REMEDIAL INVESTIGATION WORK PLAN

for

47th Street & 58th Road Site
57-00, 57-05, and 58-20 47th Street
Maspeth, Queens, New York
BCP Site No. TBD

Prepared for:

47th Street & 58th Road LLC
c/o Prologis, Inc.
Pier 1, Bay 1
San Francisco, California

Prepared by:

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

LANGAN

July 8, 2022
Langan Project No. 100965501

TABLE OF CONTENTS

LIST OF ACRONYMS ..... **III**

CERTIFICATION ..... **V**

1.0 INTRODUCTION **1**

2.0 SITE BACKGROUND **2**

2.1 Site Description 2
2.2 Surrounding Property Land Use 3
2.3 Site Physical Conditions 3
2.3.1 Topography 3
2.3.2 Site Geology 4
2.3.3 Hydrology and Hydrogeology 4
2.3.4 Wetlands 4
2.4 Summary of Previous Environmental Reports 5
2.5 Potential Areas of Concern 13

3.0 SCOPE OF WORK **17**

3.1 Geophysical Survey 18
3.2 Soil Investigation 18
3.2.1 Drilling and Logging 18
3.2.2 Soil Sampling and Analysis 19
3.3 Groundwater Investigation 20
3.3.1 Monitoring Well Installation 20
3.3.2 Groundwater Sampling and Analysis 20
3.3.3 Monitoring Well Survey and Synoptic Gauging 21
3.5 Soil Vapor Investigation 21
3.5.1 Soil Vapor Point Installation 21
3.5.2 Soil Vapor Sampling and Analysis 22
3.7 Data Management and Validation 22
3.8 Management of Investigation-Derived Waste 23
3.9 Air Monitoring 24
3.9.1 Worker Air Monitoring 24
3.9.2 Community Air Monitoring Plan 24
3.10 Qualitative Human Health Exposure Assessment 25
3.11 Fish and Wildlife Resource Impact Analysis 25

4.0 REPORTING **26**

4.1 Daily Field Reports 26
4.2 Remedial Investigation Report 26

5.0 SCHEDULE **28**

FIGURES

Figure 1 Site Location Map
Figure 2 Historical Soil Sample Locations and Analytical Data
Figure 3 Historical Groundwater Sample Locations and Analytical Data
Figure 4 Historical Vapor Sample Locations and Analytical Data
Figure 5 Potential Areas of Concern Map
Figure 6 Proposed Sample Location Map (1 of 2)
Figure 6B Proposed Sample Location Map (2 of 2)

TABLES

Table 1 Proposed Sample Summary
Table 2 Emerging Contaminants List for Soil and Groundwater Samples

APPENDICES

Appendix A Previous Environmental Reports
Appendix B Health and Safety Plan
Appendix C Quality Assurance Project Plan
Appendix D Daily Site Observation Report Template

LIST OF ACRONYMS

Acronym	Definition
Alpha	Alpha Analytical, Inc.
SGVs	Ambient Water Quality Standards and Guidance Values
ALTA	American Land Title Association
ASP	Analytical Services Protocol
AOC	areas of concern
ASTM	ASTM International
BOD	biological oxygen demand
BCP	Brownfield Cleanup Program
COD	chemical oxygen demand
CAMP	Community Air Monitoring Program
DNAPL	dense non-aqueous phase liquid
DRO	diesel range organic
DER	Division of Environmental Remediation
TOGS	Division of Water Technical and Operation Guidance Series
eV	electron volt
el	Elevation
ECL	Environmental Conservation Law
EIMS	Environmental Information Management System
ELAP	Environmental Laboratory Approval Program
ESA	Environmental Site Assessments
ESI	Environmental Site Investigation
bgs	feet below grade surface
FWRIA	Fish and Wildlife Resources Impact Analysis
UST	gallon underground storage tank
GRO	gasoline range organics
GPR	ground-penetrating radar
HASP	Health and Safety Plan
IDW	Investigation-derived wastes
LNAPL	light non-aqueous phase liquid
$\mu g/m^3$	micrograms per cubic meter
NSPS	National Society of Professional Surveyors
NYCRR	New York Codes, Rules, and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NAVD88	North American Vertical Datum of 1988
PM-10	particulate matter less than 10 micrometers in size

Acronym	Definition
ppm	parts per million
ASTM	American Society for Testing and Materials
PID	Photoionization Detector
PCB	polychlorinated biphenyls
PFAS	polyfluoroalkyl substances
PVC	polyvinyl chloride
DUSR	Preparation of Data Usability Summary Reports
QHHEA	Qualitative Human Health Exposure Assessment
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
REC	Recognized Environmental Condition
RI	Remedial Investigation
RIR	Remedial Investigation Report
RIWP	Remedial Investigation Work Plan
RCRA	Resource Conservation and Recovery Act
RURR	Restricted Use Restricted-Residential
SDG	sample delivery group
SVOC	semivolatile organic compounds
SB	soil borings
SCO	Soil Cleanup Objectives
SCG	Standards, Criteria, and Guidance
TOC	total organic carbon
TOV	total organic vapor
TPH	total petroleum hydrocarbon
TCLP	Toxicity Characteristic Leaching Procedure
TCE	trichloroethene
UN/DOT	United Nations/Department of Transportation
USEPA	United States Environmental Protection Agency
UU	Unrestricted Use
VOC	volatile organic compounds
XRF	X-ray fluorescence

CERTIFICATION

I, Rory Johnston, 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.

_____

Rory Johnston, PE

1.0 INTRODUCTION

This Remedial Investigation Work Plan (RIWP) was prepared on behalf of 47th Street & 58th Road LLC (the Volunteer) for the property located at 57-00, 57-05, and 58-20 47th Street in the Maspeth neighborhood of Queens, New York (the Site). The Volunteer will implement the RIWP under the New York State Brownfield Cleanup Program (BCP) (Site No. *To Be Determined*), pursuant to the Brownfield Cleanup Program (BCP) Application being submitted to the New York State Department of Environmental Conservation (NYSDEC) concurrently with this RIWP.

The objective of the Remedial Investigation (RI) is to investigate and characterize the nature and extent of environmental conditions at the Site and to evaluate whether any contamination is emanating from the Site. The RI is intended to generate a data set sufficient to perform a qualitative on- and off-site human health exposure assessment and to evaluate remedial alternatives. 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); NYSDEC Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) (June 2021); and the New York State Department of Health (NYSDOH) "Guidance for Evaluating Soil Vapor Intrusion in the State of New York" (October 2006, with updates).

2.0 SITE BACKGROUND

2.1 Site Description

The Site is located at 57-00, 57-05, and 58-20 47th Street in the Queens neighborhood of Maspeth, New York and is identified as Block 2601, Lots 1 and 6 and Block 2602, Lot 72 on the Borough of Queens Tax Map. The Site is bisected by 47th Street, the 57-00 and 58-20 parcels are located on the western side of 47th Street and the 57-05 parcel is located on the eastern side of 47th Street. The Site encompasses a total of 3.74-acres. The Site is bordered to the north by 58th Road, followed by the NYC Department of Sanitation Queens West 5 Garage; to the east by produce wholesaler Raja Foods and Vegetables, Inc. and a multitenant warehouse; to the south by the NYC Department of Environmental Protection Newtown Creek aeration facility; and to the west by Newtown Creek.

The Site is currently vacant. The Site is improved with a one story garage building with an attached two story office at 57-00 47th Street (the 57-00 parcel) and a one story office/garage building at 57-05 47th Street (the 57-05 parcel); associated impervious parking areas surrounding the two buildings. The property located at the 57-00 parcel is unimproved. A Site location map is provided as **Figure 1**.

A self-contained storm water underground infiltration basin is located on the southern end of the 57-00 parcel. The underground infiltration basin consists of a chamber which accepts storm water from the 57-00 parcel parking lot runoff along with discharge from a potential oil/water separator identified during a geophysical survey. Two underground injection control (UIC) units were identified on the 57-05 parcel that accept storm water runoff from the parking lot. A geophysical survey indicated that one of the UIC units was potentially connected to trench drains in the building on the 57-05 parcel.

The Site is located in an area of minimal flood hazard (Zone X), indicating a .2 percent annual chance flood risk by the Federal Emergency Management Agency (FEMA). According to the New York City Planning Commission Zoning Map 13b, the Site is located in a M3-1 manufacturing district, which is designated for areas with heavy industrial uses that generate noise, traffic, or pollutants.

2.2 Surrounding Property Land Use

The Site is generally surrounded by industrial buildings to the north, east, and south, and by Newtown Creek to the west. The following is a summary of adjoining and surrounding property use:

Direction	Block	Lot	Adjoining Properties	Surrounding Properties
North	2600	1	NYC Department of Sanitation Queens West 5 Garage	Wholesale distributor industrial/commercial warehouses
East	2602	58	Multitenant warehouse, most notable tenants are Molloy Brothers Moving and Storage and LaserShip	Wholesale distributor industrial/commercial warehouses
South	2601	25	NYC Department of Environmental Protection Newtown Creek aeration facility	Wholesale distributor industrial/commercial warehouses and mixed use industrial (i.e. concrete manufacturing, equipment storage, and bus depot)
West	Newtown Creek			

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

Land use within a half-mile radius of the Site is urban and includes predominantly industrial and commercial uses, followed by residential use. The nearest ecological receptor is Newtown Creek, which adjoins the Site to the west. Sensitive receptors, as defined in NYSDEC DER-10, *Technical Guidance for Site Investigation and Remediation* (DER-10), located within a half mile of the Site include those listed below:

Number	Name (Approximate distance from Site)	Address
1	Walter Reed Public School (P.S. 9) (approximately 2,945 feet southeast)	58-74 57th Street Maspeth, NY 11378

2.3 Site Physical Conditions

2.3.1 Topography

According to the 2013 United State Geological Survey (USGS) Brooklyn Quadrangle 7.5-Minute Series Topographic Maps, the Site is at an elevation of about seven feet above mean sea level (msl). The topography of the Site and surrounding area is generally flat with a regional topographic downward gradient towards Newtown Creek to the west.

2.3.2 Site Geology

The United States Department of Agriculture indicates the surficial geology of the Site consists of predominantly Urban Land, with a till substratum and also Urban land, tidal marsh. According to Bakersville's Bedrock and Engineering Maps of New York County and Parts of Kings and Queen Counties, New York, and Parts of Bergen and Hudson Counties, New Jersey", dated 1994, the bedrock underlying the Site is part of the Hartland Formation. The Hartland Formation is comprised of micaschist and quartz-feldspar granulite, with localized intrusions of granite and pegmatite.

Recent Phase II Environmental Site Investigations (ESIs) completed in December and July 2021 indicate the Site contains surficial fill material. Fill material consisting of fine-grained sand with varying amounts of fine gravel, silt, brick, wood, and concrete was identified from below surface grade to depths ranging from about 4 to 16 feet bgs. Native soil, typically consisting of fine-grained sand and silt with varying amounts of medium sand, peat and fine gravel was identified beneath the fill layer to the boring termination depths, ranging from 5 to 20 feet bgs. Peat was detected in some boring locations at a depth of approximately eleven and a half feet below grade.

2.3.3 Hydrology and Hydrogeology

Groundwater is typically influenced topographically, 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 hydrogeological network often governs groundwater flow at depth or in the bedrock aquifer. Groundwater depth and flow direction are also subject to hydrogeological and anthropogenic variables such as precipitation, evaporation, extent of vegetation cover, and coverage by impervious surfaces. Other factors influencing groundwater include depth to bedrock, the presence of artificial fill, and variability in local geology and groundwater sources or sinks.

Groundwater from temporary well points installed on the Site as part of the Langan July 2021 Phase II ESI indicate groundwater is present at a depth of approximately 10 to 10.5 feet below grade. Groundwater flow is expected to be westerly towards Newtown Creek.

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 reservoirs in the Croton, Catskill, and Delaware watersheds.

2.3.4 Wetlands

Wetlands on or near the Site were evaluated by reviewing the National Wetlands Inventory (NWI) and the NYSDEC regulated wetlands map. Mapped wetlands were not identified on the Site. The Newtown Creek is mapped as an Estuarine and Marine Deepwater wetland habitat by the NWI; Newtown Creek adjoins the Site to the West. Newtown Creek is not mapped as a NYSDEC State

Regulated Freshwater Wetland. An area on the western end of the 57-00 and 58-20 parcel consist of a planted wetland buffer area. This wetland buffer area was planted as per an Order on Consent, which was issued by NYSDEC in spring 2021.

2.4 Summary of Previous Environmental Reports

Previous environmental reports were reviewed to inform this RIWP. These reports are listed and summarized below.

- *Tank Tightness Test Reporting, dated December 28, 2007, prepared by The Tyree Organization, Ltd. (Tyree)*
- *Investigation Summary Report, dated November 2010, prepared by Environmental Management Solutions, Inc. (EMSI)*
- *Sample Collection Summary Letter, dated August 20, 2012, prepared by Taylord Environment (Taylord)*
- *Diesel Fuel Spill Remediation- Spill No. 13-06438, dated December 5, 2013, prepared by Preferred Environmental Services (PES)*
- *Phase I Environmental Site Assessment, dated July 21, 2021, prepared by Langan*
- *Phase II Environmental Site Investigation, dated July 26, 2021, prepared by Langan*
- *Phase I Environmental Site Assessment, dated December 20, 2021, prepared by Langan*
- *Phase II Environmental Site Investigation, dated December 22, 2021, prepared by Langan*
- *Underground Storage Tank Removal and Underground Injection Control Unit Sampling Summary Letter, dated June 13, 2022, prepared by Langan*
- *Vapor Intrusion Summary Letter, dated June 13, 2022, prepared by Langan*

Pervious environmental reports are included as **Appendix A**.

Tank Tightness Testing Report, dated December 28, 2007, prepared by Tyree

A tank tightness test was completed on a 4,000-gallon diesel underground storage tank (UST) located on the southeastern portion of the 57-00 parcel (57-00 47th Street) on December 18, 2007. The UST did not pass the tank tightness test. A spill was reported to the New York State Department of Environmental Conservation (NYSDEC) and Spill No. 07-09978 was assigned to this incident. Subsequent faxes to NYSDEC indicate that the failure was due to a cross over line that had not been removed from the tank top. The line was removed and the tank passed a

subsequent tank tightness test on December 21, 2007. The spill was administratively closed according to the NYSDEC Spill Report Form on December 28, 2007.

Investigation Summary Report, dated November 2010, prepared by EMSI

This report summarizes remedial investigation efforts associated with NYSDEC Spill No. 08-08170 on 57-00 parcel. This spill was reported by NYSDEC for petroleum releases in association with illegally storing and dispensing petroleum. This report prompted various field work which is summarized below.

- A total of 351.04 tons of petroleum impacted soil was excavated and disposed of off-site from the western side of the building north of the former oil storage room. In addition, a concrete pad with a floor drain (without connected piping) was removed from this area.

- Seven post excavation soil samples were collected from the sidewalls and center base of the excavation. Samples were analyzed for volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs).

- Laboratory analytical results indicated polycyclic aromatic hydrocarbons (PAHs), including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and ideno(1,2,3-cd)pyrene, exceeded the NYSDEC Part 375 Restricted Use Commercial and Industrial Soil Cleanup Objectives (SCOs).

- As per an NYSDEC letter dated April 16, 2012, a groundwater monitoring well was required to be installed within the soil excavation to evaluate groundwater quality.

According to a NYSDEC Spill Report Form, this spill was closed October 27, 2012.

Sample Collection Summary Letter, dated August 20, 2012, prepared by Taylord

A post remedial soil boring and a temporary well point were installed on the Site to further evaluate the remedial excavation which occurred as described above in 2010. A soil and groundwater sample were collected from the post-remedial soil boring/temporary well point location and analyzed for the 2010 NYSDEC CP-51 Guidance listed VOCs and SVOCs. Soil results were compared to the CP-51 SCOs. All analyzed compounds were below their respective CP-51 SCOs.

Diesel Fuel Spill Remediation- Spill No. 13-06438, dated December 5, 2013, prepared by PES

This report summarizes remedial actions taken to remedy NYSDEC Spill No. 13-06438. This spill was reported in association with the removal of a 4,000-gallon diesel UST from the 57-00 parcel. Below is a summation of pertinent parts of this report.

- One out-of-service 4,000-gallon diesel UST was removed on September 19, 2013. During the removal, staining and petroleum impacted pea gravel was identified within the underground tank vault.
- Two soil borings were collected from below the concrete base of the UST vault. Fill material was identified and sampled from within these locations.
- PES compared post-excavation samples to CP-51 NYSDEC standards and concluded benzo(a)anthracene at 1,100 ppb, chrysene at 1,100 ppb, and indeo(1,2,3-c,d)pyrene at 570 ppb.

According to NYSDEC data, the 13-06438 case was closed with the NYSDEC on February 11, 2014.

Phase I Environmental Site Assessment, dated July 21, 2021, prepared by Langan

Langan completed a Phase I Environmental Site Assessment (ESA) on behalf of Bay Crane Service of New York in July 2021. The ESA identified the following two recognized environmental conditions (RECs):

- Historical Use of Subject Property: Historically, the 57-00 and 58-20 parcels were utilized to accept/recycle concrete from construction and demolition. In addition, historical records indicate the Site was utilized for various industrial operations since circa 1902.
- Western-Adjoining Superfund Site: The adjoining Newtown Creek is listed as a USEPA Superfund Site on the National Priority List.

Phase II Environmental Site Investigation, dated July 26, 2021, prepared by Langan

Langan completed a Phase II Environmental Site Investigation (ESI) on behalf of Bay Crane Service of New York in July 2021. The ESI was completed to investigate the two RECs identified in the Phase I ESA. A geophysical survey was completed on all three parcels prior to ground

intrusive activities. A total of eleven soil borings and four temporary well points were installed, as depicted in **Figures 2 and 3.**

Three soil borings exhibited petroleum-like odor and staining (SB-01, SB-02, and SB-04). Two of these soil borings were installed on the 57-00 parcel and one of these soil borings was on the 57-05 parcel. Soil samples were compared to the NYSDEC Part 375 Protection of Groundwater, Commercial Use, and Industrial Use SCOs. Soil analytical results indicated VOCs, SVOCs, and metals were greater than their respective Protection of Groundwater SCOs. SVOCs and metals were greater than their respective Commercial and Industrial SCOs. Within collected groundwater samples, several metals and VOCs were identified greater than their respective NYSDEC Title 6 Technical and Operational Guidance Series (TOGS) Groundwater Standards and Guidance Values for Class GA waters (SGVs)

Soil

- 57-00 Parcel: Soil analytical results indicated the 57-00 parcel contained benzo(a)pyrene and arsenic at concentrations greater than their respective Commercial Use and Industrial Use SCOs. Dibenzo(a,h)anthracene, mercury, and lead were identified at concentrations greater than their respective Commercial SCOs. Methyl ethyl ketone, benzo(k)fluoranthene, acetone, benzo(b)fluoranthene, and chrysene were identified at concentrations greater than their respective Protection of Groundwater SCOs.
- 58-20 Parcel: Soil analytical results indicated the 58-20 parcel contained benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and ideno(1,2,3-cd)pyrene at concentrations greater than their respective Commercial Use and Industrial Use SCOs. Chrysene and mercury were identified at concentrations greater than their respective Commercial Use SCOs.
- 57-05 Parcel: Soil analytical results from the 57-05 parcel indicated a lack of Commercial Use and Industrial Use SCO exceedances. However, methyl ethyl ketone was identified at a concentration above the Protection of Groundwater SCO.

Groundwater

- 57-00 Parcel: Petroleum related VOCs and SVOCs were identified in groundwater on parcel 57-00 below their respective TOGS SGVs. Metals which exceeded their respective groundwater TOGS SGVs on the 57-00 parcel include antimony, arsenic, iron, lead, magnesium, manganese, and sodium in unfiltered (total) samples. Filtered (dissolved)

samples contained iron, magnesium, manganese, and sodium greater than their respective TOGS SGVs.

- 57-05 Parcel: Groundwater analytical results indicated a sample collected on the 57-05 parcel contained the VOC methyl tert-butyl ether (MTBE) and total and dissolved metals greater than their respective TOGS SGVs.
    - Total- antimony, arsenic, beryllium, cadmium, total chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, selenium, sodium, and zinc.
    - Dissolved- Antimony, iron, manganese, and sodium.
- 57-06 Parcel: Metals which exceeded their respective TOGS SGVs on the 57-05 parcel include iron, manganese, and sodium.

Phase I Environmental Site Assessment, dated December 20, 2021, prepared by Langan

Langan completed a Phase I ESA on behalf of Prologis, L.P. dated December 2021. The ESA identified the following four RECs:

- Historical Site Use: Commercial/industrial use of the Site dates back to the 1800s. Most recently the 57-00 and 58-20 parcels operated as a concrete recycling facility.
- Newtown Creek Superfund: The adjoining Newtown Creek is listed as a USEPA Superfund Site on the National Priority List.
- On-site Storm Water Vault & Oil/Water Separator: A potential oil/water separator (OWS) was identified within a former vehicle maintenance garage. The OWS is connected to an on-site storm water vault.
- Methyl Tert-Butyl Ether (MTBE) in Groundwater: MTBE was identified within groundwater during July 2021 Phase II ESI activities on the 57-05 parcel.

Phase II Environmental Site Investigation, dated December 22, 2021, prepared by Langan

Langan completed a Phase II ESI on behalf of Prologis, L.P. in December 2021 to investigate the four RECs identified in the Phase I ESA. A geophysical was completed on all three parcels prior to ground intrusive activities. A total of ten soil borings and nine temporary well points were installed, as depicted in **Figures 2 and 3**.

Geophysical activities identified two anomalies consistent with potential USTs on the 57-05 parcel. One of the anomalies was located north of a building addition along 47th Street and the other anomaly was identified within the northeastern end of the parcel.

Soil analytical results indicated the SVOCs benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene were detected at concentrations greater than their respective

Commercial Use and/or Industrial Use SCOs on the 57-00 parcel. Specifically, benzo(a)pyrene was identified at a concentration greater than its Commercial Use and Industrial Use SCOs, benzo(b)fluoranthere was identified at a concentration greater than its Commercial Use SCO, and dibenzo(a,h)anthracene was identified at a concentration greater than the Commercial Use SCO. Select metals were also detected at concentrations greater than their respective Commercial Use and/or Industrial Use SCOs on the 57-00 parcel. Specifically, arsenic, barium, copper, cyanide, lead and mercury were identified in soil at concentrations greater than their respective SCOs. Arsenic and mercury were identified in soil at concentrations greater than their respective Industrial SCOs.

On the 57-00 parcel, VOCs 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, acetone, ethylbenzene, n-butylbenzene, n-propylbenzene, and total xylenes were identified in soil at concentrations greater than their respective Protection of Groundwater SCOs. The SVOC chrysene and the metal selenium were identified in soil at concentrations greater than their respective Protection of Groundwater SCOs.

Acetone and ethylbenzene were detected in soil at concentrations greater than their respective Protection of Groundwater SCOs at the 57-05 parcel.

Groundwater Analytical results identified ethylbenzene at a concentration above its SGV on the 57-00 parcel. Select SVOCs were detected in groundwater at concentrations exceeding their TOGS SGVs on the 57-00 parcel. Isopropylbenzene and toluene were detected at concentrations exceeding their respective SGV on the 57-05 parcel.

Underground Storage Tank Removal and Underground Injection Control Unit Sampling Summary Letter, dated June 13, 2022, prepared by Langan

Two underground storage tanks (USTs) were removed from the 57-05 parcel on February 21, 2022. The USTs consisted of one 550-gallon waste oil tank (UST 002) and one 3,500-gallon diesel tank (UST 003). Once uncovered, it was observed that the tanks had previously been abandoned by cutting holes in the top of the tanks. The 3,500-gallon diesel tank contained soil and approximately 2,550 gallons of liquid (mixture of predominantly rain water mixed with product). The 550-gallon waste oil UST contained approximately 550 gallons of liquid (mixture of predominantly rain water mixed with product) and a nominal quantity of sludge. Once the tanks were removed, samples were collected from the sides and center base of the excavations. Laboratory results are summarized below, samples exceeding their respective SCOs are depicted in **Figure 2** along with detections from the underground injection control (UIC) structure.

- Five soil samples were collected from the 3,500-gallon diesel UST grave. Soil samples were analyzed for Commissioner Policy 51 (CP51) Fuel Oil and CP51 PAHs.

    - Analytical results indicated a detectable amount of xylenes in sample USTB-3. Xylene (m/p and total) concentrations were below the Commercial and Industrial SCOs but greater than CP-51 standards.

    - Three of the five samples had detectable levels of SVOCs. Sample USTB-4 contained benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and ideno(1,2,3-cd)pyrene at concentrations greater than their respective Commercial and Industrial SCOs. Additionally, this sample contained benzo(k)fluoranthene, chrysene, and phenanthrene at concentrations greater than their respective CP-51 NYSDEC standard.

    - The xylene concentration and the SVOC concentrations were indicative of a petroleum release, therefore NYSDEC was contacted. Spill No. 21-05-17 was assigned to this incident.

- Five soil samples were collected from the 550-gallon waste oil UST grave. Soil samples were analyzed for target compound list (TCL) VOCs+15, SVOCs+20, (target analyte list) TAL Metals, and polychlorinated biphenyls (PCBs). Additionally, a sample was collected of discolored soil above the UST prior to removal, the sample was analyzed for the same parameters as post removal samples.

    - Analytical results indicate that the post UST removal soil samples did not contain concentrations of VOCs, SVOCs, PCBs, and metals greater than the NYSDEC Commercial SCOs or the Industrial SCOs. SVOCs dibenzo(a,h)anthrace and ideno(1,2,3-cd)pyrene were identified in both samples USTA-1 and USTA-2 at concentrations greater than their respective CP-51 SCOs. All samples contained detectable concentrations of metals and SVOCs.

    - Analytical results from the soil sample obtained from the discolored soil did not contain concentrations of VOCs, SVOCs, PCBs, and metals greater than the NYSDEC Part 375 Use Commercial Soil Cleanup Objectives (Commercial SCOs) or the Use Industrial Soil Cleanup Objectives (Industrial SCOs). SVOCs Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and ideno(1,2,3-cd)pyrene exceeded their respective CP-51 Soil Cleanup Guidance (CP-51) SCOs.
- The northern underground injection control unit (UIC) sludge and liquid on the 57-05 parcel was sampled. The sludge sample was analyzed for TCL VOC+15, SVOCs+20, TAL metals, and toxicity characteristic leaching procedure (TCLP) Resource Conservation and

Recovery Act (RCRA) 8 metals. The liquid was analyzed for TCL VOCs+15, SVOCs+20, and TAL metals.

- Laboratory results indicated the sludge contained detectable concentrations of 1,2,4-trimethylbenzene, 2-hexanone, methyl ethyl ketone, acetone, cymene, toluene, bis(2-ethylhexyl) phthalate, and dibutyl phthalate. TCLP results indicate the sludge is not considered a characteristic hazardous waste for metals.
- Laboratory results indicated the liquid contained detectable concentrations of acetone, methyl ethyl ketone, toluene, 2-methylnaphthalene, acenaphthalene, benzo(b)fluoranthene, benzo(g,h,i)perylene, bis(2-ethylhexyl) phthalate, chrysene, fluoranthene, fluorene, ideo(1,2,3-cd)pyrene, pentachlorophenol, phenanthrene, and pyrene.

Vapor Intrusion Summary Letter, dated June 13, 2022, prepared by Langan

On May 12, 2022, Langan completed indoor air and sub-slab vapor (SSV) within the 57-00 building (Block 2601 Lot 6) and 57-05 building (Block 2602 Lot 72). SSV samples were co-located with indoor air samples. An ambient air sample was also collected upwind of the 57-00 building**. Figure 4** depicts the SSV, indoor air, and ambient air sample locations.

- SSV samples SSV01 through SSV03 and indoor air samples IA01 through IA03 were located on the 57-00 property (Block 2601, Lot 6). SSV samples SSV04 and SSV05 and indoor air samples IA04 and IA05 samples were located on the 57-05 parcel (Block 2602, Lot 72). Indoor air and sub-slab vapor (SSV) laboratory results were compared to the appropriate New York State Department of Health (NYSDOH) Soil Vapor/Indoor Air Matrices (NYSDOH Matrices) and NYSDOH Air Guideline Values (AGVs). All indoor air values were well below the AGVs. A results summary is included below.
- Laboratory results from the ambient air and indoor air samples were input into the NYSDOH Matrices. Carbon tetrachloride was identified in all indoor air and the ambient air samples at a concentration recommending "no further action". Carbon tetrachloride appears to be a background impact and not Site specific.
- 57-00 (Block 2601, Lot 6) Building:
  - Chlorinated solvent and petroleum related VOCs were identified in SSV beneath the building. Locations SSV01 and SSV02 contained VOCs at concentrations less than NYSDOH Matrices, further action is not recommended for these locations.
  - Sample results from location SSV03 was input into the NYSDOH Matrices which recommended "mitigation" for this location. Concentrations of vinyl chloride within the SSV03 sample were identified at a concentration which recommended "mitigation" regardless of indoor air concentrations.
  - Due to the magnitude of the vinyl chloride concentration in the SSV03 sample, the laboratory was unable to meet reporting limits for compounds 1,1-dichloroethene, cis1,2-dichloroethene, and trichloroethene. Due to the lack of meeting reporting

limits, these compounds exceeded the minimum concentrations for SSV for which mitigation is recommended regardless of indoor air concentration for their respective matrices.

- 57-05 (Block 2602, Lot 72) Building:
    - When evaluated using the NYSDOH Matrices, each of the co-located soil vapor and indoor air samples yielded a recommendation for "no further action". The only VOC included in the NYSDOH Soil Vapor/Indoor Air Matrices detected in indoor air was carbon tetrachloride. As discussed above, carbon tetra chloride is considered a background contaminant and not related to VI within the building.

2.5 Potential Areas of Concern

Based on Site history and findings from previous studies (discussed above), the potential areas of concern (PAOCs) to be further investigated during the Remedial Investigation (RI) are described below and depicted in **Figure 5**.

PAOC 1: Underground Injection Control Units

Two UIC units were identified on the northern and southeastern portions of the 57-05 parcel. The UIC structures were observed to receive storm water within the parking area. The northern unit contains toluene in liquid and sludge material collected from within the UIC structure and groundwater sampled from a nearby monitoring well also contained toluene above its SGV. The northern unit is the presumed source of toluene impacted groundwater in that area of the Site. The southeastern unit was investigated during a prior Phase II ESI and no compounds were detected in soil or groundwater above their respective and applicable regulatory criteria. The northern structure is a PAOC; the southeastern structure is not.

<u>Northern Structure</u>

During Langan's December 22, 2021 Phase II ESI, underground piping was identified leading from an interior trench drain within the on-site building on the 57-05 parcel into the northern UIC unit, this unit also receives storm water runoff from the parking area. Liquid and sludge samples were collected within the northern UIC unit on February 21 and 22, 2022 and results were summarized in Langan's Underground Storage Tank Removal and Underground Injection Control Unit Sampling Summary Letter, dated June 13, 2022. The liquid sample contained detectable levels of several compounds, including toluene. The sludge within this structure contained detectable levels several compounds, including toluene.

Within the immediate radius of this UIC, groundwater samples were collected as part of Langan's July 2021 and November 2021 Phase II ESIs. Toluene was identified in groundwater during the November 2021 sampling event at concentrations greater than its TOGS SGV. The UIC structure

is the presumed source of toluene in groundwater. UIC sludge and liquid sample laboratory results are depicted on **Figures 2 and 3**. Additionally, the presence or absence of potential soil, groundwater, and vapor impacts should be determined.

Southeastern Structure

During video inspection of sewer lines in March 2022, a UIC structure was identified within the southeastern area of parcel 57-05. The structure was identified to be connected a sewer drain west of this structure. A soil boring and temporary well point were installed down-gradient from this structure. Soil and groundwater results from samples within this location were well below the NYSDEC Commercial/Industrial and SGV standards. The material within this structure should be characterized for off-site disposal. Additionally, the presence or absence of potential soil, groundwater, and vapor impacts should be determined.

PAOC 2: Storm Water Vault

Ethylbenzene was identified on the 57-00 parcel during Langan's November 2021 Phase II ESI in a groundwater sample collected from the temporary well TW-1 at a concentration of 8.6 ug/L, which is greater than the NYSDEC SGV for ethylbenzene of 5 ug/L. Temporary well TW-1 was located down-gradient of a storm water vault that receives discharge water from an oil/water separator located inside the 57-00 building. The oil/water separator the presumed source of toluene impacted groundwater in that area of the Site.

PAOC 3: On-Site Historical Use

The Site has been occupied by a variety of industrial and commercial businesses since circa 1902 Most notably, the Site has been occupied by a fertilizer works, an oil depot, a truck repair and parking operation, a motor freight station, vehicle maintenance, equipment/materials staging and a concrete recycling company. Previous studies have identified groundwater to contain VOCs, SVOCs, and total and dissolved metals greater than their respective TOGS SGVs. Soil was identified to contain VOCs, SVOCs, and metals greater than one or more of the following SCOs-Protection of Groundwater, Commercial Use, and Industrial Use. These exceedances may be related to these historical Site uses. Additional investigation is necessary to further evaluate whether these historical Site uses have impacted subsurface conditions on the Site.

PAOC 4: Vapor Intrusion

A vapor intrusion investigation was completed May 12, 2022 which included five sub-slab and five co-located indoor air samples along with an ambient air sample. Three of these samples were collected within building 57-00 (Block 2601 Lot 6) and two of these samples were collected within building 57-05 (Block 2602 Lot 72). Soil vapor samples are included as **Figure 4.**

When evaluating sub-slab vapor and indoor air samples from within the 57-00 (Block 2601, Lot 6) building using the NYSDOH Matrices, the recommended outcome is 'mitigate'. When evaluating sub-slab vapor and indoor air samples from within the 57-05 building using the NYSDOH Matrices, the recommended outcome is 'no further action'. Additional investigation is necessary to determine the source of CVOC impacts in the 57-00 building. Further, VOCs were identified in soil and groundwater in other areas of the Site that are not improved by buildings. A soil vapor investigation is necessary in these unimproved areas to understand if VOCs detected in soil and groundwater are impacting soil vapor.

PAOC 5: Petroleum Impacts Associated with Former Underground Storage Tank B

A 3,500-gallon diesel UST was removed from the 57-05 parcel on February 21, 2022. Upon removal of the tank, soil staining and petroleum-like odors were identified in soil and concrete surrounding the tank. Five soil samples were collected from the sidewalls and center base of the tank grave in accordance with DER-10.

One post-excavation soil sample (USTB-4) contained benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and ideno(1,2,3-cd)pyrene at concentrations greater than Commercial Use and Industrial Use SCOs. Based on these results, a spill was reported to the NYSDEC and Spill No. 211-05-17 was assigned to the release.

PAOC 6: Semivolatile Organic Compound Impacts

SVOCs were identified in soil on the 57-00 and 58-20 parcels at concentrations greater than Industrial Use and/or Commercial Use SCOs, including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, dibenzo(a,h)anthracene, and ideno(1,2,3-cd)pyrene. The soil sample location and associated laboratory data are depicted as **Figure 2**. Since select PAHs were detected in soil sample SB07 at concentrations above the Commercial and Industrial SCOs and at higher concentrations than what is typically detected in urban or historic fill material, additional investigation is warranted.

PAOC 7: Metal Impacts

Area 1

Metals have been detected in soil throughout the Site at concentrations greater than Industrial Use and/or Commercial Use SCOs, including arsenic, lead, and mercury. Notably, arsenic was detected soil sample SB10 during the July 2021 Phase II ESI at a concentration of 276 mg/kg and in soil sample LB-10 during the December 2021 Phase II ESI at a concentration of 1,900 mg/kg (the Commercial Use and Industrial Use SCOs are 16 mg/kg for arsenic). Mercury was also identified in LB-10 at a concentration of 6.5 mg/kg (the Commercial Use and Industrial Use SCOs are 2.8 and 5.7 mg/kg, respectively). Soil metal exceedances are depicted in **Figure 2**.

3.0 SCOPE OF WORK

The objective of this RIWP is to investigate and attempt to characterize the nature and extent of the contamination at and/or emanating from the Site in accordance with Environmental Conservation Law (ECL) Article 27, Title 14 (Brownfield Cleanup Program), 6 NYCRR 375-3 and DER-10. The rationale for each sampling location in relation to the PAOCs and analytical parameters for each proposed sample are provided in **Table 1**. The field tasks are discussed in more detail in the following sections.

Soil Borings and Sampling

- Advance up to thirty-five soil borings to at least two feet into native soil or at least four feet below the groundwater table (estimated at about fifteen feet bgs), whichever is deeper. See **Figures 6** and **6B** for planned boring locations.
- Collect up to three soil samples from each boring location, for up to one hundred soil samples (plus quality assurance/quality control [QA/QC] samples) for laboratory analysis.

Monitoring Well Installation and Sampling

- Install and develop eight groundwater monitoring wells. See **Figures 6** and **6B** for planned monitoring well locations.
- Collect one groundwater sample from all monitoring wells (plus QA/QC samples) for laboratory analysis.
- Survey and gauge monitoring wells to evaluate groundwater elevations and flow direction.

Soil Vapor Sampling

- Install one confirmatory co-located sub-slab soil vapor and indoor air sample within the 57-00 building. See **Figure 6** for the planned location.
- Collection of six soil vapor points to at least two feet above the groundwater table.
- Collect one soil vapor sample from each point for laboratory analysis.
- Collect one outdoor ambient air sample concurrently with soil vapor samples.

Modifications to this scope of work may be required: 1) due to Site operations, equipment or restrictions; 2) in the event that unexpected contamination is detected and additional analytical data is needed; and 3) to attempt to adequately characterize and delineate impacts in compliance with the Brownfield Cleanup Program, regulations and applicable investigation guidance documents (e.g., DER-10). NYSDEC will be contacted to obtain approval for these modifications.

The field investigation will be completed using the guidelines in the DER-10, 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 personnel, project managers, and subcontractors are listed below. The HASP (**Appendix B**) contains emergency contact information (HASP Table 5) and a map with a route to the nearest hospital (HASP Figure 2). Resumes for Langan employees involved in the project are included in the QAPP (**Appendix C**).

Personnel	Investigation Role	Contact Information
Rory Johnston, PE Langan Engineering	Remedial Engineer/Qualified Environmental Professional	Phone – (908) 202-1407 Email – rjohnston@langan.com
Alan Arico Langan Engineering	Project Manager	Phone – (973) 524-8124 Email – mailto:aarico@langan.com
Tony Moffa, CHMM Langan Engineering	Langan Health & Safety Officer	Phone – (215) 756-2523 Email – tmoffa@langan.com
Rebekah Diehl Langan Engineering	Field Safety Officer	Phone – (570) 213-9020 Email – rdiehl@langan.com
Rebekah Diehl Langan Engineering	Field Team Leader	Phone – (570) 213-9020 Email – mailto:rdiehl@langan.com
Mimi Raygorodetsky Langan Engineering	Quality Assurance Officer	Phone – (212) 479-5441 Email – mailto:mraygorodetsky@langan.com
Ben Rao Alpha Analytical	Laboratory Contractor	Phone – (201) 847-9100 Email – brao@alphalab.com
Joe Conboy Langan Engineering	Data Validator/Program Quality Assurance Monitor	Phone – (609) 282-8055 Email – jconboy@langan.com

3.1 Geophysical Survey

Geophysical activities were completed across the entirety of the Site during Phase II ESI activities completed in November 2021. During this geophysical, subsurface utilities were marked out in spray paint, additionally, utility maps were created. New subsurface utilities have not been installed since the last completed geophysical survey, therefore an additional geophysical survey will not be completed.

3.2 Soil Investigation

3.2.1 Drilling and Logging

An environmental drilling subcontractor will advance up to a total of thirty-five soil borings to further investigate the PAOCs identified in Section 2.5. All samples collected ten feet from the center boring will have an analytical hold pending laboratory results from samples collected five

feet from the center location. The soil borings will be advanced to at least two feet into native soil or at least four feet below the groundwater table (estimated at about fifteen feet bgs), whichever is deeper, using direct-push drilling technology. Plans showing the proposed boring locations is included as **Figures 6 and 6B**. In the event that field indications of contamination or suspect buried structures are encountered (e.g., sump pits, trenches, drains, etc.), additional soil borings may be advanced, or other planned borings may be relocated to those areas. Langan field staff will document the work, screen the soil samples for environmental impacts, and collect samples for laboratory analysis. Soil will be screened continuously to the boring termination depth with a PID equipped with a 10.6 electron volt (eV) bulb and for visual and olfactory evidence of environmental impacts (e.g., staining and odor). Soil descriptions will be recorded in a field log.

Non-disposable, down-hole drilling equipment and sampling apparatus will be decontaminated between locations with Alconox® (or similar) and water where grossly impacted material is identified. Soil borings will be backfilled with soil cuttings from soil borings and a bentonite-grout slurry between the water table and grade surface.

3.2.2 Soil Sampling and Analysis

Two to three soil samples will be collected for laboratory analysis per boring. The soil samples will be collected in laboratory-supplied containers and will be sealed, labeled, and placed in a cooler containing ice (to attempt to maintain a temperature of approximately 4 degrees Celsius) for delivery to a NYSDOH Environmental Laboratory Approval Program (ELAP)-certified analytical laboratory.

Soil samples collected from borings 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 8270D Select Ion Monitoring [SIM] isotope dilution);
- Polychlorinated biphenyls (PCBs) by USEPA Method 8082A;
- TAL metals (including cyanide, trivalent chromium, and hexavalent chromium) by USEPA Methods 6010C/7471B/9010C/7196A;
- Pesticides and herbicides by USEPA methods 8081B and 8151A; and
- Per- and poly-fluoroalkyl substances (PFAS) compound list and analysis as per June 2021 NYSDEC Sampling, Analysis, and Assessment of PFAS.

The proposed soil sample analyses are summarized in **Table 1**. A list of the emerging contaminants for soil samples are provided in **Table 2**. QA/QC procedures are described in the QAPP provided As **Appendix C**.

3.3 Groundwater Investigation

3.3.1 Monitoring Well Installation

Eight monitoring wells will be installed on the Site. During well installation, soil conditions will be screened, logged and sampled as described in Section 3.2. Proposed monitoring well locations are depicted in **Figures 6** and **6B**.

The proposed monitoring wells will be constructed utilizing 4-inch diameter polyvinyl chloride (PVC) riser pipe with 10-foot long, and 0.01-inch slotted screens. The proposed monitoring wells will be installed so that the well screen straddles the observed groundwater table. The well annulus around the slotted screen will be a minimum of 8-inch-diameter and will be backfilled with clean sand to about 2 feet above the top of the screen. A minimum 1-foot bentonite seal will be installed above the sand placed within the screen area. The monitoring wells will be finished with flush-mounted metal manhole covers set in concrete.

Following installation, the monitoring wells will be developed via surge and purge method. This method involves the use of a whale pump pushed up and down the water column in the well screen to agitate and remove fine particles. The pump will be surged across the well screen in 2- to 3-foot increments for approximately 2 minutes per increment. Following surging, groundwater will be removed from the well until clear (having turbidity under approximately 50 Nephelometric Turbidity Units [NTU]). Groundwater evacuated from the well will be containerized and removed from the Site. Groundwater sampling will be completed following a one week stabilization period.

3.3.2 Groundwater Sampling and Analysis

Prior to sampling, the headspace of each well will be monitored with a PID. In addition, the monitoring wells will be gauged for static water levels and each well will be purged. Physical and chemical parameters (e.g., temperature, dissolved oxygen, oxygen reduction potential, pH, turbidity) will be allowed to stabilize to the ranges specified in the USEPA Low Stress Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells, dated July 30, 1996 and Revised September 19, 2017. Samples will be collected with a submersible monsoon pump or similar pump with polyethylene tubing. The pump will be decontaminated with Alconox® and water between each sample location. Development and purge water will be containerized for off-site disposal.

One groundwater sample will be collected from each monitoring well for a total of four groundwater samples, plus additional QA/QC samples. Groundwater samples will not be collected from monitoring wells containing NAPL, if present. Groundwater sampling will comply with NYSDEC DER-10 3.7.2 (c)(6). The samples will be collected in laboratory-supplied containers and will be sealed, labeled, and placed in a cooler containing ice (to attempt to maintain a

temperature of approximately 4 degrees Celsius) for delivery to a NYSDOH ELAP-certified analytical 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 8270D Select Ion Monitoring [SIM] isotope dilution);
- Polychlorinated biphenyls (PCBs) by USEPA Method 8082A;
- TAL metals (including cyanide, trivalent chromium, and hexavalent chromium) by USEPA Methods 6010C/7471B/9010C/7196A;
- Pesticides and herbicides by USEPA methods 8081B and 8151A; and
- Per- and poly-fluoroalkyl substances (PFAS) compound list and analysis as per June 2021 NYSDEC Sampling, Analysis, and Assessment of PFAS.

The proposed groundwater sample analyses are summarized in **Table 1**. A list of the emerging contaminants for soil samples are provided in **Table 2**. QA/QC procedures are described in the QAPP provided as **Appendix C**.

3.3.3 Monitoring Well Survey and Synoptic Gauging

Langan will survey the elevation of the monitoring wells, including ground surface elevation, outer casing elevation, and inner casing elevation. This data will be used with the groundwater well gauging data to prepare a sample location plan and a groundwater contour map depicting the elevation of the water table across the Site. Vertical control will be established by surveying performed relative to North American Vertical Datum of 1988 (NAVD88) by a New York State-licensed land surveyor. Elevations of the top of monitoring well casings and protective well casings will be surveyed to the nearest 0.01 foot. A synoptic gauging event will be performed to document static water levels. All accessible wells will surveyed and gauged to evaluate groundwater elevations and flow direction.

3.5 Soil Vapor Investigation

3.5.1 Soil Vapor Point Installation

One sub-slab soil vapor point with one co-located indoor air sample (SSV03 and IA03) will be installed within the 57-00 building. Six soil vapor points will be installed at least two feet above the water table within proposed monitoring well locations (SV01 through SV06) on the 57-00 and 57-05 parcels. One ambient air sample will be collected each time sub-slab or soil vapor samples are collected. All vapor related sampling will be installed in accordance with the NYSDOH "Guidance for Evaluating Soil Vapor Intrusion in the State of New York, with updates" (October

2006, with updates). The vapor collection points will consist of inert sample tubing attached to a 1.875-inch polyethylene implant. The annulus (i.e., the sampling zone) around the installed implants and/or tubing will be filled with a clean, coarse sand pack followed by a hydrated bentonite seal to surface grade. Sample locations and are depicted on **Figures 6 and 6B**.

3.5.2 Soil Vapor Sampling and Analysis

Samples will be collected in general accordance with the NYSDOH Guidance. Before collecting vapor samples, 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. Purged soil vapor will be monitored for VOCs and methane with the MultiRAE® during this process.

A helium tracer gas will be used in accordance with NYSDOH protocols to serve as a QA/QC technique to document the integrity of each soil vapor point seal before and after sampling. The tracer gas will be introduced into a container surrounding 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 outside air infiltration.

After integrity of each seal is confirmed, soil vapor samples will be collected concurrently with ambient air samples (AA01+) into laboratory-supplied, batch-certified clean 2.7- or 6-liter Summa® canisters with calibrated flow controllers, and collected over a 2-hour sampling period.

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.

All vapor samples will be analyzed for VOCs by USEPA Method TO-15. The proposed vapor sample analyses are summarized in Table 1. QA/QC procedures to be followed are described in the QAPP provided in **Appendix C**.

3.7 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
- Verification of the identification of sample results (both positive hits and non-detects)
- Recalculation of 10% 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**.

3.8 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
- 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. Excess investigation-derived waste (IDW), including soil cuttings, purged groundwater, and decontamination fluids, will be containerized in

properly-labeled and sealed United Nations/Department of Transportation (UN/DOT)-approved 55-gallon drums and staged for future waste characterization and off-site disposal at a facility permitted to accept the waste. All drums will be properly labeled, sealed, and characterized as necessary. If RI analytical data is insufficient to gain disposal facility acceptance, additional waste characterization samples will be collected. Additional sampling and analyses may be required based on the selected disposal facility. Waste characterization samples will be submitted to by a NYSDOH ELAP-approved laboratory for analysis in accordance with the QAPP provided in **Appendix C**. Management of IDW will comply with NYSDEC DER-10 3.3(e).

3.9 Air Monitoring

Air monitoring will be conducted for Site workers and the community during soil intrusive activities. Air monitoring results will be recorded in the field book during the investigation activities. Fugitive particulate (dust) generation that could affect Site workers or the community is not expected for the following reasons:

- Most of the work area is 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.

3.9.1 Worker Air Monitoring

Air monitoring of the breathing zone will be performed periodically during ground intrusive activities to document health and safety protection for the Langan team. Langan will monitor VOCs with a PID in accordance with the HASP (**Appendix B**). Subcontractors are responsible for their own health and safety and their monitoring procedures must, at a minimum, adhere to the HASP. If air monitoring during intrusive operations identifies the presence of VOCs, the field engineer will follow the guidelines outlined in the HASP regarding action levels, permissible exposure, engineering controls, and personal protective equipment. If the VOC 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.

3.9.2 Community Air Monitoring Plan

In addition to air monitoring in the worker breathing zone, community air monitoring will be performed in compliance with the NYSDOH Generic Community Air Monitoring Plan (CAMP)

during any outdoor intrusive work or during indoor intrusive where potential exists for outdoor exposure (e.g., indoor drilling activities performed adjacent to an open door or window). CAMP deployment will comply with NYSDEC DER-10 Appendix 1A and 1B.

Langan will conduct periodic monitoring for VOCs 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, when bailing/purging a well, as well as upon departure from the location.

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. The results will be presented in the daily reports (see DER-10 for details).

3.10 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 included in the Remedial Investigation Report (RIR).

3.11 Fish and Wildlife Resource Impact Analysis

The NYSDEC Fish and Wildlife Resource Impact Analysis Decision Key (Appendix 3C of NYSDEC DER-10) was consulted in determining if the Site is subject to a Fish and Wildlife Impact Analysis. It was determined that contamination at the Site does not have a potential to migrate, erode into, or otherwise impact any on-site or off-site habitats of endangered, threatened, or special concern species or other fish and wildlife resources. This determination was made based on the fact that, according to the NYSDEC EAF Mapper, Newtown Creek does not contain endangered, threatened, or special concern species or other fish and wildlife resources.

4.0 REPORTING

4.1 Daily Field Reports

Daily reports will be prepared and submitted to the NYSDEC and NYSDOH project managers by the end of each day following the reporting period and will include:

- An update of progress made during the reporting day
- Photographic documentation of the activities completed during the reporting day
- Identification of samples collected during the reporting day
- Locations and references to a Site map for completed activities
- A summary of any and all complaints with relevant details, including contact information
- A summary of CAMP findings, including elevated concentrations and response actions, if any
- An explanation of notable Site conditions, if any
- A list of anticipated work for the following reporting day

Daily reports are not intended to notify the NYSDEC of emergencies (e.g., accident, spill), request changes to the RIWP, or communicate other sensitive or time-critical information. However, such conditions will also be included in the daily reports. Emergency conditions and changes to the RIWP will be communicated directly to the NYSDEC Project Manager. An example of the Daily Field Report is included as **Appendix D**.

4.2 Remedial Investigation Report

Following completion of the RI and receipt of analytical data, an RIR will be prepared. The report will include:

- A summary of the Site history and previous investigations
- A description of Site conditions
- Sampling methodology and field observations
- An evaluation of the results and findings
- Conclusions and recommendations for any further assessment (if warranted)

The report will summarize the nature and extent of contamination for each PAOC and identify complete and potentially complete exposure pathways (as determined through the qualitative human health exposure assessment [QHHEA]). DUSRs will be included in the RIR and electronic data deliverables will be submitted to the NYSDEC EQuIS database prior to submission of the draft RIR.

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 applicable Standards, Criteria, and Guidance (SCG) pertaining to the Site and contaminants of concern for comparison. The report will include scaled figures showing the locations of soil borings, monitoring wells, and soil vapor points, sample concentrations above SCGs for each media, groundwater elevation contours and flow direction, and, if appropriate, groundwater contaminant concentration contours.

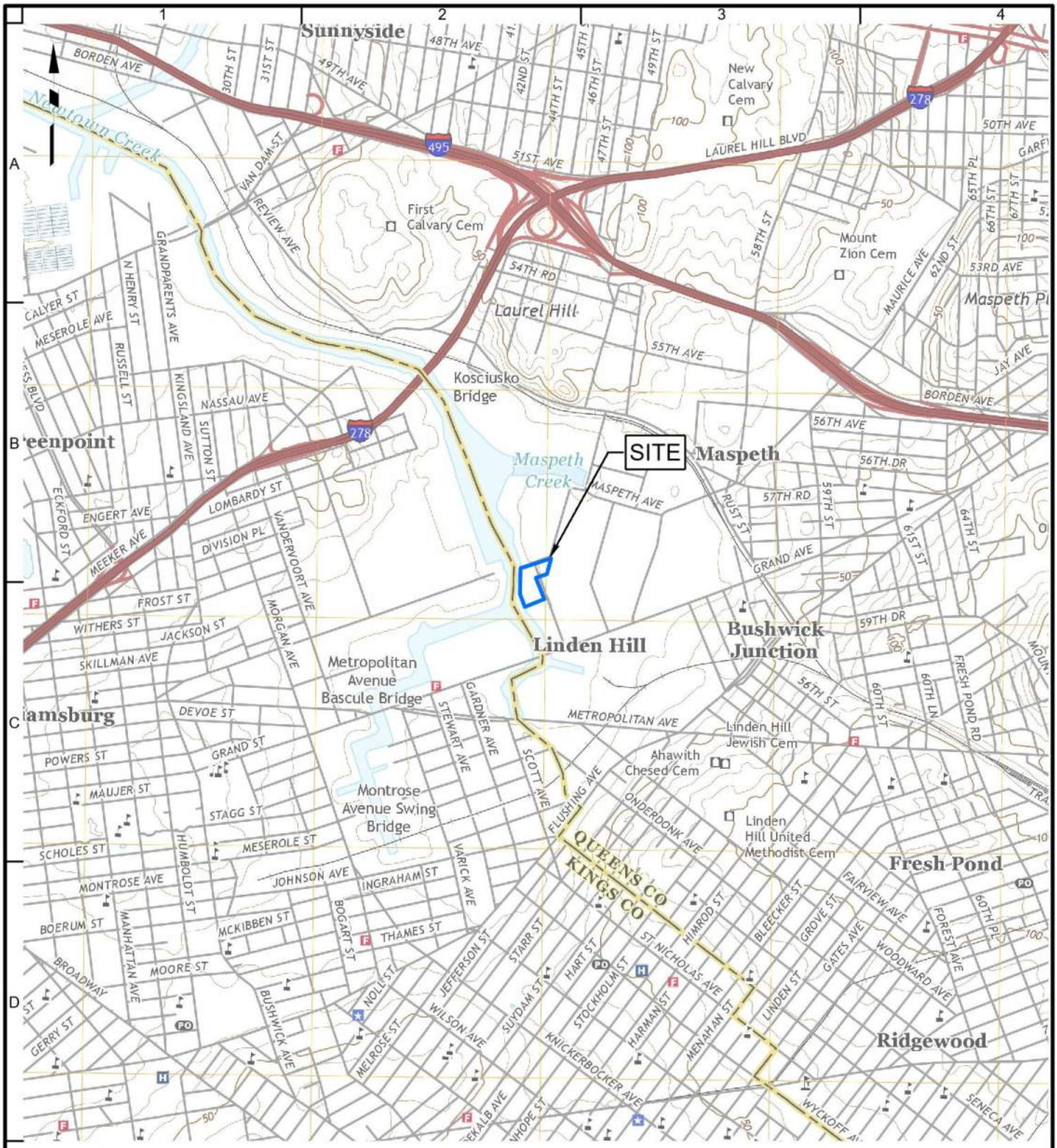
Soil analytical results will be compared to the Part 375 Unrestricted Use, Commercial Use and Industrial Use SCOs. Groundwater analytical results will be compared to the NYSDEC TOGS SGVs for Class GA water, the maximum contaminant level (MCL) (drinking water standard) of 1,4-dioxane, and the screening levels set forth in the NYSDEC Part 375 Remedial Programs guidance for Sampling, Analysis, and Assessment of PFAS. (January 2021). Soil vapor results will be evaluated using the NYSDOH Decision Matrices. The RIR will be provided in an electronic format to the NYSDEC.

5.0 SCHEDULE

The table below presents an anticipated schedule for the proposed RI and reporting following RIWP approval. If the schedule changes, it will be updated and submitted to the NYSDEC.

Schedule Milestone	Duration (weeks)	Weeks from Approval of RIWP
Mobilization	2	2
Field Work (drilling, well installation, surveying, sampling)	3	5
Lab Analysis	5	10
Report Preparation and Submittal	8	18

FIGURES



Legend

Approximate Site Boundary

2,000 0 2,000

SCALE IN FEET

NOTES:
1. BASEMAP ADAPTED FROM UNITED STATES GEOLOGICAL SURVEY (USGS) 7.5-MINUTE SERIES TOPOGRAPHICAL MAPS, BROOKLYN, NEW YORK, QUADRANGLE.

LANGAN

21 Penn Plaza, 360 West 31st Street, 8th Floor
New York, NY 10001-2727
T: 212.479.5400 F: 212.479.5444 www.langan.com

Langan Engineering & Environmental Services, Inc.
Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.
Langan International LLC

Collectively known as Langan

Project

57-00, 57-05 and 58-20 47th Street

BLOCK Nos. 2601; 2602
LOT Nos. 1 and 6; 72

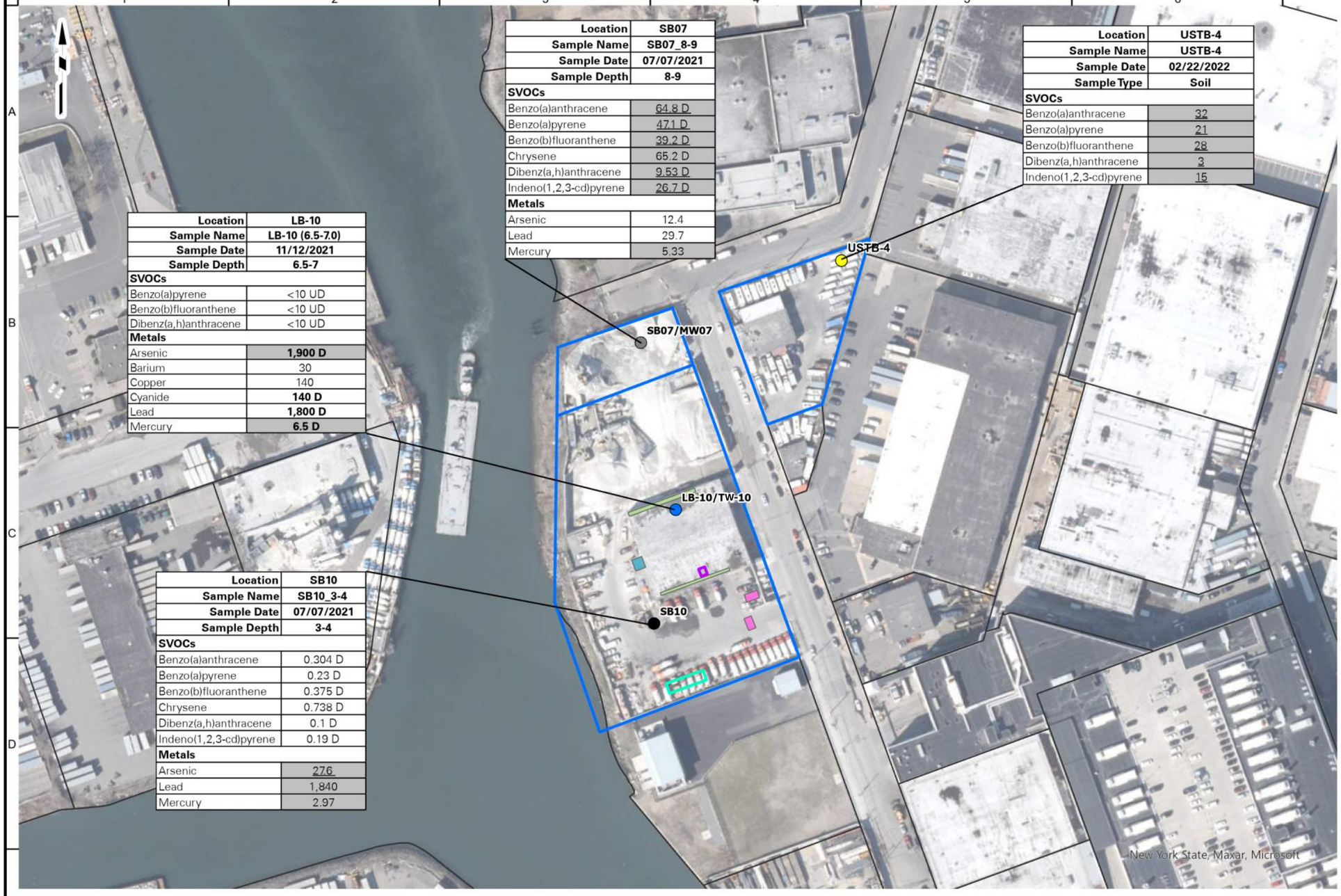
QUEENS NEW YORK

Figure Title

SITE LOCATION MAP

Project No. 100965501	Figure No. 1
Date 3/21/2022	
Scale 1"=2,000'	
Drawn By MG	
Submission Date	

Path: \\langan.com\data\PAR\data5\100965501\Project Data\ArcGIS\APRX\100965501\100965501.aprx Date: 3/21/2022 User: mgeorgalas Time: 4:15 PM



Location	SB07
Sample Name	SB07_8-9
Sample Date	07/07/2021
Sample Depth	8-9
SVOCs	
Benzo(a)anthracene	64.8 D
Benzo(a)pyrene	47.1 D
Benzo(b)fluoranthene	39.2 D
Chrysene	65.2 D
Dibenz(a,h)anthracene	9.53 D
Indeno(1,2,3-cd)pyrene	26.7 D
Metals	
Arsenic	12.4
Lead	29.7
Mercury	5.33

Location	USTB-4
Sample Name	USTB-4
Sample Date	02/22/2022
Sample Type	Soil
SVOCs	
Benzo(a)anthracene	32
Benzo(a)pyrene	21
Benzo(b)fluoranthene	28
Dibenz(a,h)anthracene	3
Indeno(1,2,3-cd)pyrene	15

Location	LB-10
Sample Name	LB-10 (6.5-7.0)
Sample Date	11/12/2021
Sample Depth	6.5-7
SVOCs	
Benzo(a)pyrene	<10 UD
Benzo(b)fluoranthene	<10 UD
Dibenz(a,h)anthracene	<10 UD
Metals	
Arsenic	**1,900 D**
Barium	30
Copper	140
Cyanide	**140 D**
Lead	**1,800 D**
Mercury	**6.5 D**

Location	SB10
Sample Name	SB10_3-4
Sample Date	07/07/2021
Sample Depth	3-4
SVOCs	
Benzo(a)anthracene	0.304 D
Benzo(a)pyrene	0.23 D
Benzo(b)fluoranthene	0.375 D
Chrysene	0.738 D
Dibenz(a,h)anthracene	0.1 D
Indeno(1,2,3-cd)pyrene	0.19 D
Metals	
Arsenic	276
Lead	1,840
Mercury	2.97

Legend

- Soil Boring Location (July 2021)
- Soil Boring/ Temporary Monitoring Well Location (July 2021)
- Underground Storage Tank Sample Location
- Approximate Site Boundary
- Tax Parcels
- Stormwater infiltration basins
- AST Room
- Floor Trenches and Pits
- Oil Water Separator
- UST Grave

Analyte	NYSDEC Part 375 Restricted Use Commercial SCOs	NYSDEC Part 375 Restricted Use Industrial SCOs
SVOCs		
Benzo(a)anthracene	5.6	11
Benzo(a)pyrene	1	1.1
Benzo(b)fluoranthene	5.6	11
Chrysene	56	110
Dibenz(a,h)anthracene	0.56	1.1
Indeno(1,2,3-cd)pyrene	5.6	11
Metals		
Arsenic	16	16
Lead	1000	3900
Mercury	2.8	5.7

Exceedance Summary:

10 - Result exceeds Restricted Use Commercial SCOs

10 - Result exceeds Restricted Use Industrial SCOs

NOTES:
1. WORLD IMAGERY BASEMAP PROVIDED THROUGH LANGAN'S SUBSCRIPTION TO ESRI'S ARCGIS SOFTWARE LICENSING.
2. ALL SITE FEATURES ARE APPROXIMATE.

150 0 150
SCALE IN FEET

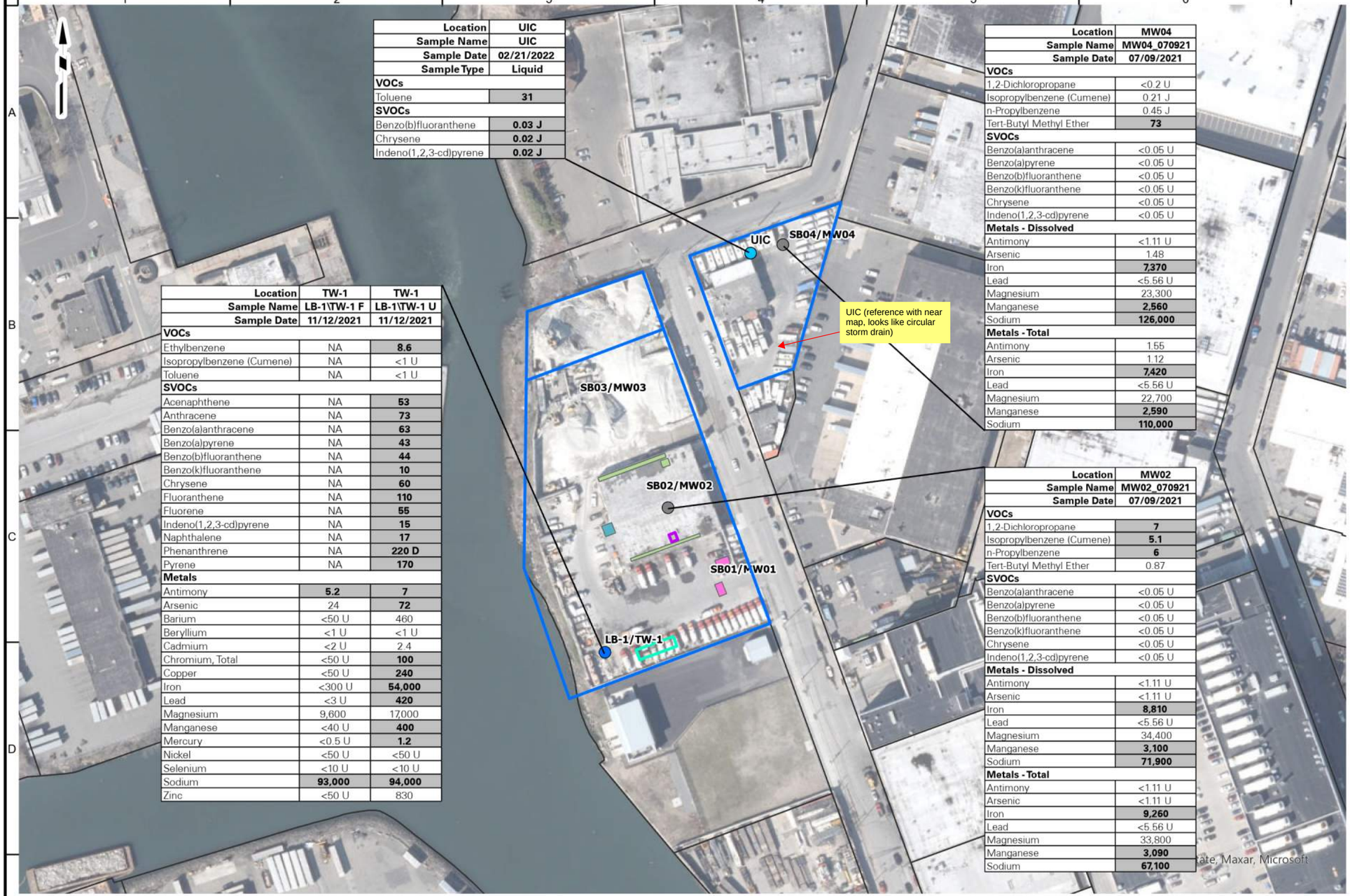
LANGAN
Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.
21 Penn Plaza, 360 West 31st Street, 8th Floor
New York, NY 10001
T: 212.479.5400 F: 212.479.5444 www.langan.com

Project
57-00, 57-05 and 58-20 47th Street
BLOCK Nos. 2601; 2602
LOT Nos. 1 and 6; 72
QUEENS NEW YORK

Figure Title
HISTORIC SOIL SAMPLE LOCATIONS AND ANALYTICAL DATA

Project No. 100965501
Date 4/1/2022
Scale 1"=150'
Drawn By AR
Figure No. 2

Path: C:\Users\Aruane\Documents\Project Work\WorkFromHome-Covid\100965501\APRX\170686701\170686701.aprx Date: 4/1/2022 User: aruane Time: 12:20 PM



Location	UIC
Sample Name	UIC
Sample Date	02/21/2022
Sample Type	Liquid
VOCs	
Toluene	**31**
SVOCs	
Benzo(b)fluoranthene	**0.03 J**
Chrysene	**0.02 J**
Indeno(1,2,3-cd)pyrene	**0.02 J**

Location	TW-1	TW-1
Sample Name	LB-1\TW-1 F	LB-1\TW-1 U
Sample Date	11/12/2021	11/12/2021
VOCs		
Ethylbenzene	NA	**8.6**
Isopropylbenzene (Cumene)	NA	<1 U
Toluene	NA	<1 U
SVOCs		
Acenaphthene	NA	**53**
Anthracene	NA	**73**
Benzo(a)anthracene	NA	**63**
Benzo(a)pyrene	NA	**43**
Benzo(b)fluoranthene	NA	**44**
Benzo(k)fluoranthene	NA	**10**
Chrysene	NA	**60**
Fluoranthene	NA	**110**
Fluorene	NA	**55**
Indeno(1,2,3-cd)pyrene	NA	**15**
Naphthalene	NA	**17**
Phenanthrene	NA	**220 D**
Pyrene	NA	**170**
Metals		
Antimony	**5.2**	**7**
Arsenic	24	**72**
Barium	<50 U	460
Beryllium	<1 U	<1 U
Cadmium	<2 U	2.4
Chromium, Total	<50 U	**100**
Copper	<50 U	**240**
Iron	<300 U	**54,000**
Lead	<3 U	**420**
Magnesium	9,600	17,000
Manganese	<40 U	**400**
Mercury	<0.5 U	**1.2**
Nickel	<50 U	<50 U
Selenium	<10 U	<10 U
Sodium	**93,000**	**94,000**
Zinc	<50 U	830

Location	MW04
Sample Name	MW04_070921
Sample Date	07/09/2021
VOCs	
1,2-Dichloropropane	<0.2 U
Isopropylbenzene (Cumene)	0.21 J
n-Propylbenzene	0.45 J
Tert-Butyl Methyl Ether	**73**
SVOCs	
Benzo(a)anthracene	<0.05 U
Benzo(a)pyrene	<0.05 U
Benzo(b)fluoranthene	<0.05 U
Benzo(k)fluoranthene	<0.05 U
Chrysene	<0.05 U
Indeno(1,2,3-cd)pyrene	<0.05 U
Metals - Dissolved	
Antimony	<1.11 U
Arsenic	1.48
Iron	**7,370**
Lead	<5.56 U
Magnesium	23,300
Manganese	**2,560**
Sodium	**126,000**
Metals - Total	
Antimony	1.55
Arsenic	1.12
Iron	**7,420**
Lead	<5.56 U
Magnesium	22,700
Manganese	**2,590**
Sodium	**110,000**

Location	MW02
Sample Name	MW02_070921
Sample Date	07/09/2021
VOCs	
1,2-Dichloropropane	**7**
Isopropylbenzene (Cumene)	**5.1**
n-Propylbenzene	**6**
Tert-Butyl Methyl Ether	0.87
SVOCs	
Benzo(a)anthracene	<0.05 U
Benzo(a)pyrene	<0.05 U
Benzo(b)fluoranthene	<0.05 U
Benzo(k)fluoranthene	<0.05 U
Chrysene	<0.05 U
Indeno(1,2,3-cd)pyrene	<0.05 U
Metals - Dissolved	
Antimony	<1.11 U
Arsenic	<1.11 U
Iron	**8,810**
Lead	<5.56 U
Magnesium	34,400
Manganese	**3,100**
Sodium	**71,900**
Metals - Total	
Antimony	<1.11 U
Arsenic	<1.11 U
Iron	**9,260**
Lead	<5.56 U
Magnesium	33,800
Manganese	**3,090**
Sodium	**67,100**

Legend

- Soil Boring / Temporary Well Point Location (November 2021)
- Underground Injection Control Unit Sample Location
- July 2021 Soil Borings/Temporary Monitoring Well Locations (July 2021)
- Approximate Site Boundary
- Tax Parcels
- Stormwater infiltration basins
- AST Room
- Floor Trenches and Pits
- Oil Water Separator
- UST Grave

Analyte	NYSDEC SGVs
VOCs	
1,2-Dichloropropane	1
Isopropylbenzene (Cumene)	5
n-Propylbenzene	5
Tert-Butyl Methyl Ether	10
SVOCs	
Benzo(a)anthracene	0.002
Benzo(a)pyrene	0
Benzo(b)fluoranthene	0.002
Benzo(k)fluoranthene	0.002
Chrysene	0.002
Indeno(1,2,3-cd)pyrene	0.002
Metals - Dissolved	
Antimony	3
Arsenic	25
Iron	300
Lead	25
Magnesium	35000
Manganese	300
Sodium	20000
Metals - Total	
Antimony	3
Arsenic	25
Iron	300
Lead	25
Magnesium	35000
Manganese	300
Sodium	20000

Exceedance Summary:

10 - Result exceeds NYSDEC SGVs

NOTES:
1. WORLD IMAGERY BASEMAP PROVIDED THROUGH LANGAN'S SUBSCRIPTION TO ESRI'S ARCGIS SOFTWARE LICENSING.
2. ALL SITE FEATURES ARE APPROXIMATE.

150 0 150
SCALE IN FEET

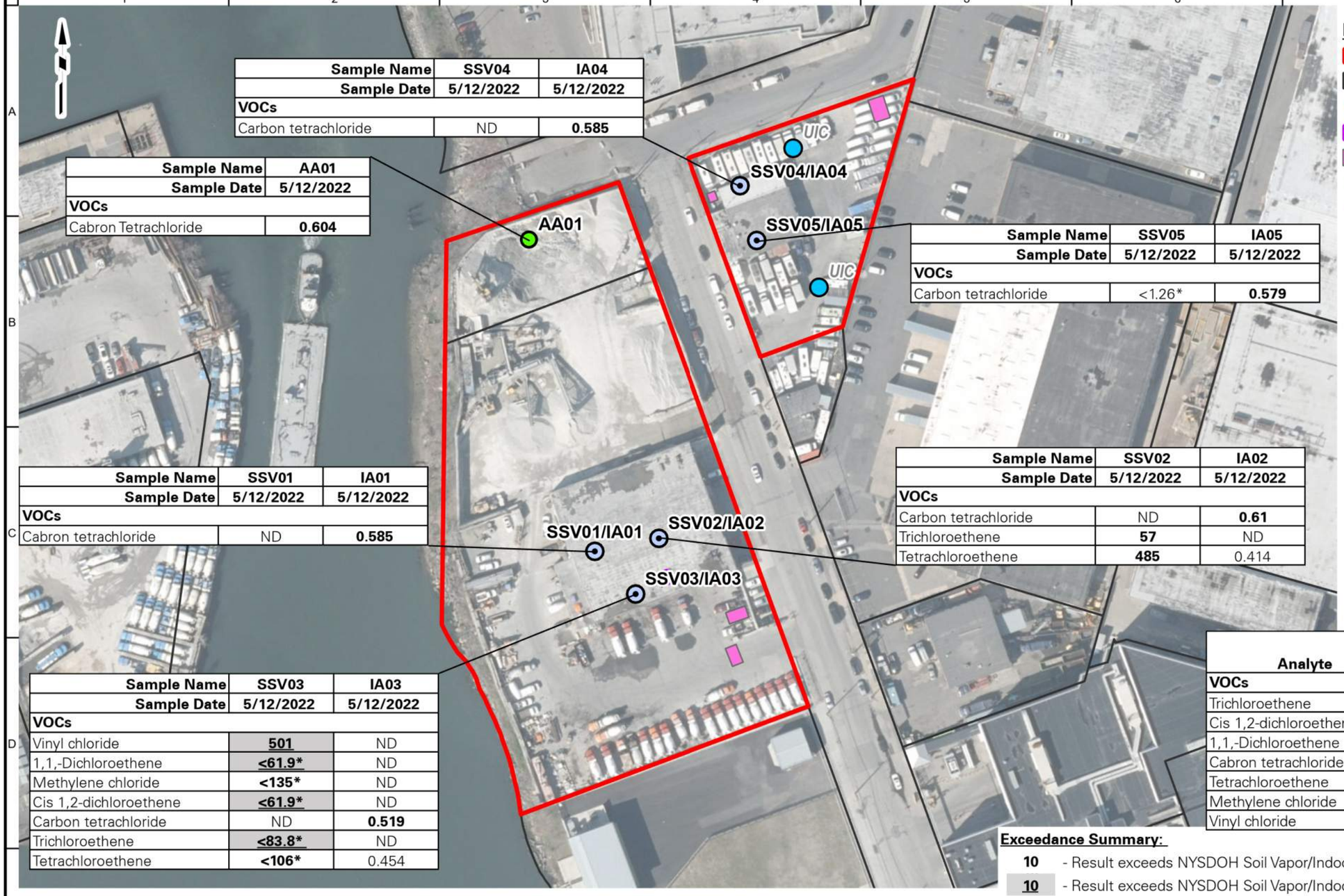
LANGAN
Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.
21 Penn Plaza, 360 West 31st Street, 8th Floor
New York, NY 10001
T: 212.479.5400 F: 212.479.5444 www.langan.com

Project
57-00, 57-05 and 58-20 47th Street
BLOCK Nos. 2601; 2602
LOT Nos. 1 and 6; 72
QUEENS NEW YORK

Figure Title
HISTORIC GROUNDWATER SAMPLE LOCATIONS AND ANALYTICAL DATA

Project No. 100965501
Date 4/1/2022
Scale 1"=150'
Drawn By AR
Figure No. 3

Path: C:\Users\Aruane\Documents\Project Work\WorkFromHome-Covid\100965501\APRX\170686701\170686701.aprx Date: 4/1/2022 User: aruane Time: 12:07 PM



Sample Name	SSV04	IA04
Sample Date	5/12/2022	5/12/2022
VOCs		
Carbon tetrachloride	ND	**0.585**

Sample Name	AA01
Sample Date	5/12/2022
VOCs	
Cabron Tetrachloride	**0.604**

Sample Name	SSV05	IA05
Sample Date	5/12/2022	5/12/2022
VOCs		
Carbon tetrachloride	<1.26*	**0.579**

Sample Name	SSV01	IA01
Sample Date	5/12/2022	5/12/2022
VOCs		
Cabron tetrachloride	ND	**0.585**

Sample Name	SSV02	IA02
Sample Date	5/12/2022	5/12/2022
VOCs		
Carbon tetrachloride	ND	**0.61**
Trichloroethene	**57**	ND
Tetrachloroethene	**485**	0.414

Sample Name	SSV03	IA03
Sample Date	5/12/2022	5/12/2022
VOCs		
Vinyl chloride	**501**	ND
1,1,-Dichloroethene	**<61.9***	ND
Methylene chloride	**<135***	ND
Cis 1,2-dichloroethene	**<61.9***	ND
Carbon tetrachloride	ND	**0.519**
Trichloroethene	**<83.8***	ND
Tetrachloroethene	**<106***	0.454

Legend

- Approximate Site Boundary
- Tax Parcels
- Underground Injection Control Unit
- Oil Water Separator
- Former Underground Storage Tank
- Ambient Air Sample Location
- Soil Vapor/Indoor Air Sample Location

Analyte	NYSDOH Decision Matrix (IA)		NYSDOH Decision Matrix (SSV)	
VOCs				
Trichloroethene	0.2	1	6	60
Cis 1,2-dichloroethene	0.2	1	6	60
1,1,-Dichloroethene	0.2	1	6	60
Cabron tetrachloride	0.2	1	6	60
Tetrachloroethene	3	10	100	1000
Methylene chloride	3	10	100	1000
Vinyl chloride	0	0.2	6	60

Exceedance Summary:

10 - Result exceeds NYSDOH Soil Vapor/Indoor Air Matrix and does not require further action

10 - Result exceeds NYSDOH Soil Vapor/Indoor Air Matrix and requires mitigation

*Reporting Limit greater than NYSDOH Soil Vapor/Indoor Air Matrix

NOTES:
1. WORLD IMAGERY BASEMAP PROVIDED THROUGH LANGAN'S SUBSCRIPTION TO ESRI'S ARCGIS SOFTWARE LICENSING.
2. ALL SITE FEATURES ARE APPROXIMATE.

100 0 100
SCALE IN FEET

LANGAN
Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.
21 Penn Plaza, 360 West 31st Street, 8th Floor
New York, NY 10001
T: 212.479.5400 F: 212.479.5444 www.langan.com

Project
57-00, 57-05, and 58-20 47th Street
BLOCK Nos. 2601, 2602, 2603,
LOT Nos. 1, 6, 72
QUEENS NEW YORK

Figure Title
HISTORICAL VAPOR SAMPLE LOCATIONS AND ANALYTICAL DATA

Project No. 100965501
Date 5/25/2022
Scale 1"=100'
Drawn By ATR
Figure No. 4

Path: C:\Users\Aruane\Documents\Project Work\WorkFromHome-Covid\100965501\APRX\170686701\170686701.aprx Date: 5/25/2022 User: aruane Time: 1:46 PM

PAOC 1- Underground Injection Control Units
PAOC 2- Storm Water Vault
PAOC 3- On-Site Historical Use (Not Depicted)
PAOC 4- Vapor Intrusion inside Structures
PAOC 5- Former Underground Storage Tank B
PAOC 6- Semi-Volatile Organic Compound Exceedance
PAOC 7- Metal Impacts

NOTES:
1. WORLD IMAGERY BASEMAP PROVIDED THROUGH LANGAN'S SUBSCRIPTION TO ESRI'S ARCGIS SOFTWARE LICENSING.
2. ALL SITE FEATURES ARE APPROXIMATE.

100 0 100
SCALE IN FEET

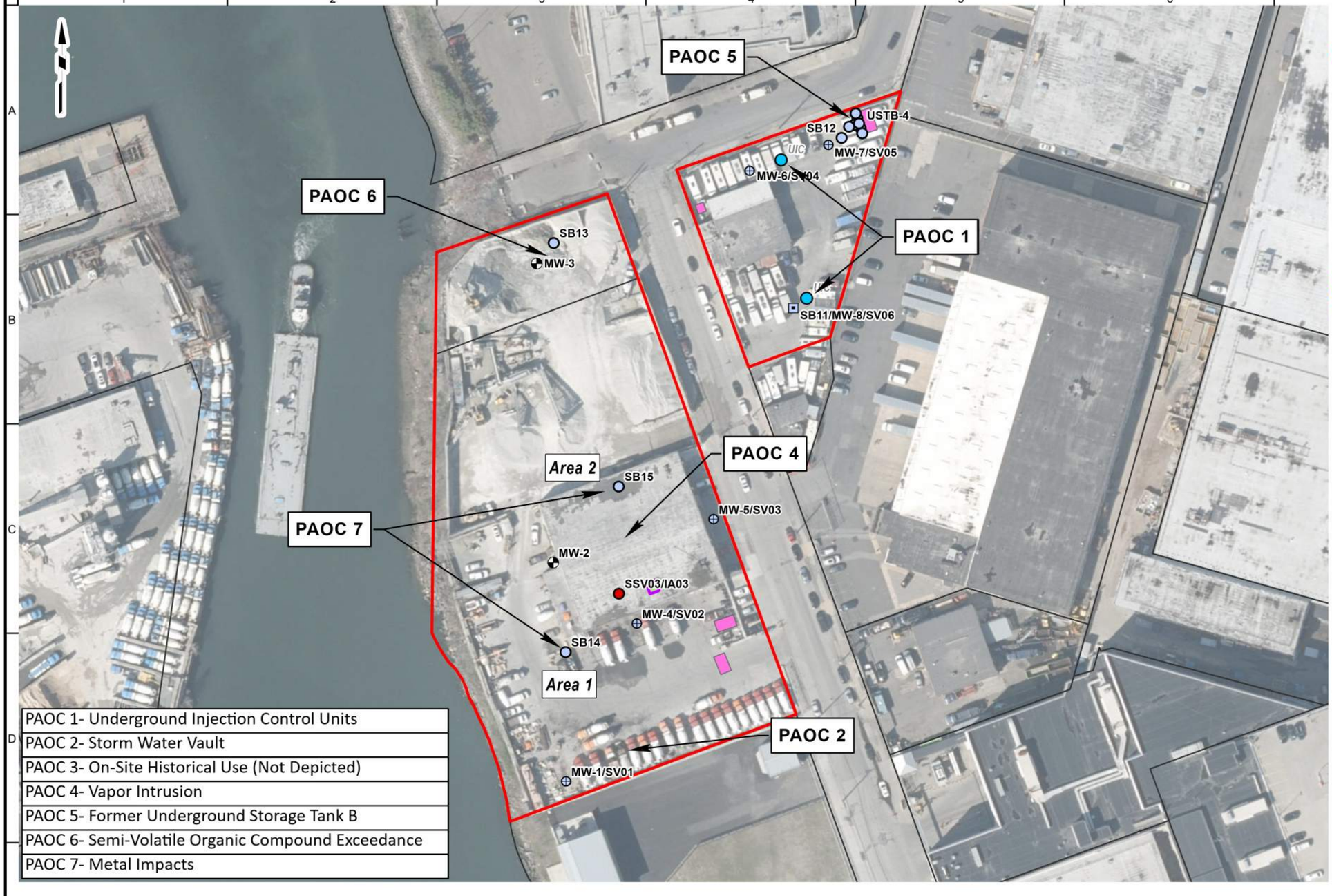
LANGAN
Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.
21 Penn Plaza, 360 West 31st Street, 8th Floor
New York, NY 10001
T: 212.479.5400 F: 212.479.5444 www.langan.com

Project
57-00, 57-05, and 58-20 47th Street
BLOCK Nos. 2601, 2602, 2603,
LOT Nos. 1, 6, 72
QUEENS NEW YORK

Figure Title
POTENTIAL AREAS OF CONCERN

Project No. 100965501
Date 5/24/2022
Scale 1"=100'
Drawn By ATR
Figure No. 5

Path: C:\Users\Aruane\Documents\Project Work\WorkFromHome-Covid\100965501\APRX\170686701\170686701.aprx Date: 5/24/2022 User: aruane Time: 12:35 PM



Legend

- Approximate Site Boundary
- Tax Parcels
- Proposed Monitoring Well Location
- Proposed Soil Boring Location
- Proposed Soil Vapor/Indoor Air Sample Location
- Proposed Monitoring Well/Soil Vapor Sample Location
- Proposed Soil Boring/Monitoring Well/Soil Vapor Sample Location
- Underground Injection Control Unit
- Oil Water Separator
- Former Underground Storage Tank

PAOC 1- Underground Injection Control Units
PAOC 2- Storm Water Vault
PAOC 3- On-Site Historical Use (Not Depicted)
PAOC 4- Vapor Intrusion
PAOC 5- Former Underground Storage Tank B
PAOC 6- Semi-Volatile Organic Compound Exceedance
PAOC 7- Metal Impacts

NOTES:
1. WORLD IMAGERY BASEMAP PROVIDED THROUGH LANGAN'S SUBSCRIPTION TO ESRI'S ARCGIS SOFTWARE LICENSING.
2. ALL SITE FEATURES ARE APPROXIMATE.

100 0 100
SCALE IN FEET

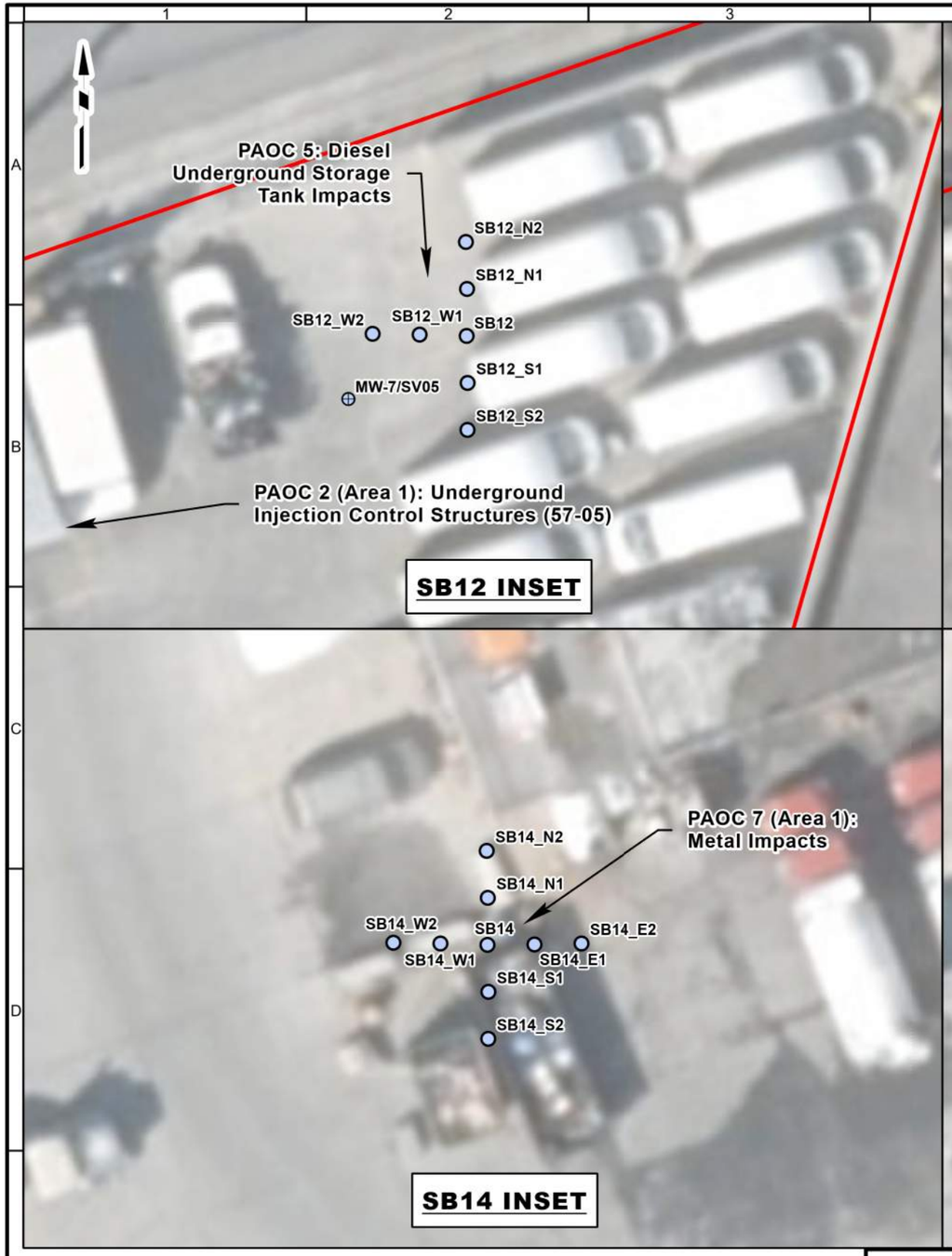
LANGAN
Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.
21 Penn Plaza, 360 West 31st Street, 8th Floor
New York, NY 10001
T: 212.479.5400 F: 212.479.5444 www.langan.com

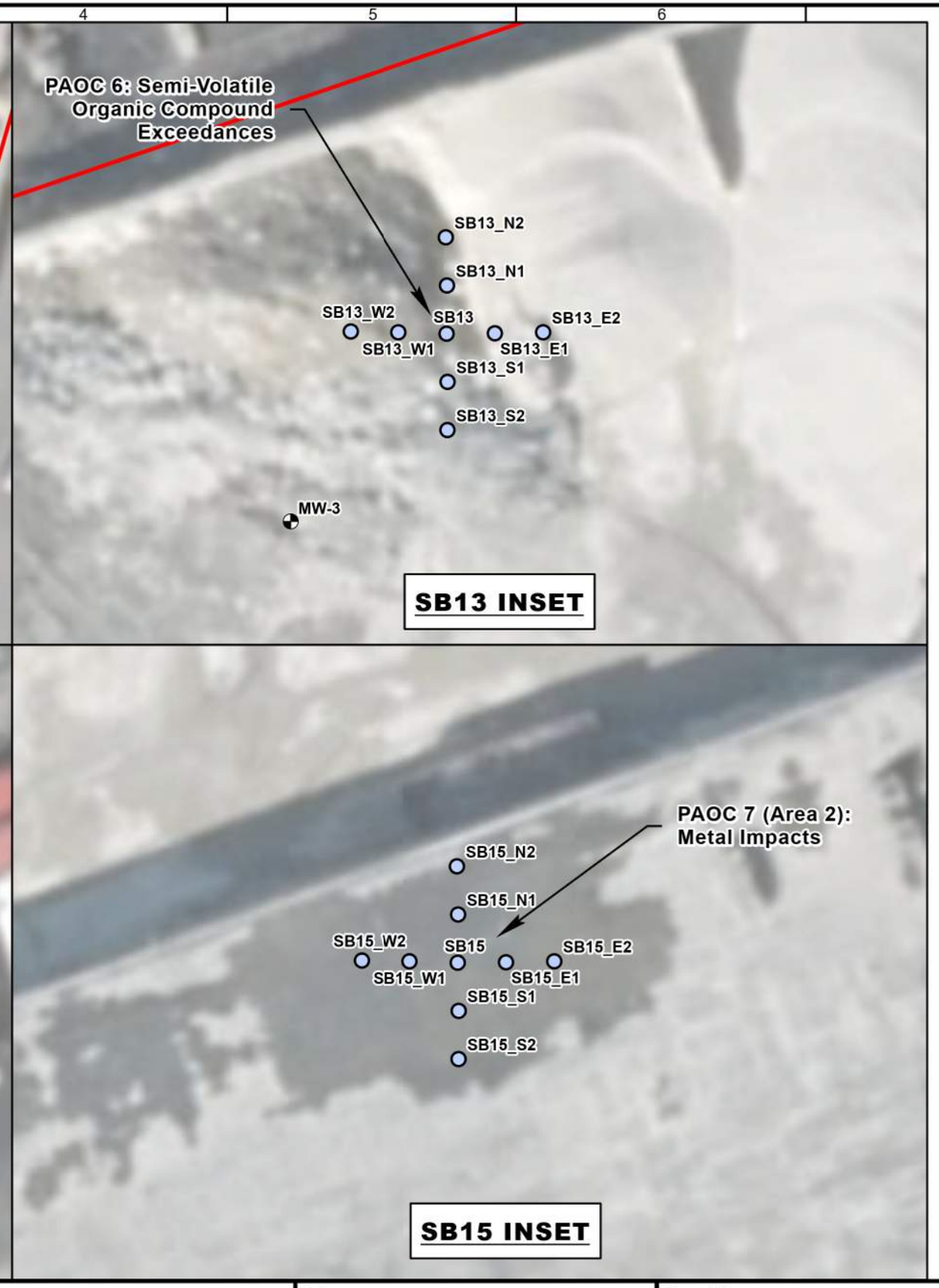
Project
57-00, 57-05, and 58-20 47th Street
BLOCK Nos. 2601, 2602, 2603,
LOT Nos. 1, 6, 72
QUEENS NEW YORK

Figure Title
PROPOSED SAMPLE LOCATION MAP

Project No. 100965501
Date 6/21/2022
Scale 1"=100'
Drawn By ATR
Figure No. 6

Path: C:\Users\Aruane\Documents\Project Work\WorkFromHome-Covid\100965501\APRX\170686701\170686701.aprx Date: 6/21/2022 User: aruane Time: 9:07 AM





Legend

- Approximate Site Boundary
- Proposed Soil Boring Location
- Proposed Monitoring Well/Soil Vapor Sample Location

NOTES:
1. WORLD IMAGERY BASEMAP PROVIDED THROUGH LANGAN'S SUBSCRIPTION TO ESRI'S ARCGIS SOFTWARE LICENSING.
2. ALL SITE FEATURES ARE APPROXIMATE.

100 0 100
SCALE IN FEET

LANGAN
Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.
21 Penn Plaza, 360 West 31st Street, 8th Floor
New York, NY 10001
T: 212.479.5400 F: 212.479.5444 www.langan.com

Project
57-00, 57-05, and 58-20 47th Street
BLOCK Nos. 2601, 2602, 2603,
LOT Nos. 1, 6, 72
QUEENS NEW YORK

Figure Title
SAMPLE LOCATION MAP (2 OF 2)

Project No.	Figure No.
100965501	6B
Date: 6/21/2022	
Scale: 1"=15'	
Drawn By: ATR	

Path: C:\Users\Aruane\Documents\Project Work\WorkFromHome-Covid\100965501\APRX\170686701\170686701.aprx Date: 6/21/2022 User: aruane Time: 9:12 AM

TABLES

Table 1
Proposed Sample Summary
Remedial Investigation Work Plan
57-00, 57-05, and 58-20 47th Street, Maspeth, New York
Langan Project No. 100965501

Sample No.	Sample Name	Type	Boring	Depth	Sampling Rationale	Analysis
SOIL						
1	SB11_depth	Grab	SB11	Collected at interval 0'-0.5' above groundwater interface	Investigate PAOCs 1 and 3	TCL VOCs, SVOCs, PCBs, Pesticides, TAL Metals (including cyanide, trivalent chromium, and hexavalent chromium), PFAS
2	SB11_depth			Collected at the highest exhibited degree of observed contamination		
3	SB12_depth		SB12	Collected from a depth of 0'-0.5' above groundwater interface	Investigate PAOCs 5 and 3	
4	SB12_depth			As per field conditions- staining, odors, etc.		
5	SB12_N1_7.0-7.5		SB12_N1	Collected from a depth of 7 to 7.5 feet bgs.		
6	SB12_N1_depth			Collected from a depth of 0'-0.5' above groundwater interface		
7	SB12_N1_depth			As per field conditions- staining, odors, etc.		
8	SB12_N2_7.0-7.5		*SB12_N2	Collected from a depth of 7 to 7.5 feet bgs.		
9	SB12_N2_depth			Collected from a depth of 0'-0.5' above groundwater interface		
10	SB12_N2_depth			As per field conditions- staining, odors, etc.		
11	SB12_S1_7.0-7.5		SB12_S1	Collected from a depth of 7 to 7.5 feet bgs.		
12	SB12_S1_depth			Collected from a depth of 0'-0.5' above groundwater interface		
13	SB12_S1_depth			As per field conditions- staining, odors, etc.		
14	SB12_S2_7.0-7.5		*SB12_S2	Collected from a depth of 7 to 7.5 feet bgs.		
15	SB12_S2_depth			Collected from a depth of 0'-0.5' above groundwater interface		
16	SB12_S2_depth			As per field conditions- staining, odors, etc.		
17	SB12_W1_7.0-7.5		SB12_W1	Collected from a depth of 7 to 7.5 feet bgs.		
18	SB12_W1_depth			Collected from a depth of 0'-0.5' above groundwater interface		
19	SB12_W1_depth			As per field conditions- staining, odors, etc.		
20	SB12_W2_7.0-7.5		*SB12_W2	Collected from a depth of 7 to 7.5 feet bgs.		
21	SB12_W2_depth			Collected from a depth of 0'-0.5' above groundwater interface		
22	SB12_W2_depth			As per field conditions- staining, odors, etc.		
23	SB13_depth		SB13	Collected from a depth of 0'-0.5' above groundwater interface	Investigate PAOCs 6 and 3	
24	SB13_depth			As per field conditions- staining, odors, etc.		
25	SB13_N1_8.0-9.0		SB13_N1	Collected from a depth of 8.0 to 9.0 feet bgs.		
26	SB13_N1_depth			Collected from a depth of 0'-0.5' above groundwater interface		
27	SB13_N1_depth			As per field conditions- staining, odors, etc.		
28	SB13_N2_8.0-9.0		*SB13_N2	Collected from a depth of 8.0 to 9.0 feet bgs.		
29	SB13_N2_depth			Collected from a depth of 0'-0.5' above groundwater interface		
30	SB13_N2_depth			As per field conditions- staining, odors, etc.		
31	SB13_E1_8.0-9.0		SB13_E1	Collected from a depth of 8.0 to 9.0 feet bgs.		
32	SB13_E1_depth			Collected from a depth of 0'-0.5' above groundwater interface		
33	SB13_E1_depth			As per field conditions- staining, odors, etc.		
34	SB13_E2_8.0-9.0		*SB13_E2	Collected from a depth of 8.0 to 9.0 feet bgs.		
35	SB13_E2_depth			Collected from a depth of 0'-0.5' above groundwater interface		
36	SB13_E2_depth			As per field conditions- staining, odors, etc.		
37	SB13_S1_8.0-9.0		SB13_S1	Collected from a depth of 8.0 to 9.0 feet bgs.		
38	SB13_S1_depth			Collected from a depth of 0'-0.5' above groundwater interface		
39	SB13_S1_depth			As per field conditions- staining, odors, etc.		
40	SB13_S2_8.0-9.0		*SB13_S2	Collected from a depth of 8.0 to 9.0 feet bgs.		
41	SB13_S2_depth			Collected from a depth of 0'-0.5' above groundwater interface		
42	SB13_S2_depth			As per field conditions- staining, odors, etc.		
43	SB13_W1_8.0-9.0		SB13_W1	Collected from a depth of 8.0 to 9.0 feet bgs.		
44	SB13_W1_depth			Collected from a depth of 0'-0.5' above groundwater interface		
45	SB13_W1_depth			As per field conditions- staining, odors, etc.		
46	SB13_W2_8.0-9.0		*SB13_W2	Collected from a depth of 8.0 to 9.0 feet bgs.		
47	SB13_W2_depth			Collected from a depth of 0'-0.5' above groundwater interface		
48	SB13_W2_depth			As per field conditions- staining, odors, etc.		

Table 1
Proposed Sample Summary
Remedial Investigation Work Plan
57-00, 57-05, and 58-20 47th Street, Maspeth, New York
Langan Project No. 100965501

49	SB14_depth		SB14	Collected from a depth of 0'-0.5' above groundwater interface	Investigate PAOC 7 (Area 1) and PAOC 3	TCL VOCs, SVOCs, PCBs, Pesticides, TAL Metals (including cyanide, trivalent chromium, and hexavalent chromium), PFAS
50	SB14_depth			As per field conditions- staining, odors, etc.		
51	SB14_N1_6.5-7.0		SB14_N1	Collected from a depth of 6.5 to 7.0 feet bgs.		
52	SB14_N1_depth			Collected from a depth of 0'-0.5' above groundwater interface		
53	SB14_N1_depth			As per field conditions- staining, odors, etc.		
54	SB14_N2_6.5-7.0		*SB14_N2	Collected from a depth of 6.5 to 7.0 feet bgs.		
55	SB14_N2_depth			Collected from a depth of 0'-0.5' above groundwater interface		
56	SB14_N2_depth			As per field conditions- staining, odors, etc.		
57	SB14_E1_6.5-7.0		SB14_E1	Collected from a depth of 6.5 to 7.0 feet bgs.		
58	SB14_E1_depth			Collected from a depth of 0'-0.5' above groundwater interface		
59	SB14_E1_depth			As per field conditions- staining, odors, etc.		
60	SB14_E2_6.5-7.0		*SB14_E2	Collected from a depth of 6.5 to 7.0 feet bgs.		
61	SB14_E2_depth			Collected from a depth of 0'-0.5' above groundwater interface		
62	SB14_E2_depth			As per field conditions- staining, odors, etc.		
63	SB14_S1_6.5-7.0		SB14_S1	Collected from a depth of 6.5 to 7.0 feet bgs.		
64	SB14_S1_depth			Collected from a depth of 0'-0.5' above groundwater interface		
65	SB14_S1_depth			As per field conditions- staining, odors, etc.		
66	SB14_S2_6.5-7.0		*SB14_S2	Collected from a depth of 6.5 to 7.0 feet bgs.		
67	SB14_S2_depth			Collected from a depth of 0'-0.5' above groundwater interface		
68	SB14_S2_depth			As per field conditions- staining, odors, etc.		
69	SB14_W1_6.5-7.0		SB14_W1	Collected from a depth of 6.5 to 7.0 feet bgs.		
70	SB14_W1_depth			Collected from a depth of 0'-0.5' above groundwater interface		
71	SB14_W1_depth			As per field conditions- staining, odors, etc.		
72	SB14_W2_6.5-7.0		*SB14_W2	Collected from a depth of 6.5 to 7.0 feet bgs.		
73	SB14_W2_depth			Collected from a depth of 0'-0.5' above groundwater interface		
74	SB14_W2_depth			As per field conditions- staining, odors, etc.		
75	SB15_depth		SB15	Collected from a depth of 0'-0.5' above groundwater interface	Investigate PAOC 7 (Area 2) and PAOC 3	
76	SB15_depth			As per field conditions- staining, odors, etc.		
77	SB15_N1_3.0-4.0		SB15_N1	Collected from a depth of 3.0 to 4.0 feet bgs.		
78	SB15_N1_depth			Collected from a depth of 0'-0.5' above groundwater interface		
79	SB15_N1_depth			As per field conditions- staining, odors, etc.		
80	SB15_N2_3.0-4.0		*SB15_N2	Collected from a depth of 3.0 to 4.0 feet bgs.		
81	SB15_N2_depth			Collected from a depth of 0'-0.5' above groundwater interface		
82	SB15_N2_depth			As per field conditions- staining, odors, etc.		
83	SB15_E1_3.0-4.0		SB15_E1	Collected from a depth of 3.0 to 4.0 feet bgs.		
84	SB15_E1_depth			Collected from a depth of 0'-0.5' above groundwater interface		
85	SB15_E1_depth			As per field conditions- staining, odors, etc.		
86	SB15_E2_3.0-4.0		*SB15_E2	Collected from a depth of 3.0 to 4.0 feet bgs.		
87	SB15_E2_depth			Collected from a depth of 0'-0.5' above groundwater interface		
88	SB15_E2_depth			As per field conditions- staining, odors, etc.		
89	SB15_S1_3.0-4.0		SB15_S1	Collected from a depth of 3.0 to 4.0 feet bgs.		
90	SB15_S1_depth			Collected from a depth of 0'-0.5' above groundwater interface		
91	SB15_S1_depth			As per field conditions- staining, odors, etc.		
92	SB15_S2_3.0-4.0		*SB15_S2	Collected from a depth of 3.0 to 4.0 feet bgs.		
93	SB15_S2_depth			Collected from a depth of 0'-0.5' above groundwater interface		
94	SB15_S2_depth			As per field conditions- staining, odors, etc.		
95	SB15_W1_3.0-4.0		SB15_W1	Collected from a depth of 3.0 to 4.0 feet bgs.		
96	SB15_W1_depth			Collected from a depth of 0'-0.5' above groundwater interface		
97	SB15_W1_depth			As per field conditions- staining, odors, etc.		
98	SB15_W2_3.0-4.0		*SB15_W2	Collected from a depth of 3.0 to 4.0 feet bgs.		
99	SB15_W2_depth			Collected from a depth of 0'-0.5' above groundwater interface		
100	SB15_W2_depth			As per field conditions- staining, odors, etc.		
SOIL QA/QC						
1	SODUP01_date	Blind Duplicate	TBD	TBD	Quality Assurance/Quality Control	TCL VOCs, SVOCs, PCBs, Pesticides, TAL Metals (including cyanide, trivalent chromium, and hexavalent chromium), PFAS
2	SODUP02_date					
3	SODUP03_date					
4	SODUP04_date					
5	SODUP05_date					
6	SOFB01_date	Field Blank	NA	NA		Dependent on analysis associated with collected samples
7	SOFB02_date					
8	SOFB03_date					
9	SOFB04_date					
10	SOFB05_date					

Notes:
1. PAOC 1 = Underground Injection Control Units
2. PAOC 2 = Storm Water Vault
3. PAOC 3 = On-Site Historical Use
4. PAOC 4 = Vapor Intrusion
5. PAOC 5 = Former Underground Storage Tank B
6. PAOC 6 = Semi-Volatile Organic Compound Exceedance
6. PAOC 7 = Metal Impacts

10. TBD = To be determined
11. NA = Not Applicable
12. bgs. = below grade surface
13. * = Hold laboratory analysis

Table 1
Proposed Sample Summary
Remedial Investigation Work Plan
57-00, 57-05, and 58-20 47th Street, Maspeth, New York
Langan Project No. 100965501

Sample No.	Sample Name	Type	Boring/ Monitoring Well	Depth	Sampling Rationale	Analysis
GROUNDWATER						
1	MW-1_date	Grab	MW-1	Middle of observed water column based on initial gauging results	Investigate PAOCs 2 and 3	TCL VOCs, SVOCs with SIM, PCBs, Pesticides, TAL Metals, PFAS, Cr3, Cr6, Cyanide
2	MW-2_date		MW-2		Investigate PAOCs 7 and 3	
3	MW-3_date		MW-3		Investigate PAOCs 3 and 6	
4	MW-4_date		MW-4		Investigate PAOCs 3 and 4	
5	MW-5_date		MW-5		Investigate PAOCs 3 and 4	
6	MW-6_date		MW-6		Investigate PAOCs 1 and 3	
7	MW-7_date		MW-7		Investigate PAOCs 5 and 3	
8	MW-8_date		MW-8		Investigate PAOCs 1 and 3	
GROUNDWATER QA/QC						
1	GWDUP01_date	Blind Duplicate	TBD	TBD	Quality Assurance/Quality Control	TCL VOCs, SVOCs with SIM, PCBs, Pesticides, TAL Metals, PFAS, Cr3, Cr6, Cyanide
2	GWFB01_date	Field Blank	TBD	NA		
3	GWTB01_date	Trip Blank	TBD	NA		TCL VOCs+15 via Method 8260C

Sample No.	Sample Name	Type	Boring/ Monitoring Well	Depth	Sampling Rationale	Analysis
SOIL VAPOR						
1	SSV06_date	Grab	N/A	Sub-Slab Soil Vapor (about 2 inches below concrete building slab)	Investigate PAOCs 4 and 3	TO-15 VOCs
1	SV01_date		MW-1	Soil Vapor Point (about 2 feet above groundwater table)	Investigate PAOCs 4, 2, and 3	
2	SV02_date		MW-4		Investigate PAOCs 3 and 4	
3	SV03_date		MW-5		Investigate PAOCs 3 and 4	
4	SV04_date		MW-4		Investigate PAOCs 1, 3, and 4	
5	SV05_date		MW-7		Investigate PAOCs 3, 4, and 5	
6	SV06_date		MW-8		Investigate PAOCs 1, 3, and 4	
INDOOR AIR						
1	IA01_date	Grab	N/A	3 to 5 feet above grade surface	Invetsigate PAOCs 4 and 3	TO-15 VOCs
AMBIENT AIR						
1	AA01_date	Grab	N/A	3 to 5 feet above grade surface	N/A	TO-15 VOCs

Notes:
1. PAOC 1 = Underground Injection Control Units
2. PAOC 2 = Storm Water Vault
3. PAOC 3 = On-Site Historical Use
4. PAOC 4 = Vapor Intrusion
5. PAOC 5 = Former Underground Storage Tank B
6. PAOC 6 = Semi-Volatile Organic Compound Exceedance
6. PAOC 7 = Metal Impacts
10. TBD = To be determined
11. NA = Not Applicable

Table 2
Emerging Contaminants List for Soil and Groundwater Samples
Remedial Investigation Work Plan
57-00, 57-05, and 58-20 47th Street
Maspeth New York
Langan Project No. 100965501

PFAS Compound Analyte	
Compound Name	**Analytical Method**
Perfluorohexanoic acid (PFHxA)	USEPA Method 537
Perfluoroheptanoic acid (PFHpA)	
Perfluorooctanoic acid (PFOA)	
Perfluorobutanoic acid (PFBA)	
Perfluoropentanoic acid (PFPeA)	
Perfluorononanoic acid (PFNA)	
Perfluorodecanoic acid (PFDA)	
Perfluoroundecanoic acid (PFUA/PFUdA)	
Perfluorododecanoic acid (PFDoA)	
Perfluorotridecanoic acid (PFTriA/PFTrDA)	
Perfluorotetradecanoic acid (PFTA/PFTeDA)	
Perfluorobutanesulfonic acid (PFBS)	
Perfluorohexanesulfonic acid (PFHxS)	
Perfluoroheptanesulfonic acid (PFHpS)	
Perfluorodecanesulfonic acid (PFDS)	
Perfluorooctanesulfonic acid (PFOS)	
N-methyl perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	
N-ethyl perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	
6:2 Fluorotelomer sulfonate (6:2 FTS)	
8:2 Fluorotelomer sulfonate (8:2 FTS)	
Perfluoroctancesulonamide (FOSA)	
1,4-Dioxane	
1,4-dioxane	USEPA Method 8270 SIM

Notes:
1. PFAS - per- and polyfluoroalkyl substances

APPENDIX A
PREVIOUS ENVIRONMENTAL REPORTS

APPENDIX B
HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

for

47th Street Site
57-00, 57-05, and 58-20 47th Street
Maspeth, Queens, New York

Prepared For:

47th Street & 58th Road LLC
c/o Prologis, Inc.
Pier 1, Bay 1
San Francisco, California

Prepared By:

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

LANGAN

June 2022
Langan Project Number: 100965501

TABLE OF CONTENTS

Page No.

1.0 INTRODUCTION 1

1.1 GENERAL 1
1.2 SITE LOCATION AND BACKGROUND 1
1.3 SUMMARY OF WORK TASKS 2
1.3.1 Hand Clearing of Borehole Locations 2
1.3.2 Soil Investigation and Sampling 2
1.3.3 Soil Sampling 3
1.3.4 Groundwater Investigation and Sampling 4
1.3.5 QA/QC Soil Sampling 5
1.3.6 Observation/Monitoring Well Plugging and Abandonment 5
1.3.7 Equipment Decontamination 5
1.3.8 Management of Investigative-Derived Waste 5
1.3.9 Drum Sampling 6
1.3.10 Surveying 6

2.0 IDENTIFICATION OF KEY PERSONNEL/HEALTH AND SAFETY PERSONNEL 6

2.1 LANGAN PROJECT MANAGER 6
2.2 LANGAN CORPORATE HEALTH AND SAFETY MANAGER 6
2.3 LANGAN SITE HEALTH & SAFETY OFFICER 7
2.4 LANGAN FIELD TEAM LEADER RESPONSIBILITIES 7
2.5 CONTRACTOR RESPONSIBILITIES 8

3.0 TASK/OPERATION SAFETY AND HEALTH RISK ANALYSES 8

3.1 SPECIFIC TASK SAFETY ANALYSIS 9
3.1.1 Hand Clearing of Borehole Locations 9
3.1.2 Indoor Drilling and Excavation 9
3.1.3 Soil Investigation and Sampling 10
3.1.4 Hot Spot Delineation 10
3.1.5 Groundwater Investigation and Sampling 11
3.1.6 Drum Sampling 11
3.2 RADIATION HAZARDS 11
3.3 PHYSICAL HAZARDS 11
3.3.1 Explosion 11
3.3.2 Heat Stress 11
3.3.3 Cold-Related Illness 13
3.3.4 Noise 14
3.3.5 Hand and Power Tools 14
3.3.6 Slips, Trips and Fall Hazards 14
3.3.7 Utilities (Electrocution and Fire Hazards) 14
3.3.7.1 Utility Clearance 14
3.3.7.2 Lockout-Tagout 15
3.3.8 Physical Hazard Considerations for Material Handling 15
3.3.9 Hearing Conservation 16
3.3.9 Open Water 16
3.4 BIOLOGICAL HAZARDS 17
3.4.1 Animals 17

3.4.2 Insects 17
3.4.3 Plants 18
3.4.4 Coronavirus 18
3.4.4.1 General Preventative Measures 18
3.4.4.2 Construction Trailers 18
3.4.4.3 Communication 18
3.4.4.4 Sick/Ill Workers 19
3.5 ADDITIONAL SAFETY ANALYSIS 19
3.5.1 Presence of Non-Aqueous Phase Liquids (NAPL) 19
3.6 JOB SAFETY ANALYSIS 20

4.0 PERSONNEL TRAINING 20

4.1 BASIC TRAINING 20
4.2 INITIAL SITE-SPECIFIC TRAINING 20
4.3 TAILGATE SAFETY BRIEFINGS 20

5.0 MEDICAL SURVEILLANCE 21

6.0 PERSONAL PROTECTIVE EQUIPMENT 21

6.1 LEVELS OF PROTECTION 21
6.2 RESPIRATOR FIT-TEST 23
6.3 RESPIRATOR CARTRIDGE CHANGE-OUT SCHEDULE 23

7.0 AIR QUALITY MONITORING AND ACTION LEVELS 23

7.1 MONITORING DURING SITE OPERATIONS 23
7.1.1 Volatile Organic Compounds 24
7.1.2 Metals 24
7.2 MONITORING EQUIPMENT CALIBRATION AND MAINTENANCE 24
7.3 DETERMINATION OF BACKGROUND LEVELS 25

8.0 COMMUNITY AIR MONITORING PROGRAM 25

8.1 DUST SUPPRESSION TECHNIQUES 26

9.0 WORK ZONES AND DECONTAMINATION 27

9.1 SITE CONTROL 27
9.2 CONTAMINATION ZONE 27
9.2.1 Personnel Decontamination Station 27
9.2.2 Minimization of Contact with Contaminants 27
9.2.3 Personnel Decontamination Sequence 28
9.2.4 Emergency Decontamination 28
9.2.5 Hand-Held Equipment Decontamination 28
9.2.6 Heavy Equipment Decontamination 28
9.3 SUPPORT ZONE 29
9.4 COMMUNICATIONS 29
9.5 THE BUDDY SYSTEM 29

10.0 NEAREST MEDICAL ASSISTANCE 30

11.0 STANDING ORDERS/SAFE WORK PRACTICES 30

12.0 SITE SECURITY 30

13.0 UNDERGROUND UTILITIES 30

14.0 SITE SAFETY INSPECTION 31

15.0 HAND AND POWER TOOLS 31

16.0 EMERGENCY RESPONSE 31

16.1 GENERAL 31
16.2 RESPONSIBILITIES 31
16.2.1 Health and Safety Officer (HSO) 31
16.2.2 Emergency Coordinator 32
16.2.3 Site Personnel 32
16.3 COMMUNICATIONS 32
16.4 LOCAL EMERGENCY SUPPORT UNITS 32
16.5 PRE-EMERGENCY PLANNING 33
16.6 EMERGENCY MEDICAL TREATMENT 33
16.8 EMERGENCY SITE EVACUATION ROUTES AND PROCEDURES 33
16.8.1 Designated Assembly Locations 34
16.8.2 Accounting for Personnel 35
16.9 FIRE PREVENTION AND PROTECTION 35
16.9.1 Fire Prevention 35
16.10 SIGNIFICANT VAPOR RELEASE 35
16.11 OVERT CHEMICAL EXPOSURE 36
16.12 DECONTAMINATION DURING MEDICAL EMERGENCIES 36
16.13 ADVERSE WEATHER CONDITIONS 36
16.14 SPILL CONTROL AND RESPONSE 37
16.15 EMERGENCY EQUIPMENT 38
16.16 RESTORATION AND SALVAGE 38
16.17 DOCUMENTATION 38

17.0 SPECIAL CONDITIONS 39

17.1 SCOPE 39
17.2 RESPONSIBILITIES 39
17.3 PROCEDURES 39
17.3.1 Ladders 39
17.3.1.1 Ladder Use 39
17.3.1.2 Portable Ladders 40
17.3.1.3 Step Stools 40
17.3.1.4 Extension Ladders 40
17.3.1.5 Inspection 40
17.3.2 First Aid/Cardiopulmonary Resuscitation (CPR) 41
17.3.2.1 Emergency Procedures 41
17.3.2.2 First Aid Supplies 41
17.3.3 Hydrogen Sulfide 42
17.3.3.1 Characteristics 42
17.3.3.2 Health Effects 42
17.3.3.3 Protective Clothing and Equipment 42
17.3.3.4 Emergency and First Aid Procedures 43
19.3.4 Fire Protection/Extinguishers 44
17.3.5 Overhead lines 44
17.3.5.1 Vehicle and Equipment Clearance 45
17.3.6 Trade Secret 46
17.3.7 Bloodborne Pathogens 46
17.3.7.1 Training 46
17.3.7.2 Recordkeeping 48

18.0 RECORDKEEPING 49

18.1 FIELD CHANGE AUTHORIZATION REQUEST 49
18.2 MEDICAL AND TRAINING RECORDS 49
18.3 ONSITE LOG 49
18.4 DAILY SAFETY MEETINGS ("TAILGATE TALKS") 49
18.5 EXPOSURE RECORDS 49
18.6 HAZARD COMMUNICATION PROGRAM/MSDS-SDS 50
18.7 DOCUMENTATION 50
18.7.1 Accident and Injury Report Forms 50
18.7.1.1 Accident/Incident Report 50
18.7.1.2 First Aid Treatment Record 50
18.7.1.3 OSHA Form 300 50
19.0 CONFINED SPACE ENTRY 51
20.0 HASP ACKNOWLEDGEMENT FORM 51

LIST OF TABLES

Table 1 Task Hazard Analysis
Table 2 Contaminant Hazards of Concern
Table 3 Summary of Monitoring Equipment
Table 4 Instrumentation Action Levels
Table 5 Emergency Notification List*****
Table 6 Suggested Frequency of Physiological Monitoring For Fit and Acclimated Workers
Table 7 Heat Index

LIST OF FIGURES

Figure 1 Site Location Map
Figure 2 Route to Hospital (map with directions)*****

LIST OF APPENDICES

Attachment A Standing Orders*
Attachment B Decontamination Procedures
Attachment C Employee Exposure/Injury Incident Report
Attachment D Calibration Log
Attachment E Material Data Safety Sheets / Safety Data Sheets*
Attachment F Jobsite Safety Inspection Checklist
Attachment G Job Safety Analysis Forms
Attachment H Tailgate Safety Meeting Log

***** 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 for the property located at 57-00, 58-20, and 57-05 47th Street, Maspeth, Queens, New York. The Site is identified as Block 2601, Lots 6 and 1; and Block 2602, Lot 72 on the Queens Borough Tax Map. All contractors performing work on this site shall implement their own HASP that, at a minimum, adheres to this HASP. The contractor is responsible for their own health and safety and that of their subcontractors. Langan personnel will implement this HASP while onsite.

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 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 3.74-acres and consists of a former concrete recycling facility with associated offices and concrete testing laboratory and vehicle maintenance garage on parcel 57-00, former concrete recycling operations on 58-20, and former concrete/construction equipment storage and vehicle maintenance operations on parcel 57-05. The Site is bound to the north by 58th Road, followed by the NYC Department of Sanitation Queens West 5 Garage; to the east by a moving and storage facility and also a delivery company; to the south by the NYC Department of Environmental Protection Newtown Creek aeration facility and 57-57 47th Street (former eatery and retail store); to the west by Newtown Creek (a National Priorities List [NPL] site). The site is located in the M3-1 manufacturing district, which is designated for areas with heavy industrial uses that generate noise, traffic, or pollutants. A Site Location Map is provided as **Figure 1**.

The Site was first developed as a fertilizer works circa 1897, followed by an oil depot circa 1914-1936. The building currently located on the 57-00 parcel was constructed in mid-1960s and operated as a truck parking area. Truck repair occurred on the 57-00 parcel from approximately 1982 until operations ceased in 2021. Concrete recycling began on the 57-00 parcel circa 2004 and continued simultaneously with the truck repair until 2021. Operations occurred on the 58-20 parcel congruently with 57-00 parcel operations.

The 57-05 parcel also historically operated as a fertilizer works and oil depot with the 57-00 parcel. A motor freight station operated on this parcel circa 1963 and 1982 to 2006. From 2006 to 2021 the parcel was utilized to store material, maintain vehicles, and stage equipment/trucks. The 57-00 and 57-05 parcels are listed in the NYSDEC Petroleum Bulk Storage Facility program. The 57-00 and 58-20 parcels are listed in the NYSDEC Solid Waste Disposal Facility program. The 57-00 and 58-20 parcels are listed with a NYSDEC Administrative Consent Order.

Previous Phase II Environmental Site Investigations (ESI) sampling activities indicated several locations with soil and groundwater exceedances on the Site. Contaminants of concern include volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals. Additional investigation is required to further investigate these areas with NYSDEC Restricted Use Commercial Soil Cleanup Objectives (Commercial SCOs) or the Restricted Use Industrial Soil Cleanup Objectives (Industrial SCOs) and NYSDEC Title 6 Ambient Water Quality Standards and Guidance Value for Class GA Water (SGV) exceedances.

1.3 Summary of Work Tasks

1.3.1 Hand Clearing of Borehole Locations

If there is no geophysical survey for utility clearance planned, a geophysical investigation was completed November 2021 and ground marks remain. As per the results of the geophysical investigation, the contractor may hand clear each location to confirm utilities or other known or suspected subsurface structures. Hand clearing of a soil boring location should extend to a depth of 5-feet and be about 1.5 times the anticipated diameter of the borehole when drilled. Langan personnel will confirm that hand clearing activities are completed to these specifications.

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 will be installed at the approximate locations indicated in Langan's work plan, but may be moved in the field based on utility clearance and accessibility. The drilling contractor will contact the appropriate utility mark-out authority and make available to their drilling staff the verification number and effective dates. Langan will record the verification

number and effective dates from the drillers. Langan will also note the location of marked out utilities on the site plan and scan the data into the project folder.

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 duly field-calibrated photoionization detector (PID) (or equivalent). Langan personnel will collect soil samples from the proposed soil boring locations following the sampling plan outlined in the work plan. The borings will be filled with clean soil cuttings, clean sand or bentonite grout and capped at grade to match the surrounding surface after samples are collected.

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 Soil Sampling

Langan may retain a drilling contractor to advance soil borings to a depth bgs as will be specified in the work plan. Borings locations will be based on the results of new analytical data, 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. Health and safety air monitoring guidelines for lead delineation are specified in Section 3.1.5 and must implemented before lead delineation begins. The borings may be filled with clean soil cuttings after samples are collected.

Langan will screen soil for visual, olfactory, and instrumental indicators suggestive of a potential petroleum release. Instrument screening for the presence of VOCs may be performed with a calibrated PID. Langan will collect soil samples as specified in the hot spot delineation portion of the work plan. Soil samples will be submitted to a NYSDOH ELAP-certified laboratory and analyzed in accordance with work plan specifications.

1.3.4 Sub Slab or Soil Vapor Point Installation and Sampling

Langan will install sub-slab and soil vapor points at selected locations. The sub-slab points will be set at or just below the bottom of the slab in accordance with the work plan. The sub-slab points may be installed using an electric hammer drill to advance small diameter borings through the concrete (or equivalent) slab as defined in the work plan. The borings will terminate in and sample from the gravel substrate below the slab. Conditions in the field may require adjustment of sampling locations.

Langan personnel (or contractor) will install VaporPin® vapor points (or equivalent) in accordance with the manufacturer's instructions. If no point is used, Langan (or contractor) will set a sampling tube defined as an open ended Teflon™-lined polyethylene tubing (or equivalent tubing as approved by the project manager [PM]). The sampling tube will be set either within the base of the concrete slab or within the support gravel underlying the slab.

When using the VaporPin® or equivalent, the installation sleeve will provide the necessary annulus seal required for subsequent sampling. However, if a sampling tube as defined above is use, the annulus at the top of the concrete slab will be filled with bentonite or food grade clay to seal the slab. A sand pack is not required for sub-slab vapor sampling. Unless specified by the work plan, the sub slab points are temporary and will be pulled after the sampling event and the hole will be patched at grade with material similar to the surrounding surface.

Langan personnel will confirm that the soil vapor points (implants) are approximately 2-inches in length constructed of polyethylene material and are connected to the surface by Teflon™-line polyethylene material (equivalent materials for the point and tubing are acceptable as approved by the PM). The annulus around the implant will be filled with clean sand to 6-inches above the implant. A 1-foot bentonite slurry will be applied to the top of the sand up to seal the sampling points. The remaining soil vapor point annulus may be backfilled with clean cuttings are sand to grade. Unless specified by the work plan, the vapor points are temporary and will be pulled after the sampling event and the hole will be patched at grade with material similar to the surrounding surface.

Vapor samples will be collected in accordance with following guidance including: Final Guidance for Evaluating Soil Vapor Intrusion published by the NYSDOH in October 2006, Langan's Sub-Slab Vapor Sampling SOP (SOP #14) and as specified in the work plan. In addition, ambient air and indoor air samples may be collected for use as a comparison sample. As part of the indoor air sampling program, Langan personnel may complete a building inventory inspection. The inspection may take place prior to the commencement of actual field sampling. Vapor samples may be submitted to a NYSDOH ELAP-certified laboratory and analyzed in accordance with work plan specifications or to another laboratory as specified by the client.

1.3.5 Groundwater Investigation and Sampling

Selected soil borings will be converted into groundwater monitoring wells and sampled to evaluate groundwater quality. Groundwater samples will be collected from one or more of the new and if available, pre-existing monitoring wells in accordance with the Langan Low Flow Groundwater Sampling SOP (SOP #12). Groundwater samples will be submitted to an approved laboratory and analyzed for constituents as specified in the work plan. Temporary monitoring wells will be plugged and abandoned during the investigation in the manner defined in Section

1.3.2 for soil boring. Permanent monitoring wells will be completed with a road box set in concrete, Permanent monitoring wells will be eventually backfilled and abandoned in accordance with State and Local regulations.

Groundwater samples will be submitted to a NYSDOH ELAP-certified laboratory and analyzed in accordance with work plan specifications.

1.3.6 QA/QC Soil Sampling

Soil samples for quality assurance/quality control [QA/QC] samples may also be collected and submitted to an approved laboratory and analyzed in accordance with work plan specifications. Information regarding the QA/QC samples including required method of analysis may be included in the same COC as the soil samples unless otherwise instructed by the work plan.

1.3.7 Observation/Monitoring Well Plugging and Abandonment

At an unspecified future date, the observation/monitoring wells will be abandoned. Plugging and abandonment will be in accordance with federal and state requirements. Langan may retain a drilling contractor to complete the plugging and abandonment activities. The contractor will contact the appropriate utility mark-out authority and make available to their field staff the verification number and effective dates. Langan may observe the plugging and abandonment of one or more observation/monitoring wells to document that the plugging and abandonment activities were completed in accordance with the work plan and regulations.

1.3.8 Equipment Decontamination

Before the start of the day's sampling and after sampling each run, sampling equipment will be decontaminated by the decontamination process outlined Attachment B - Decontamination Procedures. Decontamination wastes and purge water will be temporarily stored on site pending analytical results.

1.3.9 Management of Investigative-Derived Waste

The investigative-derived waste (IDW) generated during this investigation will be contained in DOT-approved 55-gallon drums. The drums will be temporarily stored on the site or as directed by the client representative. All drums will be filled between to two-thirds full to allow easy maneuvering during drum pickup and disposal. Drum labels are to be provided by Langan (Environmental Closet). All drums will be labeled as "IDW Pending Analysis" until sample data are reported from the laboratory. Drum labels will include date filled and locations where waste was generated along with the standard information required by the labels in accordance with the

Langan SOP09, Drum Labeling..

Closed top drums are to be used to store liquids. Debris, including plastic sheeting, polyethylene tubing, personal protection equipment (PPE), decontamination debris, etc. will be segregated from and disposed in large heavy duty garbage bags and disposed of at the site. Excess unused glassware should be returned to the lab along with the last day of collection samples.

1.3.10 Drum Sampling

Langan personnel may 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 an approved laboratory and analyzed in accordance with work plan specifications, if required.

1.3.11 Surveying

Surveying activities defined in the work plan may be completed by Langan. Surveying will be conducted by licensed surveyors.

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 Environmental Project Manager (PM) is Alan Arico, his responsibilities include:

- Ensuring that this HASP is developed, current, 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 *Construction 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 Rebekah Diehl. Her 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) will be determined prior to the start of the start of field 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 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; and
- 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. The potential contaminants that might be encountered during the field activities and the exposure limits are listed in Table 2 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 Hand Clearing of Borehole Locations

Hand clearing will be completed by the contractor. Langan personnel are not permitted to operate or otherwise handle the contractor equipment. Langan will update the site map to include the locations of the cleared borehole locations as well as possible utilities and other artifacts that may interfere with the subsurface investigation.

3.1.2 Indoor Drilling and Excavation

The work scope may require indoor drilling or drilling in locations where there may not be adequate ventilation sufficient to safely operate any rig or excavation equipment powered by an internal combustion engine. Where possible, all such work should be done by equipment powered by electricity. If such equipment is used and must be directly wired to the buildings electrical system or to an independent system, this work must be completed by a licensed electrician in accordance with all electrical codes applicable to the work.

Indoor work which is to be completed with equipment powered by an internal combustion engine must incorporate air monitoring of carbon monoxide (CO) using calibrated air monitoring equipment (MultiRAE or equivalent). In addition, the work plan should incorporate mitigation for venting engine exhaust fumes directly to the outdoors and for circulating fresh air into the work area.

The OSHA Time Weighted Average (TWA) Permissible Exposure Limit (PEL) for CO from 50 to 35 parts per million (ppm). Langan will monitor CO with a suitable monitoring device. If CO levels exceed 5 ppm, Langan will instruct contractors to begin mitigation measures. These measures are at a minimum:

- Increase air circulation using industrial size fans to bring additional fresh air into the building or vent exhaust to the outside;
- Modify the passive exhaust method being used to increase venting circulation by using wider diameter tubing or sealing tubing connections; or
- Modify the work schedule where the rig is turned off to allow time for CO levels to fall back to background

All work must cease if CO levels reach 35 ppm. The Langan engineer is to report to the PM and H&S officer when an action level is reached.

3.1.3 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.

3.1.4 Hot Spot Delineation

If hot spot delineation is undertaken, sampling requires additional precautions to mitigate exposure. Langan will monitor dust using air-dust monitoring equipment (DustTrak™ 2 or equivalent). The dust monitoring equipment should be equipped with an alarm. The HSO will provide alarm limits when the data triggering hot spot delineation is available. Work cannot commence until the action limits are set by the HSAO. The primary alarm should be set for 5 milligrams per cubic meter (mg/m^3) above the 15 minute average background. The secondary alarm may be set for 24 mg/m^3. The alarm limits are based on known lead soil concentrations.

If the primary alarm activates during work, the PM notified, and dust control measures should be implemented and all workers should don half face respirator with HEPA dust filters to continue to work. Dust control measures include applying a fine water spray wet all surfaces in the work area to dampen dust and activating ventilation. Workers can remove half respirators when air borne dust concentrations return to background. If dust mitigation does not lower dust concentrations and dust levels continue to climb, all work should cease when dust concentrations exceed secondary alarm level and the PM should be notified.

3.1.5 Electric Hammer Drill

Langan or the contractor may use an electric hammer drills to install the sub slab vapor points, Langan will confirm that hammer drill and all extension cords are inspect prior to us3e. The electrical cords must be a grounded and connect to the power source using a functional three prong grounded plug. The power source must be a Ground Fault Circuit Interrupter (GFI or GFCI) receptacle. Langan will confirm that there is a portable GFCI circuit from the outlet to the extension cord and that the GFCI is tested before commencing drilling activities.

3.1.6 Vapor Investigation and Sampling

Sampling 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 contractor equipment nor assemble or install the contractor vapor point sampling equipment unless instructed by the

work plan. When not instructed by the work plan, these tasks are to be completed by the contractor.

3.1.7 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.

3.1.8 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°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°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°F, or wind-chill less than 30°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°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 (GFCI) 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)

3.3.7.1 Utility Clearance

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.

3.3.7.2 Lockout-Tagout

The potential adverse effects of electrical hazards include burns and electrocution, which could result in death. Therefore, there is a procedure that establishes the requirements for the lockout/tagout (LOTO) of energy isolating devices in accordance with the OSHA electrical lockout and tagging requirements as specified in 29 CFR 1926.417. This procedure will be used to ensure that all machines and equipment are isolated from potentially hazardous energy. If possible, equipment that could cause injury due to unexpected energizing, start-up, or release of stored energy will be locked/tagged, before field personnel perform work activities.

Depending upon the specific work task involved, Langan's SSC or FTL will serve as the authorized lockout/tagout coordinator, implement the lockout/tagout procedure and will be responsible to locate, lock and tag valves, switches, etc.

SPECIAL NOTE: Project personnel will assume that all electrical equipment at surface, subsurface and overhead locations is energized, until equipment has been designated and confirmed as de-energized by a utility company representative. Langan will notify the designated utility representative prior to working adjacent to this equipment and will verify that the equipment is energized or de-energized in the vicinity of the work location.

No project work shall be performed by Langan personnel or subcontractors on or near energized electrical lines or equipment unless hazard assessments are completed in writing, reviewed by Langan's SSHO, and clearly communicated to the field personnel.

The FTL shall conduct a survey to locate and identify all energy isolating devices. They shall be certain which switches, valves or other isolating devices apply to the equipment. The lockout/tagout procedure involves, but is not limited to, electricity, motors, steam, natural gas, compressed air, hydraulic systems, digesters, sewers, etc.

3.3.8 Physical Hazard Considerations for Material Handling

There are moderate to severe risks associated with moving heavy objects at the Site. The following physical hazards should be considered when handling materials at the Site:

- Heavy objects will be lifted and moved by mechanical devices rather than manual effort whenever possible.
- The mechanical devices will be appropriate for the lifting of moving task and will be operated only by trained and authorized personnel.

- Objects that require special handling or rigging will only be moved under the guidance of a person who has been specifically trained to move such objects.
- Lifting devices will be inspected, certified, and labeled to confirm their weight capacities. Defective equipment will be taken out of service immediately and repaired or destroyed.
- The wheels of any trucks being loaded or unloaded will be chocked to prevent movement. Outriggers will be fully extended on a flat, firm surface during operation.
- Personnel will not pass under a raised load, nor will a suspended load be left unattended.
- Personnel will not be carried on lifting equipment, unless it is specifically designed to carry passengers.
- All reciprocating, rotating, or other moving parts will be guarded at all times.
- Accessible fire extinguishers, currently (monthly) inspected, will be available in all mechanical lifting devices.
- Verify all loads/materials are secure before transportation.

Material handling tasks that are unusual or require specific guidance will need a written addendum to this HASP. The addendum must identify the lifting protocols before the tasks are performed. Upon approval, the plan must be reviewed with all affected employees and documented. Any deviation from a written plan will require approval by the Langan HSM.

3.3.9 Hearing Conservation

Under the construction industry standard, the maximum permissible occupational noise exposure is 90 dbA (8-hour TWA), and noise levels in excess of 90 dbA must be reduced through feasible administrative and engineering controls (20 CFR 1926.52). Hearing protection is required when working within 15 feet of vacuum extraction equipment and drill rigs.

3.3.9 Open Water

Employees working over or near water, where the danger of drowning exists, shall be provided with U.S. Coast Guard-approved life jackets or buoyant work vests. Prior to and after each use, the buoyant work vests or life preservers shall be inspected for defects which would alter their strength or buoyancy. Defective units shall not be used.

And should a worker fall into the water, OSHA requires (29 CFR 1926.106(c)) that ring buoys with at least 90 feet of line shall be provided and readily available for emergency rescue operations. The distance between ring buoys shall not exceed 200 feet. Another remedial action required by OSHA (29 CFR 1926.106(d)) is the use of lifesaving skiffs.

OSHA requires that at least one lifesaving skiff shall be immediately available at locations where employees are working over or adjacent to water and must include the following provisions.

- The skiff must be in the water or capable of being quickly launched by one person.
- At least one person must be present and specifically designated to respond to water emergencies and operate the skiff at all times when there are employees above water.
- When the operator is on break another operator must be designated to provide requisite coverage when there are employees above water.
- The designated operator must either have the skiff staffed at all times or have someone remain in the immediate area such that the operator can quickly reach the skiff and perform rescue services.
- The skiff operator maybe assigned other tasks provided the tasks do not interfere with the operator's ability to quickly reach the skiff.
- A communication system, such as a walkie-talkie, must be used to inform the skiff operator of an emergency and to inform the skiff operator where the skiff is needed.
- The skiff must be equipped with both a motor and oars.

With regard to the number of skiffs required and the appropriate maximum response time, the following factors must be evaluated:

- The number of work locations where there is a danger of falling into water;
- The distance to each of those locations;
- Water temperature and currents;
- Other hazards such as, but not limited to, rapids, dams, and water intakes;

Other regulations that present S&H practices and PPE for work on or near water include: 29 CFR 1910, Subpart T (401 – 440)

3.4 Biological Hazards

3.4.1 Animals

There is a possibility of encountering wildlife including reptiles, rodents and other small and medium size mammals. The Langan personnel is to avoid interacting with any wildlife.

3.4.2 Insects

Ticks and other biting or stinging insects may to be encountered during site operations. Langan personnel should take necessary precautions including donning long sleeve shirts and insecticide to prevent bites and stings. After field work, Langan personnel should perform a complete visual inspection of their clothing to insure they are not inadvertently harboring ticks. If they do observe a tick bite, they are to contact the HSM or HSO and report the event.

3.4.3 Plants

Poisonous plants may to be encountered during site operations. Langan personnel should take necessary precautions including donning long sleeve shirts and applying preventative poison Ivy/Sumac lotion to prevent or limit effects of exposure. If after field work, Langan employees do observe a reaction to poisonous plant exposure, they are to contact the HSM or HSO and report the event.

3.4.4 Coronavirus

3.4.4.1 General Preventative Measures

Field personnel must follow general proper hygiene measures while in the field including:

- Avoid touching eyes, nose and mouth.
- Cover cough or sneeze with tissue, and throw in trash.
- Wash hands often with soap and water for 20 seconds after going to bathroom, before eating, after blowing nose, coughing or sneezing.
- Use hand sanitizer with at least 60% alcohol if soap and water are not available.
- Avoid physical contact with other people (e.g., no handshakes).
- Maintain a safe distance of at least 6 feet from other people (social distancing).
- Wear face coverings when around other worker to minimize spread of COVID-19. (May be required in certain states or locations.)

3.4.4.2 Construction Trailers

Employees should avoid use of shared construction trailers or where employees cannot maintain a safe distance (minimum 6 feet) from other workers. If trailer use is needed, areas such as desks, phones, chairs and other common areas, should be cleaned and disinfected before and after use. Protocols should be developed to minimize trailer use to essential personal, restrict use from any workers who are ill or showing symptoms of being ill, and ensure a safe distance of 6 feet can be established between workers.

3.4.4.3 Communication

Include Coronavirus topics and prevention topics in daily tailgate meetings to ensure Coronavirus awareness is communicated daily. Discussions can focus on general topics including: social distancing, prevention measures for field personnel, signs and symptoms and recent news on the Coronavirus. Site-specific topics should include minimizing face-to-face contact, disinfecting/sterilizing field equipment, use of PPE to reduce exposure, site security and other

potential exposure issues/concerns.

3.4.4.4 Sick/Ill Workers

No Langan employee is permitted to be onsite when ill and/or showing potential symptoms of the Coronavirus. Symptoms of the Coronavirus may appear 2-14 days after exposure and can range from mild to severe. The most common symptoms include: fever, fatigue, dry cough and shortness of breath. If an employee or subcontractor is observed being ill or exhibiting symptoms of Coronavirus, employees must immediately utilize their Stop Work Authority and contact their project manager to address the situation. If an employee observes another worker onsite exhibiting symptoms of Coronavirus, immediately utilize Stop Work Authority and notify their project manager and site construction manager or safety officer. Work should resume when the safety and health of Langan and subcontractors is adequately addressed.

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 ground water 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 PERSONAL PROTECTIVE EQUIPMENT

6.1 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 D Protection (Modified, as needed)

- Safety glasses with sideshields or chemical splash goggles
- Safety boots/shoes (toe-protected)
- Disposable chemical-resistant boot covers
- Coveralls (polycoated Tyvek or equivalent to be worn when contact with wet contaminated soil, groundwater, or non-aqueous phase liquids is anticipated)
- Hard hat
- Long sleeve work shirt and work pants
- Nitrile gloves
- Hearing protection (as needed)
- Personal floatation device (for work within 5 feet of the water)
- Reflective traffic 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).

6.2 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, air-purifying respirator and have been successfully fit-tested within the past year. Fit-test records are maintained by the HSM.

6.3 Respirator Cartridge Change-Out Schedule

Respiratory protection is required to be worn when certain action levels (table 2) are reached. A respirator cartridge change-out schedule has been developed in order to comply with 29 CFR 1910.134. The respirator cartridge change-out schedule for this project is as follows:

- Cartridges shall be removed and disposed of at the end of each shift, when cartridges become wet or wearer experiences breakthrough, whichever occurs first.
- If the humidity exceeds 85%, then cartridges shall be removed and disposed of after 4 hours of use.

Respirators shall not be stored at the end of the shift with contaminated cartridges left on. Cartridges shall not be worn on the second day, no matter how short the time period was the previous day they were used.

7.0 AIR QUALITY MONITORING AND ACTION LEVELS

7.1 Monitoring During Site Operations

Atmospheric air monitoring results may be collected and used to provide data to determine when exclusion zones need to be established and when certain levels of personal protective equipment are required. For all instruments there are Site-specific action level criteria which are used in making field health and safety determinations. Other data, such as the visible presence of contamination or the steady state nature of air contaminant concentration, are also used in making field health and safety decisions. Therefore, the HSO may establish an exclusion zone or require a person to wear a respirator even though atmospheric air contaminant concentrations are below established HASP action levels.

During site work involving disturbance of petroleum-impacted or fill material, real time air monitoring may be conducted for volatile organic compounds (VOCs). A photoionization detector (PID) and/or flame ionization detector (FID) will be used to monitor concentrations of VOCs at personnel breathing-zone height. Air monitoring will be the responsibility of the HSO or designee. Air monitoring may be conducted during intrusive activities associated with the completion of

excavation, debris removal, and soil grading. All manufacturers' instructions for instrumentation and calibration will be available onsite.

Subcontractors' air monitoring plans must be equal or more stringent as the Langan plan.

An air monitoring calibration log is provided in Attachment D of this HASP.

7.1.1 Volatile Organic Compounds

Monitoring with a PID, such as a MiniRAE 2000 (10.6v) or equivalent may occur during intrusive work in the PAOCs. Colormetric Indicator Tubes for benzene may be used as backup for the PID, if measurements remain above background monitor every 2 hours. The HSO will monitor the employee breathing zone at least every 30 minutes, or whenever there is any indication that concentrations may have changed (odors, visible gases, etc.) since the last measurement. If VOC levels are observed above 5 ppm for longer than 5 minutes or if the site PPE is upgraded to Level C, the HSO will begin monitoring the site perimeter at a location downwind of the PAOC every 30 minutes in addition to the employee breathing zone. Instrument action levels for monitored gases are provided in Table 4.

7.1.2 Metals

Based upon the Site history, there is a potential for the soils to contain PAHs and metals. During invasive procedures which have the potential for creating airborne dust, such as excavation of dry soils, a real time airborne dust monitor such as a Mini-Ram may be used to monitor for air particulates. The HSO will monitor the employee breathing zone at least every 30 minutes, or whenever there is any indication that concentrations may have changed (appearance of visible dust) since the last measurement. If dust levels are observed to be greater than 0.100 mg/m^3 or visible dust is observed for longer than 15 minutes or if the site PPE is upgraded to Level C, the HSO will begin monitoring the site perimeter at a location downwind of the PAOC every 30 minutes in addition to the employee breathing zone. Instrument action levels for dust monitoring are provided in Table 4.

7.2 Monitoring Equipment Calibration and Maintenance

Instrument calibration shall be documented and included in a dedicated safety and health logbook or on separate calibration pages of the field book. All instruments shall be calibrated before and after each shift. Calibration checks may be used during the day to confirm instrument accuracy. Duplicate readings may be taken to confirm individual instrument response.

All instruments shall be operated in accordance with the manufacturers' specifications. Manufacturers' literature, including an operations manual for each piece of monitoring equipment will be maintained on site by the HSO for reference.

7.3 Determination of Background Levels

Background (BKD) levels for VOCs and dust will be established prior to intrusive activities within the PAOC at an upwind location. A notation of BKD levels will be referenced in the daily monitoring log. BKD levels are a function of prevailing conditions. BKD levels will be taken in an appropriate upwind location as determined by the HSO.

Table 4 lists the instrument action levels.

8.0 COMMUNITY AIR MONITORING PROGRAM

Community air monitoring may be conducted in compliance with local standards or the 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 local standards or, default to the performance standards below:

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 shut down.

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.

8.1 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.

9.0 WORK ZONES AND DECONTAMINATION

9.1 Site Control

Work zones are intended to control the potential spread of contamination throughout the site and to assure that only authorized individuals are permitted into potentially hazardous areas.

Any person working in an area where the potential for exposure to site contaminants exists will only be allowed access after providing the HSO with proper training and medical documentation.

Exclusion Zone (EZ) - All activities which may involve exposure to site contaminants, hazardous materials and/or conditions should be considered an EZ. Decontamination of field equipment will also be conducted in the Contaminant Reduction Zone (CRZ) which will be located on the perimeter of the EZ. The EZ and the CRZ will be clearly delineated by cones, tapes or other means. The HSO may establish more than one EZ where different levels of protection may be employed or different hazards exist. The size of the EZ shall be determined by the HSO allowing adequate space for the activity to be completed, field members and emergency equipment.

9.2 Contamination Zone

9.2.1 Personnel Decontamination Station

Personal hygiene, coupled with diligent decontamination, will significantly reduce the potential for exposure.

9.2.2 Minimization of Contact with Contaminants

During completion of all site activities, personnel should attempt to minimize the chance of contact with contaminated materials. This involves a conscientious effort to keep "clean" during site activities. All personnel should minimize kneeling, splash generation, and other physical contact with contamination as PPE is intended to minimize accidental contact. This may ultimately minimize the degree of decontamination required and the generation of waste materials from site operations.

Field procedures will be developed to control over spray and runoff and to ensure that unprotected personnel working nearby are not affected.

9.2.3 Personnel Decontamination Sequence

Decontamination may be performed by removing all PPE used in EZ and placing it in drums/trash cans at the CRZ. Baby wipes should be available for wiping hands and face. Drums/trash cans will be labeled by the field crews in accordance with all local, state, and federal requirements. Management plans for contaminated PPE, and tools are provided below.

9.2.4 Emergency Decontamination

If circumstances dictate that contaminated clothing cannot be readily removed, then remove gross contamination and wrap injured personnel with clean garments/blankets to avoid contaminating other personnel or transporting equipment. If the injured person can be moved, he/she will be decontaminated by site personnel as described above before emergency responders handle the victim. If the person cannot be moved because of the extent of the injury (a back or neck injury), provisions shall be made to ensure that emergency response personnel will be able to respond to the victim without being exposed to potentially hazardous atmospheric conditions. If the potential for inhalation hazards exist, such as with open excavation, this area will be covered with polyethylene sheeting to eliminate any potential inhalation hazards. All emergency personnel are to be immediately informed of the injured person's condition, potential contaminants, and provided with all pertinent data.

9.2.5 Hand-Held Equipment Decontamination

Hand-held equipment includes all monitoring instruments as stated earlier, samples, hand tools, and notebooks. The hand-held equipment is dropped at the first decontamination station to be decontaminated by one of the decontamination team members. These items must be decontaminated or discarded as waste prior to removal from the CRZ.

To aid in decontamination, monitoring instruments can be sealed in plastic bags or wrapped in polyethylene. This will also protect the instruments against contaminants. The instruments will be wiped clean using wipes or paper towels if contamination is visually evident. Sampling equipment, hand tools, etc. will be cleaned with non-phosphorous soap to remove any potentially contaminated soil, and rinsed with deionized water. All decontamination fluids will be containerized and stored on-site pending waste characterization sampling and appropriate off-site disposal.

9.2.6 Heavy Equipment Decontamination

All heavy equipment and vehicles arriving at the work site will be free from contamination from offsite sources. Any vehicles arriving to work that are suspected of being impacted will not be

permitted on the work site. Potentially contaminated heavy equipment will not be permitted to leave the EZ unless it has been thoroughly decontaminated and visually inspected by the HSO or his designee.

9.3 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.

9.4 Communications

The following communications equipment will be utilized as appropriate.

- Telephones - A cellular telephone will be located with the HSO for communication with the HSM and emergency support services/facilities.
- Hand Signals - Hand signals shall be used by field teams, along with the buddy system. The entire field team shall know them before operations commence and their use covered during site-specific training. Typical hand signals are the following:

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

9.5 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.

10.0 NEAREST MEDICAL ASSISTANCE

The address and telephone number of the nearest hospital:

Wyckoff Heights Medical Center
374 Stockholm Street
Brooklyn, New York
718-963-7272

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.

11.0 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.

12.0 SITE SECURITY

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

13.0 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.

14.0 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.

15.0 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.

16.0 EMERGENCY RESPONSE

16.1 General

This section establishes procedures and provides information for use during a project emergency. Emergencies happen unexpectedly and quickly, and require an immediate response; therefore, contingency planning and advanced training of staff is essential. Specific elements of emergency support procedures that are addressed in the following subsections include communications, local emergency support units, and preparation for medical emergencies, first aid for injuries incurred on site, record keeping, and emergency site evacuation procedures. In case of emergency, in addition to 911, call *Incident Intervention®* at 1-888-479-7787 to report their injuries. For all other communications, contact the Langan Incident Hotline at **(800) 9-LANGAN** (800-952-6426) extension 4699 as soon as possible.

Should outside assistance be needed for accidents, fire, or release of hazardous substances, the emergency numbers will be available and posted at the site (Table 5) where a readily accessible telephone is made available for emergency use.

16.2 Responsibilities

16.2.1 Health and Safety Officer (HSO)

The HSO is responsible for ensuring that all personnel are evacuated safely and that machinery and processes are shut down or stabilized in the event of a stop work order or evacuation. The

HSO is responsible for ensuring the HSM are notified of all incidents, all injuries, near misses, fires, spills, releases or equipment damage. The HSO is required to immediately notify the HSM of any fatalities or catastrophes (three or more workers injured and hospitalized) so that the HSM can notify OSHA within the required time frame.

16.2.2 Emergency Coordinator

The HSO or their designated alternate will serve as the Emergency Coordinator. The Emergency Coordinator is responsible for ensuring that all personnel are evacuated safely and that machinery and processes are shut down or stabilized in the event of a stop work order or evacuation. They are also responsible for ensuring the HSM are notified of all incidents, all injuries, near misses, fires, spills, releases or equipment damage. The Emergency Coordinator is required to immediately notify the HSM of any fatalities or catastrophes (three or more workers injured and hospitalized.

The Emergency Coordinator shall locate emergency phone numbers and identify hospital routes prior to beginning work on the sites. The Emergency Coordinator shall make necessary arrangements to be prepared for any emergencies that could occur.

The Emergency Coordinator is responsible for implementing the Emergency Response Plan.

16.2.3 Site Personnel

Project site personnel are responsible for knowing the Emergency Response Plan and the procedures contained herein. Personnel are expected to notify the Emergency Coordinator of situations that could constitute a site emergency. Project site personnel, including all subcontractors will be trained in the Emergency Response Plan.

16.3 Communications

Once an emergency situation has been stabilized, or as soon as practically, the injured Langan personnel should contact *Incident Intervention®* at 1-888-479-7787 to report their injuries. For all other communications, contact the Langan Incident Hotline at **(800) 9-LANGAN** (800-952-6426) extension 4699 as soon as possible.

16.4 Local Emergency Support Units

In order to be able to deal with any emergency that might occur during investigative activities at the site, the Emergency Notification Numbers (Table 5) will be posted and provided to all personnel conducting work within the EZ.

Figure 2 shows the hospital route map. Outside emergency number 911 and local ambulance should be relied on for response to medical emergencies and transport to emergency rooms. Always contact first responders when there are serious or life threatening emergencies on the site. Project personnel are instructed not to drive injured personnel to the Hospital. In the event of an injury, provide first aid and keep the injured party calm and protected from the elements and treat for shock when necessary.

16.5 Pre-Emergency Planning

Langan will communicate directly with administrative personnel from the emergency room at the hospital in order to determine whether the hospital has the facilities and personnel needed to treat cases of trauma resulting from any of the contaminants expected to be found on the site. Instructions for finding the hospital will be posted conspicuously in the site office and in each site vehicle.

16.6 Emergency Medical Treatment

The procedures and rules in this CHASP are designed to prevent employee injury. However, should an injury occur, no matter how slight, immediately report it will be reported to the HSO. First-aid equipment will be available on site at the following locations:

- First Aid Kit: Contractor Vehicles
- Emergency Eye Wash: Contractor Vehicles

During the site safety briefing, project personnel will be informed of the location of the first aid station(s) that has been set up. Some injuries, such as severe cuts and lacerations or burns, may require immediate treatment. Any first aid instructions that can be obtained from doctors or paramedics, before an emergency-response squad arrives at the site or before the injured person can be transported to the hospital, will be followed closely. Personnel with current first aid and CPR certification will be identified.

Only in non-emergency situations may an injured person be transported to an urgent care facility. 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.

16.8 Emergency Site Evacuation Routes and Procedures

All project personnel will be instructed on proper emergency response procedures and locations of emergency telephone numbers during the initial site safety meeting. If an emergency occurs

as a result of the site investigation activities, including but not limited to fire, explosion or significant release of toxic gas into the atmosphere, the Langan Project Manager will be verbally notified immediately. All heavy equipment will be shut down and all personnel will evacuate the work areas and assemble at the nearest intersection to be accounted for and to receive further instructions.

In the event that an emergency situation arises, the FTL will implement an immediate evacuation of all project personnel due to immediate or impending danger. The FTL will also immediately communicate with the contractor to coordinate any needed evacuation of the property.

The FTL or Site Supervisor will give necessary instructions until the Designated Incident Commander (IC) assumes control. After the emergency has been resolved, the FTL or Site Supervisor will coordinate with the IC and indicate when staff should resume their normal duties. If dangers are present for those at the designated assembly point, another designated location of assembly will be established.

It will be the responsibility of the FTL or Site Supervisor to report a fire or emergency, assess the seriousness of the situation, and initiate emergency measures until the arrival of the local fire fighters or other first responders, should they be necessary. The FTL, working with emergency responders, may also order the closure of the Site for an indefinite period as long as it is deemed necessary.

Under no circumstances will incoming visitors be allowed to proceed to the area of concern, once an emergency evacuation has been implemented. Visitors or other persons present in the area of the emergency shall be instructed to evacuate the area. The FTL will ensure that access roads are not obstructed and will remain on-site to provide stand-by assistance upon arrival of emergency personnel.

If it is necessary to temporarily control traffic in the event of an emergency, those persons controlling traffic will wear proper reflection warning vests until the arrival of police or fire personnel.

16.8.1 Designated Assembly Locations

All personnel will evacuate the site and assemble at a designated assembly location. The assembly location will be designated by Langan personnel and discussed during each shift's pre-job safety briefing.

16.8.2 Accounting for Personnel

All contractor and subcontractor supervisors are responsible for the accounting of all personnel assembled at the designed assembly area. The Designated Incident Commander shall be notified if personnel are not found.

16.9 Fire Prevention and Protection

In the event of a fire or explosion, procedures will include immediately evacuating the site and notification of the Langan Project Manager of the investigation activities. Portable fire extinguishers will be provided at the work zone. The extinguishers located in the various locations should also be identified prior to the start of work. No personnel will fight a fire beyond the stage where it can be put out with a portable extinguisher (incipient stage).

16.9.1 Fire Prevention

Fires will be prevented by adhering to the following precautions:

- Good housekeeping and storage of materials.
- Storage of flammable liquids and gases away from oxidizers.
- Shutting off engines to refuel.
- Grounding and bonding metal containers during transfer of flammable liquids.
- Use of UL approved flammable storage cans.
- Fire extinguishers rated at least 10 pounds ABC located on all heavy equipment, in all trailers and near all hot work activities.

The person responsible for the control of fuel source hazards and the maintenance of fire prevention and/or control equipment is the HSO.

16.10 Significant Vapor Release

Based on the proposed tasks, the potential for a significant vapor release is low. However, if a release occurs, the following steps will be taken:

- Move all personnel to an upwind location. All non-essential personnel shall evacuate.
- Upgrade to Level C Respiratory Protection.
- Downwind perimeter locations shall be monitored for volatile organics.
- If the release poses a potential threat to human health or the environment in the community, the Emergency Coordinator shall notify the Langan Project Manager.
- Local emergency response coordinators will be notified.

16.11 Overt Chemical Exposure

The following are standard procedures to treat chemical exposures. Other, specific procedures detailed on the Material Safety Data Sheet (MSDS) will be followed, when necessary.

SKIN AND EYE: Use copious amounts of soap and water from eye-wash kits and portable hand wash stations.

CONTACT: Wash/rinse affected areas thoroughly, then provide appropriate medical attention. Skin shall also be rinsed for 15 minutes if contact with caustics, acids or hydrogen peroxide occurs. Affected items of clothing shall also be removed from contact with skin.

Providing wash water and soap will be the responsibility of each individual contractor or subcontractor on-site.

16.12 Decontamination during Medical Emergencies

If emergency life-saving first aid and/or medical treatment is required, normal decontamination procedures may need to be abbreviated or omitted. The HSO or designee will accompany contaminated victims to the medical facility to advice on matters involving decontamination when necessary. The outer garments can be removed if they do not cause delays, interfere with treatment or aggravate the problem. Respiratory equipment must always be removed. Protective clothing can be cut away. If the outer contaminated garments cannot be safely removed on site, a plastic barrier placed between the injured individual and clean surfaces should be used to help prevent contamination of the inside of ambulances and/or medical personnel. Outer garments may then be removed at the medical facility. No attempt will be made to wash or rinse the victim if his/her injuries are life threatening, unless it is known that the individual has been contaminated with an extremely toxic or corrosive material which could also cause severe injury or loss of life to emergency response personnel. For minor medical problems or injuries, the normal decontamination procedures will be followed.

16.13 Adverse Weather Conditions

In the event of adverse weather conditions, the HSO will determine if work will continue without potentially risking the safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat stress and heat-related injuries.
- Potential for cold stress and cold-related injuries.
- Treacherous weather-related working conditions (hail, rain, snow, ice, high winds).
- Limited visibility (fog).

- Potential for electrical storms.
- Earthquakes.
- Other major incidents.

Site activities will be limited to daylight hours, or when suitable artificial light is provided, and acceptable weather conditions prevail. The HSO will determine the need to cease field operations or observe daily weather reports and evacuate, if necessary, in case of severe inclement weather conditions.

16.14 Spill Control and Response

All small spills/environmental releases shall be contained as close to the source as possible. Whenever possible, the MSDS will be consulted to assist in determining proper waste characterization and the best means of containment and cleanup. For small spills, sorbent materials such as sand, sawdust or commercial sorbents should be placed directly on the substance to contain the spill and aid recovery. Any acid spills should be diluted or neutralized carefully prior to attempting recovery. Berms of earthen or sorbent materials can be used to contain the leading edge of the spills. All spill containment materials will be properly disposed. An exclusion zone of 50 to 100 feet around the spill area should be established depending on the size of the spill.

All contractor vehicles shall have spill kits on them with enough material to contain and absorb the worst-case spill from that vehicle. All vehicles and equipment shall be inspected prior to be admitted on site. Any vehicle or piece of equipment that develops a leak will be taken out of service and removed from the job site.

The following seven steps shall be taken by the Emergency Coordinator:

1. Determine the nature, identity and amounts of major spills.
2. Make sure all unnecessary persons are removed from the spill area.
3. Notify the HSO immediately.
4. Use proper PPE in consultation with the HSO.
5. If a flammable liquid, gas or vapor is involved, remove all ignition sources and use non-sparking and/or explosion-proof equipment to contain or clean up the spill (diesel-only vehicles, air-operated pumps, etc.)
6. If possible, try to stop the leak with appropriate material.
7. Remove all surrounding materials that can react or compound with the spill.

In addition to the spill control and response procedures described in this HASP, Langan personnel will coordinate with the designated project manager relative to spill response and control actions.

Notification to the Project Manager must be immediate and, to the extent possible, include the following information:

- Time and location of the spill.
- Type and nature of the material spilled.
- Amount spilled.
- Whether the spill has affected or has a potential to affect a waterway or sewer.
- A brief description of affected areas/equipment.
- Whether the spill has been contained.
- Expected time of cleanup completion. If spill cleanup cannot be handled by Langan's on-site personnel alone, such fact must be conveyed to the Project Manager immediately.

Langan shall not make any notification of spills to outside agencies. The client will notify regulatory agencies as per their reporting procedures.

16.15 Emergency Equipment

The following minimum emergency equipment shall be kept and maintained on site:

- Industrial first aid kit.
- Fire extinguishers (one per site).

16.16 Restoration and Salvage

After an emergency, prompt restoration of utilities, fire protection equipment, medical supplies and other equipment will reduce the possibility of further losses. Some of the items that may need to be addressed are:

- Refilling fire extinguishers.
- Refilling medical supplies.
- Recharging eyewashes and/or showers.
- Replenishing spill control supplies.

16.17 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 SPECIAL CONDITIONS

This guideline contains information and requirements for special conditions that may not be routinely encountered.

17.1 Scope

The guideline applies to the specific projects identified within this document. Additional provisions will be addressed in each Site-Specific HASP, as needed.

17.2 Responsibilities

Site Personnel - All site personnel must be alert to safety hazards on work sites and take action to minimize such hazards. Personnel must utilize the buddy system, watch for inappropriate behavior, and be alert to changes in site conditions.

Health and Safety Officer (HSO) - The HSO is responsible for considering these procedures in the development of site specific HASPs. The HSO shall schedule frequent "tail gate" safety briefings to enhance safety awareness and discuss potential problems.

17.3 Procedures

The procedures outlined below shall be followed when such conditions are encountered.

17.3.1 Ladders

Langan safety procedures shall be used to ensure employee safety when using ladders in the office or work sites. All ladders shall be coated or repaired to prevent injury to the employee from punctures or lacerations and to prevent snagging or clothing. Any wood ladders used must have an opaque covering except for identification or warning labels, which may be placed on one face only of a side rail.

17.3.1.1 Ladder Use

Employees shall only use ladders for the purposes, which they were designed and shall not be used as scaffolding. Ladders will be maintained and inspected prior to use for slip hazards including oil and grease. Employees shall use ladders only on stable and level surfaces unless the ladder is secured to prevent possible displacement. Ladders should not be used on slippery surfaces unless secured or provided with slip resistant feet to prevent accidental displacement. Ladders should not be used in locations where they could be displaced by workplace activities or traffic. Ladder rungs, cleats and steps shall be parallel, level and uniformly spaced when the

ladder is in the use position.

Employees should not be carrying anything including equipment that could cause injury if there was a fall while utilizing the ladder. The top and bottom of the ladder area must remain clear while in use. When ascending and descending the ladder, employees must face the ladder.

Ladders shall not be loaded beyond the maximum intended load for which they were built or the manufacturer's rated capacity.

17.3.1.2 Portable Ladders

Rungs, cleats and steps for portable ladders and fixed ladders shall be spaced not less than 10 inches apart, nor more than 14 inches apart, as measured between center lines of the rungs, cleats and steps. When used to access an upper landing surface, the ladder side rails must extend at least three feet above the upper landing surface to which the ladder is used to gain access. If this is not possible, due to the ladders length, then the top of the ladder shall be secured at its top to a rigid support.

17.3.1.3 Step Stools

Rungs, cleats and steps of step stools shall not be less than 8 inches apart, nor more than 12 inches apart, as measured between center lines of the rungs, cleats and steps.

17.3.1.4 Extension Ladders

Rungs, cleats and steps of the base section of extension trestle ladders shall be spaced not less than 8 inches apart, nor more than 18 inches apart, as measured between center lines of the rungs, cleats and steps. The rung spacing on the extension section of the extension trestle ladder shall not be less than 6 inches nor more than 12 inches, as measured between center lines of the rungs, cleats and steps. Ladders shall be used at an angle such that the horizontal distance from the top support to the foot of the ladder is approximately one-quarter of the working length of the ladder (the distance along the ladder between the foot and the top support).

17.3.1.5 Inspection

Ladders will be inspected for visible detects periodically, prior to utilization or after any occurrence that could have negatively affected the ladder. Portable ladders with defects including broken or missing rungs, cleats, or steps, broken or split rails, corroded components or other faulty or defective components shall not be used. The ladder will be immediately marked as defective, tagged as "Do Not Use" or blocked from being used and removed from service until repaired.

17.3.2 First Aid/Cardiopulmonary Resuscitation (CPR)

Langan field and office personnel will be encouraged to be trained in First Aid and Cardiopulmonary Resuscitation (CPR). Training will be provided free of charge by Langan to all employees. Employees will receive a training certificate that will be kept on file with the Health & Safety Coordinator (HSC). Training and certification will be provided by a credited provider such as American Red Cross or equivalent.

17.3.2.1 Emergency Procedures

Prior to work at sites the Langan employees certified in first aid and CPR will be identified in the site specific HASP. Langan will endear to have at least one employee at a job site trained and able to render first aid and CPR. The site specific HASP will contain first aid information on both potential chemical and physical hazards. Emergency procedures to be followed are in case of injury or illnesses are provided in the HASP. The HASP will include emergency contact information including local police and fire departments, hospital emergency rooms, ambulance services, on-site medical personnel and physicians. The HASP will also include directions and contact information to the nearest emergency facility in case immediate medical attention is required. The emergency contact information will be conspicuously posted at the worksite. Employees that are injured and require immediate medical attention shall call either 911 or the local posted emergency contacts. Employees should use ambulatory services to transport injured workers to the nearest facility for emergency medical care. In areas where 911 is not available, the telephone numbers of the physicians, hospitals, or ambulances shall be conspicuously posted.

17.3.2.2 First Aid Supplies

First aid supplies are readily available to all Langan employees when required. First aid kits are located in each Langan office. Portable first aid kits are available for employees to use at work sites. First aid kits should consist of items needed to treat employees for potential chemical and physical injuries. At a minimum, first aid kits should contain items to allow basic first aid to be rendered. Where the eyes or body of an employee may be exposed to corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use including eye wash.

First aid kits will be weatherproof with individual sealed packages of each item. All portable first aid kits shall be inspected by Langan employees before and after use to ensure all used items are replaced. When out in the field, employees shall check first aid kits weekly to ensure used items are replaced.

17.3.3 Hydrogen Sulfide

Langan employees with the potential to be exposed to hydrogen sulfide while at work sites shall have training in hydrogen sulfide awareness. The training will include identification of areas where employees could be exposed to hydrogen sulfide, health effects, permissible exposure limits, and first aid procedures and personnel protective equipment. Langan employees could be exposed to hydrogen sulfide while at job sites including petroleum refineries, hazardous waste treatment, storage and disposal facilities, uncontrolled hazardous waste sites and remediation projects.

17.3.3.1 Characteristics

Hydrogen sulfide is a colorless gas with a strong odor of rotten eggs that is soluble in water. Hydrogen sulfide is used to test and make other chemicals. It is also found as a by-product of chemical reactions, such as in sewer treatment. It is a highly flammable gas and a dangerous fire hazard. Poisonous gases are produced in fires including sulfur oxides. Hydrogen sulfide is not listed as a carcinogen.

17.3.3.2 Health Effects

Hydrogen Sulfide can affect employees if inhaled or through contact with skin or eyes. Acute (or short term) health effects of hydrogen sulfide exposure include irritation of the nose and throat, dizziness, confusion, headache and trouble sleeping. Inhalation of hydrogen sulfide can irritate the lungs causing coughing and/or shortness of breath. Higher levels of exposure can cause build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.

Chronic (or long term) health effects of low levels of exposure to hydrogen sulfide can cause pain and redness of the eyes with blurred vision. Repeated exposure may cause bronchitis with cough, phlegm and shortness of breath.

17.3.3.3 Protective Clothing and Equipment

Respirators are required for those operations in which employees will be exposed to hydrogen sulfide above OSHA permissible exposure level. The maximum OSHA permissible exposure limit (PEL) for hydrogen sulfide is 20 parts of hydrogen sulfide vapor per million parts of air (20 ppm) for an 8-hour workday and the maximum short-term exposure limit (STEL) is 10 ppm for any 10-minute period.

Where employees are exposed to levels up to 100 parts of hydrogen sulfide vapor per million

parts of air (100 ppm), the following types of respiratory protection are allowed:

- Any powered, air purifying respirator with cartridge(s);
- Any air purifying, full-facepiece respirator (gas mask) with a chin style, front- or back-mounted canister;
- Any supplied air system with escape self-contained breathing apparatus, if applicable; and,
- Any self-contained breathing apparatus with a full facepiece.

Respirators used by employees must have joint Mine Safety and Health Administration and the National Institute for Occupational Safety and Health (NIOSH) seal of approval. Cartridges or canisters must be replaced before the end of their service life, or the end of the shift, whichever occurs first. Langan employees that have the potential to be exposed to hydrogen sulfide will be trained in the proper use of respirators. Respirator training is discussed under– Langan's Respiratory Protection Program.

Employees with potential exposure to hydrogen sulfide, or when required by the client, will wear a portable hydrogen sulfide gas detector. The detector should have an audible, visual and vibrating alarm. The detector may also provide detection for carbon monoxide, sulfur dioxide and oxygen deficient atmospheres. The hydrogen sulfide monitor will, at a minimum, be calibrated to detect hydrogen sulfide at a level of 20 parts of hydrogen sulfide vapor per million parts of air (20 ppm). Many portable gas detectors will have factory defaults with a low level alarm at 10 ppm and a high level alarm at 15 ppm. Langan employees shall consult clients to determine if any site specific threshold levels exist.

If the hydrogen sulfide gas detector sounds and employees are not wearing appropriate respiratory protection, employees must immediately vacate the area and meet at the assigned emergency location. Langan employees may not re- enter the site without proper respiratory protection and approval from the client or property owner, if needed.

Employees shall wear PPE to prevent eye and skin contact with hydrogen sulfide. Employees must wear appropriate protective clothing including boots, gloves, sleeves and aprons, over any parts of their body that could be exposed to hydrogen sulfide. Non-vented, impact resistant goggles should be worn when working with or exposed to hydrogen sulfide.

17.3.3.4 Emergency and First Aid Procedures

Eye and Face Exposure

If hydrogen sulfide comes in contact with eyes, it should be washed out immediately with large

amounts of water for 30 minutes, occasionally lifting the lower and upper eye lids. Seek medical attention immediately.

Skin Exposure

If hydrogen sulfide contaminates clothing or skin, remove the contaminated clothing immediately and wash the exposed skin with large amounts of water and soap. Seek medical attention immediately. Contaminated clothing should either be disposed of or washed before wearing again.

Breathing

If a Langan employee or other personnel breathe in hydrogen sulfide, immediately get the exposed person to fresh air. If breathing has stopped, artificial respiration should be started. Call for medical assistance or a doctor as soon as possible.

Safety Precautions

Hydrogen sulfide is a highly flammable gas and a dangerous fire hazard. Containers of hydrogen sulfide may explode in a fire situation. Poisonous gases are produced during fires.

Langan employees should contact property owners and operators prior to conducting work onsite to be aware of any site specific contingency plans, identify where hydrogen sulfide is used at the facility and be informed about additional safety rules or procedures.

19.3.4 Fire Protection/Extinguishers

Langan field personnel that have been provided with portable fire extinguishers for use at worksites will be trained to familiarize employees with general principles of fire extinguisher use and hazards associated with the incipient stage of firefighting. Training will be provided prior to initial assignment for field work and annually thereafter.

Portable fire extinguishers shall be visually inspected monthly and subjected to an annual maintenance check. Langan shall retain records of the annual maintenance date.

17.3.5 Overhead lines

When field work is performed near overhead lines, the lines shall be deenergized and grounded, or other protective measures shall be provided before the work shall commence. If overhead lines are to be deenergized, arrangements shall be made with the client, property owner or organization that operates or controls the electric circuits involved to deenergize and ground

them. If protective measures, such as guarding, isolating, or insulating, are provided, these precautions shall prevent employees from contacting such lines directly with any part of their body or indirectly through conductive materials, tools, or equipment.

When unqualified Langan personnel are working in an elevated position near overhead lines, the location shall be such that the person and the longest conductive object they may contact cannot come closer to any unguarded, energized overhead line than the following distances:

1. For voltages to ground 50kV or below - 10 feet; and
2. For voltages to ground over 50kV - 10 feet, plus 4 inches for every 10kV over 50kV.

As previously indicated, Langan does not retain qualified employees to perform work on energized equipment.

17.3.5.1 Vehicle and Equipment Clearance

Any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines shall be operated so that a clearance of 10 feet is maintained. If the voltage of the overhead lines is higher than 50kV, the clearance shall be increased 4 inches for every 10kV over that voltage.

If any of the following discussed conditions occur, the clearance may be reduced.

- If the vehicle is in transit with its structure lowered, the clearance may be reduced to 4 ft. If the voltage is higher than 50kV, the clearance shall be increased 4 in. for every 10 kV over that voltage.
- If insulating barriers are installed to prevent contact with the lines, and if the barriers are rated for the voltage of the line being guarded and are not a part of or an attachment to the vehicle or its raised structure, the clearance may be reduced to a distance within the designed working dimensions of the insulating barrier.

Employees standing on the ground may not contact the vehicle or mechanical equipment or any of its attachments, unless the employee is using protective equipment rated for the voltage; or the equipment is located so that no uninsulated part of its structure (that portion of the structure that provides a conductive path to employees on the ground) can come closer to the overhead line than permitted.

If any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines is intentionally grounded, employees working on the ground near the point of grounding may not stand at the grounding location whenever there is a possibility of overhead line contact. Additional precautions, such as the use of barricades or insulation, shall

be taken to protect employees from hazardous ground potentials, depending on earth resistivity and fault currents, which can develop within the first few feet or more outward from the grounding point.

17.3.6 Trade Secret

Langan employees could potentially be provided trade secret information by the client or property owner when site specific information is provided about highly hazardous chemicals. Trade secret means any confidential formula, pattern, process, device, information or compilation of information that is used in an employer's business, and that gives the employer an opportunity to obtain an advantage over competitors who do not know or use it. Langan employees understand that this information should be kept confident and if required, may enter into a confidentially agreement with the client.

17.3.7 Bloodborne Pathogens

Langan employees that can reasonably anticipate exposure to blood or other potentially infectious material while at work sites shall have training in bloodborne pathogens. Applicable employees would include those trained in first aid and serving a designated role as an emergency medical care provider. Bloodborne pathogens are pathogenic microorganisms that are present in human blood and can cause disease in humans. These pathogens include, but are not limited to, hepatitis B virus and human immunodeficiency virus.

17.3.7.1 Training

Langan employees with potential occupational exposure to blood or other potentially infectious material must participate in a training program. Training must be conducted prior to initial assignment where there would be potential for exposure and annually thereafter within one year of previous training. The training program will be provided to Langan employees at no cost to them and during working hours.

Langan will ensure the training program shall consist of the following:

- An accessible copy of the regulatory text of 29 CFR 1910.1030 and an explanation of its contents;
- A general explanation of the epidemiology and symptoms of bloodborne diseases;
- An explanation of the modes of transmission of bloodborne pathogens;
- An explanation of Langan's exposure control plan and the means by which the employee can obtain a copy of the written plan;
- An explanation of the appropriate methods for recognizing tasks and other activities that

may involve exposure to blood and other potentially infectious materials;

- An explanation of the use and limitations of personal protective
  - equipment (PPE) to prevent and reduce exposure;
  - Information on the types, proper use, location, removal, handling and disposal of PPE;
  - An explanation of the basis for selection of PPE;
  - Information on the hepatitis B vaccine, including information on its efficacy, safety, method of administration, the benefits of being vaccinated, and that the vaccine and vaccination will be offered free of charge;
  - Information on the appropriate actions to take and persons to contact in an emergency involving blood or other potentially infectious materials;
  - An explanation of the procedure to follow if an exposure incident occurs, including the method of reporting the incident and the medical follow-up that will be made available;
  - Information on the post-exposure evaluation and follow-up that the
  - employer is required to provide for the employee following an exposure incident;
  - An explanation of the signs and labels and/or color coding required by paragraph 29 CFR 1910.1030(g)(1); and
  - An opportunity for interactive questions and answers with the person conducting the training session.

Langan will develop and implement a written Exposure Control Plan, which will be designed to eliminate or minimize employee exposure to bloodborne pathogens. The Exposure Control Plan will contain the following elements:

- An exposure determination for employees;
- The schedule and method of implementation for Methods of Compliance (29 CFR 191.1030(d)), Hepatitis B Vaccination and Post-Exposure Evaluation and Follow-up (29 CFR 1910.1030(f)), Communication of Hazards to Employees (29 CFR 1910.1030(g)) and (h) Recordkeeping (29 CFR 1910.1030(h));
- The procedure for the evaluation of circumstances surrounding exposure incidents;
- Ensure a copy of the Exposure Control Plan will be accessible to employees; and,
- The Exposure Control Plan shall be reviewed and updated at least annually.

Langan employees with occupational exposure to bloodborne pathogens include any employees trained in first aid that would be expected to provide emergency medical care. This determination is made without regards to the use of PPE, which could eliminate or minimize exposure.

Universal precautions shall be observed to prevent contact with blood or other potentially infectious materials. According to the concept of Universal Precautions, all human blood and certain human body fluids are treated as if known to be infectious for bloodborne pathogens. Under circumstances in which differentiation between body fluid types is difficult or impossible,

all body fluids shall be considered potentially infectious materials.

Work practice controls shall be used to eliminate or minimize employee exposure, if applicable. Since Langan employees will have occupational exposure only during rendering of first aid, personnel protective equipment will be utilized to reduce or minimize exposure. PPE that could be available to Langan personnel when administering first aid includes safety glasses, gloves, and Tyvek suits or sleeves. PPE and first aid kits will be provided to employees at no cost to them.

Langan employees that render first aid in office areas will have access to hand washing facilities or restrooms. For first aid rendered at field locations, first aid kits will contain an appropriate antiseptic hand cleanser and clean cloth/paper towels or antiseptic towelettes. After using antiseptic hand cleansers or towelettes, employees shall wash their hands with soap and running water as soon as feasible.

After administering first aid, potentially infectious materials, including towels, personnel protective equipment, clothes and bandages, shall be placed in a container, which prevents leakage during collection, handling, processing, storage, transport, or shipping. All PPE will be dispose of after use. Any equipment or working surfaces which was been exposed to blood or potentially infectious materials due to an injury, will be decontaminated prior to reuse.

Langan will make available the hepatitis B vaccine and vaccination series to all employees who have occupational exposure, and post-exposure evaluation and follow-up to all employees who have had an exposure incident. These services will be available to the employee at no cost to them through a medical provider.

17.3.7.2 Recordkeeping

Langan will maintain training and medical records for each employee with occupational exposure to blood or potentially infectious materials. Medical and training records will be maintained by Langan's H&S Department.

Training records will include the following:

- Dates of the training sessions;
- Contents or a summary of the training sessions;
- Names and qualifications of persons conducting the training; and
- Names and job titles of all persons attending the training sessions.

Training records shall be maintained for 3 years from the date on which the training occurred.

Medical records will be will be preserved and maintained for the duration of employment plus 30 years.

All records will be made available upon request to employees, the Assistant Secretary of Labor for Occupational Safety and Health, and Director of National Institute for Occupational Safety and Health Director of OSHA for examination and copying. Medical records must have written consent from employee before releasing.

If Langan ceases to do business, all records shall be transferred to the successor employer. The successor employer shall receive and maintain these records.

If there will not be a successor, Langan will notify current employees of their rights to access records at least three months prior to the cessation of business.

18.0 RECORDKEEPING

The following is a summary of required health and safety logs, reports and recordkeeping.

18.1 Field Change Authorization Request

Any changes to the work to be performed that is not included in the CHASP will require an addendum that is approved by the Langan project manager and Langan HSM to be prepared. Approved changes will be reviewed with all field personnel at a safety briefing.

18.2 Medical and Training Records

Copies or verification of training (40-hour, 8-hour, supervisor, site-specific training, documentation of three-day OJT, and respirator fit-test records) and medical clearance for site work and respirator use will be maintained in the office and available upon request. Records for all subcontractor employees must also be available upon request. All employee medical records will be maintained by the HSM.

18.3 Onsite Log

A log of personnel on site each day will be kept by the HSO or designee.

18.4 Daily Safety Meetings (“Tailgate Talks”)

Completed safety briefing forms will be maintained by the HSO.

18.5 Exposure Records

All personal monitoring results, laboratory reports, calculations, and data sheets are part of an employee exposure record. These records will be maintained by the HSO during site work. At

the end of the project they will be maintained according to 29 CFR 1910.1020.

18.6 Hazard Communication Program/MSDS-SDS

Material safety data sheets (MSDS) of Safety Data Sheets (SDS) have been obtained for applicable substances and are included in this CHASP (Attachment D). Langan's written hazard communication program, in compliance with 29 CFR 1910.1200, is maintained by the HSM.

18.7 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 1-800-952-6426, extension 4699 and the Project Manager to report the incident or near miss. The Project Manager will contact the client or client representative. A written report must be completed and submitted HSM within 24 hours of the incident. For emergencies involving personnel injury and/or exposure, employee will complete and submit the Langan incident/injury report to the Langan corporate health and safety manager as soon as possible following the incident. Accidents will be investigated in-depth to identify all causes and to recommend hazard control measures.

18.7.1 Accident and Injury Report Forms

18.7.1.1 Accident/Incident Report

All injuries, no matter how slight, shall be reported to the FTL and the PM immediately. The accident/incident report forms, attached in Attachment C will be filled out on all accidents by the applicable contractor supervision personnel, the FTL, or the HSO. Copies of all accident/incident reports shall be kept on-site and available for review. Project personnel will be instructed on the location of the first aid station, hospital, and doctor and ambulance service near the job. The emergency telephone numbers will be conspicuously posted in site vehicles near the work zone. First aid supplies will be centrally located and conspicuously posted between restricted and non-restricted areas to be readily accessible to all on the site.

18.7.1.2 First Aid Treatment Record

The first aid treatment record forms will be used for recording all non-lost time injuries treated by the project first-aid attendant, the local physician or hospital will be entered in detail on this record. "Minor" treatment of scratches, cuts, etc. will receive the same recording attention as treatment of more severe injuries.

18.7.1.3 OSHA Form 300

An OSHA Form 300 will be kept at the Langan Corporate Office in Parsippany, New Jersey. All recordable injuries or illnesses will be recorded on this form. Subcontractor employers must also meet the requirements of maintaining an OSHA 300 form. The Incident Report form used to capture the details of work-related injuries/illnesses meets the requirements of the OSHA Form 301 (supplemental record) and must be maintained with the OSHA Form 300 for all recordable injuries or illnesses.

19.0 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.

20.0 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 – 1.3.6	Lacerations, abrasions, and punctures	Cutting bailer twine, pump tubing, acetate liners, etc. with knife; cuts from sharp 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 – 1.3.6	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	Noise	Drilling equipment and hand tools	Wear hearing protection; maintain safe distance from construction activities	Seek medical attention as required
1.3.1 – 1.3.6	Falling objects	Soil material, tools, etc. dropping from drill rigs	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 may make contact with underground objects; drilling boom may touch overhead utilities	"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 – 1.3.10	Insects (bees, wasps, hornets, mosquitos, and spiders)	Stings and bites	Insect repellent; wear proper 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 – 1.3.6	Vehicle traffic/Heavy Equipment Operation	Vehicles unable to see workers on-site, operation of heavy equipment in tight spaces, equipment failure, and malfunctioning alarms	Wear proper PPE, especially visibility vest; use a buddy system to look for traffic; rope off area 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	Acenaphthene 1,2-Dihydroacenaphthylene 1,8-Ethylenenaphthalene peri-Ethylenenaphthalene Naphthyleneethylene Tricyclododecapentaene	83-32-9	PID	NA NA	Groundwater	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
1.3.1 – 1.3.5	Anthracene	120-12-7	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater	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
1.3.1 – 1.3.5	Antimony	7440-36-0	None	0.5 mg/m^3 50 mg/m^3	Groundwater	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

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	Arsenic	NA	None	0.5 mg/m³ 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/m³ 50 mg/m³	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
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/m³ 80 mg/m³ (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

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(a)pyrene	50-32-8	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, seek medical attention Skin: Soap wash immediately; Breathing: move to fresh air; Swallow: Induce vomiting if conscious, seek medical attention immediately
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)	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	Benzo(k)fluoranthene	207-08-9	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater	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	Beryllium	7440-41-7	None	0.002 mg/m^3 4 mg/m^3	Groundwater	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 Skin: Water wash
1.3.1 – 1.3.5	Cyanide	57-12-5	None	5 mg/m^3/25 mg/m^3	Soil	inhalation, skin or eye contact, ingestion	dizziness, headache, nausea and vomiting, rapid breathing, rapid heart rate, restlessness, and weakness	Eye: Irrigate immediately Skin: Water wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.5	Cadmium	7440-43-9	None	0.005 mg/m^3 9 mg/m^3	Groundwater	skin or eye contact, 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

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 Total Chromium Chromium, Total	7440-47-3	None	1.0 mg/m^3 250 mg/m^3	Groundwater	skin or eye contact, 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	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, skin or eye contact, ingestion	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	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
1.3.1 – 1.3.5	Cumene Cumol Isopropylbenzene 2-Phenyl propane 1-methylethy lbenzene	98-82-8	PID	50 ppm 900 ppm	Groundwater	skin or eye contact, ingestion	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	Dibenz(a,h)anthracene Dibenzo(a,h)anthracene Dibenzo[a,h]anthracene	53-70-3	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	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	Ethyl benzene Ethylbenzene Ethylbenzol Phenylethane	100-41-4	PID	435 mg/m^3 3,472 mg/m^3	Groundwater	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	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	Ideno(1,2,3-cd)pyrene	193-39-5	None	None	Groundwater Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Fresh air, rest Swallow: Rinse mouth, 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	Iron	7439-89-6	None	10 mg/m³ NA	Groundwater	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
1.3.1 – 1.3.5	Lead	7439-92-1	None	0.050 mg/m³ 100 mg/m³	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	Magnesium	7439-95-4	None	15 mg/m³ NA	Groundwater	skin or eye contact, ingestion	irritation to the eyes, skin, respiratory system; cough	Eye: Irrigate immediately Breathing: Fresh air Skin: Soap flush promptly Breathing: Respiratory support Swallow: Do not induce vomiting, 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	Manganese	7439-96-5	None	5 mg/m^3 500 mg/m^3	Groundwater	skin or eye contact, 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	Mercury	7439-97-6	None	0.1 mg/m^3 10 mg/m^3	Groundwater Soil	inhalation, skin or eye contact, ingestion	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
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 Methyl tert butyl ether	1634-04-4	PID	NA NA	Groundwater	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	m-Xylenes 1,3-Dimethylbenzene m-Xylol Metaxylene	108-38-3 179601-23-1	PID	100 ppm 900 ppm	Groundwater	skin or eye contact, ingestion	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	Naphthalene Naphthalin Tar camphor White tar	91-20-3	PID	50 mg/m^3 250 ppm	Groundwater	skin or eye contact, ingestion	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	Nickel	7440-02-0	None	NA 10 mg/m^3	Groundwater	skin or eye contact, ingestion	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	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

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	n-Propylbenzene Isocumene Propylbenzene 1-Phenylpropane 1-Propylbenzene Phenylpropane	103-65-1	PID	NA NA	Groundwater	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
1.3.1 – 1.3.5	1,2,4-Trimethylbenzene	95-63-6	PID	None None	Soil	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	2-Hexanone Butyl methyl ketone MBK Methyl butyl ketone Methyl n-butyl ketone	591-78-6	PID	100 ppm 1600 ppm	Soil	inhalation, skin or eye contact, ingestion	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

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	Acetone Dimethyl ketone Ketone propane 2-Propanone	67-64-1	PID	1000 ppm 2500 ppm	Soil	inhalation, skin or eye contact, ingestion	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	4-Isopropyltoulene 1-Methyl-4-(1-methylethyl)benzene 4-Isopropyltoluene; 4-Methylcumene; 1-Methyl-4-isopropylbenzene Dolcymene Camphogen Paracymene Cymene p-Cymene p-Isopropyltoluene	99-87-6	PID	NA NA	Groundwater	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	2-Butanone Ethyl methyl ketone MEK Methyl acetone Methyl ethyl ketone	78-93-3	PID	200 ppm 3000 ppm	Soil	inhalation, skin or eye contact, ingestion	irritation to the eyes, skin, nose; headache; dizziness; vomiting; dermatitis	Eye: Irrigate immediately Skin: Water wash immediately Breathing: Fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.5	Bis(2-ethylhexyl)phthalate Bis(2-Ethylhexyl) Phthalate Di-sec octyl phthalate DEHP Di(2-ethylhexyl)phthalate Octyl phthalate bis(2-ethylexyl)phthalate Bis(2-Ethylhexyl) Phthalate	117-81-7	None	5 mg/m^3 5000 mg/m^3	Groundwater	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

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	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	Dibutyl phthalate	84-74-2	None	5 mg/m^3/4000 mg/m^3	Soil	inhalation, skin or eye contact, ingestion	Dizziness, nausea, seizures, central nervous system damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Fresh air, respiration, and medical attention Swallow: Rinse mouth out with water, medical attention immediately
1.3.1 – 1.3.5	Selenium	7782-49-2	None	1 mg/m^3 0.2 mg/m^3	Groundwater	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

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	Sodium	7440-23-5	None	NA NA	Groundwater	skin or eye contact, ingestion	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	1,2-Dichloropropane	78-87-5	None	350 mg/m³/400 ppm	Groundwater	skin or eye contact, ingestion	irritation to eyes, skin, and respiratory system, drowsiness, liver and kidney damage	Eye: Irrigate immediately Skin: Irrigate immediately 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	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	Zinc	7440-62-2	None	15 mg/m^3 500 mg/m^3	Groundwater	skin or eye contact, ingestion	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`

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

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.
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.
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.

Instrument	Operation Parameters
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[1]	No Respirator, no further action
>5ppm but </= 15 ppm at the parameter of the work area	Work temporarily halted and monitoring continues If instantaneous readings decrease below 5 ppm above background, work activities will resume with continued monitoring
>5ppm but </= 25 ppm at the downwind parameter of the hot zone	Work activities will be halted Source of vapors identified Corrective actions taken to abate emissions Continued monitoring Workers will don appropriate respirators and work can resume if vapor levels 200 feet downwind or the hot zone or half the distance to the nearest potential receptor or residential/commercial structure, Work can continue when vapor levels be whichever is less – but in no case less than 20 feet, is below 5 ppm above background for the 15-minute average
>25ppm at the perimeter of the hot zone	Activities will shut down

Particulate Monitoring Action Levels	**Action Required**
Background to 100 micrograms per cubic meter ($\mu g/m^3$)[2] , no dust observed	No further action
Background to 100 $\mu g/m^3$, dust observed leaving the work area	Dust suppression must be employed
100 to 150 $\mu g/m^3$ at the downwind perimeter of the hot zone	Work activities will be halted Source of dust identified Dust suppression activities initiated Corrective actions taken to abate emissions Continued monitoring Workers will don appropriate respirators Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM10 concentration to within 150 $\mu g/m^3$ of the upwind level and in preventing visible dust migration.
>150 $\mu g/m^3$ at the perimeter of the hot zone	Activities will shut down

[1] VOC concentrations are 15-minute averages above site background (upwind parameter)
[2] Particulate concentrations are 15 minute averages above site background (upwind parameter)

TABLE 5
EMERGENCY NOTIFICATION LIST

ORGANIZATION	CONTACT	TELEPHONE
Local Police Department		911
Local Fire Department		911
Ambulance/Rescue Squad		911
Hospital	Wyckoff Heights Hospital Center	911 or 718-963-7272
Langan Incident Hotline		800-952-6426 ex 4699
Medical Treatment Hotline	Incident Intervention	888-449-7787
Langan Environmental Project Manager	Rory Johnston	908-202-1407 (cell)
Langan Health and Safety Manager (HSM)	Tony Moffa	215-756-2523 (cell)
Langan Health & Safety Officer (HSO)	Alan Arico	973-524-8124 (cell)
Langan Field Team Leader (FTL)	To Be Determined	
Client's Representative	Brett Richer	415-733-9574
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 injury, unless immediate emergency medical treatment is required, the injured employee must contact Incident Intervention® at 888-449-7787.

For all other incidents or near misses, unless emergency response is required, either the employee or a coworker must contact the Langan Incident 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

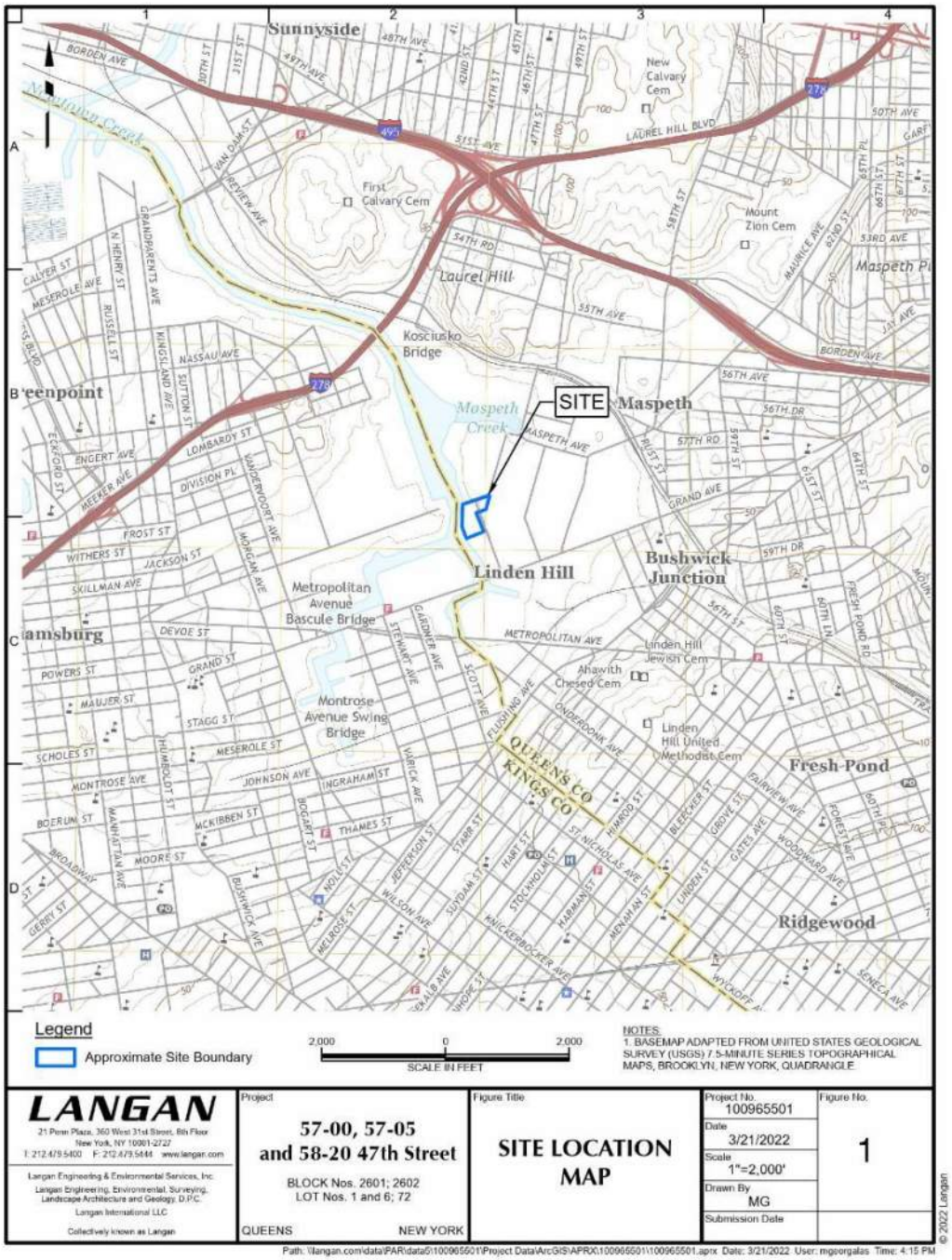


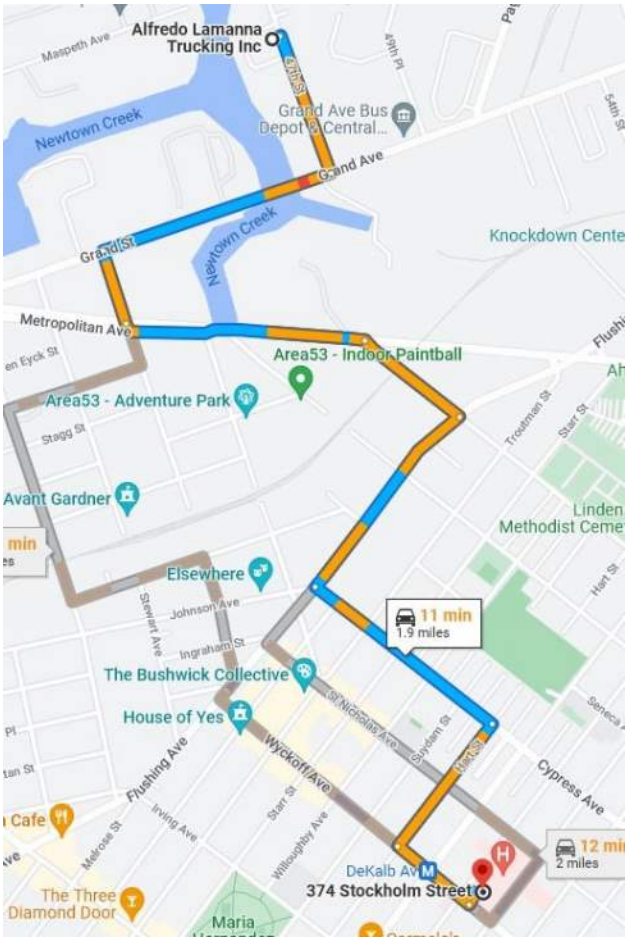
FIGURE 2
HOSPITAL ROUTE PLAN

Hospital Location: **Wyckoff Heights Medical Center**
374 Stockholm Street
Brooklyn, New York
718-963-7272

START: 57-00 47th Street, Maspeth, New York

1. Head south on 47th Street toward Grand Avenue
2. Continue on Grand Avenue to Woodward Avenue
3. Turn right onto Woodward Avenue
4. Take Cypress Avenue to Hart Street
5. Turn right onto Hart Street
6. Turn left at the 2nd cross street onto Wyckoff Avenue
7. Turn left, destination will be on the right.

END: Wyckoff Heights Medical Center, 374 Stockholm Street, Brooklyn, New York



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 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 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

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 power lines?				
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: COVID-19 Awareness – Site Work **JSA Number: JSA046-00**	
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. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.	

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):				
☒ Safety Boots	☐ 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: Alcohol-based hand sanitizer, disinfectant wipes/spray				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
1. All Activities	1. Transmittal/exposure of COVID-19	1. Ask yourself and your managers – is this work essential? Can this be done remotely? 2. Stay home if sick or showing symptoms of COVID-19 (e.g. fever, cough, etc.). 3. Carry nitrile gloves, alcohol-based hand sanitizer, face coverings and disinfectant wipes/spray during field work. 4. Check federal, state, and/or local travel restrictions **prior** to travel. Many states, counties, and cities are passing strict "shelter-in-place" or business restrictions in response to COVID-19. 5. Immediately notify Beverly Williams or Rory Johnston (Supervisor if employee chooses) if you display symptoms of COVID-19. Symptoms include fever (over 100.4 F), cough, and shortness of breath. 6. Notify Beverly Williams or Rory Johnston, Supervisor and Coronavirus Task Force if you had close contact with an individual who tested positive or displayed symptoms of COVID-19. 7. Do not touch your face, to the extent possible. 8. Wear face coverings when around other worker to minimize spread of COVID-19. (May be required in certain states or locations.)

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		9. Practice social distancing, maintaining at least 6 feet of distance between yourself and others. Avoid gatherings of more than 10 people. Limit, to the extent possible, contact with public items/objects. 10. Clean your hands frequently with soap and water for at least 20 seconds especially after you have been in a public place, or after blowing your nose, coughing, sneezing, or using the rest room. 11. If soap and water are not readily available, use a hand sanitizer that contains at least 60% alcohol. Cover all surfaces of your hands and rub them together until they feel dry. 12. Cover your mouth and nose with a tissue when you cough or sneeze or use the inside of your elbow. 13. Clean and disinfect frequently touched surfaces daily, for example, cell phones, computer equipment, headsets, tables, doorknobs, light switches, countertops, handles, desks, toilets, faucets, and sinks.
2. Travel to Jobsite	1. Transmittal/exposure of COVID-19 between passengers 2. Transmittal/exposure of COVID-19 from previous occupants (rental and fleet vehicles) 3. Transmittal/exposure of COVID-19 while refueling	1. Limit the number of occupants to each vehicle to 2 people. Employees should sit as far away from each other as possible. 2. Disinfect high “hand-traffic” areas of the vehicle: Door handles, steering wheel, turn signal and control rods, dashboard controls, seatbelts, armrests, etc. To the extent possible, do not use recycled air for heat/AC and travel with the windows open. 3. Use hand sanitizer before and after pumping gas and only return to the inside of the vehicle after refueling is complete. 4. Wear nitrile gloves if available or disinfect the key pad, pump handle, and fuel grade button prior to use. 5. Recommend face coverings are worn to minimize spread of COVID-19.
3. Conduct Tailgate Safety Meeting & Complete H&S Paperwork	1. Transmittal/exposure of COVID-19 between meeting participants	1. Practice social distancing, maintaining at least 6 feet of distance between yourself and others. 2. Recommend face coverings are worn when around other workers to minimize spread of COVID-19, 3. Hold meetings outside and keep in mind wind direction. To the extent possible, remain cross-wind from other people. 4. Designate a single person to maintain sign-in sheets/permits throughout the day to limit the passing of pens/clipboards between people. 5. Each person should complete their own JSA, even if they are completing similar tasks as others in order to limit the passing of paper/pens/clipboards between people. 6. Include COVID-19 topics and prevention measures in safety meetings.
4. Conduct Site Work	1. Transmittal/exposure of COVID-19 between site workers and public.	1. Practice social distancing maintaining 6 feet of distance between yourself and others. 2. Recommend face coverings are worn when around other workers to minimize spread of COVID-19, 3. To the extent possible, do not interact with the public. If it is necessary, politely explain you are practicing social distance and request they stay at least 6 feet away and they do not attempt to pass objects to you. 4. Wear nitrile gloves during site work underneath the appropriate gloves for your task. Utilize appropriate decontamination procedures, securely bag all waste (including nitrile gloves) generated during site work and dispose of.

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		5. Do not share tools. Each person should be equipped with the tools to complete their task or tasks should be divided to remove the need to share tools. If tools must be shared, surfaces should be disinfected. 6. Clean and disinfect surfaces of rental tools and equipment upon receipt. To the extent possible rent equipment from Langan's internal equipment reservation center, where cleaning/disinfecting procedures can be verified.
5. Use of Construction Trailers	1. Transmittal/exposure of COVID-19 between site workers and others.	1. Avoid use of shared trailers, if possible. Minimize trailer use to essential personnel. 2. Practice social distancing; maintaining 6 feet of distance between yourself and others in trailer. 3. Clean and disinfect areas including desks, phones, chairs and other common areas, before and after use.
6. Purchasing Food from a Restaurant	1. Transmittal/exposure of COVID-19 from other customers, staff, surfaces.	1. To the extent possible, bring your own food. 2. If you must visit a restaurant, call ahead for take-out or "contactless delivery". Do not dine in. When picking up food, follow guidelines for Job Step #8: Purchasing Supplies at Retail/Shipping Centers. 3. Wash hands before and after eating.
7. Smoking Cigarettes	1. Transmittal/exposure of COVID-19 by touching mouth with hands	1. Cigarette smokers maybe at greater risk of complications arising from COVID-19. Nicotine patches/lozenges/gum, smoking cessation programs, and prescription medications may aid in "kicking the habit" if you decide to quit. 2. Wash hands thoroughly before and after smoking. 3. Discard cigarette butts properly. Do not light cigarettes from others and do not give cigarettes to others.
8. Hotel Stay	1. Transmittal/exposure of COVID-19 from previous occupants, hotel staff, common areas.	1. Verify the hotel chain/brand has modified cleaning procedures to reflect risk of COVID-19. Most hotel companies have issued statements on their websites and in email blasts reflecting these new procedures. 2. Use the front door, and not peripheral entrances. Front doors of hotels are generally automatic. 3. Request ground floor room to avoid elevator use and a room that has not be utilized in 48-72 hours. 4. If elevator use is required, do not directly touch elevator buttons with your hands. Do not ride elevators with other people, to the extent possible. 5. Bring disinfecting wipes or sanitizing spray. Upon arrival, disinfect high "hand-traffic" areas of the hotel room: Door handles, light switches, shower/sink faucet handles, TV remote, curtain/blind handles. Clean these surfaces daily. 6. Place the "Do Not Disturb" Sign on your door to prevent people (housekeeping) from entering your room. 7. Avoid common spaces and hotel sponsored events where crowds will be present. 8. Confirm hotel cleaning procedures have been modified to address COVID-19. Confirm no COVID-19 cases have occurred in hotel
9. Purchasing Supplies at Retail/Shipping Centers	1. Transmittal/exposure of COVID-19 from other customers, staff, surfaces.	1. Plan your travel to limit the need to visit retail/shipping centers. 2. Practice social distancing, maintaining at least 6 feet of distance between yourself and others. If the store is too crowded/small, consider visiting another store or returning at a different time. 3. Avoid high "hand-traffic" items/areas like door handles (i.e. use your shoulder, hip/butt, or open with a disposable napkin/paper towel), credit cards terminals (i.e. use Apple/Android pay if available), shopping carts/baskets (i.e. bring your own shopping

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		bags), counter tops (i.e. ask clerk if you can hold the items while they are scanned) and bulk/buffet items (i.e. just avoid them). 4. Disinfect your hands before and after visiting a retail/shipping center.

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

LANGAN	Job Safety Analysis (JSA) Health and Safety
JSA Title: Environmental Sampling **JSA Number:** JSA021-01 **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. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.**	

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
1. Drive to sample location	1. Rough/Off Road terrain	1. Pay attention to road conditions such as road erosion, unprotected embankments, and soft road conditions.
2. Sample Collection (Walking)	1. Slip/Trips/Falls 2. Back strains 3. Wildlife (Insects, Stray animals, rodents) 4. Poisonous vegetation	1. Minimize distance to sample area/ Plan route and check surface prior to carrying heavy equipment/ Locate safest access point/ Follow good housekeeping procedures/ Mark significant below grade hazards (holes, trenches) with spray paint or cones/ Wear foot protection with ankle support and gripping soles. 2. Use proper lifting techniques/ Use wheeled transport/ Obtain assistance where and when needed/ Consider load weight when evaluating what is safe and unsafe to carry. 3. Be aware of surroundings for the presence of wildlife. Do not approach stray animals. Carry and use animal repellant when needed/ Use bug spray when needed. 4. Keep skin covered/ Identify and avoid poisonous vegetation/ Clean areas after contact with suspected vegetation.
3. Sample Collection (Water)	1. Drowning Hazards 2. Chemical burns (when adding acid preservative to sample) 3. Back Strains 4. Ergonomic issues 5. Slip/Trips/Falls	1. Use buddy system/ Wear flotation vest if water is deeper than 2 feet or swift moving/ Select working area with stable footing. Do not attempt to cross or stand in swift moving water. 2. Wear proper PPE (Nitrile gloves, Tyvek Sleeves) 3. Use proper lifting techniques/ Use wheeled transport/ Obtain assistance where and when needed/ Consider load weight when evaluating what is safe or unsafe to carry. 4. When possible avoid bending over for long periods of time/ Use a small stool for sitting or knee pad for kneeling.

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		5. Minimize distance to sample area/ Plan route and check surface prior to carrying heavy equipment/ Locate safest access point/ Follow good housekeeping procedures/ Mark significant below grade hazards (holes, trenches) with spray paint or cones/ Wear foot protection with ankle support and gripping soles/ Avoid standing water or slippery terrain.
4. All activities	1. Slips/ Trips/ Falls 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	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.		
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: 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. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.

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
5. Transport equipment to work area	2. Back/strain 3. Slip/Trip/Falls 4. Traffic 5. Cuts/abrasions/contusions from equipment 6. 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
6. 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.
7. 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).

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		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
8. All activities	1. Slips/ Trips/ Falls 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	7. Be aware of potential trip hazards / Follow good housekeeping 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: 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. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.	

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
9. Unpack/Transport equipment to work area.	7. Back Strains 8. Slip/Trips/Falls 9. Cuts/Abrasions from equipment 10. Contusions from dropped equipment	6. Use proper lifting techniques/Use wheeled transport 7. Minimize distance to work area/Unobstructed path to work area/follow good housekeeping procedures. Mark slip/trip/fall hazards with orange safety cones. 8. Wear proper PPE (leather gloves, long sleeves). 9. Wear proper PPE (Langan approved safety shoes).
10. Initial Site Arrival-Site Assessment	5. Traffic	5. Situational awareness (be alert of your surroundings). Secure area from through traffic.
11. Surface Water Sampling	6. Contaminated media. Skin/eye contact with biological agents and/or chemicals.	6. Wear appropriate PPE (Safety glasses, appropriate gloves). Review (M)SDS for all chemicals being.
12. Sampling from bridges	1. Struck by vehicles	1. Wear appropriate PPE (Safety Vest). Use buddy system and orange safety cones.
13. Icing of Samples/ Transporting coolers/equipment from work area.	11. Back Strains 12. Slips/Trips/Falls 13. Cuts/Abrasions from equipment 14. Pinch/Crushing Hazards.	17. Drain coolers of water. Use proper lifting techniques. Use wheeled transport. 18. Have unobstructed path from work area. Aware of surroundings. 19. Wear proper PPE (Leather gloves, long sleeves) 20. Wear proper PPE (Leather gloves, long sleeves)
14. 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.

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
15. All activities	1. Slips/ Trips/ Falls 2. Hand injuries, cuts or lacerations during manual handling of materials 3. Foot injuries 4. Back injuries 15. Traffic 16. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 17. High Noise levels 18. Overhead hazards 19. Heat Stress/ Cold Stress 20. 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 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 dogs / Carry/use dog/animal repellant / 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: Equipment Transportation and Set-up **JSA Number:** JSA012-01	
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. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.	

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
16. Transport equipment to work area	11. Back Strain 12. Slips/ Trips/ Falls 13. Traffic 14. Cuts/abrasions from equipment 15. 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)
17. Moving equipment to its planned location	6. Pinch Hazard 7. Slips/ Trips/ Falls	1. Wear proper PPE (leather gloves) 2. Be aware of potential trip hazards / Practice good housekeeping procedures / Mark significant below-grade hazards (i.e. holes, trenches) with safety cones or spray paint
18. Equipment Set-up	7. Pinch Hazard 8. Cuts/abrasions to knuckles/hands 9. Back Strain	1. Wear proper PPE (leather gloves) 2. Wear proper PPE (leather gloves) 3. Use proper lifting techniques / Use wheeled transport
19. All activities	21. Slips/ Trips/ Falls 22. Hand injuries, cuts or lacerations during manual handling of materials 23. Foot injuries 24. Back injuries 25. Traffic 26. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.)	27. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 28. 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 29. Wear Langan approved safety shoes

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
4. All activities (cont'd)	27. High Noise levels 28. Overhead hazards 29. Heat Stress/ Cold Stress 30. Eye Injuries	30. 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 31. Wear high visibility clothing & vest / Use cones or signs to designate work area 32. 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 33. Wear hearing protection 34. Wear hard hat / Avoid areas were overhead hazards exist. 35. 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 36. 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: 55-gallon Drum Sampling **JSA Number:** JSA043-01	 **S** – ***Stop,*** *what has changed?* **T** – ***Think*** *about the task* **E** – ***Evaluate*** *potential hazards* **P** – ***Plan*** *safe approach* **S** - ***Start*** *task /* ***Stop*** *& regroup*
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. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.	

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: All Drums are required to be labeled. Langan employees do not open or move undocumented drums or unlabeled drums without proper project manager authorization.				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
20. Unpack/Transport equipment to work area.	16. Back Strains 17. Slip/Trips/Falls 18. Cuts/Abrasions from equipment 4. Contusions from dropped equipment	10. Use proper lifting techniques/Use wheeled transport 11. Minimize distance to work area/Unobstructed path to work area/follow good housekeeping procedures. Mark slip/trip/fall hazards with orange safety cones. 12. Wear proper PPE (leather gloves, long sleeves). 4. Wear proper PPE (Langan approved safety shoes).
21. Open Drums	1. Hand Injuries, cuts or lacerations when untightening drum locking bolt, removing drum lid strap, or removing lid. 2. Pressure from drums.	1. 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. Use non-metallic mallet and non-sparking tools/wrenches. 2. Open drum slowly to relieve pressure. Wear proper PPE: face shield and goggles; correct gloves; and over garments.
22. Collecting Soil/Fluid Sample	8. Irritation to eye from vapor, soil dust, or splashing 9. Irritation to exposed skin	6. Wear proper eye protection including safety glasses/ face shield/googles and when necessary, splash guard. If dust or vapor phase is present, wear appropriate safety breathing gear (1/2 mask or full face mask with correct filter) 7. Wear proper skin protection including nitrile gloves.
23. Closing Drums	1. Hand Injuries, cuts or lacerations when untightening drum locking bolt, removing drum lid strap, or removing lid.	7. 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. Use non-metallic mallet and non-sparking tools/wrenches.

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
24. Moving Drums	2. Hand Injuries, cuts or lacerations when untightening drum locking bolt, removing drum lid strap, or removing lid. 3. Back Strains	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. Use non-metallic mallet and non-sparking tools/wrenches. 3. Use proper lifting techniques/Use wheeled transport
25. 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	37. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 38. 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 39. Wear Langan approved safety shoes 40. 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 41. Wear high visibility clothing & vest / Use cones or signs to designate work area 42. 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 43. Wear hearing protection 44. Wear hard hat / Avoid areas were overhead hazards exist. 45. 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 46. 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: **Direct-Push Soil Borings**
JSA Number: **JSA004-01**

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. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.

S – ***Stop,*** *what has changed?*
T – ***Think*** *about the task*
E – ***Evaluate*** *potential hazards*
P – ***Plan*** *safe approach*
S - ***Start*** *task / **Stop** & regroup*

PERSONAL PROTECTIVE EQUIPMENT REQUIRED:				
☒ 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: Half-face respirator, dust cartridges, PID (if applicable)				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
26. Move equipment to work site	19. Back strain when lifting equipment 20. Slips/ Trips/ Falls while moving equipment 21. Traffic (if applicable) 22. Pinched fingers or running over toes during geoprobe set-up 23. Overturn drilling rig while transporting to loading dock on flat-bed tow truck	13. Use proper lifting technique (use legs for bending and lifting and not the back)/ Use wheeled transport for heavy equipment / Get assistance when handling loads greater than 50 lbs. / Minimize distance to vehicle 14. Use proper lifting technique (use legs for bending and lifting and not the back) / Use wheeled transport for heavy equipment / Get assistance when handling loads greater than 50 lbs. / Minimize distance to vehicle / Have unobstructed path to vehicle or collection point / Do not lift/walk with boxes that are heavy/difficult to lift 15. Wear high visibility safety vests or clothing / Exercise caution 16. Wear proper PPE (cut-resistant gloves) / Stay alert, be aware of geoprobe rig at all times 17. Drill rig should be parked in center of flat-bed tow truck / Emergency brake shall be used at all times during transport on the flat-bed truck/ All unnecessary personnel should stay away from the flat-bed truck during moving activities
27. Calibration of monitoring equipment	10. Skin or eye contact with calibration chemicals 11. Pinch fingers in monitoring equipment	8. Wear proper PPE (safety glasses/ goggles) 9. Wear proper PPE (leather gloves)
28. Set-up geoprobe rig	10. Geoprobe rig movement	8. All field personnel should stay clear of the geoprobe rig while moving / Use a spotter when backing up the geoprobe
29. Advance geoprobe rods below ground surface to desired depth	4. Underground utilities 5. High noise levels	4. Clean all subsurface soil borings to a minimum of 5 feet below grade 5. Wear proper PPE (hearing protection)

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
30. Remove and open acetate liner 5. Remove and open acetate liner (cont'd)	41. Pinched fingers while removing macrocore 42. Cuts/lacerations when cutting acetate liner open 43. Exposure to hazardous vapors 44. Skin contact with contaminated soil	1. Wear proper PPE (nitrile gloves, cut-resistant or leather gloves 2. Wear proper PPE (cut-resistant or leather gloves) 3. Do not place face over acetate liner when opening / Monitor hazardous vapors in air with PID / Upgrade PPE as necessary based on levels contained in the Health and Safety Plan 4. Wear proper PPE (nitrile gloves)
31. Sample Collections a) Monitor parameters b) Prepare sample containers and labels	1. Contact with potentially contaminated soil 2. Lacerations from broken sample bottles 3. Back strain while transporting full coolers 4. Internal exposure to contaminants and metals through inhalation of dust 5. Slips/ Trips/ Falls	1. Use monitoring devices / Wear proper PPE (safety glasses, nitrile gloves) 2. Do not over-tighten bottle caps / Handle bottles safely to prevent breakage 6. Use proper lifting techniques / Do not lift heavy loads without assistance 7. Avoid creating dust / If necessary, wear a half mask respirator with applicable dust cartridge / Inspect respirator for damage and cleanliness prior to use / Clean respirator after each use and store in a clean, secure location 8. Be alert / Follow good housekeeping procedures
32. Remove excess soil from acetate liner and place in 55-gallon drum (IF NOT PERFORMED BY LANGAN, REMOVE!)	1. Cuts/lacerations from acetate liner 2. Pinched fingers/hand while opening/closing drum 3. Skin contact with contaminated soil 4. Soil debris in eyes	1. Wear proper PPE (cut-resistant or leather gloves) 2. Wear proper PPE (cut-resistant or leather gloves) 3. Wear proper PPE (nitrile gloves) 4. Wear proper PPE (safety glasses)

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
8. Transport drums to central staging location (IF NOT PERFORMED BY LANGAN, REMOVE!)	1. Back, arm or shoulder strain from moving drums 2. Pinch fingers/hand in drum cart when moving drums 3. Pinch fingers/hand when operating lift-gate on vehicle 4. Contact with potentially contaminated groundwater when moving improperly sealed drums 5. Slips when moving drums 6. Drop drum on feet/toes	47. Use drum cart for moving drums / Use proper lifting techniques / Do not lift heavy loads without assistance 48. Wear proper PPE (cut-resistant or leather gloves) 49. Wear proper PPE (cut-resistant or leather gloves) 50. Wear proper PPE (nitrile gloves underneath work gloves) 51. Follow good housekeeping procedures / Ensure route to move drum and storage space is free from obstructions 52. Wear proper PPE (safety shoes) / Work in a safe manner to prevent dropped drum
9. All activities 9. All activities (cont'd)	1. Slips/ Trips/ Falls 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	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.		
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. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.	

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
33. 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 techniques / 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)
34. Remove well cover	12. Scrape knuckles/hand 13. Strain wrist/bruise palm 14. Pinch fingers or hand	3. Wear proper PPE (leather gloves) 4. Using a hammer, tap the end of the wrench to loosen grip of bolts 5. Wear proper PPE (leather gloves)
35. 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	5. Remove cap slowly to relieve pressure / Do not place face over well when opening / Wear proper PPE (safety glasses) 6. Use direct air monitoring/reading instrument (i.e. PID) / Be familiar with and follow actions prescribed in the HASP / Wear proper PPE (nitrile gloves) 7. Wear proper PPE (leather gloves) 8. Using hammer, tap the end of the wrench to loosen grip
36. Measure head-space vapor levels	1. Exposure to hazardous substances through inhalation	1. Do not place face over well when collecting measurement
37. Remove dedicated 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)

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
38. 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
39. 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)
40. Calibrate monitoring equipment	1. Skin or eye contact with calibration chemicals 2. Pinch fingers or hand in monitoring equipment	1. Wear proper PPE (safety glasses, nitrile gloves) 2. Wear proper PPE (leather gloves) / Avoid pinch points
41. 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 safety 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

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
10. Purge water	1. Contact with potentially contaminated 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 designated disposal drum	1. Pressure build-up inside drum 2. Pinch hazard	1. Remove cap from bung hole in drum to relieve pressure 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	45. Slips/ Trips/ Falls 46. Hand injuries, cuts or lacerations during manual handling of materials 47. Foot injuries 48. Back injuries 49. Traffic 50. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.)	53. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 54. 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 55. Wear Langan approved safety shoes

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
	51. High Noise levels 52. Overhead hazards 53. Heat Stress/ Cold Stress 54. Eye Injuries	56. 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 57. Wear high visibility clothing & vest / Use cones or signs to designate work area 58. 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 59. Wear hearing protection 60. Wear hard hat / Avoid areas were overhead hazards exist. 61. 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 62. 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: Well Installation **JSA Number: JSA019-01**	 **S – Stop,** *what has changed?* **T – Think** *about the task* **E – Evaluate** *potential hazards* **P – Plan** *safe approach* **S - Start** *task /* **Stop** *&* *regroup*
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. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.	

PERSONAL PROTECTIVE EQUIPMENT REQUIRED:				
☒ 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: PID, Tyvek sleeves				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
42. Move equipment to work site	24. Back strain when lifting equipment	18. Use proper lifting technique (use legs for bending and lifting and not the back)/ Use wheeled transport for heavy equipment / Get assistance when handling loads greater than 50 lbs. / Minimize distance to vehicle
	25. Slips/ Trips/ Falls while moving equipment	19. Use proper lifting technique (use legs for bending and lifting and not the back) / Use wheeled transport for heavy equipment / Get assistance when handling loads greater than 50 lbs. / Minimize distance to vehicle / Have unobstructed path to vehicle or collection point / Do not lift/walk with boxes that are heavy/difficult to lift
	26. Traffic (if applicable)	20. Wear high visibility safety vests or clothing / Exercise caution
	27. Pinched fingers or running over toes during geoprobe set-up	21. Wear proper PPE (cut-resistant gloves) / Stay alert, be aware of geoprobe rig at all times
	28. Overturn drilling rig while transporting to loading dock on flat-bed tow truck	22. Drill rig should be parked in center of flat-bed tow truck / Emergency brake shall be used at all times during transport on the flat-bed truck/ All unnecessary personnel should stay away from the flat-bed truck during moving activities
43. Calibration of monitoring equipment	15. Skin or eye contact with calibration chemicals 16. Pinch fingers in monitoring equipment	10. Wear proper PPE (safety glasses/ goggles) 11. Wear proper PPE (leather gloves)
12. Set-up geoprobe rig	15. Geoprobe rig movement	9. All field personnel should stay clear of the geoprobe rig while moving / Use a spotter when backing up the geoprobe
13. Advance geoprobe rods below ground surface to desired depth	6. Underground utilities 7. High noise levels	9. Clean all subsurface soil borings to a minimum of 5 feet below grade 10. Wear proper PPE (hearing protection)

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
14. Remove and open acetate liner 5. Remove and open acetate liner (cont'd)	55. Pinched fingers while removing macrocore 56. Cuts/lacerations when cutting acetate liner open 57. Exposure to hazardous vapors 58. Skin contact with contaminated soil	5. Wear proper PPE (nitrile gloves, cut-resistant or leather gloves 6. Wear proper PPE (cut-resistant or leather gloves) 7. Do not place face over acetate liner when opening / Monitor hazardous vapors in air with PID / Upgrade PPE as necessary based on levels contained in the Health and Safety Plan 8. Wear proper PPE (nitrile gloves)
6. Remove excess soil from acetate liner and place in 55-gallon drum (IF NOT PERFORMED BY LANGAN, REMOVE!)	5. Cuts/lacerations from acetate liner 6. Pinched fingers/hand while opening/closing drum 7. Skin contact with contaminated soil 8. Soil debris in eyes	5. Wear proper PPE (cut-resistant or leather gloves) 6. Wear proper PPE (cut-resistant or leather gloves) 7. Wear proper PPE (nitrile gloves) 8. Wear proper PPE (safety glasses)
7. Attach hollow-stem augers to the geoprobe rig; Advance augers and attach additional augers until desired depth is reached	1. Strain wrist/bruise palm 2. Pinched fingers 3. Back Strain 4. Clothing entanglement 5. Carbon monoxide poisoning 6. Bruise toes/foot 7. High noise levels 8. Skin contact with contaminated soil	1. Wear proper PPE (cut-resistant or leather gloves) 2. Wear proper PPE (cut-resistant or leather gloves) 3. Use proper lifting techniques 4. Wear proper work attire(no loose clothing/strings) 5. Properly ventilate work area 6. Wear proper PPE (safety shoes) 7. Wear proper PPE (hearing protection) 8. Wear proper PPE (Tyvek sleeves, nitrile gloves)
8. Install monitoring well	1. Pinched fingers 2. Lacerations/abrasions 3. Back Strain	1. Wear proper PPE (cut-resistant or leather gloves) 2. Wear proper PPE (cut-resistant or leather gloves) 3. Use proper lifting techniques
9. Tremie-grout annulus space above bentonite seal	1. Back strain 2. Pinched fingers	1. Use proper lifting techniques 2. Wear proper PPE (cut-resistant or leather gloves)
10. Install flush-mount monitoring well pad	1. Splashed concrete 2. Pinched fingers 3. Cuts/lacerations	1. Wear proper PPE (safety glasses) 2. Wear proper PPE (cut-resistant or leather gloves) 3. Wear proper PPE (cut-resistant or leather gloves)
11. Decontaminate equipment	1. Splashing water/soap 2. Contact with potentially contaminated groundwater/soil 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
12. Transport drums to central staging location (IF NOT PERFORMED BY LANGAN, REMOVE!)	7. Back, arm or shoulder strain from moving drums 8. Pinch fingers/hand in drum cart when moving drums 9. Pinch fingers/hand when operating lift-gate on vehicle 10. Contact with potentially contaminated groundwater when moving improperly sealed drums 11. Slips when moving drums 12. Drop drum on feet/toes	63. Use drum cart for moving drums / Use proper lifting techniques / Do not lift heavy loads without assistance 64. Wear proper PPE (cut-resistant or leather gloves) 65. Wear proper PPE (cut-resistant or leather gloves) 66. Wear proper PPE (nitrile gloves underneath work gloves) 67. Follow good housekeeping procedures / Ensure route to move drum and storage space is free from obstructions 68. Wear proper PPE (safety shoes) / Work in a safe manner to prevent dropped drum

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
13. All activities 13. All activities (cont'd)	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 dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 17. High Noise levels 18. Overhead hazards 19. Heat Stress/ Cold Stress 20. Eye Injuries	11. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 12. 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 13. Wear Langan approved safety shoes 14. 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 15. Wear high visibility clothing & vest / Use cones or signs to designate work area 16. 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 17. Wear hearing protection 18. Wear hard hat / Avoid areas were overhead hazards exist. 19. 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 20. 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. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.	

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
44. Transport equipment to work area	29. Back Strains 30. Slips/Trips/Falls 31. Traffic 32. Cuts/Abrasions/Contusions from equipment	23. Use proper lifting techniques/ Use wheeled transport/ use buddy system when lifting equipment. 24. Minimize distance from work area/ unobstructed path to collection points and vehicle/ Follow good housekeeping procedures. 25. Wear high-visibility vest or clothing/Exercise caution/ Use traffic cones or signage if needed. 26. Wear proper PPE (leather gloves, long sleeves, Langan approved safety shoes).
45. Measure depth of water	17. Exposure to hazardous substances 18. Pinched fingers	15. Wear proper PPE (Nitrile gloves, Safety glasses/Face shield). 16. Wear proper PPE (cut-resistant gloves).
46. Install Tremie pipe in the monitoring well and connect to water source.	16. Hand injuries during installation (pinched fingers/hands). 17. Back strain from holding Tremie pipe. 18. High pressure water spray.	10. Wear proper PPE (Nitrile gloves/cut-resistant gloves). 11. Use proper lifting techniques/ Use two personnel when lowering pump greater than 80 feet. 12. Ensure all hose connections are tight and secure/ Use proper PPE (face shield and safety glasses).
47. 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	8. Hand injuries during pump installation and sample tubing cutting. 9. Back strain 10. Electric shock 11. Exhaust gases from generator 12. Burns from hot equipment	11. Wear proper PPE when installing pump and cutting sample tubing (Nitrile and cut-resistant gloves)/ Use tubing cutter. 12. 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. 13. 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.

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
(generator) e. Turn on power source (generator)		14. Position generator so that exhaust is flowing away from work area. 15. 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)
48. Develop monitoring well 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.	59. Hand injuries 60. Face injuries 61. Contaminated spray from water	69. Wear proper PPE (cut-resistant gloves and nitrile gloves). 70. Wear proper PPE (face shield and safety glasses)/do not stand over well opening. 71. 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.
49. 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.
50. 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. 72. Wear proper PPE (leather gloves, long sleeves, Langan approved safety shoes).
51. All activities	1. Slips/ Trips/ Falls 2. Hand injuries, cuts or lacerations during manual handling of materials 3. Foot injuries 62. Back injuries 63. Traffic 64. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 65. High Noise levels 66. Overhead hazards 67. Heat Stress/ Cold Stress 68. 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

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		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.		
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

for

47th Street Site
57-00, 57-05, and 58-20 47th Street
Maspeth, Queens, New York 11378

Prepared for:

47th Street & 58th Road LLC
c/o Prologis, Inc.
Pier 1, Bay 1
San Francisco, California

Prepared by:

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

June 24, 2022
Langan Project No. 100965501

LANGAN

TABLE OF CONTENTS

PAGE

1.0 PROJECT DESCRIPTION 4
1.1 Introduction 4
1.2 Project Objectives 4
1.3 Scope of Work 4
2.0 DATA QUALITY OBJECTIVES AND PROCESS 7
3.0 PROJECT ORGANIZATION 9
4.0 QUALITY ASSURANCE OBJECTIVES FOR COLLECTION OF DATA 10
4.1 Precision 10
4.2 Accuracy 13
4.3 Completeness 14
4.4 Representativeness 14
4.5 Comparability 15
4.6 Sensitivity 15
5.0 SAMPLE COLLECTION AND FIELD DATA ACQUISITION PROCEDURES 17
5.1 Field Documentation Procedures 17
5.1.1 Field Data and Notes 17
5.1.2 Sample Labeling 18
5.2 Equipment Calibration and Preventative Maintenance 18
5.3 Sample Collection 19
5.3.1 Soil Samples 19
5.3.2 Groundwater Samples 20
5.3.4 Sample Equipment Blanks and Duplicates 21
5.4 Sample Containers and Handling 22
5.6 Sample Preservation 22
5.7 Sample Shipment 24
5.7.1 Packaging 24
5.7.2 Shipping 24
5.8 Decontamination Procedures 24
5.9 Residuals Management 25
5.10 Chain of Custody Procedures 25
5.11 Laboratory Sample Storage Procedures 30
6.0 DATA REDUCTION, VALIDATION, AND REPORTING 30
6.1 Introduction 30
6.2 Data Reduction 31
6.3 Data Validation 31

6.4 Reporting 31
7.0 QUALITY ASSURANCE PERFORMANCE AUDITS AND SYSTEM AUDITS 33
7.1 Introduction 33
7.2 System Audits 33
7.3 Performance Audits 33
7.4 Formal Audits 33
8.0 CORRECTIVE ACTION 35
8.1 Introduction 35
8.2 Procedure Description 35
9.0 REFERENCES 38

FIGURES

Figure 5.1 Sample Custody 28
Figure 5.2 Chain-of-Custody Record - Air Samples 30
Figure 5.2 Chain-of-Custody Record - Soil and Groundwater Samples 30
Figure 8.1 Corrective Action Request Form 39

TABLES

Table 4.1 Quality Control Limits for Water Samples 11
Table 4.2 Quality Control Limits for Soil Samples 12

ATTACHMENTS

Attachment A: Résumés
Attachment B: Laboratory Reporting Limits and Method Detection Limits
Attachment C: Analytical Methods and Quality Assurance Summary Table
Attachment D: Sample Nomenclature Standard Operating Procedure
Attachment E: PFAs Sampling and Analysis Protocols

1.0 PROJECT DESCRIPTION

1.1 Introduction

This Quality Assurance Project Plan (QAPP) for the proposed remedial investigation (RI) was completed on behalf of 47th Street & 58th Road LLC (the Volunteer) for the property located at 57-00, 57-05, and 58-20 47th Street in the Maspeth neighborhood of Queens, New York ("the Site"). The Volunteer selected Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, 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 or emanating from the site and to provide sufficient information to evaluate remedial alternatives, as required. Additional site information and data was previously collected by Langan and is summarized 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 potential areas of concern (PAOC) and historical uses of the site and to assess the presence of emerging contaminants, including per- and polyfluoroalkyl substances (PFAS) and 1,3-dioxane in soil and groundwater. 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:

- Advancement of soil borings to evaluate potential subsurface impacts from the identified areas of concerns and historical site uses;
- Installation of monitoring wells;
- Completion of a monitoring well survey;
- Installation of vapor points;
- Collection and chemical analysis of soil and groundwater samples; and

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

Soil Boring Installation and Soil Sampling

An environmental drilling subcontractor will advance a total of thirty-five soil borings to further investigate areas of concern. All soil borings are to be installed at least two feet into native soil or at least four feet below the groundwater table using direct-push drilling technology. Langan field personnel will document efforts, screen soil samples for environmental impacts, and collect 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 three soil samples will be collected for laboratory analysis from each boring location. One sample will be collected from an AOC specific depth as per prior soil samples. One sample will be collected from 0'-0.5' above the groundwater interface. A potential third sample to be collected as per dictated by field conditions.

Monitoring Well Installation and Groundwater Sampling

Eight monitoring wells will be installed as per dictated by previous groundwater samples. The proposed monitoring wells will be constructed utilizing 2-inch diameter polyvinyl chloride (PVC) riser pipe with 10-foot long, and 0.01-inch slotted screens. The proposed monitoring wells will be installed so that the well screen straddles the observed groundwater table. The well annulus around the slotted screen will be a minimum of 2-inches (minimum 6-inch-diameter borehole) and will be backfilled with clean sand to about 2 feet above the top of the screen. A minimum 1-foot bentonite seal will be installed above the sand, and the borehole annulus will be backfilled with non-impacted soil cuttings and clean sand. The monitoring wells will be finished with flush-mounted metal manhole covers set in concrete.

The proposed temporary well point will be constructed utilizing 1 to 1.5-inch diameter PVC riser pipe with a 10-foot long, and 0.01-inch slotted screen. The proposed temporary well will be installed so that the well screed straddles the observed groundwater table. The well annulus around the slotted screen will be a minimum of two inches and will be backfilled with clean sand. Post groundwater sample, the well location will be backfilled with non-impacted soil cuttings and clean sand. Following installation, the temporary well will be purged via a peristaltic pump until groundwater becomes clear. Removed groundwater will be containerized.

Following installation, the monitoring wells will be developed via surge and purge method. This method involves the use of a whale pump pushed up and down the water column in the well screen to agitate and remove fine particles. The pump will be surged across the well screen in 2- to 3-foot increments for approximately 2 minutes per increment. Following surging, groundwater will be removed from the well until clear (having turbidity under approximately 50 Nephelometric Turbidity Units [NTU]). Groundwater evacuated from the well will be containerized and removed from the Site. Groundwater sampling will be completed a minimum of two weeks before sampling.

One groundwater sample will be collected from each newly-installed well in general accordance with NYSDEC DER-10 and United States Environmental Protection Agency's (USEPA) *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.

Soil Vapor Installation and Sampling

One sub-slab vapor point and six soil vapor points will be installed in accordance with the NYSDOH "Guidance for Evaluating Soil Vapor Intrusion in the State of New York, with updates" (October 2006, with updates). The sub-slab vapor points will be installed about 2 inches below the concrete building slab. The vapor collection points will consist of inert sample tubing attached to a 1.875-inch polyethylene implant. The annulus (i.e., the sampling zone) around the installed implants and/or tubing will be filled with a clean, coarse sand pack followed by a hydrated bentonite seal to surface grade.

Samples will be collected in general accordance with the NYSDOH "Guidance for Evaluating Soil Vapor Intrusion in the State of New York" (October 2006, with updates). Before collecting vapor samples, 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. Purged soil vapor will be monitored for VOCs and methane with the MultiRAE® during this process.

A helium tracer gas will be used in accordance with NYSDOH protocols to serve as a QA/QC technique to document the integrity of each soil vapor point seal before and after sampling. The tracer gas will be introduced into a container surrounding 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 outside air infiltration.

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, and collected over a 2-hour sampling period.

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. All vapor samples will be analyzed for VOCs by USEPA Method TO-15.

2.0 DATA QUALITY OBJECTIVES AND PROCESS

Data Quality Objectives (DQO) are qualitative and quantitative statements to help ensure that data of known and appropriate quality are obtained during the project. The overall project objective is to investigate subsurface conditions associated with AOCs for the site. The sampling program will provide for collection of soil, groundwater and vapor samples as part of the RIWP. DQOs for sampling activities are determined by evaluating five factors:

- Data needs and uses: The types of data required and how the data will be used after it is obtained.
- Parameters of Interest: The types of chemical or physical parameters required for the intended use.
- Level of Concern: Levels of constituents, which may require remedial actions or further investigations.
- Required Analytical Level: The level of data quality, data precision, and QA/QC documentation required for chemical analysis.
- Required Detection Limits: The detection limits necessary based on the above information.

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 quality control (QC) duplicates and/or 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. For soil and groundwater samples, 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), internal standards, laboratory method blanks, instrument calibration, and the percent recoveries of matrix spike compounds added to selected samples and laboratory blanks. For soil vapor or air samples, analytical accuracy will be assessed by examining the percent recoveries that are added to each sample, internal standards, laboratory method blanks, and instrument calibration.

- **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 dependent upon the adequate design of the sampling program and will be satisfied by ensuring that the scope of work is followed and that specified sampling and analysis techniques are used. Representativeness in the laboratory is ensured by compliance to nationally-recognized analytical methods, meeting sample holding times, and maintaining sample integrity while the samples are in the laboratory's possession. This is accomplished by following all applicable methods, laboratory-issued standard operating procedures (SOP), the laboratory's Quality Assurance Manual, and this QAPP. The laboratory is required to be properly certified and accredited.
- **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 as documented in the QAPP, 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 quality assurance (QA) personnel, sampling and analytical procedures that achieve the required levels of detection.

3.0 PROJECT ORGANIZATION

The execution of the RIWP will be overseen by Langan on behalf of 47th Street & 58th Road LLC. Langan will collect media samples and will subcontract a qualified driller and an Environmental Laboratory Approval Program (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, New York State Department of Health (NYSDOH) ELAP certification number 11148. Data validation services will be performed by Joe Conboy; resume attached (**Attachment A**).

Key contacts for this project are as follows:

47th Street & 58th Road LLC	Mr. Brett Richer Telephone: (415) 394-9000
Langan Project Manager*:	Mr. Rory Johnston Telephone: (908) 202-1407
Langan Project Leader*:	Mr. Alan Arico Telephone: (973) 524-8124
Program Quality Assurance Officer (QAO)*:	Mrs. Mimi Raygorodetsky Telephone: (215) 479-5441
Health & Safety Officer (HSO)*:	Mr. Tony Moffa, CHMM Telephone: (215) 491-6500
Data Validator*:	Mr. Joe Conboy Telephone: (609) 282-8055
Laboratory Representative:	Ben Rao Telephone: (201) 812-2633

*résumés provided in **Attachment A**

4.0 QUALITY ASSURANCE OBJECTIVES FOR COLLECTION OF DATA

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 USEPA SW-846. The laboratory will aim to achieve low reporting limits for all analytical methods. The analytical methods and their Contract Required Quantification Limits (CRQLs) are given in **Attachment B**.

4.1 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 4.1 and 4.2.

TABLE 4.1
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 4.2
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

4.2 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 4.1 and 4.2.

4.3 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.

4.4 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.

4.5 Comparability

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.

4.6 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 2.1. The frequency of associated equipment blanks and duplicate samples will be based on the recommendations listed in DER-10 and as described in Table 2.1.

Site-specific MS and MSD samples will be prepared and analyzed internally 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.

5.0 SAMPLE COLLECTION AND FIELD DATA ACQUISITION PROCEDURES

Soil and groundwater sampling will be conducted in accordance with the established NYSDEC protocols contained in DER-10/Technical Guidance for Site Investigation and Remediation (May 2010) and the NYSDEC's "Guidance for Sampling and Analysis of PFAS Under NYSDEC's Part 375 Remedial Programs" (January 2020). Air sampling will be conducted in accordance with the established NYSDOH protocols contained in the Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006, updated May 2017). The following sections describe procedures to be followed for specific tasks.

5.1 Field Documentation Procedures

Field documentation procedures will include summarizing field observations in field books, logging soil borings and monitoring well construction, completing forms for groundwater and soil vapor sampling, and proper sample labeling. These procedures are described in the following sections.

5.1.1 Field Data and Notes

Field notebooks contain the documentary evidence regarding procedures conducted by field personnel. Hard cover, bound field notebooks will be used because of their compact size, durability, and secure page binding. The pages of the notebook will not be removed.

Entries will be made in waterproof, permanent blue or black ink. No erasures will be allowed. If an incorrect entry is made, the information will be crossed out with a single strike mark and the change initialed and dated by the team member making the change. Each entry will be dated. Entries will be legible and contain accurate and complete documentation of the individual or sampling team's activities or observations made. The level of detail will be sufficient to explain and reconstruct the activity conducted. Each entry will be signed by the person(s) making the entry.

The following types of information will be provided for each sampling task, as appropriate:

- Project name and number
- Reasons for being on-site or taking the sample
- Date and time of activity
- Sample identification numbers
- Geographical location of sampling points with references to the site, other facilities or a map coordinate system. Sketches will be made in the field logbook when appropriate
- Physical location of sampling locations such as depth below ground surface

- Description of the method of sampling including procedures followed, equipment used and any departure from the specified procedures
- Description of the sample including physical characteristics, odor, etc.
- Readings obtained from health and safety equipment
- Weather conditions at the time of sampling and previous meteorological events that may affect the representative nature of a sample
- Photographic information including a brief description of what was photographed, the date and time, the compass direction of the picture and the number of the picture on the camera
- Other pertinent observations such as the presence of other persons on the site, actions by others that may affect performance of site tasks, etc.
- Names of sampling personnel and signature of persons making entries

Field records will also be collected on field data sheets including boring logs, which will be used for geologic and drilling data during soil boring activities. Field data sheets will include the project-specific number and stored in the field project files when not in use. At the completion of the field activities, the field data sheets will be maintained in the central project file.

5.1.2 Sample Labeling

Each sample collected will be assigned a unique identification number in accordance with the sample nomenclature guidance included in Attachment D, and placed in an appropriate sample container. Each sample container will have a sample label affixed to the outside with the date and time of sample collection and project name. In addition, the label will contain the sample identification number, analysis required and chemical preservatives added, if any. All documentation will be completed in waterproof ink.

5.2 Equipment Calibration and Preventative Maintenance

A PID will be used during the sampling activities to evaluate work zone action levels, 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.

5.3 Sample Collection

5.3.1 Soil Samples

Soil samples will be visually classified and field screened using a PID to assess potential impacts from VOCs and for health and safety monitoring. Soil samples collected for analysis of VOCs will be collected using either EnCore® or Terra Core® sampling equipment. For analysis of non-volatile parameters, samples will be homogenized and placed into glass jars. After collection, all sample jars will be capped and securely tightened, and placed in iced coolers and maintained at 4°C ±2°C until they are transferred to the laboratory for analysis, in accordance with the procedures outlined in Section 5.4. Analysis and/or extraction and digestion of collected soil samples will meet the holding times required for each analyte as specified in **Attachment C**. In addition, analysis of collected soil sample will meet all quality assurance criteria set forth by this QAPP and DER-10.

5.3.2 Groundwater Samples

Groundwater sampling will be conducted using low-flow sampling procedures following USEPA guidance ("Low Stress [low flow] Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells", EQASOP-GW4, September 19, 2017).

During purging, field parameters should be measured, including: water level drawdown, purge rate, pH, specific conductance, temperature, dissolved oxygen, turbidity and ORP, every five minutes using a water quality meter (Horiba U-52 or similar) and a depth-to-water oil-water interface probe that should be decontaminated between wells. Samples should generally not be collected until the field parameters have stabilized. Field parameters will be considered stable once three sets of measurements are within ±0.1 standard units for pH, ±3% for conductivity and temperature, ±10 millivolts for ORP, and ±10% for turbidity and dissolved oxygen. Purge rates should be adjusted to keep the drawdown in the well to less than 0.3 feet, as practical. Additionally, an attempt should be made to achieve a stable turbidity reading of less than 10 Nephelometric Turbidity Units (NTU) prior to sampling. If the turbidity reading does not stabilize at reading of less than 10 NTU for a given well, then both filtered and unfiltered samples should be collected from that well. If necessary, field filtration should be performed using a 0.45 micron disposable in-line filter. Groundwater samples should be collected after parameters have stabilized as noted above or the readings are within the precision of the meter. Deviations from the stabilization and drawdown criteria, if any, should be noted on the sampling logs.

Samples should be collected directly into pre-cleaned laboratory-supplied jars. After collection, sample jars will be capped and securely tightened, and placed in iced coolers to attempt to maintain a temperature of 4°C ±2°C until they are transferred to the laboratory for analysis, in accordance with the procedures outlined in Section 5.4. Analysis and/or extraction and digestion of collected groundwater samples will meet the holding times required for each analyte as specified in Attachment C. In addition, analysis of collected groundwater samples will meet all quality assurance criteria set forth by this QAPP and DER-10.

5.3.3 Vapor Samples

Sub-slab vapor points will be installed to about 2 inches below the building foundation slab. Vapor samples will be installed within proposed monitoring well locations. The vapor collection points will consist of inert sample tubing attached to a 1.875-inch polyethylene implant, to be installed at the sampling depth. Samples will be collected in accordance with the NYSDOH Soil Vapor Guidance. Before collecting vapor samples, the points will be screened for methane then 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. Purged soil vapor will be monitored for VOCs with the MultiRAE during this process.

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 vapor 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 will be considered compromised and will be enhanced or reconstructed to reduce outdoor air infiltration. The tracer gas seal test will not be conducted on sampling points where methane is detected at greater than 0.5% because methane build-up in the helium shrouds could pose a safety risk to field personnel.

After the integrity of each seal is confirmed, vapor samples will be collected into laboratory-supplied batch-certified clean 6-liter Summa canisters with calibrated flow controllers. Vapor samples will be collected over an 8-hour sampling period and analyzed for VOCs by USEPA Method TO-15 and Methane.

5.3.4 Sample Equipment Blanks and Blind Duplicates

To assess cross-contamination and effectiveness of equipment decontamination, one type 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. 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. **Field Blanks** - Field blanks will be collected for quality assurance purposes at a rate of one per 20 investigative samples per matrix (soil and groundwater only). Field blanks will be obtained by pouring laboratory-demonstrated deionized water on or through a 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. **Blind Duplicate** - To determine the representativeness of the sampling methods, coded blind duplicates will be collected at a minimum frequency of one per 20 field samples for each matrix (soil and groundwater). 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.

5.4 Sample Containers and Handling

Certified, commercially clean sample containers will be obtained from the analytical laboratory. For soil and groundwater samples, the laboratory will also prepare and supply the required trip blanks and equipment blank sample containers and reagent preservatives. Sample bottle containers, including the field blank containers, will be placed into plastic coolers by the laboratory. These coolers will be received by the field sampling team within 24 hours of their preparation in the laboratory. Prior to the commencement of field work, Langan field personnel will fill the plastic coolers with ice in Ziploc® bags (or equivalent) to attempt to maintain a temperature of 4° ±2° C.

Soil, groundwater and vapor samples collected in the field for laboratory analysis will be placed directly into the laboratory-supplied sample containers. Soil and groundwater samples will then be placed and stored on-ice in laboratory provided coolers until shipment to the laboratory. Blue ice will not be used to cool PFAS samples.

Possession of samples collected in the field will be traceable from the time of collection until they are analyzed by the analytical laboratory or are properly disposed. Chain-of-custody procedures, described in Section 5.10, will be followed to maintain and document sample possession. Samples will be packaged and shipped as described in Section 5.7.

5.5 Special Considerations for Emerging Contaminant Sample Collection

The following special considerations apply to the collection of soil and groundwater samples for PFAS analysis to prevent cross-contamination:

- Field equipment will not contain Teflon®
- All sampling material will be made from stainless steel, HDPE, acetate, silicon, or polypropylene
- No waterproof field books will be used
- No plastic clipboards, binders, or spiral hard cover notebooks will be used
- No adhesives will be used
- No sharpies or permanent markers will be used; ball point pens are acceptable
- Aluminum foil will not be used
- PFAS samples will be kept in a separate cooler from other sampling containers

- Coolers will be filled only with regular ice

PFAS will be analyzed by modified USEPA Method 537 for the PFAS target analyte list developed by the DER. At minimum, the laboratory will report the following PFAS target compounds:

Group	Analyte Name	Abbreviation	CAS #
Perfluoroalkyl carboxylates	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
Perfluoroalkyl sulfonates	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanessulfonic acid	PFOS	1763-23-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Fluorinated Telomer Sulfonates	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

The laboratory reporting limits for PFAS are 2 nanograms per liter (ng/L) in aqueous samples and 1 microgram per kilogram (µg/kg) in soil samples. The laboratory SOP for PFAS analysis and PFAS compound sampling protocol are provided in **Attachment E**.

Soil samples analyzed for 1,4-dioxane will be analyzed via USEPA method 8270, and groundwater samples will be analyzed by USEPA Method 8270 SIM. The laboratory reporting limits for 1,4-dioxane are 0.15 micrograms per liter (µg/L) in aqueous samples and 0.08 milligrams per kilogram (mg/kg) in soil samples.

5.6 Sample Preservation

Samples shall be preserved according to the preservation techniques given in **Attachment C**. 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 5.10. Air samples will not be preserved in a cooler with ice.

5.7 Sample Shipment

5.7.1 Packaging

Soil and groundwater sample containers will be placed in plastic coolers. Ice in Ziploc bags (or equivalent) will be placed around sample containers. PFAS samples will be stored in separate coolers, and blue ice will not be used to cool PFAS samples. Cushioning material will be added around the sample containers if necessary. Chains-of-custody 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.

5.7.2 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.

5.8 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

Sample equipment used to collect PFAS samples will be decontaminated via a standard two step decontamination procedure using PFAS-free water. Decontamination water will be verified to be PFAS-free via laboratory analysis or certification in accordance with NYSDEC's "Guidance for Sampling and Analysis of PFAS Under NYSDEC's Part 375 Remedial Programs" (January 2020).

5.9 Residuals Management

Debris (e.g., paper, plastic and disposable personal protective equipment [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. If applicable, residual solids (e.g., leftover soil cuttings) will be placed back in the borehole from which it was sampled. 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. The residual materials stored in a designated storage area at the site for further characterization, treatment or disposal.

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 transported to the on-site wastewater treatment plant or 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.

5.10 Chain of Custody Procedures

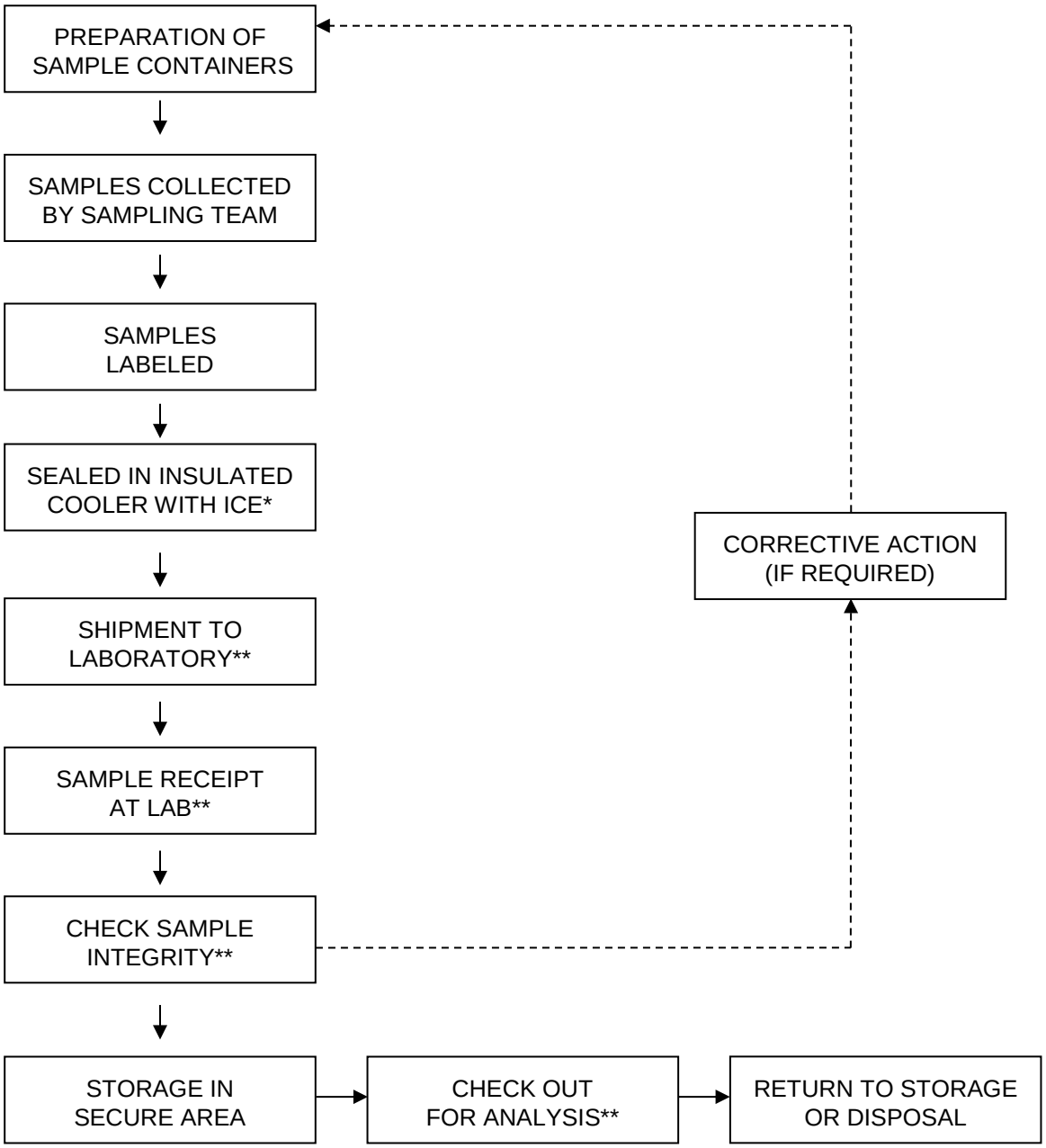
A chain-of-custody protocol has been established for collected samples that will be followed during sample handling activities in both field and laboratory operations. The primary purpose of the chain-of-custody procedures is to document the possession of the samples from collection through shipping, storage and analysis to data reporting and disposal. Chain-of-custody refers to actual possession of the samples. Samples are considered to be in custody if they are within sight of the individual responsible for their security or locked in a secure location. Each person who takes possession of the samples, except the shipping courier, is responsible for sample integrity and safe keeping. Chain-of-custody procedures are provided below:

- Chain-of-custody will be initiated by the laboratory supplying the pre-cleaned and prepared sample containers. Chain-of-custody forms will accompany the sample containers.
- Following sample collection, the chain-of-custody form will be completed for the sample collected. The sample identification number, date and time of sample collection, analysis requested and other pertinent information (e.g., preservatives) will be recorded on the form. All entries will be made in waterproof, permanent blue or black ink.
- Langan field personnel will be responsible for the care and custody of the samples collected until the samples are transferred to another party, dispatched to the laboratory, or disposed. The sampling team leader will be responsible for enforcing chain-of-custody procedures during field work.
- When the form is full or when all samples have been collected that will fit in a single cooler, the sampling team leader will check the form for possible errors and sign the chain-of-custody form. Any necessary corrections will be made to the record with a single strike mark, dated, and initialed.

Sample coolers will be accompanied by the chain-of-custody form, sealed in a Ziploc® bag (or equivalent) and placed on top of the samples or taped to the inside of the cooler lid. If applicable, a shipping bill will be completed for each cooler and the shipping bill number recorded on the chain-of-custody form.

Samples will be packaged for shipment to the laboratory with the appropriate chain-of-custody form. A copy of the form will be retained by the sampling team for the project file and the original will be sent to the laboratory with the samples. Bills of lading will also be retained as part of the documentation for the chain-of-custody records, if applicable. When transferring custody of the samples, the individuals relinquishing and receiving custody of the samples will verify sample numbers and condition and will document the sample acquisition and transfer by signing and dating the chain-of-custody form. This process documents sample custody transfer from the sampler to the analytical laboratory. A flow chart showing a sample custody process is included as **Figure 5.1**. A blank chain-of-custody form from Alpha is included as **Figures 5.2** and **5.3**.

Figure 5.1 Sample Custody



*SUMMA CANISTERS SHOULD NOT BE ICED
**REQUIRES SIGN-OFF ON CHAIN-OF-CUSTODY FORM

Figure 5.2 Sample Chain-of-Custody Form – Air Sample

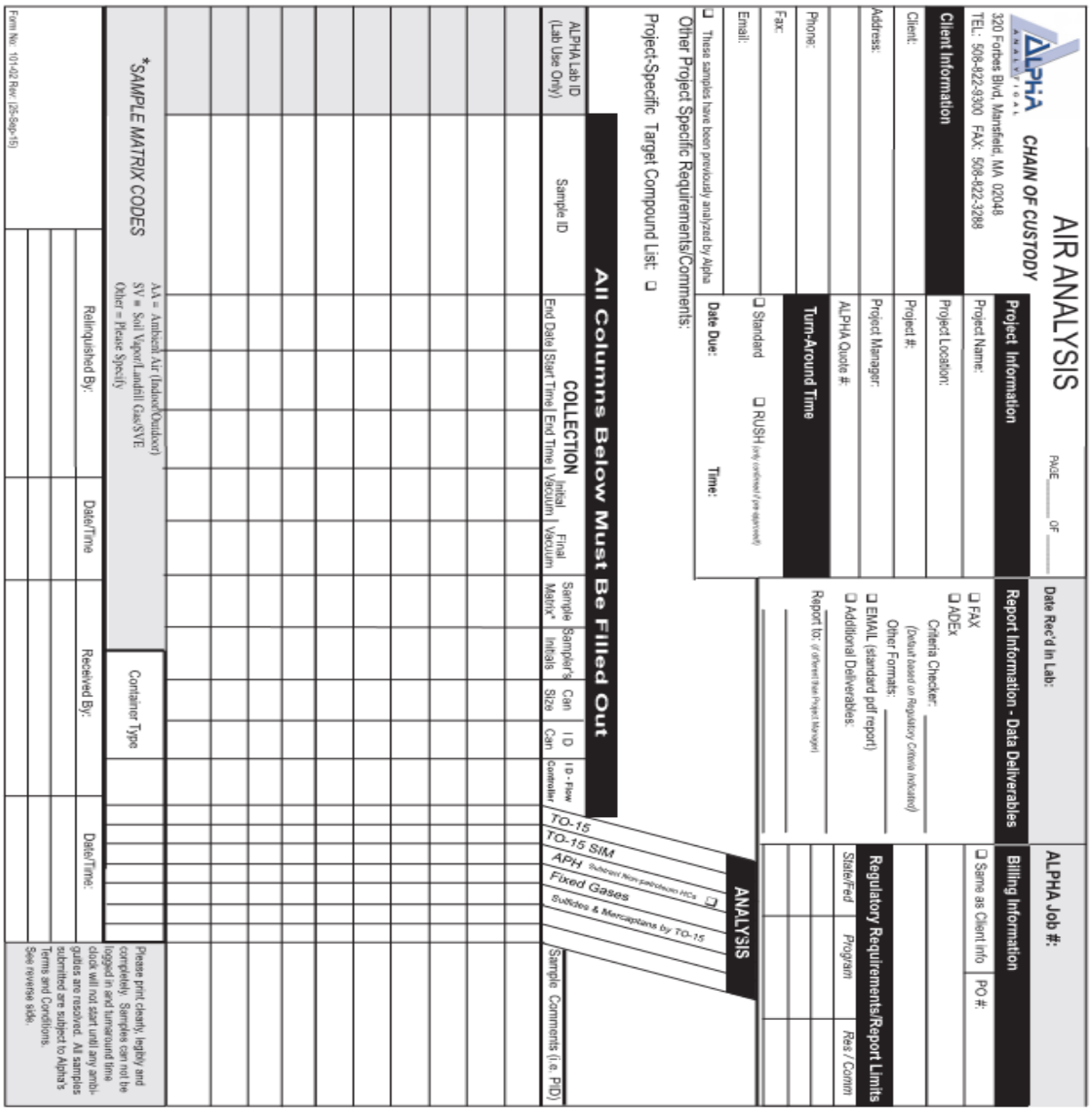
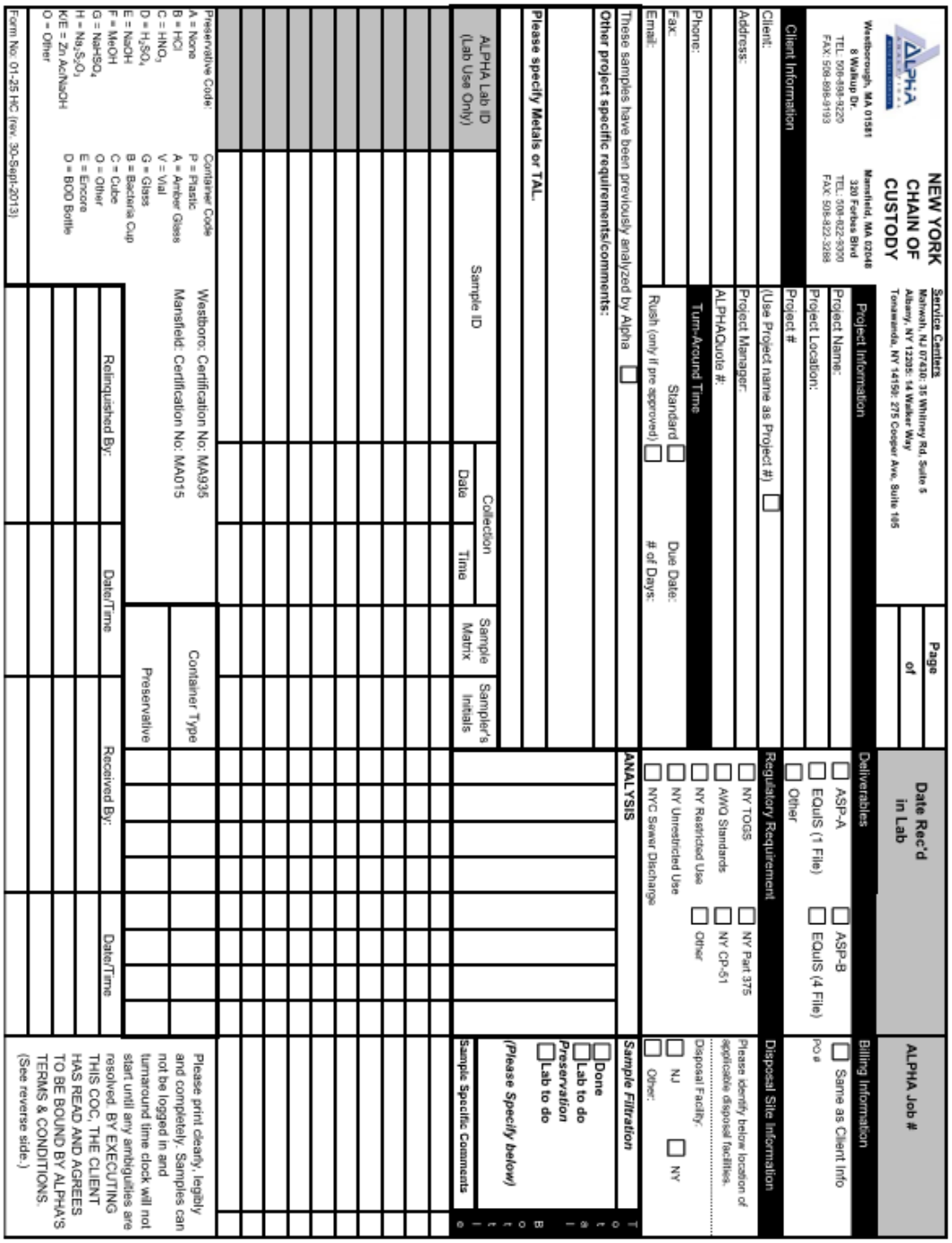


Figure 5.3 Sample Chain-of-Custody Form – Soil and Groundwater



Laboratory chain-of-custody will be maintained throughout the analytical processes as described in the laboratory's QA Manual. The analytical laboratory will provide a copy of the chain-of-custody in the analytical data deliverable package. The chain-of-custody becomes the permanent record of sample handling and shipment.

5.11 Laboratory Sample Storage Procedures

The subcontracted laboratory will use a laboratory information management system (LIMS) to track and schedule samples upon receipt by the analytical laboratories. Any sample anomalies identified during sample log-in must be evaluated on individual merit for the impact upon the results and the data quality objectives of the project. When irregularities do exist, the environmental consultant must be notified to discuss recommended courses of action and documentation of the issue must be included in the project file.

For samples requiring thermal preservation, the temperature of each cooler will be immediately recorded. Each sample and container will be will be assigned a unique laboratory identification number and secured within the custody room walk-in coolers designated for new samples. Samples will be, as soon as practical, disbursed in a manner that is functional for the operational team. The temperature of all coolers and freezers will be monitored and recorded using a certified temperature sensor. Any temperature excursions outside of acceptance criteria (i.e., below 2°C or above 6°C) will initiate an investigation to determine whether any samples may have been affected. Samples for VOCs will be maintained in satellite storage areas within the VOC laboratory. Following analysis, the laboratory's specific procedures for retention and disposal will be followed as specified in the laboratory's SOPs and/or QA manual.

6.0 DATA REDUCTION, VALIDATION, AND REPORTING

6.1 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.

6.2 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 or Task 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 has been completed, the Project Manager may direct the Team Leaders or others to initiate and finalize the analytical data assessment.

6.3 Data Validation

Data validation will be performed in accordance with the USEPA Region 2 SOPs for data validation and USEPA's National Functional Guidelines for Organic and Inorganic Data Review. Tier 1 data validation (the equivalent of USEPA's Stage 2A validation) will be performed to evaluate data quality. Tier 1 data validation is based on completeness and compliance checks of sample-related QC results including:

- Holding times;
- Sample preservation;
- Blank results (method, trip, and field blanks);
- Surrogate recovery compounds and extracted internal standards (as applicable);
- LCS and LCSD recoveries and RPDs;
- MS and MSD recoveries and RPDs;
- Laboratory duplicate RPDs; and
- Field duplicate RPDs

A DUSR will be prepared by the data validator and reviewed by the QAM before issuance. The DUSR will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and chain-of-custody procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method.

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" - Analyte is present. Reported value may be associated with a higher level of uncertainty than is normally expected with the analytical method
- "R" – Unreliable result; data is rejected or unusable. Analyte may or may not be present in the sample; and
- No Flag - Result accepted without qualification.

6.4 Reporting

Upon receipt of validated analytical results, NYSDEC format EDDs, compatible with EQuIS, will be prepared and submitted to the NYSDEC.

7.0 QUALITY ASSURANCE PERFORMANCE AUDITS AND SYSTEM AUDITS

7.1 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.

7.2 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 if the Project Manager requests, additional audits may be performed.

7.3 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.

7.4 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.

8.0 CORRECTIVE ACTION

8.1 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.

8.2 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 8.1** 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 8.1 Corrective Action Request Form

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. FOLLOW UP:

CORRECTIVE ACTION VERIFIED BY: _____ DATE:_____

9.0 REFERENCES

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

NYSDEC. Guidance for Sampling and Analysis for Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs, dated January 2020.

NYSDOH. Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006, updated May 2017.

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

USEPA, 2014. "Test Method for Evaluating Solid Waste," Update V dated July 2014 U.S. Environmental Protection Agency, Washington, D.C.

USEPA, 2016. Region II Standard Operating Procedure (SOP) #HW-34, "Trace Volatile Data Validation" (July 2015, Revision 0), USEPA Hazardous Waste Support Section. USEPA Region II

USEPA, 2016. Region II SOP #HW-35A, "Semivolatile Data Validation" (June 2015, Revision 0), USEPA Hazardous Waste Support Section. USEPA Region II

USEPA, 2016. Region II SOP #HW-36A, "Pesticide Data Validation" (June 2015, Revision 0), USEPA Hazardous Waste Support Section. USEPA Region II

USEPA, 2015. Region II SOP #HW-37A, "PCB Aroclor Data Validation" (June 2015, Revision 0), USEPA Hazardous Waste Support Section. USEPA Region II

USEPA 2016. Region II SOP #HW-3a, "ICP-AES Data Validation" (July 2015, Revision 0), USEPA Hazardous Waste Support Section. USEPA Region II

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

USEPA 2017. National Functional Guidelines for Superfund Organic Methods Data Review, Office of Superfund Remediation and Technology Innovation, EPA-540-R-2017-002, January 2017.

USEPA 2017b. National Functional Guidelines for Superfund Inorganic Methods Data Review, Office of Superfund Remediation and Technology Innovation, EPA-540-R-201 7-001, January 2017.

ATTACHMENT A
RESUMES

ALAN R. ARICO, LSRP

SENIOR PROJECT MANAGER

ENVIRONMENTAL CONSULTANT/DUE DILIGENCE, SITE INVESTIGATION

Mr. Arico has 15 years of environmental consulting and remediation experience. His professional experience includes technical leadership for environmental programs and projects as well as office staff and project management. His expertise includes design and implementation of Phase I and Phase II environmental assessments for private parties involved in industrial and commercial real estate transactions, site investigation and remediation of soil, ground water, and indoor air quality at sites involved in regulatory oversight. He has worked with a wide-range of industrial and commercial clients assisting them with Regulatory and ISRA Compliance issues. He has dealt extensively in all phases of remediation from Preliminary Assessments to Remedial Actions for ISRA and Brownfield's Redevelopment projects. Mr. Arico has extensive experience working with law firms, commercial and industrial clients, and regulators, coordinating and conducting single site and multi-site projects for acquisition, divestiture and environmental cleanup and response actions at manufacturing facilities, office buildings, commercial properties, residential developments, and brownfields projects.

SELECTED PROJECTS

- 20-Acre Brownfield's Redevelopment Site, Englewood, NJ
- Accurate Box, Paterson, NJ
- American Airlines UST, Philadelphia, PA
- American Airlines, Boston Logan Airport, Terminal B
- American BOS US Airways Legacy, East Boston, MA
- Child Care Facility, Somerville, NJ
- Former Bulk Fuel Storage and Distribution Facility, Cedar Knolls, NJ
- Former Dry Cleaners, Parsippany, NJ
- Former Exxon Site, Edison, NJ
- Former Gas Station, Somerville, NJ
- Former Manufacturing Facility, Linden, NJ
- PANYNJ Bayonne Bridge, Bayonne, NJ
- PANYNJ Goethals Bridge, Perth Amboy, NJ
- PANYNJ Hanger 16, New York, NY
- PANYNJ Newark International Airport Feasibility Study, Newark, NJ
- PANYNJ PATH Substation, New York, NY
- Project Coda, Houston, TX
- Project Liberty, Union, NJ
- Reagent Chemical, Middlesex, NJ
- Seaman Ave Elementary School, Perth Amboy, NJ
- UST Removal, Perth Amboy, NJ

EDUCATION

B.S., Park Management and Natural Resource Conservation
University of Maryland

A.A., Liberal Arts & Humanities
County College of Morris

PROFESSIONAL REGISTRATION

Licensed Site Remediation Professional (LSRP)

8-Hour Hazardous Waste Operations Site Supervisor Training

40-hour Hazardous Waste Operations Training

Adult CPR/First Aid/AED Certified

Boat Operator License

U.S.C.G. Boating Safety Certificate (BSIA)

AFFILIATIONS

Licensed Site Remediation Professionals Association

EXPERT WITNESS

December 2013. 190 Main Street Associates and John Pjeternikaj, Plaintiff, vs. Lew Corporation, Defendant and Lew Corporation, Plaintiff, vs. Environmental Consulting & Management Services, Inc., Third-Party Defendant. Superior Court of New Jersey, Passaic County, Law Division. Docket No. PAS-L-4778-10. Retained by Steinvurzel Law Group, P.C. (Expert report).

April 2011. BEBP Development Company, LLC, Plaintiff, vs. Environmental Technologies Group of New Jersey, Inc., Defendant. Superior Court of New Jersey, Bergen County, Law Division. Docket No. BER-L-001508-10. Retained by Steinvurzel Law Group, P.C. (Expert report).

JOSEPH CONBOY

SENIOR STAFF CHEMIST

ENVIRONMENTAL ENGINEERING

Joseph has 7 years of experience in environmental consulting, specializing in chemical data validation, data quality assessments, data usability evaluations, and EQuIS database management.

SELECTED PROJECTS

- 23-30 Borden Avenue, Long Island City, NY
- 25-01 Queens Plaza North, Long Island City, NY
- 37-11 30th Street, Long Island City, NY
- 266 West 96th Street, New York, NY
- 414 Gerard Avenue, Bronx, NY
- 445 Gerard Avenue, Bronx, NY
- 475 Bay Street, Staten Island,
- 538-544 Hudson Street, New York, NY
- 805-825 Atlantic Avenue, Brooklyn, NY
- 1400 Ferris Place, Bronx, NY
- 1607 Surf Avenue, Coney Island, NY
- 1900 River Road, Burlington, NJ
- 2447 Third Avenue, New York, NY
- ABC - Block 27, Long Island City, NY
- American Dream Meadowlands, East Rutherford, NJ
- Bedford Armory, Brooklyn, NY
- Former Ballantine Brewery, Newark, NJ
- Former Curtiss-Wright Facility, Wood-Ridge, NJ
- Former Duane Marine Site, Perth Amboy, NJ
- Former Perth Amboy Gas Works, Perth Amboy, NJ
- Former Plessey Dynamics Site, Hillside, NJ
- Former MGP Site, Wildwood, NJ
- Gowanus Canal Northside, Brooklyn, NY
- JCP&L Union Beach District Office, Keyport, NJ
- K-8 School, New Brunswick, NJ
- Linden Terminal, Linden, NJ
- Paulsboro Packaging Site, Paulsboro, NJ
- President Street Properties, New York, NY
- Suffolk Street, New York, NY
- Willets Point, Queens, NY

EDUCATION

B.S., Chemistry
Rowan University

MIMI RAYGORODETSKY

PRINCIPAL/VICE PRESIDENT

ENVIRONMENTAL ENGINEERING

Ms. Raygorodetsky sources and directs complex environmental remediation and redevelopment projects from the earliest stages of pre-development diligence, through the remediation/construction phase, to long-term operation and monitoring of remedial systems and engineering controls. She has a comprehensive understanding of federal, state and local regulatory programs and utilizes this expertise to guide her clients through a preliminary cost benefit analysis to select the right program(s) given the clients' legal obligations, development desires and risk tolerance. Ms. Raygorodetsky is particularly strong at integrating the programmatic requirements and client development needs to design targeted and streamlined diligence programs and remediation strategies. She has played a key communication role on highly contentious remediation projects in the center of the public eye, as is uniquely skilled in distilling complex technical matters down to easily understandable concepts for a variety of stakeholders.

EDUCATION

B.A., Biology and Spanish Literature
Colby College

AFFILIATIONS

New York Women Executives in Real Estate (WX) - Board Member; Networking and Special Events Committee Co-Chair

New York Building Congress, Council of Industry Women - Committee Member

New York City Brownfield Partnership - Founding Member and President

NYC Office of Environmental Remediation Technical Task Force - Committee Member

SELECTED PROJECTS

ABC Blocks 25-27, Mixed-Use, Brownfield Cleanup Program, Long Island City, NY – Associate. Performed environmental diligence as part of a multi-disciplinary master planning process on a three block parcel. Project includes a public open space and public school. The waterfront site has a heavy industrial-use history and potentially very significant contamination. The project was entered into the NYS Brownfield Cleanup Program as three separate sites.

42-02 Crescent Street Redevelopment, Phase I and II Environmental, Long Island City, NY – Senior Project Scientist. Provided Phase I and Phase II site assessments, and geotechnical engineering during site redevelopment.

27-19 44th Drive, Residential Redevelopment, Long Island City, NY– Senior Project Scientist. Provided Phase I and Phase II site assessments, and geotechnical engineering during site redevelopment.

22-12 Jackson Avenue, Residential Redevelopment, Due Diligence , Long Island City, NY – Served as the lead environmental strategist for due diligence, regulatory program evaluation, site investigation, remediation and construction, and community relations.

Greenpoint Landing, Remediation/Redevelopment, Brooklyn, NY – Lead Environmental Strategist. Fifteen years of experience on this 11 tower, 22-acre waterfront residential redevelopment with public open space, and a public school. Served as the lead environmental strategist for due diligence, regulatory program evaluation, site investigation, remediation and construction, and community relations.

Brooklyn Bridge Park, Pier 1, Brooklyn, NY – Senior Project Scientist. Responsible for waste characterization and remediation oversight for a large waterfront mixed-use hotel/residential construction.

Brooklyn Bridge Park, One John Street Development, Brooklyn, NY – Senior Project Scientist. Responsible for pre-construction due diligence and construction administration for a mixed-use residential/retail/cultural development on the Brooklyn waterfront.

250 Water Street, New York, NY – Principal. Howard Hughes Corporation will be constructing a residential and commercial building on this full block site in lower Manhattan. Langan is providing survey, environmental, and geotechnical services. Environmental services include site investigation and remediation under the NYS Brownfield Cleanup Program. The site has a varied environmental history including four thermometer factories/workshops. The remedial investigation included sampling for mercury in soil, groundwater, soil vapor, and ambient air, as well as speciation of mercury in soil samples. Because the site is adjoined by two K-12 schools (one public and one private), extensive public participation is necessary, including multiple community meetings, briefings to elected officials, establishment of a project website, and media interviews.

420 Kent Avenue, Brooklyn, NY – Associate. Performed Phase I, Phase II, waste characterization, remediation planning and building materials studies on a six-acre former industrial parcel along the Brooklyn waterfront. Responsible for entering two sites into the NYS Brownfield Cleanup Program and worked diligently to satisfy the requirements for the 421A expiration in June 2015.

Echo Bay Development, New Rochelle, NY – Associate. Five years of due diligence and design-phase support for developer of 25-acres of waterfront property in Westchester County. Performed Phase I and Phase II Site Assessments/Investigations and evaluated several remedial strategies and alternatives during master planning phase of development. A portion of the project was entered into the NYS Brownfield Cleanup Program in 2015.

KIPP and Achievement First Charter Schools, Bronx and Brooklyn, NY – Senior Environmental Scientist. Performed Phase I and Phase II, waste characterization, and remediation on two charter school sites for a private and non-profit client. Sites were both subject to NYC Office of Environmental Remediation's E-Designation program and work was performed under NYC School Construction Authority.

Post-Hurricane Sandy Mold Remediation, Various Private Homes, Far Rockaway (Queens), Nassau and Suffolk Counties, Long Island, NY – Senior Project Scientist. Provided environmental consulting services, oversight, and final assessments during microbial cleaning and remediation efforts. Services included preliminary visual assessments to determine the presence of mold, verification of effectiveness of work activities, written work plans, and project reporting.

Pratt Institute, 550 Myrtle Avenue Renovations, Environmental Remediation, Brooklyn, NY – Senior Project Scientist. Completed investigation and remediation on two university sites subject to NYC Office of Environmental Remediation's E-Designation program.

711 Eleventh Avenue, New York, NY – Senior Project Scientist. Performed due diligence and served as owner's representative during a complex long-term lease negotiation on a former and future auto dealership site.

7 West 21st Street, New York, NY – Associate. Brownfields remediation project included Phase I and Phase II assessments, waste classification, regulatory coordination with the New York City Office of Environmental Remediation, and remediation oversight and closure.

546 West 44th Street, New York, NY – Senior Project Scientist. Brownfields Remediation services included remedial investigation; waste classification; regulatory coordination with the New York City Office of Environmental Remediation; and remediation oversight and closure.

Erickson Retirement Communities, Multiple Locations in NY, ME, MA, CT and NJ – Senior Project Scientist. A senior housing developer required land comprising 100 developable acres for campuses in the northeast. Responsible for Phase I Environmental Site Assessments and targeted Phase II Environmental Site Investigations on 100+ acre sites that were primarily undeveloped wooded areas, agricultural lands, former landfills, and a golf course. Worked closely with other members of the development team, including natural resource experts and architects to focus investigations on land that would be disturbed as part of future development. Also, liaised with state and local environmental regulators where lands were located.

55 West 17th Street, New York, NY – Senior Project Scientist. Completed brownfield remediation for a six-story, 54,000 SF mixed-use office and retail building. Service included Phase I and Phase II assessments and remediation oversight and closure.

Georgetown Heating Plant, Demolition of Power Plant, Washington, D.C. – Senior Project Scientist. Provided services during demolition of a power plant. Services included a hazardous materials study for mercury and PCBs; demolition plan preparations.

SELECTED PUBLICATIONS, REPORTS, AND PRESENTATIONS

Raygorodetsky, M., "The Perils and Pleasures of Urban Waterfront Development", Environmental Law In New York, February 3, 2020.

REBEKAH DIEHL

SENIOR STAFF SCIENTIST

SITE REMEDIATION/ENVIRONMENTAL SPECIALIST

Ms. Diehl is a Senior Staff Scientist in the Site Remediation/Hazardous Waste Group with 8 years of experience. She has attained various skills while working predominantly under New Jersey Department of Environmental Protection (NJDEP) and New York State Department of Environmental Conservation (NYSDEC) regulations.

Ms. Diehl has conducted various environmental investigations for various contaminant categories and in in various remedial phases. This has included: chlorinated solvents; petroleum products; metals; pesticides/fumigants; and polychlorinated biphenyls. She specializes in research and field work involving soil, groundwater, sediment, potable water, DNAPL/LNAPL, and vapor intrusion related sampling.

Ms. Diehl has prepared various remedial documents that have included: remedial investigation/action reports; background investigation conceptual site models; health and safety plans; scopes of work; information for bidders, quarterly monitoring reports, preliminary assessment/site investigation reports, ASTM E1527-13 Phase I environmental site assessment reports, and quality assurance project plans. She has also created geographic information system (GIS) shapefiles for deed notices, remedial investigations, and classification exemption areas in accordance with the NJDEP. Ms. Diehl has a strong understanding of NJDEP technical requirements and guidance documents

SELECTED PROJECTS

- Mahwah Public Housing – Phase I ESA, Mahwah, NJ
- Ramsey Public Housing – Phase I ESA, Ramsey, NJ
- 1755 Amwell Road – Phase I ESA, Franklin Township, NJ
- 2301 Route 27 – Phase I ESA, Franklin Township, NJ
- Victory Boulevard – Phase I ESA, Staten Island, NY
- Amboy Road Property – Phase I ESA, Long Island, NY
- NC-15/NC-16 – Phase I ESA, Staten Island, NY
- NC-18 – Phase I ESA, Staten Island, NY
- SBE-1A/SBE-1B – Phase I ESA, Staten Island, NY
- 851 and 879 Father Capodanno Boulevard – Phase I ESA, Staten Island, NY
- Former Lever Brothers Baltimore Manufacturing Plant – Phase I ESA, Baltimore, MD
- Former Gasoline Service Station – Phase II ESA, Maspeth, NY
- Bordentown Maintenance Facility – EO215 ESA, Bordentown, NJ
- Maintenance Facility – EO215 ESA, Freehold, NJ
- Hanover Maintenance Facility – EO215 ESA, Whippany, NJ
- Extra Yard – EO215 ESA, Wantage, NJ
- Murch's Auto Body Newton, NJ
- Fairchild Gas & Auto Service, Morristown, NJ
- Dumont Senior Citizen Housing, Dumont, NJ

EDUCATION

BS, Environmental Studies, East Stroudsburg University of Pennsylvania

PROFESSIONAL REGISTRATION

OSHA 40-Hour Hazardous Waste Operations & Emergency Resp. (HAZWOPER)

NJ, NY, PA Lead Inspector and Risk Assessor

NJ, PA, NYS/ EPA/AHERA Asbestos Inspector

OSHA 10-Hour Construction Safety

Practical Applications in Hydrogeology (4-day), Rutgers University

Introduction to Wetland Identification (1-day), Rutgers University

Underground Storage Tank (UST) Training (1-day), Rutgers University

AFFILIATIONS

Association of Environmental & Engineering Geologists (AEG)

- Pro Staff Real Estate, Nutley, NJ
- Patrician Creative Floors, Garwood, NJ
- Hanover Supply Company, East Hanover, NJ
- County Concrete Company, Morristown, NJ
- FW Speer, Passaic, NJ
- Former Southend Pyramid Gasoline Station, Montclair, NJ
- Former Britton Transportation, Wayne, NJ
- NAES/Pace Analytical, Linden,
- New Jersey Turnpike Authority, Interchange 3, Runnemede, NJ
- New Jersey Turnpike Authority, Woodbridge, NJ
- New Jersey Turnpike Authority, Ocean View Service Area, Ocean View, NJ
- Martin Shopping Plaza, Fairfield, NJ
- Essex County Municipal Airport, Fairfield, NJ
- Harris Corporation, Route 3 Facility, Clifton,
- Harris Corporation, River Road Facility, Nutley,
- Haller Testing Laboratories, Plainfield, NJ
- Former Ronson Metals, Newark, NJ
- Atlantic Hard Chromium, Piscataway, NJ
- Fairclough & Sons, Inc., Towaco, NJ
- Monroe Township Wells 4 and 5, Monroe Township,
- Municipal Building Groundwater Contamination, Elk Township, NJ
- South Black Horse Pike, Monroe Township, NJ
- TCE Groundwater Contamination, North Haledon, NJ
- Greenwich Township MUA Well #4 and 6, Greenwich Township, NJ
- Wayne Court and Passaic Avenue Groundwater Contamination, North Haledon, NJ
- MAC Products, Inc., Kearny, NJ
- Atlantic Cleaners, Manasquan, NJ
- Fuel One, Milltown, NJ
- East Elmer Road Groundwater Contamination, Vineland, NJ
- Bay Avenue BP, Manahawkin, NJ
- South East Boulevard Groundwater Contamination, Vineland, NJ
- Bloomingdale Borough Regional Groundwater Contamination, Bloomingdale, NJ
- Groundwater Contamination, Villas, NJ
- Groundwater Contamination, Franklin Township, NJ
- Paramount Express, Paterson, NJ
- Twin Rivers Shopping Plaza, East Windsor, NJ
- Rutgers Newark Alumni Building, Newark, NJ
- LSRP On-Call Contract, Monmouth County, NJ
- Route 15 & Meadows Road, Lafayette, NJ
- Camden County Trail, Camden County, NJ
- Jaggers Point Recreational Area, Pittsgrove Township, NJ
- Route 287 Dump, Boonton, NJ
- Greystone Psychiatric Hospital, Morris Plains, NJ
- 272 Wagaraw Road, Hawthorne, NJ
- Garden State Parkway Over Passaic River, Clifton/Elmwood Park, NJ
- Route 280 Tire Dump, East Hanover, NJ
- Maintenance Yard, Clinton, NJ
- Auto Spa, Wayne, NJ
- Richmond Terrace, Staten Island, NY
- Ashokan High Point Reservoir, Shokan, NY
- East River, New York, NY

- Macbeth Plant, Newburgh, NY
- Caddell Dry Dock, Long Island, NY
- 829 Father Capodanno Boulevard, Staten Island, NY
- W.A.T.E.R. Project, Waterbury, CT
- Pequonnock River Trail, Bridgeport, CT
- Childcare Facility Lead Paint Inspection, Philadelphia, PA
- Adelphia Gateway, Philadelphia, PA
- Herbology, Grassroots Cannabis, King Of Prussia, PA

Robert (Rory) S. Johnston, PE, BCEE

Principal / Vice President
Environmental & Geotechnical Engineering

30 years in the industry

Mr. Johnston's consulting career spans almost 30 years ranging from geotechnical engineering on large industrial projects to environmental investigation and remediation. At Langan a key part of his role is to lead client development in various market sectors, including an emphasis on the oil and gas markets.

Mr. Johnston experience includes all aspects of geotechnical engineering for a wide range of industrial, commercial, private, and government clients. He has been involved in the geotechnical design and construction management of a wide range of infrastructure projects around the nation, major improvements at all NYC airports, baseball stadiums, landfills, refineries, LNG facilities, industrial developments, and more. Mr. Johnson has conducted and directed extensive site investigations, developed geotechnical and environmental solutions, and provided oversight of the implementation of these solutions.

Selected Projects

Shell Western Exploration, Inc.: Bolivar Decommissioning Project, TX
Shell Western Exploration, Inc: Permian Asset Water Evaluation, Pecos, TX
Shell Western Exploration, Inc. Permian Asset Evaluation (300 Well Pads), Pecos, TX
Shell UA Offshore, Inc: Desalinization Study for EOR, Houston, TX
Shell Oil Products, US: Metairie Lubes Plant, Metairie, LA
Calypso LNG Project; Port Everglades, FL
Amerada Hess: Hess Brooklyn Terminal, Brooklyn, NY.
Amerada Hess: Weavers Cove LNG, Weavers Cove, MA
Shell Oil Products, US: Roosevelt Refinery, Roosevelt, UT
Shell Oil Products, US: St. Marys Refinery, St. Marys, WV
Shell Oil Products, US: Elk Refinery, Elk, WV
Shell UA, Inc; Due Diligence for East Resources Acquisition, PA and WV
Conoco/Phillips 66: Bayway Refinery, Linden, NJ
Exxon: Bayway Geotechnical Evaluation, Linden,NJ
Unocal: Manufacturing Site Restoration, PA
Pennzoil Quaker State: Major Well Plugging and Abandonment Program, PA/NY
Hovic/Hovensa Refinery; Christiansted, St. Croix, USVI
Dominion Resources; Cove Point FERC Evaluation
Saudi Aramco: Home Ownership Environmental Site Assessment, South Dhahran, Saudi Arabia
Saudi Aramco: Investigation of Southern Area Oily Pits, Eastern Province, Southern Oil Operations, Saudi Arabia.
Cuyamaca West Landfill Stabilization, Sand Diego, CA
American Airlines Terminal 8 Redevelopment, JFK Airport , New York, NY
American Airlines: LaGuardia Airport Redevelopment, New York, NY

Education

B.A. English Rutgers University

B.Sc. Civil Engineering Rutgers University

M. Sc. Civil Engineering University of California

Professional Registration

Registered Professional Engineer in TX, CA, NJ, NY, PA, KS, and WV.
Registered Geotechnical Engineer, CA

Affiliations

American Concrete Institute

American Society of Civil Engineers

Association of Firms Practicing in Geosciences, Past President

LANGAN

American Airlines: Terminals 8 and 9 Redevelopment, New York, NY
ALCOA Trinidad Smelter: Cap-de-Ville, Trinidad
Bayway Refinery Lagoon, Linden NJ
Bros Superfund Project: Gloucester County/New Jersey.
Camp Pendleton Marine Corp Air Station: Site Remedial Investigation/ Remediation, Camp Pendleton, CA
City of Newark: Albert Steel Drum, Newark NJ
City of Newark: Environmental Services, Newark NJ
Geotechnical Investigations at Baseball Stadium, Staten Island NY
Hanger 10 Project at JFK Airport, New York, NY
Harbor Charlie Pier Rehabilitation, Brooklyn NY
Hudson River Waterfront Park, New York, NY
Jersey City v. Honeywell: Study Area SA6-N Jersey City, NJ
JetBlue Airways: Jet Blue Hangar, Orlando FL
John F. Kennedy Airport: Terminal 4 Redevelopment Project, New York, NY
Kara Homes: Geotechnical & Environmental Services, Aberdeen NJ
Murphy Canyon Business Park, San Diego, CA
New Jersey Schools Construction Corporation: Proposed Elementary and Middle School, Gloucester City, NJ
New York City Water Tunnel Claims Contract, New York, NY
Newark Housing Authority: Environmental Services, Newark NJ
NJ Transit: Long Slip Canal Fill/Tunnel Project, Hoboken, NJ
North Island Naval Air Station: Carrier Home Porting Project, Coronado, CA
PEPCO: Pitman Dam, Pitman, NJ
Port Authority of NY & NJ (Eng. Dept): Call-in Contract, NY/NJ
Port Authority of NY & NJ (Eng. Dept.): BFF and SFF Upgrades Contract JFK-1036, Jamaica NY
Port Authority of NY & NJ (Eng. Dept.): Site Closure Workplans, Jamaica NY
San Clemente Naval Air Station: Utility Project, San Clemente Island, CA
San Ysidro MCA Amphitheater, Otay Mesa, CA
Scripps Ranch Project, San Diego, CA

Publications

Stanin, F.T., Johnston, R.S., "Vapor Intrusion and Property Development - Prudent Actions to Take," Proceedings, 35th Annual Conference on Environmental Law, American Bar Association, Keystone CO, March 9-12, 2006.

ANTHONY MOFFA, JR., ASP, CHMM, COSS, CSP

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 29 years of 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. His 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)

Certified Safety Professional (CSP)

AFFILIATIONS

Pennsylvania Chamber of Business & Industry

Chemical Council of New Jersey

New Jersey Business & Industry Association

American Society of Safety Professionals

ATTACHMENT B
LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS

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 the following table.

TABLE
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
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

TABLE
PROJECT QUANTITATION LIMITS - SOIL

			Estimated Quantitation Limits (Soil)	
	Compound	**Method**	**RL (mg/kg)**	**MDL(mg/kg)**
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
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

TABLE
PROJECT QUANTITATION LIMITS - SOIL

	Compound	Method	Estimated Quantitation Limits (Soil) RL (mg/kg)	MDL(mg/kg)
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
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

TABLE
PROJECT QUANTITATION LIMITS - SOIL

			Estimated Quantitation Limits (Soil)	
	Compound	**Method**	**RL (mg/kg)**	**MDL(mg/kg)**
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
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

TABLE
PROJECT QUANTITATION LIMITS - SOIL

			Estimated Quantitation Limits (Soil)	
	Compound	**Method**	**RL (mg/kg)**	**MDL(mg/kg)**
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
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

TABLE
PROJECT QUANTITATION LIMITS - SOIL

			Estimated Quantitation Limits (Soil)	
	Compound	**Method**	**RL (mg/kg)**	**MDL(mg/kg)**
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
3	Trivalent Chromium	7196	0.8	0.8
	PFAS	**Method**	**RL (µg/kg)**	**MDL (µg/kg)**
1	Perfluorobutanoic Acid (PFBA)	537 Rev 1.15	0.5	0.0227
2	Perfluoropentanoic Acid (PFPeA)	537 Rev 1.15	0.5	0.046
3	Perfluorobutanesulfonic Acid (PFBS)	537 Rev 1.15	0.5	0.039
4	Perfluorohexanoic Acid (PFHxA)	537 Rev 1.15	0.5	0.0525
5	Perfluoroheptanoic Acid (PFHpA)	537 Rev 1.15	0.5	0.0451
6	Perfluorohexanesulfonic Acid (PFHxS)	537 Rev 1.15	0.5	0.0605
7	Perfluorooctanoic Acid (PFOA)	537 Rev 1.15	0.5	0.0419
8	1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	537 Rev 1.15	0.5	0.1795
9	Perfluoroheptanesulfonic Acid (PFHpS)	537 Rev 1.15	0.5	0.1365
10	Perfluorononanoic Acid (PFNA)	537 Rev 1.15	0.5	0.075

TABLE
PROJECT QUANTITATION LIMITS - SOIL

	Compound	Method	Estimated Quantitation Limits (Soil) RL (mg/kg)	MDL(mg/kg)
11	Perfluorooctanesulfonic Acid (PFOS)	537 Rev 1.15	0.5	0.13
12	Perfluorodecanoic Acid (PFDA)	537 Rev 1.15	0.5	0.067
13	1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	537 Rev 1.15	0.5	0.287
14	N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	537 Rev 1.15	0.5	0.2015
15	Perfluoroundecanoic Acid (PFUnA)	537 Rev 1.15	0.5	0.0468
16	Perfluorodecanesulfonic Acid (PFDS)	537 Rev 1.15	0.5	0.153
17	Perfluorooctanesulfonamide (FOSA)	537 Rev 1.15	0.5	0.098
18	N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	537 Rev 1.15	0.5	0.0845
19	Perfluorododecanoic Acid (PFDoA)	537 Rev 1.15	0.5	0.07
20	Perfluorotridecanoic Acid (PFTrDA)	537 Rev 1.15	0.5	0.2045
21	Perfluorotetradecanoic Acid (PFTA)	537 Rev 1.15	0.5	0.054

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
6) µg/kg = microgram per kilogram

TABLE
PROJECT QUANTITATION LIMITS - GROUNDWATER

	Compound	Method	Estimated Quantitation Limits (Groundwater) 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

TABLE
PROJECT QUANTITATION LIMITS - GROUNDWATER

			Estimated Quantitation Limits (Groundwater)	
	Compound	**Method**	**RL (ug/L)**	**MDL(ug/L)**
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
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

TABLE
PROJECT QUANTITATION LIMITS - GROUNDWATER

			Estimated Quantitation Limits (Groundwater)	
	Compound	**Method**	**RL (ug/L)**	**MDL(ug/L)**
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
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

TABLE
PROJECT QUANTITATION LIMITS - GROUNDWATER

			Estimated Quantitation Limits (Groundwater)	
	Compound	**Method**	**RL (ug/L)**	**MDL(ug/L)**
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
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

TABLE
PROJECT QUANTITATION LIMITS - GROUNDWATER

			Estimated Quantitation Limits (Groundwater)	
	Compound	**Method**	**RL (ug/L)**	**MDL(ug/L)**
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
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

TABLE
PROJECT QUANTITATION LIMITS - GROUNDWATER

			Estimated Quantitation Limits (Groundwater)	
	Compound	**Method**	**RL (ug/L)**	**MDL(ug/L)**
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
	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

TABLE
PROJECT QUANTITATION LIMITS - GROUNDWATER

	Compound	Method	Estimated Quantitation Limits (Groundwater) RL (ug/L)	MDL(ug/L)
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
	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	0.1264
2	Perfluoroheptanoic acid (PFHpA)	537 Rev 1.15	2	0.0924
3	Perfluorooctanoic acid (PFOA)	537 Rev 1.15	2	0.0504
4	Perfluorononanoic acid (PFNA)	537 Rev 1.15	2	0.1008
5	Perfluorodecanoic acid (PFDA)	537 Rev 1.15	2	0.1904
6	Perfluoroundecanoic acid (PFUdA)	537 Rev 1.15	2	0.1912
7	Perfluorododecanoic acid (PFDoA)	537 Rev 1.15	2	0.0916
8	Perfluorotridecanoic Acid (PRTrDA)	537 Rev 1.15	2	0.0904
9	Perfluorotetradecanoic acid (PFTA)	537 Rev 1.15	2	0.072
10	Perfluorobutanesulfonic acid (PFBS)	537 Rev 1.15	2	0.11
11	Perfluorohexanesulfonic acid (PFHxS)	537 Rev 1.15	2	0.1076
12	Perfluorooctanesulfonic acid (PFOS)	537 Rev 1.15	2	0.1116
13	Perfluorodecanesulfonic Acid (PFDS)	537 Rev 1.15	2	0.2224
14	Perfluorobutanoic Acid (PFBA)	537 Rev 1.15	2	0.1312
15	Perfluoropentanoic Acid (PFPeA)	537 Rev 1.15	2	0.0856
16	Perfluoroheptane Sulfonic Acid (PFHpS)	537 Rev 1.15	2	0.1552
17	1H,1H,2H,2H-Perfluorooctane Sulfonate (6:2 FTS)	537 Rev 1.15	2	0.194
18	1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2 FTS)	537 Rev 1.15	2	0.2908
19	Perfluorooctanesulfonamide (FOSA)	537 Rev 1.15	2	0.2268
20	N-methyl perfluorooctanesulfonamidoacetic acid (MeFOSAA)	537 Rev 1.15	2	0.2504
21	N-ethyl perfluorooctanesulfonamidoacetic acid (EtFOSAA)	537 Rev 1.15	2	0.3728

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
PROJECT QUANTITATION LIMITS – AIR

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

TABLE
PROJECT QUANTITATION LIMITS – AIR

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

TABLE
PROJECT QUANTITATION LIMITS – AIR

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

TABLE
PROJECT QUANTITATION LIMITS – AIR

			Estimated Quantitation Limits (Groundwater)	
	Compound	**Method**	**RL (ppbV)**	**MDL(ppbV)**
110	Decane (C10)	TO-15	0.2	0.0484
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

ATTACHMENT C
ANALYTICAL METHODS AND QUALITY ASSURANCE SUMMARY TABLE

ATTACHMENT C
ANALYTICAL METHODS/QUALITY ASSURANCE SUMMARY TABLE

Matrix Type	Field Parameters	Laboratory Parameters	Analytical Methods	Sample Preservation	Sample Container Volume and Type	Sample Hold Time	Field Duplicate Samples	Equipment Blank Samples	Trip Blank Samples	Ambient Air Samples	MS/MSD Samples
Groundwater	Temperature, Turbidity, pH, ORP, Conductivity, Dissolved Oxygen	Part 375 and TCL VOCs	EPA 8260C	Cool to 4°C; HCl to pH <2; no headspace	Three 40-mL VOC vials with Teflon® -lined cap	Analyze within 14 days of collection	1 per 20 samples (minimum 1)	1 per 20 samples (minimum 1)	1 per Shipment of VOC samples	NA	1 per 20 samples
		Part 375 and TCL SVOCs	EPA 8270D and 8270D with SIM	Cool to 4°C	Two 1-Liter Amber Glass	7 days to extract; 40 days after extraction to analyze			NA		
		Part 375 and TCL Pesticides	EPA 8081B	Cool to 4°C	Two 1-Liter Amber Glass	7 days to extract; 40 days after extraction to analyze					
		PCBs	EPA 8082A	Cool to 4°C							
		Part 375 and TAL Metals	EPA 6010C, 6020A, 7470A	Cool to 4°C; HNO_3 to pH <2	250 mL plastic	6 months, except Mercury 28 days					
		Hexavalent Chromium	EPA 7196A	Cool to 4°C	250 mL plastic	24 Hours					
		Cyanide	EPA 9012B/SM4500 C/E	NaOH plus 0.6g ascorbic acid	250 mL plastic	14 days					
		PFAS**	EPA 537M	Cool to 4°C; Trizma	Three 250-mL HDPE or polypropylene container	14 days to extract; 28 days after extraction to analyze		1 per sampling day			
		1,4-Dioxane as SVOC***	EPA 8270D with SIM	Cool to 4°C	Two 250-mL Amber Glass	7 days to extract; 40 days after extraction to analyze		1 per sampling day			
Soil	Total VOCs via PID	Part 375 and TCL VOCs	EPA 8260C	Cool to 4°C	Two 40-mL VOC Vials with 5mL H_2O, one with MeOH	48 hours after sampling if not frozen to -70 or extruded into methanol. If frozen. analyze within 14 days of collection	1 per 20 samples (minimum 1)	1 per 20 samples (minimum 1)	1 per Shipment of VOC samples	NA	1 per 20 samples
		Part 375 and TCL SVOCs	EPA 8270D and 8270D with SIM	Cool to 4°C	4 oz. glass jar*	14 days to extract; 40 days after extraction to analyze			NA		
		Part 375 and TCL Pesticides	EPA 8081B	Cool to 4°C	4 oz .glass jar*	14 days to extract; 40 days after extraction to analyze					
		PCBs	EPA 8082A	Cool to 4°C							
		Part 375 and TAL Metals	EPA 6010C, 7471B	Cool to 4°C	2 oz. glass jar*	6 months, except Mercury 28 days					
		PFAS**	EPA 537M	Cool to 4°C; Trizma	One plastic 8 oz. jar	14 days to extract; 40 days after extraction to analyze		1 per sampling day			
		1,4-Dioxane as SVOC***	EPA 8270D	Cool to 4°C	8 oz. glass jar	14 days		1 per sampling day			
		Percent Solids	SM 2540G	Cool to 4°C	2 oz. plastic container	NA		NA			NA
Soil Vapor	Total VOCs via PID	TO-15 Listed VOCs	EPA TO-15	Ambient Temperature	6-Liter Summa Canister	Analyze within 30 days of collection	1 per 20 samples (minimum 1)	1 per 20 samples (minimum 1)	NA	1 per 10 samples	NA
Indoor and Ambient Air	Total VOCs via PID	TO-15 Listed VOCs	EPA TO-15	Ambient Temperature	6-Liter Summa Canister	Analyze within 30 days of collection	1 per 20 samples (minimum 1)	1 per 20 samples (minimum 1)	NA	1 per 10 samples	NA

Notes:
ORP - Oxidation-Reduction Potential
VOCs - Volatile Organic Compounds
SVOCs - Semivolatile Organic Compounds
PCBs - Polychlorinated Biphenyls
PFAS - Per- and Polyfluoroalkyl Substances
SIM - Selected Ion Monitoring
HCl - Hydrochloric Acid
HNO_3 - Nitric Acid
MeOH - Methanol
NaOH - Sodium Hydroxide
*Can be combined in one or more 8 oz. jars
**The Reporting Limit for PFAS compounds in soil is 1 µg/kg and in water is 2 ng/L
***The Reporting Limits for 1,4-Dioxane in soil is 25.05 µg/kg and in water is 0.15 µg/L.

ATTACHMENT D
SAMPLE NOMENCLATURE STANDARD OPERATING PROCEDURE

SOP #01 – Sample Nomenclature

INTRODUCTION

The Langan Environmental Group conducts an assortment of site investigations where samples (Vapor, Solids, and Aqueous) are collected and submitted to analytical laboratories for analysis. The results of which are then evaluated and entered into a data base allowing quick submittal to the state regulatory authority (New York State Division of Environmental Conservation [NYSDEC]). In addition, Langan is linking their data management system to graphic and analytical software to enable efficient evaluation of the data as well as creating client-ready presentational material.

SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) is applicable to the general framework for labeling vapor, solid (soil) and aqueous (groundwater) samples that will be submitted for laboratory analysis. The nomenclature being introduced is designed to meet the NYSDEC EQuIS standard and has been incorporated into Langan software scripts to assist project personnel in processing the data. While this SOP is applicable to all site investigation; unanticipated conditions may arise which may require considerable flexibility in complying with this SOP. Therefore, guidance provided in this SOP is presented in terms of general steps and strategies that should be applied; but deviation from this SOP must be reported to the Project Manager (PM) immediately.

GENERAL SAMPLE IDENTIFICATION CONSIDERATIONS

Sample Labels

All sample ware must have a label. Recall that when you are using the Encore™ samples (see below); they are delivered in plastic lined foil bags. You are to label the bags[1]:

All other samples containers including Terra Cores™ must be labeled with laboratory provided self-adhesive labels.

Quick Breakdown of Sample Format

The general format for sample nomenclature is:

[1]Both Alpha and York laboratories permit the combining of the three Encore™ into a single bag. This may not be appropriate for all laboratories so please confirm with the labs themselves

LLNN_ID

Where

LL is a grouping of two (2) to four (4) letters signifying the sample media source. In older nomenclature SOPs this portion of the sample identification is commonly referred to as the *Sample Investigation Code*

NN represents a two digit number identifying the specific sample location or sample sequence number

_ ***(underscore)*** is required between the sample lettering and numeric identification and additional modifying data that determines the date of sampling or the depth of the sample interval

ID is a modifier specific to the sample type media (depth of soil sample or date of groundwater sample)

LL – Sample Investigation Code

Langan has devised a list of two to four letters to insure a quick ability to identify the sample investigation.

Code	Investigation
AA	Ambient Air
DS	Drum
EPB	Endpoint Location - Bottom (Excavation)
EPSW	Endpoint Location - Sidewall (Excavation)
FP	Free Product
IA	Indoor Air
IDW	Investigation Derived Waste (Soil Pile)
MW	Monitoring Well (Permanent)
SB	Soil Boring
SG	Staff Gauge (Stream Gauging)
SL	Sludge
SV	Soil Vapor Point
SVE	Soil Vapor Extraction Well
SW	Surface Water
TMW	Temporary Monitoring Well
TP	Test Pit (Excavated Material from Test Pit Not Associated With Sidewall or Bottom Samples)
WC	Waste Characterization Boring
COMP	Composite Sample
TB	Trip Blank (QA/QC Sampling – All Investigations)
FB	Field Blank (QA/QC Sampling – All Investigations)
DUP	Duplicate (QA/QC Sampling – All Investigations)

NN – Numeric Identifier

The two digit number that follows the sample investigation code (LL) identifies the specific sample based on the soil boring, monitoring well, endpoint or other location identification. For a subset of samples

where there is no specific location identifier, the two digit number is the sequence number for the sample submitted. For example, an aqueous sample from a monitoring well identified as MW-1 would have the sample investigation code of MW and the numeric identifier as 01. Note there is no hyphen. The same can be done for soil borings, a soil sample collected from soil boring 9 (SB-9) would be have the LLNN identification of SB09 (again, no hyphen).

Note however that there is a subset of samples related to laboratory analytical quality assurance, among these includes TB, FB, and DUP. On many investigations, the Scope will require multiple collections of these types of samples, therefore the numerical number represents the sequence sample count where the first sample is 01, the second sample is 02, and the third sample is 03 and so on.

_ Underscore
The underscore is required. It separates the investigation code and numeric identifier from the modifier specific to the sample itself. Note that every effort should be made to insure that the underscore is clear on the sample label and chain of custody (COC).

ID – Modifier Specific to Type Media
Each sample investigation code and numeric identifier is further modified by an ID specific to the sample type media. In general, soil samples (soil borings or endpoint samples) use an ID that indicates the depth at which the sample was taken. Aqueous samples (groundwater or surface water samples) are identified by the date the sample was collected. Other types of samples including quality control (TB, FB, and DUP), Vapor samples (AA, IA, SV or SVE), other soil type samples (IDW, sludge, free product, drum, and others) are also identified by a date. The following rules apply to the ID when using sample depth or sample date.

Sample Depth
The sample depth must be whole numbers (no fractions) separated by a hyphen. Thus for a soil sample collected from the soil boring SB-1 from a depth of 6 feet to 8 feet, the sample would be identified as:

SB01_6-8

Unfortunately, the NYSDEC EQuIS system does not accept fractions. Therefore, if your sample interval is a fraction of a foot (6.5-7.5), round up to the larger interval (6-8).

Sample Date
The sample date is always in the format of MMDDYY. Note that the year is two digits. Thus for a groundwater sample collected on July 1, 2015 from the monitoring well MW-1, the sample would be identified as:

MW01_070115

Special Cases
There are a couple of specific sample types that require further explanation.

Endpoint Sampling
End point sidewall samples are sometimes modified by magnetic direction (N, S, E, and W). For example, the first sidewall endpoint sample from the north wall of an excavation at a depth of 5 feet would be written as:

EPSW01_N_5

Again, note that the N in the identification refers to north and is separated from the prefix investigation code/numeric identifier and ID modifier suffix by underscores.

Vapor Extraction Well Sample
As with the sidewall endpoint samples, the sample name is altered by inserting a middle modifier between the prefix and suffix of the sample name. The middle modifier is used to identify the source of the sample (inlet sample port, midpoint sample port or outlet sample port). For example the midpoint port of the vapor extraction well number 1 sampled on July 1, 2015 would be written as;

SVE01_MID_070115

Matrix Spike and Matrix Spike Duplicate
On occasion, a Langan investigation will collect a sample to be used to provide the lab with a site specific medium to spike to determine the quality of the analytical method. This special case of sampling requires additional information to be used in the sample name, specifically, a suffix specifying whether the sample is the matrix spike (MS) or the matrix spike duplicate (MSD). In the following example, the sample is collected from soil boring number 1 at a depth of 2-4 feet. For the matrix spike sample:

SB01_2-4_MS

and for the matrix spike duplicate sample:

SB01_2-4_MSD

Multiple Interval Groundwater Sampling
Although not currently a common practice, low flow sampling facilitates stratigraphic sampling of a monitoring well. If the scope requires stratigraphic sampling then groundwater samples will be labeled with a lower case letter following the well number. For example, placing the pump or sampling tube at 10 feet below surface in MW01 on July 1, 2015 would require the sample to be labeled as:

MW01a_070115

While a second sample where the pump or tubing intake is placed at 20 feet would be labeled as:

MW01b_070115

Note that it is important that you record what depth the intake for each sample represents in your field notes; as this information is going to be critical to interpreting the results.

ATTACHMENT E
PFAS SAMPLING AND ANALYSIS PROTOCOLS

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 procedure used must be consistent with the NYSDEC March 1991 Sampling Guidelines and Protocols http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf with the following materials limitations.

At this time acceptable materials for sampling include: stainless steel, high density polyethylene (HDPE), PVC, silicone, acetate and polypropylene. Equipment blanks should be generated at least daily. Additional materials may be acceptable if pre-approved by NYSDEC. Requests to use alternate equipment should include clean equipment blanks. **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 will be performed 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.

Groundwater Sampling for Emerging Contaminants

February 2018

Issue: NYSDEC has committed to analyzing representative groundwater samples at remediation sites for emerging contaminants (1,4-dioxane and PFAS) as described in the below guidance.

Implementation

NYSDEC project managers will be contacting site owners to schedule sampling for these chemicals. Only groundwater sampling is required. The number of samples required will be similar to the number of samples where "full TAL/TCL sampling" would typically be required in a remedial investigation. If sampling is not feasible (e.g., the site no longer has any monitoring wells in place), sampling may be waived on a site-specific basis after first considering potential sources of these chemicals and whether there are water supplies nearby.

Upon a new site being brought into any program (i.e., SSF, BCP), PFAS and 1,4-dioxane will be incorporated into the investigation of groundwater as part of the standard "full TAL/TCL" sampling. Until an SCO is established for PFAS, soil samples do not need to be analyzed for PFAS unless groundwater contamination is detected. Separate guidance will be developed to address sites where emerging contaminants are found in the groundwater. The analysis currently performed for SVOCs in soil is adequate for evaluation of 1,4-dioxane, which already has an established SCO.

Analysis and Reporting

Labs should provide a full category B deliverable, and a DUSR should be prepared by a data validator.

The work plan should explicitly describe analysis and reporting requirements.

PFAS sample analysis: Samples should be analyzed by an environmental laboratory certified by ELAP to use EPA method 537 or ISO 25101. ELAP does not currently offer certification for PFAS analysis of non-drinking water samples (including groundwater, soil and sediment), so there is no requirement to use an ELAP certified method. The preferred method is the modified EPA Method 537. Labs have been able to achieve reporting limits for PFOA and PFOS of 2 ng/l (part per trillion). If labs are not able to achieve similar reporting limits, the NYSDEC project manager will make case-by-case decisions as to whether the analysis can meet the needs for the specific site.

PFAS sample reporting: DER has developed a PFAS target analyte list (below) with the intent of achieving reporting consistency between labs for commonly reportable analytes. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. This list may be updated in the future as new information is learned and as labs develop new capabilities. If lab and/or matrix specific issues are encountered for any particular compounds, the NYSDEC project manager will make case-by-case decisions as to whether particular analytes may be temporarily or permanently discontinued from analysis for each site. Any technical lab issues should be brought to the attention of a NYSDEC chemist.

Some sampling using this full PFAS target analyte list is needed to understand the nature of contamination. It may also be critical to differentiate PFAS compounds associated with a site from other sources of these chemicals. Like routine refinements to parameter lists based on investigative findings, the full PFAS target analyte list may not be needed for all sampling intended to define the extent of

contamination. Project managers may approve a shorter analyte list (e.g., just the UCMR3 list) for some reporting on a case by case basis.

1,4-Dioxane Analysis and Reporting: The method detection limit (MDL) for 1,4-dioxane should be no higher than 0.28 µg/l (ppb). ELAP offers certification for both EPA Methods 8260 and 8270. In order to get the appropriate detection limits, the lab would need to run either of these methods in "selective ion monitoring" (SIM) mode. DER is advising PMS to use 8270, since this method provides a more robust extraction procedure, uses a larger sample volume, and is less vulnerable to interference from chlorinated solvents (we acknowledge that 8260 has been shown to have a higher recovery in some studies).

Full PFAS Target Analyte List

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonates	**Perfluorobutanesulfonic acid**	**PFBS**	**375-73-5**
	Perfluorohexanesulfonic acid	**PFHxS**	**355-46-4**
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanessulfonic acid	**PFOS**	**1763-23-1**
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluoroalkyl carboxylates	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	**PFHpA**	**375-85-9**
	Perfluorooctanoic acid	**PFOA**	**335-67-1**
	Perfluorononanoic acid	**PFNA**	**375-95-1**
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
Fluorinated Telomer Sulfonates	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

Bold entries depict the 6 original UCMR3 chemicals

Determination of Selected Perfluorinated Alkyl Substances by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry Isotope Dilution (LC/MS/MS)

Reference: EPA Method 537, Version 1.1, September 2009, EPA Document #: EPA/600/R-08/09

EPA Method 537.1, Version 1, November 2018, EPA Document #: EPA/600/R-18/352

Department of Defense, Quality Systems Manual for Environmental Laboratories, Version 5.2, .2019

1. Scope and Application

Matrices: Drinking water, Non-potable Water, and Soil Matrices

Definitions: Refer to Alpha Analytical Quality Manual.

1.1 This is a liquid chromatography/tandem mass spectrometry (LC/MS/MS) method for the determination of selected perfluorinated alkyl substances (PFAS) in Non-Drinking Water and soil Matrices. Accuracy and precision data have been generated in reagent water, and finished ground and surface waters for the compounds listed in Table 1.

1.2 The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

1.3 This method is restricted to use by or under the supervision of analysts experienced in the operation of the LC/MS/MS and in the interpretation of LC/MS/MS data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

2. Summary of Method

2.1 A 250-mL water sample is fortified with extracted internal standards (EIS) and passed through a solid phase extraction (WAX) cartridge containing a mixed mode, Weak Anion Exchange, reversed phase, water-wettable polymer to extract the method analytes and isotopically-labeled compounds. The compounds are eluted from the solid phase in two fractions with methanol followed by a small amount of 2% ammonium hydroxide in methanol solution. The extract is concentrated with nitrogen in a heated water bath, and then adjusted to a 1-mL volume with 80:20% (vol/vol) methanol:water. A 3 µl injection is made into an LC equipped with a C18 column that is interfaced to an MS/MS. The analytes are separated and identified by comparing the acquired mass spectra and retention times to reference spectra and retention times for calibration standards acquired under identical LC/MS/MS conditions. The concentration of each analyte is determined by using the isotope dilution technique. Extracted Internal Standards (EIS) analytes are used to monitor the extraction efficiency of the method analytes.

2.2 Method Modifications from Reference

None.

Table 1

Parameter	Acronym	CAS
PERFLUOROALKYL ETHER CARBOXYLIC ACIDS (PFECAs)		
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid	HFPO-DA	62037-80-3
4,8-dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
PERFLUOROALKYLCARBOXILIC ACIDS (PFCAs)		
Perfluorobutanoic acid	PFBA	375-22-4
Perfluoropentanoic acid	PFPeA	2706-90-3
Perfluorohexanoic acid	PFHxA *	307-24-4
Perfluoroheptanoic acid	PFHpA *	375-85-9
Perfluorooctanoic acid	PFOA *	335-67-1
Perfluorononanoic acid	PFNA *	375-95-1
Perfluorodecanoic acid	PFDA *	335-76-2
Perfluoroundecanoic acid	PFUnA *	2058-94-8
Perfluorododecanoic acid	PFDoA *	307-55-1
Perfluorotridecanoic acid	PFTrDA *	72629-94-8
Perfluorotetradecanoic acid	PFTA *	376-06-7
Perfluorohexadecanoic acid	PFHxDA	67905-19-5
Perfluorooctadecanoic acid	PFODA	16517-11-6
PERFLUOROALKYLSULFONATES (PFASs)		
Perfluorobutanesulfonic acid	PFBS *	375-73-5
Perfluoropentanesulfonic acid	PFPeS	2706-91-4
Perfluorohexanesulfonic acid	PFHxS *	355-46-4
Perfluoroheptanesulfonic acid	PFHpS	375-92-8
Perfluorooctanesulfonic acid	PFOS *	1763-23-1
Perfluorononanesulfonic acid	PFNS	68259-12-1
Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanesulfonic acid	PFDoS	79780-39-5

*** also reportable via the standard 537 method**

Table 1 Cont.

Parameter	Acronym	CAS
CHLORO-PERFLUOROALKYLSULFONATE		
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	9Cl-PF3ONS	756426-58-1
PERFLUOROOCTANESULFONAMIDES (FOSAs)		
Perfluorooctanesulfonamide	PFOSA	754-91-6
N-methylperfluoro-1-octanesulfonamide	NMeFOSA	31506-32-8
N-ethylperfluoro-1-octanesulfonamide	NEtFOSA	4151-50-2
TELOMER SULFONATES		
1H,1H,2H,2H-perfluorohexane sulfonate (4:2)	4:2FTS	27619-93-8
1H,1H,2H,2H-perfluorooctane sulfonate (6:2)	6:2FTS	27619-97-2
1H,1H,2H,2H-perfluorodecane sulfonate (8:2)	8:2FTS	39108-34-4
1H,1H,2H,2H-perfluorododecane sulfonate (10:2)	10:2FTS	120226-60-0
PERFLUOROOCTANESULFONAMIDOACETIC ACIDS		
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA *	2355-31-9
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA *	2991-50-6
NATIVE PERFLUOROOCTANESULFONAMIDOETHANOLS (FOSEs)		
2-(N-methylperfluoro-1-octanesulfonamido)-ethanol	NMeFOSE	24448-09-7
2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol	NEtFOSE	1691-99-2

*** also reportable via the standard 537 method**

3. Reporting Limits

The reporting limit for PFAS's is 2 ng/L for aqueous samples (20 ng/L for HFPO-DA) and 1 ng/g (10 ng/g for HFPO-DA) for soil samples.

4. Interferences

4.1 PFAS standards, extracts and samples should not come in contact with any glass containers or pipettes as these analytes can potentially adsorb to glass surfaces. PFAS analyte and EIS standards commercially purchased in glass ampoules are acceptable; however, all subsequent transfers or dilutions performed by the analyst must be prepared and stored in polypropylene containers.

4.2 Method interferences may be caused by contaminants in solvents, reagents (including reagent water), sample bottles and caps, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in the chromatograms. The method analytes in this method can also be found in many common laboratory supplies and equipment, such

as PTFE (polytetrafluoroethylene) products, LC solvent lines, methanol, aluminum foil, SPE sample transfer lines, etc. All items such as these must be routinely demonstrated to be free from interferences (less than 1/3 the RL for each method analyte) under the conditions of the analysis by analyzing laboratory reagent blanks as described in Section 9.2. **Subtracting blank values from sample results is not permitted.**

4.3 Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature of the water. Humic and/or fulvic material can be co-extracted during SPE and high levels can cause enhancement and/or suppression in the electrospray ionization source or low recoveries on the SPE sorbent. Total organic carbon (TOC) is a good indicator of humic content of the sample.

4.4 SPE cartridges can be a source of interferences. The analysis of field and laboratory reagent blanks can provide important information regarding the presence or absence of such interferences. Brands and lots of SPE devices should be tested to ensure that contamination does not preclude analyte identification and quantitation.

5. Health and Safety

5.1 The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

5.2 All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

5.3 PFOA has been described as "likely to be carcinogenic to humans." Pure standard materials and stock standard solutions of these method analytes should be handled with suitable protection to skin and eyes, and care should be taken not to breathe the vapors or ingest the materials.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection for Aqueous Samples

6.1.1 Samples must be collected in two (2) 250-mL high density polyethylene (HDPE) container with an unlined plastic screw cap.

6.1.2 The sample handler must wash their hands before sampling and wear nitrile gloves while filling and sealing the sample bottles. PFAS contamination during sampling can occur from a number of common sources, such as food packaging and certain foods and beverages. Proper hand washing and wearing nitrile gloves will aid in minimizing this type of accidental contamination of the samples.

6.1.3 Open the tap and allow the system to flush until the water temperature has stabilized (approximately 3 to 5 min). Collect samples from the flowing system.

6.1.4 Fill sample bottles. Samples do not need to be collected headspace free.

6.1.5 After collecting the sample and cap the bottle. Keep the sample sealed from time of collection until extraction.

6.1.6 Field Reagent Blank (FRB)

6.1.6.1 A FRB must be handled along with each sample set. The sample set is composed of samples collected from the same sample site and at the same time. At the laboratory, fill the field blank sample bottle with reagent water and preservatives, seal, and ship to the sampling site along with the sample bottles. For each FRB shipped, an empty sample bottle (no preservatives) must also be shipped. At the sampling site, the sampler must open the shipped FRB and pour the reagent water into the empty shipped sample bottle, seal and label this bottle as the FRB. The FRB is shipped back to the laboratory along with the samples and analyzed to ensure that PFAS's were not introduced into the sample during sample collection/handling.

The reagent water used for the FRBs must be initially analyzed for method analytes as a MB and must meet the MB criteria in Section 9.2.1 prior to use. This requirement will ensure samples are not being discarded due to contaminated reagent water rather than contamination during sampling.

6.2 Sample Collection for Soil and Sediment samples.

Grab samples are collected in polypropylene containers. Sample containers and contact surfaces containing PTFE shall be avoided.

6.3 Sample Preservation

Not applicable.

6.4 Sample Shipping

Samples must be chilled during shipment and must not exceed 10 °C during the first 48 hours after collection. Sample temperature must be confirmed to be at or below 10 °C when the samples are received at the laboratory. Samples stored in the lab must be held at or below 6 °C until extraction, but should not be frozen.

NOTE: Samples that are significantly above 10° C, at the time of collection, may need to be iced or refrigerated for a period of time, in order to chill them prior to shipping. This will allow them to be shipped with sufficient ice to meet the above requirements.

6.5 Sample Handling

6.5.1 Holding Times

6.5.1.1 Water samples should be extracted as soon as possible but must be extracted within 14 days. Soil samples should be extracted within 28 days. Extracts are stored at < 10 ° C and analyzed within 28 days after extraction.

7. Equipment and Supplies

7.1 SAMPLE CONTAINERS – 250-mL high density polyethylene (HDPE) bottles fitted with unlined screw caps. Sample bottles must be discarded after use.

7.2 POLYPROPYLENE BOTTLES – 4-mL narrow-mouth polypropylene bottles.

7.3 CENTRIFUGE TUBES – 50-mL conical polypropylene tubes with polypropylene screw caps for storing standard solutions and for collection of the extracts.

7.4 AUTOSAMPLER VIALS – Polypropylene 0.7-mL autosampler vials with polypropylene caps.

7.4.1 NOTE: Polypropylene vials and caps are necessary to prevent contamination of the sample from PTFE coated septa. However, polypropylene caps do not reseal, so evaporation occurs after injection. Thus, multiple injections from the same vial are not possible.

7.5 POLYPROPYLENE GRADUATED CYLINDERS – Suggested sizes include 25, 50, 100 and 1000-mL cylinders.

7.6 Auto Pipets – Suggested sizes include 5, 10, 25, 50, 100, 250, 500, 1000, 5000 and 10,000-µls.

7.7 PLASTIC PIPETS – Polypropylene or polyethylene disposable pipets.

7.8 ANALYTICAL BALANCE – Capable of weighing to the nearest 0.0001 g.

7.9 SOLID PHASE EXTRACTION (SPE) APPARATUS FOR USING CARTRIDGES

7.9.1 SPE CARTRIDGES – 0.5 g SPE cartridges containing a reverse phase copolymer characterized by a weak anion exchanger (WAX) sorbent phase.

7.9.2 VACUUM EXTRACTION MANIFOLD – A manual vacuum manifold with large volume sampler for cartridge extractions, or an automatic/robotic sample preparation system designed for use with SPE cartridges, may be used if all QC requirements discussed in Section 9 are met. Extraction and/or elution steps may not be changed or omitted to accommodate the use of an automated system. Care must be taken with automated SPE systems to ensure the PTFE commonly used in these systems does not contribute to unacceptable analyte concentrations in the MB (Sect. 9.2.1).

7.9.3 SAMPLE DELIVERY SYSTEM – Use of a polypropylene transfer tube system, which transfers the sample directly from the sample container to the SPE cartridge, is recommended, but not mandatory. Standard extraction manifolds come equipped with PTFE transfer tube systems. These can be replaced with 1/8" O.D. x 1/16" I.D. polypropylene or polyethylene tubing cut to an appropriate length to ensure no sample contamination from the sample transfer lines. Other types of non-PTFE tubing may be used provided it meets the MB (Sect. 9.2.1) and LCS (Sect. 9.3) QC requirements. The PTFE transfer tubes may be used, but an MB must be run on each PFTE transfer tube and the QC requirements in Section 13.2.2 must be met. In the case of automated SPE, the removal of PTFE lines may not be feasible; therefore, MBs will need to be rotated among the ports and must meet the QC requirements of Sections 13.2.2 and 9.2.1.

7.10 Extract Clean-up Cartridge – 250 mg 6ml SPE Cartridge containing graphitized polymer carbon

7.11 EXTRACT CONCENTRATION SYSTEM – Extracts are concentrated by evaporation with nitrogen using a water bath set no higher than 65 °C.

7.12 LABORATORY OR ASPIRATOR VACUUM SYSTEM – Sufficient capacity to maintain a vacuum of approximately 10 to 15 inches of mercury for extraction cartridges.

7.13 LIQUID CHROMATOGRAPHY (LC)/TANDEM MASS SPECTROMETER (MS/MS) WITH DATA SYSTEM

7.13.1 LC SYSTEM – Instrument capable of reproducibly injecting up to 10-µL aliquots, and performing binary linear gradients at a constant flow rate near the flow rate used for development of this method (0.4 mL/min). The LC must be capable of pumping the water/methanol mobile phase without the use of a degasser which pulls vacuum on the mobile phase bottle (other types of degassers are acceptable). Degassers which pull vacuum on the mobile phase bottle will volatilize the ammonium acetate mobile phase causing the analyte peaks to shift to earlier retention times over the course of the analysis batch. The usage of a column heater is optional.

NOTE: During the course of method development, it was discovered that while idle for more than one day, PFAS's built up in the PTFE solvent transfer lines. To prevent long delays in purging high levels of PFAS's from the LC solvent lines, they were replaced with PEEK tubing and the PTFE solvent frits were replaced with stainless steel frits. It is not possible to remove all PFAS background contamination, but these measures help to minimize their background levels.

7.13.2 LC/TANDEM MASS SPECTROMETER – The LC/MS/MS must be capable of negative ion electrospray ionization (ESI) near the suggested LC flow rate of 0.4 mL/min. The system must be capable of performing MS/MS to produce unique product ions for the method analytes within specified retention time segments. A minimum of 10 scans across the chromatographic peak is required to ensure adequate precision.

7.13.3 DATA SYSTEM – An interfaced data system is required to acquire, store, reduce, and output mass spectral data. The computer software should have the capability of processing stored LC/MS/MS data by recognizing an LC peak within any given retention time window. The software must allow integration of the ion abundance of any specific ion within specified time or scan number limits. The software must be able to calculate relative response factors, construct linear regressions or quadratic calibration curves, and calculate analyte concentrations.

7.13.4 ANALYTICAL COLUMN – An LC BEH C_{18} column (2.1 x 50 mm) packed with 1.7 µm d_p C_{18} solid phase particles was used. Any column that provides adequate resolution, peak shape, capacity, accuracy, and precision (Sect. 9) may be used.

8. Reagents and Standards

8.1 GASES, REAGENTS, AND SOLVENTS – Reagent grade or better chemicals should be used.

8.1.1 REAGENT WATER – Purified water which does not contain any measurable quantities of any method analytes or interfering compounds greater than 1/3 the RL for each method analyte of interest. Prior to daily use, at least 3 L of reagent water should be flushed from the purification system to rinse out any build-up of analytes in the system's tubing.

8.1.2 METHANOL (CH_3OH, CAS#: 67-56-1) – High purity, demonstrated to be free of analytes and interferences.

8.1.3 AMMONIUM ACETATE ($NH_4C_2H_3O_2$, CAS#: 631-61-8) – High purity, demonstrated to be free of analytes and interferences.

8.1.4 ACETIC ACID (H_3CCOOH, CAS#: 64-19-7) - High purity, demonstrated to be free of analytes and interferences.

8.1.5 1M AMMONIUM ACETATE/REAGENT WATER – High purity, demonstrated to be free of analytes and interferences.

8.1.6 2mM AMMONIUM ACETATE/METHANOL:WATER (5:95) – To prepare, mix 2 ml of 1M AMMONIUM ACETATE,1 ml ACETIC ACID and 50 ml METHANOL into l Liter of REAGENT WATER.

8.1.7 Methanol/Water (80:20) – To prepare a 1 Liter bottle, mix 200 ml of REAGENT WATER with 800 ml of METHANOL.

8.1.8 AMMONIUM HYDROXIDE (NH_3, CAS#: 1336-21-6) – High purity, demonstrated to be free of analytes and interferences.

8.1.9 Sodium Acetate ($NaOOCCH_3$, CAS#: 127-09-3) – High purity, demonstrated to be free of analytes and interferences.

8.1.10 25 mM Sodium Acetate Buffer – To prepare 250mls, dissolve .625 grams of sodium acetate into 100 mls of reagent water. Add 4 mls Acetic Acid and adjust the final volume to 250 mls with reagent water.

8.1.11 NITROGEN – Used for the following purposes: Nitrogen aids in aerosol generation of the ESI liquid spray and is used as collision gas in some MS/MS instruments. The nitrogen used should meet or exceed instrument manufacturer's specifications. In addition, Nitrogen is used to concentrate sample extracts (Ultra High Purity or equivalent).

8.1.12 ARGON – Used as collision gas in MS/MS instruments. Argon should meet or exceed instrument manufacturer's specifications. Nitrogen gas may be used as the collision gas provided sufficient sensitivity (product ion formation) is achieved.

8.2 STANDARD SOLUTIONS – When a compound purity is assayed to be 96% or greater, the weight can be used without correction to calculate the concentration of the stock standard. PFAS analyte and IS standards commercially purchased in glass ampoules are acceptable; however, all subsequent transfers or dilutions performed by the analyst must be prepared and stored in polypropylene containers. Standards for sample fortification generally should be prepared in the smallest volume that can be accurately measured to minimize the addition of excess organic solvent to aqueous samples.

NOTE: Stock standards and diluted stock standards are stored at ≤4 °C.

8.2.1 ISOTOPE DILUTION Extracted Internal Standard (ID EIS) STOCK SOLUTIONS - ID EIS stock standard solutions are stable for at least 6 months when stored at 4 °C. The stock solution is purchased at a concentration of 1000 ng/mL.

8.2.2 ISOTOPE DILUTION Extracted Internal Standard PRIMARY DILUTION STANDARD (ID EIS PDS) – Prepare the ID EIS PDS at a concentration of 500 ng/mL. The ID PDS is prepared in 80:20% (vol/vol) methanol:water. The ID PDS is stable for 6 months when stored at ≤4 °C.

Table 2

Isotope Labeled Standard	Conc. of EIS Stock (ng/mL)	Vol. of EIS Stock (mL)	Final Vol. of EIS PDS (mL)	Final Conc. of EIS PDS (ng/mL)
M4PFBA	1000	1.0	2.0	500
M5PFPeA	1000	1.0	2.0	500
M5PFHxA	1000	1.0	2.0	500
M4PFHpA	1000	1.0	2.0	500
M8PFOA	1000	1.0	2.0	500
M9PFNA	1000	1.0	2.0	500
M6PFDA	1000	1.0	2.0	500
M7PFUdA	1000	1.0	2.0	500
MPFDoA	1000	1.0	2.0	500
M2PFTeDA	1000	1.0	2.0	500
M2PFHxDA	50,000	.02	2.0	500
d3-N-MeFOSA	50,000	.02	2.0	500
d5-N-EtFOSA	50,000	.02	2.0	500
d7-N-MeFOSE	50,000	.02	2.0	500
d9-N-EtFOSE	50,000	.02	2.0	500
M8FOSA	1000	1.0	2.0	500
d3-N-MeFOSAA	1000	1.0	2.0	500
d5-N-EtFOSAA	1000	1.0	2.0	500
M3PFBS	929	1.0	2.0	464.5
M3PFHxS	946	1.0	2.0	473
M8PFOS	957	1.0	2.0	478.5
M2-4:2FTS	935	1.0	2.0	467.5
M2-6:2FTS	949	1.0	2.0	474.5
M2-8:2FTS	958	1.0	2.0	479
M3HFPO-DA	50,000	.4	2.0	10,000

8.2.3 ANALYTE STOCK STANDARD SOLUTION – Analyte stock standards are stable for at least 6 months when stored at 4 °C. When using these stock standards to prepare a PDS, care must be taken to ensure that these standards are at room temperature and adequately vortexed.

8.2.4 Analyte Secondary Spiking Standard Prepare the spiking solution of additional add on components for project specific requirements only. ANALYTE PRIMARY SPIKING STANDARD – Prepare the spiking standard at a concentration of 500 ng/mL in methanol. The spiking standard is stable for at least two months when stored in polypropylene centrifuge tubes at room temperature.

Table 3

Analyte	Conc. of IS Stock (ng/mL)	Vol. of IS Stock (mL)	Final Vol. of IS PDS (mL)	Final Conc. of IS PDS (ng/mL)
PFBA	2000	1	4	500
PFPeA	2000	1	4	500
PFHxA	2000	1	4	500
PFHpA	2000	1	4	500
PFOA	2000	1	4	500
PFNA	2000	1	4	500
PFDA	2000	1	4	500
PFUdA	2000	1	4	500
PFDoA	2000	1	4	500
PFTrDA	2000	1	4	500
PFTeDA	2000	1	4	500
FOSA	2000	1	4	500
N-MeFOSAA	2000	1	4	500
N-EtFOSAA	2000	1	4	500
L-PFBS	1770	1	4	442.5
L-PFPeS	1880	1	4	470
L-PFHxSK	1480	1	4	370
Br-PFHxSK	344	1	4	86
L-PFHpS	1900	1	4	475
L-PFOSK	1460	1	4	365
Br-PFOSK	391	1	4	97.75
L-PFNS	1920	1	4	480
L-PFDS	1930	1	4	482.5
4:2FTS	1870	1	4	467.5
6:2FTS	1900	1	4	475
8:2FTS	1920	1	4	480

8.2.5 Analyte Secondary Spiking Standard Prepare the spiking solution of additional add on components for project specific requirements only.

Table 4

Analyte	Conc. of IS Stock (ng/mL)	Vol. of IS Stock (mL)	Final Vol. of IS PDS (mL)	Final Conc. of IS PDS (ng/mL)
ADONA	2000	1	4	500
PFHxDA	2000	1	4	500
PFODA	2000	1	4	500
HFPO-DA	100,000	.4	4	10,000
9ClPF3ONS	50,000	0.04	4	500
11ClPF3OUdS	50,000	0.04	4	500

8.2.6 LOW, MEDIUM AND HIGH LEVEL LCS – The LCS's will be prepared at the following concentrations and rotated per batch; 2 ng/L, 40 ng/L, 500 ng/l for drinking waters. The analyte PDS contains all the method analytes of interest at various concentrations in methanol. The analyte PDS has been shown to be stable for six months when stored at ≤4 °C.

8.2.7 Isotope Dilution Labeled Recovery Stock Solutions (ID REC) – ID REC Stock solutions are stable for at least 6 months when stored at 4 °C. The stock solution is purchased at a concentration of 1000 ng/mL.

8.2.8 Isotope Dilution Labeled Recovery Primary Dilution Standard (ID REC PDS) - Prepare the ID REC PDS at a concentration of 500 ng/mL. The ID REC PDS is prepared in 80:20% (vol/vol) methanol:water. The ID REC PDS is stable for at least six months when stored in polypropylene centrifuge tubes at ≤4 °C.

Table 5

Analyte	Conc. of REC Stock (ng/mL)	Vol. of REC Stock (mL)	Final Vol. of REC PDS (mL)	Final Conc. of REC PDS (ng/mL)
M2PFOA	2000	1	4	500
M2PFDA	2000	1	4	500
M3PFBA	2000	1	4	500
M4PFOS	2000	1	4	500

8.2.9 CALIBRATION STANDARDS (CAL) –

Current Concentrations (ng/mL): 0.5, 1.0, 5.0, 10.0, 50.0, 125, 150, 250, 500

Prepare the CAL standards over the concentration range of interest from dilutions of the analyte PDS in methanol containing 20% reagent water. 20 µl of the EIS PDS and REC PDS are added to the CAL standards to give a constant concentration of 10 ng/ml. The lowest concentration CAL standard must be at or below the RL (2 ng/L), which may depend on system sensitivity. The CAL standards may also be used as CCVs (Sect. 9.8). To make calibration stock standards:

Table 6

Calibration Standard Concentration	Final Aqueous Cal STD Level Concentration	Final Soil Cal STD Level Concentration	24 compound stock added (ul)	PFHxDA Stock added (ul)	500 ng/ml PFHxDA dilution added (ul)	PFODA Stock added (ul)	500 ng/ml PFODA dilution added (ul)	ADONA, HFPO-DA, 11Cl-PF3OUdS, 9Cl-PF3ONS Stock added (ul)	500 ng/ml ADONA dilution added (ul)	Final Volume in MeOH/H_2O (82:20)
.5 ng/ml	2 ng/L	.25 ng/g	6.25		25		25		25	25 mls
1 ng/ml	4 ng/L	.5 ng/g	5		20		20		20	10 mls
5 ng/ml	20 ng/L	1 ng/g	25		100		100		100	10 mls
10 ng/ml	40 ng/L	5 ng/g	125	5		5		5		25 mls

50 ng/ml	200 ng/L	25 ng/g	250	10		10		10		10 mls
125 ng/ml	500 ng/L	62.5 ng/g	625	25		25		25		10 mls
150 ng/ml	600 ng/L	75 ng/g	750	30		30		30		10 mls
250 ng/ml	1000 ng/L	125 ng/g	625							5 mls
500 ng/ml	2000 ng/L	250 ng/g	1250							5 mls

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 MINIMUM REPORTING LIMIT (MRL) CONFIRMATION

9.1.1 Fortify, extract, and analyze seven replicate LCSs at 2 ng/l. Calculate the mean measured concentration (*Mean*) and standard deviation for these replicates. Determine the Half Range for the prediction interval of results (HR_{PIR}) using the equation below

$$HR_{PIR} = 3.963s$$

Where:

s = the standard deviation
3.963 = a constant value for seven replicates.

9.1.2 Confirm that the upper and lower limits for the Prediction Interval of Result ($PIR = Mean \pm HR_{PIR}$) meet the upper and lower recovery limits as shown below

The Upper PIR Limit must be ≤150% recovery.

$$\frac{Mean + HR_{PIR}}{Fortified\ Concentration} \times 100\% \leq 150\%$$

The Lower PIR Limit must be ≥ 50% recovery.

$$\frac{Mean - HR_{PIR}}{Fortified\ Concentration} \times 100\% \geq 50\%$$

9.1.3 The RL is validated if both the Upper and Lower PIR Limits meet the criteria described above. If these criteria are not met, the RL has been set too low and must be determined again at a higher concentration.

9.2 Blank(s)

9.2.1 **METHOD BLANK (MB)** - A Method Blank (MB) is required with each extraction batch to confirm that potential background contaminants are not interfering with the identification or quantitation of method analytes. Prep and analyze a MB for every 20 samples. If the MB produces a peak within the retention time window of any analyte that would prevent the determination of that analyte, determine the source of contamination and eliminate the interference before processing samples. Background contamination must be reduced to an acceptable level before proceeding. Background from method analytes or other contaminants that

interfere with the measurement of method analytes must be below the RL. If the method analytes are detected in the MB at concentrations equal to or greater than this level, then all data for the problem analyte(s) must be considered invalid for all samples in the extraction batch. Because background contamination is a significant problem for several method analytes, it is highly recommended that the analyst maintain a historical record of MB data.

9.2.2 **FIELD REAGENT BLANK (FRB)** - The purpose of the FRB is to ensure that PFAS's measured in the Field Samples were not inadvertently introduced into the sample during sample collection/handling. Analysis of the FRB is required only if a Field Sample contains a method analyte or analytes at or above the RL. The FRB is processed, extracted and analyzed in exactly the same manner as a Field Sample.

9.3 Laboratory Control Sample (LCS) and Laboratory Control Sample Duplicates (LCSD)

9.3.1 An LCS is required with each extraction batch. The fortified concentration of the LCS may be rotated between low, medium, and high concentrations from batch to batch. Default limits of 50-150% of the true value may be used for analytes until sufficient replicates have been analyzed to generate proper control limits. Calculate the percent recovery (%*R*) for each analyte using the equation

$$\%R = \frac{A \times 100}{B}$$

Where:

A = measured concentration in the fortified sample
B =fortification concentration.

9.3.2 Where applicable, LCSD's are to be extracted and analyzed. The concentration and analyte recovery criteria for the LCSD must be the same as the batch LCS The RSD's must fall within ≤30% of the true value for medium and high level replicates, and ≤50% for low level replicates. Calculate the relative percent difference (RPD) for duplicate MSs (MS and MSD) using the equation

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

9.3.3 **If the LCS and or LCSD results do not meet these criteria for method analytes, then all data for the problem analyte(s) must be considered invalid for all samples in the extraction batch.**

9.4 Labeled Recovery Standards (REC)

The analyst must monitor the peak areas of the REC(s) in all injections during each analysis day.

9.5 Extracted Internal Standards (EIS)

9.5.1 The EIS standard is fortified into all samples, CCVs, MBs, LCSs, MSs, MSDs, FD, and FRB prior to extraction. It is also added to the CAL standards. The EIS is a means of assessing method performance from extraction to final

chromatographic measurement. Calculate the recovery (%R) for the EIS using the following equation

$$\%R = (A / B) \times 100$$

Where:

A = calculated EIS concentration for the QC or Field Sample
B = fortified concentration of the EIS.

9.5.2 Default limits of 50-150% may be used for analytes until sufficient replicates have been analyzed to generate proper control limits. A low or high percent recovery for a sample, blank, or CCV does not require discarding the analytical data but it may indicate a potential problem with future analytical data. When EIS recovery from a sample, blank, or CCV are outside control limits, check 1) calculations to locate possible errors, 2) standard solutions for degradation, 3) contamination, and 4) instrument performance. For CCVs and QC elements spiked with all target analytes, if the recovery of the corresponding target analytes meet the acceptance criteria for the EIS in question, the data can be used but all potential biases in the recovery of the EIS must be documented in the sample report. If the associated target analytes do not meet the acceptance criteria,the data must be reanalyzed.

9.6 Matrix Spike (MS)

9.6.1 Analysis of an MS is required in each extraction batch and is used to determine that the sample matrix does not adversely affect method accuracy. Assessment of method precision is accomplished by analysis of a Field Duplicate (FD) (Sect. 9.6); however, infrequent occurrence of method analytes would hinder this assessment. If the occurrence of method analytes in the samples is infrequent, or if historical trends are unavailable, a second MS, or MSD, must be prepared, extracted, and analyzed from a duplicate of the Field Sample. Extraction batches that contain MSDs will not require the extraction of a field sample duplicate. If a variety of different sample matrices are analyzed regularly, for example, drinking water from groundwater and surface water sources, method performance should be established for each. Over time, MS data should be documented by the laboratory for all routine sample sources.

9.6.2 Within each extraction batch, a minimum of one Field Sample is fortified as an MS for every 20 Field Samples analyzed. The MS is prepared by spiking a sample with an appropriate amount of the Analyte Stock Standard (Sect. 8.2.3). Use historical data and rotate through the low, mid and high concentrations when selecting a fortifying concentration. Calculate the percent recovery (%*R*) for each analyte using the equation

$$\%R = \frac{(A - B)}{C} \times 100$$

Where:

A = measured concentration in the fortified sample
B = measured concentration in the unfortified sample
C = fortification concentration.

9.6.3 Analyte recoveries may exhibit matrix bias. For samples fortified at or above their native concentration, recoveries should range between 50-150%. If the accuracy of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the LCS, the recovery is judged to be

matrix biased. The result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.7 Laboratory Duplicate

9.7.1 FIELD DUPLICATE OR LABORATORY FORTIFIED SAMPLE MATRIX DUPLICATE (FD or MSD) – Within each extraction batch (not to exceed 20 Field Samples), a minimum of one FD or MSD must be analyzed. Duplicates check the precision associated with sample collection, preservation, storage, and laboratory procedures. If method analytes are not routinely observed in Field Samples, an MSD should be analyzed rather than an FD.

9.7.2 Calculate the relative percent difference (*RPD*) for duplicate measurements (*FD1* and *FD2*) using the equation

$$RPD = \frac{|FD1 - FD2|}{(FD1 + FD2) / 2} \times 100$$

9.7.3 RPDs for FDs should be ≤30%. Greater variability may be observed when FDs have analyte concentrations that are within a factor of 2 of the RL. At these concentrations, FDs should have RPDs that are ≤50%. If the RPD of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the CCV, the recovery is judged to be matrix biased. The result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.7.4 If an MSD is analyzed instead of a FD, calculate the relative percent difference (RPD) for duplicate MSs (MS and MSD) using the equation

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

9.7.5 RPDs for duplicate MSs should be ≤30% for samples fortified at or above their native concentration. Greater variability may be observed when MSs are fortified at analyte concentrations that are within a factor of 2 of the RL. MSs fortified at these concentrations should have RPDs that are ≤50% for samples fortified at or above their native concentration. If the RPD of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the LCSD where applicable, the result is judged to be matrix biased. If no LCSD is present, the associated MS and MSD are to be re-analyzed to determine if any analytical has occurred. If the resulting RPDs are still outside control limits, the result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.8 Initial Calibration Verification (ICV)

9.8.1 As part of the IDC (Sect. 13.2), and after each ICAL, analyze a QCS sample from a source different from the source of the CAL standards. If a second vendor is not available, then a different lot of the standard should be used. The QCS should be prepared and analyzed just like a CCV. Acceptance criteria for the QCS are identical to the CCVs; the calculated amount for each analyte must be ±

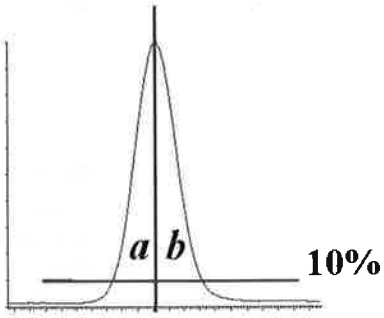
30% of the expected value. If measured analyte concentrations are not of acceptable accuracy, check the entire analytical procedureto locate and correct the problem.

9.9 Continuing Calibration Verification (CCV)

9.9.1 CCV Standards are analyzed at the beginning of each analysis batch, after every 10 Field Samples, and at the end of the analysis batch. See Section 10.7 for concentration requirements and acceptance criteria.

9.10 Method-specific Quality Control Samples

9.10.1 PEAK ASYMMETRY FACTOR – A peak asymmetry factor must be calculated using the equation below during the IDL and every time a calibration curve is generated. The peak asymmetry factor for the first two eluting peaks in a midlevel CAL standard (if only two analytes are being analyzed, both must be evaluated) must fall in the range of 0.8 to 1.5. Modifying the standard or extract composition to more aqueous content to prevent poor shape is not permitted. See guidance in Section 10.6.4.1 if the calculated peak asymmetry factors do not meet the criteria.



$$A_s = b / a$$

Where:

A_s = peak asymmetry factor .
b = width of the back half of the peak measured (at 10% peak height) from the trailing edge of the peak to a line dropped perpendicularly from the peak apex
a = the width of the front half of the peak measured (at 10% peak height) from the leading edge of the peak to a line dropped perpendicularly from the apex.

9.11 Method Sequence

- CCV-LOW
- MB
- LCS
- LCSD
- MS
- Duplicate or MSD
- Field Samples (1-10)
- CCV-MID
- Field Samples (11-20)
- CCV-LOW

10. Procedure

10.1 Equipment Set-up

10.1.1 This procedure may be performed manually or in an automated mode using a robotic or automatic sample preparation device. If an automated system is used to prepare samples, follow the manufacturer's operating instructions, but all extraction and elution steps must be the same as in the manual procedure. Extraction and/or elution steps may not be changed or omitted to accommodate the use of an automated system. If an automated system is used, the MBs should be rotated among the ports to ensure that all the valves and tubing meet the MB requirements (Sect. 9.2).

10.1.2 Some of the PFAS's adsorb to surfaces, including polypropylene. Therefore, the aqueous sample bottles must be rinsed with the elution solvent (Sect 10.3.4) whether extractions are performed manually or by automation. The bottle rinse is passed through the cartridge to elute the method analytes and is then collected (Sect. 10.3.4).

10.1.3 **NOTE:** The SPE cartridges and sample bottles described in this section are designed as single use items and should be discarded after use. They may not be refurbished for reuse in subsequent analyses.

10.2 Sample Preparation and Extraction of Aqueous Samples

10.2.1 Samples are preserved, collected and stored as presented in Section 6.

The entire sample that is received must be sent through the SPE cartridge. In addition, the bottle must be solvent rinsed and this rinse must be sent through the SPE cartridge as well. The method blank (MB) and laboratory control sample (LCS) must be extracted in exactly the same manner (i.e., must include the bottle solvent rinse). It should be noted that a water rinse alone is not sufficient. This does not apply to samples with high concentrations of PFAS that are prepared using serial dilution and not SPE.

10.2.2 Determine sample volume. Weigh all samples to the nearest 1g. If visible sediment is present, centrifuge and decant into a new 250mL HDPE bottle and record the weight of the new container.

NOTE: Some of the PFAS's adsorb to surfaces, thus the sample volume may **NOT** be transferred to a graduated cylinder for volume measurement.

10.2.3 The MB, LCS and FRB may be prepared by measuring 250 mL of reagent water with a polypropylene graduated cylinder or filling a 250-mL sample bottle to near the top.

10.2.4 Adjust the QC and sample pH to 3 by adding acetic acid in water dropwise

10.2.5 Add 20 µL of the EIS PDS (Sect. 8.2.2) to each sample and QC, cap and invert to mix.

10.2.6 If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS (Sect. 8.2.3). Cap and invert each sample to mix.

10.3 Cartridge SPE Procedure

10.3.1 CARTRIDGE CLEAN-UP AND CONDITIONING – DO NOT allow cartridge packing material to go dry during any of the conditioning steps. Rinse each cartridge with 3 X 5 mL of 2% ammonium hydroxide in methanol, followed by 5mls of methanol. Next, rinse each cartridge with 5 mls of the 25 mM acetate buffer, followed by 15 mL of reagent water, without allowing the water to drop below the top edge of the packing. If the cartridge goes dry during the conditioning phase, the conditioning must be started over. Add 4-5 mL of reagent water to each cartridge, attach the sample transfer tubes (Sect. 7.9.3), turn on the vacuum, and begin adding sample to the cartridge.

10.3.2 SAMPLE EXTRACTON – Adjust the vacuum so that the approximate flow rate is approximately 4 mL/min. Do not allow the cartridge to go dry before all the sample has passed through.

10.3.3 SAMPLE BOTTLE AND CARTRIDGE RINSE – After the entire sample has passed through the cartridge, rinse the sample bottles with 4 ml reagent water followed by 4 ml 25 mM acetate buffer at pH 4 and draw the aliquot through the sample transfer tubes and the cartridges. Draw air or nitrogen through the cartridge for 5-10 min at high vacuum (10-15 in. Hg). **NOTE: If empty plastic reservoirs are used in place of the sample transfer tubes to pass the samples through the cartridges, these reservoirs must be treated like the transfer tubes. After the entire sample has passed through the cartridge, the reservoirs must be rinsed to waste with reagent water.**

10.3.4 SAMPLE BOTTLE AND CARTRIDGE ELUTION, Fraction 1 – Turn off and release the vacuum. Lift the extraction manifold top and insert a rack with collection tubes into the extraction tank to collect the extracts as they are eluted from the cartridges. Rinse the sample bottles with 12 mls of methanol and draw the aliquot through the sample transfer tubes and cartridges. Use a low vacuum such that the solvent exits the cartridge in a dropwise fashion.

SAMPLE BOTTLE AND CARTRIDGE ELUTION, Fraction 2 In a separate collection vial, rinse the sample bottles with 12 mL of 2% ammonium hydroxide in methanol and elute the analytes from the cartridges by pulling the 4 mL of methanol through the sample transfer tubes and the cartridges. Use a low vacuum such that the solvent exits the cartridge in a dropwise fashion. To the final extract, add 50 ul of acetic acid.

NOTE: If empty plastic reservoirs are used in place of the sample transfer tubes to pass the samples through the cartridges, these reservoirs must be treated like the transfer tubes. After the reservoirs have been rinsed in Section 10.3.3, the elution solvent used to rinse the sample bottles must be swirled down the sides of the reservoirs while eluting the cartridge to ensure that any method analytes on the surface of the reservoirs are transferred to the extract.

CLEAN-UP CARTRIDGE ELUTION, Elute the clean-up cartridge with 8 additional mls of methanol and draw the aliquot through the cartridge. Use a low vacuum such that the solvent exits the cartridge in a dropwise fashion.

10.3.5 Fractions 1 and 2 are to be combined during the concentration stage (section10.6)

10.4 Sample Prep and Extraction Protocol for Soils

10.4.1 Homogenize and weigh 2 grams of sample (measured to the nearest hundredth of a gram) intoa 50 ml polypropylene centrifuge tube. For laboratory control blanks and spikes, 2 grams of clean sand is used.

10.4.2 Add 20 µL of the EIS PDS (Sect. 8.2.2) to each sample and QC.

10.4.3 If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS (Sect. 8.2.3). Cap and invert each sample to mix.

10.4.4 To all samples, add 10 mls of methanol, cap, vortex for 25 seconds at 3000RPM and mix for 30 minutes using a shaker table of tumbler at 120RPM.

10.4.5 Following mixing, sonicate each sample for 30 minutes and let samples sit overnight (at least 2 hours is required for RUSH samples).

10.4.6 Centrifuge each sample at 3500RPM for 10 minutes.

10.4.7 Remove supernatant, and reserve for clean-up.

10.5 Extract Clean-up

10.5.1 CARTRIDGE CLEAN-UP AND CONDITIONING –. Rinse each cartridge with 15 mL of methanol and discard. If the cartridge goes dry during the conditioning phase, the conditioning must be started over. Attach the sample transfer tubes (Sect. 7.9.3), turn on the vacuum, and begin adding sample to the cartridge.

10.5.2 Adjust the vacuum so that the approximate flow rate is 1-2 mL/min. Do not allow the cartridge to go dry before all the sample has passed through.

10.5.3 SAMPLE BOTTLE AND CARTRIDGE RINSE – After the entire sample has passed through the cartridge, rinse the sample collection vial with two 1-mL aliquots of methanol and draw each aliquot through the cartridges. Draw air or nitrogen through the cartridge for 5 min at high vacuum (10-15 in. Hg).

10.5.4 If extracts are not to be immediately evaporated, cover collection tubes and store at ambient temperature till concentration.

10.6 Extract Concentration

10.6.1 Concentrate the extract to dryness under a gentle stream of nitrogen in a heated water bath (60-65 °C) to remove all the water/methanol mix. Add the appropriate amount of 80:20% (vol/vol) methanol:water solution and 20 µl of the ID REC PDS (Sect. 8.2.7) to the collection vial to bring the volume to 1 mL and vortex. Transfer two aliquots with a plastic pipet (Sect. 7.6) into 2 polypropylene autosampler vials.

NOTE: It is recommended that the entire 1-mL aliquot not be transferred to the autosampler vial because the polypropylene autosampler caps do not reseal after injection. Therefore, do not store the extracts in the autosampler vials as evaporation losses can occur occasionally in these autosampler vials. Extracts can be split between 2 X 700 µl vials (Sect. 7.4).

10.7 Sample Volume Determination

10.7.1 If the level of the sample was marked on the sample bottle, use a graduated cylinder to measure the volume of water required to fill the original sample bottle to the mark made prior to extraction. Determine to the nearest 10 mL.

10.7.2 If using weight to determine volume, weigh the empty bottle to the nearest 10 g and determine the sample weight by subtraction of the empty bottle weight from the original sample weight (Sect. 10.2.2). Assume a sample density of 1.0 g/mL. In either case, the sample volume will be used in the final calculations of the analyte concentration (Sect. 11.2).

10.8 Initial Calibration - Demonstration and documentation of acceptable initial calibration is required before any samples are analyzed. After the initial calibration is successful, a CCV is required at the beginning and end of each period in which analyses are performed, and after every tenth Field Sample.

10.8.1 ESI-MS/MS TUNE

10.8.1.1 Calibrate the mass scale of the MS with the calibration compounds and procedures prescribed by the manufacturer.

10.8.1.2 Optimize the [M-H]- for each method analyte by infusing approximately 0.5-1.0 µg/mL of each analyte (prepared in the initial mobile phase conditions) directly into the MS at the chosen LC mobile phase flow rate (approximately 0.4 mL/min). This tune can be done on a mix of the method analytes. The MS parameters (voltages, temperatures, gas flows, etc.) are varied until optimal analyte responses are determined. The method analytes may have different optima requiring some compromise between the optima.

10.8.1.3 Optimize the product ion for each analyte by infusing approximately 0.5-1.0 µg/mL of each analyte (prepared in the initial mobile phase conditions) directly into the MS at the chosen LC mobile phase flow rate (approximately 0.4 mL/min). This tune can be done on a mix of the method analytes. The MS/MS parameters (collision gas pressure, collision energy, etc.) are varied until optimal analyte responses are determined. Typically, the carboxylic acids have very similar MS/MS conditions and the sulfonic acids have similar MS/MS conditions.

10.8.2 Establish LC operating parameters that optimize resolution and peak shape. Modifying the standard or extract composition to more aqueous content to prevent poor shape is not permitted.

Cautions: LC system components, as well as the mobile phase constituents, contain many of the method analytes in this method. Thus, these PFAS's will build up on the head of the LC column during mobile phase equilibration. To minimize the background PFAS peaks and to keep background levels constant, the time the LC column sits at initial conditions must be kept constant and as short as possible (while ensuring reproducible retention times). In addition, prior to daily use, flush the column with 100% methanol for at least 20 min before initiating a sequence. It may be necessary on some systems to flush other LC components such as wash syringes, sample needles or any other system components before daily use.

10.8.3 Inject a mid-level CAL standard under LC/MS conditions to obtain the retention times of each method analyte. If analyzing for PFTA, ensure that the LC

conditions are adequate to prevent co-elution of PFTA and the mobile phase interferants. These interferants have the same precursor and products ions as PFTA, and under faster LC conditions may co-elute with PFTA. Divide the chromatogram into retention time windows each of which contains one or more chromatographic peaks. During MS/MS analysis, fragment a small number of selected precursor ions ([M-H]-) for the analytes in each window and choose the most abundant product ion. For maximum sensitivity, small mass windows of ±0.5 daltons around the product ion mass were used for quantitation.

10.8.4 Inject a mid-level CAL standard under optimized LC/MS/MS conditions to ensure that each method analyte is observed in its MS/MS window and that there are at least 10 scans across the peak for optimum precision.

10.8.4.1 If broad, split or fronting peaks are observed for the first two eluting chromatographic peaks (if only two analytes are being analyzed, both must be evaluated), change the initial mobile phase conditions to higher aqueous content until the peak asymmetry ratio for each peak is 0.8 – 1.5. The peak asymmetry factor is calculated as described in Section 9.9.1 on a mid-level CAL standard. The peak asymmetry factor must meet the above criteria for the first two eluting peaks during the IDL and every time a new calibration curve is generated. Modifying the standard or extract composition to more aqueous content to prevent poor shape is not permitted.

NOTE: PFHxS, PFOS, NMeFOSAA, and NEtFOSAA have multiple chromatographic peaks using the LC conditions in Table 5 due to chromatographic resolution of the linear and branched isomers of these compounds. Most PFAS's are produced by two different processes. One process gives rise to linear PFAS's only while the other process produces both linear and branched isomers. Thus, both branched and linear PFAS's can potentially be found in the environment. For the aforementioned compounds that give rise to more than one peak, all the chromatographic peaks observed in the standard must be integrated and the areas totaled. Chromatographic peaks in a sample must be integrated in the same way as the CAL standard.

10.8.5 Prepare a set of CAL standards as described in Section 8.2.5. The lowest concentration CAL standard must be at or below the RL (2 ng/L), which may depend on system sensitivity.

10.8.6 The LC/MS/MS system is calibrated using the IS technique. Use the LC/MS/MS data system software to generate a linear regression or quadratic calibration curve for each of the analytes. This curve **must always** be forced through zero and may be concentration weighted, if necessary. Forcing zero allows for a better estimate of the background levels of method analytes. A minimum of 5 levels are required for a linear calibration model and a minimum of 6 levels are required for a quadratic calibration model.

10.8.7 CALIBRATION ACCEPTANCE CRITERIA – A linear fit is acceptable if the coefficient of determination (r^2) is greater than 0.99. When quantitated using the initial calibration curve, each calibration point, except the lowest point, for each analyte should calculate to be within 70-130% of its true value. The lowest CAL point should calculate to be within 50-150% of its true value. If these criteria cannot be met, the analyst will have difficulty meeting ongoing QC criteria. It is

recommended that corrective action is taken to reanalyze the CAL standards, restrict the range of calibration, or select an alternate method of calibration (forcing the curve through zero is still required).

10.8.7.1 CAUTION: When acquiring MS/MS data, LC operating conditions must be carefully reproduced for each analysis to provide reproducible retention times. If this is not done, the correct ions will not be monitored at the appropriate times. As a precautionary measure, the chromatographic peaks in each window must not elute too close to the edge of the segment time window.

10.9 CONTINUING CALIBRATION CHECK (CCV) – Minimum daily calibration verification is as follows. Verify the initial calibration at the beginning and end of each group of analyses, and after every tenth sample during analyses. In this context, a "sample" is considered to be a Field Sample. MBs, CCVs, LCSs, MSs, FDs FRBs and MSDs are not counted as samples. The beginning CCV of each analysis batch must be at or below the RL in order to verify instrument sensitivity prior to any analyses. If standards have been prepared such that all low CAL points are not in the same CAL solution, it may be necessary to analyze two CAL standards to meet this requirement. Alternatively, the analyte concentrations in the analyte PDS may be customized to meet these criteria. Subsequent CCVs should alternate between a medium and Low concentration CAL standard.

10.9.1 Inject an aliquot of the appropriate concentration CAL standard and analyze with the same conditions used during the initial calibration.

10.9.2 Calculate the concentration of each analyte and EIS in the CCV. The calculated amount for each analyte for medium level CCVs must be within ± 30% of the true value with an allowance of 10% of the reported analytes to be greater than 30%, but less than 40%. The calculated amount for each EIS must be within ± 50% of the true value. The calculated amount for the lowest calibration point for each analyte must be within ± 50%. If these conditions do not exist, then all data for the problem analyte must be considered invalid, and remedial action should be taken (Sect. 10.7.4) which may require recalibration. Any Field or QC Samples that have been analyzed since the last acceptable calibration verification should be reanalyzed after adequate calibration has been restored, with the following exception. **If the CCV fails because the calculated concentration is greater than 130% (150% for the low-level CCV) for a particular method analyte, and Field Sample extracts show no detection for that method analyte, non-detects may be reported without re-analysis.**

10.9.3 REMEDIAL ACTION – Failure to meet CCV QC performance criteria may require remedial action. Major maintenance, such as cleaning the electrospray probe, atmospheric pressure ionization source, cleaning the mass analyzer, replacing the LC column, etc., requires recalibration (Sect 10.6) and verification of sensitivity by analyzing a CCV at or below the RL (Sect 10.7).

10.10 EXTRACT ANALYSIS

10.10.1 Establish operating conditions equivalent to those summarized in Tables 6-8 of Section 16. Instrument conditions and columns should be optimized prior to the initiation of the IDC.

10.10.2 Establish an appropriate retention time window for each analyte. This should be based on measurements of actual retention time variation for each method analyte in CAL standard solutions analyzed on the LC over the course of time. A value of plus or minus three times the standard deviation of the retention time obtained for each method analyte while establishing the initial calibration and completing the IDC can be used to calculate a suggested window size. However, the experience of the analyst should weigh heavily on the determination of the appropriate retention window size.

10.10.3 Calibrate the system by either the analysis of a calibration curve (Sect. 10.6) or by confirming the initial calibration is still valid by analyzing a CCV as described in Section 10.7. If establishing an initial calibration, complete the IDC as described in Section 13.2.

10.10.4 Begin analyzing Field Samples, including QC samples, at their appropriate frequency by injecting the same size aliquots under the same conditions used to analyze the CAL standards.

10.10.5 At the conclusion of data acquisition, use the same software that was used in the calibration procedure to identify peaks of interest in predetermined retention time windows. Use the data system software to examine the ion abundances of the peaks in the chromatogram. Identify an analyte by comparison of its retention time with that of the corresponding method analyte peak in a reference standard.

10.10.6 The analyst must not extrapolate beyond the established calibration range. If an analyte peak area exceeds the range of the initial calibration curve, the sample should be re-extracted with a reduced sample volume in order to bring the out of range target analytes into the calibration range. If a smaller sample size would not be representative of the entire sample, the following options are recommended. Re-extract an additional aliquot of sufficient size to insure that it is representative of the entire sample. Spike it with a higher concentration of internal standard. Prior to LC/MS analysis, dilute the sample so that it has a concentration of internal standard equivalent to that present in the calibration standard. Then, analyze the diluted extract.

11. Data Evaluation, Calculations and Reporting

11.1 Complete chromatographic resolution is not necessary for accurate and precise measurements of analyte concentrations using MS/MS. In validating this method, concentrations were calculated by measuring the product ions listed in Table 7.

11.2 Calculate analyte concentrations using the multipoint calibration established in Section 10.6. Do not use daily calibration verification data to quantitate analytes in samples. Adjust final analyte concentrations to reflect the actual sample volume determined in Section 10.6 where:

C_{ex} = (Area of target analyte * Concentration of Labeled analog) / (area of labeled analog * CF)

C_s = (C_{ex} / sample volume in ml) * 1000

C_{ex} = The concentration of the analyte in the extract
CF = calibration factor from calibration.

11.3 Prior to reporting the data, the chromatogram should be reviewed for any incorrect peak identification or poor integration.

11.4 PFHxS, PFOS, PFOA, NMeFOSAA, and NEtFOSAA have multiple chromatographic peaks using the LC conditions in Table 5 due to the linear and branch isomers of these compounds (Sect. 10.6.4.1). The areas of all the linear and branched isomer peaks observed in the CAL standards for each of these analytes must be summed and the concentrations reported as a total for each of these analytes.

11.5 Calculations must utilize all available digits of precision, but final reported concentrations should be rounded to an appropriate number of significant figures (one digit of uncertainty), typically two, and not more than three significant figures.

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

12.1 Section 9.0 outlines sample batch QC acceptance criteria. If non-compliant organic compound results are to be reported, the Organic Section Head and/or the Laboratory Director, and the Operations Manager must approve the reporting of these results. The laboratory Project Manager shall be notified, and may choose to relay the non-compliance to the client, for approval, or other corrective action, such as re-sampling and re-analysis. The analyst, Data Reviewer, or Department Supervisor performing the secondary review initiates the project narrative, and the narrative must clearly document the non-compliance and provide a reason for acceptance of these results.

12.2 All results for the organic compounds of interest are reportable without qualification if extraction and analytical holding times are met, preservation requirements (including cooler temperatures) are met, all QC criteria are met, and matrix interference is not suspected during extraction or analysis of the samples. If any of the below QC parameters are not met, all associated samples must be evaluated for re-extraction and/or re-analysis.

13. Method Performance

13.1 Detection Limit Study (DL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

13.1.1 The laboratory follows the procedure to determine the DL, LOD, and/or LOQ as outlined in Alpha SOP ID 1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

13.2.1 The IDC must be successfully performed prior to analyzing any Field Samples. Prior to conducting the IDC, the analyst must first generate an acceptable Initial Calibration following the procedure outlined in Section 10.6.

13.2.2 INITIAL DEMONSTRATION OF LOW SYSTEM BACKGROUND – Any time a new lot of SPE cartridges, solvents, centrifuge tubes, disposable pipets, and autosampler vials are used, it must be demonstrated that an MB is reasonably free of contamination and that the criteria in Section 9.2.1 are met. If an automated extraction system is used, an MB should be extracted on each port to ensure that all the valves and tubing are free from potential PFAS contamination.

13.2.3 INITIAL DEMONSTRATION OF PRECISION (IDP) – Prepare, extract, and analyze four to seven replicate LCSs fortified near the midrange of the initial calibration curve according to the procedure described in Section 10. Sample preservatives as described in Section 6.2.1 must be added to these samples. The relative standard deviation (RSD) of the results of the replicate analyses must be less than 20%.

13.2.4 INITIAL DEMONSTRATION OF ACCURACY (IDA) – Using the same set of replicate data generated for Section 13.2.3, calculate average recovery. The average recovery of the replicate values must be within ± 30% of the true value.

13.2.5 INITIAL DEMONSTRATION OF PEAK ASYMMETRY FACTOR – Peak asymmetry factors must be calculated using the equation in Section 9.10.1 for the first two eluting peaks (if only two analytes are being analyzed, both must be evaluated) in a mid-level CAL standard. The peak asymmetry factors must fall in the range of 0.8 to 1.5. See guidance in Section 10.6.4.1 if the calculated peak asymmetry factors do not meet the criteria.

13.2.6 Refer to Alpha SOP ID 1739 for further information regarding IDC/DOC Generation.

13.2.7 The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

14.1 Refer to Alpha's Chemical Hygiene Plan and Hazardous Waste Management and Disposal SOP for further pollution prevention and waste management information.

14.2 This method utilizes SPE to extract analytes from water. It requires the use of very small volumes of organic solvent and very small quantities of pure analytes, thereby minimizing the potential hazards to both the analyst and the environment as compared to the use of large volumes of organic solvents in conventional liquid-liquid extractions.

14.3 The analytical procedures described in this method generate relatively small amounts of waste since only small amounts of reagents and solvents are used. The matrices of concern are finished drinking water or source water. However, laboratory waste management practices must be conducted consistent with all applicable rules and regulations, and that laboratories protect the air, water, and land by minimizing and controlling all releases from fume hoods and bench operations. Also, compliance is required with any sewage discharge permits and regulations, particularly the hazardous waste identification rules and land disposal restrictions.

15. Referenced Documents

Chemical Hygiene Plan – ID 2124

SOP ID 1732 Detection Limit (DL), Limit of Detection (LOD) & Limit of Quantitation (LOQ) SOP

SOP ID 1739 Demonstration of Capability (DOC) Generation SOP

SOP ID 1728 Hazardous Waste Management and Disposal SOP

16. Attachments

Table 7: LC Method Conditions

Time (min)	2 mM Ammonium Acetate (5:95 MeOH/H_2O)	100% Methanol
Initial	100.0	0.0
1.0	100.0	0.0
2.2	85.0	15.0
11	20.0	80.0
11.4	0.0	100.0
12.4	100.0	00.0
15.5	100.0	0.0
Waters Aquity UPLC ® BEHC_{18} 2.1 x 50 mm packed with 1.7 µm BEH C_{18} stationary phase Flow rate of 0.4 mL/min 2-5 µL injection		

Table 8: ESI-MS Method Conditions

ESI Conditions	
Polarity	Negative ion
Capillary needle voltage	.5 kV
Cone Gas Flow	25 L/hr
Nitrogen desolvation gas	1000 L/hr
Desolvation gas temp.	500 °C

Table 9: Method Analyte Source, Retention Times (RTs), and EIS References

#	Analyte	Transition	RT	IS	Type
1	M3PBA	216>171	2.65		REC
2	PFBA	213 > 169	2.65	2: M4PFBA	
3	M4PFBA	217 > 172	2.65	1: M3PBA	EIS
4	PFPeA	263 > 219	5.67	4: M5PFPEA	
5	M5PFPEA	268 > 223	5.66	1: M3PBA	EIS
6	PFBS	299 > 80	6.35	6: M3PFBS	
7	M3PFBS	302 > 80	6.35	29:M4PFOS	EIS
8	FtS 4:2	327 > 307	7.47	9: M2-4:2FTS	

#	Analyte	Transition	RT	IS	Type
9	M2-4:2FTS	329 > 81	7.47	29:M4PFOS	EIS
10	PFHxA	303 > 269	7.57	10: M5PFHxA	
11	M5PFHxA	318 > 273	7.57	19:M2PFOA	EIS
12	PFPeS	349 > 80	7.88	18: M3PFHxS	
13	PFHpA	363 > 319	8.80	14: M4PFHpA	
14	M4PFHpA	367 > 322	8.80	19:M2PFOA	EIS
15	L-PFHxS	399 > 80	8.94	18: M3PFHxS	
16	br-PFHxS	399 > 80	8.72	18: M3PFHxS	
17	PFHxS Total	399 > 80	8.94	18: M3PFHxS	
18	M3PFHxS	402 > 80	8.94	29:M4PFOS	EIS
19	MPFOA	415 > 370	9.7		REC
20	PFOA	413 > 369	9.7	23: M8PFOA	
21	br-PFOA	413 > 369	9.48	23: M8PFOA	
22	PFOA Total	413 > 369	9.7	23: M8PFOA	
23	M8PFOA	421 > 376	9.7	19: M2PFOA	EIS
24	FtS 6:2	427 > 407	9.66	25: M2-6:2FTS	
25	M2-6:2FTS	429 > 409	9.66	29:M4PFOS	EIS
26	PFHpS	449 > 80	9.78	33: M8PFOS	
27	PFNA	463 > 419	10.41	33: M8PFOS	
28	M9PFNA	472 > 427	10.41	19: M2PFOA	EIS
29	M4PFOS	501 > 80	10.45		REC
30	PFOS	499 > 80	10.45	33: M8PFOS	
31	br-PFOS	499 > 80	10.27	33: M8PFOS	
32	PFOS Total	499 > 80	10.45	33: M8PFOS	
33	M8PFOS	507 > 80	10.45	29: M4PFOS	EIS
34	FtS 8:2	527 > 507	10.99	38: M2-8:2FTS	
35	M2-8:2FTS	529 > 509	10.99	29:M4PFOS	EIS
36	M2PFDA	515 > 470	11.00		REC
37	PFDA	513 > 469	11.00	38: M6PFDA	
38	M6PFDA	519 > 474	11.00	36: M2PFDA	EIS
39	PFNS	549 > 80	11.02	33:M8PFOS	
40	NMeFOSAA	570 > 419	11.41	41: D3-NMeFOSAA	
41	d3-NMeFOSAA	573 > 419	11.41	36: M2PFDA	EIS
42	PFOSA	498 > 78	11.48	29: M8FOSA	
43	M8FOSA	506 > 78	11.48	19: M2PFOA	EIS
44	PFUnDA	563 > 519	11.51	41: M7-PFUDA	
45	M7-PFUDA	570 > 525	11.51	36: M2PFDA	EIS
46	PFDS	599 > 80	11.51	33:M8PFOS	
47	NEtFOSAA	584 > 419	11.68	48: d5-NEtFOSAA	

#	Analyte	Transition	RT	IS	Type
48	d5-NEtFOSAA	589 > 419	11.68	36: M2PFDA	EIS
49	PFDoA	613 > 569	11.96	50: MPFDOA	
50	MPFDOA	615 > 570	11.96	36: M2PFDA	EIS
51	PFTriA	663 > 619	12.34	50: MPFDOA	
52	PFTeA	713 > 669	12.6	53: M2PFTEDA	
53	M2PFTEDA	715 > 670	12.6	36: M2PFDA	EIS
54	M3HFPO-DA	329>285	7.97	19: M2PFOA	EIS
55	HFPO-DA	332>287	7.97	54: M3HFPO-DA	
56	ADONA	377>251	8.00	23: M8PFOA	
57	PFHxDA	813>769	13.20	59: M2PFHxDA	
58	PFODA	913>869	13.50	59: M2PFHxDA	
59	M2PFHxDA	815>770	13.20	36:M2PFDA	EIS
60	NEtFOSA	526>169	11.00	61: NMeFOSA	
61	NMeFOSA	512>169	10.50	63: d3-NMeFOSA	
62	d3-NMeFOSA	515>169	10.50	29: M4PFOS	EIS
63	d5-NEtFOSA	531>169	11.00	29: M4PFOS	EIS
64	NMeFOSE	556>122	11.25	66: d7-NMeFOSE	
65	NEtFOSE	570>136	10.75	67: d9-NEtFOSE	
66	d7-NMeFOSE	563>126	11.25	29: M4PFOS	EIS
67	d9-NEtFOSE	579>142	10.75	29: M4PFOS	EIS
68	FtS 10:2	627>607	11.50	25: M2-6:2FTS	
69	PFDoS	699>99	12.50	33: M8PFOS	

APPENDIX D
DAILY SITE OBSERVATION REPORT TEMPLATE

LANGAN

SITE OBSERVATION REPORT

PROJECT No.: 100965501	**CLIENT:** 47th Street & 58th Road LLC	**DATE:**	Monday, June 20, 2022
PROJECT: 47th Street Site		**WEATHER:**	Sunny, 70-87 ^{0}F Wind: NE @ 11 mph
LOCATION: Queens (Maspeth), NY		**TIME:**	7:00 am – 3:45 pm
BCP SITE ID: TBD			
CONTRACTOR: AARCO Environmental		**LANGAN REP. :**	LANGAN REP

CONTRACTOR'S EQUIPMENT: Geoprobe 6610DT	**PRESENT AT SITE:** **RI Day #** LANGAN REP – Langan Driller Helper/ Driller – AARCO Environmental

OBSERVATIONS, DISCUSSIONS, TEST RESULTS, ETC.:

Langan was present to implement the June 2022 Remedial Investigation Work Plan (RIWP) for New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) Site No. TBD located at 57-00, 57-05, and 58-20 47th Street (Block 2601, Lots 1&6, Block 2602, Lot 72). Observed activities were as follows:

Site Activities

- Drilling activity:
  - AARCO Environmental utilized a Geoprobe 6610DT rig and advanced soil boring SB11 to approximately 10 feet below grade surface (bgs). No petroleum-like odors, staining, or elevated photoionization detector (PID) readings above 0.0 parts per million (ppm) were observed.
- Langan implemented the Community Air Monitoring Plan (CAMP) per the NYSDEC-approved RIWP during intrusive activities.

Material Tracking

- No material was imported to the site.
- No material was exported from the site.

Sampling

Langan collected 2 soil samples for laboratory analysis of NYSDEC Part 375 and target compound list (TCL) volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), pesticides, target analyte list (TAL) metals, and PFAS. The sample IDs are listed below:

- Langan collected soil samples SB11_3.0-3.5 and SB11_6.5-6.5.

Cc:	A. Arico, M. Raygorodetsky	By:	Langan Representative **LANGAN**

SITE OBSERVATION REPORT

Work Zone Monitoring Activities

The PM10, VOCs, and mercury vapor action levels were not exceeded during the monitoring period at the work zone station.

Averaging Period	Particulate Monitoring (mg/m3)	Organic Vapor Monitoring (ppm)
Daily Average		
Maximum 15-min Average		
Minimum 1-min Instant Reading		
Maximum 1-min Instant Reading		

mg/m^3 = milligrams per cubic meter
ppm = parts per million
$\mu g/m^3$ = micrograms per cubic meter

CAMP Activities

The PM10, VOCs, and mercury vapor action levels were not exceeded during the monitoring period at the downwind CAMP station.

Averaging Period	Upwind Monitor	Downwind Monitor 1	Downwind Monitor 2
Daily Average			
Maximum 15-min Average			
Minimum 1-min Instant Reading			
Maximum 1-min Instant Reading			

Averaging Period	Upwind Monitor	Downwind Monitor 1	Downwind Monitor 2
Daily Average			
Maximum 15-min Average			
Minimum 1-min Instant Reading			
Maximum 1-min Instant Reading			

Imported Material

Soil importation is not to be completed at this time.

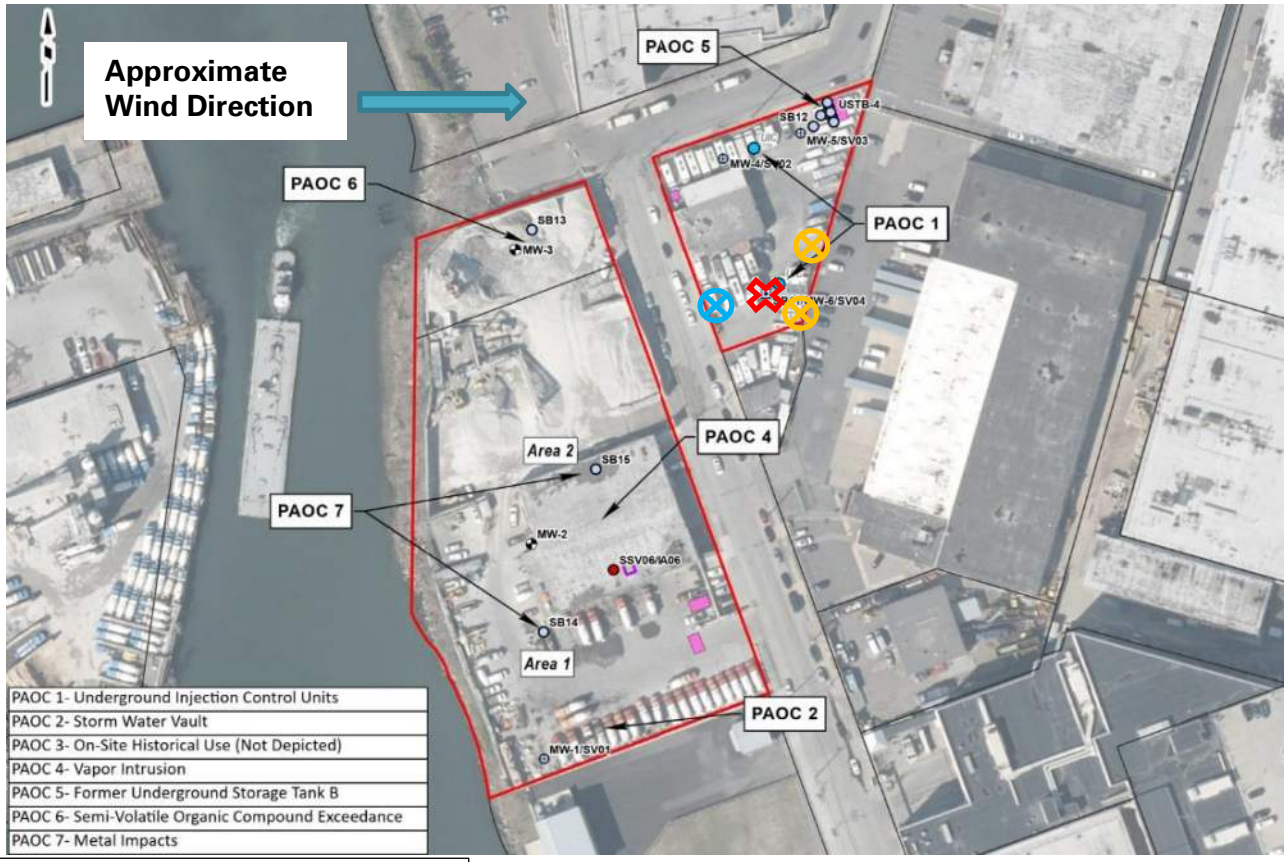
Anticipated Activities

- Advancement of soil borings, installation of monitoring wells and collection of soil samples.

Cc:	A. Arico, M. Raygorodetsky	By:	Langan Representative
			LANGAN

SITE OBSERVATION REPORT

Figure 1: Site Map



Legend:

Site Boundary

Upwind CAMP Station

Downwind CAMP Station

Completed

Cc:	A. Arico, M. Raygorodetsky	By:	Langan Representative
			LANGAN

SITE OBSERVATION REPORT

Photographs:

Photo 1: Description (facing direction)

Photo 2: Description (facing direction)

Cc:	A. Arico, M. Raygorodetsky	By:	Langan Representative
			LANGAN