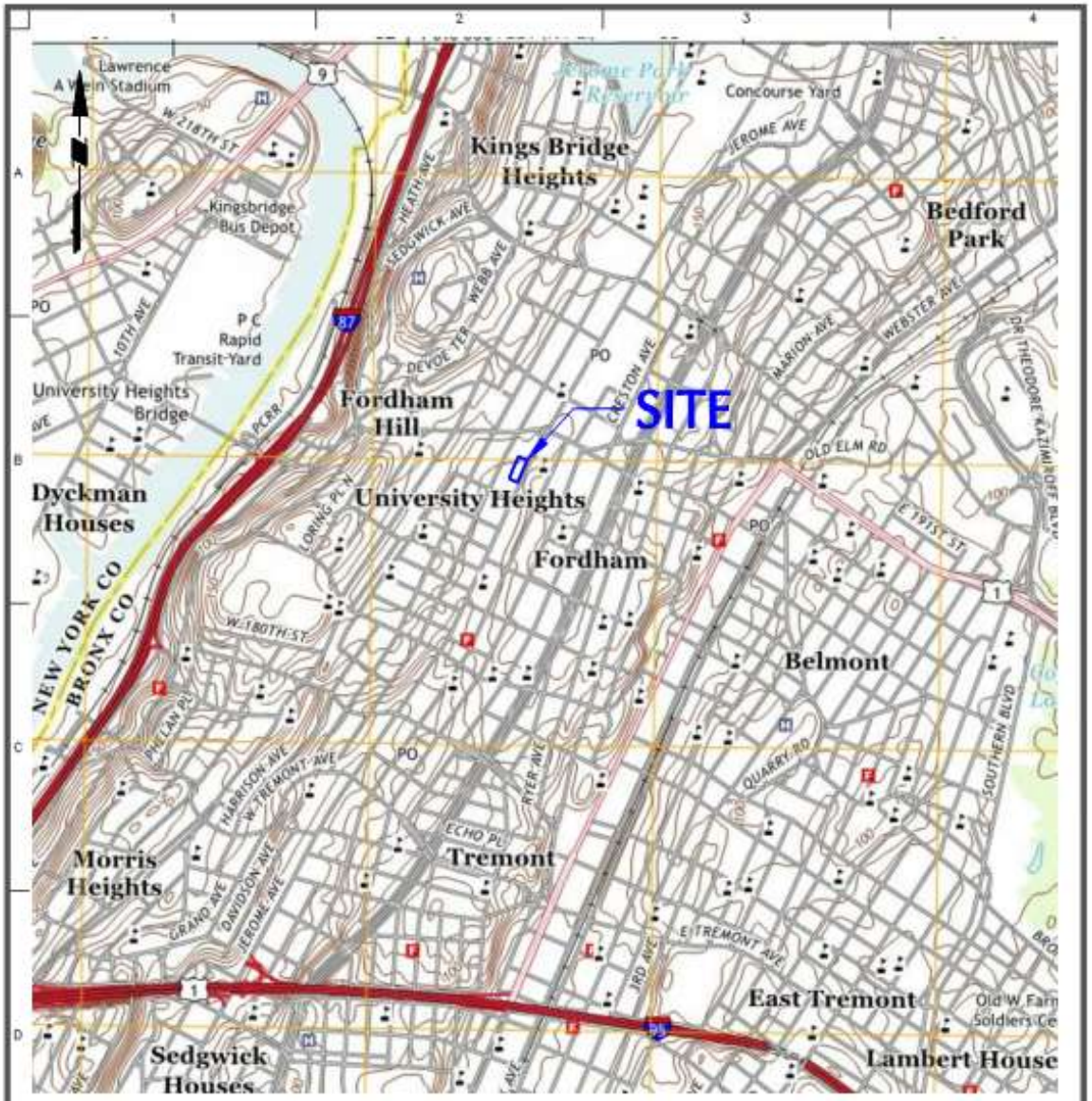


FIGURE 2

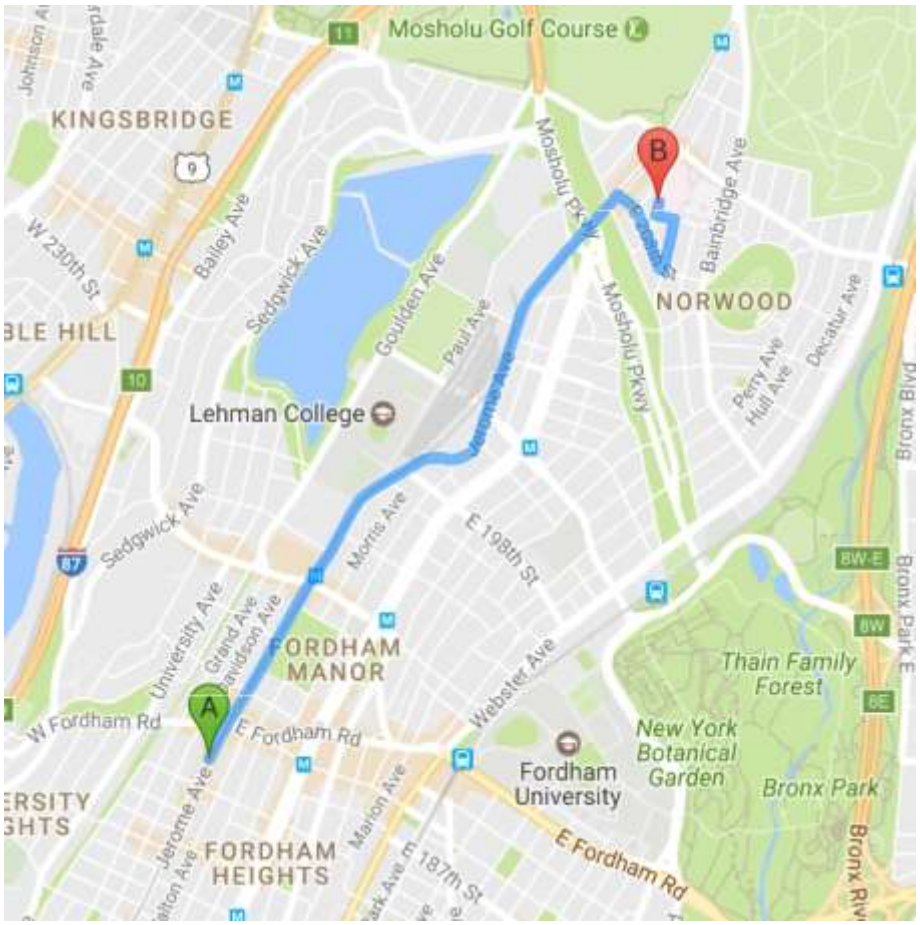
HOSPITAL ROUTE PLAN

Hospital Location: **North Central Bronx Hospital**
3424 Kossuth Avenue
Bronx, NY
718-519-3500

START: 2409 Jerome Avenue, Bronx, NY

1. Head northeast on Jerome Avenue toward E. Fordham Road
2. Turn right onto East 208th Street
3. Sharp left onto Steuben Avenue
4. Turn left onto East 210th Street
5. Turn right at first cross street onto Kossuth Avenue; destination will be on the right.

END: North Central Bronx Hospital, 3424 Kossuth Avenue, Bronx, NY



ATTACHMENT A

STANDING ORDERS

STANDING ORDERS

GENERAL

- No smoking, eating, or drinking in this work zone.
- Upon leaving the work zone, personnel will thoroughly wash their hands and face.
- Minimize contact with contaminated materials through proper planning of work areas and decontamination areas, and by following proper procedures. Do not place equipment on the ground. Do not sit on contaminated materials.
- No open flames in the work zone.
- Only properly trained and equipped personnel are permitted to work in potentially contaminated areas.
- Always use the appropriate level of personal protective equipment (PPE).
- Maintain close contact with your buddy in the work zone
- Contaminated material will be contained in the Exclusion Zone (EZ).
- Report any unusual conditions.
- Work areas will be kept clear and uncluttered. Debris and other slip, trip, and fall hazards will be removed as frequently as possible.
- The number of personnel and equipment in the work zone will be kept to an essential minimum.
- Be alert to the symptoms of fatigue and heat/cold stress, and their effects on the normal caution and judgment of personnel.
- Conflicting situations which may arise concerning safety requirements and working conditions must be addressed and resolved quickly by the site HSO.

TOOLS AND HEAVY EQUIPMENT

- Do not, under any circumstances, enter or ride in or on any backhoe bucket, materials hoist, or any other device not specifically designed to carrying passengers.
- Loose-fitting clothing or loose long hair is prohibited around moving machinery.
- Ensure that heavy equipment operators and all other personnel in the work zone are using the same hand signals to communicate.
- Drilling/excavating within 10 feet in any direction of overhead power lines is prohibited.
- The locations of all underground utilities must be identified and marked out prior to initiating any subsurface activities.
- Check to insure that the equipment operator has lowered all blades and buckets to the ground before shutting off the vehicle.
- If the equipment has an emergency stop device, have the operator show all personnel its location and how to activate it.
- Help the operator ensure adequate clearances when the equipment must negotiate in tight quarters; serve as a signalman to direct backing as necessary.
- Ensure that all heavy equipment that is used in the Exclusion Zone is kept in that zone until the job is done, and that such equipment is completely decontaminated before moving it into the clean area of the work zone.
- Samplers must not reach into or get near rotating equipment such as the drill rig. If personnel must work near any tools that could rotate, the equipment operator must completely shut down the rig prior to initiating such work. It may be necessary to use a remote sampling device.

ATTACHMENT B

DECONTAMINATION PROCEDURES

PERSONNEL DECONTAMINATION

LEVEL C DECONTAMINATION

Station 1:	Equipment Drop	1. Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, cool down stations may be set up within this area.
Station 2:	Outer Garment, Boots, and Gloves Wash and Rinse	2. Scrub outer boots, outer gloves and chemical-resistant splash suit with decon solution or detergent and water. Rinse off using copious amounts of water.
Station 3:	Outer Boot and Glove Removal	3. Remove outer boots and gloves. Deposit in container with plastic liner.
Station 4:	Canister or Mask Change	4. If worker leaves Exclusion Zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.
Station 5:	Boot, Gloves and Outer Garment Removal	5. Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic.
Station 6:	Face piece Removal	6. Face piece is removed (avoid touching face with fingers). Face piece deposited on plastic sheets.
Station 7:	Field Wash	7. Hands and face are thoroughly washed. Shower as soon as possible.

LEVEL D DECONTAMINATION

Station 1:	Equipment Drop	1. Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, cool down stations may be set up within this area.
Station 2:	Outer Garment, Boots, and Gloves Wash and Rinse	2. Scrub outer boots, outer gloves and chemical-resistant splash suit with decon solution or detergent and water. Rinse off using copious amounts of water.
Station 3:	Outer Boot and Glove Removal	3. Remove outer boots and gloves. Deposit in container with plastic liner.
Station 4:	Boot, Gloves and Outer Garment Removal	4. Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic.
Station 5:	Field Wash	5. Hands and face are thoroughly washed. Shower as soon as possible.

EQUIPMENT DECONTAMINATION

GENERAL:

Equipment to be decontaminated during the project may include tools, monitoring equipment, respirators, sampling containers, laboratory equipment and drilling equipment.

All decontamination will be done by personnel in protective gear, appropriate for the level of decontamination, as determined by the site HSO. The decontamination work tasks will be split or rotated among support and work crews.

Depending on site conditions, backhoe and pumps may be decontaminated over a portable decontamination pad to contain wash water; or, wash water may be allowed to run off into a storm sewer system. Equipment needed may include a steam generator with high-pressure water, empty drums, screens, screen support structures, and shovels. Drums will be used to hold contaminated wash water pumped from the lined pit. These drums will be labeled as such.

Miscellaneous tools and equipment will be dropped into a plastic pail, tub, or other container. They will be brushed off and rinsed with a detergent solution, and finally rinsed with clean water.

MONITORING EQUIPMENT:

Monitoring equipment will be protected as much as possible from contamination by draping, masking, or otherwise covering as much of the instruments as possible with plastic without hindering the operation of the unit. The PID, HNu or OVA meter, for example, can be placed in a clear plastic bag, which allows reading of the scale and operation of knobs. The probes can be partially wrapped keeping the sensor tip and discharge port clear.

The contaminated equipment will be taken from the drop area and the protective coverings removed and disposed in the appropriate containers. Any dirt or obvious contamination will be brushed or wiped with a disposable paper wipe.

RESPIRATORS:

Respirators will be cleaned and disinfected after every use. Taken from the drop area, the masks (with the cartridges removed and disposed of with other used disposable gear) will be immersed in a cleaning solution and scrubbed gently with a soft brush, followed by a rinse in plain warm water, and then allowed to air dry. In the morning, new cartridges will be installed. Personnel will inspect their own masks for serviceability prior to donning them. And, once the mask is on, the wearer will check the respirator for leakage using the negative and positive pressure fit check techniques.

ATTACHMENT C

EMPLOYEE EXPOSURE/ INJURY INCIDENT REPORT

EMPLOYEE INCIDENT/INJURY REPORT
LANGAN ENGINEERING & ENVIRONMENTAL SERVICES

(Complete and return to Tony Moffa in the Doylestown Office)

Affected Employee Name: _____ Date: _____

Incident type: ☐ Injury ☐ Report Only/No Injury

☐ Near Miss ☐ Other: _____

EMPLOYEE INFORMATION (Person completing Form)

Employee Name: _____ Employee No: _____

Title: _____ Office Location: _____

Length of time employed or date of hire: _____

Mailing address: _____

_____

Sex: M ☐ F ☐ Birth date: _____

Business phone & extension: _____ Residence/cell phone: _____

ACCIDENT INFORMATION

Project: _____ Project #: _____

Date & time of incident: _____ Time work started & ended: _____

Site location: _____

Incident Type: Possible Exposure ☐ Exposure ☐ Physical Injury ☐

Names of person(s) who witnessed the incident: _____

_____

Exact location incident occurred: _____

_____

Describe work being done: _____

Describe what affected employee was doing prior to the incident occurring: _____

Describe in detail how the incident occurred: _____

Nature of the incident (List the parts of the body affected): _____

Person(s) to whom incident was reported (Time and Date): _____

List the names of other persons affected during this incident: _____

Possible causes of the incident (equipment, unsafe work practices, lack of PPE, etc.): _____

Weather conditions during incident: _____

MEDICAL CARE INFORMATION

Did affected employee receive medical care? Yes ☐ No ☐

If Yes, when and where was medical care received: _____

Provide name of facility (hospital, clinic, etc.): _____

Length of stay at the facility? _____

Did the employee miss any work time? Yes ☐ No ☐ Undetermined ☐

Date employee last worked: _____ Date employee returned to work: _____

Has the employee returned to work? Yes ☐ No ☐

Does the employee have any work limitations or restrictions from the injury? : Yes ☐ No ☐

If Yes, please describe: _____

_____

Did the exposure/injury result in permanent disability? Yes ☐ No ☐ Unknown ☐

If Yes, please describe: _____

HEALTH & SAFETY INFORMATION

Was the operation being conducted under an established site specific CONSTRUCTION HEALTH AND SAFETY PLAN?
Yes ☐ No ☐ Not Applicable: ☐

Describe protective equipment and clothing used by the employee:

_____

_____

_____

Did any limitations in safety equipment or protective clothing contribute to or affect exposure / injury? If so, explain:

_____

_____

_____

_____ _____

Employee Signature Date

_____ _____

Langan Representative Date

ATTACHMENT D

CALIBRATION LOG

DATE:________________ **PROJECT:____________________**

CALIBRATION LOG

Date & Time	Inst Type	Inst #	Media	Initial Reading	Span #	Calibrat. Reading	Performed By:

ATTACHMENT E

MATERIAL SAFETY DATA SHEETS

SAFETY DATA SHEETS

All Langan Field Personnel Completing This Work Plan Are To Have Real Time Accessibility To Material Safety Data Sheet (MSDs) or Safety Data Sheet (SDSs) Through Their Smart Phone.

The link is http://www.msds.com/
The login name is "drapehead"
The password is "2angan987"

If You Are Unable To Use the Smart Phone App, You Are To Bring Printed Copies of the MSDs/SDSs to The Site

ATTACHMENT F

JOBSITE SAFETY INSPECTION CHECKLIST

Jobsite Safety Inspection Checklist

Date: _____ **Inspected By:** _____

Location: _____ **Project #:** _____

Check one of the following: **A:** Acceptable **NA**: Not Applicable **D**: Deficiency

	A	NA	D	Remark
1. HASP available onsite for inspection?				
2. Health & Safety Compliance agreement (in HASP) appropriately signed by Langan employees and contractors?				
3. Hospital route map with directions posted on site?				
4. Emergency Notification List posted on site?				
5. First Aid kit available and properly stocked?				
6. Personnel trained in CPR/First Aid on site?				
7. MSDSs readily available, and all workers knowledgeable about the specific chemicals and compounds to which they may be exposed?				
8 Appropriate PPE being worn by Langan employees and contractors?				
9. Project site safe practices ("Standing Orders") posted?				
10. Project staff have 40-hr./8-hr./Supervisor HAZWOPER training?				
11. Project staff medically cleared to work in hazardous waste sites and fit-tested to wear respirators, if needed?				
12. Respiratory protection readily available?				
13. Health & Safety Incident Report forms available?				
14. Air monitoring instruments calibrated daily and results recorded on the Daily Instrument Calibration check sheet?				
15. Air monitoring readings recorded on the air monitoring data sheet/field log book?				
16. Subcontract workers have received 40-hr./8-hr./Spvsr. HAZWOPER training, as appropriate?				
17. Subcontract workers medically cleared to work on site, and fit-tested for respirator wear?				
18. Subcontract workers have respirators readily available?				
19. Mark outs of underground utilities done prior to initiating any subsurface activities?				
20. Decontamination procedures being followed as outlined in HASP?				
21. Are tools in good condition and properly used?				
22. Drilling performed in areas free from underground objects including utilities?				

23. Adequate size/type fire extinguisher supplied?				
24. Equipment at least 20 feet from overhead powerlines?				
25. Evidence that drilling operator is responsible for the safety of his rig.				
26. Trench sides shored, layer back, or boxed?				
27. Underground utilities located and authorities contacted before digging?				
28. Ladders in trench (25-foot spacing)?				
29. Excavated material placed more than 2 feet away from excavation edge?				
30. Public protected from exposure to open excavation?				
31. People entering the excavation regarding it as a permit-required confined space and following appropriate procedures?				
32. Confined space entry permit is completed and posted?				
33. All persons knowledgeable about the conditions and characteristics of the confined space?				
34. All persons engaged in confined space operations have been trained in safe entry and rescue (non-entry)?				
35. Full body harnesses, lifelines, and hoisting apparatus available for rescue needs?				
36. Attendant and/or supervisor certified in basic first aid and CPR?				
37. Confined space atmosphere checked before entry and continuously while the work is going on?				
38. Results of confined space atmosphere testing recorded?				
39. Evidence of coordination with off-site rescue services to perform entry rescue, if needed?				
40. Are extension cords rated for this work being used and are they properly maintained?				
41. Are GFCIs provided and being used?				

Unsafe Acts: _____

_____

_____

_____

Notes: _____

_____

_____

_____

ATTACHMENT G

JOB SAFETY ANALYSIS FORM

LANGAN	Job Safety Analysis (JSA) Health and Safety
JSA TITLE: **JSA NUMBER:**	**DATE CREATED:** **CREATED BY**: **REVISION DATE:** **REVISED BY:**

Langan employees must review and revise the Job Safety Analysis (JSA) as needed to address the any site specific hazards not identified. Employees must provide their signatures on the last page of the JSA indicating they have review the JSA and are aware the potential hazards associated with this work and will follow the provided preventive or corrective measures.

PERSONAL PROTECTIVE EQUIPMENT REQUIRED: (PPE): ■ Required ☒ As Needed		
☐ Steel-toed boots	☐ Nitrile gloves	☐ Dermal Protection (Specify)
☐ Long-sleeved shirt	☐ Leather/ Cut-resistant gloves	☐ High visibility vest/clothing
☐ Safety glasses	☐ Face Shield	☐ Hard hat
ADDITIONAL PERSONAL PROTECTIVE EQUIPMENT NEEDED (Provide specific type(s) or descriptions)		
☐ Air Monitoring:	☐ Respirators:	☐ Other:
☐ Dermal Protection:	☐ Cartridges:	☐ Other:

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE OR CORRECTIVE ACTION
1.	1. 2.	1a. 1b. 2a. 2b.
2.	1.	1
Additional items identified in the field.		
Additional Items.		

If additional items are identified during daily work activities, please notify all relevant personnel about the change and document on this JSA.

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: **Subsurface Investigation**

JSA Number: **JSA030-01**

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions.

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):

☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☒ Safety Goggles	☐ Face Shield	☐ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☒ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	
☒ Other: Dielectric Overshoes, Sun Block				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
1. Transport equipment to work area	1. Back/strain 2. Slip/Trip/Falls 3. Traffic 4. Cuts/abrasions/contusions from equipment 5. Accidents due to vehicle operations	1. Use proper lifting techniques/Use wheeled transport 2. Minimize distance to work area/unobstructed path to work area/follow good housekeeping procedures 3. Wear proper PPE (high visibility vest or clothing) 4. Wear proper PPE (leather gloves, long sleeves, Langan approved safety shoes) 5. Observe posted speed limits/ Wear seat belts at all times
2. Traffic	1. Hit by moving vehicle	1. Use traffic cones and signage/ Use High visibility traffic vests and clothing/ Caution tape when working near active roadways.
3. Field Work (drilling, resistivity testing, and inspection)	1. Biological Hazards: insects, rats, snakes, poisonous plants, and other animals 2. Heat stress/injuries 3. Cold Stress/injuries 4. High Energy Transmission Lines 5. Underground Utilities 6. Electrical (soil resistivity testing)	1. Inspect work area to identify biological hazards. Wear light colored long sleeve shirt and long pants/ Use insect repellant as necessary/ Beware of tall grass, bushes, woods and other areas where ticks may live/ Avoid leaving garbage on site to prevent attracting animals/ Identify and avoid contact with poisonous plants/Beware of rats, snakes, or stray animals. 2. Wear proper clothing (light colored)/ drink plenty of water/ take regular breaks/use sun block 3. Wear proper clothing/ dress in layers/ take regular breaks. 4. Avoid direct contact with high energy transmission lines/ position equipment at least 15 feet or as required by PSE&G from the transmission lines/ wear proper PPE (dielectric overshoes 15 kV minimum rating). 5. Call one-call service before performing intrusive field work/ Review utility mark-outs and available utility drawings (with respect to proposed work locations)/ Follow Underground Utility Guidelines 6. See AGI Sting R1 operating manual for specific concerns during operating instrument
4. All activities	1. Slips/ Trips/ Falls	7. Be aware of potential trip hazards / Follow good housekeeping

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
	2. Hand injuries, cuts or lacerations during manual handling of materials 3. Foot injuries 4. Back injuries 5. Traffic 6. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 7. High Noise levels 8. Overhead hazards 9. Heat Stress/ Cold Stress 10. Eye Injuries	procedures/ Mark significant hazards 8. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 9. Wear Langan approved safety shoes 10. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 11. Wear high visibility clothing & vest / Use cones or signs to designate work area 12. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 13. Wear proper hearing protection 14. Wear hard hat / Avoid areas were overhead hazards exist. 15. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 16. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	**Sign Name**	**Date**
Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: Sub-slab soil gas temporary point installation and sampling

JSA Number: JSA037-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions.

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):

☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☐ Hearing Protection
☒ Safety Glasses	☒ Safety Goggles	☐ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☒ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☒ Traffic Cones/Signs	☐ Life Vest/Jacket	
☒ Other: Tyvek Sleeves				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
5. Transport equipment to work site	6. Back injuries 7. Slips/Trips/Falls 8. Traffic 9. Hand injuries	6. Use proper lifting techniques/ Use wheeled transport/ Get assistance when need with moving equipment/ Minimize distance from vehicle 7. Minimize distance from vehicle/ Have unobstructed pathway to vehicle and collection points/ Mark tripping hazards with spray paint, cones, or caution tape/ Observe good housekeeping procedures. 8. Wear proper PPE (High Visibility vest and clothing)/ Exercise caution (stay alert-stay alive) 9. Wear proper PPE (leather gloves)/ Keep finger and hands clear of pinch points.
6. Mark area for drilling	1. Slips/Trips/Falls	1. Minimize distance from vehicle/ Have unobstructed pathway to vehicle and collection points/ Mark tripping hazards with spray paint, cones, or caution tape/ Observe good housekeeping procedures
7. Drill sampling points with hammer drill	1. Eye injuries 2. Dust exposure 3. Hand injuries 4. Catch items (clothing) 5. Electric shock 6. Chemical atmosphere hazard (vapor) 7. Slips/Trips/Falls	1. Wear proper PPE (safety glasses) 2. Wear proper PPE (dust mask) 3. Wear proper PPE (leather gloves)/ Keep hands and fingers out of pinch points/ Avoid drill catching on ground and twisting wrist or hand/ Release drill grip if drill becomes caught/ Ensure drill is unplugged prior to inserting bit. 4. Tie up or tuck-in all loose clothing/ Maintain distance from drill 5. Inspect power cable for cuts or nicks before use/ Use GFCI outlet on power cord/ Do not use in wet conditions 6. Monitor air, vapors with Photo-ionization detector (PID) 7. Minimize distance from vehicle/ Have unobstructed pathway to vehicle and collection points/ Mark tripping hazards with spray paint, cones, or caution tape/ Observe good housekeeping procedures
8. Measure vapor content and depth to bottom of hole	1. Chemical atmosphere hazard (vapors)	1. Monitor air, vapors with Photo-ionization detector (PID)/ Keep face away from opening of hole while collecting measurements

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
9. Set-up of shroud and sampling canister system	1. Hand injuries 2. Chemical atmosphere hazard (vapors) 3. Slips/Trips/Falls	1. Wear proper PPE (leather gloves, nitrile gloves)/ Keep fingers away from pinch points when installing pump/ Do not use open blades, use tubing cutter 2. Monitor air, vapors with Photo-ionization detector (PID)/ Keep face away from opening of hole while collecting measurements 3. Minimize distance from vehicle/ Have unobstructed pathway to vehicle and collection points/ Mark tripping hazards with spray paint, cones, or caution tape/ Observe good housekeeping procedures
10. Purge soil gas	1. Chemical atmosphere hazard (vapors)	1. Monitor air, vapors with Photo-ionization detector (PID)/ Keep face away from exhaust port of pump
11. Sample collection (opening and closing valves)	1. Hand injuries	1. Wear proper PPE (leather gloves)/ Keep fingers away from pinch points
12. Sealing sampling holes	1. Back injuries 2. Concrete dust 3. Eye injuries	1. Use proper lifting techniques for lifting of cement bags 2. Wear proper PPE (dust mask) 3. Wear proper PPE (safety glasses)
13. All activities	11. Slips/ Trips/ Falls 12. Hand injuries, cuts or lacerations during manual handling of materials 13. Foot injuries 14. Back injuries 15. Traffic 16. Wildlife: Stray animals, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 17. High Noise levels 18. Overhead hazards 19. Heat or cold injuries 20. Eye Injuries	17. Be aware of potential trip hazards/ Follow good housekeeping procedures/ Mark significant hazards 18. Inspect for jagged/sharp edges, and rough or slippery surfaces/ Keep fingers away from pinch points/ Wipe off greasy, wet, slippery or dirty objects before handling/ Wear leather/ cut-resistant gloves 19. Wear proper PPE (Langan approved safety shoes) 20. Use proper lifting techniques/ Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift/ Obtain assistance when possible 21. Wear high visibility clothing & vest/ Use cones or signs to designate work area 22. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray animals/ Carry and use animal repellant when needed/ Use bug spray when needed 23. Wear hearing protection 24. Wear hard hat/ Avoid areas were overhead hazards exist. 25. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather)/ Drink plenty of fluids to avoid dehydration/ Takes breaks as necessary to avoid heat/cold stress 26. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	Sign Name	Date

Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: **Monitoring Well Development**

JSA Number: **JSA026-01**

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions.

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):

☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☐ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☒ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☒ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	
☒ Other: Tyvek Sleeves				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
14.Transport equipment to work area	10.Back Strains 11.Slips/Trips/Falls 12.Traffic 13.Cuts/Abrasions/Contusions from equipment	10. Use proper lifting techniques/ Use wheeled transport/ use buddy system when lifting equipment. 11. Minimize distance from work area/ unobstructed path to collection points and vehicle/ Follow good housekeeping procedures. 12. Wear high-visibility vest or clothing/Exercise caution/ Use traffic cones or signage if needed. 13. Wear proper PPE (leather gloves, long sleeves, Langan approved safety shoes).
15.Measure depth of water	2. Exposure to hazardous substances 3. Pinched fingers	2. Wear proper PPE (Nitrile gloves, Safety glasses/Face shield). 3. Wear proper PPE (cut-resistant gloves).
16.Install Tremie pipe in the monitoring well and connect to water source.	8. Hand injuries during installation (pinched fingers/hands). 9. Back strain from holding Tremie pipe. 10. High pressure water spray.	8. Wear proper PPE (Nitrile gloves/cut-resistant gloves). 9. Use proper lifting techniques/ Use two personnel when lowering pump greater than 80 feet. 10. Ensure all hose connections are tight and secure/ Use proper PPE (face shield and safety glasses).
17.Install pump in to well a. Connect pump to sample tubing. b. Lower pump to desired depth in well. c. Connect sample tubing to flow cell d. Connect pump to power source (generator) e. Turn on power source (generator)	1. Hand injuries during pump installation and sample tubing cutting. 2. Back strain 3. Electric shock 4. Exhaust gases from generator 5. Burns from hot equipment	1. Wear proper PPE when installing pump and cutting sample tubing (Nitrile and cut-resistant gloves)/ Use tubing cutter. 2. Proper lifting techniques/ Two personnel when installing pump at depths greater than 80 feet/ Use buddy when lifting heavy loads (pump, generator)/Use wheeled transport. 3. Ensure equipment is (LO/TO: locked out/tagged out) prior to preforming any electrical connections/ Inspect wires for frays or cuts/Ensure generator is properly grounded prior to starting. 4. Position generator so that exhaust is flowing away from work area. 5. Do not touch exhaust or any hot part of generator/ Allow equipment time to cool down prior to carrying/ Use proper PPE (long sleeves, leather gloves)
18. Develop monitoring well	21. Hand injuries	27. Wear proper PPE (cut-resistant gloves and nitrile gloves).

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
a. Jet water into well using Tremie pipe b. Turn pump on and adjust to desired flow rate. c. Surge pump up and down well to remove sediment from screen d. Containerize all purge water from well.	22. Face injuries 23. Contaminated spray from water	28. Wear proper PPE (face shield and safety glasses)/do not stand over well opening. 29. Wear proper PPE (Face shield and safety goggles)/Tyvek over garments/ Ensure all connections are secure and tight/ Tubing outlet is contained in an overflow container.
19. Drum staging area.	1. Back, Arm, and shoulder strain. 2. Pinch points 3. Cross contamination 4. Slip/Trips/Falls	1. Use proper lifting techniques/ Use drum carts when moving drums/ use buddy system for moving of drums if needed/Move drums shortest distance needed. 2. Keep fingers and feet away from pinch points/ Use proper PPE (cut-resistant gloves, Langan approved safety shoes) 3. Use proper PPE (Nitrile gloves, Tyvek sleeves) 4. Ensure pathway is clear prior to moving equipment/ Mark all hazards/ Use additional person as a spotter if needed.
20. Equipment pack-up	1. Back Strains 2. Slips/Trips/Falls 3. Traffic 4. Cuts/Abrasions/Contusions from equipment.	1. Use proper lifting techniques/ Use wheeled transport/ use buddy system when lifting equipment. 2. Minimize distance from work area/ Unobstructed path to collection points and vehicle/ Follow good housekeeping procedures. 3. Wear high-visibility vest or clothing/Exercise caution/ Use traffic cones or signage if needed. 30. Wear proper PPE (leather gloves, long sleeves, Langan approved safety shoes).
21. All activities	1. Slips/ Trips/ Falls 2. Hand injuries, cuts or lacerations during manual handling of materials 3. Foot injuries 24. Back injuries 25. Traffic 26. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 27. High Noise levels 28. Overhead hazards 29. Heat Stress/ Cold Stress 30. Eye Injuries	1. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 2. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 3. Wear Langan approved safety shoes 4. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 5. Wear high visibility clothing & vest / Use cones or signs to designate work area 6. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 7. Wear hearing protection 8. Wear hard hat / Avoid areas were overhead hazards exist. 9. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 10. Wear safety glasses.
Additional items.		

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: **Groundwater Sampling**

JSA Number: **JSA008-01**

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions.

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):

☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☒ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	

☒ Other: Tyvek sleeves, Dermal Protection, PID

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
22. Transport equipment to work area	1. Back Strain 2. Slips/ Trips/ Falls 3. Traffic 4. Cuts/abrasions from equipment 5. Contusions from dropped equipment	1. Use proper lifting techniuqes / Use wheeled transport 2. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures 3. Wear proper PPE (high visibility vest or clothing) 4. Wear proper PPE (leather gloves, long sleeves) 5. Wear proper PPE (safety shoes)
23. Remove well cover	4. Scrape knuckles/hand 5. Strain wrist/bruise plam 6. Pinch fingers or hand	1. Wear proper PPE (leather gloves) 2. Using a hammer, tap the end of the wrench to loosen grip of bolts 3. Wear proper PPE (leather gloves)
24. Remove well cap and lock	11. Well can pops from pressure 12. Exposure to hazardous substances through inhalation or dermal exposure 13. Scrape knuckles/hand 14. Strain write/bruise palm	1. Remove cap slowly to relieve pressure / Do not place face over well when opening / Wear proper PPE (safety glasses) 2. Use direct air monitoring/reading instrument (i.e. PID) / Be familiar with and follow actions prescribed in the HASP / Wear proper PPE (nitrile gloves) 3. Wear proper PPE (leather gloves) 4. Using hammer, tap the end of the wrench to loosen grip
25. Measure head-space vapor levels	1. Exposure to hazardous substances through inhalation	1. Do not place face over well when collecting measurement
26. Remove deciated tubing (if necessary)	1. Exposure to hazardous substances through inhalation or dermal exposure 2. Tubing swings around after removal	1. Wear proper PPE (nitrile gloves, Tyvek sleeves) 2. Wear proper PPE (safety glasses)
27. Set-up plastic sheeting for work site around the well	1. Lacerations when cutting plastic sheeting	1. Use scissors to cut plastic sheeting / Cut motions should always be away from body and body parts
28. Measure depth to water	1. Exposure to hazardous substances through inhalation or dermal exposure 2. Pinch fingers or hand in water level instrument	1. Wear proper PPE (nitrile gloves) 2. Wear proper PPE (leather gloves)
29. Calibrate monitoring	1. Skin or eye contact with calibration chemicals	1. Wear proper PPE (safety glasses, nitrile gloves)

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
equipment	2. Pinch fingers or hand in monitoring equipment	2. Wear proper PPE (leather gloves) / Avoid pinch points
30. Install sampling pump in well	1. Hand injuries during installation of pump 2. Lacerations when cutting tubing 3. Back strain during installation of pump 4. Physical hazards associated with manual lifting of heavy equipment 5. Back strain from starting generator 6. Burns from hot exhaust from generator 7. Electrical shock from improper use of generator and pump 8. Contaminated water spray from loose connections	1. Wear proper PPE (leather gloves, nitrile gloves) 2. Use safey tubing cutter 3. Use proper lifting techniques 4. Use proper lifting techniques / Use wheeled transport for heavy equipment 5. Use arm when starting generator / Do not over-strain if generator does not start 6. Do not touch generator near exhaust / Use proper handle to carry / Allow generator to cool down before moving 7. Properly plug in pump to generator / Do not allow the pump or generator to contact water / Check for breaks in the cord 8. Check all tubing connections to ensure they are tight and secure
10. Purge water	1. Contact with potentially contamined groundwater 2. Back strain from lifting buckets of water 3. Tripping potential on sample discharge lines and pump electric line	1. Wear proper PPE (safety glasses, nitrile gloves) 2. Use proper lifting techniques / Use wheeled transport 3. Organize discharge of electric line to keep out of way as much as possible / Mark potential tripping hazards with caution tape or safety cones
11. Sample water collection	1. Contact with potentially contaminated groundwater through dermal exposure 2. Contact with and burns from acid used for sample preservation 3. Tripping potential on sample discharge lines and pump electric line 4. Lacerations from broken sample bottles 5. Back strain when transporting coolers full of collected samples 6. Slips/ Trips/ Falls	1. Wear proper PPE (safety glasses, nitrile gloves) 2. Wear proper PPE (safety glasses, nitrile gloves) / Ensure sample bottle lids are secure before use and after sample collection 3. Organize line to keep out of the way as much as possible / Mark potential tripping hazards with caution tape or safety cones 4. Do not over-tighten bottle caps / Handle bottles safely to prevent breakage / Wrap glass bottles in bubble wrap, if possible 5. Use proper lifting techniques / Use wheeled transport / Seek assistance if coolers weight exceeds 50lbs. / Minimize distance to vehicle 6. Have unobstructed path to vehicle or collection point / Follow good housekeeping procedures / Do not lift/walk with coolers that are too heavy/difficult to lift
12. Remove pump and pack up equipment	1. Back strain when removing pump or lifting heavy equipment	1. Use proper lifting technique / Use wheeled transport for heavy equipment
13. Replace well cap and lock	1. Scrape fingers/hand 2. Strain wrist/bruise palm	1. Wear proper PPE (leather gloves) 2. Using hammer, tap the end of the well cap to tighten grip
14. Replace well cover	1. Scrape knuckles/hand 2. Strain write/bruise palm 3. Pinch fingers or hand	1. Wear proper PPE (leather gloves) 2. Using hammer, tap the end of the wrench to tighten the grip of the bolts 3. Wear proper PPE (leather gloves)
15. Transport drums to disposal staging location	1. Back, arm or shoulder strain from moving drums 2. Pinch hazard 3. Contact with potentially contaminated groundwater when moving improperly sealed drums 4. Slips/ Trips/ Falls when moving drum 5. Drop drum on feet/toes	1. Use drum cart for moving drums / Use proper lifting techniques / Obtain assistance, if needed 2. Wear proper PPE (leather gloves) 3. Wear proper PPE (nitrile gloves under leather gloves) / Properly seal drum to prevent leak 4. Ensure route to move drum to storage space is dry and free from obstructions 5. Wear proper PPE (safety shoes)
16. Place used PPE in	1. Pressure build-up inside drum	1. Remove cap from bung hole in drum to relieve pressure

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
designated dispoal drum	2. Pinch hazard	2. Wear proper PPE (leather gloves)
17. Decontaminate equipment	1. Splashing water/soap from decontamination 2. Contact with potentially contaminated groundwater through dermal exposure 3. Electrical shock from broken electric cords	1. Wear proper PPE (safety glasses) 2. Wear proper PPE (safety glasses, dermal protection) 3. Properly plug in pump to generator / Do not allow the pump or generator to contact water / Check for breaks in the cord
18. All activities	31. Slips/ Trips/ Falls 32. Hand injuries, cuts or lacerations during manual handling of materials 33. Foot injuries 34. Back injuries 35. Traffic 36. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 37. High Noise levels 38. Overhead hazards 39. Heat Stress/ Cold Stress 40. Eye Injuries	31. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 32. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 33. Wear Langan approved safety shoes 34. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 35. Wear high visibility clothing & vest / Use cones or signs to designate work area 36. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 37. Wear hearing protection 38. Wear hard hat / Avoid areas were overhead hazards exist. 39. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 40. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	Sign Name	Date

Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: Field Sampling

JSA Number: JSA022-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions.

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):

☒ Safety Shoes	☒ Long Sleeves	☐ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☒ Traffic Cones/Signs	☐ Life Vest/Jacket	
☐ Other:				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
31. Unpack/Transport equipment to work area.	14. Back Strains 15. Slip/Trips/Falls 16. Cuts/Abrasions from equipment 17. Contusions from dropped equipment	14. Use proper lifting techniques/Use wheeled transport 15. Minimize distance to work area/Unobstructed path to work area/follow good housekeeping procedures. Mark slip/trip/fall hazards with orange safety cones. 16. Wear proper PPE (leather gloves, long sleeves). 17. Wear proper PPE (Langan approved safety shoes).
32. Initial Site Arrival-Site Assessment	7. Traffic	4. Situational awareness (be alert of your surroundings). Secure area from through traffic.
33. Surface Water Sampling	15. Contaminated media. Skin/eye contact with biological agents and/or chemicals.	11. Wear appropriate PPE (Safety glasses, appropriate gloves). Review (M)SDS for all chemicals being.
34. Sampling from bridges	6. Struck by vehicles	6. Wear appropriate PPE (Safety Vest). Use buddy system and orange safety cones.
35. Icing of Samples/ Transporting coolers/equipment from work area.	41. Back Strains 42. Slips/Trips/Falls 43. Cuts/Abrasions from equipment 44. Pinch/Crushing Hazards.	41. Drain coolers of water. Use proper lifting techniques. Use wheeled transport. 42. Have unobstructed path from work area. Aware of surroundings. 43. Wear proper PPE (Leather gloves, long sleeves) 44. Wear proper PPE (Leather gloves, long sleeves)
36. Site Departure	1. Contaminated PPE/Vehicle	1. Contaminated PPE should be disposed of on-site. Remove boots and soiled clothing for secure storage in trunk. Wash hands promptly.
37. All activities	1. Slips/ Trips/ Falls 2. Hand injuries, cuts or lacerations during manual handling of materials 3. Foot injuries 4. Back injuries 45. Traffic 46. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.)	1. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 2. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 3. Wear Langan approved safety shoes 4. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
	47. High Noise levels 48. Overhead hazards 49. Heat Stress/ Cold Stress 50. Eye Injuries	when possible 45. Wear high visibility clothing & vest / Use cones or signs to designate work area 46. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 47. Wear hearing protection 48. Wear hard hat / Avoid areas were overhead hazards exist. 49. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 50. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: Geophysical Investigation

JSA Number: JSA023-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions.

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):

☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☒ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	
☐ Other:				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
38. Transport equipment to work area	18. Back/strain 19. Slip/Trip/Falls 20. Traffic 21. Cuts/abrasions/contusions from equipment	18. Use proper lifting techniques/Use wheeled transport 19. Minimize distance to work area/unobstructed path to work area/follow good housekeeping procedures 20. Wear proper PPE (high visibility vest or clothing) 21. Wear proper PPE (leather gloves, long sleeves, Langan approved safety shoes)
39. Supervision of subcontractor and all other activities	8. Slip/Trips/Falls 9. Hand injuries 10. Foot injuries 11. Back injuries/Strains 12. Traffic 13. Wildlife a. Wildlife b. Mice/rats c. Vectors (i.e. mosquitoes, bees, etc.) 7. Heat/Cold Stress	5. Be aware of potential trip hazards/follow good housekeeping procedures/mark significant below-grade hazards (i.e. holes, trenches, wires, ropes) with safety cones or spray paint. 6. Wear proper PPE (leather gloves)/watch wear you place your hands/inspect material or equipment for jagged, rough or slippery surfaces/ watch for pinch points/ wipe off slippery, wet, or dirty items prior to handling. 7. Wear proper PPE (Langan approved safety shoes)/ Be aware of uneven terrain) 8. Use proper lifting techniques/ Buddy system when lifting/ use wheeled transport. 9. Wear proper PPE (high-visibility shirts and vests)/ use cones if appropriate/ notify equipment operators of work area. 10. Be aware of surroundings at all times for the presence of wildlife. a. Do not approach stray animals b. Carry animal repellant/ use if situation arrises. c. Use bug spray when needed. 7. Wear proper attire for weather conditions (sunscreen, protective clothing in sunlight or layer clothing in cold weather)/ drink plenty of fluids/ take regular breaks.
40. All actvities	51. Slips/ Trips/ Falls	51. Be aware of potential trip hazards / Follow good housekeeping

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
	52. Hand injuries, cuts or lacerations during manual handling of materials 53. Foot injuries 54. Back injuries 55. Traffic 56. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 57. High Noise levels 58. Overhead hazards 59. Heat Stress/ Cold Stress 60. Eye Injuries	procedures/ Mark significant hazards 52. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 53. Wear Langan approved safety shoes 54. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 55. Wear high visibility clothing & vest / Use cones or signs to designate work area 56. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 57. Wear proper hearing protection 58. Wear hard hat / Avoid areas were overhead hazards exist. 59. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 60. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	**Sign Name**	**Date**
Prepared by:		
Reviewed by:		

ATTACHMENT H

TAILGATE SAFETY BRIEFING FORM

LANGAN TAILGATE SAFETY BRIEFING

Date:_____ Time: _____

Leader:_____ Location:_____

Work Task: _____

SAFETY TOPICS (*provide some detail of discussion points*)

Chemical Exposure Hazards and Control:_____
_____

Physical Hazards and Control: _____

Air Monitoring: _____

PPE: _____
_____

Communications:_____

Safe Work Practices: _____
_____

Emergency Response: _____

Hospital/Medical Center Location: _____

Phone Nos.: _____

Other: _____

FOR FOLLOW-UP (the issues, responsibilities, due dates, etc.**)**

_____
_____
_____

ATTENDEES

PRINT NAME	COMPANY	SIGNATURE

APPENDIX C

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

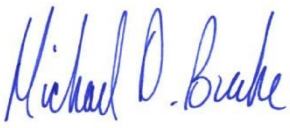
2409 JEROME AVENUE
BRONX, NEW YORK
NYSDEC BCP Site No. C203087

Prepared For:

2409 Jerome, Inc.
29 East Fordham Road
Bronx, NY 10468

Prepared By:

Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C.
21 Penn Plaza
360 West 31st Street, 8th Floor
New York, New York 10001



Michael D. Burke, CHMM
Vice President/ Senior Associate

September 14, 2017
Langan Project No. 170390601

LANGAN

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FIGURES

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ATTACHMENTS

1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) for the proposed remedial investigation (RI) was completed on behalf of 2409 Jerome, Inc. pursuant to the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) for the site at 2409 Jerome Avenue, Bronx, New York (the site). 2409 Jerome, Inc. selected Langan Engineering, Environmental, Surveying, and Landscape Architecture, DPC (Langan) to complete the RI. The objective of the RI is to investigate and characterize the nature and extent of environmental impacts at the site and emanating from the site and to provide sufficient information to evaluate remedial alternatives, as required. Additional site information and data collected previously by Langan is provided in the Remedial Investigation Work Plan (RIWP).

This QAPP specifies analytical methods to be used to ensure that data from the proposed Remedial Investigation (RI) at the site are precise, accurate, representative, comparable, and complete.

1.2 PROJECT OBJECTIVES

The objective of the RI is to investigate and characterize the nature and extent of on-site and off-site environmental impacts associated with areas of concern (AOC). This QAPP addresses sampling and analytical methods that may be necessary in support of the RI. These objectives were established in order to meet standards that will protect public health and the environment for the site.

1.3 SCOPE OF WORK

The field investigation will include the tasks listed below to supplement the data and findings of previous investigations, and is described in detail in the RIWP. All RI work will be overseen by Langan. The proposed RI consists of the following:

- Completion of a geophysical survey;
- Advancement of soil borings to evaluate potential subsurface impacts from the identified areas of concerns and historical site uses;
- Installation of monitoring wells, including one bedrock monitoring well;
- Completion of a monitoring well survey;
- Installation of soil vapor and sub-slab vapor points;
- Collection and chemical analysis of soil, groundwater, soil vapor, sub-slab vapor, and ambient air samples;
- Implementation of a community air monitoring plan (CAMP); and

- A qualitative assessment of potential exposure pathways based on the investigation findings.

1.3.1 SUMMARY OF PROPOSED FIELD SAMPLING ACTIVITIES

Soil Boring Installation and Soil Sampling

A geophysical subcontractor will clear subsurface testing locations of potential subsurface utilities and to locate any underground storage tanks (USTs). The geophysical survey will be completed using a collection of geophysical instruments, including electromagnetic and utility line locator instruments and ground-penetrating radar (GPR). The results of the survey may require relocating subsurface testing locations.

Soil Boring Installation and Soil Sampling

A drilling subcontractor will advance at least nine soil borings. Two of these borings will be installed off-site to support an off-site exposure assessment. Each soil boring will terminate at the bedrock surface. A Langan field engineer, scientist or geologist will document the work, screen soil samples for environmental impacts, and collect environmental soil samples for laboratory analyses. Soil will be screened continuously to the boring termination depth for organic vapors with a photoionization detector (PID) equipped with a 10.6 electron volt (eV) bulb and for visual and olfactory evidence of environmental impacts (e.g., non-aqueous phase liquid [NAPL], staining, and/or odor). Soil will be visually classified for color, grain size, texture, and moisture content, and will be recorded in a field log. Non-disposable, down-hole drilling equipment and sampling apparatus will be decontaminated between locations with Alconox® and water. Up to six grab soil samples will be collected for laboratory analysis from each boring location.

Monitoring Well Installation and Groundwater Sampling

A total of eleven permanent groundwater monitoring wells will be installed during the investigation. Seven of the nine soil borings will be converted into monitoring wells, two of which will be installed off-site. Four additional permanent groundwater monitoring wells will be installed at the site, one of which will be installed as a bedrock well. Wells will be constructed across the observed water table. The wells will be constructed with 2-inch diameter, threaded, flush-joint, polyvinyl chloride (PVC) casing and 0.01-inch slot screens. Clean sand will be used to fill the annulus around the screen up to approximately two feet above the top of the screened interval. A two-foot bentonite seal will be installed above the sand, and the borehole annulus will be grouted to the surface with bentonite/cement slurry. The bedrock well will be installed into bedrock by advancing steel casing into the rock, grouting the annulus of the casing and borehole, and drilling through the bottom of the casing to the target depth. After installation, wells will be developed by surging either a weighted bailer or surge block across the well screen/casing to

agitate and remove fines. Before sampling, the headspace of each well will be monitored with a PID and the wells will be gauged and purged. Dedicated tubing will be used at each well, and the interface probe and any sampling apparatus will be decontaminated between locations with Alconox® and water.

One groundwater sample will be collected from each existing and newly-installed well in general accordance with NYSDEC DER-10 and USEPA's *Low Flow Purging and Sampling Procedures for the Collection of Groundwater Samples from Monitoring Wells*. Groundwater samples will be collected about one week after new wells are installed. No groundwater samples will be collected from monitoring wells containing NAPL.

Per- and poly-fluoroalkyl substances (PFAS) will be sampled in accordance with the protocol outlined in Attachment A.

Soil Vapor and Sub-slab Vapor Point Installation and Vapor and Indoor and Ambient Air Sampling

Five soil vapor points and eleven sub-slab vapor points will be installed using direct-push technology in accordance with the NYSDOH's *Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (October 2006). Ten of the sub-slab vapor points will be installed at five off-site properties (two per building) as part of an off-site soil vapor intrusion investigation. The sub-slab vapor points (tubing only) will be installed below the existing building slab using a concrete core or hammer drill to about 2 inches beneath the base of the slab. Soil vapor points will be installed by advancing a 1.875-inch polyethylene implant with tubing to the anticipated depth of proposed foundation footings, if known at the time of the investigation, or to 2 feet above the groundwater table. Samples will be collected in general accordance with the NYSDOH guidance. Before collecting vapor samples, a minimum of three vapor probe volumes (i.e., the volume of the sample implant and tubing) will be purged from each sample point at a rate of less than 0.2 liters per minute using a RAE Systems MultiRAE® meter. Indoor and ambient air samples will be collected concurrently with the off-site sub-slab vapor sample at a height above the ground to represent the breathing zone (about 3 to 5 feet). An indoor air sample will be co-located with each sub-slab soil vapor sample. Soil vapor and indoor air samples will be collected into laboratory-supplied batch-certified clean 2.7- or 6-liter Summa® canisters with calibrated flow controllers for an 8-hour sampling period (samples collected on-site) or 24-hour sampling period (samples collected during the off-site vapor intrusion investigation).

A dust and organic vapor control and monitoring plan will be implemented during investigation activities. A table summarizing the sampling plan as outlined in the RIWP is included in Table 1.1.

1.4 DATA QUALITY OBJECTIVES AND PROCESS

The quality assurance and quality control objectives for all measurement data include:

- **Precision** – an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Field sampling precision will be determined by analyzing coded duplicate samples and analytical precision will be determined by analyzing internal QC duplicates and matrix spike duplicates.
- **Accuracy** – a measure of the degree of agreement of a measured value with the true or expected value of the quantity of concern. Sampling accuracy will be determined through the assessment of the analytical results of field blanks and trip blanks for each sample set. Analytical accuracy will be assessed by examining the percent recoveries of surrogate compounds that are added to each sample (organic analyses only), and the percent recoveries of matrix spike compounds added to selected samples and laboratory blanks.
- **Representativeness** – expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness will be determined by assessing a number of investigation procedures, including chain of custody, decontamination, and analysis of field blanks and trip blanks.
- **Completeness** – the percentage of measurements made which are judged to be valid. Completeness will be assessed through data validation. The QC objective for completeness is generation of valid data for at least 90 percent of the analyses requested.
- **Comparability** – expresses the degree of confidence with which one data set can be compared to another. The comparability of all data collected for this project will be ensured using several procedures, including standard methods for sampling and analysis, instrument calibrations, using standard reporting units and reporting formats, and data validation.
- **Sensitivity** - the ability of the instrument or method to detect target analytes at the levels of interest. The project manager will select, with input from the laboratory and QA personnel, sampling and analytical procedures that achieve the required levels of detection.

Each of the above objectives is discussed in detail in Section 3.

TABLE 1.1
Analytical Methods / Quality Assurance Summary Table

SOIL

	Quantity (1)	Analysis (2, 3, 4)
Soil Samples	54	TCL VOCs, TCL SVOCs, pesticides, PCBs, herbicides, and TAL metals (including all 6 NYCRR Part 375 compounds)
Duplicate Soil Samples	3 (one per 20 soil samples)	
Soil Matrix Spike/Matrix Spike Duplicate	3 (one per 20 soil samples)	

GROUNDWATER

	Quantity (5)	Analysis (2, 3, 4, 6)
Groundwater Samples	14	TCL VOCs, TCL SVOCs, pesticides, PCBs, herbicides, and TAL metals (including all 6 NYCRR Part 375 compounds), PFAS
Duplicate Groundwater Samples	1 (one per 20 groundwater samples)	
Groundwater Matrix Spike/Matrix Spike Duplicate	1 (one per 20 groundwater samples)	

SOIL VAPOR

	Quantity	Analysis (2)
Soil/Sub-slab Vapor / Air Samples	33	TO-15 VOCs
Duplicate Soil Vapor Samples	2 (one per 20 soil vapor samples)	

FIELD AND TRIP BLANKS

	Quantity	Analysis (2)
Soil Equipment Blanks	3 (one per 20 soil samples)	TCL VOCs, TCL SVOCs, pesticides, PCBs, herbicides, and TAL metals (including all 6 NYCRR Part 375 compounds)
Groundwater Equipment Blanks	1 (one per 20 groundwater samples)	
Trip Blanks	One per shipment of groundwater samples for VOC analysis	TCL VOCs

Notes

1) Up to six soil samples are proposed for collection at each of eight proposed soil boring.
2) For details regarding sample containerization, volume requirements, preservation, and holding times for water, soil, and soil vapor samples, refer to tables 4.1, 4.2, and 4.3, respectively.
3) For analytical methods and reporting limits, see Table 7.1.
4) For detailed information on matrix spike and matrix spike duplicate analysis for groundwater and soil samples, see tables 3.1 and 3.2, respectively.
5) Additional samples may be collected based on encountered field conditions.
6) Eight of the groundwater samples and the duplicate groundwater sample will also be analyzed for PFAS

PFAS = per- and poly-fluoroalkyl substances (PFAS)
VOCs = volatile organic compounds
SVOCs = semivolatile organic compounds
PCBs = polychlorinated biphenyls
TCL = target compound list
TAL = target analyte list
NA = not applicable

Figure 1.1 Soil, Groundwater, Soil and Sub-Slab Vapor, and Indoor and Ambient Air Sample Locations Map

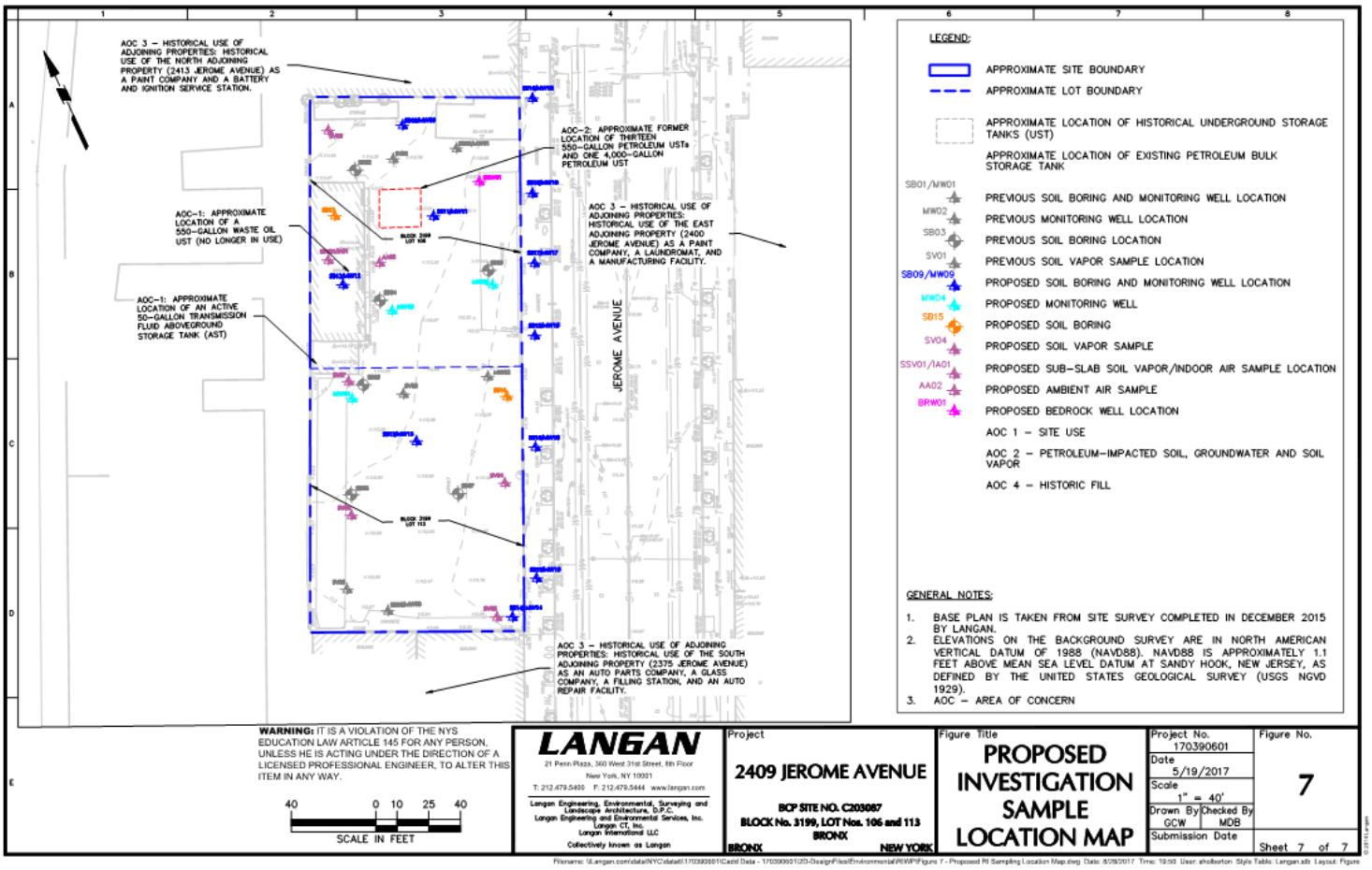
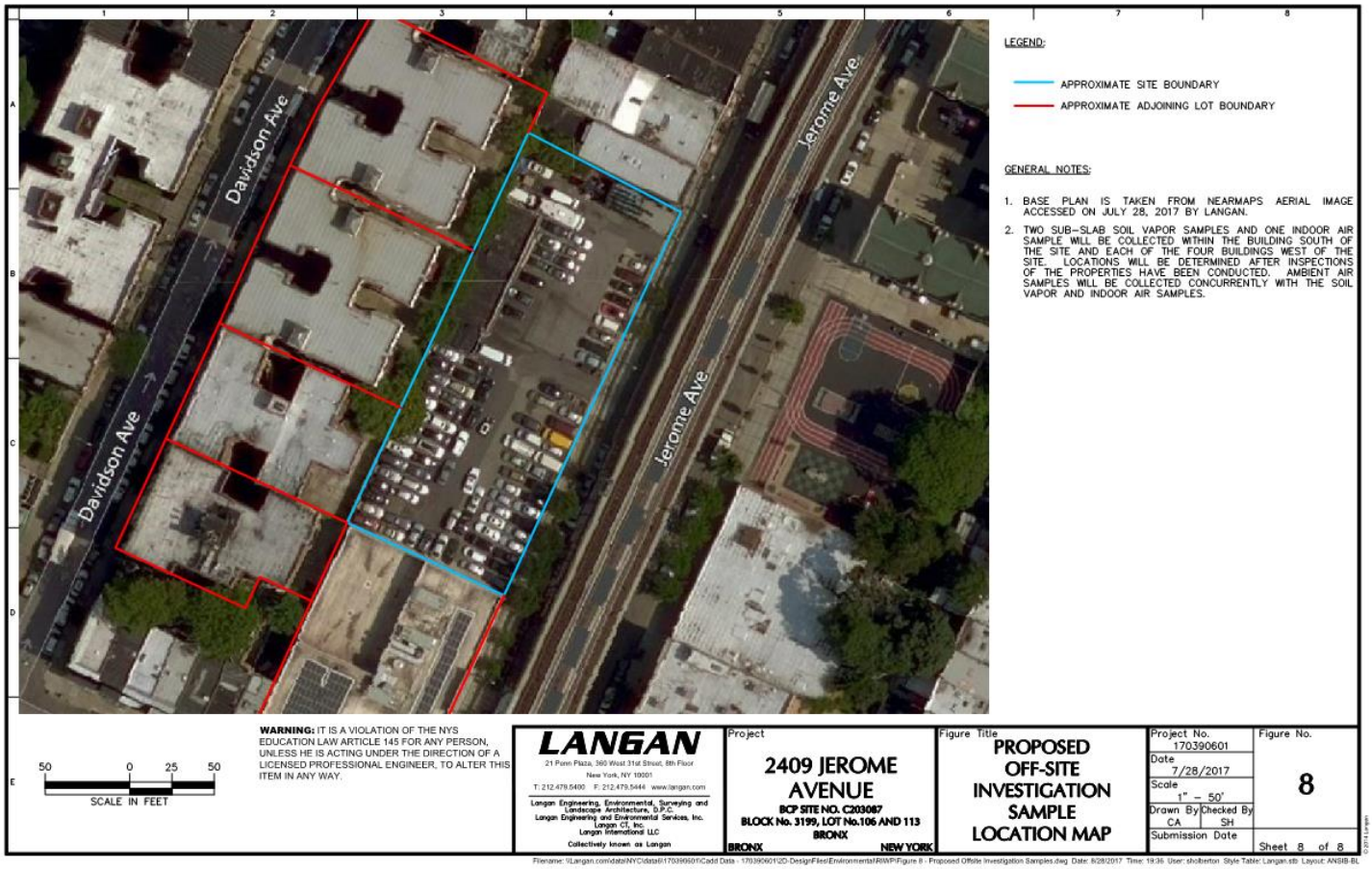


Figure 1.2 Off-site Vapor Intrusion Investigation Map



2.0 PROJECT ORGANIZATION

The execution of the RIWP will be overseen by Langan on behalf of 2409 Jerome, Inc. Langan will collect media samples and will subcontract with a qualified driller and an ELAP-certified laboratory. Langan will also perform the data analysis, evaluation, and reporting tasks.

The analytical services will be performed by Alpha Analytical Laboratories, Inc. of Mansfield, MA, NYSDOH ELAP certification number 11148. Data validation services will be performed by Emily Strake; resume attached (Attachment B).

Key contacts for this project are as follows:

2409 Jerome, Inc.:	Mr. David Dimond Telephone: (914)740-6436
Langan Project Manager:	Mr. Greg Wyka Telephone: (212) 479-5476
Qualified Environmental Professional (QEP):	Mr. Michael Burke, CHMM Telephone: (212) 479-5413
Langan Quality Assurance Officer (QAO):	Ms. Shana Holberton Telephone: (212)479-5527
Data Validator:	Ms. Emily Strake Telephone: (215) 491-5499x5750
Laboratory Representatives:	Alpha Analytical Laboratories, Inc. Mr. Kevin Hoogerhyde Telephone: (201) 847-2951

3.0 QUALITY ASSURANCE OBJECTIVES FOR COLLECTION OF DATA

3.1 INTRODUCTION

The quality assurance and quality control objectives for all data include precision, accuracy, representativeness, completeness, comparability, and sensitivity. These objectives are defined in following subsections. They are formulated to meet the requirements of the United States Environmental Protection Agency (USEPA) SW-846. The analytical methods and their Contract Required Quantification Limits (CRQLs) are given in Section 7.

3.2 PRECISION

Precision is an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Specifically, it is a quantitative measurement of the variability of a group of measurements compared to their average value (USEPA, 1987). Precision is usually stated in terms of standard deviation, but other estimates such as the coefficient of variation (relative standard deviation), range (maximum value minus minimum value), relative range, and relative percent difference (RPD) are common.

For this project, field sampling precision will be determined by analyzing coded duplicate samples (labeled so that the laboratory does not recognize them as duplicates) for the same parameters, and then, during data validation (Section 8), calculating the RPD for duplicate sample results.

Analytical precision will be determined by the laboratory by calculating the RPD for the results of the analysis of internal QC duplicates and matrix spike duplicates. The formula for calculating RPD is as follows:

$$RPD = \frac{|V1 - V2|}{(V1 + V2)/2} \times 100$$

where:

RPD	=	Relative Percent Difference.
V1, V2	=	The two values to be compared.
$\|V1 - V2\|$	=	The absolute value of the difference between the two values.
$(V1 + V2)/2$	=	The average of the two values.

The data quality objectives for analytical precision, calculated as the RPD between duplicate analyses, are presented in Tables 3.1 and 3.2.

TABLE 3.1
QUALITY CONTROL LIMITS FOR WATER SAMPLES

		Laboratory Accuracy and Precision					
Analytical Parameters	**Analytical Method (a)**	**Matrix Spike (MS) Compounds**	**MS/MSD (b) % Recovery**	**MS/MSD RPD l**	**LCS (d) % Recovery**	**Surrogate Compounds**	**Surrogate % Recovery**
VOCs (e)	8260	1,1-Dichloroethane	61-145	-	NA	Toluene-d8	88-110
		Trichloroethene	71-120	-	NA	Bromofluorobenzene	86-115
		Benzene	76-127	-	NA	1,2-Dichloroethane-d4	76-114
		Toluene	76-125	-	NA		
		Chlorobenzene	75-130	-	NA		
SVOCs (f)	8270	Phenol	12-110	-	NA	Nitrobenzene-d5	35-114
		2-Chlorophenol	27-123	-	NA	2-Fluorobiphenyl	43-116
		1,4-Dichlorobenzene	36-97	-	NA	Terphenyl-d14	33-141
		N-Nitroso-di-n-propylamine	41-116	-	NA	Phenol-d5	10-110
		1,2,4-Trichlorobenzene	39-98	-	NA	2-Fluorophenol	21-110
		4-Chloro-3-methylphenol	23-97	-	NA	2,4,6-Tribromophenol	10-123
		Acenaphthene	46-118	-	NA	2-Chlorophenol-d4	33-110 (g)
		4-Nitrophenol	10-80	-	NA	1,2-Dichlorobenzene-d4	16-110 (g)
		2,4-Dinitrotoluene	24-96	-	NA		
		Pentachlorophenol	9-103	-	NA		
		Pyrene	26-127	-	NA		
Inorganics (i)	6010,7470/7471,7841,9010, OIA-1677	Inorganic Analyte	75-125 (j)	- (k)	80-120	NA	NA

(a) Analytical Methods: USEPA SW-846, 3rd edition, Revision 1, November 1990; any subsequent revisions shall supersede this information
(b) Matrix Spike/Matrix Spike Duplicate
(c) Relative Percent Difference
(d) Laboratory Control Sample
(e) TCL VOCs plus library search
(f) TCL SVOCs plus library search
(g) Limits are advisory only
(i) Target Analyte List Inorganics (metals)
(j)Matrix spike only
(k) Laboratory duplicate RPD
NA - Not Applicable

TABLE 3.2
QUALITY CONTROL LIMITS FOR SOIL SAMPLES

Laboratory Accuracy and Precision

Analytical Parameter	Analytical Method (a)	Matrix Spike (MS) Compounds	MS/MSD (b) % Recovery	MS/MSD RPD (c)	LCS (d) % Recovery	Surrogate Compounds	Surrogate % Recovery
VOCs (e)	8260	1,1-Dichloroethane	59-172	22	NA	Toluene-d8	84-138
		Trichloroethene	62-137	24	NA	Bromofluorobenzene	59-113
		Benzene	66-142	21	NA	1,2-Dichloroethane-d4	70-121
		Toluene	59-139	21	NA		
		Chlorobenzene	60-133	21	NA		
SVOCs (f)	8270	Phenol	26-90	35	NA	Nitrobenzene-d5	23-120
		2-Chlorophenol	25-102	50	NA	2-Fluorobiphenyl	30-115
		1,4-Dichlorobenzene	28-104	27	NA	Terphenyl-d14	18-137
		N-Nitroso-di-n-propylamine	41-126	38	NA	Phenol-d5	24-113
		1,2,4-Trichlorobenzene	38-107	23	NA	2-Fluorophenol	25-121
		4-Chloro-3-methylphenol	26-103	33	NA	2,4,6-Tribromophenol	19-122
		Acenaphthene	31-137	19	NA	2-Chlorophenol-d4	20-130 (g)
		4-Nitrophenol	11-114	50	NA	1,2-Dichlorobenzene-d4	20-130 (g)
		2,4-Dinitrotoluene	28-89	47	NA		
		Pentachlorophenol	17-109	47	NA		
		Pyrene	35-142	36	NA		
Inorganics (i)	6010, 7470/7471, 7841, 9010	Inorganic Analyte	75-125 (j)	20 (k)	80-120	NA	NA
PCBs (h)	8082	PCBs (Aroclor 1260)	50-128	50	NA	Tetrachlorometaxylene Decachlorobiphenyl	24-154 25-159

(a) Analytical Methods: USEPA SW-846, 3rd edition, Revision 1, November 1990, any subsequent revisions shall supersede this information
(b) Matrix Spike/Matrix Spike Duplicate
(c) Relative Percent Difference
(d) Laboratory Control Sample
(e) TCL VOCs plus library search
(f) TCL SVOCs plus library search
(g) Limits are advisory only
(h) PCBs
(i) Target Analyte List Inorganics (metals and cyanide)
(j) Matrix spike only
(k) Laboratory duplicate RPD
NA - Not Applicable

3.3 ACCURACY

Accuracy is a measure of the degree of agreement of a measured value with the true or expected value of the quantity of concern (Taylor, 1987), or the difference between a measured value and the true or accepted reference value. The accuracy of an analytical procedure is best determined by the analysis of a sample containing a known quantity of material, and is expressed as the percent of the known quantity, which is recovered or measured. The recovery of a given analyte is dependent upon the sample matrix, method of analysis, and the specific compound or element being determined. The concentration of the analyte relative to the detection limit of the analytical method is also a major factor in determining the accuracy of the measurement. Concentrations of analytes, which are close to the detection limits are less accurate because they are more affected by such factors as instrument "noise." Higher concentrations will not be as affected by instrument noise or other variables and thus will be more accurate.

Sampling accuracy may be determined through the assessment of the analytical results of field blanks and trip blanks for each sample set. Analytical accuracy is typically assessed by examining the percent recoveries of surrogate compounds that are added to each sample (organic analyses only), and the percent recoveries of matrix spike compounds added to selected samples and laboratory blanks. Additionally, initial and continuing calibrations must be performed and accomplished within the established method control limits to define the instrument accuracy before analytical accuracy can be determined for any sample set.

Accuracy is normally measured as the percent recovery (%R) of a known amount of analyte, called a spike, added to a sample (matrix spike) or to a blank (blank spike). The %R is calculated as follows:

$$\%R = \frac{SSR - SR}{SA} \times 100$$

where:

- %R = Percent recovery.
- SSR = Spike sample result: concentration of analyte obtained by analyzing the sample with the spike added.
- SR = Sample result: the background value, i.e., the concentration of the analyte obtained by analyzing the sample.
- SA = Spiked analyte: concentration of the analyte spike added to the sample.

The acceptance limits for accuracy for each parameter are presented in Tables 3.1 and 3.2.

3.4 REPRESENTATIVENESS

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter, which is most concerned with the proper design of the sampling program (USEPA, 1987). Samples must be representative of the environmental media being sampled. Selection of sample locations and sampling procedures will incorporate consideration of obtaining the most representative sample possible.

Field and laboratory procedures will be performed in such a manner as to ensure, to the degree that is technically possible, that the data derived represents the in-place quality of the material sampled. Every effort will be made to ensure chemical compounds will not be introduced into the sample via sample containers, handling, and analysis. Decontamination of sampling devices and digging equipment will be performed between samples as outlined in the Field Sampling Plan. Analysis of field blanks, trip blanks, and method blanks will also be performed to monitor for potential sample contamination from field and laboratory procedures.

The assessment of representativeness also must consider the degree of heterogeneity in the material from which the samples are collected. Sampling heterogeneity will be evaluated during data validation through the analysis of coded field duplicate samples. The analytical laboratory will also follow acceptable procedures to assure the samples are adequately homogenized prior to taking aliquots for analysis, so the reported results are representative of the sample received.

Chain-of-custody procedures will be followed to document that contamination of samples has not occurred during container preparation, shipment, and sampling. Details of blank, duplicate and Chain-of-custody procedures are presented in Sections 4 and 5.

3.5 COMPLETENESS

Completeness is defined as the percentage of measurements made which are judged to be valid (USEPA, 1987). The QC objective for completeness is generation of valid data for at least 90 percent of the analyses requested. Completeness is defined as follows for all sample measurements:

$$\%C = \frac{V}{T} \times 100$$

where:

%C = Percent completeness.

V = Number of measurements judged valid.
T = Total number of measurements.

3.6 COMPATABILITY

Comparability expresses the degree of confidence with which one data set can be compared to another (USEPA, 1987). The comparability of all data collected for this project will be ensured by:

- Using identified standard methods for both sampling and analysis phases of this project;
- Requiring traceability of all analytical standards and/or source materials to the USEPA or National Institute of Standards and Technology (NIST);
- Requiring that all calibrations be verified with an independently prepared standard from a source other than that used for calibration (if applicable);
- Using standard reporting units and reporting formats including the reporting of QC data;
- Performing a complete data validation on a representative fraction of the analytical results, including the use of data qualifiers in all cases where appropriate; and
- Requiring that all validation qualifiers be used any time an analytical result is used for any purpose.

These steps will ensure all users of either the data or the conclusions drawn from them will be able to judge the comparability of the data and conclusions.

3.7 SENSITIVITY

Sensitivity is the ability of the instrument or method to detect target analytes at the levels of interest. The project manager will select, with input from the laboratory and QA personnel, sampling and analytical procedures that achieve the required levels of detection and QC acceptance limits that meet established performance criteria. Concurrently, the project manager will select the level of data assessment to ensure that only data meeting the project data quality objectives are used in decision-making.

Field equipment will be used that can achieve the required levels of detection for analytical measurements in the field. In addition, the field sampling staff will collect and submit full volumes of samples as required by the laboratory for analysis, whenever possible. Full volume aliquots will help ensure achievement of the required limits of detection and allow for reanalysis if necessary. The concentration of the lowest level check standard in a multi-point calibration curve will represent the reporting limit.

Analytical methods and quality assurance parameters associated with the sampling program are presented in Table 1.1. The frequency of associated equipment blanks and duplicate samples will be based on the recommendations listed in DER-10 and as described in Table 1.1.

Site-specific MS and MSD samples will be prepared and analyzed by the analytical laboratory by spiking an aliquot of submitted sample volume with analytes of interest. Additional sample volume is not required by the laboratory for this purpose. An MS/MSD analysis will be analyzed at a rate of 1 out of every 20 samples, or one per analytical batch. MS/MSD samples are only required for soil and groundwater samples.

4.0 SAMPLING PROGRAM

4.1 INTRODUCTION

Soil and groundwater sampling will be conducted in accordance with the established NYSDEC protocols contained in DER-10. Air sampling will be conducted in accordance with the established New York State Department of Health (NYSDOH) protocols contained in the *Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (October 2006). The following sections describe procedures to be followed for specific tasks.

4.2 SAMPLE NOMENCLATURE

The sample nomenclature system was devised such that the following objectives can be attained (see Attachment C):

- Sorting of data by matrix;
- Sorting of data by depth;
- Maintenance of consistency (filed, laboratory, and database sample numbers);
- Accommodation of all project-specific requirements; and
- Accommodation of laboratory sample number length constraints (maximum 20 characters).

4.3 SAMPLE CONTAINER PREPARATION AND SAMPLE PRESERVATION

Sample containers will be properly washed and decontaminated prior to their use by either the analytical laboratory or the container vendor to the specifications required by the USEPA. Copies of the sample container QC analyses will be provided by the laboratory for each container lot used to obtain samples. The containers will be labeled and the appropriate preservatives will be added. The types of containers are shown in Tables 4.1 and 4.2.

Samples shall be preserved according to the preservation techniques given in Tables 4.1 and 4.2. Preservatives will be added to the sample bottles by the laboratory prior to their shipment in sufficient quantities to ensure that proper sample pH is met. Following sample collection, the sample bottles should be placed on ice in the shipping cooler, cooled to 4°C with ice in Ziploc® bags (or equivalent), and delivered to the laboratory within 48 hours of collection. Chain-of-custody procedures are described in Section 5.

4.4 SAMPLE HOLDING TIMES

The sample holding times for organic and inorganic parameters are given in Tables 4.1 and 4.2 and must be in accordance with the USEPA requirements for each method. The USEPA

technical holding times must be strictly adhered to by the laboratory. Any holding time exceedances must be reported to Langan.

4.5 FIELD QC SAMPLES

To assess cross-contamination and effectiveness of equipment decontamination, two types of "blanks" will be collected and submitted to the laboratory for analyses. In addition, the precision of field sampling procedures will be assessed by collecting coded field duplicates and matrix spike/matrix spike duplicates (MS/MSDs). The blanks will include:

a. **Trip Blanks** - A trip blank will be prepared before the sample containers are sent by the laboratory. The trip blank will consist of a 40-ml vials containing distilled, deionized water, which accompanies the other water sample bottles into the field and back to the laboratory. A trip blank will be included with each shipment of water samples for Part 375 volatiles analysis. The trip blank will be analyzed for volatile organic compounds to assess any contamination from sampling and transport, and internal laboratory procedures.

b. **Equipment Blanks** - Equipment blanks will be collected for quality assurance purposes at a rate of one per 20 investigative samples per matrix (soil and groundwater only). Equipment blanks will be obtained by pouring laboratory-demonstrated analyte-free water on or through a decontaminated sampling device following use and implementation of decontamination protocols. The water will be collected off of the sampling device into a laboratory-provided sample container for analysis. Equipment blank samples will be analyzed for the complete list of analytes on the day of sampling.

The duplicates will include:

a. **Coded Field Duplicate** - To determine the representativeness of the sampling methods, coded field duplicates will be collected at a minimum frequency of one per 20 field samples for each matrix (soil, groundwater, and soil vapor). The samples are termed "coded" because they will be labeled in such a manner that the laboratory will not be able to determine that they are a duplicate sample. This will eliminate any possible bias that could arise.

b. **Matrix Spike/Matrix Spike Duplicate (MS/MSD)** - MS/MSD samples (MS/MSD for organics; MS and laboratory duplicate for inorganics) will be taken at a frequency of one pair per 20 field samples (soil and groundwater). These samples are used to assess the effect of the sample matrix on the recovery of target compounds or target analytes. The percent recoveries and RPDs are given in Tables 3.1 and 3.2.

4.6 DECONTAMINATION PROCEDURES

Decontamination procedures will be used for non-dedicated sampling equipment. Decontamination of field personnel is discussed in the site-specific HASP. Field sampling equipment that is to be reused will be decontaminated in the field in accordance with the following procedures:

1. Laboratory-grade glassware detergent and tap water scrub to remove visual contamination
2. Generous tap water rinse
3. Distilled/de-ionized water rinse

4.7 RESIDUALS MANAGEMENT

Debris (e.g., paper, plastic and disposable PPE) will be collected in plastic garbage bags and disposed of as non-hazardous industrial waste. Debris is expected to be transported to a local municipal landfill for disposal. Drill cuttings will be placed back in the borehole from which it was sampled unless the soil is grossly-contaminated. If gross contamination is observed, soil will be collected and stored in Department of Transportation (DOT)-approved 55-gallon drums in a designated storage area at the site. Grossly-contaminated drill cuttings contained in drums will be stored in a designated storage area at the site and will be analyzed, characterized and disposed off-site in accordance with applicable federal and state regulations.

Residual fluids (such as purge water) will be collected and stored in DOT-approved (or equivalent) 55-gallon drums in a designated storage area at the site. The residual fluids will be analyzed, characterized and disposed off-site in accordance with applicable federal and state regulations. Residual fluids such as decontamination water may be discharged to the ground surface; however, if gross contamination is observed, the residual fluids will be collected, stored, and transported similar purge water or other residual fluids.

TABLE 4.1
WATER SAMPLE CONTAINERIZATION, PRESERVATION, AND HOLDING TIMES

Analysis	Bottle Type	Preservation (a)	Holding Time (b)
VOCs	40 mL glass VOA vials w/ Teflon-lined cap	HCl pH<2, Cool to 4°C	14 days
SVOCs	1000 mL glass w/ Teflon-lined cap	Cool to 4°C	14 days*
PCBs	1000 mL glass w/ Teflon-lined cap	Cool to 4°C	7 days**
PCBs	1000 mL glass w/ Teflon-lined cap	Cool to 4°C	7 days**
Metals	1000 mL plastic bottle	HNO_3 to pH < 2 Cool to 4°C	180 days, except mercury (28 days)
1,4-Dioxane	1000 mL glass w/ Teflon-lined cap	Cool to 4°C	7 days**
PFAS	250 mL bottles	Cool to 4°C	14 days

(a) All samples to be preserved in ice during collection and transport. Select samples preserved with hydrochloric acid (HCl) and nitric acid (HNO_3) as noted.

(b) Days from date of sample collection.

* Continuous liquid-liquid extraction is the required extraction for water samples for SVOCs. Continuous liquid-liquid extraction and concentration of water samples for SVOC analysis completed within 7 days from the date of sample collection. Extracts of water samples must be analyzed within 40 days of extraction.

** Procedures for extraction and concentration of water samples for PCBs must be completed within 7 days from the date of sample collection. Extracts of water samples must be analyzed within 40 days of extraction.

TABLE 4.2
SOIL SAMPLE
CONTAINERIZATION, PRESERVATION AND HOLDING TIMES

Analysis	Bottle Type	Preservation [(a)]	Holding Time [(b)]
VOCs	40 mL glass VOA vials or 5-g Encore samplers	Cool to 4°C, MeOH (VOA vials)	14 days*
SVOCs	Wide-mouth glass w/ Teflon lined cap	Cool to 4°C	14 days*
Metals	Wide-mouth plastic or glass	Cool to 4°C	180 days, except mercury (28 days)
PCBs	Wide-mouth glass w/ Teflon-lined cap	Cool to 4°C	14 days**
Herbicides	Wide-mouth glass w/ Teflon-lined cap	Cool to 4°C	14 days**
Cyanide, Total	Wide-mouth glass w/ Teflon-lined cap	Cool to 4°C	14 days
Hexavalent Chromium	Wide-mouth glass w/ Teflon-lined cap	Cool to 4°C	30 Days

(a) All samples to be preserved in ice during collection and transport. Samples collected for VOC analysis in VOA vials are preserved with methanol (MeOH).

(b) Days from date of sample collection.

* Samples collected for VOC analysis using Encore samplers must be analyzed within 48 hours unless frozen. Samples frozen within 48 hours can be analyzed up to 14 days from the date of sample collection.

* Soxhlet or sonication procedures for extraction and concentration of soil/waste samples for SVOCs must be completed within 14 days from the date of sample collection. Extracts of soil samples must be analyzed within 40 days of extraction.

** Procedures for extraction and concentration of soil/waste samples for PCBs and herbicides must be completed within 14 days from the date of sample collection. Extracts of soil samples must be analyzed within 40 days of extraction.

TABLE 4.3
SOIL VAPOR, INDOOR AIR, AND AMBIENT AIR SAMPLES
CONTAINERIZATION PRESENTATION AND HOLDING TIMES

Analysis	Bottle Type	Preservation	Holding Time [(a)]
VOCs	Summa Canister	None	30 days

(a) Days from date of sample collection.

* Summa canisters will be batch-certified by the analytical laboratory.

5.0 SAMPLE SHIPMENT, TRACKING AND CUSTODY

5.1 INTRODUCTION

This section presents sample custody procedures for both the field and laboratory. Implementation of proper custody procedures for samples generated in the field is the responsibility of field personnel. Both laboratory and field personnel involved in the Chain-of-custody (COC) and transfer of samples will be trained as to the purpose and procedures prior to implementation.

Evidence of sample traceability and integrity is provided by COC procedures. These procedures document the sample traceability from the selection and preparation of the sample containers by the laboratory, to sample collection, to sample shipment, to laboratory receipt and analysis. The sample custody flowchart is shown in Figure 5.1. A sample is considered to be in a person's custody if the sample is:

- In his/her possession;
- Maintained in view after possession is accepted and documented;
- Locked and tagged with custody seals so that no one can tamper with it after having been in physical custody; or
- In a secured area, restricted to authorized personnel.

5.2 PACKAGING

Air samples canisters can be stored and transported without additional packaging. Soil and groundwater sample containers will be placed in plastic coolers. Ice in Ziploc® bags (or equivalent) will be placed around sample containers. Cushioning material will be added around the sample containers if necessary. COCs and other paperwork will be placed in a Ziploc® bag (or equivalent) and placed inside the cooler. The cooler will be taped closed and custody seals will be affixed to one side of the cooler at a minimum. If the samples are being shipped by an express delivery company (e.g. FedEx) then laboratory address labels will be placed on top of the cooler

5.3 SHIPPING

Standard procedures to be followed for shipping environmental samples to the analytical laboratory are outlined below.

- All environmental samples will be transported to the laboratory by a laboratory-provided courier under the chain-of-custody protocols.

Prior notice will be provided to the laboratory regarding when to expect shipped samples. If the number, type or date of shipment changes due to site constraints or program changes, the laboratory will be informed.

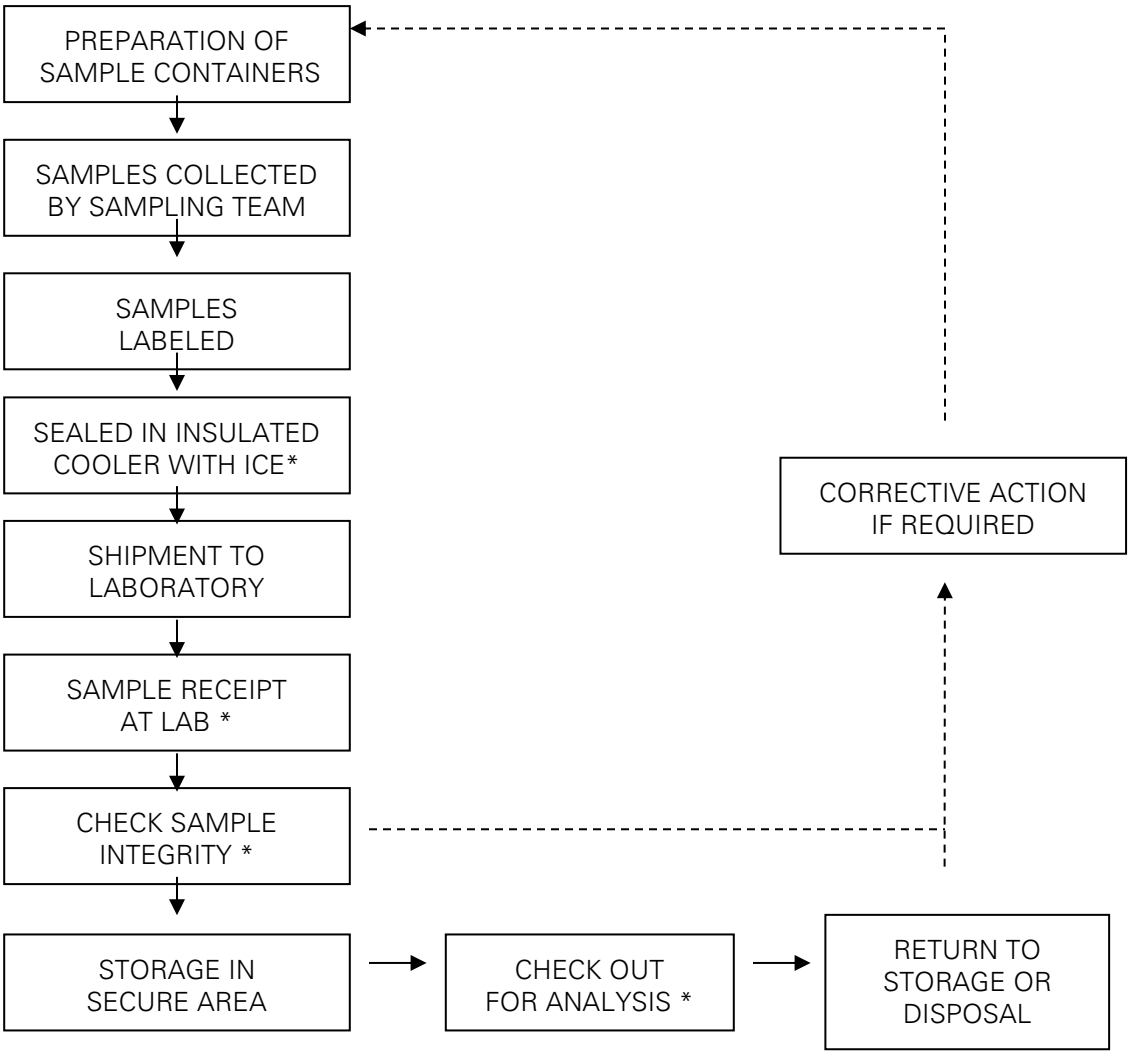
5.4 FIELD SAMPLE CUSTODY

A COC record (Figure 5.2 or similar) accompanies the sample containers from selection and preparation at the laboratory, during shipment to the field for sample containment and preservation, and during return to the laboratory. Triplicate copies of the COC must be completed for each sample set collected.

The COC lists the field personnel responsible for taking samples, the project name and number, the name of the analytical laboratory to which the samples are sent, and the method of sample shipment. The COC also lists a unique description of every sample bottle in the set. If samples are split and sent to different laboratories, a copy of the COC record will be sent with each sample.

The *REMARKS* space on the COC is used to indicate if the sample is a matrix spike, matrix spike duplicate, or any other sample information for the laboratory. Since they are not specific to any one sample point, trip and field blanks are indicated on separate rows. Once all bottles are properly accounted for on the form, a sampler will write his or her signature and the date and time on the first *RELINQUISHED BY* space. The sampler will also write the method of shipment, the shipping cooler identification number, and the shipper airbill number on the top of the COC.

Figure 5.1 Sample Custody



* REQUIRES SIGN-OFF ON CHAIN-OF-CUSTODY FORM

Figure 5.2 Sample Chain-of-Custody Form

NEW YORK CHAIN OF CUSTODY

Westborough, MA 01581 — 8 Walkup Dr. — TEL: 508-898-9220 — FAX: 508-898-9193
Mansfield, MA 02048 — 320 Forbes Blvd — TEL: 508-822-9300 — FAX: 508-822-3288

Service Centers
Mahwah, NJ 07430: 35 Whitney Rd, Suite 5
Albany, NY 12205: 14 Walker Way
Tonawanda, NY 14150: 275 Cooper Ave, Suite 105

Page of

Date Rec'd in Lab

ALPHA Job #

Client Information
Client:
Address:
Phone:
Fax:
Email:

Project Information
Project Name:
Project Location:
Project #
(Use Project name as Project #)
Project Manager:
ALPHAQuote #:

Turn-Around Time
Standard
Rush (only if pre approved)
Due Date:
# of Days:

These samples have been previously analyzed by Alpha
Other project specific requirements/comments:
Please specify Metals or TAL.

ALPHA Lab ID (Lab Use Only)
Sample ID
Collection Date
Collection Time
Sample Matrix
Sampler's Initials

Deliverables
ASP-A
EQuIS (1 File)
Other
ASP-B
EQuIS (4 File)

Regulatory Requirement
NY TOGS
AWQ Standards
NY Restricted Use
NY Unrestricted Use
NYC Sewer Discharge
NY Part 375
NY CP-51
Other

Billing Information
Same as Client Info
PO #

Disposal Site Information
Please identify below location of applicable disposal facilities.
Disposal Facility:
NJ
NY
Other:

ANALYSIS

Sample Filtration
Done
Lab to do
Preservation
Lab to do
(Please Specify below)

Sample Specific Comments

Total Bottle

Preservative Code:
A = None
B = HCl
C = HNO_3
D = H_2SO_4
E = NaOH
F = MeOH
G = $NaHSO_4$
H = $Na_2S_2O_3$
K/E = Zn Ac/NaOH
O = Other

Container Code
P = Plastic
A = Amber Glass
V = Vial
G = Glass
B = Bacteria Cup
C = Cube
O = Other
E = Encore
D = BOD Bottle

Westboro: Certification No: MA935
Mansfield: Certification No: MA015

Container Type
Preservative

Relinquished By:
Date/Time
Received By:
Date/Time

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. BY EXECUTING THIS COC, THE CLIENT HAS READ AND AGREES TO BE BOUND BY ALPHA'S TERMS & CONDITIONS. (See reverse side.)

Form No: 01-25 HC (rev. 30-Sept-2013)

Mistakes will be crossed out with a single line in ink and initialed by the author.

One copy of the COC is retained by sampling personnel (notations identifying blind duplicate samples will be added to this copy of the COC, but not the others that will go to the laboratory) and the other two copies are put into a sealable plastic bag and taped inside the lid of the shipping cooler. The cooler lid is closed, custody seals provided by the laboratory are affixed to the latch and across the back and front lids of the cooler, and the person relinquishing the samples signs their name across the seal. The seal is taped, and the cooler is wrapped tightly with clear packing tape. It is then relinquished by field personnel to personnel responsible for shipment, typically an overnight carrier. The COC seal must be broken to open the container. Breakage of the seals before receipt at the laboratory may indicate tampering. If tampering is apparent, the laboratory will contact the Project Manager, and the sample will not be analyzed.

5.5 LABORATORY SAMPLE CUSTODY

The Project Manager or Field Team Leader will notify the laboratory of upcoming field sampling activities, and the subsequent shipment of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped as well as the anticipated date of arrival.

The following laboratory sample custody procedures will be used:

- The laboratory will designate a sample custodian who will be responsible for maintaining custody of the samples, and for maintaining all associated records documenting that custody.
- Upon receipt of the samples, the custodian will check cooler temperature, and check the original COC documents and compare them with the labeled contents of each sample container for correctness and traceability. The sample custodian will sign the COC record and record the date and time received.
- Care will be exercised to annotate any labeling or descriptive errors. In the event of discrepant documentation, the laboratory will immediately contact the Project Manager or Field Team Leader as part of the corrective action process. A qualitative assessment of each sample container will be performed to note any anomalies, such as broken or leaking bottles. This assessment will be recorded as part of the incoming chain-of-custody procedure.
- The samples will be stored in a secured area at a temperature of approximately 4°C until analyses commence.

- A laboratory tracking record will accompany the sample or sample fraction through final analysis for control.
- A copy of the tracking record will accompany the laboratory report and will become a permanent part of the project records.

6.0 CALIBRATION PROCEDURES

6.1 FIELD INSTRUMENTS

A PID will be used during the sampling activities to evaluate work zone action levels, collect pre- and post-sample readings for air samples, screen soil samples, and collect monitoring well headspace readings. Field calibration and/or field checking of the PID will be the responsibility of the field team leader and will be accomplished by following the procedures outlined in the operating manual for the instrument. At a minimum, field calibration and/or field equipment checking will be performed once daily, prior to use. Field calibration will be documented in the field notebook. Entries made into the logbook regarding the status of field equipment will include the following information:

- Date and time of calibration
- Type of equipment serviced and identification number (such as serial number)
- Reference standard used for calibration
- Calibration and/or maintenance procedure used
- Other pertinent information

A water quality meter (Horiba U-52 or similar) will be used during purging and sampling of groundwater to measure pH, specific conductance, temperature, dissolved oxygen, turbidity and oxidation-reduction-potential (ORP) every five minutes. Water-quality meters should be calibrated and the results documented before use each day using standardized field calibration procedures and calibration checks.

Equipment that fails calibration or becomes inoperable during use will be removed from service and segregated to prevent inadvertent utilization. The equipment will be properly tagged to indicate that it is out of calibration. Such equipment will be repaired and recalibrated to the manufacturer's specifications by qualified personnel. Equipment that cannot be repaired will be replaced.

Off-site calibration and maintenance of field instruments will be conducted as appropriate throughout the duration of project activities. All field instrumentation, sampling equipment and accessories will be maintained in accordance with the manufacturer's recommendations and specifications and established field equipment practice. Off-site calibration and maintenance will be performed by qualified personnel. A logbook will be kept to document that established calibration and maintenance procedures were followed. Documentation will include both scheduled and unscheduled maintenance.

6.2 LABORATORY INSTRUMENTS

The laboratory will follow all calibration procedures and schedules as specified in the sections of the USEPA SW-846 and subsequent updates that apply to the instruments used for the analytical methods given in Section 7.

7.0 ANALYTICAL PROCEDURES

7.1 INTRODUCTION

Samples will be analyzed according to the USEPA SW-846 "Test Methods for Evaluating Solid Waste," November 1986, 3rd edition and subsequent updates. The methods for the laboratory analysis of soil, water, and air samples and the quantitation limits presented in Table 7.1.

TABLE 7.1
PROJECT QUANTITATION LIMITS - SOIL

			Estimated Quantitation Limits (Soil)	
	Compound	**Method**	**RL (mg/kg)**	**MDL(mg/kg)**
	VOCs			
1	Methylene chloride	8260C/5035	0.01	0.00165
2	1,1-Dichloroethane	8260C/5035	0.0015	0.00027
3	Chloroform	8260C/5035	0.0015	0.00037
4	Carbon tetrachloride	8260C/5035	0.001	0.000345
5	1,2-Dichloropropane	8260C/5035	0.0035	0.000228
6	Dibromochloromethane	8260C/5035	0.001	0.000176
7	1,1,2-Trichloroethane	8260C/5035	0.0015	0.000313
8	Tetrachloroethene	8260C/5035	0.001	0.000302
9	Chlorobenzene	8260C/5035	0.001	0.000348
10	Trichlorofluoromethane	8260C/5035	0.005	0.000417
11	1,2-Dichloroethane	8260C/5035	0.001	0.000246
12	1,1,1-Trichloroethane	8260C/5035	0.001	0.00035
13	Bromodichloromethane	8260C/5035	0.001	0.000308
14	trans-1,3-Dichloropropene	8260C/5035	0.001	0.000208
15	cis-1,3-Dichloropropene	8260C/5035	0.001	0.000231
16	1,3-Dichloropropene, Total	8260C/5035	0.001	0.000208
17	1,1-Dichloropropene	8260C/5035	0.005	0.000328
18	Bromoform	8260C/5035	0.004	0.000237
19	1,1,2,2-Tetrachloroethane	8260C/5035	0.001	0.000298
20	Benzene	8260C/5035	0.001	0.000193
21	Toluene	8260C/5035	0.0015	0.000195
22	Ethylbenzene	8260C/5035	0.001	0.00017
23	Chloromethane	8260C/5035	0.005	0.000436
24	Bromomethane	8260C/5035	0.002	0.000338
25	Vinyl chloride	8260C/5035	0.002	0.000315
26	Chloroethane	8260C/5035	0.002	0.000316
27	1,1-Dichloroethene	8260C/5035	0.001	0.000372
28	trans-1,2-Dichloroethene	8260C/5035	0.0015	0.000241
29	Trichloroethene	8260C/5035	0.001	0.000302

TABLE 7.1
PROJECT QUANTITATION LIMITS - SOIL

			Estimated Quantitation Limits (Soil)	
	Compound	**Method**	**RL (mg/kg)**	**MDL(mg/kg)**
30	1,2-Dichlorobenzene	8260C/5035	0.005	0.000182
31	1,3-Dichlorobenzene	8260C/5035	0.005	0.000218
32	1,4-Dichlorobenzene	8260C/5035	0.005	0.000182
33	Methyl tert butyl ether	8260C/5035	0.002	0.000153
34	p/m-Xylene	8260C/5035	0.002	0.000351
35	o-Xylene	8260C/5035	0.002	0.000338
36	Xylene (Total)	8260C/5035	0.002	0.000338
37	cis-1,2-Dichloroethene	8260C/5035	0.001	0.000342
38	1,2-Dichloroethene (total)	8260C/5035	0.001	0.000241
39	Dibromomethane	8260C/5035	0.01	0.000239
40	Styrene	8260C/5035	0.002	0.000401
41	Dichlorodifluoromethane	8260C/5035	0.01	0.0005
42	Acetone	8260C/5035	0.01	0.00229
43	Carbon disulfide	8260C/5035	0.01	0.0011
44	2-Butanone	8260C/5035	0.01	0.00069
45	Vinyl acetate	8260C/5035	0.01	0.000153
46	4-Methyl-2-pentanone	8260C/5035	0.01	0.000244
47	1,2,3-Trichloropropane	8260C/5035	0.01	0.000177
48	2-Hexanone	8260C/5035	0.01	0.000666
49	Bromochloromethane	8260C/5035	0.005	0.000357
50	2,2-Dichloropropane	8260C/5035	0.005	0.00045
51	1,2-Dibromoethane	8260C/5035	0.004	0.000199
52	1,3-Dichloropropane	8260C/5035	0.005	0.000183
53	1,1,1,2-Tetrachloroethane	8260C/5035	0.001	0.000318
54	Bromobenzene	8260C/5035	0.005	0.000219
55	n-Butylbenzene	8260C/5035	0.001	0.000228
56	sec-Butylbenzene	8260C/5035	0.001	0.000217
57	tert-Butylbenzene	8260C/5035	0.005	0.000247
58	o-Chlorotoluene	8260C/5035	0.005	0.000221
59	p-Chlorotoluene	8260C/5035	0.005	0.000183
60	1,2-Dibromo-3-chloropropane	8260C/5035	0.005	0.000396
61	Hexachlorobutadiene	8260C/5035	0.005	0.000348
62	Isopropylbenzene	8260C/5035	0.001	0.000194
63	p-Isopropyltoluene	8260C/5035	0.001	0.000202
64	Naphthalene	8260C/5035	0.005	0.000138
65	Acrylonitrile	8260C/5035	0.01	0.000514
66	n-Propylbenzene	8260C/5035	0.001	0.000215

TABLE 7.1
PROJECT QUANTITATION LIMITS - SOIL

			Estimated Quantitation Limits (Soil)	
	Compound	**Method**	**RL (mg/kg)**	**MDL(mg/kg)**
67	1,2,3-Trichlorobenzene	8260C/5035	0.005	0.000251
68	1,2,4-Trichlorobenzene	8260C/5035	0.005	0.000215
69	1,3,5-Trimethylbenzene	8260C/5035	0.005	0.000161
70	1,2,4-Trimethylbenzene	8260C/5035	0.005	0.000186
71	1,4-Dioxane	8260C/5035	0.04	0.0144
72	1,4-Diethylbenzene	8260C/5035	0.004	0.004
73	4-Ethyltoluene	8260C/5035	0.004	0.000234
74	1,2,4,5-Tetramethylbenzene	8260C/5035	0.004	0.000156
75	Ethyl ether	8260C/5035	0.005	0.00026
76	trans-1,4-Dichloro-2-butene	8260C/5035	0.005	0.000392
	SVOCs			
1	Acenaphthene	8270D	0.1332	0.0172494
2	1,2,4-Trichlorobenzene	8270D	0.1665	0.0190476
3	Hexachlorobenzene	8270D	0.0999	0.018648
4	Bis(2-chloroethyl)ether	8270D	0.14985	0.0225774
5	2-Chloronaphthalene	8270D	0.1665	0.0165168
6	1,2-Dichlorobenzene	8270D	0.1665	0.0299034
7	1,3-Dichlorobenzene	8270D	0.1665	0.028638
8	1,4-Dichlorobenzene	8270D	0.1665	0.0290709
9	3,3'-Dichlorobenzidine	8270D	0.1665	0.044289
10	2,4-Dinitrotoluene	8270D	0.1665	0.0333
11	2,6-Dinitrotoluene	8270D	0.1665	0.0285714
12	Fluoranthene	8270D	0.0999	0.0191142
13	4-Chlorophenyl phenyl ether	8270D	0.1665	0.0178155
14	4-Bromophenyl phenyl ether	8270D	0.1665	0.0254079
15	Bis(2-chloroisopropyl)ether	8270D	0.1998	0.0284382
16	Bis(2-chloroethoxy)methane	8270D	0.17982	0.0166833
17	Hexachlorobutadiene	8270D	0.1665	0.0243756
18	Hexachlorocyclopentadiene	8270D	0.47619	0.150849
19	Hexachloroethane	8270D	0.1332	0.0269397
20	Isophorone	8270D	0.14985	0.0216117
21	Naphthalene	8270D	0.1665	0.0202797
22	Nitrobenzene	8270D	0.14985	0.024642
23	NitrosoDiPhenylAmine(NDPA)/DPA	8270D	0.1332	0.0189477
24	n-Nitrosodi-n-propylamine	8270D	0.1665	0.0257076
25	Bis(2-Ethylhexyl)phthalate	8270D	0.1665	0.057609

TABLE 7.1
PROJECT QUANTITATION LIMITS - SOIL

			Estimated Quantitation Limits (Soil)	
	Compound	**Method**	**RL (mg/kg)**	**MDL(mg/kg)**
26	Butyl benzyl phthalate	8270D	0.1665	0.041958
27	Di-n-butylphthalate	8270D	0.1665	0.0315684
28	Di-n-octylphthalate	8270D	0.1665	0.05661
29	Diethyl phthalate	8270D	0.1665	0.0154179
30	Dimethyl phthalate	8270D	0.1665	0.034965
31	Benzo(a)anthracene	8270D	0.0999	0.0187479
32	Benzo(a)pyrene	8270D	0.1332	0.040626
33	Benzo(b)fluoranthene	8270D	0.0999	0.0280386
34	Benzo(k)fluoranthene	8270D	0.0999	0.02664
35	Chrysene	8270D	0.0999	0.017316
36	Acenaphthylene	8270D	0.1332	0.0257076
37	Anthracene	8270D	0.0999	0.0324675
38	Benzo(ghi)perylene	8270D	0.1332	0.0195804
39	Fluorene	8270D	0.1665	0.0161838
40	Phenanthrene	8270D	0.0999	0.0202464
41	Dibenzo(a,h)anthracene	8270D	0.0999	0.0192474
42	Indeno(1,2,3-cd)Pyrene	8270D	0.1332	0.0232101
43	Pyrene	8270D	0.0999	0.0165501
44	Biphenyl	8270D	0.37962	0.038628
45	4-Chloroaniline	8270D	0.1665	0.030303
46	2-Nitroaniline	8270D	0.1665	0.0321012
47	3-Nitroaniline	8270D	0.1665	0.0314019
48	4-Nitroaniline	8270D	0.1665	0.068931
49	Dibenzofuran	8270D	0.1665	0.0157509
50	2-Methylnaphthalene	8270D	0.1998	0.0201132
51	Acetophenone	8270D	0.1665	0.0206127
52	2,4,6-Trichlorophenol	8270D	0.0999	0.0315684
53	P-Chloro-M-Cresol	8270D	0.1665	0.0248085
54	2-Chlorophenol	8270D	0.1665	0.0196803
55	2,4-Dichlorophenol	8270D	0.14985	0.0267732
56	2,4-Dimethylphenol	8270D	0.1665	0.054945
57	2-Nitrophenol	8270D	0.35964	0.062604
58	4-Nitrophenol	8270D	0.2331	0.067932
59	2,4-Dinitrophenol	8270D	0.7992	0.077589
60	4,6-Dinitro-o-cresol	8270D	0.4329	0.07992
61	Pentachlorophenol	8270D	0.1332	0.03663
62	Phenol	8270D	0.1665	0.0251415

TABLE 7.1
PROJECT QUANTITATION LIMITS - SOIL

			Estimated Quantitation Limits (Soil)	
	Compound	**Method**	**RL (mg/kg)**	**MDL(mg/kg)**
63	2-Methylphenol	8270D	0.1665	0.0258075
64	3-Methylphenol/4-Methylphenol	8270D	0.23976	0.0260739
65	2,4,5-Trichlorophenol	8270D	0.1665	0.0319014
66	Benzoic Acid	8270D	0.53946	0.168498
67	Benzyl Alcohol	8270D	0.1665	0.050949
68	Carbazole	8270D	0.1665	0.0161838
	Pesticides			
1	Delta-BHC	8081B	0.007992	0.0015651
2	Lindane	8081B	0.00333	0.00148851
3	Alpha-BHC	8081B	0.00333	0.00094572
4	Beta-BHC	8081B	0.007992	0.0030303
5	Heptachlor	8081B	0.003996	0.00179154
6	Aldrin	8081B	0.007992	0.00281385
7	Heptachlor epoxide	8081B	0.014985	0.0044955
8	Endrin	8081B	0.00333	0.0013653
9	Endrin aldehyde	8081B	0.00999	0.0034965
10	Endrin ketone	8081B	0.007992	0.00205794
11	Dieldrin	8081B	0.004995	0.0024975
12	4,4'-DDE	8081B	0.007992	0.00184815
13	4,4'-DDD	8081B	0.007992	0.00285048
14	4,4'-DDT	8081B	0.014985	0.0064269
15	Endosulfan I	8081B	0.007992	0.00188811
16	Endosulfan II	8081B	0.007992	0.00267066
17	Endosulfan sulfate	8081B	0.00333	0.00152181
18	Methoxychlor	8081B	0.014985	0.004662
19	Toxaphene	8081B	0.14985	0.041958
20	cis-Chlordane	8081B	0.00999	0.00278388
21	trans-Chlordane	8081B	0.00999	0.00263736
22	Chlordane	8081B	0.064935	0.0264735
	Herbicides			
1	2,4,5-TP (Silvex)	8151A	0.1665	0.0044289
	PCBs			
1	Aroclor 1016	8082A	0.0335	0.0026465
2	Aroclor 1221	8082A	0.0335	0.0030887

TABLE 7.1
PROJECT QUANTITATION LIMITS - SOIL

			Estimated Quantitation Limits (Soil)	
	Compound	**Method**	**RL (mg/kg)**	**MDL(mg/kg)**
3	Aroclor 1232	8082A	0.0335	0.0039262
4	Aroclor 1242	8082A	0.0335	0.0041004
5	Aroclor 1248	8082A	0.0335	0.0028274
6	Aroclor 1254	8082A	0.0335	0.0027537
7	Aroclor 1260	8082A	0.0335	0.0025527
8	Aroclor 1262	8082A	0.0335	0.0016616
9	Aroclor 1268	8082A	0.0335	0.0048575
10	PCBs, Total	8082A	0.0335	0.0016616
	Metals			
1	Aluminum, Total	6010C	4	1.08
2	Antimony, Total	6010C	2	0.152
3	Arsenic, Total	6010C	0.4	0.0832
4	Barium, Total	6010C	0.4	0.0696
5	Beryllium, Total	6010C	0.2	0.0132
6	Cadmium, Total	6010C	0.4	0.0392
7	Calcium, Total	6010C	4	1.4
8	Chromium, Total	6010C	0.4	0.0384
9	Cobalt, Total	6010C	0.8	0.0664
10	Copper, Total	6010C	0.4	0.1032
11	Iron, Total	6010C	2	0.3612
12	Lead, Total	6010C	2	0.1072
13	Magnesium, Total	6010C	4	0.616
14	Manganese, Total	6010C	0.4	0.0636
15	Mercury	7471B	0.08	0.016896
16	Nickel, Total	6010C	1	0.0968
17	Potassium, Total	6010C	100	5.76
18	Selenium, Total	6010C	0.8	0.1032
19	Silver, Total	6010C	0.4	0.1132
20	Sodium, Total	6010C	80	1.26
21	Thallium, Total	6010C	0.8	0.126
22	Vanadium, Total	6010C	0.4	0.0812
23	Zinc, Total	6010C	2	0.1172
	General Chemistry			
1	Cyanide	9010C	0.8	0.16
2	Hexavalent Chromium	7196A	1	0.166

TABLE 7.1
PROJECT QUANTITATION LIMITS - SOIL

			Estimated Quantitation Limits (Soil)	
	Compound	**Method**	**RL (mg/kg)**	**MDL(mg/kg)**
3	Trivalent Chromium	7196	0.8	0.8

Notes:
1) RL = Reporting Limit
2) MDL = Method Detection Limit
3) RL and MDL values were supplied by Alpha Analytical Laboratories
4) RL and MDL values are estimated and may vary depending on instruments
5) mg/kg = milligram per kilogram

TABLE 7.1
PROJECT QUANTITATION LIMITS - GROUNDWATER

			Estimated Quantitation Limits (Groundwater)	
	Compound	**Method**	**RL (ug/L)**	**MDL(ug/L)**
	VOCs			
1	Methylene chloride	8260C	2.5	0.7
2	1,1-Dichloroethane	8260C	5	0.7
3	Chloroform	8260C	2.5	0.7
4	Carbon tetrachloride	8260C	5	0.134
5	1,2-Dichloropropane	8260C	5	0.133
6	Dibromochloromethane	8260C	5	0.149
7	1,1,2-Trichloroethane	8260C	5	0.5
8	Tetrachloroethene	8260C	5	0.181
9	Chlorobenzene	8260C	5	0.7
10	Trichlorofluoromethane	8260C	5	0.7
11	1,2-Dichloroethane	8260C	2.5	0.132
12	1,1,1-Trichloroethane	8260C	2.5	0.7
13	Bromodichloromethane	8260C	2	0.192
14	trans-1,3-Dichloropropene	8260C	2.5	0.164
15	cis-1,3-Dichloropropene	8260C	2.5	0.144
16	1,3-Dichloropropene, Total	8260C	2.5	0.144
17	1,1-Dichloropropene	8260C	2.5	0.7
18	Bromoform	8260C	2.5	0.65
19	1,1,2,2-Tetrachloroethane	8260C	2.5	0.144
20	Benzene	8260C	2.5	0.159
21	Toluene	8260C	2.5	0.7
22	Ethylbenzene	8260C	2.5	0.7
23	Chloromethane	8260C	2.5	0.7
24	Bromomethane	8260C	2.5	0.7
25	Vinyl chloride	8260C	2.5	0.0699
26	Chloroethane	8260C	2.5	0.7
27	1,1-Dichloroethene	8260C	2.5	0.142

TABLE 7.1
PROJECT QUANTITATION LIMITS - GROUNDWATER

			Estimated Quantitation Limits (Groundwater)	
	Compound	**Method**	**RL (ug/L)**	**MDL(ug/L)**
28	trans-1,2-Dichloroethene	8260C	2.5	0.7
29	Trichloroethene	8260C	2.5	0.175
30	1,2-Dichlorobenzene	8260C	2.5	0.7
31	1,3-Dichlorobenzene	8260C	250	0.7
32	1,4-Dichlorobenzene	8260C	2	0.7
33	Methyl tert butyl ether	8260C	2	0.7
34	p/m-Xylene	8260C	2	0.7
35	o-Xylene	8260C	2.5	0.7
36	Xylene (Total)	8260C	2.5	0.7
37	cis-1,2-Dichloroethene	8260C	2.5	0.7
38	1,2-Dichloroethene (total)	8260C	2.5	0.7
39	Dibromomethane	8260C	5	1
40	1,2,3-Trichloropropane	8260C	2.5	0.7
41	Acrylonitrile	8260C	5	1.5
42	Styrene	8260C	2.5	0.7
43	Dichlorodifluoromethane	8260C	5	1
44	Acetone	8260C	5	1.46
45	Carbon disulfide	8260C	5	1
46	2-Butanone	8260C	5	1.94
47	Vinyl acetate	8260C	5	1
48	4-Methyl-2-pentanone	8260C	5	1
49	2-Hexanone	8260C	5	1
50	Bromochloromethane	8260C	2.5	0.7
51	2,2-Dichloropropane	8260C	2.5	0.7
52	1,2-Dibromoethane	8260C	2	0.65
53	1,3-Dichloropropane	8260C	2.5	0.7
54	1,1,1,2-Tetrachloroethane	8260C	2.5	0.7
55	Bromobenzene	8260C	2.5	0.7
56	n-Butylbenzene	8260C	2.5	0.7
57	sec-Butylbenzene	8260C	2.5	0.7
58	tert-Butylbenzene	8260C	2.5	0.7
59	o-Chlorotoluene	8260C	2.5	0.7
60	p-Chlorotoluene	8260C	2.5	0.7
61	1,2-Dibromo-3-chloropropane	8260C	2.5	0.7
62	Hexachlorobutadiene	8260C	2.5	0.7
63	Isopropylbenzene	8260C	2.5	0.7
64	p-Isopropyltoluene	8260C	2.5	0.7

TABLE 7.1
PROJECT QUANTITATION LIMITS - GROUNDWATER

			Estimated Quantitation Limits (Groundwater)	
	Compound	**Method**	**RL (ug/L)**	**MDL(ug/L)**
65	Naphthalene	8260C	2.5	0.7
66	n-Propylbenzene	8260C	2.5	0.7
67	1,2,3-Trichlorobenzene	8260C	2.5	0.7
68	1,2,4-Trichlorobenzene	8260C	2.5	0.7
69	1,3,5-Trimethylbenzene	8260C	2.5	0.7
70	1,2,4-Trimethylbenzene	8260C	2.5	0.7
71	1,4-Dioxane	8270 SIM Isotope Dilution	0.15	0.075
72	1,4-Diethylbenzene	8260C	2	0.7
73	4-Ethyltoluene	8260C	2	0.7
74	1,2,4,5-Tetramethylbenzene	8260C	2	0.65
75	Ethyl ether	8260C	2.5	0.7
76	trans-1,4-Dichloro-2-butene	8260C	2.5	0.7
	SVOCs			
1	Acenaphthene	8270D	2	0.591
2	1,2,4-Trichlorobenzene	8270D	5	0.661
3	Hexachlorobenzene	8270D	2	0.579
4	Bis(2-chloroethyl)ether	8270D	2	0.669
5	2-Chloronaphthalene	8270D	2	0.64
6	1,2-Dichlorobenzene	8270D	2	0.732
7	1,3-Dichlorobenzene	8270D	2	0.732
8	1,4-Dichlorobenzene	8270D	2	0.708
9	3,3'-Dichlorobenzidine	8270D	5	1.39
10	2,4-Dinitrotoluene	8270D	5	0.845
11	2,6-Dinitrotoluene	8270D	5	1.12
12	Fluoranthene	8270D	2	0.568
13	4-Chlorophenyl phenyl ether	8270D	2	0.625
14	4-Bromophenyl phenyl ether	8270D	2	0.731
15	Bis(2-chloroisopropyl)ether	8270D	2	0.696
16	Bis(2-chloroethoxy)methane	8270D	5	0.626
17	Hexachlorobutadiene	8270D	2	0.658
18	Hexachlorocyclopentadiene	8270D	20	7.84
19	Hexachloroethane	8270D	2	0.682
20	Isophorone	8270D	5	0.601
21	Naphthalene	8270D	2	0.68
22	Nitrobenzene	8270D	2	0.753

TABLE 7.1
PROJECT QUANTITATION LIMITS - GROUNDWATER

			Estimated Quantitation Limits (Groundwater)	
	Compound	**Method**	**RL (ug/L)**	**MDL(ug/L)**
23	NitrosoDiPhenylAmine(NDPA)/DPA	8270D	2	0.644
24	n-Nitrosodi-n-propylamine	8270D	5	0.7
25	Bis(2-Ethylhexyl)phthalate	8270D	3	0.91
26	Butyl benzyl phthalate	8270D	5	1.26
27	Di-n-butylphthalate	8270D	5	0.689
28	Di-n-octylphthalate	8270D	5	1.14
29	Diethyl phthalate	8270D	5	0.628
30	Dimethyl phthalate	8270D	5	0.65
31	Benzo(a)anthracene	8270D	2	0.61
32	Benzo(a)pyrene	8270D	2	0.539
33	Benzo(b)fluoranthene	8270D	2	0.635
34	Benzo(k)fluoranthene	8270D	2	0.597
35	Chrysene	8270D	2	0.543
36	Acenaphthylene	8270D	2	0.658
37	Anthracene	8270D	2	0.645
38	Benzo(ghi)perylene	8270D	2	0.611
39	Fluorene	8270D	2	0.619
40	Phenanthrene	8270D	2	0.613
41	Dibenzo(a,h)anthracene	8270D	2	0.548
42	Indeno(1,2,3-cd)Pyrene	8270D	2	0.707
43	Pyrene	8270D	2	0.569
44	Biphenyl	8270D	2	0.757
45	4-Chloroaniline	8270D	5	0.632
46	2-Nitroaniline	8270D	5	1.14
47	3-Nitroaniline	8270D	5	1.14
48	4-Nitroaniline	8270D	5	1.3
49	Dibenzofuran	8270D	2	0.656
50	2-Methylnaphthalene	8270D	2	0.72
51	Acetophenone	8270D	5	0.847
52	2,4,6-Trichlorophenol	8270D	5	0.681
53	P-Chloro-M-Cresol	8270D	2	0.617
54	2-Chlorophenol	8270D	2	0.631
55	2,4-Dichlorophenol	8270D	5	0.769
56	2,4-Dimethylphenol	8270D	5	1.64
57	2-Nitrophenol	8270D	10	1.52
58	4-Nitrophenol	8270D	10	1.77
59	2,4-Dinitrophenol	8270D	20	5.47

TABLE 7.1
PROJECT QUANTITATION LIMITS - GROUNDWATER

			Estimated Quantitation Limits (Groundwater)	
	Compound	**Method**	**RL (ug/L)**	**MDL(ug/L)**
60	4,6-Dinitro-o-cresol	8270D	10	2.1
61	Pentachlorophenol	8270D	10	3.43
62	Phenol	8270D	5	1.89
63	2-Methylphenol	8270D	5	1.02
64	3-Methylphenol/4-Methylphenol	8270D	5	1.11
65	2,4,5-Trichlorophenol	8270D	5	0.715
66	Benzoic Acid	8270D	50	12.9
67	Benzyl Alcohol	8270D	2	0.725
68	Carbazole	8270D	2	0.627
69	1,4-Dioxane	8270 SIM Isotope Dilution	0.15	0.075
	Pesticides			
1	Delta-BHC	8081B	0.02	0.00467
2	Lindane	8081B	0.02	0.00434
3	Alpha-BHC	8081B	0.02	0.00439
4	Beta-BHC	8081B	0.02	0.0056
5	Heptachlor	8081B	0.02	0.0031
6	Aldrin	8081B	0.02	0.00216
7	Heptachlor epoxide	8081B	0.02	0.00415
8	Endrin	8081B	0.04	0.00429
9	Endrin aldehyde	8081B	0.04	0.0081
10	Endrin ketone	8081B	0.04	0.00477
11	Dieldrin	8081B	0.04	0.00429
12	4,4'-DDE	8081B	0.04	0.00381
13	4,4'-DDD	8081B	0.04	0.00464
14	4,4'-DDT	8081B	0.04	0.00432
15	Endosulfan I	8081B	0.02	0.00345
16	Endosulfan II	8081B	0.04	0.00519
17	Endosulfan sulfate	8081B	0.04	0.00481
18	Methoxychlor	8081B	0.2	0.00684
19	Toxaphene	8081B	0.2	0.063
20	cis-Chlordane	8081B	0.02	0.00666
21	trans-Chlordane	8081B	0.02	0.00627
22	Chlordane	8081B	0.2	0.0463
	Herbicides			
1	2,4,5-TP (Silvex)	8151A	2	0.539

TABLE 7.1
PROJECT QUANTITATION LIMITS - GROUNDWATER

	Compound	Method	Estimated Quantitation Limits (Groundwater) RL (ug/L)	MDL(ug/L)
	PCBs			
1	Aroclor 1016	8082A	0.083	0.05478
2	Aroclor 1221	8082A	0.083	0.05312
3	Aroclor 1232	8082A	0.083	0.03071
4	Aroclor 1242	8082A	0.083	0.05976
5	Aroclor 1248	8082A	0.083	0.05063
6	Aroclor 1254	8082A	0.083	0.03403
7	Aroclor 1260	8082A	0.083	0.03154
8	Aroclor 1262	8082A	0.083	0.02905
9	Aroclor 1268	8082A	0.083	0.03735
10	PCBs, Total	8082A	0.083	0.02905
	Metals			
1	Aluminum, Total	6010C	0.00001	0.00000327
2	Antimony, Total	6010C	0.000004	0.000000429
3	Arsenic, Total	6010C	0.0000005	0.000000165
4	Barium, Total	6010C	0.0000005	0.000000173
5	Beryllium, Total	6010C	0.0000005	0.000000107
6	Cadmium, Total	6010C	0.0000002	0.0000000599
7	Calcium, Total	6010C	0.0001	0.0000394
8	Chromium, Total	6010C	0.000001	0.000000178
9	Cobalt, Total	6010C	0.0000005	0.000000163
10	Copper, Total	6010C	0.000001	0.000000384
11	Iron, Total	6010C	0.00005	0.0000191
12	Lead, Total	6010C	0.000001	0.000000343
13	Magnesium, Total	6010C	0.00007	0.0000242
14	Manganese, Total	6010C	0.000001	0.00000044
15	Mercury	7040A	0.0000002	0.000000066
16	Nickel, Total	6010C	0.000002	0.000000556
17	Potassium, Total	6010C	0.0001	0.0000309
18	Selenium, Total	6010C	0.000005	0.00000173
19	Silver, Total	6010C	0.0000004	0.000000163
20	Sodium, Total	6010C	0.0001	0.0000293
21	Thallium, Total	6010C	0.0000005	0.000000143
22	Vanadium, Total	6010C	0.000005	0.00000157
23	Zinc, Total	6010C	0.00001	0.00000341

TABLE 7.1
PROJECT QUANTITATION LIMITS - GROUNDWATER

	Compound	Method	Estimated Quantitation Limits (Groundwater) RL (ug/L)	MDL(ug/L)
	General Chemistry			
1	Cyanide	9010C/9012A	0.00001	0.000003
2	Hexavalent Chromium	7196A	0.000005	0.0000018
3	Trivalent Chromium	7196	0.00001	0.00001

	Compound	Method	Estimated Quantitation Limits (Groundwater) RL (ng/L)	MDL (ng/L)
	PFAS			
1	Perfluorohexanoic acid (PFHxA)	537 Rev 1.15	2	0.404
2	Perfluoroheptanoic acid (PFHpA)	537 Rev 1.15	2	0.236
3	Perfluorooctanoic acid (PFOA)	537 Rev 1.15	2	0.26
4	Perfluorononanoic acid (PFNA)	537 Rev 1.15	2	0.256
5	Perfluorodecanoic acid (PFDA)	537 Rev 1.15	2	0.288
6	Perfluoroundecanoic acid (PFUnA)	537 Rev 1.15	2	0.216
7	Perfluorododecanoic acid (PFDoA)	537 Rev 1.15	2	0.284
8	Perfluorotridecanoic Acid (PFTriA)	537 Rev 1.15	2	0.576
9	Perfluorotetradecanoic acid (PFTeA)	537 Rev 1.15	2	0.516
10	Perfluorobutanesulfonic acid (PFBS)	537 Rev 1.15	2	0.648
11	Perfluorohexanesulfonic acid (PFHxS)	537 Rev 1.15	2	0.328
12	Perfluorooctanesulfonic acid (PFOS)	537 Rev 1.15	2	0.224
13	N-methyl perfluorooctanesulfonamidoacetic acid (MeFOSAA)	537 Rev 1.15	2	0.636
14	N-ethyl perfluorooctanesulfonamidoacetic acid (EtFOSAA)	537 Rev 1.15	2	0.596

Notes:
1) RL = Reporting Limit
2) MDL = Method Detection Limit
3) RL and MDL values were supplied by Alpha Analytical Laboratories
4) RL and MDL values are estimated and may vary depending on instruments
5) µg/L = micrograms per liter
6) ng/L = nanograms per liter

TABLE 7.1
PROJECT QUANTITATION LIMITS – AIR

	Compound	Method	Estimated Quantitation Limits (Groundwater) RL (ppbV)	MDL(ppbV)
	VOCs			

TABLE 7.1
PROJECT QUANTITATION LIMITS – AIR

			Estimated Quantitation Limits (Groundwater)	
	Compound	**Method**	**RL (ppbV)**	**MDL(ppbV)**
1	1,1,1-Trichloroethane	TO-15	0.2	0.057
2	1,1-Dichloroethene	TO-15	0.2	0.0566
3	1,2,3-Trimethylbenzene	TO-15	0.2	0.0751
4	1,2,4-Trichlorobenzene	TO-15	0.2	0.0611
5	1,2,4-Trimethylbenzene	TO-15	0.2	0.0694
6	1,2,4,5-Tetramethylbenzene	TO-15	0.2	0.0795
7	1,2-Dibromoethane	TO-15	0.2	0.0779
8	1,2-Dichlorobenzene	TO-15	0.2	0.0614
9	1,2-Dichloroethane	TO-15	0.2	0.0552
10	1,2-Dichloropropane	TO-15	0.2	0.0697
11	1,3,5-Trimethylbenzene	TO-15	0.2	0.0584
12	1,3-Butadiene	TO-15	0.2	0.0799
13	1,3-Dichlorobenzene	TO-15	0.2	0.0637
14	1,4-Dichlorobenzene	TO-15	0.2	0.0418
15	1,4-Dioxane	TO-15	0.2	0.078
16	2,2,4-Trimethylpentane	TO-15	0.2	0.0659
17	2-Butanone	TO-15	0.5	0.0522
18	2-Hexanone	TO-15	0.2	0.0604
19	2-Methylthiophene	TO-15	0.2	0.0789
20	3-Methylthiophene	TO-15	0.2	0.0669
21	3-Chloropropene	TO-15	0.2	0.0812
22	2-Ethylthiophene	TO-15	0.2	0.0571
23	4-Ethyltoluene	TO-15	0.2	0.0776
24	Acetone	TO-15	1	0.269
25	Benzene	TO-15	0.2	0.0537
26	Benzyl chloride	TO-15	0.2	0.0645
27	Benzothiophene	TO-15	0.5	0.0468
28	Bromodichloromethane	TO-15	0.2	0.0656
29	Bromoform	TO-15	0.2	0.0523
30	Bromomethane	TO-15	0.2	0.0696
31	Carbon disulfide	TO-15	0.2	0.0345
32	Carbon tetrachloride	TO-15	0.2	0.0471
33	Chlorobenzene	TO-15	0.2	0.0789
34	Chloroethane	TO-15	0.2	0.0767
35	Chloroform	TO-15	0.2	0.0452
36	Chloromethane	TO-15	0.2	0.0958
37	cis-1,2-Dichloroethene	TO-15	0.2	0.0587

TABLE 7.1
PROJECT QUANTITATION LIMITS – AIR

			Estimated Quantitation Limits (Groundwater)	
	Compound	**Method**	**RL (ppbV)**	**MDL(ppbV)**
38	cis-1,3-Dichloropropene	TO-15	0.2	0.0745
39	Cyclohexane	TO-15	0.2	0.0656
40	Dibromochloromethane	TO-15	0.2	0.0747
41	Dichlorodifluoromethane	TO-15	0.2	0.0466
42	Ethyl Alcohol	TO-15	5	0.542
43	Ethyl Acetate	TO-15	0.5	0.131
44	Ethylbenzene	TO-15	0.2	0.0555
45	1,1,2-Trichloro-1,2,2-Trifluoroethane	TO-15	0.2	0.0511
46	1,2-Dichloro-1,1,2,2-tetrafluoroethane	TO-15	0.2	0.0419
47	Hexachlorobutadiene	TO-15	0.2	0.0732
48	iso-Propyl Alcohol	TO-15	0.5	0.114
49	Methylene chloride	TO-15	0.5	0.188
50	4-Methyl-2-pentanone	TO-15	0.5	0.0607
51	Methyl tert butyl ether	TO-15	0.2	0.0452
52	Methyl Methacrylate	TO-15	0.5	0.148
53	p/m-Xylene	TO-15	0.4	0.139
54	o-Xylene	TO-15	0.2	0.0631
55	Xylene (Total)	TO-15	0.2	0.0631
56	Heptane	TO-15	0.2	0.0553
57	n-Heptane	TO-15	0.2	0.0553
58	n-Hexane	TO-15	0.2	0.0518
59	Propylene	TO-15	0.5	0.0929
60	Styrene	TO-15	0.2	0.0799
61	Tetrachloroethene	TO-15	0.2	0.0758
62	Thiophene	TO-15	0.2	0.0528
63	Tetrahydrofuran	TO-15	0.5	0.0622
64	Toluene	TO-15	0.2	0.0628
65	trans-1,2-Dichloroethene	TO-15	0.2	0.074
66	1,2-Dichloroethene (total)	TO-15	0.2	0.0587
67	trans-1,3-Dichloropropene	TO-15	0.2	0.0693
68	1,3-Dichloropropene, Total	TO-15	0.2	0.0693
69	Trichloroethene	TO-15	0.2	0.071
70	Trichlorofluoromethane	TO-15	0.2	0.0416
71	Vinyl acetate	TO-15	1	0.0567
72	Vinyl bromide	TO-15	0.2	0.0699
73	Vinyl chloride	TO-15	0.2	0.0533

TABLE 7.1
PROJECT QUANTITATION LIMITS – AIR

			Estimated Quantitation Limits (Groundwater)	
	Compound	**Method**	**RL (ppbV)**	**MDL(ppbV)**
74	Naphthalene	TO-15	0.2	0.0432
75	Total HC As Hexane	TO-15	10	0.0518
76	Total VOCs As Toluene	TO-15	10	0.0628
77	Propane	TO-15	0.5	0.114
78	Acrylonitrile	TO-15	0.5	0.079
79	Acrolein	TO-15	0.5	0.114
80	1,1,1,2-Tetrachloroethane	TO-15	0.2	0.0547
81	Isopropylbenzene	TO-15	0.2	0.043
82	1,2,3-Trichloropropane	TO-15	0.2	0.0767
83	Acetonitrile	TO-15	0.2	0.0761
84	Bromobenzene	TO-15	0.2	0.079
85	Chlorodifluoromethane	TO-15	0.2	0.0626
86	Dichlorofluoromethane	TO-15	0.2	0.0572
87	Dibromomethane	TO-15	0.2	0.0476
88	Pentane	TO-15	0.2	0.0475
89	Octane	TO-15	0.2	0.0421
90	Tertiary-Amyl Methyl Ether	TO-15	0.2	0.0795
91	o-Chlorotoluene	TO-15	0.2	0.0487
92	p-Chlorotoluene	TO-15	0.2	0.0764
93	2,2-Dichloropropane	TO-15	0.2	0.0581
94	1,1-Dichloropropene	TO-15	0.2	0.0715
95	Isopropyl Ether	TO-15	0.2	0.0656
96	Ethyl-Tert-Butyl-Ether	TO-15	0.2	0.0515
97	1,2,3-Trichlorobenzene	TO-15	0.2	0.0436
98	Ethyl ether	TO-15	0.2	0.0591
99	n-Butylbenzene	TO-15	0.2	0.0639
100	sec-Butylbenzene	TO-15	0.2	0.0731
101	tert-Butylbenzene	TO-15	0.2	0.0402
102	1,2-Dibromo-3-chloropropane	TO-15	0.2	0.0744
103	p-Isopropyltoluene	TO-15	0.2	0.0608
104	n-Propylbenzene	TO-15	0.2	0.0559
105	1,3-Dichloropropane	TO-15	0.2	0.0776
106	Methanol	TO-15	5	0.736
107	Acetaldehyde	TO-15	2.5	0.547
108	Butane	TO-15	0.2	0.0442
109	Nonane (C9)	TO-15	0.2	0.0644
110	Decane (C10)	TO-15	0.2	0.0484

TABLE 7.1
PROJECT QUANTITATION LIMITS – AIR

			Estimated Quantitation Limits (Groundwater)	
	Compound	**Method**	**RL (ppbV)**	**MDL(ppbV)**
111	Undecane	TO-15	0.2	0.0528
112	Indane	TO-15	0.2	0.0795
113	Indene	TO-15	0.2	0.0608
114	1-Methylnaphthalene	TO-15	1	0.286
115	Dodecane (C12)	TO-15	0.2	0.0564
116	Butyl Acetate	TO-15	0.5	0.114
117	tert-Butyl Alcohol	TO-15	0.5	0.0599
118	2-Methylnaphthalene	TO-15	1	0.0273

Notes:
1) RL = Reporting Limit
2) MDL = Method Detection Limit
3) RL and MDL values were supplied by Alpha Analytical Laboratories
4) RL and MDL values are estimated and may vary depending on instrument
5) ppbV = parts per billion volume

8.0 DATA REDUCTION, VALIDATION, AND REPORTING

8.1 INTRODUCTION

Data collected during the field investigation will be reduced and reviewed by the laboratory QA personnel, and a report on the findings will be tabulated in a standard format. The criteria used to identify and quantify the analytes will be those specified for the applicable methods in the USEPA SW-846 and subsequent updates. The data package provided by the laboratory will contain all items specified in the USEPA SW-846 appropriate for the analyses to be performed, and be reported in standard format.

The completed copies of the chain-of-custody records (both external and internal) accompanying each sample from time of initial bottle preparation to completion of analysis shall be attached to the analytical reports.

8.2 DATA REDUCTION

The Analytical Services Protocol (ASP) Category B data packages and an electronic data deliverable (EDD) will be provided by the laboratory after receipt of a complete sample delivery group. The Project Manager will immediately arrange for archiving the results and preparation of result tables. These tables will form the database for assessment of the site contamination condition.

Each EDD deliverable must be formatted using a Microsoft Windows operating system and the NYSDEC data deliverable format for EQuIS. To avoid transcription errors, data will be loaded directly into the ASCII format from the laboratory information management system (LIMS). If this cannot be accomplished, the consultant should be notified via letter of transmittal indicating that manual entry of data is required for a particular method of analysis. All EDDs must also undergo a QC check by the laboratory before delivery. The original data, tabulations, and electronic media are stored in a secure and retrievable fashion.

The Project Manager will maintain close contact with the QA reviewer to ensure all non-conformance issues are acted upon prior to data manipulation and assessment routines. Once the QA review is completed, the Project Manager may direct others to initiate and finalize the analytical data assessment.

8.3 DATA VALIDATION

Data validation will be performed in accordance with the USEPA validation guidelines for organic and inorganic data review. Validation will include the following:

- Verification of the QC sample results,
- Verification of the identification of sample results (both positive hits and non-detects),
- Recalculation of 10% of all investigative sample results, and
- Preparation of Data Usability Summary Reports (DUSR).

A DUSR will be prepared and reviewed by the QAO. The DUSR will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and COC procedures, and a summary assessment of precision, accuracy, representativeness, comparability, completeness, and sensitivity for each analytical method. A detailed assessment of each sample delivery group (SDG) will follow. For each of the organic analytical methods, the following will be assessed:

- Holding times;
- Instrument tuning;
- Instrument calibrations;
- Blank results;
- System monitoring compounds or surrogate recovery compounds (as applicable);
- Internal standard recovery results;
- MS and MSD results;
- Target compound identification;
- Chromatogram quality;
- Pesticide cleanup (if applicable);
- Compound quantitation and reported detection limits;
- System performance; and
- Results verification.

For each of the inorganic compounds, the following will be assessed:

- Holding times;
- Calibrations;
- Blank results;
- Interference check sample;
- Laboratory check samples;
- Duplicates;

- Matrix Spike;
- Furnace atomic absorption analysis QC;
- ICP serial dilutions; and
- Results verification and reported detection limits.

Based on the results of data validation, the validated analytical results reported by the laboratory will be assigned one of the following usability flags:

- "U" – Not detected. The associated number indicates the approximate sample concentration necessary to be detected significantly greater than the level of the highest associated blank;
- "UJ" – Not detected. Quantitation limit may be inaccurate or imprecise;
- "J" – The analyte is present. Reported value may be associated with a higher level of uncertainty than is normally expected with the analytical method;
- "N" – Tentative identification. The analyte is considered present in the sample;
- "R" – Unreliable result; data is rejected or unusable. The analyte may or may not be present in the sample; and
- No Flag - Result accepted without qualification

9.0 INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

9.1 QUALITY ASSURANCE BATCHING

Each set of samples will be analyzed concurrently with calibration standards, method blanks, matrix spikes (MS), matrix spike duplicates (MSD) or laboratory duplicates, and QC check samples (if required by the protocol). The MS/MSD samples will be designated by the field personnel. If no MS/MSD samples were designated, the laboratory will contact the Langan Project Manager for corrective action.

9.2 CALIBRATION STANDARDS AND SURROGATES

All organic standard and surrogate compounds are checked by the method of mass spectrometry for correct identification and gas chromatography for degree of purity and concentration. All standards are traceable to a source of known quality certified by the USEPA or NIST, or other similar program. When the compounds pass the identity and purity tests, they are certified for use in standard and surrogate solutions. Concentrations of the solutions are checked for accuracy before release for laboratory use. Standard solutions are replaced monthly or more frequently, based upon data indicating deterioration.

9.3 ORGANIC BLANKS AND MATRIX SPIKE

Analysis of blank samples verifies that the analytical method does not introduce contaminants or detect "false positives." The blank water can be generated by reverse osmosis and Super-Q filtration systems, or distillation of water containing $KMnO_4$. The matrix spike is generated by addition of surrogate standard to each sample.

9.4 TRIP AND EQUIPMENT BLANKS

Trip blanks and equipment blanks will be utilized in accordance with the specifications in Section 4. These blanks will be analyzed to provide a check on sample bottle preparation and evaluate the effectiveness of field decontamination procedures.

10.0 QUALITY ASSURANCE PERFORMANCE AUDITS AND SYSTEM AUDITS

10.1 INTRODUCTION

Quality assurance audits may be performed by the project quality assurance group under the direction and approval of the QAO. These audits will be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). Functioning as an independent body and reporting directly to corporate quality assurance management, the QAO may plan, schedule, and approve system and performance audits based upon procedures customized to the project requirements. At times, the QAO may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits. However, these personnel will not have responsibility for the project work associated with the performance audit.

10.2 SYSTEM AUDITS

System audits may be performed by the QAO or designated auditors, and encompass a qualitative evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory quality control procedures and associated documentation may be system audited. These audits may be performed once during the performance of the project. However, if conditions adverse to quality are detected or at the request of the Project Manager, additional audits may occur.

10.3 PERFORMANCE AUDITS

The laboratory may be required to conduct an analysis of Performance Evaluation samples or provide proof that Performance Evaluation samples submitted by the USEPA or a state agency were analyzed within the past twelve months.

10.4 FORMAL AUDITS

Formal audits refer to any system or performance audit that is documented and implemented by the QA group. These audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that quality assurance requirements were developed, documented, and instituted in accordance with contractual and project criteria. Formal audits may be performed on project and subcontractor work at various locations.

Audit reports will be written by auditors who have performed the site audit after gathering and evaluating all data. Items, activities, and documents determined by lead auditors to be in noncompliance shall be identified at exit interviews conducted with the involved management.

Non-compliances will be logged, and documented through audit findings, which are attached to and are a part of the integral audit report. These audit-finding forms are directed to management to satisfactorily resolve the noncompliance in a specified and timely manner.

The Project Manager has overall responsibility to ensure that all corrective actions necessary to resolve audit findings are acted upon promptly and satisfactorily. Audit reports must be submitted to the Project Manager within fifteen days of completion of the audit. Serious deficiencies will be reported to the Project Manager within 24 hours. All audit checklists, audit reports, audit findings, and acceptable resolutions will be reviewed and approved by the QAO. Verification of acceptable resolutions may be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the QAO will close out the audit report and findings.

11.0 PREVENTIVE MAINTENANCE PROCEDURES AND SCHEDULES

11.1 PREVENTIVE MAINTENANCE PROCEDURES

Equipment, instruments, tools, gauges, and other items requiring preventive maintenance will be serviced in accordance with the manufacturer's specified recommendations and written procedure developed by the operators.

A list of critical spare parts will be established by the operator. These spare parts will be available for use in order to reduce the downtime. A service contract for rapid instrument repair or backup instruments may be substituted for the spare part inventory.

11.2 SCHEDULES

Written procedures will establish the schedule for servicing critical items to minimize the downtime of the measurement system. Rental equipment subcontractors and the laboratory will adhere to the maintenance schedule, and arrange any necessary and prompt service. Required service will be performed by qualified personnel.

11.3 RECORDS

Logs shall be established to record and control maintenance and service procedures and schedules. All maintenance records will be documented and traceable to the specific equipment, instruments, tools, and gauges. Records produced shall be reviewed, maintained, and filed by the operators at the laboratories. The QAO may audit these records to verify complete adherence to these procedures.

12.0 CORRECTIVE ACTION

12.1 INTRODUCTION

The following procedures were established to ensure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

12.2 PROCEDURE DESCRIPTION

When a significant condition adverse to quality is noted at site or laboratory, the cause of the condition will be determined and corrective action will be taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the QAO, Project Manager, Field Team Leader and laboratory management, at a minimum. Implementation of corrective action is verified by documented follow-up action.

All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality. Corrective actions will be initiated as follows:

- When predetermined acceptance standards are not attained;
- When procedure or data compiled are determined to be deficient;
- When equipment or instrumentation is found to be faulty;
- When samples and analytical test results are not clearly traceable;
- When quality assurance requirements have been violated;
- When designated approvals have been circumvented;
- As a result of system and performance audits;
- As a result of a management assessment;
- As a result of laboratory/field comparison studies; and
- As required by USEPA SW-846, and subsequent updates, or by the NYSDEC ASP.

Project management and staff, such as field investigation teams and laboratory groups, will monitor on-going work performance in the normal course of daily responsibilities. Work may be audited at the sites or laboratory. Activities ascertained to be noncompliant with quality assurance requirements will be documented. Corrective actions will be mandated through audit finding sheets attached to the audit report. Audit findings are logged, maintained, and controlled by the Project Manager.

Personnel assigned to quality assurance functions will have the responsibility to issue and control Corrective Action Request (CAR) Forms (Figure 12.1 or similar). The CAR identifies the out-of-compliance condition, reference document(s), and recommended corrective action(s) to be administered. The CAR is issued to the personnel responsible for the affected item or activity. A copy is also submitted to the Project Manager. The individual to whom the CAR is addressed returns the requested response promptly to the QA personnel, affixing his/her signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The QA personnel maintain the log for status of CARs, confirms the adequacy of the intended corrective action, and verifies its implementation. CARs will be retained in the project file for the records.

Any project personnel may identify noncompliance issues; however, the designated QA personnel are responsible for documenting, numbering, logging, and verifying the close out action. The Project Manager will be responsible for ensuring that all recommended corrective actions are implemented, documented, and approved.

FIGURE 12.1

CORRECTIVE ACTION REQUEST

Number: _____ Date: _____

TO: _____

You are hereby requested to take corrective actions indicated below and as otherwise determined by you to (a) resolve the noted condition and (b) to prevent it from recurring. Your written response is to be returned to the project quality assurance manager by _____

CONDITION:

REFERENCE DOCUMENTS:

RECOMMENDED CORRECTIVE ACTIONS:

_____ _____ _____ _____ _____ _____

Originator Date Approval Date Approval Date

RESPONSE

CAUSE OF CONDITION

CORRECTIVE ACTION

(A) RESOLUTION

(B) PREVENTION

(C) AFFECTED DOCUMENTS

C.A. FOLLOWUP:

CORRECTIVE ACTION VERIFIED BY: _____ DATE:_____

13.0 REFERENCES

NYSDEC. Division of Environmental Remediation. DER-10/Technical Guidance for Site Investigation and Remediation, dated May 3, 2010.

Taylor, J. K., 1987. Quality Assurance of Chemical Measurements. Lewis Publishers, Inc., Chelsea, Michigan

USEPA. Validating Volatile Organic Compounds By Gas Chromatography/Mass Spectrometry. SOP No. HW-24, Revision 4, dated October 2014. USEPA Region II.

USEPA. Analysis of Volatile Organic Compounds in Air Contained in Canisters by Method TO-15. SOP No. HW-31, Revision 6, dated June 2014. USEPA Region II.

USEPA. Polychlorinated Biphenyl (PCB) Aroclor Data Validation. SOP No. HW-37, Revision 3, dated May 2013. USEPA Region II.

USEPA. Pesticide Data Validation. SOP No. HW-36, Revision 4, dated May 2013. USEPA Region II.

USEPA. Semivolatile Data Validation. SOP No. HW-35, Revision 2, dated March 2013. USEPA Region II.

USEPA. Tetro-through Octa-chlorinated Dioxins and Furans by Isotope Dilution (HRGC/HRMS). SOP For EPA Method 1613, Revision B, dated December 2010. USEPA Region II.

USEPA. PCDDs/PCDFs using HRGC/HRMS. SOP for SW-846 Method 8290 HW-19, Revision 1.1, dated December 2010. USEPA Region II.

USEPA, Polychlorinated Dibenzodioxins/Polychlorinated Dibenzofurans. SW-846 Method 8280 HW-11, Revision 3, dated December 2010. USEPA Region II.

USEPA. Low/Medium Volatile Data Validation. SOP No. HW-33, Revision 3, dated March 2013. USEPA Region II.

USEPA. ICP-AES Data Validation. SOP No. HW-2a, Revision 15, dated December 2012. USEPA Region II.

USEPA. ICP-MS Data Validation. SOP No. HW-2b, Revision 15, dated December 2012. USEPA Region II.

USEPA. Mercury and Cyanide Data Validation. SOP No. HW-2c, Revision 15, dated December 2012, USEPA Region II.

USEPA. Trace Volatile Data Validation. SOP No. HW-34, Revision 3, dated February 2013, USEPA Region II.

ATTACHMENT A

PER- AND POLY-FLUOROALKYL SUBSTANCES SAMPLING PROTOCOL

Collection of Groundwater Samples for Perfluorooctanoic Acid (PFOA) and Perfluorinated Compounds (PFCs) from Monitoring Wells Sample Protocol

Samples collected using this protocol are intended to be analyzed for perfluorooctanoic acid (PFOA) and other perfluorinated compounds by Modified (Low Level) Test Method 537.

The sampling procedure used must be consistent with the NYSDEC March 1991 SAMPLING GUIDELINES AND PROTOCOLS
http://www.dec.ny.gov/regulations/2636.html with the following materials limitations.

At this time acceptable materials for sampling include: stainless steel, high density polyethylene (HDPE) and polypropylene. Additional materials may be acceptable if proven not to contain PFCs. **NOTE: Grunfos pumps and bladder pumps are known to contain PFC materials (e.g. Teflon™ washers for Grunfos pumps and LDPE bladders for bladder pumps).** All sampling equipment components and sample containers should not come in contact with aluminum foil, low density polyethylene (LDPE), glass or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer. Standard two step decontamination using detergent and clean water rinse should be considered for equipment that does come in contact with PFC materials. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFC materials must be avoided. Many food and drink packaging materials and "plumbers thread seal tape" contain PFCs.

All clothing worn by sampling personnel must have been laundered multiple times. The sampler must wear nitrile gloves while filling and sealing the sample bottles.

Pre-cleaned sample bottles with closures, coolers, ice, sample labels and a chain of custody form will be provided by the laboratory.

1. Fill two pre-cleaned 500 mL HDPE or polypropylene bottle with the sample.
2. Cap the bottles with an acceptable cap and liner closure system.
3. Label the sample bottles.
4. Fill out the chain of custody.
5. Place in a cooler maintained at 4 ± 2º Celsius.

Collect one equipment blank for every sample batch, not to exceed 20 samples.

Collect one field duplicate for every sample batch, not to exceed 20 samples.

Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, not to exceed 20 samples.

Request appropriate data deliverable (Category A or B) and an electronic data deliverable.

ATTACHMENT B

RESUMES

Emily G. Strake, CEP

Senior Project Chemist/ Risk Assessor
Human Health Risk Assessment
Chemical Data Validation

17 years in the industry ~ 5 years with Langan

Ms. Strake has 17 years of environmental chemistry, risk assessment, auditing, and quality assurance experience. Most recently, she has focused her efforts on human health risk assessment, and has been the primary author or key contributor of risk assessment reports and screening evaluations for projects governed under RCRA, CERCLA, NJDEP, DNREC, SWRCB, DTSC, PADEP, CTDEEP, ODEQ, NYSDEC and MDE. She has experience in site-specific strategy development, which has enabled her to perform assessments to focus areas of investigation and identify risk-based alternatives for reducing remediation costs. Ms. Strake is a member of the Interstate Technology and Regulatory Council Risk Assessment Team responsible for the development and review of organizational risk assessment guidance documents and serves as a National Trainer in risk assessment for the organization.

Ms. Strake has extensive experience in environmental data validation, focused on ensuring laboratory deliverables follow specific guidelines as described by regulatory agencies and the analytical methods employed. In addition, she has experience in EQuIS chemical database management. She also has a broad range of environmental field experience and maintains current OSHA HAZWOPER certification. Ms. Strake is experienced in auditing laboratory and field-sampling activities for compliance with Quality Assurance Project Plans (QAPPs), the National Environmental Laboratory Accreditation Conference Standards Quality Systems manual, and applicable USEPA Guidance. Ms. Strake has also audited on-site laboratories in support of groundwater treatment operations and implemented corrective actions. Her responsibilities include writing reports on the value of laboratory work, writing/editing QAPPs for clients and project-specific sites, peer reviewing colleague's work, and mentoring staff within the office. She has also served as the Quality Assurance officer for several long-term projects, responsible for the achievement of all forms of Quality Control/Quality Assurance by onsite personnel relating to sampling, analysis, and data evaluation.

Selected Project Experience

Human Health Risk Assessment:

Central Chemical, Hagerstown, MD – Performed a baseline risk assessment for hypothetical future residents at a CERCLA site in Hagerstown, Maryland. The evaluation included evaluation of ingestion, dermal contact, and inhalation of of chemicals in groundwater. Linear low dose cancer risk was assessed as well as one-hit cancer risk.

Delaware City Refinery, Delaware City, DE – Performed comprehensive human health risk assessment for a petroleum refinery in Delaware City, Delaware. The risk assessment was the basis for a thorough

Education

MBA
The University of Scranton

B.S., Chemistry
Cedar Crest College

Professional Licenses

Board Certified Environmental Professional (CEP)

Training

40 hr. OSHA HAZWOPER Training/Nov 2002

8 hr. HAZWOPER Supervisor/June 2004

8 hr. OSHA HAZWOPER Refresher/2013

Affiliations

The Society for Risk Analysis

Interstate Technology and Regulatory Council

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characterization and assessment of potential risks posed by site-specific conditions. Developed various human exposure scenarios by using both Federal and State-Specific guidance for soil, groundwater, and surface water exposure.

Major League Soccer's San Jose Earthquakes Stadium – Utilized the Johnson and Ettinger advanced soil gas model to calculate risk and hazard associated with inhalation of chlorinated solvents for the redevelopment of a public soccer stadium. Soil gas data was modeled assuming three soil stratum and site-specific soil, building, and exposure parameters. The Earthquakes' stadium is set to open in 2015.

Texas Instruments – Participated in a collaboration with Geosyntec Consulting to develop comments to USEPA Region IX and the San Francisco Regional Water Quality Control Board regarding vapor intrusion at South Bay Superfund Sites. The focus of the response was to outline scientific and policy objections to EPA's recommended TCE interim short-term indoor air response action levels and guidelines, and to clarify the use of California-modified indoor air screening levels for assessing and responding to TCE and PCE subsurface vapor intrusion into indoor air.

DuPont, South River VA - Worked as a key participant in the human health risk evaluation of mercury associated with legacy contamination of the South River located in Waynesboro, Virginia.

Veteran's Affairs - Completed a human health risk evaluation of the potential future risk associated with inhalation of indoor air for the Veteran's Administration. Soil, soil gas, and groundwater samples were collected as part of the site characterization. Achieved DTSC approval of the risk assessment approach and conclusions.

Santa Clara Landfill – Developed a human health risk assessment to characterize risk associated with exposure to landfill gas at the Santa Clara All Purpose Landfill. The risk assessment evaluated specific compounds in landfill gas, their concentrations, spatial patterns, and extent throughout the site, and assessed the potential for vapor intrusion associated with a proposed future redevelopment.

Occidental Chemical, Bakersfield, CA - Completed multiple AOC-specific risk assessments utilizing and applying the guidance set forth by the DTSC's Human Health Risk Assessment Note 1 (Default Exposure Factors for Use in Risk Assessment), Note 3 (Recommended Methodology for Use of USEPA Regional Screening Levels, and Note 4 (Screening Level Human Health Risk Assessments).

Exelon, Bristol, PA - Developed a human health risk assessment for a utility-owned former Manufactured Gas Plant (MGP) site in Pennsylvania, under Pennsylvania's Act 2 Program. Used ProUCL 4.0 statistical software to determine upper limits for full data sets and non-detect data. Conducted vapor intrusion modeling (via the Johnson & Ettinger model) and prepared vapor intrusion reports showing that risks to volatile organic compounds in soils and groundwater were not impacting indoor air quality.

Avon, Rye, NY - Completed a human health risk assessment in accordance with NYSDEC guidance for a redevelopment property located in Rye, New York. The objective of the evaluation was to characterize the risks associated with potential future human exposures to soil and groundwater affected by a release from the Site's former No. 2 fuel oil UST.

The intended future use of the Site was a playground to be utilized by the general public for open play on commercial recreational equipment.

Golden Gate National Parks Conservancy – Peer reviewed a Preliminary Endangerment Assessment Report for the Battery East Trail. The assessment included a human health risk evaluation that estimated carcinogenic risk from exposure to PAHs and dioxin/furans in soil using toxic equivalency to benzo(a)pyrene and 2,3,7,8-TCDD.

Sunoco Refineries, Philadelphia, PA – Derived site-specific soil PRGs for lead using the EPA's adult lead model for two former Sunoco refineries. Achieved PADEP approval in May 2015. Completed receptor evaluations in accordance with USEPA risk assessment guidance to develop exposure parameters under current and reasonably anticipated future land use scenarios.

Honeywell - Completed a focused human health risk evaluation of PAH contaminants for under NJDEP's Site Remediation Program. Applied a blended approach of qualitative risk characterization and quantitative risk calculation to propose closure of AOCs following the remedial investigation.

Floreffe Terminal, Jefferson Hills, PA - Performed human health risk assessment for contamination resulting from a 3.9 million gallon diesel oil tank collapse along the Monongahela River. Evaluated potential impacts to human health via exposure to soil, groundwater, and surface water. Calculated site-specific standards for soil remediation.

DOW Chemical, Bristol, PA - Calculated Medium Specific Concentrations for unregulated contaminants using the PADEP protocols to assist in the clean-up of a monomer tank explosion in Bristol, Pennsylvania. Selected appropriate surrogate toxicity data and evaluated novel on-site constituents by analogy.

Rohm and Haas, Philadelphia, PA - Prepared an Act 2 site-specific human health risk assessment for the oldest industrial facility in the United States, located in southeast Philadelphia. The objective of the risk assessment was to determine achievable possible future land-use options under Pennsylvania's Land Recycling Program. The risk assessment included evolution of multiple site-COPCs and constituent suites: VOCs, SVOCs, PCBs, pesticides, and metals (including lead). Evaluated the potential for indoor air inhalation through J&E modeling of soil gas and groundwater.

Regency Center - Conducted vapor intrusion modeling for a dry cleaning facility in the Philadelphia area. Predictive modeling using the Johnson and Ettinger approach indicated that estimated contaminant levels would not adversely affect human receptors.

Chemical Data Quality:

Participated in a CERCLA site investigation; assessed the usability of sample results for numerous matrices including dust, sediment, soils, and various aqueous matrices for a remedial investigation under the Contract Laboratory Program. Implemented an on-site pesticide immunoassay program to delineate soil contamination in real-time.

Validated laboratory analytical data consistent with the requirements of NJDEP's Data of Known Quality Protocol guidance documents. Completed

Data Quality Assessment and Data Usability Evaluations for dozens of sits in the Site Remediation Program.

Coordinated the collection of fish tissue samples and determined the validity of the analytical results associated with CERCLA and RCRA site characterizations. Assessed duck blood analytical results for the Connecticut Department of Energy and Environmental Protection Bureau of Natural Resources.

Audited multiple accredited laboratories in New Jersey, Massachusetts and Pennsylvania on behalf of clients using USEPA Guidance on Technical Audits and Related Assessments for Environmental Data Operations. The audits included full-suite USEPA and SW-846 methodology; and included reviewing staff experience and training records, equipment and facilities, policies, practices, procedures, and documentation for sample receipt, analysis, instrument maintenance, standard preparation, calibration and traceability, control charting, corrective actions, data reduction and review, report generation, and waste disposal.

Reviewed and validated data packages for RCRA Facilities Investigation at a Philadelphia-area chemical site; issued data validation reports to project personnel and regulatory agencies. The reviews included evaluation of quarterly groundwater, soil, and soil vapor matrices. Participated in RCRA groundwater sampling, developed and executed the investigation's QAPP, and coordinated with the laboratory to schedule and perform field-sampling events.

Completed Data Usability Summary Reports in accordance with NYSDEC DER-10 guidance for soil, groundwater, sediment surface water, soil gas, ambient air and indoor air analytical results.

Acted as the Quality Assurance Officer for several long-term projects in Pennsylvania, Maryland, and New Jersey, Delaware, responsible for the achievement of all forms of QA/QC as it related to sampling, analysis, and data evaluation.

EQuIS data manager for database migration of historical groundwater results associated with remediation activities; assisted with natural attenuation data evaluation and gained experience in geochemical trends associated with intrinsic biodegradation.

Recent Publications / Presentations

Decision Making at Contaminated Sites: Issues and Options in Human Health Risk Assessment. Interstate Technology and Regulatory Council

Alternate Approaches for Act 2 Risk Assessments Using Site-Specific Information. Pennsylvania Brownfields Conference

Tools from NJDEP's Attainment Guidance to Support Site Closure LSRP Summit V

EPA Region IX Vapor Intrusion Policy for Silicon Valley 2014 Environmental Workshop

Monika Boguszewski

Senior Staff Scientist
Environmental Engineering

8 years in the industry

Ms. Boguszewski is an environmental scientist with experience in New York and New Jersey. Her experience includes subsurface inspections, groundwater, soil and air sampling, monitoring well installations, underground tank removals, remedial excavation oversight, and Community Air Monitoring Program (CAMP) management. She has experience with the analysis of laboratory analytical database management using the Environmental Quality Information System (EQuIS) for the New York State Department of Environmental Conservation (NYSDEC). Her work also involves coordinating and conducting Phase I Environmental Site Assessments (ESA), Phase II Environmental Site Investigations (ESI), environmental remediation oversight and the preparation of bid specifications. Her projects have included commercial, residential, and industrial sites throughout New York and New Jersey.

Selected Projects

Bushwick Inlet Park, Brooklyn, NY
Residential Tower, 29 Flatbush Avenue, Brooklyn, NY
1966 Broad Hollow Road, Farmingdale, NY
West 17th Street Development, New York, NY
1752 Shore Parkway, Brooklyn, NY
Aquatic Entertainment Complex, Randall's Island, NY
Queens Family Courthouse, Jamaica Hills, NY
Trump SoHo Hotel (246 Spring Street), New York, NY
246 Lafayette Street, New York, NY
Myrtle Ave & Flatbush Property, Brooklyn, NY
Queens West Development (Stage II), Long Island City, NY
Hoffmann-La Roche Inc., Nutley, NJ
Harrison Avenue Landfill, Harrison, NJ
Con Edison, First Avenue Property, New York, NY
Residences at 11 North Moore Street, New York, NY
HighLine 28-29 (Mixed-Use Residential), New York, NY
UHP–1095 Southern Blvd, NY
1676 Third Avenue, New York, NY
Governor's Island, Con Edison, New York, NY
Brooklyn Solvent Site, Brooklyn, NY
The Shops at Atlas Park, Glendale, NY
Pier 57 SuperPier, New York, NY
Multiple Buildings (Ross Associates), New York, NY
Greenpoint Waterfront Development, Brooklyn, NY
BAM North Tower Site 1, Brooklyn, NY
Chelsea Market, New York, NY
Retail/Office Tower, 855 Sixth Avenue, New York, NY
Residences at 173 Kent Avenue, Brooklyn, NY

Education

Graduate Studies, Environmental Chemistry and Geology
Rutgers University

M.S., Environmental Protection
University of Gdansk

Professional Registration

OSHA 40hr HAZWOPER Certified

OSHA 40-Hour HAZWOPER (8 hour Refresher)

10-Hour OSHA Construction

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Residences at 224 Wythe Avenue, Brooklyn, NY
Hotel at 400 West 42nd Street (aka 577 9th Avenue), New York, NY
Kings Plaza Mall, Brooklyn, NY
Greenpoint Landing, Brooklyn, NY
Riverside Center Parcel II, New York, NY
Residential Tower, 86 Fleet Street, Brooklyn, NY
Residences at 416-420 Kent Ave, Brooklyn, NY
PSAC II, Bronx, NY
1525 Bedford Avenue, Brooklyn, NY 300 Coffey Street, Brooklyn, NY
438-540 Hudson Street, New York, NY
220 Central Park South, New York, NY

William Bohrer

Project Geologist
Geologist

32 years in the industry

Mr. Bohrer is an experienced geologist responsible for managing Langan's environmental standards and Health and Safety compliance for projects throughout New York City. His services include dissemination of environmental protocols, troubleshooting at project sites, in-house/field training, and maintenance of quality standards across the environmental discipline. Mr. Bohrer has a diverse and extensive background in geophysics, hydrogeology, mining and petroleum, and geotechnical engineering. He has developed conceptual site models for public, industrial and commercial facilities nationwide.

Selected Projects

NYU Poly – 122 Johnson Street, Brooklyn, NY
Con Edison of New York at Governor's Island, NY, NY
535 4th Avenue, Brooklyn, NY
27 Wooster Street, New York, NY
42 West Street, Brooklyn, NY
455 West 19th Street, New York, NY
Kings Plaza Mall, Brooklyn, NY
Hudson Yards "Terra Firma", New York, NY
Hudson Yards, Platform Special Inspection, New York, NY
PSAC II, Bronx, NY
595-647 Smith Street, Brooklyn, NY
New York University, 7-13 Washington Square North Investigation
New York, NY
New York University, 4 Washington Square Village, New York, NY
125th Street and Lenox Avenue, New York, NY
Sullivan Street Development, New York, NY
Hudson Crossing II, New York, NY
New York Aquarium, Shark Tank & Animal Care Facility, Brooklyn, NY
209-219 Sullivan Street, New York, NY
261 Hudson Street, New York, NY
460 Washington Street, New York, NY
552 West 24th Street, New York, NY
Brooklyn Bridge Park Pier 1, New York, NY
International Leadership Bronx Charter School, Bronx, NY
203 East 92nd Street, New York, NY
HighLine 28-29, New York, NY
539 Smith Street Bulkhead, Brooklyn, NY
Willets Point, Corona, NY
Plume Migration and Fracture Flow Aquifer Investigation, Brunswick, MD
Plume Migration and Fracture Flow Aquifer Investigation, Fallston, MD

Education

Post Graduate Studies in Geophysics
Cornell University

B.S., Geology
Tufts University

Professional Registration

40 Hour OSHA HazWOPER

OSHA Construction Safety & Health

OSHA Supervisory Certification Credential (TWIC)

Transportation Worker Identification

NYS DEC- Protecting New York's Natural Resources with Better Construction Site Management"

Affiliations

American Association of Petroleum Geologists

National Groundwater Association

Geological Society of America

PA Council of Professional Geologists

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Emergency Response Site Investigation & Remediation,
Wappingers Falls, NY
Emergency Response Site Investigation & Remediation, Allentown, PA
Emergency Response Site Investigation & Remediation, Shamokin, PA
Bermuda International Airport, Jet Fuel Release Investigation, Bermuda
Little Missouri River Basin, Geotechnical Site Evaluation (Horizontal Drilling
Pipeline Install), ND
Seismic Susceptibility Evaluation (Class 2 Injection Wells), Litchfield, OH
Bedrock Mapping, Bradford and Sullivan Counties, PA
Soil Solidification, Carteret, NJ

Michael D. Burke, CHMM, LEED AP

Principal

Environmental Engineering and Remediation

16 years in the industry

Mr. Burke is a geologist/environmental scientist whose practice involves site investigation and remediation, transactional due diligence, environmental site assessments, in-situ remedial technology, and manufactured gas plant (MGP) site characterization and remediation. His additional services include multi-media compliance audits, sub-slab depressurization system design, non-hazardous and hazardous waste management, emergency response, community air monitoring programs, environmental and geotechnical site investigations, and health and safety monitoring. He has experience with projects in the New York State Department of Environmental Conservation (NYSDEC) and New York State Brownfield Cleanup (NYS BCP) Programs; Inactive Hazardous Waste, and Spill Programs, and New York City Office of Environmental Remediation (OER) e-designated and New York City Voluntary Cleanup Program (NYC VCP) sites.

Selected Projects

227-14 North Conduit Avenue, Industrial Wastewater Compliance, Jamaica, NY
420 Kent Avenue, NYS BCP, Brooklyn, NY
572 Eleventh Avenue, NYC VCP, New York, NY
Monian Site A, OER E-Designated Site, New York, NY
537 Sackett Street, Gowanus Canal Due Diligence/MGP Site, Brooklyn, NY
ABC Blocks 25, 26 and 27, NYS BCP Sites, Long Island City, NY
432 Rodney Street, NYS BCP, Petroleum and Chlorinated Volatile Organic Compound Investigation and Remediation, Brooklyn, NY
787 Eleventh Avenue, NYS BCP Site, New York, NY
President Street at Gowanus Canal, NYS BCP Site, Brooklyn, NY
22-36 Second Avenue at Gowanus Canal, NYS BCP Site, Brooklyn, NY
563 Sacket Street, NYS BCP Site, MGP Investigation, and Remediation, Brooklyn, NY
156-162 Perry Street, NYS BCP Site, New York, NY
Christopher and Weehawken Streets, NYS BCP, New York, NY
Phelps Dodge Block 2529 (Lots 40, 50, and 45), Inactive Hazardous Waste Disposal Site, Maspeth NY
42-50 24th Street, NYS BCP Site, Long Island City, NY
Storage Deluxe (163 6th Street), OER E-Designation Site, New York, NY
Prospect Park Redevelopment, Landfill Reclamation, Prospect Park, NJ
431 Carroll Street, Gowanus Canal Due Diligence, Brooklyn, NY
76 4th Street Property, Gowanus Due Diligence, Brooklyn, NY
Foxgate/MREC, Solid Waste Compliance, Central Islip, NY
175-225 3rd Street at Gowanus Canal, NYS BCP, Brooklyn, NY
New York University Tandon School of Engineering, Spill Investigation/ Remediation Dual Phase Recovery, and Laser Fluorescence Investigation, Brooklyn, NY

Education

M.S., Environmental Geology
Rutgers University

B.S., Geological Sciences
Rutgers University

B.S., Environmental Science
Rutgers University

Professional Registration

Certified Hazardous Materials Manager – CHMM No. 15998

OSHA Certification for Hazardous Waste Site Supervisor

OSHA 29 CFR 1910.120 Certification for Hazardous Waste Operations and Emergency Response

NJDEP Certification for Community Noise Enforcement

Troxler Certification for Nuclear Densometer Training

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2420-2430 Amsterdam Avenue, NYS BCP/Board of Standards and Appeals Variance, New York, NY
170 Amsterdam Avenue, NYC VCP, New York, NY
538-540 Hudson Street, NYS BCP (Former Gas Station), New York, NY
234 Butler Street, Gowanus Canal Due Diligence, Brooklyn, NY
550 Clinton Street, NYS BCP E-Designation, Brooklyn, NY
111 Leroy Street, OER E-Designation Site, New York, NY
335 Bond Street, NYS BCP, New York, NY
Gowanus Canal Northside, NYS BCP Former Fuel Oil Terminal, Brooklyn, NY
Multiple Buildings, Major Oil Storage Facility, Gowanus Canal Location, Brooklyn, NY
197-205 Smith Street at Gowanus Canal, MGP Due Diligence, Brooklyn, NY
450 Union Street at Gowanus Canal, NYS BCP, Brooklyn, NY
86 Fleet Place, NYC VCP E-Designation, Brooklyn, NY
New York University College of Nursing at 433 1st Avenue, NYS BCP, Bronx, NY
Retail Building at 225 3rd Street, Brooklyn, NY
29-37 41st Avenue, NYS BCP, Long Island City, NY
43-01 22nd Street, NYS BCP, Long Island City, NY
Compliance Audit for NYU at Washington Square Park, New York, NY
Former Watermark Locations, NYS BCP, Chlorinated Volatile Organic Compound Investigation and Remediation; AS/SVE, Brooklyn, NY
Former Gas Station (1525 Bedford Avenue), Brooklyn, NY
NYS BCP at 514 West 24th Street, New York, NY
Gowanus Canal Due Diligence at 76 4th Street, Brooklyn, NY
United Health Plan at 1095 Southern Boulevard, NYS BCP CVOC Investigation and Remediation, Bronx, NY
420 East 54th Street, NYS Spill Closure, New York, NY
Equity Residential at 160 Riverside Boulevard, NYS Spill Closure, New York, NY
357-359 West Street and 156 Leroy Street, NYC VCP, New York, NY
Emergency Spill Response at 322 West 57th Street, Investigation and Closure, New York, NY
Hurricane Sandy, Emergency Response at 21 West Street, New York, NY
Hurricane Sandy, Emergency Response at 71 Pine Street, New York, NY
Greenpoint Landing, NYC E-Designation, Brooklyn, NY
23-01 42nd Road, NYS BCP, Long Island City, NY
Greenpoint Waterfront Development, NYS BCP, Brooklyn, NY
125th Street and Lenox Avenue, NYC VCP, New York, NY
Whitehead Realty Solvent Site, Inactive Hazardous Waste site, CVOC Investigation and Remediation, Brooklyn, NY
SunCap Property Group Environmental On-Call Consulting, Various Locations, Nationwide
Consolidated Edison Company of New York, Underground Storage Tank On-Call Contract, Five Boroughs of New York City, NY
Consolidated Edison Company of New York, Appendix B Spill Sites On-Call Contract, Five Boroughs of New York City, NY
Meeker Avenue Plume Trackdown Site, Brooklyn, NY
Borden Avenue Distribution Facility, Superfund Redevelopment, Long Island City, NY
Edison Properties, West 17th Street Development Site (Former MGP Site), New York, NY
Con Edison on Governors Island, Dielectric Fluid Spill, Investigation and Remediation, New York, NY
144-150 Barrow Street, NYS BCP, New York, NY

West 17th Street Development, NYS BCP, MGP Investigation and Remediation, New York, NY
Montefiore Medical Center, Emergency Response, PCB Remediation, Bronx, NY
New York University, 4 Washington Square Village Fuel Oil Remediation, New York, NY
NYCSCA, Proposed New York City School Construction Sites, Five Boroughs of New York City, NY
Con Edison, East 60th Street Generating Station, New York, NY
Residential Building at 82 Irving Place, Environmental Remediation, New York, NY
1113 York Avenue, Storage Tank Closures, New York, NY
Peter Cooper Village/Stuyvesant Town, Phase I ESA, New York, NY
Superior Ink, Waste Characterization and Remedial Action Plans, New York, NY
Bronx Mental Health Redevelopment Project, Phase I ESA, Bronx, NY
2950 Atlantic Avenue, Site Characterization Investigation, Brooklyn, NY
Con Edison, East 74th Street Generating Station, Sediment Investigation, New York, NY
Con Edison, First Avenue Properties, New York, NY
Queens West Development Corp. Stage II, Long Island City, NY
Article X Project Environmental Reviews, Various New York State Electrical Generation Sites, NY
Poletti Generating Station, Astoria, NY
Arthur Kill Generating Station, Staten Island, NY

Ilkay Cam-Spanos

Senior Project Manager
Environmental Engineering & Project Management

16 years in the industry

Ms. Cam-Spanos is an environmental engineer with experience in Phase I Environmental Site Assessments, Phase II Environmental Site Investigations, site remediation (soil and groundwater), field and office management of remedial investigations and tank closures, preparation of environmental reports, indoor air sampling, health and safety, and environmental and geotechnical database management. She manages large redevelopment projects from due diligence phases through remedial closures.

Ms. Cam-Spanos has experience working with regulatory agencies such as New York State Department of Environmental Conservation (NYSDEC), New York City Department of Environmental Protection (NYCDEP), New York City Office of Environmental Remediation (OER), and the United States Environmental Protection Agency (EPA), and she works closely with project teams to integrate remediation strategies with construction and development activities. She is also experienced in underground storage tank closures, remedial excavation oversight, spill closures, design of sub-slab vapor mitigation, and excavation and off-site treatment and/or disposal of contaminated material.

In 2017, Ms. Cam-Spanos was honored at the Pioneering Women in Real Estate Awards Gala.

Selected Projects

Spill Closure and Waste Characterization, 1802-1810 Second Avenue, New York, NY
Soil Sampling, Alley Creek, Bayside, NY
Brownfield Cleanup Program, 55 Bank Street, White Plains, NY
Brownfield Cleanup Program, Monroe College (2409 Jerome Avenue), Bronx, NY
Brownfield Cleanup Program, 22-36 Second Avenue, Brooklyn, NY
Environmental Assessments, Madison Square Boys and Girls Club, New York, NY
Phase II, Noise RAP and Waste Characterization, 19 East Houston, New York, NY
Environmental Due Diligence, 85 Jay Street, Brooklyn, NY
Environmental Remediation, 400 West 42nd Street, New York, NY
Environmental Assessments, Sea Cliff, NY
Phase I ESA, Trinity Real Estate, New York, NY
Phase I ESA, Second Avenue/East 127th Street, New York, NY
Site Characterization, Oval Concierge, Peter Cooper Village/ Stuyvesant Town, New York, NY
Phase I ESA, Trinity Square, New York, NY

Education

MBA, Masters of Business Administration, University of Cyprus

M.S., Environmental Science
New Jersey Institute of Technology/ Rutgers University

B.S., Environmental Engineering
Marmara University, Turkey

Professional Registration

LEED Green Associate

OSHA 40-Hour HAZWOPER

OSHA HAZWOPER Site Supervisor

EQuIS Database Management

Turkish Professional Environmental Personnel

Affiliations

American Society of Civil Engineers (ASCE)

Turkish-American Association of Engineers & Architect

Turkish Society of Environmental Engineers

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Phase I and II for Newburgh Waterfront Development, Newburgh, NY
Confidential Residential Complex, New York, NY
Gateway Center II Retail, Brooklyn, NY
Columbia University, Manhattanville Development, New York, NY
Port Authority of New York and New Jersey (PANYNJ), Southwest Brooklyn Waterfront Study, Brooklyn, NY
Mixed-Use Hotel/Residential (50 West Street), New York, NY
Brownfield Cleanup Program, 261 Hudson Street, New York, NY
Voluntary Cleanup Program, 42 Crosby Street, New York, NY
Spill Site, 422 West 15th Street, New York, NY
Environmental Due Diligence, Terracity Shopping Center, Antalya, Turkey
Microsoft Access and EQuIS Databases, Port Authority of New York and New Jersey, Newark, NJ
NYCDEP Dewatering Permit, Private Client, New York, NY
Site Remediation, Element West 59th Street, New York, NY
Management of EQuIS Chemistry Database, Shoppes at Atlas Park
Environmental Services, Columbia University, The Studebaker Building (615 West 131st Street), New York, NY
Soil Remediation, The Alexander Development Project, New York, NY
Management of EQuIS Chemistry Database, Jacob Javits Convention Center Site Assessment, New York, NY
Management of EQuIS Chemistry Database, Archstone Clinton (Apartments), New York, NY
UST Investigations, New York City School Construction Authority (NYCSCA), New York, NY
Monitoring Well Sampling, Schmid Labs, Little Falls, NJ
Phase I, Phase II and Phase III Environmental Site Assessments, Confidential Developers, Various Locations, Nationwide
Management of EQuIS Chemistry Database, Con Edison of New York, NY
Contaminated Soil Investigation, Random House, New York, NY
Monitoring of Well Sampling, Penick Lyndhurst, NJ
Geotechnical Site Investigations at Gateway Shopping Center, Brooklyn, NY
Sampling of TPH Contaminated Soil, Polytechnic University, Brooklyn, NY
Site Investigation, 1st Avenue Properties (Con Edison), New York, NY
Environmental Site Assessments, NYCSCA Primary School 192, New York, NY
Geotechnical Engineering for Gateway Retail Center, Brooklyn, NY

Selected Publications, Reports, and Presentations

Vitamin Effect on Bioremediation of Phenanthrene, Anthracene, Fluoranthene, and Pyrene in a Contaminated Soil from an Industrial Site.
M.S Thesis, New Jersey Institute of Technology, New Jersey

Natural Polymers in Turkey: Their Application to Drinking Water Treatment.
Senior Project, Marmara, University, Turkey

Jason J. Hayes, PE, LEED AP

Principal
Environmental Engineering

15 years in the industry

Mr. Hayes has experience in New York, New Jersey, Washington D.C., California, Washington, Oregon, Alaska, and Internationally. His experience includes Environmental Protection Agency (EPA), New York State (NYS) Brownfield's application, investigation, and remediation; New York City Department of Environmental Protection (NYCDEP) and New York City Office of Environmental Remediation (OER) E-designated site application, investigation, and remediation. His expertise also includes Phase I and II Environmental Site Investigations and Assessments; contaminated building cleanup and demolition; Underground Storage Tank (UST) permitting, removal specifications, and closure reporting; soil vapor intrusion investigation and mitigation system design (depressurization systems, etc.); development of groundwater contaminant plume migration models; environmental analysis; and oversight, design and specification generation for remediation operations with contaminants of concern to include polychlorinated biphenyls (PCBs), solvents, mercury, arsenic, petroleum products, asbestos, mold and lead.

Selected Projects

Confidential Location (Remediation for Mercury-Contaminated Site), New York, NY
Confidential Location (Phase II ESI and Remedial Design for Mercury Impacted Site), Brooklyn, NY
NYC School Construction Authority (PCB Remediation), Various Locations, New York, NY
28-29 High Line (Phase I ESA, Phase II ESI, and Environmental Remediation), New York, NY
Georgetown Heating Plant (Phase II ESI and Remedial Design for Mercury Impacted Site), Washington D.C.
268 West Street (BCP Application, RI and RIWP), New York, NY
Confidential Multiple Mixed-Use Tower Location (BCP Application, RI, Phase I ESA, and Phase II ESI), New York, NY
Brooklyn Navy Yard Dry-Dock (NYS Voluntary Cleanup Program), Brooklyn, NY
27-21 44th Drive (BCP Application, Remedial Investigation Phase I ESA, and Phase II ESI), Long Island City, NY
4430 Purves Street (BCP Application, RAWP, and Phase II ESI), Long Island City, NY
267-273 West 87th Street (BCP Application, Remedial Investigation, RIWP, RAWP), New York, NY
New York Aquarium, Shark Tank and Animal Care Facility (Environmental Remediation), Coney Island, NY
International Leadership Charter School (Environmental Remediation), Bronx, NY
West & Watts (BCP Application), New York, NY

Education

M.S., Environmental Engineering
Columbia University

B.S., Chemistry, Environmental Toxicology
Humboldt State University

Business Administration (minor)
Humboldt State University

Professional Registration

Professional Engineer (PE) in NY

LEED Accredited Professional (LEED AP)

Troxler Certification for Nuclear Densometer Training

CPR and First Aid Certification

OSHA 40-Hour (HAZWOPER)

OSHA HAZWOPER Site Supervisor

Affiliations

US Green Building Council, NYC Chapter (USGBC), Communications Committee

Urban Land Institute (ULI), member

Commercial Real Estate Development Association (NAIOP), member

NYC Brownfield Partnership, member

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Hudson Yards Redevelopment (Phase I ESA and Phase II ESI), New York, NY
627 Smith Street (RI and Report), Brooklyn, NY
Gateway Center II Retail (Phase I ESA and Phase II ESI), Brooklyn, NY
261 Hudson Street (Phase I ESA, Phase II ESI, BCP, and RAWP), New York, NY
Riverside Center, Building Two (BCP, Phase I ESA and Phase II ESI), New York, NY
New York Police Academy, (Sub-Slab Depressurization and Vapor Barrier System), College Point, NY
Bronx Terminal Market (BCP, RIWP, RAWP, Phase I ESA and Phase II ESI), Bronx, NY
Jacob Javits Convention Center (Phase I ESA and Phase II ESI), New York, NY
Yankee Stadium Development Waterfront Park (NYSDEC Spill Sites), Bronx, NY
Bushwick Inlet Park (Phase I ESA, Approvals for NYC E-Designation), Brooklyn, NY
Silvercup West Residential (BCP, RIWP, RIR, RAWP, and RAA), Long Island City, NY
29 Flatbush Residential Tower (Groundwater Studies, RIR and RAWP), Brooklyn, NY
Gowanus Village I (BCP, RIWP and RIR), Brooklyn, NY
Sullivan Street Hotel (Site Characterization Study and Owner Representation), New York, NY
Riker's Island Co-Generation Plant (Soil and Soil Vapor Quality Investigations), Bronx, NY
The Shops at Atlas Park (Sub-Slab Depressurization and Vapor Barrier Design), Glendale, NY
Memorial Sloan-Kettering Cancer Center (Subsurface and Soil Vapor Intrusion Investigations), New York, NY
Element West 59th Street (Oversight and Monitoring of Sub-Slab Depressurization and Vapor Barrier Systems), New York, NY
Teterboro Airport (Delineation and Remedial Oversight of Petroleum-Contaminated Soils), Teterboro, NJ
Proposed New York JETS Stadium (Phase I ESA), New York, NY
Former Con Edison Manufactured Gas Plant Sites (Research Reports), New York, NY
7 World Trade Center (Endpoint Sampling and Final Closure Report), New York, NY
Peter Cooper Village, Environmental Subsurface Investigations, New York, NY

Selected Publications, Reports, and Presentations

NYC Mayor's Office of Environmental Remediation – Big Apple Brownfield Workshop – Presented on Soil Vapor Intrusion Remedies (e.g., SSD Systems, Vapor Barriers, Modified HVAC)

New York City Brownfield Partnership – Presented on environmental considerations and complications of the Hudson yards Development

Waterfront Development Technical Course – Presented on Impacted Waterfront Planning Considerations

Shana Holberton

Senior Staff Scientist
Environmental Engineering

7 years in the industry

Ms. Holberton is an environmental scientist with a diverse background which includes experience both managing and regulating environmental projects located in the New York Metropolitan and San Francisco Bay areas. As a consultant, she has managed numerous site assessments/ investigations and remedial programs at residential, commercial, and industrial properties. Ms. Holberton has implemented, reviewed, and drafted budgets, proposals, and invoices for Phase I environmental site assessments, Phase II site investigations, vapor intrusion studies, and comprehensive remedial projects. She has provided oversight for site remediation activities that included the design of waste characterization studies to determine appropriate solid waste disposal facilities, the excavation and transport of native and contaminated on-site soil, soil and groundwater treatment, the decommissioning of groundwater monitoring wells, the removal/closure of buried tanks, and the installation of engineering controls. Ms. Holberton has prepared detailed reports for both private clients and government agencies and provided guidance to clients on environmental issues and possible resolutions based on careful consideration of investigation results, applicable cleanup criteria, and proposed development plans. She has also served as the lead on business development programs including RFP bid submissions.

As a regulator for the New York City Mayor's Office of Environmental Remediation (OER), Ms. Holberton managed over 100 New York City development projects simultaneously. As OER's Chief of Contracts she also managed the selection of on-call contractors, the issuance of RFPs, and the review of bid submissions and technical documents. In addition, she served as OER's Chief of Hazardous Waste Management, overseeing the office's hazardous waste fee waiver program through ongoing coordination with the NYSDEC. While at OER, Ms. Holberton worked directly with OER's director to develop and advance initiatives which supported the mayor's goals, to include programs which supported affordable housing development as well as the design and management of a pilot program to bring clean soil to community gardens from sites remediated under OER's oversight.

Selected Projects

OER/GreenThumb/Brooklyn College Community Garden Pilot Program, Clean Soil Study for Community Gardens, Brooklyn, NY

Domino Sugar Factory Development (Hazardous Materials RIWPs, RIRs, and RAWPs; Air Quality and Noise RAPs; remediation oversight; NYCDOT, NYCDCP, NYCDPR, NYCHPD, and NYSDEC coordination), Brooklyn, NY

Hudson Yards Redevelopment, Phase I Eastern Yard (Air Quality and Noise RAPs; remediation oversight), New York, NY

Education

B.A., Environmental Science
Mills College

Professional Registration

29 CFR 1910.120 40-hour HAZWOPER

29 CFR 1910.120 8-hour HAZWOPER Annual Refresher

29 CFR 1926 10-hour Construction Safety and Health

Affiliations

New York City Brownfield Partnership – Committee Member

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Seaside Park and Community Arts Center (Hazardous Materials RIWP, RIR, and RAP; remediation oversight), Brooklyn, NY

”Edge” Condominium Tower and Waterfront Esplanade (Hazardous Materials RIWP, RIR, and RAWP; Noise Monitoring and RAP; NYCDOT and NYCDPR coordination; remediation oversight), Brooklyn, NY

Flushing Commons Phase I (Hazardous Materials RIWP, RIR, and RAWP; Air Quality and Noise RAP; remediation oversight), Flushing, NY

843 Lexington Avenue (Hazardous Materials RIWP, RIR, and RAWP; noise monitoring report; NYSDEC interaction), Brooklyn, NY

52-01 Queens Boulevard (Hazardous Materials RIR and RAWP; performed remedial oversight), Sunnyside, NY

Confidential Proposed NYCSCA Pre-K Development Site (Excavation Materials Management Plan, Health and Safety Plan, and waste characterization sampling), Brooklyn, NY

60-01 Northern Boulevard (NYSDEC-approved investigative work plan, interim remedial work plan), Woodside, NY

Confidential Development Site (Phase I ESA, Phase II ESI, and underground storage tank removal), Brooklyn, NY

Confidential Site (Phase I ESA and vapor intrusion study), Brooklyn, NY

Anthony Moffa, Jr., ASP, CHMM, COSS

Associate/Corporate Health and Safety Manager

Anthony is Langan's Corporate Health & Safety Manager and is responsible for managing health and safety compliance in all Langan office locations. He has over 15 years experience in the health and safety field. He is responsible for ensuring compliance with all federal and state occupational health and safety laws and development and implementation of corporate health and safety policies. Responsibilities include reviewing and updating Langan's Corporate Health and Safety Program and assisting employees in the development of site specific Health & Safety Plans. He maintains and manages health and safety records for employees in all Langan office locations including medical evaluations, respirator fit testing, and Hazardous Waste Operations and Emergency Response training. He is also responsible for documentation and investigation of work-related injuries and incidents and sharing this information with employees to assist in the prevention of future incidents. He is also the chairman of the Corporate Health & Safety Committee and Health & Safety Leadership Team that meet periodically throughout the year. He is responsible for coordinating and providing health and safe training to Langan employees. He was formerly the Environmental, Health and Safety Coordinator at a chemical manufacturer. His experience included employee hazard communications, development of material safety data sheets for developed products, respirator fit testing and conducting required Occupational Health & Safety Association and Department of Transportation training.

Education

B.S., Physics
West Chester University

Professional Registration

Associate Safety Professional (ASP)

Certified Hazardous Material Manager (CHMM)

Certified Occupational Safety Specialist (COSS)

Affiliations

Pennsylvania Chamber of Business & Industry

Chemical Council of New Jersey

New Jersey Business & Industry Association

Geoprofessional Business Association

Certifications and Training

Hazardous Waste Operations and Emergency Response Training

OSHA Site Supervisor Training

10 & 30-Hour Construction Safety & Health Training

30-Hour Construction Safety & Health Training

10-Hour Industry Safety & Health Training

Confined Space Awareness & Entry

Competent Person in Excavations

Hazard Communications

Defensive Driving Training

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Gregory C. Wyka, LEED AP

Project Geologist
Environmental Engineering

8 years in the industry

Mr. Wyka is a geologist with experience in regulatory government, brownfield development, and environmental liability consulting. His expertise includes site characterization, remedial investigation, waste characterization, conceptual site modeling, remedial design and implementation, construction management, GIS, and sustainability. Mr. Wyka's abilities integrate remediation with property redevelopment and he provides technical, regulatory, logistical, and risk management guidance to clients, including developers, owners, and environmental attorneys. He provides direct assistance for clients on construction and remediation projects in the New York State Inactive Hazardous Waste Disposal Site Program, New York State Spill Response Program, New York State Brownfield Cleanup Program, New York City E-Designation Program and New York City Voluntary Cleanup Program.

Selected Projects

Greenpoint Landing Waterfront Residential Development, Phase I ESAs, remedial investigations, waste characterizations, remedial action work plans, remedial action implementation, construction management, e-designation management and closure, and agency coordination, Brooklyn, NY

Brownfield Cleanup Program, remedial Investigations and agency coordination, ABC site, Long Island City, NY

Brownfield Cleanup Program, remedial investigations and agency coordination, City DPW Yard, New Rochelle, NY

160 Leroy Street, Phase I ESA, remedial investigations, waste characterizations, remedial action work plans, remedial action implementation, construction management, e-designation management, and agency/client coordination, New York, NY

2409 Jerome Avenue, phase I ESA, phase II ESI, remedial investigation, open spill management, and agency/client coordination, Bronx, NY

685 First Avenue, New York, NY – Waste characterization, construction management, and agency coordination, Bronx, NY

60 West Street, remedial investigation, waste characterization, remedial action work plan, and e-designation management, Brooklyn, NY

27-19 44th Drive, construction management and agency coordination, Long Island City, NY

82 King Street, e-designation management, New York, NY

515 West 42nd Street, e-designation management, New York, NY

421 Kent Avenue, remedial investigations, waste characterizations, remedial action work plans, remedial action implementation, construction management, e-designation management, and agency/client coordination, Brooklyn, NY

Education

B.A., Geology, Chemistry and Environmental Studies
Bowdoin College

Professional Registrations

LEED AP Neighborhood Development

40 Hour OSHA HAZWOPER
10 Hour OSHA Construction Safety
8 Hour OSHA Site Supervisor

CPR and First Aid Certified

Affiliations

New York State Council of Professional Geologists (NYSCPG)

Urban Green Council

New York City Brownfield Partnership

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Brooklyn Bridge Park, Pierhouse, construction management and agency/client coordination, Brooklyn, NY
550 Myrtle Avenue, construction management, e-designation management and closure, Brooklyn, NY
310 Meserole Street, Phase I ESA, Brooklyn, NY
13-17 Laight Street, Phase I ESA, New York, NY
460 Mother Gaston Boulevard, Phase I ESA, Brooklyn, NY
25 Kent Avenue, Phase I ESA, Brooklyn, NY
1110 Oak Point Avenue, Phase I ESA, Bronx, NY
859-863 Lexington Avenue, Phase I ESA, New York, NY
49 East 21st Street, Phase I ESA, New York, NY
1552-1560 Broadway, Phase I ESA, New York, NY
287-291 East Houston Street, Phase I ESA, New York, NY
205 Water Street, construction oversight and management, tank closure, e-designation management and closure, Brooklyn, NY
29-01 Borden Avenue, remedial investigation and petroleum spill closure, Long Island City, NY
29-10 Hunters Point Avenue, remedial investigation and tank closure, Long Island City, NY
30-27 Greenpoint Avenue, remedial investigation and petroleum spill closure, Long Island City, NY –
55 Water Street, emergency petroleum spill closure (Tropical Storm Sandy), New York, NY
489 Great Neck Road, remedial investigation and remedial design, Great Neck, NY
505 West 27th Street, remedial investigation and e-designation management, New York, NY
144 East 201st Street, Phase I ESA, remedial investigation, construction oversight, and e-designation management, Bronx, NY
Big River Study Area (Superfund), remedial investigation, Old Lead Belt, Park Hills and Desloge, MO
Berry's Creek Study Area (Superfund Site), remedial investigation, Bergen County, NJ
Everglades Restoration Project, remedial investigation, Clewiston, FL
Marble River Wind Farm, wetland delineation, Ellenburg, NY

ATTACHMENT C

SAMPLE NOMENCLATURE

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SAMPLE NOMENCLATURE

The sample nomenclature outlined below provides consistency between sample events and projects but, most importantly, establish unique sample IDs that will avoid confusion months or years after the sample has been collected. Furthermore, unique sample IDs are required for any data submitted to the NYSDEC in EDD format or being uploaded to an EQuIS database.

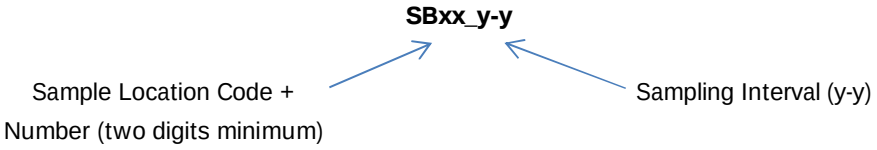
1.0 INVESTIGATION LOCATION CODES

SB	Soil Boring	SV	Soil Vapor Point
WC	Waste Characterization Boring	IA	Indoor Air
TP	Test Pit	AA	Ambient Air
EPSW	Endpoint Location (Sidewall)	SVE	Vapor Extraction Well
EPB	Endpoint Location (Bottom)	DS	Drum
MW	Monitoring Well	IDW	Investigation Derived Waste
TMW	Temporary Monitoring Well	SL	Sludge
SW	Surface Water	FP	Free Product

2.0 SAMPLE NOMENCLATURE

Each sample at a site must have a unique value.

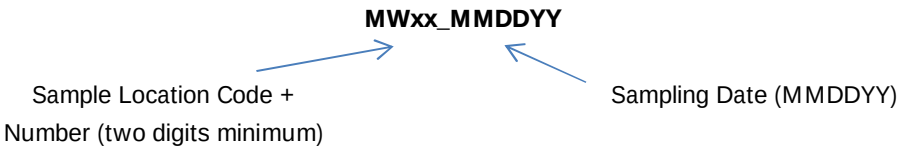
- **Soil/Sediment Samples:**



Sample Type	Sample Location Code	Sampling Depth or Interval (feet bgs or approx. elevation)	Sample Name
Phase II/Remedial Investigation			
Grab Soil Sample	SB01	2 to 4	SB01_2-4
	SB02	4	SB02_4
Waste Characterization			
Grab Soil Sample	WC01	2 to 4	WC01_2-4
	WC02	4	WC02_4
Composite Soil Sample from one or more locations	COMP01 or COMP02 + COMP03	0 to 10 (Fill)	COMP01_0-10

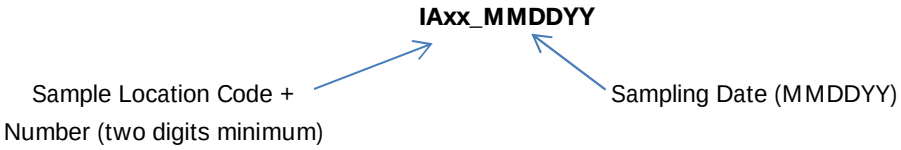
Sample Type	Sample Location Code	Sampling Depth or Interval (feet bgs or approx. elevation)	Sample Name
Endpoint Sampling			
Grab Soil Sample	EPSW01_N	5	EPSW01_N_5
	EPSW01_S	5	EPSW01_S_5
	EPSW01_E	5	EPSW01_E_5
	EPSW01_W	5	EPSW01_W_5
	EPB01	6	EPB01_6

- **Groundwater/Surface Water Samples:**



Sample Type	Sample Location Code	Sampling Date	Sample Name
Groundwater Sample	MW01	02/21/2013	MW01_022113

- **Air/Soil Vapor Samples:**



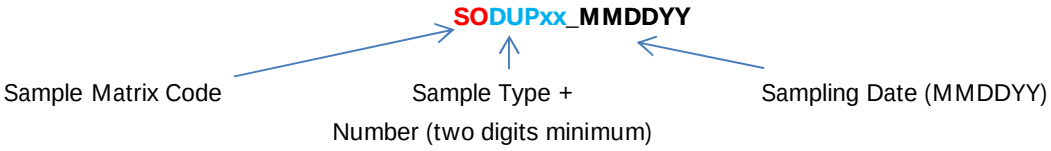
Sample Type	Sample Location Code	Date	Sample Name
Air Sample	IA01	02/21/2013	IA01_022113
Soil Vapor Sample	SV01	02/21/2013	SV01_022113
Vapor Extraction Well Sample	SVE01 (INLET/MIDPOINT/OUTLET)	02/21/2013	SVE01_IN_022113 SVE01_ MID_022113 SVE01_ OUT_022113

- **QA/QC Samples:**

Sample Matrix Codes

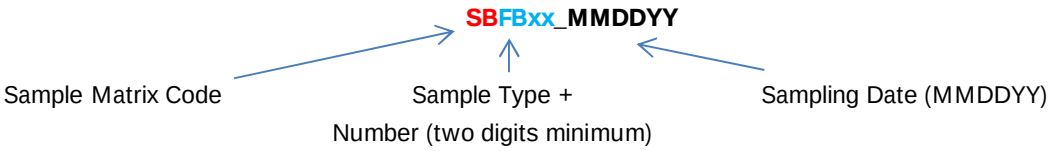
SO	Soil	AS	Air
SE	Sediment	SV	Soil Vapor
GW	Groundwater	SL	Sludge
SW	Surface Water	FP	Free Product

- Duplicates Samples



Sample Type	Parent Sample Code	Date	Sample Name
Groundwater Duplicate Sample (DUP)	MW01_022113	02/21/2013	GWDUP01_022113
Soil boring Duplicate Sample (DUP)	SBP01_022113	02/21/2013	SODUP01_022113
Grab Waste Characterization	WC01	02/21/2013	WCDUP01_022113
Composite Waste Characterization	COMP01	02/21/2013	COMPDUP01_022113

- Field Blanks and Trip Blanks



Sample Type	Date	Sample Name
Groundwater Field Blank (FB)	02/21/2013	GWFB01_022113
Groundwater Trip Blank (TB)	02/21/2013	GWTB01_022113
Soil Field Blank	02/21/2013	SOFB01_022113
Soil Trip Blank	02/21/2013	SOTB01_022113

- Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Parent Sample Name_MS or MSD

Sample Type	Sample Location	Parent Sample Name	Sample Name
Matrix Spike Soil (MS)	SB01	SB01_2-4	SB01_2-4_MS
Matrix Spike Soil Duplicate (MSD)	SB01	SB01_2-4	SB01_2-4_MSD
Matrix Spike GW (MS)	MW01	MW01	MW01_MS
Matrix Spike GW Duplicate (MSD)	MW01	MW01	MW01_MSD

3.0 NOTES

1. The sample location code should not exceed 20 characters and the sample name should not exceed 40 characters.
2. Sample location code (**SB01, MW01, etc.)** is a sequential number (starting with 01) and should be a minimum of two digits.
3. Sample Interval (SB01_**0-5**) is separated from the sample location code with an underscore, and the top and bottom interval with a dash. Soil and sediment sample intervals should always be in

feet. Soil and sediment sample intervals should contain no "/" or "()" or unit.

4. Sample date (MW01_**022113**) is separated from the sample location code with an underscore and should be provided in MMDDYY format [the date should contain no "/" or "-"].
5. If groundwater samples are collected from multiple intervals within one well, you may assign a letter designation (in lower case) to the well ID to differentiate between intervals (i.e., MW01a_022113, MW01b_022113, and MW01c_022113). The letter "a" would indicate the shallowest interval and "c" the deepest. The actual depth intervals should be documented in the project field book or field sheets and the letter designations should be used consistently between sampling events.
6. According to USEPA's Contract Laboratory Program (CLP) Guidance for Field Samplers (January 2011), field duplicate samples should remain "blind" to the laboratory (i.e., they should have separate CLP Sample numbers). Assign two separate (unique) CLP sample numbers (i.e., one number to the field sample and one to the duplicate). Submit blind to the laboratory. (http://www.epa.gov/superfund/programs/clp/download/sampler/CLPSamp-01-2011.pdf)