
REMEDIAL INVESTIGATION WORK PLAN

for

RBEC1
441 West 26th Street
New York, New York

Prepared for:

RBEC1, LLC
30 Hudson Yards, 72nd Floor
New York, New York 10001

Prepared by:

**Langan Engineering, Environmental, Surveying,
Landscape Architecture and Geology, D.P.C.**
368 Ninth Avenue, 8th Floor
New York, New York 10001

LANGAN

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CERTIFICATION

I, Jason Hayes, certify that I am currently a New York State (NYS) registered professional engineer as defined in Title 6 of the 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 and DER-31 Green Remediation.

DRAFT

Jason Hayes, P.E., LEED AP

1.0 INTRODUCTION

This Remedial Investigation Work Plan (RIWP) was prepared on behalf of RBEC1, LLC (the Applicant) for the property known as RBEC1 located at 441 West 26th Street in New York, New York (the site). The Applicant intends to implement the RIWP for Site No. C231168 under the New York State Brownfield Cleanup Program (BCP), pursuant to a Brownfield Cleanup Agreement (BCA) with the New York State Department of Environmental Conservation (NYSDEC), executed on **DATE**.

The objective of the RIWP is to further investigate and characterize the nature and extent of environmental conditions at the site, to provide sufficient information to evaluate potential impacts to human health and the environment, and to evaluate remedial alternatives, as required. This RIWP was developed in accordance with the process and requirements identified in the NYSDEC Division of Environmental Remediation (DER)-10 Technical Guidance for Site Investigation and Remediation (May 2010), Title 6 of the New York Codes, Rules, and Regulations (NYCRR) Part 375, Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs (April 2023) and the New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006, with subsequent updates through 2024).

2.0 SITE BACKGROUND

2.1 Site Description

The approximately 33,150-square-foot (sf) site is located at 441 West 26th Street in the Chelsea neighborhood of New York, New York and is identified on the Borough of Manhattan Tax Map as Tax Block 724, part of Lots 1 and 10. The site is bordered by West 27th Street (private street) followed by Chelsea Park to the north, a New York City Housing Authority (NYCHA) 12-story residential building to the east, West 26th Street followed by two NYCHA 11-story residential buildings to the south, and a 12-story NYCHA residential building to the west. The site is improved with a 14-story NYCHA residential apartment building with a full cellar, 96 apartment units, a ground floor daycare, and an attached two-story commercial building containing a community center. The southern part of the site is improved with a playground and pedestrian walkways. A site location map is included as Figure 1.

The site is in an area of historical residential, commercial, and industrial uses. Historical uses of the site included mixed-use residential and commercial dwellings and a copper works (late 1800s to 1930s). The current NYCHA buildings at the site were constructed by circa 1968.

2.2 Proposed Redevelopment Plan

The proposed redevelopment includes asbestos abatement and demolition of the existing structures and removal of paved and landscaped surfaces, followed by removal of contaminated soil to accommodate construction of a new 39-story residential building with a footprint of about 21,000 square feet (sf) and an about 19,000-sf partial cellar. The cellar will contain mechanical rooms, storage, a community facility room, and a theater. The first through fifth floors will contain community rooms, daycare/childcare facilities, a gym, and other residential amenities. The fourth through 39th floors will contain residential apartments; outdoor terraces will be located on the 14th and 20th floors. The building will contain about 423,000 sf of permanently affordable residential space; no market rate apartments are planned. The contemplated use for purposes of the BCP is restricted residential.

2.3 Surrounding Property Land Use

According to the New York City Planning Commission Zoning Map 8b, the site is in a R8 residential district. The following is a summary of surrounding property usage:

Direction	Parcel Number	Adjoining Properties	Surrounding Properties
North	Block 724, Lot 10	West 27 th Street (private street)	Chelsea Park, West 28 th Street and United States Postal Service (USPS) Morgan Processing and Distribution Center
West	Block 724, Lot 1	NYCHA multi-story residential building (278 Tenth Avenue)	Tenth Avenue and mixed-use residential and commercial buildings
South	Block 723, Lot 1	NYCHA multi-story residential building (264 Tenth Avenue)	Residential, commercial, and mixed-use residential and commercial buildings
East	Block 724, Lot 15	NYCHA multi-story residential building (427 West 26 th Street)	Public School 033 Chelsea Prep, multi-story residential and commercial buildings

Land use within a half-mile radius is urban and includes multi-story residential buildings, some with ground-level retail stores and restaurants; school and day care facilities; public parks; parking lots; office buildings; and commercial facilities. The closest ecological receptor is the Hudson River, which is about 2,100 feet to the west of the site.

A daycare facility and community center with children's programs and youth education support programs are located on the site. No other sensitive receptors are located on the site. Sensitive receptors, as defined in DER-10, within a half-mile of the site include those listed below:

Number	Name (Approximate distance from site)	Address
1	P.S. 33 Chelsea Prep (about 0.04 miles east of the site)	281 Ninth Avenue New York, NY 10001
2	Avenues: The World School (about 0.08 miles southwest of the site)	259 Tenth Avenue New York, NY 10001
3	Manhattan Schoolhouse (about 0.10 miles northwest of the site)	507 West 28 th Street #1412 New York, NY 10001
4	Penn South Social Services (about 0.11 miles east of the site)	290A Ninth Avenue New York, NY 10001
5	Church of the Holy Apostles (about 0.12 miles northeast of the site)	296 Ninth Avenue New York, NY 10001
6	Avenues: The World School Science/Design/Arts and Early Learning Center (about 0.16 miles west of the site)	536 West 26 th Street New York, NY 10001
7	Manor Community Church (about 0.16 miles east of the site)	350 West 26 th Street New York, NY 10001
8	St. Eleftherios' Greek Orthodox Church (about 0.17 miles southeast of the site)	359 West 24 th Street #361 New York, NY 10011
9	Bright Horizons at Hudson Yards (about 0.19 miles northwest of the site)	529A West 29 th Street New York, NY 10001
10	CityMD Chelsea Urgent Care – Manhattan (about 0.20 miles south of the site)	400 West 23 rd Street New York, NY 10011
11	Chelsea Nanny (about 0.21 miles southeast of the site)	341 West 24 th Street New York, NY 10011
12	Guardian Angel Roman Catholic Church (about 0.27 miles south of the site)	193 Tenth Avenue New York, NY 10011

Number	Name (Approximate distance from site)	Address
13	Mount Sinai Doctors – West 23 rd Street (about 0.28 miles southeast of the site)	309 West 23 rd Street New York, NY 10011
14	Neighborhood Church of Greenwich Village (about 0.30 miles southeast of the site)	315 West 22 nd Street New York, NY 10011
15	Bright Horizons at Chelsea (about 0.31 miles southeast of the site)	258 West 26 th Street New York, NY 10001
16	San Jose Day Nursery Inc. (about 0.32 miles south of the site)	432 West 20 th Street New York, NY 10011
17	Atlas School/Atlas Foundation for Autism (about 0.33 miles east of the site)	252 West 29 th Street New York, NY 10001
18	P.S. 11 Sarah J. Garnet School (about 0.34 miles southeast of the site)	320 West 21 st Street New York, NY 10011
19	High School of Fashion Industries (about 0.37 miles southeast of the site)	225 West 24 th Street New York, NY 10011
20	Go Beyond Family Day Care (about 0.46 miles east of the site)	178 West 27 th Street, Suite 527 New York, NY 10012
21	The Learning Experience – Hudson Yards (about 0.46 miles north of the site)	417 West 35 th Street New York, NY 10001

2.4 Site Physical Conditions

2.4.1 Topography

According to a 16 April 2022 survey for the site prepared by Fehringer Surveying, P.C., site elevations (el.¹) range from about el. 15 at the northern part of the site to about el. 17 in the southern part of the site. The regional topography slopes downward to the west toward the Hudson River, which is about 2,100 feet to the west of the site.

2.4.2 Site Geology

Based on the September 2025 Limited Subsurface Investigation (LSI) completed by Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C. (Langan), the site stratigraphy generally consists of non-native soil comprised of fine grained sand with varying amounts of silt, gravel, cobble, roots, wood, and anthropogenic materials (brick, glass, metal, coal, and/or concrete) extending from immediately below the surface cover to between 5 and 12 feet below grade surface (bgs). In borings where non-native soil did not extend to the termination depth, the non-native soil layer was underlain by native soil consisting of either tan, orange, or brown medium sand with varying amounts of silt, clay, and gravel or black to brown silt with varying amounts of gravel. Bedrock was not encountered during the LSI, with borings extending to a maximum depth of 20 feet bgs. According to the 29 August 2025 MCRE

¹ Datum refers to the North American Vertical Datum of 1988, which is approximately 1.1 feet above mean sea level datum at Sandy Hook, New Jersey as defined by the United States Geologic Survey (USGS NGVD 1929). Pls check that, as I recall, it did not have additional comments on Attachment F relating to the history.

Preliminary Geotechnical Report, depth to bedrock at the site ranges from between 40 and 55 feet bgs.

2.4.3 Hydrogeology

Groundwater flow is typically topographically influenced, as shallow groundwater tends to originate in areas of topographic highs and flow toward areas of topographic lows, such as rivers, stream valleys, ponds, and wetlands. A broader, interconnected hydrogeologic network often governs groundwater flow at depth or in the bedrock aquifer. Groundwater depth and flow direction are also subject to hydrogeologic and anthropogenic variables such as precipitation, evaporation, extent of vegetative cover, and coverage by impervious surfaces. Other factors influencing groundwater include the thickness of artificial fill and variability in local geology and groundwater sources or sinks. Potable water is provided by the City of New York and is derived from surface impoundments in the Croton, Catskill, and Delaware watersheds.

During the LSI, groundwater was observed in soil borings between about 7.5 and 12 feet bgs. Based on regional topography, groundwater flow direction is assumed to be to the west, towards the Hudson River.

2.6 Environmental History and Previous Investigations

The following previous environmental reports were prepared for the site and are summarized below. The previous reports are included in Appendix A.

- *Phase I ESA Report – Chelsea-Elliott, prepared by Hillmann, dated 21 April 2022*
- *Summary Report for Soil Waste Classification Sampling, prepared by HK Engineering & Geology, D.P.C. (HK), dated 7 March 2023*
- *Site Investigation Report (SIR) – Fulton 11 and Chelsea Elliott, prepared by HK, dated February 2024*
- *LSI Report, prepared by Langan, dated 25 September 2025*

A summary of these previous reports is provided below.

Hillman Phase I ESA Report, dated 21 April 2022

Hillmann prepared a Phase I ESA for a larger planned development property known as “Chelsea-Elliott”, which included the RBEC1 site (the RBEC1 site is referenced as the “Chelsea Addition 1” in the Phase I ESA). Relevant information from the Phase I ESA pertaining to the RBEC1 site is summarized below.

According to the Phase I ESA, the site was developed with multi-story mixed-use buildings, residential and commercial buildings, and a copper works as early as 1890. Throughout the late 1800s and early 1900s, the site remained improved with various mixed-use residential and commercial buildings. By 1910, the northern part of the site was developed with a 5-story building

with a cellar and was labeled as the Hudson Guild Neighborhood House. By 1950, all previous structures on the site excluding the Hudson Guild Neighborhood House were demolished, leaving the site mostly vacant. By 1976, the site was developed with the existing 14-story building known as the Chelsea Houses Addition.

The Phase I ESA also identified a Controlled REC (CREC) related to closed NYSDEC Spill No. 96-02200 (consolidated with 89-08401) on the NYCHA Chelsea-Elliott Houses campus. Based on a review of the spill records, investigation activities, and subsequent cleanup actions, the odors, staining, and/or sheen identified in soil by HK in 2023 and Langan in 2025 (see sections below) in the eastern part of the site are likely related to these closed spill cases.

Hillmann also noted historical manufacturing (not specified) use on the larger Chelsea-Elliott development property in the 1940s to 1960s (including the RBEC1 site) as a recognized environmental condition (REC).

HK Summary Report for Soil Waste Classification Sampling, dated 7 March 2023

HK performed a waste characterization for the larger Chelsea-Elliott development property and a second development site known as "Fulton 11" to facilitate future soil removal at both properties during planned redevelopment. One soil boring (SB1) was advanced within the RBEC1 site boundary to 15 feet bgs. Non-native soil was observed in SB1 to about 12 feet bgs. One grab and one composite soil sample were collected from 12 to 13 and 10 to 12 feet bgs, respectively, and analyzed for volatile organic compounds (VOC), semivolatile organic compounds (SVOC), polychlorinated biphenyls (PCB), Resource Conservation and Recovery Act (RCRA) metals, Toxicity Characteristic Leaching Procedure (TCLP) metals, hexavalent chromium, and general RCRA characteristics (ignitability, corrosivity, and flammability). VOC, SVOC, PCB, RCRA 8 metals and hexavalent chromium results were compared to the New York State Department of Environmental Conservation (NYSDEC) Title 6 of the New York Codes, Rules, and Regulations (NYCRR) Part 375 Unrestricted Use (UU) and Restricted Use Restricted-Residential (RURR) Soil Cleanup Objectives (SCO). TCLP metals results were compared to the NYCRR Part 371.3 Maximum Concentration of Contaminants for the Toxicity Characteristic and the 40 CFR 261 Subpart C and Table 1 of 40 CFR 261.24 – United States Environmental Protection Agency (USEPA) RCRA Characteristics of Hazardous Waste (collectively referred to herein as the EPA Hazardous Waste Limit [HWL]).

Stained soil, petroleum-like odors, and a maximum photoionization detector (PID) reading of 4.3 parts per million (ppm) were observed in soil boring SB1 from 12 to 15 feet bgs. Groundwater was encountered at 13 feet bgs and a sheen was observed on groundwater. Soil analytical results are described below.

VOCs and SVOCs were not detected above the UU or RURR SCOs. Two pesticides (4,4'-DDE and 4,4'-DDT) and two metals (lead and zinc) were detected at concentrations above the UU

and/or RURR SCOs. No metals concentrations exceeded the HWL and the soil was not found to be ignitable, corrosive or flammable.

HK SIR, dated February 2024

HK completed a site investigation (SI) at the larger Chelsea-Elliott development property and the Fulton 11 property to investigate potential impacts from historical on- and off-site uses. As part of this investigation, HK completed a geophysical survey, advanced nine soil borings, installed four temporary groundwater monitoring wells and six soil vapor sampling probes, and collected soil, groundwater, and soil vapor samples on the site. The results are summarized below:

- Geophysical Survey - The geophysical survey was conducted on 14 November 2023 across accessible areas of the site and identified visual evidence of buried utilities (e.g., electric and sewer). Subsurface anomalies consistent with underground storage tanks (UST) were not identified.
- Soil – Soil samples were collected from the 0- to 2-foot interval and the 10- to 12-foot interval to characterize the top of the non-native soil layer and soil at the anticipated development depth of a new building that was being proposed for construction at the time of the SIR. Soil samples were analyzed for VOCs, SVOCs, pesticides, PCB, and Target Analyte List (TAL) metals. Soil sample analytical results were compared to the Part 375 UU and RURR SCOs. Soil sample analytical results are described below.
 - VOCs and PCBs were not detected above the UU and RURR SCOs.
 - Seven SVOCs (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, and indeno[1,2,3-cd]pyrene) were detected at concentrations above the UU and/or RURR SCOs.
 - Three pesticides (4,4'-DDD, 4,4'-DDE, and 4,4'-DDT) were detected in the shallow samples at concentrations above the UU SCOs. Pesticides were not detected above the RURR SCOs.
 - Seven metals (barium, cadmium, copper, lead, mercury, nickel, and zinc) were detected at concentrations above the RURR and/or UU SCOs.
- Groundwater - Groundwater was observed between about 11 and 14 feet bgs. Groundwater samples were analyzed for VOCs, SVOCs, pesticides, PCBs, and TAL metals (total and dissolved). Groundwater analytical results were compared to the NYSDEC Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values for Class GA water (collectively referred to as SGVs). Groundwater sample analytical results are described below.
 - Pesticides and PCBs were not detected above the SGVs.
 - One VOC (chloroform) was detected above the SGVs in two monitoring wells.
 - Five SVOCs (benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, and indeno[1,2,3-cd] pyrene) were detected above the SGVs.

- Three total metals (lead, selenium, and sodium) and two dissolved metals (selenium and sodium) were detected above the SGVs.
- Soil Vapor - Soil vapor samples were analyzed for VOCs. Soil vapor analytical data was not compared to a standard because no regulatory standard currently exists for soil vapor samples in New York State. Petroleum-related compounds, including benzene, toluene, ethylbenzene, and xylenes (BTEX), and chlorinated VOCs (CVOc) were detected in the samples. Tetrachloroethene (PCE) was detected in all of the soil vapor samples at concentrations ranging from 1.4 to 73 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$).

Langan evaluated the soil vapor sampling results using the New York State Department of Health (NYSDOH) Decision Matrices soil vapor guidance (2006, with updates through February 2024). Full evaluation using the Decision Matrices requires sub-slab vapor and indoor air data. However, in the absence of indoor air data, the soil vapor data were evaluated against the minimum sub-slab vapor concentrations in the matrix. The outcomes for detected CVOcs and petroleum-related compounds ranged from “no further action” to “mitigate”.

Langan LSI, dated 25 September 2025

Langan conducted a subsurface investigation at the site on August 13 and 14, 2025 to evaluate potential impacts to soil resulting from historical on- and off-site uses. The investigation included a geophysical survey, advancement of nine soil borings and collection of 23 soil samples. Soil borings were advanced to depths up to 20 feet bgs or until refusal, and up to 3 soil samples were collected from each boring from one or more of the following intervals: a shallow 2-foot interval within the non-native soil layer (0 to 5 feet bgs), a deeper 2-foot interval in the non-native soil layer; the 2-foot interval at the groundwater interface; and/or the 2-foot interval exhibiting the greatest field evidence of contamination. The analytical results from Langan’s LSI are included as Table 1.

- Geophysical Survey - NOVA Geophysical Services (NOVA) conducted a geophysical survey using ground penetrating radar (GPR) and an electromagnetic (EM) detector under observation by Langan field staff to pre-clear drilling locations and to identify any USTs and other subsurface structures beneath the surface cover (i.e., pavement, asphalt, topsoil). A copy of the geophysical survey report is provided in Attachment 1.
- Subsurface Observations - The site surface cover is underlain by about 5 to 12 feet of non-native soil, predominantly consisting of black to grayish brown to tan, fine-grained sand with varying amounts of silt, gravel, brick, construction debris, and fibrous vegetation. Native soil consisting of brown to orangish brown fine- to medium-grained sand with varying amounts of silt and trace fine gravel was observed below the non-native soil layer starting at depths ranging from 5 to 12 feet bgs. Staining, petroleum-like odors, and PID readings up to 38 ppm were observed in one soil boring (SB05) at about 11 to 13

feet bgs at the groundwater interface and at the contact between the non-native soil layer and native soil layer. No sheen or free phase petroleum was identified. Based on these findings, a spill was reported to the NYSDEC Spill Hotline on October 9, 2025 and Spill No. 25-06223 was assigned to the site (see below). Groundwater was observed in the soil borings from about 7.5 to 12 feet bgs. Based on topography, the inferred regional groundwater flow direction in the vicinity of the site is to the southwest, towards the Hudson River.

- Soil Sample Analytical Results - Soil samples were analyzed for VOCs, SVOCs, TAL metals (including hexavalent and trivalent chromium), pesticides, herbicides and PCBs. Soil sample analytical results were compared to NYSDEC Part 375 UU, Protection of Groundwater (PGW), and RURR SCOs. The results are as follows:
 - VOCs and herbicides were not detected at concentrations above the UU, PGW, or RURR SCOs.
 - One or more of twelve SVOCs were detected in six soil samples collected from the non-native soil layer between 0 and 8 feet bgs at concentrations exceeding the UU, PGW, and/or RURR SCOs.
 - One or more of three pesticides (4,4'-DDD, 4,4'-DDE, and 4,4'-DDT) were detected in four soil samples collected from the non-native soil layer between 0 and 7 feet bgs at concentrations exceeding the UU SCOs.
 - Total PCBs was detected in one soil sample (SB03_2-4) at a concentration exceeding the UU SCO
 - One or more of nine metals, including arsenic, barium, copper, hexavalent chromium, trivalent chromium, lead, mercury, nickel, and/or zinc, were detected in 18 samples collected from the non-native soil layer between 0 and 8 feet bgs exceeding the UU, PGW, and/or RURR SCOs. Lead was detected above the RURR SCO in 6 out of the 24 soil samples. The maximum concentration of lead was detected in sample SB03_5-7 at 5,120 milligrams per kilogram (mg/kg), which is more than an order of magnitude above the PGW and RURR SCOs.

2.7 Areas of Concern

Based on the site history and the findings of previous studies, the areas of concern (AOC) to be further investigated by this RI are shown on Figure 4 and described below.

AOC 1: Non-Native Soil

Non-native soil beneath the site extends from immediately below the surface cover to depths ranging from 5 to 12 feet bgs. The non-native soil layer consists of fine-grained sand with varying amounts of silt, gravel, cobble, roots, wood, and anthropogenic materials (brick, glass, metal, coal, and/or concrete). SVOCs and metals detected in the non-native soil at concentrations above

the UU, PGW, and/or RURR SCOs are attributed to the non-native soil quality; metals concentrations may also be attributed to historical site use (AOC 3).

AOC 2: Off-Site Historical Uses

The area surrounding the site has a history of industrial, commercial and residential uses. Potential undocumented releases on adjoining and/or surrounding properties may have impacted soil, groundwater, and soil vapor at the site.

AOC 3: On-Site Historical Uses

A copper works facility operated in the southern part of the site from as early as 1890 until sometime between 1899 and 1911. Metals detected in shallow soil at the site at concentrations above the UU, PGW, and/or RURR SCOs may be attributed to the historical copper works facility.

AOC 4: Petroleum-Related Impacts from an Off-Site Source

Staining, petroleum-like odors, and PID readings up to 38 ppm were observed in soil borings in the eastern part of the site between about 11 to 15 feet bgs (at the groundwater interface) during HK's 2023 investigation and during Langan's 2025 LSI. HK also observed a petroleum-like sheen on groundwater. Based on Langan's observations during the 2025 LSI, a spill was reported to the NYSDEC Spill Hotline on October 9, 2025 and Spill No. 25-06223 was assigned to the site. The available data set does not show petroleum-related VOCs or SVOCs exceeding the applicable regulatory criteria. Based on a review of available spill records, investigation activities, and subsequent cleanup actions, the odors, staining, and/or sheen identified by HK and Langan in the eastern part of the site are likely related to closed NYSDEC Spill Nos 96-02200 and 89-08401, which are associated with a known petroleum release from two former USTs on the adjoining NYCHA property to the east.

3.0 SCOPE OF WORK

The objective of this RIWP is to supplement existing data to investigate and characterize “the nature and extent of the contamination at and/or emanating from a brownfield site,” as required to satisfy New York State Environmental Conservation Law (ECL) 27-1411.1.

The field investigation will include the tasks summarized below, which are discussed in more detail in the following sections. The rationale for each sampling location, in relation to the AOCs and analytical parameters for each proposed sample, is provided in Table 2.

Soil Borings and Sampling

- Advance at least 10 soil borings (RI-SB01 through RI-SB10) to at least 2 feet below the observed groundwater table, at least 2 feet below the termination of the non-native soil layer, or at least 2 feet below observed contamination (i.e., staining, odors, or PID readings above background conditions), whichever is deeper. Soil borings to be converted to groundwater monitoring wells will be advanced to at least 5 feet below the observed groundwater table (i.e., about 12 to 16 feet bgs).
- Collect at least three soil samples from each boring (plus quality assurance/quality control [QA/QC] samples) to further characterize and delineate the nature and extent of soil contamination at the site.

Monitoring Well Installation and Sampling

- Install and develop at least five permanent monitoring wells.
- Collect one groundwater sample from each new monitoring well (plus QA/QC samples) for laboratory analysis to further evaluate groundwater quality.
- Survey and gauge newly-installed monitoring wells to evaluate groundwater elevations and flow direction.

Soil Vapor Sampling

- Install two soil vapor points to about 13 feet bgs (estimated depth of the future building cellar) or to about two feet above the groundwater table, whichever is shallower.
- Install two sub-slab soil vapor points to about two inches below the existing building slab.
- Collect one soil vapor sample from each soil vapor and sub-slab soil vapor point for laboratory analysis to evaluate the nature and extent of soil vapor contamination across the site.

The field investigation will be completed in accordance with the procedures specified in the Quality Assurance Project Plan (QAPP), Health and Safety Plan (HASP), and Community Air Monitoring Program (CAMP) included as Appendices B, C, and D, respectively.

The names, contact information and roles of the principal personnel who will participate in the investigation are listed below. Résumés for Langan employees involved in the project are included in the QAPP (Appendix B).

Personnel	Investigation Role	Contact Information
Mimi Raygorodetsky Langan Engineering	Project Director	Phone – 212-479-5441 Email – mraygorodetsky@langan.com
Gregory C. Wyka, PG Langan Engineering	Project Manager	Phone – 212-479-5476 Email – gwyka@langan.com
Jason Hayes, PE Langan Engineering	Project Engineer	Phone – 415-955-5219 Email – jahayes@langan.com
Tyler Goodnough Langan Engineering	Field Team Leader	Phone – 212-479-5712 Email – tgoodnough@langan.com
Tony Moffa, CHMM Langan Engineering	Langan Health & Safety Officer	Phone – 215-491-6500 Email – tmoffa@langan.com
Bill Bohrer, PG Langan Engineering	Field Safety Officer	Phone – 212-479-5533 Email – wbohrer@langan.com
Michael Burke, PG, CHMM Langan Engineering	Quality Assurance Officer	Phone – 212-479-5413 Email – mburke@langan.com
Lorraine Kelly Lakewood Environmental Services Corp.	Drilling Contractor	Phone – 631-257-5321 Email – lkelly@lakewoodenviro.com
Lea Sherman York Analytical Laboratories	Laboratory Contractor	Phone – 203-357-5752 Email – lsherman@yorklab.com
Joe Conboy Langan Engineering	Program Quality Assurance Monitor/ Data Validator	Phone – 609-282-8055 Email – jconboy@langan.com

3.1 Soil Investigation

3.1.1 Soil Boring Installation

The drilling subcontractor will advance 10 soil borings to further investigate the AOCs identified in Section 2.7 and supplement data generated during the March 2023 Soil Waste Characterization, February 2024 SIR, and September 2025 LSI. The borings will be advanced to at least 2 feet below the observed groundwater table, at least 2 feet below the termination of the non-native soil layer, or at least 2 feet below observed contamination, whichever is deeper. Soil borings to be converted to groundwater monitoring wells will be advanced to at least 5 feet below the observed groundwater table (i.e., about 12.5 to 17 feet bgs). A plan showing the proposed soil boring locations is included as Figure 4, and a summary of the proposed laboratory analyses for each sample is included as Table 2.

The soil borings will be advanced using direct-push drilling technology. The direct-push drill rig will be equipped with a closed-point or dual-tube Macro-Core sampler to prevent the collapse of sidewall material as borings are advanced. Langan personnel will document the work, screen soil

samples for environmental impacts, and collect representative environmental soil samples for laboratory analyses. Soil will be screened continuously to the boring termination depth for organic vapors with a PID equipped with a 10.6 electron volt (eV) bulb and for visual and olfactory evidence of environmental impacts (e.g., non-aqueous phase liquid, staining, odor). Recovered soil will be visually classified for color, grain size, texture, and moisture content, and will be recorded in a field log. Site operations will comply with the safety guidelines outlined in the HASP in Appendix C. Non-disposable, down-hole drilling equipment and sampling apparatus will be decontaminated between locations with Alconox and water. Water used for decontamination and rinsate will be containerized into United Nations/Department of Transportation (UN/DOT)-approved 55-gallon drums, labeled, and staged for off-site disposal.

3.1.2 Soil Sampling and Analysis

At least three and up to four grab soil samples will be collected for laboratory analysis from borings RI-SB01 through RI-SB010 to further investigate the AOCs. Samples will be collected as follows:

- One representative non-native soil sample will be collected from within the 0- to 5-foot bgs depth interval.
- One sample will be collected at the groundwater interface.
- One sample will be collected from the depth interval exhibiting the greatest degree of contamination, based on the presence of staining, odor, and/or PID readings above background. If no impacts are observed, the third sample will be collected from the native soil interval immediately below the non-native soil layer.
- Additional samples will be collected as necessary if further evidence of contamination is found.

Depending on the site conditions (e.g., non-native soil depth and presence/absence of impacts) and recovery, the number of collected samples may vary at each boring.

Soil samples will be collected in laboratory-supplied containers and sealed, labeled, and placed in a chilled cooler (to attempt to maintain a temperature of <4°C) for delivery to a NYSDOH Environmental Laboratory Approval Program (ELAP)-certified laboratory. Soil samples will be analyzed for one or more of the following parameters:

- Target Compound List (TCL) VOCs by United States Environmental Protection Agency (USEPA) Methods 8260C/5035
- TCL SVOCs (including 1,4-dioxane) by USEPA Method 8270D
- PCBs by USEPA Method 8082A
- TAL metals (including cyanide and hexavalent and trivalent chromium) by USEPA Methods 6010C/7471B/9010C/7196A

- Pesticides and herbicides by USEPA Methods 8081B and 8151A, respectively
- PFAS (40-compound list) by USEPA Method 1633
- 1,4-Dioxane via USEPA Method 8270 Selective Ion Monitoring (SIM)

The proposed RI soil samples are summarized in Table 2. QA/QC procedures to be followed and sampling frequency are described in the QAPP in Appendix B.

3.2 Groundwater Investigation

3.2.1 Monitoring Well Installation

At least five soil borings (RI-SB01 through RI-SB05) will be converted into permanent groundwater monitoring wells (RI-MW01 through RI-MW05). A plan showing the proposed well locations is included as Figure 4. If evidence of petroleum-like impacts (odors, staining, and/or PID readings) are observed in soil borings other than RI-SB01 through RI-SB05, they will also be converted to monitoring wells. Groundwater samples from the monitoring wells will be used to investigate the AOCs identified in Section 2.7 and supplement data generated during the September 2025 LSI.

Exterior wells will be constructed using 2-inch-diameter, threaded, flush-joint, polyvinyl chloride (PVC) casing, and 10-foot-long well screens that will terminate at least 5 feet below the observed groundwater table (anticipated between 7.5 and 12 feet bgs). The exterior wells will be installed within minimum 6-inch-diameter boreholes with a hollow stem auger to accommodate a 2-inch filter pack around the circumference of the well screen. Clean sand (e.g., Morie No. 2) will be used to fill the annulus around the screens up to about 2 feet above the top of the screened interval. Because access to the existing building cellar is limited, interior borings and wells will be advanced using a Geoprobe™ 420M limited access drill rig (or equivalent). Interior wells will be constructed using 1-inch-diameter, threaded, flush-joint, PVC casing, and 10-foot-long pre-packed well screens.

At the interior and exterior wells, a two-foot-thick bentonite seal will be installed above the sand pack, and the remaining borehole annulus will be backfilled with drill cuttings with no evidence of chemical or petroleum impacts (i.e., staining, odors, or PID readings above background conditions) to within 12 inches of the surface and grouted to the surface with a bentonite and cement slurry. The monitoring wells will be finished at the surface with flush-mounted access covers. Monitoring well construction details are summarized in Table 3.

After installation, the wells will be developed by surging using either a weighted bailer or surge block across the well screen and casing to agitate and remove fines. After surging, the well will be purged via pumping until the water becomes visually clear. The well will then be allowed to stabilize for a minimum of one week prior to sampling.

3.2.2 Groundwater Sampling and Analysis

Before sampling, the headspace of each well will be measured with a PID. Wells will be gauged with an interface probe to determine the depth to groundwater and thickness of any non-aqueous phase liquid (NAPL) after groundwater samples are collected and the water table elevation stabilizes to avoid potential cross contamination of PFAS. If NAPL is encountered, representative samples of the product will be collected for laboratory fingerprint analysis. Groundwater samples will not be collected from monitoring wells that contain NAPL.

One groundwater sample will be collected from each well in general accordance with NYSDEC DER-10 and USEPA's Low Flow Purging and Sampling Procedures for the Collection of Groundwater Samples from Monitoring Wells (EQASOP-GW4 Revised Sep. 2017) and the NYSDEC guidance for Sampling, Analysis, and Assessment of PFAS under NYSDEC's Part 375 Remedial Programs (April 2023).

Before the groundwater samples are collected, wells will be continuously purged until groundwater quality parameters (pH, conductivity, turbidity, dissolved oxygen, temperature, and oxidation-reduction potential) stabilize or the wells have been purged for one hour, whichever is sooner, in accordance with the USEPA low-flow guidance. A multi-parameter water quality system will be used to monitor the groundwater quality parameters during sampling. Samples will be collected with a peristaltic pump and dedicated polyethylene tubing. Groundwater samples will be collected at a maximum flow rate of 0.5 liters per minute. Development and purge water will be containerized into UN/DOT-approved 55-gallon drums, labeled, and staged for off-site disposal.

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

- TCL VOCs by USEPA Method 8260C
- TCL SVOCs by USEPA Method 8270D (1,4-dioxane by 8270 SIM isotope dilution)
- PCBs by USEPA Method 8082A
- TAL Metals (field-filtered and unfiltered) (including cyanide and hexavalent and trivalent chromium) by USEPA Method 6010C/7470
- Pesticides and herbicides by USEPA Methods 8081B and 8151A, respectively
- PFAS (40-compound list) by USEPA Method 1633
- 1,4-Dioxane via USEPA Method 8270 SIM

The proposed groundwater samples are summarized in Table 2. QA/QC sample collection procedures and sampling frequency are described in the QAPP in Appendix B.

3.2.3 Monitoring Well Survey and Synoptic Gauging

Langan will survey the vertical location of the monitoring wells, including ground surface elevation and the top of well casing to the nearest 0.01 foot. Vertical control will be established by surveying performed relative to the NAVD88 by a New York State-licensed land surveyor. The horizontal well locations will be established using field measurements. A synoptic gauging event will be performed after the new wells are installed to document static water levels across the site. The measurement will be used to prepare a groundwater elevation contour map.

3.3 Soil Vapor Investigation

3.3.1 Soil Vapor Point Installation

Two temporary soil vapor sample points (RI-SV01 and RI-SV02) and two temporary sub-slab soil vapor points (RI-SSV01 and RI-SSV02) will be installed using direct-push technology or with a roto-hammer drill in accordance with the NYSDOH's Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006, with updates through 2024). A plan showing the proposed soil vapor and sub-slab soil vapor sample point locations is included as Figure 4. As indicated in Table 2, soil vapor samples from each sampling location will be used to investigate and characterize the nature and extent of contamination associated with the AOCs identified in Section 2.7.

Soil vapor points will be installed by advancing a probe implant to about 13 feet bgs (anticipated maximum depth of the future building cellar) or to about two feet above the groundwater table, whichever is shallower. Sub-slab soil vapor points will be installed with a roto-hammer drill to about two inches below the existing building slab.

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

3.3.2 Soil Vapor Sampling and Analysis

Soil vapor samples will be collected in general accordance with the NYSDOH's Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006, with updates through February 2024). Before sample collection, a maximum of three vapor point volumes (i.e., the volume of the sample implant and tubing) will be purged from each sample location at a rate of less than 0.2 liters per minute using a RAE Systems MultiRAE meter set at a low flow setting. The purged vapor will be monitored for VOCs with the MultiRAE during purging.

A helium tracer gas will be used 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 prevent outdoor air infiltration.

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

After the integrity of each seal is confirmed, vapor samples will be collected into laboratory-supplied, batch-certified clean 2.7- or 6-liter Summa canisters with calibrated flow controllers. Vapor samples will be collected over a 2-hour sampling period and analyzed for VOCs by USEPA Method TO-15.

The proposed vapor samples are summarized in Table 2. QA/QC sample collection procedures and sampling frequency are described in the QAPP in Appendix B.

3.4 Sampling Contingency

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

3.5 Data Management and Validation

Laboratory analyses of soil, groundwater, and vapor samples will be conducted by a NYSDOH ELAP-approved laboratory in accordance with USEPA SW-846 methods, and the analytical data will be reported in 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) and/or email.

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 during the RI. The laboratory will provide sample bottles for the RI,

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 will take precedence.

Data validation will be performed on the RI and 2025 LSI data in accordance with the USEPA validation guidelines for organic and inorganic data review. Validation will include the following:

- Verification of QC sample results (qualitative and quantitative)
- Verification of sample results (positive hits and non-detects)
- Recalculation of 10 percent of all investigative sample results
- Preparation of data usability summary reports (DUSRs)

The DUSRs will be prepared and reviewed by the Program Quality Assurance Monitor (PQAM). The DUSRs will provide a detailed assessment of each sample delivery group (SDG) and 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. Additional details on the DUSRs are provided in the QAPP in Appendix B.

The results from the RI and LSI will be reported in NYSDEC ASP Category B deliverable format and validated by the Data Validator identified in the QAPP. The DUSRs from the RI and the LSI will be prepared and included as an appendix in the remedial investigation report (RIR).

3.6 Management of Investigation-Derived Waste

Soil cuttings will be returned to the boreholes unless:

- Free product or grossly contaminated soil, per 6 NYCRR NYSDEC Part 375, is present in the cuttings;
- Backfilling the borehole with cuttings will create a significant path for vertical movement of contaminants. Soil additives (bentonite) may be added to the cuttings to reduce permeability; and/or
- The soil volume is greater than that required to backfill the borehole.

Boreholes from which drill cuttings require disposal will be filled with hydrated bentonite chips or clean (e.g., No.2 Morie) sand and capped with asphalt or concrete. Grossly-contaminated or excess soil cuttings and purge water will be containerized and staged on-site, pending proper disposal at an off-site waste management facility. Soil cuttings with no apparent staining, odors, or PID readings above background conditions will be used to backfill boreholes. Soil to be disposed of off-site will be placed in 55-gallon, UN/DOT-approved drums. Decontamination fluids, if necessary, will be placed in UN/DOT-approved fluid drums with closed tops. Drums will be properly labeled, sealed, and characterized as necessary. Drums will be labeled as nonhazardous

waste pending analysis and stored in a manner to prevent contents from discharging to the environment. Investigative derived waste will be disposed of off-site at one or more selected disposal facilities. Management of investigation-derived waste (IDW) will comply with NYSDEC DER-10 3.3(e) and DER-31 (Section 3.11).

3.7 Air Monitoring

Air monitoring will be conducted for site personnel in accordance with the HASP and the community in accordance with the CAMP (Appendix D). Fugitive particulate (dust) generation that could affect site personnel or the public is not expected, because intrusive work is limited to boring, monitoring well, and vapor point installation, which does not disturb large volumes of soil.

Dust emissions will be monitored using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM10). Organic vapors will be monitored with a PID. Odors will be periodically monitored by site personnel at and beyond the site perimeter. Dust and odor suppression measures (e.g., water misting and odor suppressant) will be implemented as needed. All PIDs used will be equipped with a 10.6 eV bulb.

3.7.1 Personnel Air Monitoring

Langan will conduct air monitoring of the breathing zone periodically during drilling and sampling activities to evaluate health and safety protection for the Langan field personnel. Initially, ambient air monitoring will be performed within the work area. Langan will monitor VOCs with a PID (MultiRAE 3000 or similar) in accordance with the HASP (Appendix C). If air monitoring during intrusive operations identifies the presence of VOCs, on-site personnel 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 be continued until the levels drop to safe limits. At that time, work can resume with continued monitoring. If concentrations continue to exceed action levels, field activities will be halted and the work relocated to another area. If dust emissions are observed, work will stop and dust suppression measures will be used.

3.7.2 Community Air Monitoring Plan

In addition to air monitoring in the worker breathing zone, Langan will conduct community air monitoring in compliance with the NYSDOH Generic CAMP. CAMP deployment will comply with NYSDEC DER-10 Appendix 1A and Appendix 1B.

Langan will also conduct continuous monitoring for VOCs and dust during ground-intrusive work (i.e., soil boring advancement and monitoring well installation). During ground-intrusive work, Langan will measure upwind concentrations at the start of each workday to establish background concentrations. Langan will monitor VOCs and dust at the upwind and downwind perimeter of the work zone; the downwind monitoring station will be established at a point on the site where the general public or site employees may be present. Monitoring for VOCs will be conducted

with a PID. Dust emissions will be monitored using real-time monitoring equipment capable of measuring PM₁₀ (e.g., DustTrak). If dust emissions are observed above the action levels defined in the CAMP, work will stop and dust suppression measures will be used. Odors will be periodically monitored by site personnel at and beyond the site perimeter.

Langan will conduct periodic monitoring for VOCs during non-intrusive work (e.g., the collection of groundwater samples). Periodic monitoring may include obtaining measurements upon arrival at a location, when opening a monitoring well cap, when bailing/purging a well, and upon departure from a location.

3.8 Qualitative Human Health Exposure Assessment

A Qualitative Human Health Exposure Assessment (QHHEA) 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 RIR.

3.9 Fish and Wildlife Resources Impact Analysis

A Fish and Wildlife Resources Impact Analysis (FWRIA) screening-level review will be conducted in accordance with Section 3.10 and Appendix 3C of the NYSDEC DER-10, Technical Guidance for Site Investigation and Remediation. If necessary, based on the results of the screening-level review, a full FWRIA will be performed. The assessment will be included in the RIR.

3.10 Green and Sustainable Remediation

Green remediation principles and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per the NYSDEC DER-31 Green Remediation Policy (DER-31). DER-31 requires the following green remediation/sustainability concepts be considered and/or implemented, to the extent feasible, during investigations:

- Increase energy efficiency/minimize total energy use and direct and indirect CO₂/greenhouse gas (GHG) emissions to the atmosphere
- Reduce emissions of air pollutants
- Minimize habitat disturbance and create or enhance habitat or usable land
- Conserve natural resources such as soil and water; promote the sequestration of carbon through reforestation or afforestation
- Minimize freshwater consumption and maximize water reuse during daily operations and treatment processes
- Prevent long-term erosion, surface runoff, and off-site water quality impacts; prevent unintended soil compaction
- Minimize waste or implement beneficial use of materials that would otherwise be considered a waste

- Minimize equipment and truck idling and use sustainably produced biofuels to reduce discharges of pollutants and GHGs to the atmosphere
- Utilize clean diesel (new or retrofitted) equipment to reduce emissions to the atmosphere
- Minimize truck travel for disposal to save energy, reduce emissions, reduce localized noise, vibration, and wear and tear on roads
- Minimize use of heavy equipment to save energy and reduce emissions

During implementation of this RIWP, the following elements will be incorporated, to the extent feasible, to reduce GHGs and other emissions:

- Use of Ultra Low Sulfur Diesel in vehicles and machinery by drilling contractor
- Use of diesel exhaust purifier scrubbers on machinery (drill rigs) by drilling contractor
- Minimization of idling of all vehicles (including construction equipment) in accordance with 6 NYCRR Part 217 Motor Vehicle Emissions, Subpart 217-3 Idling Prohibition for Heavy Duty Vehicles
- Reduction of materials consumption and off-site transport by reuse of non-impacted drilling spoils as backfill within the boring of origin and containerization of drilling spoils exhibiting visual, olfactory, and instrumental signs of contamination.
- Site workers in New York City will use public transportation to the extent feasible for commuting in lieu of personal vehicles.

3.11 Environmental Footprint Analysis

To evaluate the investigation with respect to green and sustainable remediation (GSR) principles, an environmental footprint analysis was conducted using SiteWise™. The results of the environmental footprint analysis are provided in Appendix E and detailed below.

The following metrics were quantified:

- Greenhouse Gas Emissions
- Total Energy Used
- Water Consumption
- Electrical Usage
- Onsite Nitrogen Oxides (NOx) Emissions
- Onsite Sulphur Oxides (SOx) Emissions
- Total NOx Emissions
- Total SOx Emissions
- Total PM10 Emissions

Using the above identified information, the SiteWise™ model estimated the following emissions and total energy usage:

Emissions and Energy Usage	Quantity (based on assumptions)
GHG Emissions (metric ton)	17
Total Energy Used (million british thermal unit [MMBTU])	320
Water Consumption (gallons)	150
Electricity Usage (megawatt hours [MWH])	0.0
Onsite NO _x Emissions (metric ton)	0.0013
Onsite SO _x Emissions (metric ton)	0.00013
Onsite PM10 Emissions (metric ton)	0.00012
Total NO _x Emissions (metric ton)	0.078
Total SO _x Emissions (metric ton)	0.058
Total PM10 Emissions (metric ton)	0.0066

A climate screening assessment was also conducted for the investigation and is provided in Appendix F.

3.12 Waste Characterization Sampling

Waste characterization soil sampling, which may warrant advancement of additional soil borings, may be implemented concurrently with the RI to provide data that supports off-site disposal of soil during site remediation/development. Soil samples will be collected at a frequency consistent with the requirements of many disposal facilities that receive soil from NYC sites. Waste characterization methodology and analytical results will be summarized in a separate waste characterization report, which will be included as an appendix in the Final Engineering Report (FER), following implementation of the forthcoming Remedial Action Work Plan (RAWP).

4.0 Reporting

4.1 Daily Reports

Daily reports will be prepared and submitted to the NYSDEC and NYSDOH project managers the following day 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 any exceedances
- An explanation of notable site conditions
- A list of anticipated work for the following reporting day
- Complaints received (if any)

4.2 Remedial Investigation Report

Following completion of the RI and receipt of analytical data, an RIR will be prepared in accordance with the applicable requirements of DER-10 Section 3.14. The report will include:

- (1) A summary of the site history and previous investigations
- (2) A description of site conditions and the remedial investigation
- (3) Sampling methodology and field observations
- (4) Evaluation of the results and findings
- (5) Conclusions
- (6) Recommendations for any further assessment, if warranted

The report will summarize the nature and extent of contamination for each AOC and identify complete and potentially complete exposure pathways (as determined through the QHHEA). DUSRs will be included in the RIR and electronic data deliverables will be submitted to the NYSDEC EQulS 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 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 vapor points; sample concentrations above SCGs for each media; and groundwater elevation contours and flow direction.

Soil analytical results will be compared to the UU, PGW, and RURR SCOs and the guidance values set forth in the NYSDEC Part 375 Remedial Programs guidance for Sampling, Analysis, and Assessment of PFAS (April 2023). Groundwater analytical results will be compared to the NYSDEC Standards and Guidance Values for Class GA water. Soil vapor results will be tabulated.

The RIR will be provided in an electronic format to the NYSDEC.

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5.0 SCHEDULE

A preliminary BCP schedule through RAWP submission for the site is provided as Appendix G. If the schedule changes, it will be updated and submitted to the NYSDEC.

DRAFT

TABLES

Table 1
Remedial Investigation Work Plan
Previous Analytical Results

RBEC1
441 West 26th Street
New York, New York
Langan Project No.: 170930902

Analyte	CAS Number	NYSDEC Part 375 Unrestricted Use SCOs	NYSDEC Part 375 Protection of Groundwater SCOs	NYSDEC Part 375 Restricted Use Restricted- Residential SCOs	Location	SB01	SB01	SB01	SB02	SB02	SB03	SB03	SB03	SB04	SB04	SB04
					Sample Name	SB01_2-4	SB01_6-8	SB01_11-13	SB02_3-5	SB02_5-7	SB03_2-4	SB03_5-7	SB03_10-12	SB04_2-4	SB04_5-7	SB04_11-13
					Sample Date	08/13/2025	08/13/2025	08/13/2025	08/13/2025	08/14/2025	08/14/2025	08/14/2025	08/14/2025	08/14/2025	08/14/2025	08/14/2025
					Sample Depth	2-4	6-8	11-13	3-5	5-7	2-4	5-7	10-12	2-4	5-7	11-13
					Unit	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	
Volatile Organic Compounds																
1,1,1,2-Tetrachloroethane	630-20-6	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
1,1,1-Trichloroethane	71-55-6	0.68	0.68	100	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
1,1,2,2-Tetrachloroethane	79-34-5	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
1,1,2-Trichloroethane	79-00-5	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
1,1-Dichloroethane	75-34-3	0.27	0.27	26	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
1,1-Dichloroethene	75-35-4	0.33	0.33	100	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
1,2,3-Trichlorobenzene	87-61-6	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
1,2,3-Trichloropropane	96-18-4	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
1,2,4-Trichlorobenzene	120-82-1	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
1,2,4-Trimethylbenzene	95-63-6	3.6	3.6	52	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
1,2-Dibromo-3-Chloropropane	96-12-8	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
1,2-Dibromomethane (Ethylene Dibromide)	106-93-4	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
1,2-Dichlorobenzene	95-50-1	1.1	1.1	100	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
1,2-Dichloroethane	107-06-2	0.02	0.02	3.1	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
1,2-Dichloropropane	78-87-5	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	8.4	8.4	52	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
1,3-Dichlorobenzene	541-73-1	2.4	2.4	49	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
1,4-Dichlorobenzene	106-46-7	1.8	1.8	13	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
2-Hexanone (MBK)	591-78-6	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
Acetone	67-64-1	0.05	0.05	100	mg/kg	<0.014 U	<0.01 U	<0.011 U	<0.01 U	<0.0099 U	<0.009 U	0.0087 J	<0.012 U	0.0078 J	0.011 J	<0.0092 U
Acrolein	107-02-8	NS	NS	NS	mg/kg	<0.014 U	<0.01 U	<0.011 U	<0.01 U	<0.0099 U	<0.009 U	<0.012 U	<0.0095 U	<0.012 U	<0.0092 U	<0.0092 U
Acrylonitrile	107-13-1	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
Benzene	71-43-2	0.06	0.06	4.8	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
Bromochloromethane	74-97-5	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
Bromodichloromethane	75-27-4	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
Bromoform	75-25-2	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
Bromomethane	74-83-9	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
Carbon Disulfide	75-15-0	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
Carbon Tetrachloride	56-23-5	0.76	0.76	2.4	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
Chlorobenzene	108-90-7	1.1	1.1	100	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
Chloroethane	75-00-3	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
Chloroform	67-66-3	0.37	0.37	49	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
Chloromethane	74-87-3	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
Cis-1,2-Dichloroethene	156-59-2	0.25	0.25	100	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
Cis-1,3-Dichloropropene	10061-01-5	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
Cyclohexane	110-82-7	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
Cymene	99-87-6	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
Dibromochloromethane	124-48-1	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0045 U	<0.006 U	<0.0062 U	<0.0048 U	<0.006 U	<0.0046 U
Dibromomethane	74-95-3	NS	NS	NS	mg/kg	<0.007 U	<0.0052 U	<0.0055 U	<0.0052 U	<0.0049 U	<0.0					

Table 1
Remedial Investigation Work Plan
Previous Analytical Results

RBEC1
441 West 26th Street
New York, New York
Langan Project No.: 170930902

Analyte	CAS Number	NYSDEC Part 375 Unrestricted Use SCOs	NYSDEC Part 375 Protection of Groundwater SCOs	NYSDEC Part 375 Restricted Use Restricted- Residential SCOs	Location	SB05	SB05	SB05	SB06	SB06	SB07	SB07	SB08	SB08	SB08	SB09	SB09	SB09
					Sample Name	SB05_3-5	SB05_10-12	SB05_15-17	SB06_0-2	SB06_5-7	SB07_0-2	SB07_6-8	SB08_1-3	SB08_5-7	SB08_10-12	SB09_1-3	SODUP01_081325	SB09_10-12
					Sample Date	08/14/2025	08/14/2025	08/14/2025	08/14/2025	08/14/2025	08/14/2025	08/14/2025	08/13/2025	08/13/2025	08/13/2025	08/13/2025	08/13/2025	08/13/2025
					Sample Depth	3-5	10-12	15-17	0-2	5-7	0-2	6-8	1-3	5-7	10-12	1-3	1-3	10-12
					Unit	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	
Volatile Organic Compounds																		
1,1,1,2-Tetrachloroethane	630-20-6	NS	NS	NS	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
1,1,1-Trichloroethane	71-55-6	0.68	0.68	100	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
1,1,2,2-Tetrachloroethane	79-34-5	NS	NS	NS	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	NS	NS	NS	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
1,1,2-Trichloroethane	79-00-5	NS	NS	NS	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
1,1-Dichloroethane	75-34-3	0.27	0.27	26	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
1,1-Dichloroethene	75-35-4	0.33	0.33	100	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
1,2,3-Trichlorobenzene	87-61-6	NS	NS	NS	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
1,2,3-Trichloropropane	96-18-4	NS	NS	NS	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
1,2,4-Trichlorobenzene	120-82-1	NS	NS	NS	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
1,2,4-Trimethylbenzene	95-63-6	3.6	3.6	52	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
1,2-Dibromo-3-Chloropropane	96-12-8	NS	NS	NS	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	NS	NS	NS	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
1,2-Dichlorobenzene	95-50-1	1.1	1.1	100	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
1,2-Dichloroethane	107-06-2	0.02	0.02	3.1	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
1,2-Dichloropropane	78-87-5	NS	NS	NS	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	8.4	8.4	52	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
1,3-Dichlorobenzene	541-73-1	2.4	2.4	49	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
1,4-Dichlorobenzene	106-46-7	1.8	1.8	13	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
2-Hexanone (MBK)	591-78-6	NS	NS	NS	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
Acetone	67-64-1	0.05	0.05	100	mg/kg	0.014	0.029	0.0099	<0.009 U	<0.0099 U	<0.012 U	0.0077 J	<0.013 U	<0.018 U	<0.0093 U	<0.0098 U	<0.012 U	<0.011 U
Acrolein	107-02-8	NS	NS	NS	mg/kg	<0.0099 U	<0.01 U	<0.0082 U	<0.009 U	<0.0099 U	<0.012 U	<0.01 U	<0.013 U	<0.018 U	<0.0093 U	<0.0098 U	<0.012 U	<0.011 U
Acrylonitrile	107-13-1	NS	NS	NS	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
Benzene	71-43-2	0.06	0.06	4.8	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
Bromochloromethane	74-97-5	NS	NS	NS	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
Bromodichloromethane	75-27-4	NS	NS	NS	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
Bromoform	75-25-2	NS	NS	NS	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
Bromomethane	74-83-9	NS	NS	NS	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
Carbon Disulfide	75-15-0	NS	NS	NS	mg/kg	<0.005 U	0.0047 J	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
Carbon Tetrachloride	56-23-5	0.76	0.76	2.4	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
Chlorobenzene	108-90-7	1.1	1.1	100	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
Chloroethane	75-00-3	NS	NS	NS	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
Chloroform	67-66-3	0.37	0.37	49	mg/kg	<0.005 U	<0.005 U	<0.0041 U	<0.0045 U	<0.0049 U	<0.0058 U	<0.0051 U	<0.0066 U	<0.009 U	<0.0046 U	<0.0049 U	<0.0058 U	<0.0054 U
Chloromethane	74-87-3	NS	NS	NS														

Table 1
Remedial Investigation Work Plan
Previous Analytical Results

RBEC1
441 West 26th Street
New York, New York
Langan Project No.: 170930902

Analyte	CAS Number	NYSDEC Part 375 Unrestricted Use SCOs	NYSDEC Part 375 Protection of Groundwater SCOs	NYSDEC Part 375 Restricted Use Restricted- Residential SCOs	Location	SB01	SB01	SB01	SB02	SB02	SB03	SB03	SB03	SB04	SB04	SB04
					Sample Name	SB01_2-4	SB01_6-8	SB01_11-13	SB02_3-5	SB02_5-7	SB03_2-4	SB03_5-7	SB03_10-12	SB04_2-4	SB04_5-7	SB04_11-13
					Sample Date	08/13/2025	08/13/2025	08/13/2025	08/13/2025	08/13/2025	08/14/2025	08/14/2025	08/14/2025	08/14/2025	08/14/2025	08/14/2025
					Sample Depth	2-4	6-8	11-13	3-5	5-7	2-4	5-7	10-12	2-4	5-7	11-13
Unit						Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	
Semi-Volatile Organic Compounds																
1,2,4,5-Tetrachlorobenzene	95-94-3	NS	NS	NS	mg/kg	<0.201 U	<0.179 U	<0.199 U	<0.177 U	<0.17 U	<0.169 U	<0.171 U	<0.175 U	<0.181 U	<9.06 U	<0.187 U
1,2,4-Trichlorobenzene	120-82-1	NS	NS	NS	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
1,2-Dichlorobenzene	95-50-1	1.1	1.1	100	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
1,2-Diphenylhydrazine	122-66-7	NS	NS	NS	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
1,3-Dichlorobenzene	541-73-1	2.4	2.4	49	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
1,4-Dichlorobenzene	106-46-7	1.8	1.8	13	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
1,4-Dioxane (P-Dioxane)	123-91-1	0.1	0.1	13	mg/kg	<0.0185 U	<0.0198 U	<0.0196 U	<0.0183 U	<0.0198 U	<0.0183 U	<0.0198 U	<0.0196 U	<0.0198 U	<0.0198 U	<0.0194 U
2,3,4,6-Tetrachlorophenol	58-90-2	NS	NS	NS	mg/kg	<0.201 U	<0.179 U	<0.199 U	<0.177 U	<0.17 U	<0.169 U	<0.171 U	<0.175 U	<0.181 U	<9.06 U	<0.187 U
2,4,5-Trichlorophenol	95-95-4	NS	NS	NS	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
2,4,6-Trichlorophenol	88-06-2	NS	NS	NS	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
2,4-Dichlorophenol	120-83-2	NS	NS	NS	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
2,4-Dimethylphenol	105-67-9	NS	NS	NS	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
2,4-Dinitrophenol	51-28-5	NS	NS	NS	mg/kg	<0.201 U	<0.179 U	<0.199 U	<0.177 U	<0.17 U	<0.169 U	<0.171 U	<0.175 U	<0.181 U	<9.06 U	<0.187 U
2,4-Dinitrotoluene	121-14-2	NS	NS	NS	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
2,6-Dinitrotoluene	606-20-2	NS	NS	NS	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
2-Chloronaphthalene	91-58-7	NS	NS	NS	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
2-Chlorophenol	95-57-8	NS	NS	NS	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
2-Methylnaphthalene	91-57-6	NS	NS	NS	mg/kg	<0.1 U	0.0646 JD	<0.0994 U	0.286 D	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	12.7 D	<0.0936 U
2-Methylphenol (o-Cresol)	95-48-7	0.33	0.33	100	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
2-Nitroaniline	88-74-4	NS	NS	NS	mg/kg	<0.201 U	<0.179 U	<0.199 U	<0.177 U	<0.17 U	<0.169 U	<0.171 U	<0.175 U	<0.181 U	<9.06 U	<0.187 U
2-Nitrophenol	88-75-5	NS	NS	NS	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
3 & 4 Methylphenol (m&p Cresol)	65794-96-9	0.33	0.33	100	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
3,3'-Dichlorobenzidine	91-94-1	NS	NS	NS	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
3-Nitroaniline	99-09-2	NS	NS	NS	mg/kg	<0.201 U	<0.179 U	<0.199 U	<0.177 U	<0.17 U	<0.169 U	<0.171 U	<0.175 U	<0.181 U	<9.06 U	<0.187 U
4,6-Dinitro-2-Methylphenol	534-52-1	NS	NS	NS	mg/kg	<0.201 U	<0.179 U	<0.199 U	<0.177 U	<0.17 U	<0.169 U	<0.171 U	<0.175 U	<0.181 U	<9.06 U	<0.187 U
4-Bromophenyl Phenyl Ether	101-55-3	NS	NS	NS	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
4-Chloro-3-Methylphenol	59-50-7	NS	NS	NS	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
4-Chloroaniline	106-47-8	NS	NS	NS	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
4-Chlorophenyl Phenyl Ether	7005-72-3	NS	NS	NS	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
4-Nitroaniline	100-01-6	NS	NS	NS	mg/kg	<0.201 U	<0.179 U	<0.199 U	<0.177 U	<0.17 U	<0.169 U	<0.171 U	<0.175 U	<0.181 U	<9.06 U	<0.187 U
4-Nitrophenol	100-02-7	NS	NS	NS	mg/kg	<0.201 U	<0.179 U	<0.199 U	<0.177 U	<0.17 U	<0.169 U	<0.171 U	<0.175 U	<0.181 U	<9.06 U	<0.187 U
Acenaphthene	83-32-9	20	98	100	mg/kg	<0.1 U	0.248 D	<0.0994 U	0.339 D	0.0788 JD	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	30.2 D	<0.0936 U
Acenaphthylene	208-96-8	100	107	100	mg/kg	<0.1 U	0.35 D	<0.0994 U	0.421 D	0.116 D	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	10.3 D	<0.0936 U
Acetophenone	98-86-2	NS	NS	NS	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
Aniline (Phenylamine, Aminobenzene)	62-53-3	NS	NS	NS	mg/kg	<0.402 U	<0.36 U	<0.398 U	<0.354 U	<0.34 U	<0.339 U	<0.343 U	<0.352 U	<0.363 U	<18.2 U	<0.375 U
Anthracene	120-12-7	100	1000	100	mg/kg	<0.1 U	0.807 D	<0.0994 U	1.57 D	0.414 D	<0.0847 U	0.0459 JD	<0.0878 U	0.0812 JD	39.6 D	<0.0936 U
Atrazine	1912-24-9	NS	NS	NS	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
Benzaldehyde	100-52-7	NS	NS	NS	mg/kg	<0.1 U	<0.0898 U	<0.0994 U	<0.0884 U	<0.0849 U	<0.0847 U	<0.0856 U	<0.0878 U	<0.0907 U	<4.53 U	<0.0936 U
Benzidine	92-87-5	NS	NS	NS	mg/kg	<0.402 U	&									

Table 1
Remedial Investigation Work Plan
Previous Analytical Results

RBEC1
441 West 26th Street
New York, New York
Langan Project No.: 170930902

Analyte	CAS Number	NYSDEC Part 375 Unrestricted Use SCOs	NYSDEC Part 375 Protection of Groundwater SCOs	NYSDEC Part 375 Restricted Use Restricted-Residential SCOs	Location	SB05	SB05	SB05	SB06	SB06	SB07	SB07	SB08	SB08	SB08	SB09	SB09	SB09
					Sample Name	SB05_3-5	SB05_10-12	SB05_15-17	SB06_0-2	SB06_5-7	SB07_0-2	SB07_6-8	SB08_1-3	SB08_5-7	SB08_10-12	SB09_1-3	SODUP01_081325	SB09_10-12
					Sample Date	08/14/2025	08/14/2025	08/14/2025	08/14/2025	08/14/2025	08/14/2025	08/14/2025	08/13/2025	08/13/2025	08/13/2025	08/13/2025	08/13/2025	08/13/2025
					Sample Depth	3-5	10-12	15-17	0-2	5-7	0-2	6-8	1-3	5-7	10-12	1-3	1-3	10-12
					Unit	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Semi-Volatile Organic Compounds																		
1,2,4,5-Tetrachlorobenzene	95-94-3	NS	NS	NS	mg/kg	<0.173 U	<0.193 U	<0.183 U	<0.18 U	<0.187 U	<0.169 U	<0.194 U	<0.174 U	<0.18 U	<0.183 U	<0.175 U	<0.172 U	<0.204 U
1,2,4-Trichlorobenzene	120-82-1	NS	NS	NS	mg/kg	<0.0867 U	<0.0968 U	<0.0915 U	<0.0901 U	<0.0937 U	<0.0846 U	<0.097 U	<0.0872 U	<0.0901 U	<0.0918 U	<0.0878 U	<0.0861 U	<0.102 U
1,2-Dichlorobenzene	95-50-1	1.1	1.1	100	mg/kg	<0.0867 U	<0.0968 U	<0.0915 U	<0.0901 U	<0.0937 U	<0.0846 U	<0.097 U	<0.0872 U	<0.0901 U	<0.0918 U	<0.0878 U	<0.0861 U	<0.102 U
1,2-Diphenylhydrazine	122-66-7	NS	NS	NS	mg/kg	<0.0867 U	<0.0968 U	<0.0915 U	<0.0901 U	<0.0937 U	<0.0846 U	<0.097 U	<0.0872 U	<0.0901 U	<0.0918 U	<0.0878 U	<0.0861 U	<0.102 U
1,3-Dichlorobenzene	541-73-1	2.4	2.4	49	mg/kg	<0.0867 U	<0.0968 U	<0.0915 U	<0.0901 U	<0.0937 U	<0.0846 U	<0.097 U	<0.0872 U	<0.0901 U	<0.0918 U	<0.0878 U	<0.0861 U	<0.102 U
1,4-Dichlorobenzene	106-46-7	1.8	1.8	13	mg/kg	<0.0867 U	<0.0968 U	<0.0915 U	<0.0901 U	<0.0937 U	<0.0846 U	<0.097 U	<0.0872 U	<0.0901 U	<0.0918 U	<0.0878 U	<0.0861 U	<0.102 U
1,4-Dioxane (P-Dioxane)	123-91-1	0.1	0.1	13	mg/kg	<0.0187 U	<0.0187 U	<0.0348 U	<0.0198 U	<0.0187 U	<0.0198 U	<0.0198 U	<0.0198 U	<0.0198 U	<0.0198 U	<0.0187 U	<0.0187 U	<0.0189 U
2,3,4,6-Tetrachlorophenol	58-90-2	NS	NS	NS	mg/kg	<0.173 U	<0.193 U	<0.183 U	<0.18 U	<0.187 U	<0.169 U	<0.194 U	<0.174 U	<0.18 U	<0.183 U	<0.175 U	<0.172 U	<0.204 U
2,4,5-Trichlorophenol	95-95-4	NS	NS	NS	mg/kg	<0.0867 U	<0.0968 U	<0.0915 U	<0.0901 U	<0.0937 U	<0.0846 U	<0.097 U	<0.0872 U	<0.0901 U	<0.0918 U	<0.0878 U	<0.0861 U	<0.102 U
2,4,6-Trichlorophenol	88-06-2	NS	NS	NS	mg/kg	<0.0867 U	<0.0968 U	<0.0915 U	<0.0901 U	<0.0937 U	<0.0846 U	<0.097 U	<0.0872 U	<0.0901 U	<0.0918 U	<0.0878 U	<0.0861 U	<0.102 U
2,4-Dichlorophenol	120-83-2	NS	NS	NS	mg/kg	<0.0867 U	<0.0968 U	<0.0915 U	<0.0901 U	<0.0937 U	<0.0846 U	<0.097 U	<0.0872 U	<0.0901 U	<0.0918 U	<0.0878 U	<0.0861 U	<0.102 U
2,4-Dimethylphenol	105-67-9	NS	NS	NS	mg/kg	<0.0867 U	<0.0968 U	<0.0915 U	<0.0901 U	<0.0937 U	<0.0846 U	<0.097 U	<0.0872 U	<0.0901 U	<0.0918 U	<0.0878 U	<0.0861 U	<0.102 U
2,4-Dinitrophenol	51-28-5	NS	NS	NS	mg/kg	<0.173 U	<0.193 U	<0.183 U	<0.18 U	<0.187 U	<0.169 U	<0.194 U	<0.174 U	<0.18 U	<0.183 U	<0.175 U	<0.172 U	<0.204 U
2,4-Dinitrotoluene	121-14-2	NS	NS	NS	mg/kg	<0.0867 U	<0.0968 U	<0.0915 U	<0.0901 U	<0.0937 U	<0.0846 U	<0.097 U	<0.0872 U	<0.0901 U	<0.0918 U	<0.0878 U	<0.0861 U	<0.102 U
2,6-Dinitrotoluene	606-20-2	NS	NS	NS	mg/kg	<0.0867 U	0.135 D	<0.0915 U	<0.0901 U	<0.0937 U	<0.0846 U	<0.097 U	<0.0872 U	<0.0901 U	<0.0918 U	<0.0878 U	<0.0861 U	<0.102 U
2-Chloronaphthalene	91-58-7	NS	NS	NS	mg/kg	<0.0867 U	<0.0968 U	<0.0915 U	<0.0901 U	<0.0937 U	<0.0846 U	<0.097 U	<0.0872 U	<0.0901 U	<0.0918 U	<0.0878 U	<0.0861 U	<0.102 U
2-Chlorophenol	95-57-8	NS	NS	NS	mg/kg	<0.0867 U	<0.0968 U	<0.0915 U	<0.0901 U	<0.0937 U	<0.0846 U	<0.097 U	<0.0872 U	<0.0901 U	<0.0918 U	<0.0878 U	<0.0861 U	<0.102 U
2-Methylnaphthalene	91-57-6	NS	NS	NS	mg/kg	<0.0867 U	<0.0968 U	<0.0915 U	<0.0901 U	<0.0937 U	<0.0846 U	<0.097 U	<0.0872 U	<0.0901 U	<0.0918 U	<0.0878 U	<0.0861 U	<0.102 U
2-Methylphenol (o-Cresol)	95-48-7	0.33	0.33	100	mg/kg	<0.0867 U	<0.0968 U	<0.0915 U	<0.0901 U	<0.0937 U	<0.0846 U	<0.097 U	<0.0872 U	<0.0901 U	<0.0918 U	<0.0878 U	<0.0861 U	<0.102 U
2-Nitroaniline	88-74-4	NS	NS	NS	mg/kg	<0.173 U	<0.193 U	<0.183 U	<0.18 U	<0.187 U	<0.169 U	<0.194 U	<0.174 U	<0.18 U	<0.183 U	<0.175 U	<0.172 U	<0.204 U
2-Nitrophenol	88-75-5	NS	NS	NS	mg/kg	<0.0867 U	<0.0968 U	<0.0915 U	<0.0901 U	<0.0937 U	<0.0846 U	<0.097 U	<0.0872 U	<0.0901 U	<0.0918 U	<0.0878 U	<0.0861 U	<0.102 U
3 & 4 Methylphenol (m&p Cresol)	65794-96-9	0.33	0.33	100	mg/kg	<0.0867 U	<0.0968 U	<0.0915 U	<0.0901 U	<0.0937 U	<0.0846 U	<0.097 U	<0.0872 U	<0.0901 U	<0.0918 U	<0.0878 U	<0.0861 U	<0.102 U
3,3'-Dichlorobenzidine	91-94-1	NS	NS	NS	mg/kg	<0.0867 U	<0.0968 U	<0.0915 U	<0.0901 U	<0.0937 U	<0.0846 U	<0.097 U	<0.0872 U	<0.0901 U	<0.0918 U	<0.0878 U	<0.0861 U	<0.102 U
3-Nitroaniline	99-09-2	NS	NS	NS	mg/kg	<0.173 U	<0.193 U	<0.183 U	<0.18 U	<0.187 U	<0.169 U	<0.194 U	<0.174 U	<0.18 U	<0.183 U	<0.175 U	<0.172 U	<0.204 U
4,6-Dinitro-2-Methylphenol	534-52-1	NS	NS	NS	mg/kg	<0.173 U	<0.193 U	<0.183 U	<0.18 U	<0.187 U	<0.169 U	<0.194 U	<0.174 U	<0.18 U	<0.183 U	<0.175 U	<0.172 U	<0.204 U
4-Bromophenyl Phenyl Ether	101-55-3	NS	NS	NS	mg/kg	<0.0867 U	<0.0968 U	<0.0915 U	<0.0901 U	<0.0937 U	<0.0846 U	<0.097 U	<0.0872 U	<0.0901 U	<0.0918 U	<0.0878 U	<0.0861 U	<0.102 U
4-Chloro-3-Methylphenol	59-50-7	NS	NS	NS	mg/kg	<0.0867 U	<0.0968 U	<0.0915 U	<0.0901 U	<0.0937 U	<0.0846 U	<0.097 U	<0.0872 U	<0.0901 U	<0.0918 U	<0.0878 U	<0.0861 U	<0.102 U
4-Chloroaniline	106-47-8	NS	NS	NS	mg/kg	<0.0867 U	<0.0968 U	<0.0915 U	<0.0901 U	<0.0937 U	<0.0846 U	<0.097 U	<0.0872 U	<0.0901 U	<0.0918 U	<0.0878 U	<0.0861 U	<0.102 U
4-Chlorophenyl Phenyl Ether	7005-72-3	NS	NS	NS	mg/kg	<0.0867 U	<0.0968 U	<0.0915 U	<0.0901 U	<0.0937 U	<0.0846 U	<0.097 U	<0.0872 U	<0.0901 U	<0.0918 U	<0.0878 U	<0.0861 U	<0.102 U
4-Nitroaniline	100-01-6	NS	NS	NS	mg/kg	<0.173 U	<0.193 U	<0.183 U	<0.18 U	<0.187 U	<0.169 U	<0.194 U	<0.174 U	<0.18 U	<0.183 U	<0.175 U	<0.172 U	<0.204 U
4-Nitrophenol	100-02-7	NS	NS	NS	mg/kg	<0.173 U	<0.193 U	<0.183 U	<0.18 U	<0.187 U	<0.169 U	<0.194 U	<0.174 U	<0.18 U	<0.183 U	<0.175 U	<0.172 U	<0.204 U
Acenaphthene	83-32-9	20	98	100	mg/kg	<0.0867 U</												

Table 1 Remedial Investigation Work Plan Previous Analytical Results																			Page 6 of 7
RBEC1 441 West 26th Street New York, New York Langan Project No.: 170930902																			
Analyte	CAS Number	NYSDEC Part 375 Unrestricted Use SCOs	NYSDEC Part 375 Protection of Groundwater SCOs	NYSDEC Part 375 Restricted Use Restricted- Residential SCOs	Location	SB05	SB05	SB05	SB06	SB06	SB07	SB07	SB08	SB08	SB08	SB09	SB09	SB09	
					Sample Name	SB05_3-5	SB05_10-12	SB05_15-17	SB06_0-2	SB06_5-7	SB07_0-2	SB07_6-8	SB08_1-3	SB08_5-7	SB08_10-12	SB09_1-3	SODUP01_081325	SB09_10-12	
					Sample Date	08/14/2025	08/14/2025	08/14/2025	08/14/2025	08/14/2025	08/14/2025	08/14/2025	08/13/2025	08/13/2025	08/13/2025	08/13/2025	08/13/2025	08/13/2025	
					Sample Depth	3-5	10-12	15-17	0-2	5-7	0-2	6-8	1-3	5-7	10-12	1-3	1-3	10-12	
					Unit	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	
Pesticides																			
4,4'-DDD	72-54-8	0.0033	14	13	mg/kg	<0.00174 U	<0.00195 U	<0.00184 U	<0.00181 U	0.0024 D	0.00929 D	<0.00193 U	<0.00175 U	<0.00181 U	<0.00184 U	<0.00174 U	<0.00173 U	<0.00205 U	
4,4'-DDE	72-55-9	0.0033	17	8.9	mg/kg	0.00184 D	<0.00195 U	<0.00184 U	0.00807 D	0.0296 D	0.0979 D	<0.00193 U	<0.00175 U	<0.00181 U	<0.00184 U	<0.00174 U	0.00179 D	<0.00205 U	
4,4'-DDT	50-29-3	0.0033	136	7.9	mg/kg	0.00286 D	<0.00195 U	<0.00184 U	0.0268 D	0.0478 D	0.0935 D	<0.00193 U	0.00387 DP	<0.00181 U	<0.00184 U	0.00315 D	0.00319 DP	<0.00205 U	
Aldrin	309-00-2	0.005	0.19	0.097	mg/kg	<0.00174 U	<0.00195 U	<0.00184 U	<0.00181 U	<0.00188 U	<0.00171 U	<0.00193 U	<0.00175 U	<0.00181 U	<0.00184 U	<0.00174 U	<0.00173 U	<0.00205 U	
Alpha BHC (Alpha Hexachlorocyclohexane)	319-84-6	0.02	0.02	0.48	mg/kg	<0.00174 U	<0.00195 U	<0.00184 U	<0.00181 U	<0.00188 U	<0.00171 U	<0.00193 U	<0.00175 U	<0.00181 U	<0.00184 U	<0.00174 U	<0.00173 U	<0.00205 U	
Alpha Chlordane	5103-71-9	0.094	2.9	4.2	mg/kg	<0.00174 U	<0.00195 U	<0.00184 U	<0.00181 U	<0.00188 U	<0.00171 U	<0.00193 U	<0.00175 U	<0.00181 U	<0.00184 U	<0.00174 U	<0.00173 U	<0.00205 U	
Alpha Endosulfan	959-98-8	2.4	102	24	mg/kg	<0.00174 U	<0.00195 U	<0.00184 U	<0.00181 U	<0.00188 U	<0.00171 U	<0.00193 U	<0.00175 U	<0.00181 U	<0.00184 U	<0.00174 U	<0.00173 U	<0.00205 U	
Beta Bhc (Beta Hexachlorocyclohexane)	319-85-7	0.036	0.09	0.36	mg/kg	<0.00174 U	<0.00195 U	<0.00184 U	<0.00181 U	<0.00188 U	<0.00171 U	<0.00193 U	<0.00175 U	<0.00181 U	<0.00184 U	<0.00174 U	<0.00173 U	<0.00205 U	
Beta Endosulfan	33213-65-9	2.4	102	24	mg/kg	<0.00174 U	<0.00195 U	<0.00184 U	<0.00181 U	<0.00188 U	<0.00171 U	<0.00193 U	<0.00175 U	<0.00181 U	<0.00184 U	<0.00174 U	<0.00173 U	<0.00205 U	
Delta Bhc (Delta Hexachlorocyclohexane)	319-86-8	0.04	0.25	100	mg/kg	<0.00174 U	<0.00195 U	<0.00184 U	<0.00181 U	<0.00188 U	<0.00171 U	<0.00193 U	<0.00175 U	<0.00181 U	<0.00184 U	<0.00174 U	<0.00173 U	<0.00205 U	
Dieldrin	60-57-1	0.005	0.1	0.2	mg/kg	<0.00174 U	<0.00195 U	<0.00184 U	<0.00181 U	<0.00188 U	<0.00171 U	<0.00193 U	<0.00175 U	<0.00181 U	<0.00184 U	<0.00174 U	<0.00173 U	<0.00205 U	
Endosulfan Sulfate	1031-07-8	2.4	1000	24	mg/kg	<0.00174 U	<0.00195 U	<0.00184 U	<0.00181 U	<0.00188 U	<0.00171 U	<0.00193 U	<0.00175 U	<0.00181 U	<0.00184 U	<0.00174 U	<0.00173 U	<0.00205 U	
Endrin	72-20-8	0.014	0.06	11	mg/kg	<0.00174 U	<0.00195 U	<0.00184 U	<0.00181 U	<0.00188 U	<0.00171 U	<0.00193 U	<0.00175 U	<0.00181 U	<0.00184 U	<0.00174 U	<0.00173 U	<0.00205 U	
Endrin Aldehyde	7421-93-4	NS	NS	NS	mg/kg	<0.00174 U	<0.00195 U	<0.00184 U	<0.00181 U	<0.00188 U	<0.00171 U	<0.00193 U	<0.00175 U	<0.00181 U	<0.00184 U	<0.00174 U	<0.00173 U	<0.00205 U	
Endrin Ketone	53494-70-5	NS	NS	NS	mg/kg	<0.00174 U	<0.00195 U	<0.00184 U	<0.00181 U	<0.00188 U	<0.00171 U	<0.00193 U	<0.00175 U	<0.00181 U	<0.00184 U	<0.00174 U	<0.00173 U	<0.00205 U	
Gamma Bhc (Lindane)	58-89-9	0.1	0.1	1.3	mg/kg	<0.00174 U	<0.00195 U	<0.00184 U	<0.00181 U	<0.00188 U	<0.00171 U	<0.00193 U	<0.00175 U	<0.00181 U	<0.00184 U	<0.00174 U	<0.00173 U	<0.00205 U	
Gamma-Chlordane	5566-34-7	NS	NS	NS	mg/kg	<0.00174 U	<0.00195 U	<0.00184 U	<0.00181 U	<0.00188 U	<0.00171 U	<0.00193 U	<0.00175 U	<0.00181 U	<0.00184 U	<0.00174 U	<0.00173 U	<0.00205 U	
Heptachlor	76-44-8	0.042	0.38	2.1	mg/kg	<0.00174 U	<0.00195 U	<0.00184 U	<0.00181 U	<0.00188 U	<0.00171 U	<0.00193 U	<0.00175 U	<0.00181 U	<0.00184 U	<0.00174 U	<0.00173 U	<0.00205 U	
Heptachlor Epoxide	1024-57-3	NS	NS	NS	mg/kg	<0.00174 U	<0.00195 U	<0.00184 U	<0.00181 U	<0.00188 U	<0.00171 U	<0.00193 U	<0.00175 U	<0.00181 U	<0.00184 U	<0.00174 U	<0.00173 U	<0.00205 U	
Methoxychlor	72-43-5	NS	NS	NS	mg/kg	<0.00174 U	<0.00195 U	<0.00184 U	<0.00181 U	<0.00188 U	<0.00171 U	<0.00193 U	<0.00175 U	<0.00181 U	<0.00184 U	<0.00174 U	<0.00173 U	<0.00205 U	
Toxaphene	8001-35-2	NS	NS	NS	mg/kg	<0.174 U	<0.195 U	<0.184 U	<0.181 U	<0.188 U	<0.171 U	<0.193 U	<0.175 U	<0.181 U	<0.184 U	<0.174 U	<0.173 U	<0.205 U	
Herbicides																			
2,4,5-T (Trichlorophenoxyacetic Acid)	93-76-5	NS	NS	NS	mg/kg	<0.0212 U	<0.0232 U	<0.0219 U	<0.0216 U	<0.0225 U	<0.0203 U	<0.0229 U	<0.0211 U	<0.0218 U	<0.0222 U	<0.021 U	<0.0209 U	<0.0248 U	
2,4-D (Dichlorophenoxyacetic Acid)	94-75-7	NS	NS	NS	mg/kg	<0.0212 U	<0.0232 U	<0.0219 U	<0.0216 U	<0.0225 U	<0.0203 U	<0.0229 U	<0.0211 U	<0.0218 U	<0.0222 U	<0.021 U	<0.0209 U	<0.0248 U	
Silvex (2,4,5-Tp)	93-72-1	3.8	3.8	100	mg/kg	<0.0212 U	<0.0232 U	<0.0219 U	<0.0216 U	<0.0225 U	<0.0203 U	<0.0229 U	<0.0211 U	<0.0218 U	<0.0222 U	<0.021 U	<0.0209 U	<0.0248 U	
Polychlorinated Biphenyl																			
PCB-1016 (Aroclor 1016)	12674-11-2	NS	NS	NS	mg/kg	<0.0176 U	<0.0197 U	<0.0186 U	<0.0183 U	<0.019 U	<0.0172 U	<0.0194 U	<0.0177 U	<0.0182 U	<0.0186 U	<0.0175 U	<0.0174 U	<0.0207 U	
PCB-1221 (Aroclor 1221)	11104-28-2	NS	NS	NS	mg/kg	<0.0176 U	<0.0197 U	<0.0186 U	<0.0183 U	<0.019 U	<0.0172 U	<0.0194 U	<0.0177 U	<0.0182 U	<0.0186 U	<0.0175 U	<0.0174 U	<0.0207 U	
PCB-1232 (Aroclor 1232)	11141-16-5	NS	NS	NS	mg/kg	<0.0176 U	<0.0197 U	<0.0186 U	<0.0183 U	<0.019 U	<0.0172 U	<0.0194 U	<0.0177 U	<0.0182 U	<0.0186 U	<0.0175 U	<0.0174 U	<0.0207 U	
PCB-1242 (Aroclor 1242)	53469-21-9	NS	NS	NS	mg/kg	<0.0176 U	<0.0197 U	<0.0186 U	<0.0183 U	<0.019 U	<0.0172 U	<0.0194 U	<0.0177 U	<0.0182 U	<0.0186 U	<0.0175 U	<0.0174 U	<0.0207 U	
PCB-1248 (Aroclor 1248)	12672-29-6	NS	NS	NS	mg/kg	<0.0176 U	<0.0197 U	<0.0186 U	<0.0183 U	<0.019 U	<0.0172 U	<0.0194 U	<0.0177 U	<0.0182 U	<0.0186 U	<0.0175 U	<0.0174 U	<0.0207 U	
PCB-1254 (Aroclor 1254)	11097-69-1	NS	NS	NS	mg/kg	<0.0176 U	<0.0197 U	<0.0186 U	<0.0183 U	<0.019 U	<0.0172 U	<0.0194 U	0.0231	<0.0182 U	<0.0186 U	<0.0175 U	<0.0174 U	<0.0207 U	
PCB-1260 (Aroclor 1260)	11096-82-5	NS	NS	NS	mg/kg	<0.0176 U	<0.0197 U	<0.0186 U	<0.0183 U	<0.019 U	<0.0172 U	<0.0194 U	<0.0177 U	<0.0182 U	<0.0186 U	<0.0175 U	<0.0174 U	<0.0207 U	
Total PCBs	1336-36-3	0.1	3.2	1	mg/kg	<0.0176 U	<0.0197 U	<0.0186 U	<0.0183 U	<0.019 U	<0.0172 U	<0.0194 U	0.0489	<0.0182 U	<0.0186 U	<0.0175 U	<0.0174 U	<0.0207 U	
Metals																			
Aluminum	7429-90-5	NS	NS	NS	mg/kg	5,880	7,580	5,480	7,090	16,700	10,400	5,820	8,370	7,050	15,800	7,660	8,460	8,030	
Antimony	7440-36-0	NS	NS	NS	mg/kg	<2.22 U	<2.48 U	<2.35 U	<2.31 U	<2.4 U	<2.17 U	<2.45 U	<2.21 U	<2.29 U	<2.33 U	<2.2 U	<2.19 U	<2.6 U	
Arsenic	7440-38-2	13	16	16	mg/kg	2.8	2.82	<1.41 U	4.64	4.35	7.54	2.73	5.						

Table 2
Proposed Sample Summary
Remedial Investigation Work Plan

RBEC1
441 West 26th Street
New York, NY
Langan Project No. 170930902

No.	Sample Name	Type	Location	Rationale	Depth (feet bgs)	Analysis
SOIL						
1	RI-SB01_depth	Soil	RI-SB01	Investigate all AOCs	Non-Native Fill (from within 0 to 5 foot interval)	TCL VOCs, TCL SVOCs, PCBs, Pesticides, Herbicides, TAL Metals (Including Hexavalent and Trivalent Chromium), Cyanide, PFAS, and 1,4-dioxane
2	RI-SB01_depth				Interval exhibiting greatest degree of contamination OR native soil interval below non-native fill (if no impacts are observed)	
3	RI-SB01_depth				Groundwater interface	
4	RI-SB02_depth		RI-SB02		Non-Native Fill (from within 0 to 5 foot interval)	
5	RI-SB02_depth				Interval exhibiting greatest degree of contamination OR native soil interval below non-native fill (if no impacts are observed)	
6	RI-SB02_depth				Groundwater interface	
7	RI-SB03_depth		RI-SB03		Non-Native Fill (from within 0 to 5 foot interval)	
8	RI-SB03_depth				Interval exhibiting greatest degree of contamination OR native soil interval below non-native fill (if no impacts are observed)	
9	RI-SB03_depth				Groundwater interface	
10	RI-SB04_depth		RI-SB04		Non-Native Fill (from within 0 to 5 foot interval)	
11	RI-SB04_depth				Interval exhibiting greatest degree of contamination OR native soil interval below non-native fill (if no impacts are observed)	
12	RI-SB04_depth				Groundwater interface	
13	RI-SB05_depth		RI-SB05		Non-Native Fill (from within 0 to 5 foot interval)	
14	RI-SB05_depth				Interval exhibiting greatest degree of contamination OR native soil interval below non-native fill (if no impacts are observed)	
15	RI-SB05_depth				Groundwater interface	
16	RI-SB06_depth		RI-SB06		Non-Native Fill (from within 0 to 5 foot interval)	
17	RI-SB06_depth				Interval exhibiting greatest degree of contamination OR native soil interval below non-native fill (if no impacts are observed)	
18	RI-SB06_depth				Groundwater interface	
19	RI-SB07_depth		RI-SB07		Non-Native Fill (from within 0 to 5 foot interval)	
20	RI-SB07_depth				Interval exhibiting greatest degree of contamination OR native soil interval below non-native fill (if no impacts are observed)	
21	RI-SB07_depth				Groundwater interface	
22	RI-SB08_depth		RI-SB08		Non-Native Fill (from within 0 to 5 foot interval)	
23	RI-SB08_depth				Interval exhibiting greatest degree of contamination OR native soil interval below non-native fill (if no impacts are observed)	
24	RI-SB08_depth				Groundwater interface	
25	RI-SB09_depth		RI-SB09		Non-Native Fill (from within 0 to 5 foot interval)	
26	RI-SB09_depth				Interval exhibiting greatest degree of contamination OR native soil interval below non-native fill (if no impacts are observed)	
27	RI-SB09_depth				Groundwater interface	
28	RI-SB10_depth		RI-SB10		Non-Native Fill (from within 0 to 5 foot interval)	
29	RI-SB10_depth				Interval exhibiting greatest degree of contamination OR native soil interval below non-native fill (if no impacts are observed)	
30	RI-SB10_depth				Groundwater interface	
SOIL QA/QC						
1	RI-SODUP01_date	Duplicate	TBD	QA/QC	TBD	TCL VOCs, TCL SVOCs, PCBs, Pesticides, Herbicides, TAL Metals (Including Hexavalent and Trivalent Chromium), Cyanide, PFAS, and 1,4-dioxane
2	RI-SODUP02_date	Duplicate				
3	RI-SBXX_depth	MS/MSD				
4	RI-SBXX_depth	MS/MSD				
5	RI-SOFB01_date	Field Blank	N/A		N/A	PFAS
6	RI-SOFB02_date	Field Blank				
7	RI-SOECFB01_date	PFAS Field Blank*				
8	RI-SOECFB02_date	PFAS Field Blank*				
GROUNDWATER						
1	RI-MW01_date	Groundwater	RI-MW01	Investigate all AOCs	Middle of Observed Water Column	TCL VOCs, TCL SVOCs, PCBs, Pesticides, Herbicides, Total and Dissolved TAL Metals (Including Hexavalent and Trivalent Chromium), Cyanide, PFAS, and 1,4-dioxane
2	RI-MW02_date		RI-MW02			
3	RI-MW03_date		RI-MW03			
4	RI-MW04_date		RI-MW04			
5	RI-MW05_date		RI-MW05			
GROUNDWATER QA/QC						
1	RI-GWDUP01_date	Duplicate	TBD	QA/QC	Middle of Observed Water Column	TCL VOCs, TCL SVOCs, PCBs, Pesticides, Herbicides, TAL Metals (Including Hexavalent and Trivalent Chromium), Cyanide, PFAS, and 1,4-dioxane
2	RI-MWXX_date	MS/MSD				
3	RI-GWFB01_date	Field Blank	N/A		N/A	PFAS
4	RI-GWFB02_date	PFAS Field Blank*				
5	TB01_date	Trip Blank				
6	TB02_date					
SOIL VAPOR						
1	RI-SV03_date	Soil Vapor	RI-SV01	Investigate all AOCs	About 13 feet bgs (anticipated maximum depth of future cellar) or about 2 feet above the groundwater table, whichever is shallower	TO-15 VOCs
2	RI-SV04_date		RI-SV02			
SUB-SLAB SOIL VAPOR						
1	RI-SSV01_date	Sub-Slab Soil Vapor	RI-SSV01	Investigate all AOCs	2-inches below slab	TO-15 VOCs
2	RI-SSV02_date		RI-SSV02			
SOIL VAPOR QA/QC						
1	RI-AA01_date	Ambient Air	RI-AA01	QA/QC	Ambient Air	TO-15 VOCs

Notes:
1. AOC of Concern (AOC) 1 = Non-Native Fill
2. AOC 2 = Off-site Historical Uses
3. AOC 3 = On-site Historical Uses
4. AOC 4 = Petroleum-Related Impacts from Off-Site Source
5. TBD = To Be Determined
6. VOC = Volatile Organic Compound
7. SVOC = Semivolatile Organic Compound
8. PCB = Polychlorinated Biphenyl
9. TCL = Target Compound List
10. TAL = Target Analyte List
11. PFAS = Per- and Poly-Fluoroalkyl Substances
12. QA/QC = Quality Assurance/Quality Control
13. N/A = Not Applicable
14. MS/MSD = Matrix Spike/Matrix Spike Duplicate
15. bgs = Below Grade Surface
16. * = PFAS field blanks will be collected each day that PFAS samples are collected
17. VOC analysis will be via United States Environmental Protection Agency (USEPA) Methods 8260D/5035 for soil, via USEPA Method 8260D for groundwater, and via USEPA Method TO-15 for soil vapor
18. SVOC analysis will be via USEPA Method 8270E for soil and groundwater (1,4-dioxane will be analyzed via USEPA Method 8270E Selected Ion Monitoring (SIM))
19. PCB analysis will be via USEPA Method 8062A for soil and groundwater
20. Metals analysis will be via USEPA Methods 6010D/7471B/7196A for soil and USEPA Methods 6020B/7470A/7196A for groundwater
21. Cyanide will be analyzed via USEPA Method 9010C/9012B for soil and groundwater
22. Pesticides and herbicides analysis will be via USEPA Methods 8081B and 8151A for soil and groundwater
23. PFAS analysis will be via USEPA Method 1633 for soil and groundwater

Table 3
Proposed Monitoring Well Construction Details Summary
Remedial Investigation Work Plan

RBEC1
441 West 26th Street
New York, NY
Langan Project No. 170930902

Monitoring Well ID	Well Location	Physical Access Limitations	Well Inner Diameter (inch)	Well Casing and Screen Type	Well Screen Slot Size (inch)	Well Screen Length (ft)	Approx. Borehole Diameter (inch)	Filter Pack Thickness (inch)	Filter Pack Type	Drilling/Installation Method
RI-MW01	RI-MW01	Yes	0.75	Sch. 40 PVC	0.010	10.000	2.250	1.50	20/40 mesh sand	Direct Push
RI-MW02	RI-MW02	Yes	0.75	Sch. 40 PVC	0.010	10.000	2.250	1.50	20/40 mesh sand	Direct Push
RI-MW03	RI-MW03	No	2.00	Sch. 40 PVC	0.020	10.000	6.375	2.000	WG #2	Hollow Stem Auger
RI-MW04	RI-MW04	No	2.00	Sch. 40 PVC	0.020	10.000	6.375	2.000	WG #2	Hollow Stem Auger
RI-MW05	RI-MW05	No	2.00	Sch. 40 PVC	0.020	10.000	6.375	2.00	WG #2	Hollow Stem Auger

General Well Construction Notes:

1. A 6-inch bedding layer of filter pack will be placed at bottom of each borehole before placing well screen
2. The top of the well screen will be installed about 2 to 3 feet above the observed water table to account for seasonal fluctuations of the water table elevation.
3. Filter pack will extend about 2 feet above top of well screen
4. Filter pack will be clean, inert, manufactured filtration sand/gravel media
5. A 2-foot thick bentonite (sodium bentonite) will be placed above the top of filter pack. Bentonite seal will be hydrated using drinking water from a public water supply source and allowed to set for a minimum of 30-60 minutes (or as directed by manufacturer) before continuing with the remainder of well construction.
6. Well annulus above bentonite seal to be filled with clean soil cuttings with no detectable PID measurements and/or grossly-contaminated material, surplus filter pack, or a cement-bentonite mixture.
7. Monitoring wells to be completed with protective steel casing with a diameter at least 2-inch greater than outer diameter of well casing and well plug.
8. Monitoring wells will be finished with a 2-ft x 2-ft x 6-inch deep concrete pad

FIGURES



Legend

Site Boundary



Notes:

1. Basemap adapted from United States Geological Survey (USGS) 7.5-Minute Series Topographical Maps, Jersey City, New Jersey, Quadrangle.

LANGAN

368 Ninth Avenue, 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

RBEC1
BLOCK No. 724
PARTS OF LOT Nos. 1 and 10

NEW YORK

NEW YORK

Figure Title

SITE LOCATION
MAP

Project No.

170930902

Date

9/8/2025

Scale

1"=2,000'

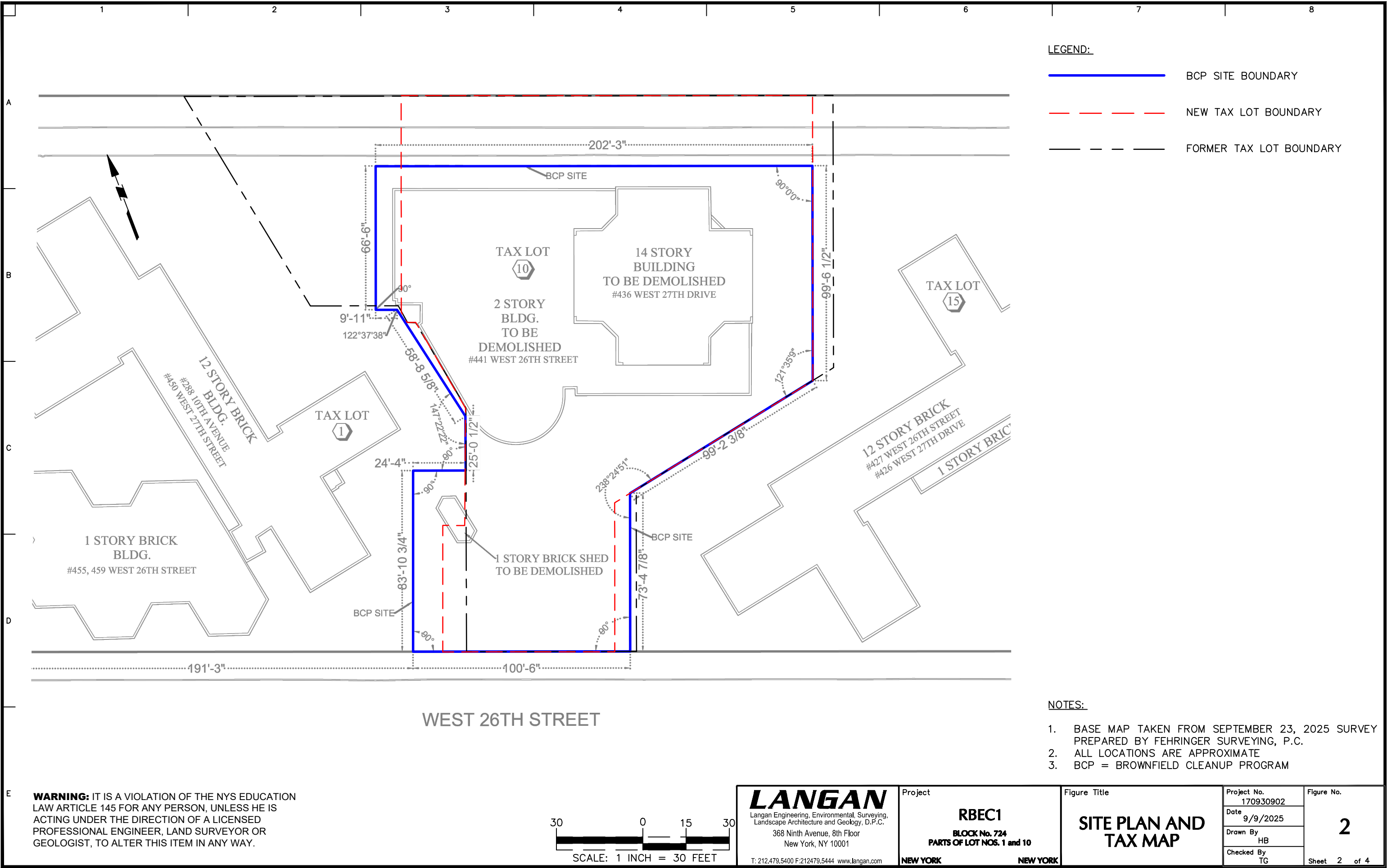
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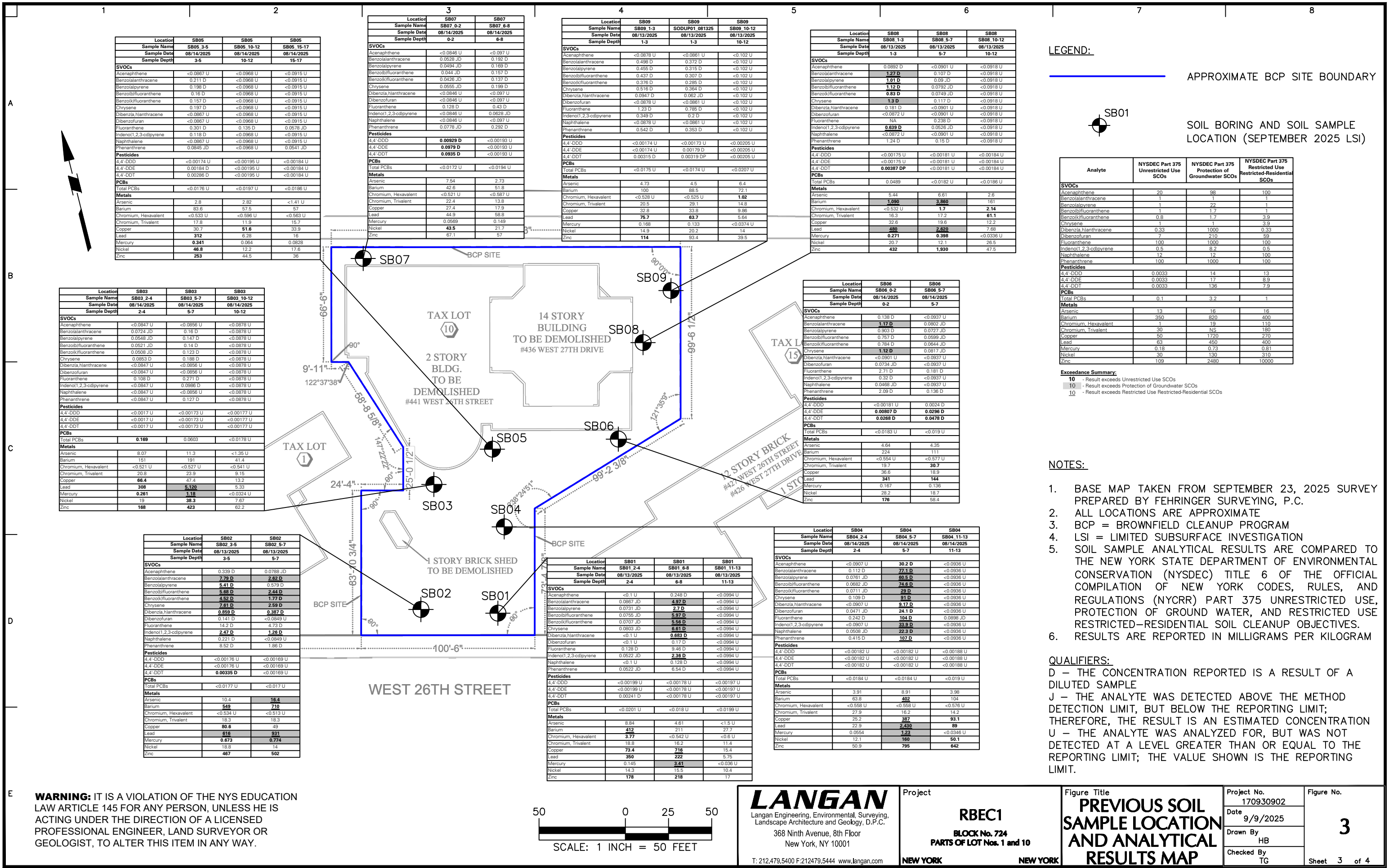
MG

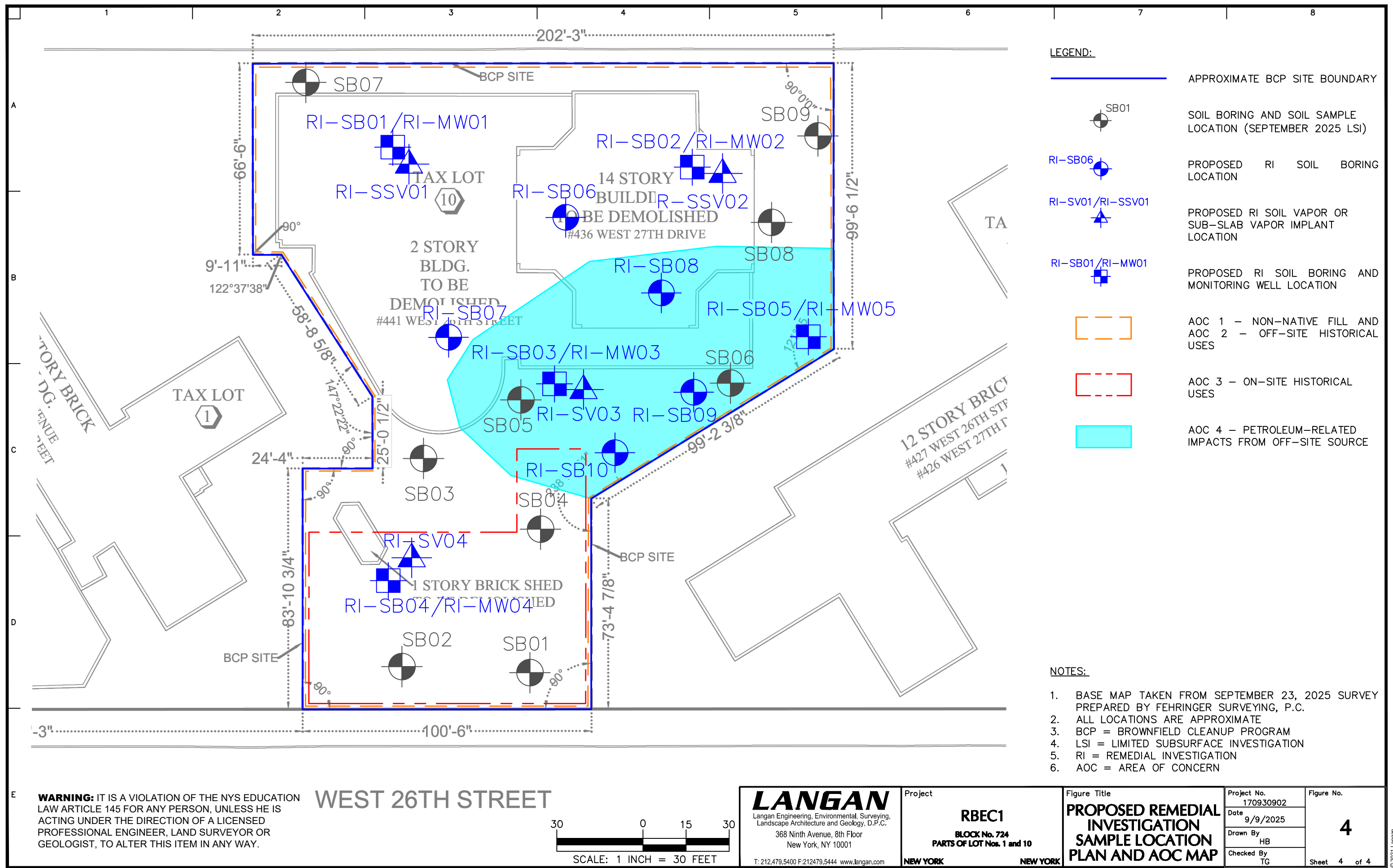
Submission Date

Figure No.

1







LEGEND:

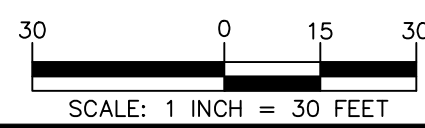
- APPROXIMATE BCP SITE BOUNDARY
- SOIL BORING AND SOIL SAMPLE LOCATION (SEPTEMBER 2025 LSI)
- PROPOSED RI SOIL BORING LOCATION
- PROPOSED RI SOIL VAPOR OR SUB-SLAB VAPOR IMPLANT LOCATION
- PROPOSED RI SOIL BORING AND MONITORING WELL LOCATION
- AOC 1 - NON-NATIVE FILL AND AOC 2 - OFF-SITE HISTORICAL USES
- AOC 3 - ON-SITE HISTORICAL USES
- AOC 4 - PETROLEUM-RELATED IMPACTS FROM OFF-SITE SOURCE

NOTES:

- BASE MAP TAKEN FROM SEPTEMBER 23, 2025 SURVEY PREPARED BY FEHRINGER SURVEYING, P.C.
- ALL LOCATIONS ARE APPROXIMATE
- BCP = BROWNFIELD CLEANUP PROGRAM
- LSI = LIMITED SUBSURFACE INVESTIGATION
- RI = REMEDIAL INVESTIGATION
- AOC = AREA OF CONCERN

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

WEST 26TH STREET



LANGAN Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C. 368 Ninth Avenue, 8th Floor New York, NY 10001 T: 212.479.5400 F: 212.479.5444 www.langan.com	Project RBEC1 BLOCK No. 724 PARTS OF LOT Nos. 1 and 10 NEW YORK	Figure Title PROPOSED REMEDIAL INVESTIGATION SAMPLE LOCATION PLAN AND AOC MAP	Project No. 170930902	Figure No. 4 Sheet 4 of 4
			Date 9/9/2025	
			Drawn By HB	
			Checked By TG	

APPENDIX A

Previous Environmental Reports

APPENDIX B

Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN

for

RBEC1
441 West 26th Street
New York, New York

Prepared For:

RBEC1, LLC
30 Hudson Yards, 72nd Floor
New York, New York 10001

Prepared By:

Langan Engineering, Environmental, Surveying,
Landscape Architecture and Geology, D.P.C.
368 Ninth Avenue, 8th Floor
New York, New York 10001

LANGAN

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1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) is for the about 30,150-square-foot site is located at 441 West 26th Street in the Chelsea neighborhood of New York, New York and is identified as part of the Borough of Manhattan Tax Map as Tax Block 724, parts of Lots 1 and 10. The site is bordered by West 27th Street (private street) followed by Chelsea Park to the north, a New York City Housing Authority (NYCHA) 12-story residential building to the east, West 26th Street followed by two NYCHA 11-story residential buildings to the south, and a 12-story NYCHA residential building to the west. The site is improved with a 14-story NYCHA residential apartment building with a full cellar, 96 apartment units, a ground floor daycare, and an attached two-story commercial building containing a community center. The southern part of the site is improved with a playground and pedestrian walkways.

This QAPP specifies analytical methods to be used to ensure that data collected during the Remedial Investigation (RI) is precise, accurate, representative, comparable, complete, and meets the sensitivity requirements of the project.

1.2 PROJECT OBJECTIVES

The objective of the scope of work is to investigate and characterize the nature and extent of environmental impacts at the site and to provide sufficient information to evaluate remedial alternatives and threats to human health and the environment, as required per the Brownfield Cleanup Program (BCP).

1.3 SCOPE OF WORK

The scope of work covered in this QAPP is detailed in the Remedial Investigation Work Plan (RIWP). In general, the RIWP proposes soil boring installation and sampling, groundwater monitoring well installation and sampling, and soil vapor sampling. The following investigation activities will be performed as part of the RIWP:

- Advance at least 10 soil borings to at least 2 feet below the observed groundwater table, at least 2 feet below the termination of the non-native soil layer, or at least 2 feet below observed contamination (i.e., staining, odors, or PID readings above background conditions), whichever is deeper. At least five soil borings will be converted to groundwater monitoring wells and will be advanced to at least 5 feet below the observed groundwater table.
- Collect at least three and up to four samples from each soil boring (plus quality assurance/quality control [QA/QC] samples) for laboratory analysis.

- Install and develop at least five temporary monitoring wells.
- Collect one groundwater sample from each new monitoring well (plus QA/QC samples) for laboratory analysis.
- Survey and gauge monitoring wells to establish groundwater elevations and evaluate flow direction.
- Develop a groundwater contour map.
- Install two soil vapor points to about 13 feet bgs (anticipated maximum depth of the future building cellar) and two sub-slab vapor points to about 2 inches below slab.
- Collect two soil vapor and two sub-slab soil vapor samples and one ambient air sample (QA/QC sample) for laboratory analysis.
- Implementation of a community air monitoring plan (CAMP).

A plan showing the proposed sample locations is included as Figure 4 of the RIWP.

2.0 DATA QUALITY OBJECTIVES AND PROCESS

Data Quality Objectives (DQOs) are qualitative and quantitative statements to help ensure that data of known and appropriate quality are obtained during the project. The quality of the data must be sufficient to fulfill the overall objective of the RI. The overall objective is to investigate and characterize the nature and extent of environmental impacts at and emanating from the site and to provide sufficient information to evaluate remedial alternatives, as required. The RIWP specifies the intended use of the data, the required constituents of interest, limits of detection, level of data assessment, and data deliverables. All data shall be defined as definitive data.

The DQO process is an iterative process where various options for implementing a project are explored, dissected, and recombined. The feasibility and costs of various options are estimated, and then the most advantageous option is selected and developed into project work plans that will be implemented.

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, based on comparison to Title 6 of the Official Compilation of New York Codes, Rules and Regulations Part 375 NYSDEC Unrestricted Use Soil Cleanup Objectives for soil samples and to the October 2006 (updated in May 2017) New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York Air Guideline Values and Decision Matrices for soil vapor samples.
- 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 investigation will be evaluated using the DQO process on an individual, task-specific basis. DQOs and the required level of review will be determined during this process.

3.0 PROJECT ORGANIZATION

Langan will arrange data analysis and reporting tasks related to the site sampling. The analytical services will be performed by an Environmental Laboratory Approval Program (ELAP)-certified laboratory. Data validation services will be performed by approved data validation contractor(s).

The required sampling will be conducted by Langan; the analytical services will be performed by York Analytical Laboratories of Queens, New York (NYSDOH ELAP certification number 12058). Data validation services will be performed by Joseph Conboy of Langan.

Resumes for Langan personnel can be found in Attachment B; key contacts for this project are as follows:

RBEC1, LLC:	Hailey Sarage Telephone: 212-801-1000
Langan Project Manager:	Greg Wyka, PG Telephone: 212-479-5476
Langan Field Team Leader:	Tyler Goodnough Telephone – 212-479-5712
Langan Health & Safety Officer:	Tony Moffa, CHMM Telephone: 215-491-6545
Langan Quality Assurance Manager:	Michael Burke, PG, CHMM Telephone: 212-479-5413
Langan Data Validator:	Joseph Conboy Telephone: 609-282-8055
Laboratory Representative:	Lea Sherman – York Analytical Laboratories Telephone: 203-357-5752

4.0 QUALITY ASSURANCE OBJECTIVES FOR COLLECTION OF DATA

The overall quality assurance objective is to develop and implement procedures for sampling, laboratory analysis, field measurements, and reporting that will provide data of sufficient quality to evaluate the engineering controls on the site. The sample set, chemical analysis results, and interpretations must be based on data that meet or exceed quality assurance objectives established for the site. Quality assurance objectives are usually expressed in terms of precision, accuracy or bias, representativeness, completeness, comparability, and sensitivity of analysis. Variances from the quality assurance objectives at any stage of the investigation will result in the implementation of appropriate corrective measures and an assessment of the impact of corrective measures on the usability of the data.

4.1 PRECISION

Precision is a measure of the degree to which two or more measurements are in agreement. Field precision is assessed through the collection and measurement of field duplicates. Laboratory precision and sample heterogeneity also contribute to the uncertainty of field duplicate measurements. This uncertainty is taken into account during the data assessment process. The following field duplicate precision criteria will be applied:

Aqueous and Canister Air Samples

- Results greater than 5 times the laboratory reporting limit (RL) must have a relative percent difference (RPD) $\leq 30\%$.
- Results less than 5 times the RL must have an absolute difference $\leq \pm RL$.

Soil Samples

- Results greater than 5 times the laboratory RL must have a RPD $\leq 50\%$.
- Results less than 5 times the RL must have an absolute difference $\leq 2 \times \pm RL$.

Soil Vapor Samples

- Results greater than 5 times the laboratory RL must have a RPD $\leq 50\%$.
- Results less than 5 times the RL must have an absolute difference $\leq 2 \times \pm RL$.

RLs and method detection limits (MDL) are provided in Attachment A.

Laboratory precision is assessed through the analysis of matrix spike/matrix spike duplicates (MS/MSD), laboratory control sample/laboratory control sample duplicates (LCS/LCSD) and subsequent calculation of RPD. For outliers, if additional sample volume is present, the MS/MSD

should be reanalyzed and the RPD recomputed. If additional volume is not present, an evaluation will be performed to determine the extent of potential matrix interference.

4.2 ACCURACY

Accuracy is the measurement of the reproducibility of the sampling and analytical methodology. It should be noted that precise data may not be accurate data. For the purpose of this QAPP, bias is defined as the constant or systematic distortion of a measurement process, which manifests itself as a persistent positive or negative deviation from the known or true value. This may be due to (but not limited to) improper sample collection, sample matrix, poorly calibrated analytical or sampling equipment, or limitations or errors in analytical methods and techniques.

Accuracy in the field is assessed through the use of field and trip blanks and through compliance to all sample handling, preservation, and holding time requirements. All field and trip blanks should be non-detect when analyzed by the laboratory. Any contaminant detected in an associated field blank will be evaluated against laboratory blanks (preparation or method) and evaluated against field samples collected on the same day to determine potential for bias.

Laboratory accuracy is assessed by evaluating the percent recoveries of MS/MSD samples, LCS/LCSD, surrogate compound recoveries, internal standard area counts, initial and continuing calibrations, and the results of method, initial and continuing calibration blanks. MS/MSD, LCS/LCSD, and surrogate percent recoveries will be compared to either method-specific control limits or laboratory-derived control limits. Sample volume permitting, samples displaying outliers should be reanalyzed. All associated method blanks should be non-detect when analyzed by the laboratory.

4.3 REPRESENTATIVENESS

Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary. 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. This is performed by following applicable standard operating procedures (SOPs) and this QAPP. All field technicians will be given copies of appropriate documents prior to sampling events and are required to read, understand, and follow each document as it pertains to the tasks at hand.

Representativeness in the laboratory is ensured by compliance with nationally recognized analytical methods, meeting sample holding times, and maintaining sample integrity while the samples are in the laboratory's possession. This is performed by following all applicable analytical

methods, laboratory-issued SOPs, the laboratory's Quality Assurance Manual, and this QAPP. The laboratory is required to be properly certified and accredited.

4.4 COMPLETENESS

Laboratory completeness is the ratio of total number of samples analyzed and verified as acceptable compared to the number of samples submitted to the fixed-base laboratory for analysis, expressed as a percent. Three measures of completeness are defined:

- Sampling completeness, defined as the number of valid samples collected relative to the number of samples planned for collection;
- Analytical completeness, defined as the number of valid sample measurements relative to the number of valid samples collected; and
- Overall completeness, defined as the number of valid sample measurements relative to the number of samples planned for collection.

Soil, groundwater and soil vapor data will meet a 90% completeness criterion. If the criterion is not met, sample results will be evaluated for trends in rejected and unusable data. The effect of unusable data required for a determination of compliance will also be evaluated.

4.5 COMPARABILITY

Comparability is an expression of the confidence with which one data set can be compared to another. Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the sampling plan is followed and that sampling is performed according to the SOPs or other project-specific procedures. Analytical data will be comparable when similar sampling and analytical methods are used as documented in the QAPP. Comparability will be controlled by requiring the use of specific nationally recognized analytical methods and requiring consistent method performance criteria. Comparability is also dependent on similar quality assurance objectives. Previously collected data will be evaluated to determine whether they may be combined with contemporary data sets.

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 quality assurance personnel, sampling and analytical procedures that achieve the required levels of detection and quality control 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 DQOs 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.

Analytical methods and quality assurance parameters associated with the sampling program are presented in Attachment C. The frequency of associated field blanks, trip blanks and duplicate samples will be based on the recommendations listed in DER-10, and as described in Section 5.3.

Site-specific MS and MSD samples will be prepared and analyzed by the analytical laboratory by spiking an aliquot of submitted sample volume with analytes of interest. A MS/MSD analysis will be analyzed at a rate of 1 out of every 20 samples, or one per analytical batch. MS/MSD samples are only required for soil and groundwater samples.

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). Soil vapor sampling will be conducted in accordance with NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006). The following sections describe procedures to be followed for specific tasks.

5.1 FIELD DOCUMENTATION PROCEDURES

Field documentation procedures will include summarizing field data in field books 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(s)
- Date and time of activity
- Sample identification number(s)
- 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 and abbreviation in accordance with the sample nomenclature guidance provided in the following table and the Standard Operating Procedure provided in Attachment D.

Sample Nomenclature Summary	
AA	Ambient Air
IA	Indoor Air
DUP	Field Duplicate
EB	Environmental Boring
LB	Langan Boring
SB	Soil Boring
FB	Field Blank
MW	Monitoring Well
SV	Soil Vapor
SSV	Sub-Slab Soil Vapor
TB	Trip Blank
(#-#)	Depth Interval
MMDDYY	Date of Sampling

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 photoionization detector (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 the Site Health & Safety Officer, 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 of groundwater to measure pH, specific conductance, temperature, dissolved oxygen, turbidity and oxidation-reduction-potential (ORP), every five minutes, or, depending on pump flow rate, after at least one full volume of the water quality meter flow through cell has passed through. A portable turbidity meter (LaMotte or similar) may also be used to measure turbidity. 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 have been followed. Documentation will include both scheduled and unscheduled maintenance.

5.3 SAMPLE COLLECTION

Soil Samples

Soil samples will be visually classified and field screened using a PID to assess potential impacts from volatile organic compounds (VOC) and for health and safety monitoring. Soil samples collected for analysis of VOCs will be collected using either En Core or Terra Core sampling equipment. For analysis of non-volatile parameters, samples will be homogenized and placed into glass jars. Samples will be collected with unused sterile sampling scoops or spoons and homogenized in unused sterile polyethylene zipper bags. After collection, all sample jars will be capped and securely tightened, and placed in iced coolers and maintained at $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ until they are transferred to the laboratory for analysis, in accordance with the procedures outlined in Sections 5.4 and 5.6. 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 samples will meet all quality assurance criteria set forth by this QAPP and DER-10.

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, dated September 19, 2017).

During purging, field parameters should be measured, including: water level drawdown, purge rate, pH, specific conductance, temperature, dissolved oxygen, turbidity and oxidation-reduction-potential (ORP), every five minutes using a water quality meter (YSI 6820 or similar) and a depth-to-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, $\pm 3\%$ for conductivity and temperature, ± 10 millivolts for ORP, and $\pm 10\%$ 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 laboratory-supplied 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 Sections 5.4 and 5.6. 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.

Soil Vapor and Ambient Air Samples

Prior to soil vapor and ambient air sample collection, a pre-sampling inspection will be conducted to document chemicals and potential subsurface pathways at the site. The pre-sampling inspection will assess the potential for impacts from any chemical or petroleum storage. Soil vapor and ambient air samples will be collected into laboratory-supplied, batch certified-clean Summa canisters calibrated for a sampling rate of two hours. The pressure gauges on each calibrated flow controller should be monitored throughout sample collection. Sample collection should be stopped when the pressure reading reaches -4 mmHg.

Emerging Contaminant Samples

Soil and groundwater samples collected for analysis of per- and polyfluoroalkyl substances (PFAS) and 1,4-dioxane will be collected in accordance with the specialized protocol outlined in this section and the *Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) under NYSDEC's Part 375 Remedial Programs*, issued by the NYSDEC in April 2023. Soil and groundwater samples collected from select sample locations will be analyzed for 1,4-dioxane by EPA Method 8270 and for PFAS by EPA Method 1633 Modified in accordance with the procedure outlined in Attachment E.

Soil samples will be homogenized and placed into glass jars. Samples will be collected with unused sterile sampling scoops or spoons. 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.

Groundwater sampling will be performed 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", January 19, 2017). Groundwater samples will be collected using a peristaltic pump fitted with dedicated, non-Teflon high-density polyethylene (HDPE) tubing and using low-flow purging techniques to minimize drawdown. A Horiba U-52 (or similar) will be used to monitor water quality parameters (pH, conductivity, temperature, dissolved oxygen, ORP, and turbidity). Groundwater samples will be collected after the

parameters stabilized within about 10 percent of consecutive values, to the extent practical, and turbidity is below 10 NTU.

Food and beverages will be prohibited near the sampling equipment. Additionally, no cosmetics, moisturizers, hand cream, sunscreen or clothing materials containing Gore-Tex or Tyvek will be worn during sampling. Non-disposable components of the pump will be decontaminated with Alconox and water. Field personnel will wear nitrile gloves while collecting and handling soil and groundwater samples.

Sample Field Blanks, Equipment Blanks, Trip Blanks and Duplicates

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 analyte-free water on or through a decontaminated sampling device following use and implementation of decontamination protocols. The water will be collected from the sampling device into a laboratory-provided sample container for analysis. Field blank samples will be analyzed for the complete list of analytes on the day of sampling. To assess contamination resulting from sample transport, trip blanks will be collected at a rate of one per day if soil or groundwater samples are analyzed for VOCs during that day. Field blanks and equipment blanks collected for aqueous PFAS samples will be collected at a minimum of one per day or one per 20 investigative samples per matrix; whichever frequency is higher. Field blanks and equipment blanks collected for soil PFAS samples will be collected at a minimum one per 20 investigative samples per matrix.

Field blanks will be obtained by pouring laboratory-demonstrated PFAS-free water on or through a decontaminated sampling device following use and implementation of decontamination protocols. The water will be collected off of the sampling device into a laboratory-provided sample container for analysis.

Duplicate soil and groundwater samples will be collected and analyzed for quality assurance purposes. Duplicate samples will be collected at a frequency of 1 per 20 investigative samples per matrix and will be submitted to the laboratory as “blind” samples. If less than 20 samples are collected during a particular sampling event, one duplicate sample will be collected.

5.4 SAMPLE CONTAINERS AND HANDLING

Certified, commercially clean sample containers will be obtained from the analytical laboratory. If soil samples or groundwater are being collected, the laboratory will also prepare and supply the required trip blanks and field 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 maintain a temperature of $4^{\circ} \pm 2^{\circ} \text{ C}$.

Soil and/or groundwater samples collected in the field for laboratory analysis will be placed directly into the laboratory-supplied sample containers. Samples will then be placed and stored on-ice in laboratory provided coolers until shipment to the laboratory. The temperature in the coolers containing samples and associated field blanks will be maintained at a temperature of $4^{\circ} \pm 2^{\circ} \text{ C}$ while on-site and during sample shipment to the analytical laboratory.

Soil and groundwater sampling for PFAS will be collected in accordance with EPA Method 1633 Field Sampling Guidelines. PFAS samples will be collected first in High Density Polyethylene (HDPE)/polypropylene containers using sampling equipment either made with stainless steel, HDPE, or polypropylene. Food and beverages will be prohibited near the sampling equipment. Additionally, no cosmetics, moisturizers, hand cream, sunscreen or clothing materials containing Gore-Tex or Tyvek will be worn during sampling.

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 5.9, will be followed to maintain and document sample possession. Samples will be packaged and shipped as described in Section 5.6.

5.5 SAMPLE PRESERVATION

Sample preservation measures will be used in an attempt to prevent sample decomposition by contamination, degradation, biological transformation, chemical interactions and other factors during the time between sample collection and analysis. Preservation will commence at the time of sample collection and will continue until analyses are performed. Should chemical preservation be required, the analytical laboratory will add the preservatives to the appropriate sample containers before shipment to the office or field. Samples will be preserved according to the requirements of the specific analytical method selected, as shown in Attachment C.

5.6 SAMPLE SHIPMENT

5.6.1 Packaging

Soil and groundwater sample containers will be placed in plastic coolers. Ice in Ziploc bags (or equivalent) will be placed around sample containers. 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.

5.6.2 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 described in Section 5.9.
- 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.

5.7 DECONTAMINATION PROCEDURES

5.7.1 Decontamination General Sample Collection

Decontamination procedures will be used for non-dedicated sampling equipment. Decontamination of field personnel is discussed in the site-specific sample Health and Safety Plan (HASP) included in Appendix A of the RIWP. 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

5.7.2 Decontamination for PFAS Sample Collection

In addition to general decontamination procedures are outlined in Section 5.7.1, sampling equipment will be thoroughly decontaminated before mobilization and between sample locations. Field sampling equipment, including water level indicators and other non-dedicated equipment, requires cleaning between uses. Non-dedicated equipment used for PFAS sampling will be rinsed using a three-bucket rinse procedure. An about 3-gallon solution of decontamination fluid consisting of Alconox or Citranox and deionized (DI) water will be prepared in a 5-gallon bucket for the first equipment rinse. A second 5-gallon bucket will be filled with about 3 gallons of DI water for the second rinse. A third 5-gallon bucket will be filled with about 3 gallons of DI water for the final rinse. Powderless nitrile (non-latex) gloves will be donned during the handling of sampling equipment and sample containers. The Safety Data Sheets of detergents used in decontamination procedures will be reviewed to ensure fluoro-surfactants and 1,4-dioxane are

not listed as ingredients. Laboratory-verified PFAS-free water will be used as the final rinse during decontamination of sampling equipment

5.8 RESIDUALS MANAGEMENT

Debris (e.g., paper, plastic and disposable personal protective equipment) will be collected in plastic garbage bags and disposed of as non-hazardous industrial waste. Soil cuttings with no apparent staining, odors, or elevated PID readings will be used to backfill boring holes. Soil to be disposed off-site will be placed in 55-gallon, UN/Department of Transportation (DOT) approved drums. Decontamination and well development/purging fluids will be placed in DOT-approved fluid drums with closed tops. All drums will be properly labeled, sealed, and characterized as necessary.

If initial analytical data is insufficient to gain disposal facility acceptance, waste characterization samples will be analyzed for parameters that are typically required by disposal facilities, such as target compounds list (TCL) VOCs, semivolatile organic compounds (SVOCs), Resource Conservation and Recovery Act (RCRA) metals, polychlorinated biphenyls (PCBs), pesticides, herbicides, Toxicity Characteristic Leaching Procedure (TCLP) VOCs, TCLP SVOCs, TCLP metals, ignitability, corrosivity, reactivity, and paint filter. Additional sampling and analyses may be required based on the selected disposal facility.

Samples will be collected in accordance with the selected disposal facility's requirements and will be collected to be representative of the material requiring disposal at a frequency consistent with disposal facility requirements. It is anticipated that all drummed material will be transported off-site and disposed of at a permitted facility.

5.9 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

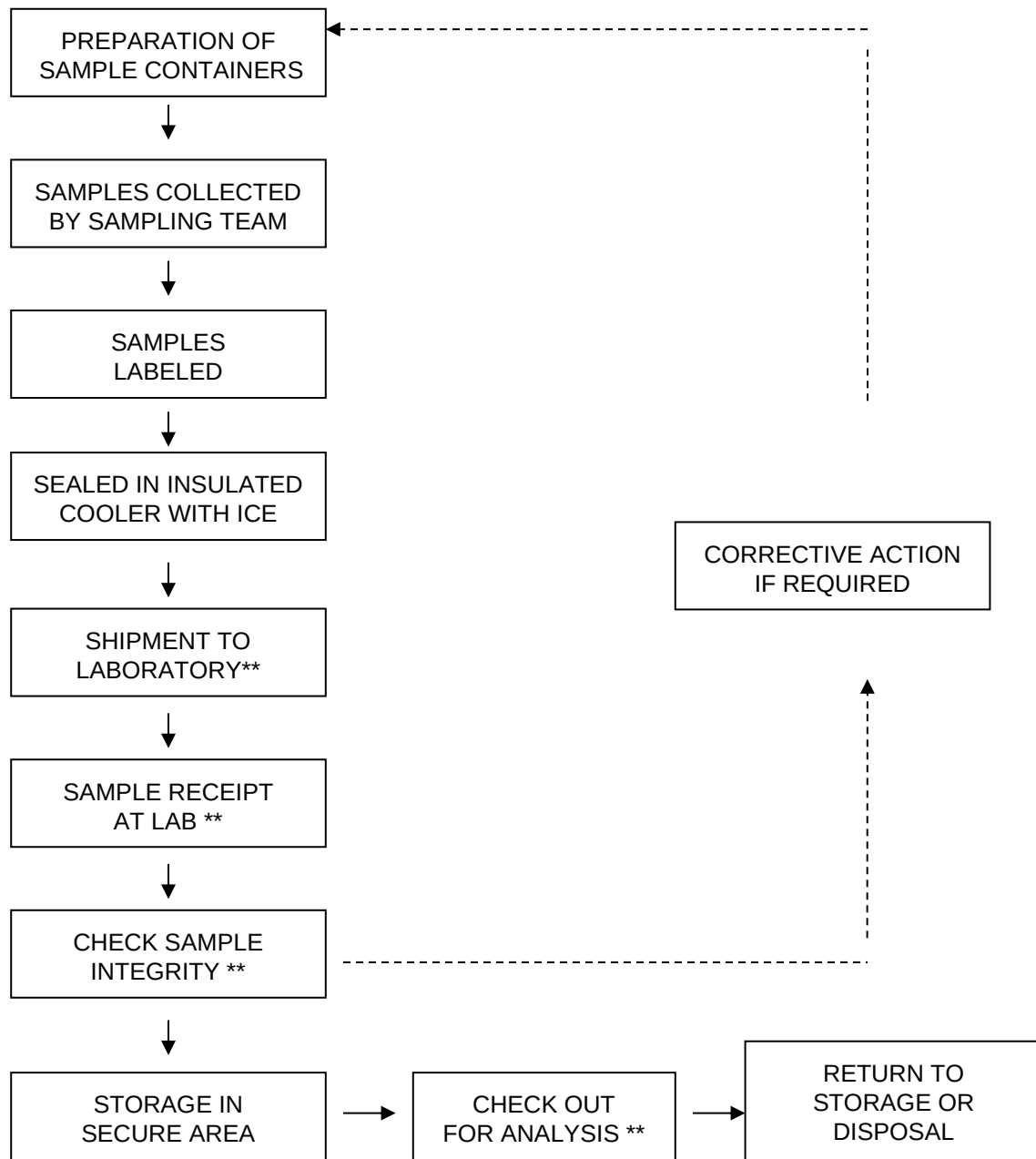
requested and other pertinent information (e.g., preservatives) will be recorded on the form. All entries will be made in waterproof, permanent blue or black ink.

- 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.

When soil and groundwater samples are collected, 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, and an example chain-of-custody form for soil and groundwater samples is included as Figure 5.2.

Figure 5.1 Sample Custody



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

[illegible]

[illegible]

Laboratory chain-of-custody will be maintained throughout the analytical processes as described in the laboratory's Quality Assurance 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.

5.10 LABORATORY SAMPLE STORAGE PROCEDURES

The subcontracted laboratory will use a laboratory information management system 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 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 Quality Assurance Manual.

5.11 SPECIAL CONSIDERATIONS FOR PFAS SAMPLE COLLECTION

Soil and groundwater samples collected for analysis of PFAS will be collected in accordance with the specialized protocol outlined in this section. Soil and groundwater samples collected from select sample locations will be analyzed for 1,4-dioxane by EPA Method 8270 SIM, and for PFAS by EPA Method 1633 Modified in accordance with the procedure outlined in Attachment E.

The following special considerations apply to the collection of 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 compound sampling protocols and the laboratory SOP are provided in Attachment E.

5.12 PFAS TARGET ANALYTE LIST

DER has developed a PFAS target analyte list. 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
Perfluoroalkyl sulfonates	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluoropentanesulfonic acid	PFPeS	2706-91-4
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanesulfonic acid	PFOS	1763-23-1
	Perfluorononanesulfonic acid	PFNS	68259-12-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Fluorotelomer sulfonic acids	Perfluorododecanesulfonic acid	PFDoS	79780-39-5
	4:2 Fluorotelomer sulfonic acid	4:2 FTS	757124-72-4
	6:2 Fluorotelomer sulfonic acid	6:2 FTS	27619-97-2
Fluorotelomer carboxylic acids	8:2 Fluorotelomer sulfonic acid	8:2 FTS	39108-34-4
	3:3 Fluorotelomer carboxylic acid	3:3 FTCA	356-02-5
	5:3 Fluorotelomer carboxylic acid	5:3 FTCA	914637-49-3
Perfluorooctane-sulfonamides	7:3 Fluorotelomer carboxylic acid	7:3 FTCA	812-70-4
	Perfluorooctanesulfonamide	PFOSA	754-91-6
	N-methylperfluorooctane sulfonamide	NMeFOSA	31506-32-8
	N-ethylperfluorooctane sulfonamide	NEtFOSA	4151-50-2

Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6
Perfluorooctane sulfonamide ethanols	N-methylperfluorooctane sulfonamidoethanol	MeFOSE	24448-09-7
	N-ethylperfluorooctane sulfonamidoethanol	EtFOSE	1691-99-2
Ether sulfonic acids	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (F-53B Major)	9Cl-PF3ONS	756426-58-1
	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor)	11Cl-PF3OUdS	763051-92-9
	Perfluoro(2-ethoxyethane) sulfonic acid	PFEESA	113507-82-7

6.0 DATA REDUCTION, VALIDATION, AND REPORTING

6.1 INTRODUCTION

Data collected during the field investigation will be reduced and reviewed by the laboratory quality assurance 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 methodology 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 EQulS. To avoid transcription errors, data will be loaded directly into the ASCII format from the laboratory information management system. 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 quality control 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 quality assurance reviewer to ensure all non-conformance issues are acted upon prior to data manipulation and assessment routines. Once the quality assurance 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 data usability summary report (DUSR) will be prepared by the data validator and reviewed by the Quality Assurance Manager 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.

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 Quality Assurance Manager (QAM). 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 QAM may plan, schedule, and approve system and performance audits based upon procedures customized to the project requirements. At times, the QAM 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 QAM 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. Additional audits may occur if conditions adverse to quality are detected or at the request of the Project Manager.

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 USEPA or a state agency have been 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 quality assurance group. These audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that quality assurance requirements have been 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 are approved by the QAM prior to issue. Verification of acceptable resolutions may be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the QAM will close out the audit report and findings.

8.0 CORRECTIVE ACTION

8.1 INTRODUCTION

The following procedures have been 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 a site, laboratory, or subcontractor location, 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 QAM, Project Manager, Field Team Leader and involved contractor 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 personnel, field investigation teams, remedial response planning personnel, and laboratory groups monitor ongoing work performance during the normal course of daily responsibilities. Work may be audited at project sites, laboratories, or contractor locations. Activities, or documents 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 Task 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 by email). 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 quality assurance 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 quality assurance 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 quality assurance 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. FOLLOWUP:					
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.
- USEPA, 2016. Low/Medium Volatile Data Validation. SOP No. HW-33A, Revision 1, dated September 2016. USEPA Region II.
- USEPA, 2015. PCB Aroclor Data Validation. SOP No. HW-37A, Revision 0, dated July 2015. USEPA Region II.
- USEPA, 2016. ICP-AES Data Validation. SOP No. HW-3a, Revision 1, dated September 2016. USEPA Region II.
- USEPA, 2016. Mercury and Cyanide Data Validation. SOP No. HW-3c, Revision 1, dated September 2016. USEPA Region II.
- USEPA, 2016. Pesticide Data Validation. SOP No. HW-36A, Revision 1, dated October 2016. USEPA Region II.
- USEPA, 2016. Semivolatile Data Validation. SOP No. HW-35A, Revision 1, dated September 2016. USEPA Region II.
- USEPA, 2016. Analysis of Volatile Organic Compounds in Air Contained in Canisters by Method TO-15, Revision 6, dated September 2016. USEPA Region II.
- 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

LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS

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PFAS SAMPLING PROTOCOL

Proposed RI Sample Location Plan and AOC Map

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LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS

APPENDIX B
LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS

Specific Method	Analysis	Matrix	Analyte	MDL	RL	Units
Volatile Organic Compounds						
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,1,1,2-Tetrachloroethane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,1,1-Trichloroethane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,1,2,2-Tetrachloroethane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,1,2-Trichloroethane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,1-Dichloroethane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,1-Dichloroethylene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,1-Dichloropropylene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,2,3-Trichlorobenzene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,2,3-Trichloropropane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,2,4,5-Tetramethylbenzene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,2,4-Trichlorobenzene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,2,4-Trimethylbenzene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,2-Dibromo-3-chloropropane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,2-Dibromoethane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,2-Dichlorobenzene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,2-Dichloroethane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,2-Dichloropropane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,3,5-Trimethylbenzene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,3-Dichlorobenzene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,3-Dichloropropane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,4-Dichlorobenzene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	1,4-Dioxane	50	100	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	2,2-Dichloropropane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	2-Butanone	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	2-Chlorotoluene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	2-Hexanone	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	4-Chlorotoluene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	4-Methyl-2-pentanone	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Acetone	5	10	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Acrolein	5	10	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Acrylonitrile	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Benzene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Bromobenzene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Bromochloromethane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Bromodichloromethane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Bromoform	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Bromomethane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Carbon disulfide	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Carbon tetrachloride	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Chlorobenzene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Chloroethane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Chloroform	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Chloromethane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	cis-1,2-Dichloroethylene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	cis-1,3-Dichloropropylene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Cyclohexane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Dibromochloromethane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Dibromomethane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Dichlorodifluoromethane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Ethyl Benzene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Hexachlorobutadiene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Isopropylbenzene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Methyl acetate	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Methyl tert-butyl ether (MTBE)	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Methylcyclohexane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Methylene chloride	5	10	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Naphthalene	2.5	10	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	n-Butylbenzene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	n-Propylbenzene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	o-Xylene	2.5	5	ug/kg

Specific Method	Analysis	Matrix	Analyte	MDL	RL	Units
Volatile Organic Compounds						
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	p- & m- Xylenes	5	10	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	p-Diethylbenzene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	p-Ethyltoluene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	p-Isopropyltoluene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	sec-Butylbenzene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Styrene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	tert-Butyl alcohol (TBA)	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	tert-Butylbenzene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Tetrachloroethylene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Toluene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	trans-1,2-Dichloroethylene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	trans-1,3-Dichloropropylene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	trans-1,4-dichloro-2-butene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Trichloroethylene	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Trichlorofluoromethane	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Vinyl acetate	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Vinyl Chloride	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Xylenes, Total	7.5	15	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Soil	Chlorodifluoromethane (Freon 22)	2.5	5	ug/kg
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,1,1,2-Tetrachloroethane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,1,1-Trichloroethane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,1,2,2-Tetrachloroethane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,1,2-Trichloroethane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,1-Dichloroethane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,1-Dichloroethylene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,1-Dichloropropylene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,2,3-Trichlorobenzene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,2,3-Trichloropropane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,2,4,5-Tetramethylbenzene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,2,4-Trichlorobenzene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,2,4-Trimethylbenzene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,2-Dibromo-3-chloropropane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,2-Dibromoethane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,2-Dichlorobenzene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,2-Dichloroethane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,2-Dichloropropane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,3,5-Trimethylbenzene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,3-Dichlorobenzene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,3-Dichloropropane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,4-Dichlorobenzene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	1,4-Dioxane	40	40	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	2,2-Dichloropropane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	2-Butanone	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	2-Chlorotoluene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	2-Hexanone	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	4-Chlorotoluene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	4-Methyl-2-pentanone	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Acetone	1	2	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Acrolein	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Acrylonitrile	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Benzene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Bromobenzene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Bromochloromethane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Bromodichloromethane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Bromoform	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Bromomethane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Carbon disulfide	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Carbon tetrachloride	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Chlorobenzene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Chloroethane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Chloroform	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Chloromethane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	cis-1,2-Dichloroethylene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	cis-1,3-Dichloropropylene	0.2	0.5	ug/L

Specific Method	Analysis	Matrix	Analyte	MDL	RL	Units
Volatile Organic Compounds						
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Cyclohexane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Dibromochloromethane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Dibromomethane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Dichlorodifluoromethane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Ethyl Benzene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Hexachlorobutadiene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Isopropylbenzene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Methyl acetate	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Methyl tert-butyl ether (MTBE)	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Methylcyclohexane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Methylene chloride	1	2	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Naphthalene	1	2	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	n-Butylbenzene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	n-Propylbenzene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	o-Xylene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	p- & m- Xylenes	0.5	1	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	p-Diethylbenzene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	p-Ethyltoluene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	p-Isopropyltoluene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	sec-Butylbenzene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Styrene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	tert-Butyl alcohol (TBA)	0.5	1	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	tert-Butylbenzene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Tetrachloroethylene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Toluene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	trans-1,2-Dichloroethylene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	trans-1,3-Dichloropropylene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	trans-1,4-dichloro-2-butene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Trichloroethylene	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Trichlorofluoromethane	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Vinyl acetate	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Vinyl Chloride	0.2	0.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Xylenes, Total	0.6	1.5	ug/L
EPA 8260D	Volatile Organics, 8260 - Comprehensive	Water	Chlorodifluoromethane (Freon 22)	0.2	0.5	ug/L

Specific Method	Analysis	Matrix	Analyte	MDL	RL	Units
Semivolatile Organic Compounds						
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	1,1-Biphenyl	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	1,2,4,5-Tetrachlorobenzene	41.7	83.3	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	1,2,4-Trichlorobenzene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	1,2-Dichlorobenzene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	1,2-Diphenylhydrazine (as Azobenzene)	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	1,3-Dichlorobenzene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	1,4-Dichlorobenzene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	2,3,4,6-Tetrachlorophenol	41.7	83.3	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	2,4,5-Trichlorophenol	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	2,4,6-Trichlorophenol	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	2,4-Dichlorophenol	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	2,4-Dimethylphenol	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	2,4-Dinitrophenol	41.7	83.3	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	2,4-Dinitrotoluene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	2,6-Dinitrotoluene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	2-Chloronaphthalene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	2-Chlorophenol	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	2-Methylnaphthalene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	2-Methylphenol	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	2-Nitroaniline	41.7	83.3	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	2-Nitrophenol	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	3- & 4-Methylphenols	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	3,3-Dichlorobenzidine	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	3-Nitroaniline	41.7	83.3	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	4,6-Dinitro-2-methylphenol	41.7	83.3	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	4-Bromophenyl phenyl ether	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	4-Chloro-3-methylphenol	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	4-Chloroaniline	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	4-Chlorophenyl phenyl ether	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	4-Nitroaniline	41.7	83.3	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	4-Nitrophenol	41.7	83.3	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Acenaphthene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Acenaphthylene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Acetophenone	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Aniline	83.5	167	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Anthracene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Atrazine	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Benzaldehyde	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Benzidine	83.5	167	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Benzo(a)anthracene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Benzo(a)pyrene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Benzo(b)fluoranthene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Benzo(g,h,i)perylene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Benzo(k)fluoranthene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Benzoic acid	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Benzyl alcohol	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Benzyl butyl phthalate	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Bis(2-chloroethoxy)methane	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Bis(2-chloroethyl)ether	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Bis(2-chloroisopropyl)ether	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Bis(2-ethylhexyl)phthalate	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Caprolactam	41.7	83.3	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Carbazole	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Chrysene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Dibenzo(a,h)anthracene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Dibenzofuran	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Diethyl phthalate	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Dimethyl phthalate	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Di-n-butyl phthalate	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Di-n-octyl phthalate	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Diphenylamine	41.7	83.3	ug/kg

Specific Method	Analysis	Matrix	Analyte	MDL	RL	Units
Semivolatile Organic Compounds						
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Fluoranthene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Fluorene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Hexachlorobenzene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Hexachlorobutadiene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Hexachlorocyclopentadiene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Hexachloroethane	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Indeno(1,2,3-cd)pyrene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Isophorone	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Naphthalene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Nitrobenzene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	N-Nitrosodimethylamine	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	N-nitroso-di-n-propylamine	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	N-Nitrosodiphenylamine	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Pentachlorophenol	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Phenanthrene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Phenol	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Pyrene	20.9	41.7	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Pyridine	83.5	167	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Soil	Benzo(a)pyrene (BAP) Equivalent-BAPE	146	292	ug/kg
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	1,1-Biphenyl	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	1,2,4,5-Tetrachlorobenzene	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	1,2,4-Trichlorobenzene	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	1,2-Dichlorobenzene	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	1,2-Diphenylhydrazine (as Azobenzene)	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	1,3-Dichlorobenzene	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	1,4-Dichlorobenzene	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	2,3,4,6-Tetrachlorophenol	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	2,4,5-Trichlorophenol	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	2,4,6-Trichlorophenol	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	2,4-Dichlorophenol	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	2,4-Dimethylphenol	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	2,4-Dinitrophenol	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	2,4-Dinitrotoluene	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	2,6-Dinitrotoluene	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	2-Chloronaphthalene	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	2-Chlorophenol	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	2-Methylnaphthalene	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	2-Methylphenol	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	2-Nitroaniline	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	2-Nitrophenol	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	3- & 4-Methylphenols	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	3,3-Dichlorobenzidine	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	3-Nitroaniline	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	4,6-Dinitro-2-methylphenol	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	4-Bromophenyl phenyl ether	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	4-Chloro-3-methylphenol	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	4-Chloroaniline	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	4-Chlorophenyl phenyl ether	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	4-Nitroaniline	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	4-Nitrophenol	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Acenaphthene	0.05	0.05	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Acenaphthylene	0.05	0.05	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Acetophenone	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Aniline	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Anthracene	0.05	0.05	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Atrazine	0.5	0.5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Benzaldehyde	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Benzidine	10	20	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Benzo(a)anthracene	0.05	0.05	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Benzo(a)pyrene	0.05	0.05	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Benzo(b)fluoranthene	0.05	0.05	ug/L

Specific Method	Analysis	Matrix	Analyte	MDL	RL	Units
Semivolatile Organic Compounds						
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Benzo(g,h,i)perylene	0.05	0.05	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Benzo(k)fluoranthene	0.05	0.05	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Benzoic acid	25	50	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Benzyl alcohol	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Benzyl butyl phthalate	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Bis(2-chloroethoxy)methane	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Bis(2-chloroethyl)ether	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Bis(2-chloroisopropyl)ether	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Bis(2-ethylhexyl)phthalate	0.5	0.5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Caprolactam	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Carbazole	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Chrysene	0.05	0.05	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Dibenzo(a,h)anthracene	0.05	0.05	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Dibenzofuran	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Diethyl phthalate	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Dimethyl phthalate	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Di-n-butyl phthalate	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Di-n-octyl phthalate	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Diphenylamine	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Fluoranthene	0.05	0.05	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Fluorene	0.05	0.05	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Hexachlorobenzene	0.02	0.02	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Hexachlorobutadiene	0.5	0.5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Hexachlorocyclopentadiene	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Hexachloroethane	0.5	0.5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Indeno(1,2,3-cd)pyrene	0.05	0.05	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Isophorone	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Naphthalene	0.05	0.05	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Nitrobenzene	0.25	0.25	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	N-Nitrosodimethylamine	0.5	0.5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	N-nitroso-di-n-propylamine	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	N-Nitrosodiphenylamine	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Pentachlorophenol	0.25	0.25	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Phenanthrene	0.05	0.05	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Phenol	2.5	5	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Pyrene	0.05	0.05	ug/L
EPA 8270E	Semi-Volatiles, 8270 - Comprehensive	Water	Pyridine	2.5	5	ug/L

Specific Method	Analysis	Matrix	Analyte	MDL	RL	Units
Pesticides						
EPA 8081B	Pesticides, 8081 target list	Soil	4,4'-DDD	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	4,4'-DDD [2C]	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	4,4'-DDE	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	4,4'-DDE [2C]	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	4,4'-DDT	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	4,4'-DDT [2C]	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Aldrin	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Aldrin [2C]	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	alpha-BHC	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	alpha-BHC [2C]	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	alpha-Chlordane	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	alpha-Chlordane [2C]	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	beta-BHC	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	beta-BHC [2C]	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Chlordane, total	6.6	6.6	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Chlordane, total [2C]	6.6	6.6	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	delta-BHC	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	delta-BHC [2C]	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Dieldrin	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Dieldrin [2C]	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Endosulfan I	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Endosulfan I [2C]	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Endosulfan II	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Endosulfan II [2C]	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Endosulfan sulfate	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Endosulfan sulfate [2C]	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Endrin	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Endrin [2C]	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Endrin aldehyde	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Endrin aldehyde [2C]	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Endrin ketone	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Endrin ketone [2C]	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	gamma-BHC (Lindane)	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	gamma-BHC (Lindane) [2C]	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	gamma-Chlordane	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	gamma-Chlordane [2C]	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Heptachlor	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Heptachlor [2C]	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Heptachlor epoxide	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Heptachlor epoxide [2C]	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Methoxychlor	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Methoxychlor [2C]	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Toxaphene	33	33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Toxaphene [2C]	33	33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Soil	Mirex	0.33	0.33	ug/kg
EPA 8081B	Pesticides, 8081 target list	Water	4,4'-DDD	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	4,4'-DDD [2C]	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	4,4'-DDE	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	4,4'-DDE [2C]	0.004	0.004	ug/L

Specific Method	Analysis	Matrix	Analyte	MDL	RL	Units
Pesticides						
EPA 8081B	Pesticides, 8081 target list	Water	4,4'-DDT	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	4,4'-DDT [2C]	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Aldrin	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Aldrin [2C]	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	alpha-BHC	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	alpha-BHC [2C]	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	alpha-Chlordane	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	alpha-Chlordane [2C]	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	beta-BHC	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	beta-BHC [2C]	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Chlordane, total	0.02	0.02	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Chlordane, total [2C]	0.02	0.02	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	delta-BHC	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	delta-BHC [2C]	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Dieldrin	0.002	0.002	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Dieldrin [2C]	0.002	0.002	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Endosulfan I	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Endosulfan I [2C]	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Endosulfan II	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Endosulfan II [2C]	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Endosulfan sulfate	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Endosulfan sulfate [2C]	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Endrin	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Endrin [2C]	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Endrin aldehyde	0.01	0.01	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Endrin aldehyde [2C]	0.01	0.01	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Endrin ketone	0.01	0.01	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Endrin ketone [2C]	0.01	0.01	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	gamma-BHC (Lindane)	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	gamma-BHC (Lindane) [2C]	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	gamma-Chlordane	0.01	0.01	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	gamma-Chlordane [2C]	0.01	0.01	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Heptachlor	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Heptachlor [2C]	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Heptachlor epoxide	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Heptachlor epoxide [2C]	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Methoxychlor	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Methoxychlor [2C]	0.004	0.004	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Toxaphene	0.1	0.1	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Toxaphene [2C]	0.1	0.1	ug/L
EPA 8081B	Pesticides, 8081 target list	Water	Mirex	0.004	0.004	ug/L

[illegible]

Specific Method	Analysis	Matrix	Analyte	MDL	RL	Units
Herbicides						
EPA 8151A	Herbicides, NYSDEC Part 375 Target List	Soil	2,4,5-T	20	20	ug/kg
EPA 8151A	Herbicides, NYSDEC Part 375 Target List	Soil	2,4,5-T [2C]	20	20	ug/kg
EPA 8151A	Herbicides, NYSDEC Part 375 Target List	Soil	2,4,5-TP (Silvex)	20	20	ug/kg
EPA 8151A	Herbicides, NYSDEC Part 375 Target List	Soil	2,4,5-TP (Silvex) [2C]	20	20	ug/kg
EPA 8151A	Herbicides, NYSDEC Part 375 Target List	Soil	2,4-D	20	20	ug/kg
EPA 8151A	Herbicides, NYSDEC Part 375 Target List	Soil	2,4-D [2C]	20	20	ug/kg
EPA 8151A	Herbicides, NYSDEC Part 375 Target List	Water	2,4,5-T	5	5	ug/L
EPA 8151A	Herbicides, NYSDEC Part 375 Target List	Water	2,4,5-T [2C]	5	5	ug/L
EPA 8151A	Herbicides, NYSDEC Part 375 Target List	Water	2,4,5-TP (Silvex)	5	5	ug/L
EPA 8151A	Herbicides, NYSDEC Part 375 Target List	Water	2,4,5-TP (Silvex) [2C]	5	5	ug/L
EPA 8151A	Herbicides, NYSDEC Part 375 Target List	Water	2,4-D	5	5	ug/L
EPA 8151A	Herbicides, NYSDEC Part 375 Target List	Water	2,4-D [2C]	5	5	ug/L

Specific Method	Analysis	Matrix	Analyte	MDL	RL	Units
Metals						
EPA 6010D	Metals, Target Analyte	Soil	Aluminum	4.17	4.17	mg/kg
EPA 6010D	Metals, Target Analyte	Soil	Antimony	2.08	2.08	mg/kg
EPA 6010D	Metals, Target Analyte	Soil	Arsenic	1.25	1.25	mg/kg
EPA 6010D	Metals, Target Analyte	Soil	Barium	2.08	2.08	mg/kg
EPA 6010D	Metals, Target Analyte	Soil	Beryllium	0.042	0.042	mg/kg
EPA 6010D	Metals, Target Analyte	Soil	Cadmium	0.25	0.25	mg/kg
EPA 6010D	Metals, Target Analyte	Soil	Calcium	4.17	4.17	mg/kg
EPA 6010D	Metals, Target Analyte	Soil	Chromium	0.417	0.417	mg/kg
EPA 7196A	Metals, Target Analyte	Soil	Hexavalent Chromium	0.35	0.5	mg/kg
EPA 7196A	Metals, Target Analyte	Soil	Trivalent Chromium	0.25	0.5	mg/kg
EPA 6010D	Metals, Target Analyte	Soil	Cobalt	0.333	0.333	mg/kg
EPA 6010D	Metals, Target Analyte	Soil	Copper	1.67	1.67	mg/kg
EPA 9013A	Metals, Target Analyte	Soil	Cyanide	0.5	0.5	mg/kg
EPA 6010D	Metals, Target Analyte	Soil	Iron	20.8	20.8	mg/kg
EPA 6010D	Metals, Target Analyte	Soil	Lead	0.417	0.417	mg/kg
EPA 6010D	Metals, Target Analyte	Soil	Magnesium	4.17	4.17	mg/kg
EPA 6010D	Metals, Target Analyte	Soil	Manganese	0.417	0.417	mg/kg
EPA 6010D	Metals, Target Analyte	Soil	Nickel	0.83	0.83	mg/kg
EPA 6010D	Metals, Target Analyte	Soil	Potassium	4.17	4.17	mg/kg
EPA 6010D	Metals, Target Analyte	Soil	Selenium	2.08	2.08	mg/kg
EPA 6010D	Metals, Target Analyte	Soil	Silver	0.42	0.42	mg/kg
EPA 6010D	Metals, Target Analyte	Soil	Sodium	41.7	41.7	mg/kg
EPA 6010D	Metals, Target Analyte	Soil	Thallium	2.08	2.08	mg/kg
EPA 6010D	Metals, Target Analyte	Soil	Vanadium	0.83	0.83	mg/kg
EPA 6010D	Metals, Target Analyte	Soil	Zinc	2.08	2.08	mg/kg
EPA 6010D	Metals, Target Analyte	Water	Aluminum	0.05	0.05	mg/L
EPA 6010D	Metals, Target Analyte	Water	Antimony	0.025	0.025	mg/L
EPA 6010D	Metals, Target Analyte	Water	Arsenic	0.015	0.015	mg/L
EPA 6010D	Metals, Target Analyte	Water	Barium	0.025	0.025	mg/L
EPA 6010D	Metals, Target Analyte	Water	Beryllium	0.0005	0.0005	mg/L
EPA 6010D	Metals, Target Analyte	Water	Cadmium	0.003	0.003	mg/L
EPA 6010D	Metals, Target Analyte	Water	Calcium	0.05	0.05	mg/L
EPA 6010D	Metals, Target Analyte	Water	Chromium	0.005	0.005	mg/L
EPA 7196A	Metals, Target Analyte	Water	Hexavalent Chromium	0.01	0.01	mg/L
EPA 7196A	Metals, Target Analyte	Water	Trivalent Chromium	0.008	0.01	mg/L
EPA 6010D	Metals, Target Analyte	Water	Cobalt	0.004	0.004	mg/L
EPA 6010D	Metals, Target Analyte	Water	Copper	0.02	0.02	mg/L
EPA 9013A	Metals, Target Analyte	Water	Cyanide	0.01	0.01	mg/L
EPA 6010D	Metals, Target Analyte	Water	Iron	0.25	0.25	mg/L
EPA 6010D	Metals, Target Analyte	Water	Lead	0.005	0.005	mg/L
EPA 6010D	Metals, Target Analyte	Water	Magnesium	0.05	0.05	mg/L
EPA 6010D	Metals, Target Analyte	Water	Manganese	0.005	0.005	mg/L
EPA 6010D	Metals, Target Analyte	Water	Nickel	0.01	0.01	mg/L
EPA 6010D	Metals, Target Analyte	Water	Potassium	0.05	0.05	mg/L
EPA 6010D	Metals, Target Analyte	Water	Selenium	0.025	0.025	mg/L
EPA 6010D	Metals, Target Analyte	Water	Silver	0.005	0.005	mg/L

Specific Method	Analysis	Matrix	Analyte	MDL	RL	Units
Metals						
EPA 6010D	Metals, Target Analyte	Water	Sodium	0.5	0.5	mg/L
EPA 6010D	Metals, Target Analyte	Water	Thallium	0.025	0.025	mg/L
EPA 6010D	Metals, Target Analyte	Water	Vanadium	0.01	0.01	mg/L
EPA 6010D	Metals, Target Analyte	Water	Zinc	0.025	0.025	mg/L

Analysis	Matrix	Analyte	MDL	RL	Units
PFAS Compounds					
PFAS, EPA 1633 Target List	Soil	Perfluorobutanesulfonic acid (PFBS)	0.111	0.177	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluorohexanoic acid (PFHxA)	0.053	0.2	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluoroheptanoic acid (PFHpA)	0.105	0.2	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluorohexanesulfonic acid (PFHxS)	0.179	0.183	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluorooctanoic acid (PFOA)	0.172	0.2	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluorooctanesulfonic acid (PFOS)	0.167	0.186	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluorononanoic acid (PFNA)	0.189	0.2	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluorodecanoic acid (PFDA)	0.191	0.2	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluoroundecanoic acid (PFUnA)	0.198	0.2	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluorododecanoic acid (PFDoA)	0.163	0.2	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluorotridecanoic acid (PFTTrDA)	0.125	0.2	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluorotetradecanoic acid (PFTA)	0.103	0.2	ug/kg
PFAS, EPA 1633 Target List	Soil	N-MeFOSAA	0.148	0.2	ug/kg
PFAS, EPA 1633 Target List	Soil	N-EtFOSAA	0.194	0.2	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluoropentanoic acid (PFPeA)	0.109	0.4	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluoro-1-octanesulfonamide (FOSA)	0.146	0.2	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluoro-1-heptanesulfonic acid (PFHpS)	0.155	0.2	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluoro-1-decanesulfonic acid (PFDS)	0.191	0.193	ug/kg
PFAS, EPA 1633 Target List	Soil	1H,1H,2H,2H-Perfluorooctanesulfonic acid (6:2 FTS)	0.595	0.76	ug/kg
PFAS, EPA 1633 Target List	Soil	1H,1H,2H,2H-Perfluorodecanesulfonic acid (8:2 FTS)	0.755	0.768	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluoro-n-butanoic acid (PFBA)	0.109	0.8	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA)	0.139	0.356	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluoro-3,6-dioxahexanoic acid (NFDHA)	0.193	0.4	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluoro-4-oxapentanoic acid (PFMPA)	0.062	0.4	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluoro-5-oxahexanoic acid (PFMBA)	0.096	0.4	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluoro-1-pentanesulfonate (PFPeS)	0.157	0.188	ug/kg
PFAS, EPA 1633 Target List	Soil	1H,1H,2H,2H-Perfluorohexanesulfonic acid (4:2 FTS)	0.595	0.75	ug/kg
PFAS, EPA 1633 Target List	Soil	HFPO-DA (Gen-X)	0.608	0.8	ug/kg
PFAS, EPA 1633 Target List	Soil	11CL-PF3OUdS	0.311	0.756	ug/kg
PFAS, EPA 1633 Target List	Soil	9CL-PF3ONS	0.246	0.748	ug/kg
PFAS, EPA 1633 Target List	Soil	ADONA	0.174	0.756	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluorododecanesulfonic acid (PFDoS)	0.169	0.194	ug/kg
PFAS, EPA 1633 Target List	Soil	Perfluoro-1-nonanesulfonic acid (PFNS)	0.124	0.192	ug/kg
PFAS, EPA 1633 Target List	Soil	3-Perfluoropropyl propanoic acid (FPrPA)	0.634	1	ug/kg
PFAS, EPA 1633 Target List	Soil	3-Perfluoropentyl propanoic acid (FPePA)	2.1	5	ug/kg
PFAS, EPA 1633 Target List	Soil	3-Perfluoroheptyl propanoic acid (FHpPA)	1.5	5	ug/kg
PFAS, EPA 1633 Target List	Soil	N-MeFOSE	0.611	2	ug/kg
PFAS, EPA 1633 Target List	Soil	N-MeFOSA	0.18	0.2	ug/kg
PFAS, EPA 1633 Target List	Soil	N-EtFOSE	0.697	2	ug/kg
PFAS, EPA 1633 Target List	Soil	N-EtFOSA	0.198	0.2	ug/kg
PFAS, EPA 1633 Target List	Water	Perfluorobutanesulfonic acid (PFBS)	0.47	1.77	ng/L
PFAS, EPA 1633 Target List	Water	Perfluorohexanoic acid (PFHxA)	0.35	2	ng/L
PFAS, EPA 1633 Target List	Water	Perfluoroheptanoic acid (PFHpA)	0.71	2	ng/L
PFAS, EPA 1633 Target List	Water	Perfluorohexanesulfonic acid (PFHxS)	0.68	1.83	ng/L
PFAS, EPA 1633 Target List	Water	Perfluorooctanoic acid (PFOA)	0.42	2	ng/L
PFAS, EPA 1633 Target List	Water	Perfluorooctanesulfonic acid (PFOS)	0.82	1.86	ng/L
PFAS, EPA 1633 Target List	Water	Perfluorononanoic acid (PFNA)	0.52	2	ng/L
PFAS, EPA 1633 Target List	Water	Perfluorodecanoic acid (PFDA)	0.75	2	ng/L
PFAS, EPA 1633 Target List	Water	Perfluoroundecanoic acid (PFUnA)	1.13	2	ng/L
PFAS, EPA 1633 Target List	Water	Perfluorododecanoic acid (PFDoA)	0.88	2	ng/L
PFAS, EPA 1633 Target List	Water	Perfluorotridecanoic acid (PFTTrDA)	0.74	2	ng/L
PFAS, EPA 1633 Target List	Water	Perfluorotetradecanoic acid (PFTA)	0.69	2	ng/L

Analysis	Matrix	Analyte	MDL	RL	Units
PFAS Compounds					
PFAS, EPA 1633 Target List	Water	N-MeFOSAA	0.79	2	ng/L
PFAS, EPA 1633 Target List	Water	N-EtFOSAA	1.03	2	ng/L
PFAS, EPA 1633 Target List	Water	Perfluoropentanoic acid (PFPeA)	0.23	4	ng/L
PFAS, EPA 1633 Target List	Water	Perfluoro-1-octanesulfonamide (FOSA)	0.88	2	ng/L
PFAS, EPA 1633 Target List	Water	Perfluoro-1-heptanesulfonic acid (PFHpS)	0.91	1.91	ng/L
PFAS, EPA 1633 Target List	Water	Perfluoro-1-decanesulfonic acid (PFDS)	1.32	1.93	ng/L
PFAS, EPA 1633 Target List	Water	1H,1H,2H,2H-Perfluorooctanesulfonic acid (6:2 FTS)	1.06	7.6	ng/L
PFAS, EPA 1633 Target List	Water	1H,1H,2H,2H-Perfluorodecanesulfonic acid (8:2 FTS)	2.05	7.68	ng/L
PFAS, EPA 1633 Target List	Water	Perfluoro-n-butanoic acid (PFBA)	0.33	8	ng/L
PFAS, EPA 1633 Target List	Water	Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA)	0.5	3.56	ng/L
PFAS, EPA 1633 Target List	Water	Perfluoro-3,6-dioxahexanoic acid (NFDHA)	2.14	4	ng/L
PFAS, EPA 1633 Target List	Water	Perfluoro-4-oxapentanoic acid (PFMPA)	0.25	4	ng/L
PFAS, EPA 1633 Target List	Water	Perfluoro-5-oxahexanoic acid (PFMBA)	0.37	4	ng/L
PFAS, EPA 1633 Target List	Water	Perfluoro-1-pentanesulfonate (PFPeS)	0.76	1.88	ng/L
PFAS, EPA 1633 Target List	Water	1H,1H,2H,2H-Perfluorohexanesulfonic acid (4:2 FTS)	1.79	7.5	ng/L
PFAS, EPA 1633 Target List	Water	HFPO-DA (Gen-X)	3.23	8	ng/L
PFAS, EPA 1633 Target List	Water	11CL-PF3OUdS	1.38	7.56	ng/L
PFAS, EPA 1633 Target List	Water	9CL-PF3ONS	0.7	7.48	ng/L
PFAS, EPA 1633 Target List	Water	ADONA	0.53	7.56	ng/L
PFAS, EPA 1633 Target List	Water	Perfluorododecanesulfonic acid (PFDoS)	0.93	1.94	ng/L
PFAS, EPA 1633 Target List	Water	Perfluoro-1-nonanesulfonic acid (PFNS)	0.86	1.92	ng/L
PFAS, EPA 1633 Target List	Water	3-Perfluoropropyl propanoic acid (FPrPA)	2.03	5	ng/L
PFAS, EPA 1633 Target List	Water	3-Perfluoropentyl propanoic acid (FPePA)	7.33	25	ng/L
PFAS, EPA 1633 Target List	Water	3-Perfluoroheptyl propanoic acid (FHpPA)	9.47	25	ng/L
PFAS, EPA 1633 Target List	Water	N-MeFOSE	3.99	20	ng/L
PFAS, EPA 1633 Target List	Water	N-MeFOSA	1.58	2	ng/L
PFAS, EPA 1633 Target List	Water	N-EtFOSE	3.99	20	ng/L
PFAS, EPA 1633 Target List	Water	N-EtFOSA	1.8	2	ng/L

Specific Method	Analysis	Matrix	Analyte	MDL	RL	Units
Volatile Organic Compounds						
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	1,1,1,2-Tetrachloroethane	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	1,1,1-Trichloroethane	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	1,1,2,2-Tetrachloroethane	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	1,1,2-Trichloroethane	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	1,1-Dichloroethane	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	1,1-Dichloroethylene	0.025	0.025	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	1,2,4-Trichlorobenzene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	1,2,4-Trimethylbenzene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	1,2-Dibromoethane	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	1,2-Dichlorobenzene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	1,2-Dichloroethane	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	1,2-Dichloropropane	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	1,2-Dichlorotetrafluoroethane	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	1,3,5-Trimethylbenzene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	1,3-Butadiene	0.3	0.3	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	1,3-Dichlorobenzene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	1,3-Dichloropropane	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	1,4-Dichlorobenzene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	1,4-Dioxane	0.2	0.2	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	2-Butanone	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	2-Hexanone	0.2	0.2	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	3-Chloropropene	0.5	0.5	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	4-Methyl-2-pentanone	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Acetone	0.2	0.2	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Acrolein	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Acrylonitrile	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Benzene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Benzyl chloride	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Bromodichloromethane	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Bromoform	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Bromomethane	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Carbon disulfide	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Carbon tetrachloride	0.025	0.025	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Chlorobenzene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Chloroethane	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Chloroform	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Chloromethane	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	cis-1,2-Dichloroethylene	0.025	0.025	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	cis-1,3-Dichloropropylene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Cyclohexane	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Dibromochloromethane	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Dichlorodifluoromethane	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Ethanol	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Ethyl acetate	0.2	0.2	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Ethyl Benzene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Hexachlorobutadiene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Isopropanol	0.2	0.2	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Isopropylbenzene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Methyl Methacrylate	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Methyl tert-butyl ether (MTBE)	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Methylene chloride	0.2	0.2	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Naphthalene	0.2	0.2	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	n-Butylbenzene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	n-Heptane	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	n-Hexane	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	n-Propylbenzene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	o-Xylene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	p- & m- Xylenes	0.2	0.2	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	p-Ethyltoluene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	p-Isopropyltoluene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Propylene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	sec-Butylbenzene	0.1	0.1	ppbv

Specific Method	Analysis	Matrix	Analyte	MDL	RL	Units
Volatile Organic Compounds						
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Styrene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	tert-Butylbenzene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Tetrachloroethylene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Tetrahydrofuran	0.2	0.2	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Toluene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	trans-1,2-Dichloroethylene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	trans-1,3-Dichloropropylene	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Trichloroethylene	0.025	0.025	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Trichlorofluoromethane (Freon 11)	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Vinyl acetate	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Vinyl bromide	0.1	0.1	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Vinyl Chloride	0.05	0.05	ppbv
EPA TO-15	Volatile Organics, EPA TO15 Full List	Air	Xylenes, Total	0.3	0.3	ppbv

Specific Method	Analysis	Matrix	Analyte	MDL	RL	Units
Volatile Organic Compounds						
EPA TO-15	VOA, TO15 Isooctane (2,2,4-TMP) Add On	Air	2,2,4-Trimethylpentane	0.025	0.05	ppbv

ATTACHMENT B

RESUMES

GERALD F. NICHOLLS, PE, CHMM

ASSOCIATE PRINCIPAL

ENVIRONMENTAL ENGINEERING & HAZARDOUS MATERIALS MANAGEMENT

Mr. Nicholls' 20 years of expertise includes management of remediation and site investigations, litigation support, expert services, brownfield cleanups, remedial design, industrial hygiene, for projects throughout New York and New Jersey. He works closely with various private, state, commercial, industrial, and municipal clients, acting as a liaison between the client and project team.

In 2019, Real Estate Weekly named Mr. Nicholls one of the Rising Stars of Real Estate.

SELECTED PROJECTS

- Willets Point Development, Brownfield Cleanup Program, Flushing, NY
- 491 Wortman Ave, Air Sparge/Soil Vapor Extraction Design and Implementation, Brownfield Cleanup Program, Bid Documents, Construction Administration, Brooklyn, NY
- Whitehead Realty, Acme Sites, DNAPL Delineation, Site Characterization, Remedial Investigation and Reporting, Brooklyn, NY
- West 17th Street Development, DNAPL Assessment, DNAPL Recovery, Remedial Design, Closure through Brownfield Cleanup Program, Remediation Oversight, Bid Documents, ISS and Containment Wall Design, Construction Administration, New York, NY
- 2 Ingraham Street, Brooklyn, NY
- New York City School Construction Authority On-Call Contract for Hazmat Consulting Services, Various Locations, Five Boroughs of New York, NY
- G4 Capital third party due diligence reviews and environmental risk evaluations, Various Locations, New York, NY
- 140 6th Avenue, Sub-Membrane Depressurization System Design, Spill Remediation, Subslab Remediation and Monitoring Well Piping Design, Remediation Oversight, and Construction Administration, New York, NY
- Gowanus Canal Northside, Demolition and Decommissioning of MOSF, Remediation Investigation, Brownfield Cleanup Program, Brooklyn, NY
- 23-01 42nd Road, Phase I, Phase II Remedial Investigation, Remedial Action Work Plan, Sub-Membrane Depressurization System Design, Underground Storage Tank Closure and Remediation, Brownfield Cleanup Program, Remediation Oversight, Construction Administration, Long Island City, NY
- 23-10 Queens Plaza South, Phase I, Phase II Remedial Investigation, Remedial Action Work Plan, Sub-Membrane Depressurization System Design, Underground Storage Tank Closure and



EDUCATION

M.S., Environmental Engineering
New Jersey Institute of Technology

B.S., Chemistry and Environmental Studies
(Double Major)
Ursinus College

PROFESSIONAL REGISTRATION

Professional Engineer (PE)
in NY

Certified Hazardous Materials Manager
(CHMM)

AFFILIATIONS

Real Estate Board New York

City of Jersey City
Environmental Commission, Former
Commissioner, Vice Chair
and Chair

Alliance of Hazardous
Materials Professionals

American Chemical
Society

New York League of
Conservation Voters

New York City Brownfield
Partnership

LANGAN

- Remediation, Brownfield Cleanup Program, Remediation Oversight, Construction Administration, Long Island City, NY
- 163 6th Street, Phase I and Phase II Due Diligence, Spill Response, Remedial Action Work Plan, Brooklyn, NY
- 170 Amsterdam Avenue, Remedial Action Work Plan, Voluntary Cleanup Program, Remediation Oversight, Construction Administration, New York, NY
- Urban Health Plan, Medical Building, DNAPL Delineation, Remedial Action Work Plan, Hazardous Waste Management and Minimization, Brownfield Cleanup Program, Bronx, NY
- Second Avenue Subway, Air Monitoring and Ventilated Air Treatment Program, New York, NY
- New York University Spill Sites, 4 Washington Square Village, 7-13, Washington Square North, and 251 Mercer Street, Fuel Oil Spill Cleanup and Closure, New York, NY
- Dormitory Authority of New York (DASNY), City College of New York, Fuel Protection and Leak Detection System Repair and Upgrades, New York, NY
- 45 Broad Street, Waste Characterization, Construction Documents, New York, NY
- 241 West 28th Street, New York, NY
- Surfactant Remediation Project, In-Situ Chemical Oxidation Design and Implementation and Site Closure, Margate City, NJ
- Koppers Site, Trans-Hudson Express Project, Kearny, NJ
- Former Cornell Manufacturing Site, Orangeburg, NY
- Horse Pasture Site, Robins Air Force Base, GA
- Williams Air Force Base, Thermal Enhanced Extraction, Mesa, AZ
- New Jersey Transit, 32nd Street Station Stop (former Hicor Site), Bayonne, NJ
- Nikolski Radio Relay Station, Umnak Island, AK
- Middletown Post Office, Due Diligence, Middletown, NY
- Lower Manhattan Construction Command Center, Environmental Services Contract, New York, NY
- Da Nang International Airport, Da Nang, Vietnam
- 22nd to 8th Street Station Light Rail Extension, Bayonne, NJ
- 69th Street Grade Separation Project, North Bergen, NJ
- Dukes Parkway Landfill, Hillsboro/Manville, NJ
- NYU Langone Medical Center, New Science Building, Remediation Oversight and Construction Administration, Voluntary Cleanup Program, New York, NY
- 86 Warren Street, Waste Characterization and Construction Documents, New York, NY
- 459 Smith Street and Gowanus Green, Due Diligence and Cost Estimating, Brooklyn, NY
- 111 Leroy Street, New York, NY
- 411 Broadway, Phase I, Remedial Investigation, Air/Noise Coordination for E-Designation, New York, NY
- Modera on the Hudson, Remediation Oversight, Remedial Action Work Plan, Submembrane Depressurization System Design, Yonkers, NY
- Honeywell Quanta, Remedial Design Peer Review, Edgewater, NJ
- New York University Tandon School of Engineering (Spill 1009933), Remediation, Laser-Induced Fluorescence Investigation, Remedial System Optimization, Product Recovery, Spill Cleanup, Brooklyn, NY

Gowanus Canal
Conservancy,
Board of Directors

GERALD F. NICHOLLS, PE, CHMM

- 237-261 North 9th Street, Peer Review and Due Diligence, Brooklyn, NY

SELECTED PUBLICATIONS, REPORTS, AND PRESENTATIONS

Burke, M., Ciambuschini, S., Nicholls, G., Tashji, A., Vaidya, S.,
"Redeveloping a Remediated MGP Site", MGP Symposium 2019, Atlantic City, NJ.

"Biodegradation Pathways and End Products of Sodium Dioctyl Sulfosuccinate/Sodium Hexadecyl Diphenyl Oxide Disulfonate Surfactant Solution." Florida Remediation Conference, Orlando, Florida, November 2005.

GREGORY C. WYKA, PG, LEED AP

SENIOR PROJECT GEOLOGIST

ENVIRONMENTAL ENGINEERING

Mr. Wyka is a professional geologist with 16 years of experience in regulatory government, brownfield redevelopment, and environmental liability consulting. His expertise includes due diligence, real estate development, site characterizations, remedial investigations, conceptual site modeling, remedial strategies and designs, remedial action implementation and management. Mr. Wyka maintains an understanding of how to integrate remediation with property redevelopment and he provides technical, regulatory, logistical, and risk management guidance to clients, including developers, owners, and environmental attorneys. Mr. Wyka manages construction projects and remediation projects in the New York State Inactive Hazardous Waste Disposal Site Program (State Superfund Program), New York State Spill Response Program, New York State Brownfield Cleanup Program, and the New York City E-Designation and Voluntary Cleanup Programs. Through many of these projects, Mr. Wyka has routine exposure to other real estate development services, including civil engineering, geotechnical engineering, surveying, natural resources and permits, land use planning, hazardous building materials, environmental compliance, landscape architecture, and waterfront engineering, that has shaped him into a resourceful and practical asset to his clients.

SELECTED PROJECTS

- Alafia/Brooklyn Development Center, Brooklyn, NY
- The Dupont, Brooklyn, NY
- Greenpoint Landing, Brooklyn, NY: Brownfield Redevelopment, BCP, E-Designation, NYC VCP
- Anable Basin, Long Island City, NY; Brownfield Redevelopment, BCP.
- NYCSCA Due Diligence, Phase I ESA and Phase II ESI, New York, NY
- Fulfillment Center Due Diligence, Phase I ESA and Phase II ESI, New York, NY
- 489 State Street/100 Flatbush Avenue, Brownfield Redevelopment, NYC VCP, Brooklyn, NY
- One Third Avenue, Brownfield Development, NYC VCP, Brooklyn, NY
- One45 – Phase I and II, Brownfield Redevelopment, BCP, New York, NY
- 25-01 Queens Plaza North, Brownfield Redevelopment, BCP, Long Island City, NY
- Alafia/Jamaica Bay Landing, Brownfield Redevelopment, Brooklyn, NY
- 111 Washington Street, Brownfield Redevelopment, BCP, New York, NY
- 41 Kensico Drive, Brownfield Development, BCP, Mt. Kisco, NY
- 2409 Jerome Avenue, Brownfield Redevelopment, BCP, Bronx, NY



EDUCATION

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

PROFESSIONAL REGISTRATION

Professional Geologist (PG)
in NY

LEED Accredited
Professional (LEED AP)
Neighborhood Development

40-Hour HAZWOPER

AFFILIATIONS

New York State Council of
Professional Geologists
(NYSCPG)

NYSCPG President

NYSCPG Fundraising Chair

New York City Brownfield
Partnership

LANGAN

GREGORY C. WYKA, PG, LEED AP

- 82 King Street, Brownfield Redevelopment, BCP, New York, NY
- 300 West 122nd Street, Brownfield Redevelopment, BCP, New York, NY
- 517 West 29th Street, Brownfield Redevelopment, NYC VCP, New York, NY
- 160 Leroy Street, New York, NY: Brownfield Redevelopment; E-Designation, NYC VCP
- 685 First Avenue, New York, NY: Brownfield Redevelopment: NYSDEC Voluntary Cleanup Program
- 700-708 First Avenue, New York, NY: Brownfield Redevelopment, BCP
- Inlet Assemblage/30 Gem Street, Brownfield Redevelopment, Brooklyn, NY
- 60 West Street, Brooklyn, NY: Brownfield Redevelopment, E-Designation
- 27-19 44th Drive, Long Island City, NY: Brownfield Redevelopment
- 515 West 42nd Street, New York, NY: E-Designation
- Brooklyn Bridge Park, Pierhouse: Brownfield Redevelopment 550 Myrtle Avenue, Brooklyn, NY: E-Designation
- 50 Jay Street, Phase I ESA, Brooklyn, NY
- 205 Water Street, Brooklyn, NY: Brownfield Redevelopment, E-Designation
- 29-01 Borden Avenue, Long Island City, NY; Brownfield Redevelopment, NYSDEC Spills
- 29-10 Hunters Point Avenue, Long Island City, NY: Brownfield Redevelopment
- 30-27 Greenpoint Avenue, Long Island City, NY: NYSDEC Spills
- 55 Water Street, New York, NY: Emergency petroleum spill closure (Tropical Storm Sandy)
- 144 East 201st Street, New York, NY: Brownfield Redevelopment, E-Designation
- 310 Meserole Street, Phase I ESA, Brooklyn, NY
- 13-17 Laight Street, Phase I ESA, New York, NY
- 460 Mother Gaston Boulevard, Phase I ESA, Brooklyn, NY
- 25 Kent Avenue, Phase I ESA, Brooklyn, NY
- 1110 Oak Point Avenue, Phase I ESA, Bronx, NY
- 859-863 Lexington Avenue, Phase I ESA, New York, NY
- 49 East 21st Street, Phase I ESA, New York, NY
- 1552-1560 Broadway, Phase I ESA, New York, NY
- 287-291 East Houston Street, Phase I ESA, New York, NY
- Big River Study Area (Superfund), Remedial Investigation, Old Lead Belt, Park Hills and Desloge, MO
- Berry's Creek Study Area (Superfund Site), Remedial Investigation, Bergen County, NJ
- Everglades Restoration Project, Remedial Investigation, Clewiston, FL
- Marble River Wind Farm, Wetland Delineation, Ellenburg, NY

TYLER GOODNOUGH

SENIOR STAFF SCIENTIST

ENVIRONMENTAL ENGINEERING

Mr. Goodnough is an environmental scientist with experience conducting numerous Phase I and Phase II environmental site assessments throughout the Hudson Valley. He also has experience managing New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) and New York City Office of Environmental Remediation (NYCOER) remedial program sites. He is responsible for conducting and managing site investigations, characterization, and remediation.

SELECTED PROJECTS

- Con Edison Construction Inspections, Brooklyn Public Improvements, Brooklyn, NY
- NYCSCA Due Diligence Projects, Multiple Sites, NY
- 1298 Inwood Avenue, Bronx, NY
- NYCHCR Vital Brooklyn Site K, Brooklyn, NY
- 80-100 Flatbush Avenue, Brooklyn, NY
- Greenpoint Landing, Parcels H1 & H2, Brooklyn, NY
- Richmond County Bank Ballpark at St. George, Staten Island, NY
- Former Hudson Generating Station, Jersey City, NJ
- Former Buckeye Terminal, Brooklyn, NY
- 445 Gerard Avenue, Bronx, NY
- 805-825 Atlantic Avenue, Brooklyn, NY
- New York University CoGen Expansion, New York, NY
- NYCEDC Manhattan Greenway – Harlem River, New York, NY
- 180 Schermerhorn Street, Brooklyn, NY
- 1 and 125 Edgewater Street, Staten Island, NY
- 501 Industry Road, Staten Island, NY
- 45-18 Court Square, Long Island City, NY
- 74 Bogart St, Brooklyn, NY
- 57-00, 57-05, 57-57 and 58-20 47th Street, Maspeth, Queens, NY
- 1500 Lexington Avenue, Greece, NY
- 131-01 39th Avenue, Flushing, NY
- 27-01 Jackson Avenue, Long Island City, NY
- 211 Lombardy Street, Brooklyn, NY
- 38-21 12th Street, Long Island City, NY
- 341 Nevins Street, Brooklyn, NY
- NYCHA Spill Investigations, Various Locations, NY*



EDUCATION

B.S., Environmental
Science
Marist College

PROFESSIONAL REGISTRATION

40-Hour OSHA
HAZWOPER

10-Hour OSHA

**Projects represent experience with a previous firm*

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

LANGAN

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

ATTACHMENT C

ANALYTICAL METHODS/ 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	Field Blank Samples	Media Blank Samples	Equipment Blank Samples	Trip Blank Samples	Ambient Air Samples	MS/MSD Samples
Soil	Total VOCs via PID	Part 375 + TCL VOCs	EPA 8260C	Cool to 4°C	Two 40-ml VOC vials with 5ml H ₂ O, one with MeOH or 3 En Core Samplers (separate container for % solids)	14 days	1 per 20 samples (minimum 1)	1 per 20 samples (minimum 1)	NA	NA	NA	NA	1 per 20 samples
		Part 375 + TCL SVOCs	EPA 8270D	Cool to 4°C	4 oz. amber glass jar	14 days extract, 40 days after extraction to analysis							
		Part 375 + TAL Metals + Cyanide	EPA 6010C, EPA 7470A, EPA 7196A, EPA 9014/9010C	Cool to 4°C	2 oz. amber glass jar	6 months, except mercury 28 days							
		Part 375 + TCL Pesticides	EPA 8081B	Cool to 4°C	4 oz. amber glass jar	14 days extract, 40 days after extraction to analysis							
		Part 375 + TCL PCBs	EPA 8082A	Cool to 4°C	4 oz. amber glass jar	14 days extract, 40 days after extraction to analysis							
		NYSDEC List PFAS	EPA 1633 Modified	Cool to 4°C	8 oz. HDPE jar	14 days to extract, 28 days after extraction to analysis				1 per day			
		1,4-Dioxane	8270 SIM	Cool to 4°C	4 oz. amber glass jar	14 days extract, 40 days after extraction to analysis				NA			
Groundwater	Temperature, Turbidity, pH, ORP, Conductivity, DO	Part 375 + 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)	NA	NA	1 per shipment of VOC samples	NA	1 per 20 samples
		Part 375 + TCL SVOCs	EPA 8270D	Cool to 4°C	Two 1-Liter amber glass	7 days to extract, 40 days after extraction to analysis							
		Part 375 + TAL Metals	EPA 6010C, EPA 7470A	HNO ₃	250 ml plastic	6 months, except Mercury 28 days							
		Hexavalent Chromium	EPA 7196A	Cool to 4°C	250 ml plastic	24 hours							
		Cyanide	SM 4500 C/E	NaOH plus 0.6g ascorbic acid	250 ml plastic	14 days							
		Part 375 + TCL Pesticides	EPA 8081B	Cool to 4°C	Two 1-Liter Amber Glass for Pesticides/PCB	7 days to extract, 40 days after extraction to analysis							
		PCBs	EPA 8082A	Cool to 4°C		7 days to extract, 40 days after extraction to analysis							
		PFAS	EPA 1633 Modified	Cool to 4°C	Two 250 mL HDPE	14 days to extract, 40 days after extraction to analysis				1 per day			
		1,4-dioxane	8270 SIM	Cool to 4°C	One 1 -Liter Amber Glass	7 days to extract, 40 days after extraction to analysis				NA			
Soil Vapor	Total VOCs, Oxygen, LEL, CO, and H ₂ S, with MultiGas Meter	TO-15 Listed VOCs	TO-15	Ambient Temperature	2.7- or 6-Liter Summa Canister	Analyze within 30 days of collection	1 per 20 samples (minimum 1)	NA	NA	NA	NA	1 per 10 samples (minimum 1)	NA
Ambient/Indoor Air	Total VOCs via PID				2.7- or 6-Liter Summa Canister		NA	NA	NA	NA			

Notes:
1. PID - Photoionization Detector
2. VOC - Volatile organic compound
3. EPA - Environmental Protection Agency
4. TCL - Target compound list
5. TAL - Target analyte list
6. ORP - Oxidation reduction potential
7. DO - Dissolved oxygen
8. LEL - Lower explosive limit
9. CO -Carbon monoxide
10. H₂S - Hydrogen sulfide
11. PFAS - Per-fluoroalkyl substances
12. HDPE - High-Density Polyethylene

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 EQulS 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 bags¹:



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:

¹Both 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 EQulS 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 PROTOCOL



NEW YORK
STATE OF
OPPORTUNITY.

**Department of
Environmental
Conservation**

SAMPLING, ANALYSIS, AND ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

Under NYSDEC's Part 375 Remedial Programs

April 2023



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ERRATA SHEET for

**SAMPLING, ANALYSIS, AND ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES
 (PFAS) Under NYSDEC's Part 375 Remedial Programs Issued January 17, 2020**

Citation and Page Number	Current Text	Corrected Text	Date
Title of Appendix I, page 32	Appendix H	Appendix I	2/25/2020
Document Cover, page 1	Guidelines for Sampling and Analysis of PFAS	Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs	9/15/2020
Data Assessment and Application to Site Cleanup Page 3	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published	Until such time as Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published	3/28/2023
Water Sample Results Page 3	PFOA and PFOS should be further assessed and considered as potential contaminants of concern in groundwater or surface water if PFOA or PFOS is detected in any water sample at or above 10 ng/L (ppt) and is determined to be attributable to the site, either by a comparison of upgradient and downgradient levels, or the presence of soil source areas, as defined below.	NYSDEC has adopted ambient water quality guidance values for PFOA and PFOS. Groundwater samples should be compared to the human health criteria of 6.7 ng/l (ppt) for PFOA and 2.7 ng/l (ppt) for PFOS. These guidance values also include criteria for surface water for PFOS applicable for aquatic life, which may be applicable at some sites. Drinking water sample results should be compared to the NYS maximum contaminant level (MCL) of 10 ng/l (ppt). Analysis to determine if PFOA and PFOS concentrations are attributable to the site should include a comparison between upgradient and downgradient levels, and the presence of soil source areas, as defined below.	3/28/2023
Soil Sample Results Page 3	Soil cleanup objectives for PFOA and PFOS have been proposed in an upcoming revision to 6 NYCRR Part 375-6. Until SCOs are in effect, the following are to be used as guidance values:	NYSDEC will delay adding soil cleanup objectives for PFOA and PFOS to 6 NYCRR Part 375-6 until the PFAS rural soil background study has been completed. Until SCOs are in effect, the following are to be used as guidance values:	3/28/2023
Protection of Groundwater Page 3	PFOA (ppb) 1.1 PFOS (ppb) 3.7	PFOA (ppb) 0.8 PFOS (ppb) 1.0	3/28/2023

Citation and Page Number	Current Text	Corrected Text	Date
Footnote 2 Page 3	The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).	The Protection of Groundwater values are based on the above referenced ambient groundwater guidance values. Details on that calculation are available in the following document, prepared for the February 2022 proposed changes to Part 375 (https://www.dec.ny.gov/docs/remediation_hudson_pdf/part375techsupport.pdf). The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).	3/28/2023
Testing for Imported Soil Page 4	If the concentrations of PFOA and PFOS in leachate are at or above 10 ppt (the Maximum Contaminant Levels established for drinking water by the New York State Department of Health), then the soil is not acceptable.	If the concentrations of PFOA and PFOS in leachate are at or above the ambient water quality guidance values for groundwater, then the soil is not acceptable.	3/28/2023
Routine Analysis, page 9	“However, laboratories analyzing environmental samples...PFOA and PFOS in drinking water by EPA Method 537, 537.1 or ISO 25101.”	“However, laboratories analyzing environmental samples...PFOA and PFOS in drinking water by EPA Method 537, 537.1, ISO 25101, or Method 533.”	9/15/2020
Additional Analysis, page 9, new paragraph regarding soil parameters	None	“In cases where site-specific cleanup objectives for PFOA and PFOS are to be assessed, soil parameters, such as Total Organic Carbon (EPA Method 9060), soil pH (EPA Method 9045), clay content (percent), and cation exchange capacity (EPA Method 9081), should be included in the analysis to help evaluate factors affecting the leachability of PFAS in site soils.”	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Data Assessment and Application to Site Cleanup Page 10	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFAS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Target levels for cleanup of PFAS in other media, including biota and sediment, have not yet been established by the DEC.	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFOA and PFOS in other media, including biota and sediment, have not yet been established by the DEC.	9/15/2020
Water Sample Results Page 10	PFAS should be further assessed and considered as a potential contaminant of concern in groundwater or surface water (...) If PFAS are identified as a contaminant of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.	PFOA and PFOS should be further assessed and considered as potential contaminants of concern in groundwater or surface water (...) If PFOA and/or PFOS are identified as contaminants of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Soil Sample Results, page 10	“The extent of soil contamination for purposes of delineation and remedy selection should be determined by having certain soil samples tested by Synthetic Precipitation Leaching Procedure (SPLP) and the leachate analyzed for PFAS. Soil exhibiting SPLP results above 70 ppt for either PFOA or PFOS (individually or combined) are to be evaluated during the cleanup phase.”	“Soil cleanup objectives for PFOA and PFOS will be proposed in an upcoming revision to 6 NYCRR Part 375-6. Until SCOs are in effect, the following are to be used as guidance values. “ [Interim SCO Table] “PFOA and PFOS results for soil are to be compared against the guidance values listed above. These guidance values are to be used in determining whether PFOA and PFOS are contaminants of concern for the site and for determining remedial action objectives and cleanup requirements. Site-specific remedial objectives for protection of groundwater can also be presented for evaluation by DEC. Development of site-specific remedial objectives for protection of groundwater will require analysis of additional soil parameters relating to leachability. These additional analyses can include any or all the parameters listed above (soil pH, cation exchange capacity, etc.) and/or use of SPLP. As the understanding of PFAS transport improves, DEC welcomes proposals for site-specific remedial objectives for protection of groundwater. DEC will expect that those may be dependent on additional factors including soil pH, aqueous pH, % organic carbon, % Sand/Silt/Clay, soil cations: K, Ca, Mg, Na, Fe, Al, cation exchange capacity, and anion exchange capacity. Site-specific remedial objectives should also consider the dilution attenuation factor (DAF). The NJDEP publication on DAF can be used as a reference: https://www.nj.gov/dep/srp/guidance/rs/daf.pdf. ”	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Testing for Imported Soil Page 11	Soil imported to a site for use in a soil cap, soil cover, or as backfill is to be tested for PFAS in general conformance with DER-10, Section 5.4(e) for the PFAS Analyte List (Appendix F) using the analytical procedures discussed below and the criteria in DER-10 associated with SVOCs. If PFOA or PFOS is detected in any sample at or above 1 µg/kg, then soil should be tested by SPLP and the leachate analyzed for PFAS. If the SPLP results exceed 10 ppt for either PFOA or PFOS (individually) then the source of backfill should be rejected, unless a site-specific exemption is provided by DER. SPLP leachate criteria is based on the Maximum Contaminant Levels proposed for drinking water by New York State's Department of Health, this value may be updated based on future Federal or State promulgated regulatory standards. Remedial parties have the option of analyzing samples concurrently for both PFAS in soil and in the SPLP leachate to minimize project delays. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.	Testing for PFAS should be included any time a full TAL/TCL analyte list is required. Results for PFOA and PFOS should be compared to the applicable guidance values. If PFOA or PFOS is detected in any sample at or above the guidance values then the source of backfill should be rejected, unless a site-specific exemption is provided by DER based on SPLP testing, for example. If the concentrations of PFOA and PFOS in leachate are at or above 10 ppt (the Maximum Contaminant Levels established for drinking water by the New York State Department of Health), then the soil is not acceptable. PFOA, PFOS and 1,4-dioxane are all considered semi-volatile compounds, so composite samples are appropriate for these compounds when sampling in accordance with DER-10, Table 5.4(e)10. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Footnotes	None	¹ TOP Assay analysis of highly contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances. ² The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the soil cleanup objective for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).	9/15/2020
Additional Analysis, page 9	In cases... soil parameters, such as Total Organic Carbon (EPA Method 9060), soil...	In cases... soil parameters, such as Total Organic Carbon (Lloyd Kahn), soil...	1/8/2021
Appendix A, General Guidelines, fourth bullet	List the ELAP-approved lab(s) to be used for analysis of samples	List the ELAP- certified lab(s) to be used for analysis of samples	1/8/2021
Appendix E, Laboratory Analysis and Containers	Drinking water samples collected using this protocol are intended to be analyzed for PFAS by ISO Method 25101.	Drinking water samples collected using this protocol are intended to be analyzed for PFAS by EPA Method 537, 537.1, 533, or ISO Method 25101	1/8/2021
Water Sample Results Page 9	“In addition, further assessment of water may be warranted if either of the following screening levels are met: a. any other individual PFAS (not PFOA or PFOS) is detected in water at or above 100 ng/L; or b. total concentration of PFAS (including PFOA and PFOS) is detected in water at or above 500 ng/L”	Deleted	6/15/2021

Citation and Page Number	Current Text	Corrected Text	Date
Routine Analysis, Page XX	Currently, New York State Department of Health's Environmental Laboratory Approval Program (ELAP)... criteria set forth in the DER's laboratory guidelines for PFAS in non-potable water and solids (Appendix H - Laboratory Guidelines for Analysis of PFAS in Non-Potable Water and Solids).	Deleted	5/31/2022
Analysis and Reporting, Page XX	As of October 2020, the United States Environmental Protection Agency (EPA) does not have a validated method for analysis of PFAS for media commonly analyzed under DER remedial programs (non-potable waters, solids). DER has developed the following guidelines to ensure consistency in analysis and reporting of PFAS.	Deleted	5/31/2022
Routine Analysis, Page XX	LC-MS/MS analysis for PFAS using methodologies based on EPA Method 537.1 is the procedure to use for environmental samples. Isotope dilution techniques should be utilized for the analysis of PFAS in all media.	EPA Method 1633 is the procedure to use for environmental samples.	
Soil Sample Results, Page XX	Soil cleanup objectives for PFOA and PFOS will be proposed in an upcoming revision to 6 NYCRR Part 375-6	Soil cleanup objectives for PFOA and PFOS have been proposed in an upcoming revision to 6 NYCRR Part 375-6	
Appendix A	"Include in the text... LC-MS/MS for PFAS using methodologies based on EPA Method 537.1"	"Include in the text EPA Method 1633"	
Appendix A	"Laboratory should have ELAP certification for PFOA and PFOS in drinking water by EPA Method 537, 537.1, EPA Method 533, or ISO 25101"	Deleted	
Appendix B	"Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1"	"Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633"	

Citation and Page Number	Current Text	Corrected Text	Date
Appendix C	“Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1”	“Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633”	
Appendix D	“Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1”	“Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633”	
Appendix G		Updated to include all forty PFAS analytes in EPA Method 533	
Appendix H		Deleted	
Appendix I	Appendix I	Appendix H	
Appendix H	“These guidelines are intended to be used for the validation of PFAS analytical results for projects within the Division of Environmental Remediation (DER) as well as aid in the preparation of a data usability summary report.”	“These guidelines are intended to be used for the validation of PFAS using EPA Method 1633 for projects within the Division of Environmental Remediation (DER).”	
Appendix H	“The holding time is 14 days...”	“The holding time is 28 days...”	
Appendix H, Initial Calibration	“The initial calibration should contain a minimum of five standards for linear fit...”	“The initial calibration should contain a minimum of six standards for linear fit...”	
Appendix H, Initial Calibration	Linear fit calibration curves should have an R ² value greater than 0.990.	Deleted	
Appendix H, Initial Calibration Verification	Initial Calibration Verification Section	Deleted	
Appendix H	secondary Ion Monitoring Section	Deleted	
Appendix H	Branched and Linear Isomers Section	Deleted	

Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs

Objective

New York State Department of Environmental Conservation's Division of Environmental Remediation (DER) performs or oversees sampling of environmental media and subsequent analysis of PFAS as part of remedial programs implemented under 6 NYCRR Part 375. To ensure consistency in sampling, analysis, reporting, and assessment of PFAS, DER has developed this document which summarizes currently accepted procedures and updates previous DER technical guidance pertaining to PFAS.

Applicability

All work plans submitted to DEC pursuant to one of the remedial programs under Part 375 shall include PFAS sampling and analysis procedures that conform to the guidelines provided herein.

As part of a site investigation or remedial action compliance program, whenever samples of potentially affected media are collected and analyzed for the standard Target Analyte List/Target Compound List (TAL/TCL), PFAS analysis should also be performed. Potentially affected media can include soil, groundwater, surface water, and sediment. Based upon the potential for biota to be affected, biota sampling and analysis for PFAS may also be warranted as determined pursuant to a Fish and Wildlife Impact Analysis. Soil vapor sampling for PFAS is not required.

Field Sampling Procedures

DER-10 specifies technical guidance applicable to DER's remedial programs. Given the prevalence and use of PFAS, DER has developed "best management practices" specific to sampling for PFAS. As specified in DER-10 Chapter 2, quality assurance procedures are to be submitted with investigation work plans. Typically, these procedures are incorporated into a work plan, or submitted as a stand-alone document (e.g., a Quality Assurance Project Plan). Quality assurance guidelines for PFAS are listed in Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS.

Field sampling for PFAS performed under DER remedial programs should follow the appropriate procedures outlined for soils, sediments, or other solids (Appendix B), non-potable groundwater (Appendix C), surface water (Appendix D), public or private water supply wells (Appendix E), and fish tissue (Appendix F).

QA/QC samples (e.g. duplicates, MS/MSD) should be collected as specified in DER-10, Section 2.3(c). For sampling equipment coming in contact with aqueous samples only, rinsate or equipment blanks should be collected. Equipment blanks should be collected at a minimum frequency of one per day per site or one per twenty samples, whichever is more frequent.

Analysis and Reporting

The investigation work plan should describe analysis and reporting procedures, including laboratory analytical procedures for the methods discussed below. As specified in DER-10 Section 2.2, laboratories should provide a full Category B deliverable. In addition, a Data Usability Summary Report (DUSR) should be prepared by an independent, third-party data validator. Electronic data submissions should meet the requirements provided at: <https://www.dec.ny.gov/chemical/62440.html>.

DER has developed a *PFAS Analyte List* (Appendix G) for remedial programs to understand the nature of contamination at sites. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. If lab and/or matrix specific issues are encountered for any analytes, the DER project manager, in consultation with the DER chemist, will make case-by-case decisions as to whether certain analytes may be temporarily or permanently discontinued from analysis at each site. As with other contaminants that are analyzed for at a site, the *PFAS Analyte List* may be refined for future sampling events based on investigative findings.

Routine Analysis

EPA Method 1633 is the procedure to use for environmental samples. Reporting limits for PFOA and PFOS in aqueous samples should not exceed 2 ng/L. Reporting limits for PFOA and PFOS in solid samples should not exceed 0.5 µg/kg. Reporting limits for all other PFAS in aqueous and solid media should be as close to these limits as possible. If laboratories indicate that they are not able to achieve these reporting limits for the entire *PFAS Analyte List*, site-specific decisions regarding acceptance of elevated reporting limits for specific PFAS can be made by the DER project manager in consultation with the DER chemist. Data review guidelines were developed by DER to ensure data comparability and usability (Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids).

Additional Analysis

Additional laboratory methods for analysis of PFAS may be warranted at a site, such as the Synthetic Precipitation Leaching Procedure (SPLP) and Total Oxidizable Precursor Assay (TOP Assay).

In cases where site-specific cleanup objectives for PFOA and PFOS are to be assessed, soil parameters, such as Total Organic Carbon (Lloyd Kahn), soil pH (EPA Method 9045), clay content (percent), and cation exchange capacity (EPA Method 9081), should be included in the analysis to help evaluate factors affecting the leachability of PFAS in site soils.

SPLP is a technique used to determine the mobility of chemicals in liquids, soils and wastes, and may be useful in determining the need for addressing PFAS-containing material as part of the remedy. SPLP by EPA Method 1312 should be used unless otherwise specified by the DER project manager in consultation with the DER chemist.

Impacted materials can be made up of PFAS that are not analyzable by routine analytical methodology. A TOP Assay can be utilized to conceptualize the amount and type of oxidizable PFAS which could be liberated in the environment, which approximates the maximum concentration of perfluoroalkyl substances that could be generated if all polyfluoroalkyl substances were oxidized. For example, some polyfluoroalkyl substances may degrade or transform to form perfluoroalkyl substances (such as PFOA or PFOS), resulting in an increase in perfluoroalkyl substance concentrations as contaminated groundwater moves away from a source. The TOP Assay converts, through oxidation, polyfluoroalkyl substances (precursors) into perfluoroalkyl substances that can be detected by routine analytical methodology.¹

¹ TOP Assay analysis of highly contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances.

Commercial laboratories have adopted methods which allow for the quantification of targeted PFAS in air and biota. The EPA's Office of Research and Development (ORD) is currently developing methods which allow for air emissions characterization of PFAS, including both targeted and non-targeted analysis of PFAS. Consult with the DER project manager and the DER chemist for assistance on analyzing biota/tissue and air samples.

Data Assessment and Application to Site Cleanup

Until such time as Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFOA and PFOS in other media, including biota and sediment, have not yet been established by the DEC.

Water Sample Results

NYSDEC has adopted ambient water quality guidance values for PFOA and PFOS. Groundwater samples should be compared to the human health criteria of 6.7 ng/l (ppt) for PFOA and 2.7 ng/l (ppt) for PFOS. These human health criteria should also be applied to surface water that is used as a water supply. This guidance also includes criteria for surface water for PFOS applicable for aquatic life, which may be applicable at some sites. Drinking water sample results should be compared to the NYS maximum contaminant level (MCL) of 10 ng/l (ppt). Analysis to determine if PFOA and PFOS concentrations are attributable to the site should include a comparison between upgradient and downgradient levels, and the presence of soil source areas, as defined below.

If PFOA and/or PFOS are identified as contaminants of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.

Soil Sample Results

NYSDEC will delay adding soil cleanup objectives for PFOA and PFOS to 6 NYCRR Part 375-6 until the PFAS rural soil background study has been completed. Until SCOs are in effect, the following are to be used as guidance values:

Guidance Values for Anticipated Site Use	PFOA (ppb)	PFOS (ppb)
Unrestricted	0.66	0.88
Residential	6.6	8.8
Restricted Residential	33	44
Commercial	500	440
Industrial	600	440
Protection of Groundwater ²	0.8	1.0

PFOA and PFOS results for soil are to be compared against the guidance values listed above. These guidance values are to be used in determining whether PFOA and PFOS are contaminants of concern for the site and for determining remedial action objectives and cleanup requirements. Site-specific remedial objectives for protection of groundwater can also be presented for evaluation by DEC. Development of site-specific remedial objectives for protection of groundwater will require analysis of additional soil parameters relating to leachability. These

² The Protection of Groundwater values are based on the above referenced ambient groundwater guidance values. Details on that calculation are available in the following document, prepared for the February 2022 proposed changes to Part 375 (https://www.dec.ny.gov/docs/remediation_hudson_pdf/part375techsupport.pdf). The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).

additional analyses can include any or all the parameters listed above (soil pH, cation exchange capacity, etc.) and/or use of SPLP.

As the understanding of PFAS transport improves, DEC welcomes proposals for site-specific remedial objectives for protection of groundwater. DEC will expect that those may be dependent on additional factors including soil pH, aqueous pH, % organic carbon, % Sand/Silt/Clay, soil cations: K, Ca, Mg, Na, Fe, Al, cation exchange capacity, and anion exchange capacity. Site-specific remedial objectives should also consider the dilution attenuation factor (DAF). The NJDEP publication on DAF can be used as a reference:

<https://www.nj.gov/dep/srp/guidance/rs/daf.pdf>.

Testing for Imported Soil

Testing for PFAS should be included any time a full TAL/TCL analyte list is required. Results for PFOA and PFOS should be compared to the applicable guidance values. If PFOA or PFOS is detected in any sample at or above the guidance values then the source of backfill should be rejected, unless a site-specific exemption is provided by DER based on SPLP testing, for example. If the concentrations of PFOA and PFOS in leachate are at or above the ambient water quality guidance values for groundwater, then the soil is not acceptable.

PFOA, PFOS and 1,4-dioxane are all considered semi-volatile compounds, so composite samples are appropriate for these compounds when sampling in accordance with DER-10, Table 5.4(e)10. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.

Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS

The following guidelines (general and PFAS-specific) can be used to assist with the development of a QAPP for projects within DER involving sampling and analysis of PFAS.

General Guidelines in Accordance with DER-10

- Document/work plan section title – Quality Assurance Project Plan
- Summarize project scope, goals, and objectives
- Provide project organization including names and resumes of the project manager, Quality Assurance Officer (QAO), field staff, and Data Validator
 - The QAO should not have another position on the project, such as project or task manager, that involves project productivity or profitability as a job performance criterion
- List the ELAP certified lab(s) to be used for analysis of samples
- Include a site map showing sample locations
- Provide detailed sampling procedures for each matrix
- Include Data Quality Usability Objectives
- List equipment decontamination procedures
- Include an “Analytical Methods/Quality Assurance Summary Table” specifying:
 - Matrix type
 - Number or frequency of samples to be collected per matrix
 - Number of field and trip blanks per matrix
 - Analytical parameters to be measured per matrix
 - Analytical methods to be used per matrix with minimum reporting limits
 - Number and type of matrix spike and matrix spike duplicate samples to be collected
 - Number and type of duplicate samples to be collected
 - Sample preservation to be used per analytical method and sample matrix
 - Sample container volume and type to be used per analytical method and sample matrix
 - Sample holding time to be used per analytical method and sample matrix
- Specify Category B laboratory data deliverables and preparation of a DUSR

Specific Guidelines for PFAS

- Include in the text that sampling for PFAS will take place
- Include in the text that PFAS will be analyzed by EPA Method 1633
- Include the list of PFAS compounds to be analyzed (*PFAS Analyte List*)
- Include the laboratory SOP for PFAS analysis
- List the minimum method-achievable Reporting Limits for PFAS
 - Reporting Limits should be less than or equal to:
 - Aqueous – 2 ng/L (ppt)
 - Solids – 0.5 µg/kg (ppb)
- Include the laboratory Method Detection Limits for the PFAS compounds to be analyzed
-
- Include detailed sampling procedures
 - Precautions to be taken
 - Pump and equipment types
 - Decontamination procedures
 - Approved materials only to be used
- Specify that regular ice only will be used for sample shipment
- Specify that equipment blanks should be collected at a minimum frequency of 1 per day per site for each matrix

Appendix B - Sampling Protocols for PFAS in Soils, Sediments and Solids

General

The objective of this protocol is to give general guidelines for the collection of soil, sediment and other solid samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Containers

Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in to contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel spoon
- stainless steel bowl
- steel hand auger or shovel without any coatings

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Sampling is often conducted in areas where a vegetative turf has been established. In these cases, a pre-cleaned trowel or shovel should be used to carefully remove the turf so that it may be replaced at the conclusion of sampling. Surface soil samples (e.g. 0 to 6 inches below surface) should then be collected using a pre-cleaned, stainless steel spoon. Shallow subsurface soil samples (e.g. 6 to ~36 inches below surface) may be collected by digging a hole using a pre-cleaned hand auger or shovel. When the desired subsurface depth is reached, a pre-cleaned hand auger or spoon shall be used to obtain the sample.

When the sample is obtained, it should be deposited into a stainless steel bowl for mixing prior to filling the sample containers. The soil should be placed directly into the bowl and mixed thoroughly by rolling the material into the middle until the material is homogenized. At this point the material within the bowl can be placed into the laboratory provided container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at $4 \pm 2^\circ$ Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A soil log or sample log shall document the location of the sample/borehole, depth of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix C - Sampling Protocols for PFAS in Monitoring Wells

General

The objective of this protocol is to give general guidelines for the collection of groundwater samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including plumbers tape and sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel inertia pump with HDPE tubing
- peristaltic pump equipped with HDPE tubing and silicone tubing
- stainless steel bailer with stainless steel ball
- bladder pump (identified as PFAS-free) with HDPE tubing

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Monitoring wells should be purged in accordance with the sampling procedure (standard/volume purge or low flow purge) identified in the site work plan, which will determine the appropriate time to collect the sample. If sampling using standard purge techniques, additional purging may be needed to reduce turbidity levels, so samples contain a limited amount of sediment within the sample containers. Sample containers that contain sediment may cause issues at the laboratory, which may result in elevated reporting limits and other issues during the sample preparation that can compromise data usability. Sampling personnel should don new nitrile gloves prior to sample collection due to the potential to contact PFAS containing items (not related to the sampling equipment) during the purging activities.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at $4 \pm 2^\circ$ Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank per day per site and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Additional equipment blank samples may be collected to assess other equipment that is utilized at the monitoring well
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A purge log shall document the location of the sample, sampling equipment, groundwater parameters, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix D - Sampling Protocols for PFAS in Surface Water

General

The objective of this protocol is to give general guidelines for the collection of surface water samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel cup

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Where conditions permit, (e.g. creek or pond) sampling devices (e.g. stainless steel cup) should be rinsed with site medium to be sampled prior to collection of the sample. At this point the sample can be collected and poured into the sample container.

If site conditions permit, samples can be collected directly into the laboratory container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at $4 \pm 2^\circ$ Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank per day per site and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A sample log shall document the location of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix E - Sampling Protocols for PFAS in Private Water Supply Wells

General

The objective of this protocol is to give general guidelines for the collection of water samples from private water supply wells (with a functioning pump) for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Drinking water samples collected using this protocol are intended to be analyzed for PFAS by EPA Method 537, 537.1, 533, or ISO Method 25101. The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials (e.g. plumbers tape), including sample bottle cap liners with a PTFE layer.

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Locate and assess the pressure tank and determine if any filter units are present within the building. Establish the sample location as close to the well pump as possible, which is typically the spigot at the pressure tank. Ensure sampling equipment is kept clean during sampling as access to the pressure tank spigot, which is likely located close to the ground, may be obstructed and may hinder sample collection.

Prior to sampling, a faucet downstream of the pressure tank (e.g., washroom sink) should be run until the well pump comes on and a decrease in water temperature is noted which indicates that the water is coming from the well. If the homeowner is amenable, staff should run the water longer to purge the well (15+ minutes) to provide a sample representative of the water in the formation rather than standing water in the well and piping system including the pressure tank. At this point a new pair of nitrile gloves should be donned and the sample can be collected from the sample point at the pressure tank.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at $4 \pm 2^{\circ}$ Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- If equipment was used, collect one equipment blank per day per site and a minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers.
- A field reagent blank (FRB) should be collected at a rate of one per 20 samples. The lab will provide a FRB bottle containing PFAS free water and one empty FRB bottle. In the field, pour the water from the one bottle into the empty FRB bottle and label appropriately.
- Request appropriate data deliverable (Category B) and an electronic data deliverable
- For sampling events where multiple private wells (homes or sites) are to be sampled per day, it is acceptable to collect QC samples at a rate of one per 20 across multiple sites or days.

Documentation

A sample log shall document the location of the private well, sample point location, owner contact information, sampling equipment, purge duration, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate and available (e.g. well construction, pump type and location, yield, installation date). Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appendix F - Sampling Protocols for PFAS in Fish

This appendix contains a copy of the current SOP developed by the Division of Fish and Wildlife (DFW) entitled “General Fish Handling Procedures for Contaminant Analysis” (Ver. 8). This SOP should be followed when collecting fish for contaminant analysis. Note, however, that the Bureau of Ecosystem Health will not be supplying bags or tags. All supplies are the responsibility of the collector

Procedure Name: General Fish Handling Procedures for Contaminant Analysis

Number: FW-005

Purpose: This procedure describes data collection, fish processing and delivery of fish collected for contaminant monitoring. It contains the chain of custody and collection record forms that should be used for the collections.

Organization: Environmental Monitoring Section
Bureau of Ecosystem Health
Division of Fish and Wildlife (DFW)
New York State Department of Environmental Conservation (NYSDEC)
625 Broadway
Albany, New York 12233-4756

Version: 8

Previous Version Date: 21 March 2018

Summary of Changes to this Version: Updated bureau name to Bureau of Ecosystem Health. Added direction to list the names of all field crew on the collection record. Minor formatting changes on chain of custody and collection records.

Originator or Revised by: Wayne Richter, Jesse Becker

Date: 26 April 2019

Quality Assurance Officer and Approval Date: Jesse Becker, 26 April 2019

**NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION**

GENERAL FISH HANDLING PROCEDURES FOR CONTAMINANT ANALYSES

- A. Original copies of all continuity of evidence (i.e., Chain of Custody) and collection record forms must accompany delivery of fish to the lab. A copy shall be directed to the Project Leader or as appropriate, Wayne Richter. All necessary forms will be supplied by the Bureau of Ecosystem Health. Because some samples may be used in legal cases, it is critical that each section is filled out completely. Each Chain of Custody form has three main sections:
1. The top box is to be filled out **and signed** by the person responsible for the fish collection (e.g., crew leader, field biologist, researcher). This person is responsible for delivery of the samples to DEC facilities or personnel (e.g., regional office or biologist).
 2. The second section is to be filled out **and signed** by the person responsible for the collections while being stored at DEC, before delivery to the analytical lab. This may be the same person as in (1), but it is still required that they complete the section. Also important is the **range of identification numbers** (i.e., tag numbers) included in the sample batch.
 3. Finally, the bottom box is to record any transfers between DEC personnel and facilities. Each subsequent transfer should be **identified, signed, and dated**, until laboratory personnel take possession of the fish.
- B. The following data are required on each **Fish Collection Record** form:
1. Project and Site Name.
 2. DEC Region.
 3. All personnel (and affiliation) involved in the collection.
 4. Method of collection (gill net, hook and line, etc.)
 5. Preservation Method.
- C. The following data are to be taken on each fish collected and recorded on the **Fish Collection Record** form:
1. Tag number - Each specimen is to be individually jaw tagged at time of collection with a unique number. Make sure the tag is turned out so that the number can be read without opening the bag. Use tags in sequential order. For small fish or composite samples place the tag inside the bag with the samples. The Bureau of Ecosystem Health can supply the tags.
 2. Species identification (please be explicit enough to enable assigning genus and species). Group fish by species when processing.
 3. Date collected.
 4. Sample location (waterway and nearest prominent identifiable landmark).
 5. Total length (nearest mm or smallest sub-unit on measuring instrument) and weight (nearest g or

smallest sub-unit of weight on weighing instrument). Take all measures as soon as possible with calibrated, protected instruments (e.g. from wind and upsets) and prior to freezing.

6. Sex - fish may be cut enough to allow sexing or other internal investigation, but do not eviscerate. Make any incision on the right side of the belly flap or exactly down the midline so that a left-side fillet can be removed.

D. General data collection recommendations:

1. It is helpful to use an ID or tag number that will be unique. It is best to use metal striped bass or other uniquely numbered metal tags. If uniquely numbered tags are unavailable, values based on the region, water body and year are likely to be unique: for example, R7CAY11001 for Region 7, Cayuga Lake, 2011, fish 1. If the fish are just numbered 1 through 20, we have to give them new numbers for our database, making it more difficult to trace your fish to their analytical results and creating an additional possibility for errors.
 2. Process and record fish of the same species sequentially. Recording mistakes are less likely when all fish from a species are processed together. Starting with the bigger fish species helps avoid missing an individual.
 3. If using Bureau of Ecosystem Health supplied tags or other numbered tags, use tags in sequence so that fish are recorded with sequential Tag Numbers. This makes data entry and login at the lab and use of the data in the future easier and reduces keypunch errors.
 4. Record length and weight as soon as possible after collection and before freezing. Other data are recorded in the field upon collection. An age determination of each fish is optional, but if done, it is recorded in the appropriate "Age" column.
 5. For composite samples of small fish, record the number of fish in the composite in the Remarks column. Record the length and weight of each individual in a composite. All fish in a composite sample should be of the same species and members of a composite should be visually matched for size.
 6. Please submit photocopies of topographic maps or good quality navigation charts indicating sampling locations. GPS coordinates can be entered in the Location column of the collection record form in addition to or instead for providing a map. These records are of immense help to us (and hopefully you) in providing documented location records which are not dependent on memory and/or the same collection crew. In addition, they may be helpful for contaminant source trackdown and remediation/control efforts of the Department.
 7. When recording data on fish measurements, it will help to ensure correct data recording for the data recorder to call back the numbers to the person making the measurements.
- E. Each fish is to be placed in its own individual plastic bag. For small fish to be analyzed as a composite, put all of the fish for one composite in the same bag but use a separate bag for each composite. It is important to individually bag the fish to avoid difficulties or cross contamination when processing the fish for chemical analysis. Be sure to include the fish's tag number inside the bag, preferably attached to the fish with the tag number turned out so it can be read. Tie or otherwise secure the bag closed. **The Bureau of Ecosystem Health will supply the bags.** If necessary, food grade bags may be procured from a suitable vendor (e.g., grocery store). It is preferable to redundantly label each bag with a manila tag tied between the knot and the body of the bag. This tag should be labeled with the project name, collection location, tag number, collection date, and fish species. If scales are collected, the scale envelope should be labeled with

the same information.

- F. Groups of fish, by species, are to be placed in one large plastic bag per sampling location. **The Bureau of Ecosystem Health will supply the larger bags.** Tie or otherwise secure the bag closed. Label the site bag with a manila tag tied between the knot and the body of the bag. The tag should contain: project, collection location, collection date, species and **tag number ranges**. Having this information on the manila tag enables lab staff to know what is in the bag without opening it.
- G. Do not eviscerate, fillet or otherwise dissect the fish unless specifically asked to. If evisceration or dissection is specified, the fish must be cut along the exact midline or on the right side so that the left side fillet can be removed intact at the laboratory. If filleting is specified, the procedure for taking a standard fillet (SOP PREPLAB 4) must be followed, including removing scales.
- H. Special procedures for PFAS: Unlike legacy contaminants such as PCBs, which are rarely found in day to day life, PFAS are widely used and frequently encountered. Practices that avoid sample contamination are therefore necessary. While no standard practices have been established for fish, procedures for water quality sampling can provide guidance. The following practices should be used for collections when fish are to be analyzed for PFAS:
 - No materials containing Teflon.
 - No Post-it notes.
 - No ice packs; only water ice or dry ice.
 - Any gloves worn must be powder free nitrile.
 - No Gore-Tex or similar materials (Gore-Tex is a PFC with PFOA used in its manufacture).
 - No stain repellent or waterproof treated clothing; these are likely to contain PFCs.
 - Avoid plastic materials, other than HDPE, including clipboards and waterproof notebooks.
 - Wash hands after handling any food containers or packages as these may contain PFCs.
 - Keep pre-wrapped food containers and wrappers isolated from fish handling.
 - Wear clothing washed at least six times since purchase.
 - Wear clothing washed without fabric softener.
 - Staff should avoid cosmetics, moisturizers, hand creams and similar products on the day of sampling as many of these products contain PFCs (Fujii et al. 2013). Sunscreen or insect repellent should not contain ingredients with “fluor” in their name. Apply any sunscreen or insect repellent well downwind from all materials. Hands must be washed after touching any of these products.
- I. All fish must be kept at a temperature <45° F (<8° C) immediately following data processing. As soon as possible, freeze at -20° C ± 5° C. Due to occasional freezer failures, daily freezer temperature logs are required. The freezer should be locked or otherwise secured to maintain chain of custody.
- J. In most cases, samples should be delivered to the Analytical Services Unit at the Hale Creek field station. Coordinate delivery with field station staff and send copies of the collection records, continuity of evidence forms and freezer temperature logs to the field station. For samples to be analyzed elsewhere, non-routine collections or other questions, contact Wayne Richter, Bureau of Ecosystem Health, NYSDEC, 625 Broadway, Albany, New York 12233-4756, 518-402-8974, or the project leader about sample transfer. Samples will then be directed to the analytical facility and personnel noted on specific project descriptions.
- K. A recommended equipment list is at the end of this document.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF FISH AND WILDLIFE
FISH COLLECTION RECORD

page _____ of _____

Project and Site Name _____ DEC Region _____

Collections made by (include all crew) _____

Sampling Method: ☐ Electrofishing ☐ Gill netting ☐ Trap netting ☐ Trawling ☐ Seining ☐ Angling ☐ Other _____

Preservation Method: ☐ Freezing ☐ Other _____ Notes (SWFDB survey number): _____

FOR LAB USE ONLY- LAB ENTRY NO.	COLLECTION OR TAG NO.	SPECIES	DATE TAKEN	LOCATION	AGE	SEX &/OR REPROD. CONDIT	LENGTH ()	WEIGHT ()	REMARKS

richter: revised 2011, 5/7/15, 10/4/16, 3/20/17; becker: 3/23/17, 4/26/19

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION CHAIN OF CUSTODY

I, _____, of _____ collected the
(Print Name) (Print Business Address)

following on _____, 20____ from _____
(Date) (Water Body)

in the vicinity of _____
(Landmark, Village, Road, etc.)

Town of _____, in _____ County.

Item(s) _____

Said sample(s) were in my possession and handled according to standard procedures provided to me prior to collection. The sample(s) were placed in the custody of a representative of the New York State Department of Environmental Conservation on _____, 20____.

Signature Date

I, _____, received the above mentioned sample(s) on the date specified and assigned identification number(s) _____ to the sample(s). I have recorded pertinent data for the sample(s) on the attached collection records. The sample(s) remained in my custody until subsequently transferred, prepared or shipped at times and on dates as attested to below.

Signature Date

SECOND RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
THIRD RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
FOURTH RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
RECEIVED IN LABORATORY BY (Print Name)	TIME & DATE	REMARKS
SIGNATURE	UNIT	
LOGGED IN BY (Print Name)	TIME & DATE	ACCESSION NUMBERS
SIGNATURE	UNIT	

NOTICE OF WARRANTY

By signature to the chain of custody (reverse), the signatory warrants that the information provided is truthful and accurate to the best of his/her ability. The signatory affirms that he/she is willing to testify to those facts provided and the circumstances surrounding the same. Nothing in this warranty or chain of custody negates responsibility nor liability of the signatories for the truthfulness and accuracy of the statements provided.

HANDLING INSTRUCTIONS

On day of collection, collector(s) name(s), address(es), date, geographic location of capture (attach a copy of topographic map or navigation chart), species, number kept of each species, and description of capture vicinity (proper noun, if possible) along with name of Town and County must be indicated on reverse.

Retain organisms in manila tagged plastic bags to avoid mixing capture locations. Note appropriate information on each bag tag.

Keep samples as cool as possible. Put on ice if fish cannot be frozen within 12 hours. If fish are held more than 24 hours without freezing, they will not be retained or analyzed.

Initial recipient (either DEC or designated agent) of samples from collector(s) is responsible for obtaining and recording information on the collection record forms which will accompany the chain of custody. This person will seal the container using packing tape and writing his signature, the time and the date across the tape onto the container with indelible marker. Any time a seal is broken, for whatever purpose, the incident must be recorded on the Chain of Custody (reason, time, and date) in the purpose of transfer block. Container then is resealed using new tape and rewriting signature, with time and date.

EQUIPMENT LIST

Scale or balance of appropriate capacity for the fish to be collected.

Fish measuring board.

Plastic bags of an appropriate size for the fish to be collected and for site bags.

Individually numbered metal tags for fish.

Manila tags to label bags.

Small envelopes, approximately 2" x 3.5", if fish scales are to be collected.

Knife for removing scales.

Chain of custody and fish collection forms.

Clipboard.

Pens or markers.

Paper towels.

Dish soap and brush.

Bucket.

Cooler.

Ice.

Duct tape.

Appendix G – PFAS Analyte List

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonic acids	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluoropentanesulfonic acid	PFPeS	2706-91-4
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanesulfonic acid	PFOS	1763-23-1
	Perfluorononanesulfonic acid	PFNS	68259-12-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
	Perfluorododecanesulfonic acid	PFDoS	79780-39-5
Perfluoroalkyl carboxylic acids	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUnA	2058-94-8
	Perfluorododecanoic acid	PFDaA	307-55-1
	Perfluorotridecanoic acid	PFTTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTeDA	376-06-7
Per- and Polyfluoroether carboxylic acids	Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6
	4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
	Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1
	Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5
	Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6
Fluorotelomer sulfonic acids	4:2 Fluorotelomer sulfonic acid	4:2-FTS	757124-72-4
	6:2 Fluorotelomer sulfonic acid	6:2-FTS	27619-97-2
	8:2 Fluorotelomer sulfonic acid	8:2-FTS	39108-34-4
Fluorotelomer carboxylic acids	3:3 Fluorotelomer carboxylic acid	3:3 FTCA	356-02-5
	5:3 Fluorotelomer carboxylic acid	5:3 FTCA	914637-49-3
	7:3 Fluorotelomer carboxylic acid	7:3 FTCA	812-70-4
Perfluorooctane sulfonamides	Perfluorooctane sulfonamide	PFOSA	754-91-6
	N-methylperfluorooctane sulfonamide	NMeFOSA	31506-32-8
	N-ethylperfluorooctane sulfonamide	NEtFOSA	4151-50-2
Perfluorooctane sulfonamidoacetic acids	N-methylperfluorooctane sulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethylperfluorooctane sulfonamidoacetic acid	N-EtFOSAA	2991-50-6
Perfluorooctane sulfonamide ethanol	N-methylperfluorooctane sulfonamidoethanol	MeFOSE	24448-09-7
	N-ethylperfluorooctane sulfonamidoethanol	EtFOSE	1691-99-2

Group	Chemical Name	Abbreviation	CAS Number
Ether sulfonic acids	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (F-53B Major)	9Cl-PF3ONS	756426-58-1
	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor)	11Cl-PF3OUdS	763051-92-9
	Perfluoro(2-ethoxyethane) sulfonic acid	PFEESA	113507-82-7

Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids

General

These guidelines are intended to be used for the validation of PFAS using EPA Method 1633 for projects within the Division of Environmental Remediation (DER). Data reviewers should understand the methodology and techniques utilized in the analysis. Consultation with the end user of the data may be necessary to assist in determining data usability based on the data quality objectives in the Quality Assurance Project Plan. A familiarity with the laboratory's Standard Operating Procedure may also be needed to fully evaluate the data. If you have any questions, please contact DER's Quality Assurance Officer, Dana Barbarossa, at dana.barbarossa@dec.ny.gov.

Preservation and Holding Time

Samples should be preserved with ice to a temperature of less than 6°C upon arrival at the lab. The holding time is 28 days to extraction for aqueous and solid samples. The time from extraction to analysis for aqueous samples is 28 days and 40 days for solids.

Temperature greatly exceeds 6°C upon arrival at the lab*	Use professional judgement to qualify detects and non-detects as estimated or rejected
Holding time exceeding 28 days to extraction	Use professional judgement to qualify detects and non-detects as estimated or rejected if holding time is grossly exceeded

*Samples that are delivered to the lab immediately after sampling may not meet the thermal preservation guidelines. Samples are considered acceptable if they arrive on ice or an attempt to chill the samples is observed.

Initial Calibration

The initial calibration should contain a minimum of six standards for linear fit and six standards for a quadratic fit. The relative standard deviation (RSD) for a quadratic fit calibration should be less than 20%.

The low-level calibration standard should be within 50% - 150% of the true value, and the mid-level calibration standard within 70% - 130% of the true value.

%RSD >20%	J flag detects and UJ non detects

Continuing Calibration Verification

Continuing calibration verification (CCV) checks should be analyzed at a frequency of one per ten field samples. If CCV recovery is very low, where detection of the analyte could be in question, ensure a low level CCV was analyzed and use to determine data quality.

CCV recovery <70 or >130%	J flag results

Blanks

There should be no detections in the method blanks above the reporting limits. Equipment blanks, field blanks, rinse blanks etc. should be evaluated in the same manner as method blanks. Use the most contaminated blank to evaluate the sample results.

Blank Result	Sample Result	Qualification
Any detection	<Reporting limit	Qualify as ND at reporting limit
Any detection	>Reporting Limit and >10x the blank result	No qualification
>Reporting limit	>Reporting limit and <10x blank result	J+ biased high

Field Duplicates

A blind field duplicate should be collected at rate of one per twenty samples. The relative percent difference (RPD) should be less than 30% for analyte concentrations greater than two times the reporting limit. Use the higher result for final reporting.

RPD >30%	Apply J qualifier to parent sample

Lab Control Spike

Lab control spikes should be analyzed with each extraction batch or one for every twenty samples. In the absence of lab derived criteria, use 70% - 130% recovery criteria to evaluate the data.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects

Matrix Spike/Matrix Spike Duplicate

One matrix spike and matrix spike duplicate should be collected at a rate of one per twenty samples. Use professional judgement to reject results based on out of control MS/MSD recoveries.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only
RPD >30%	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only

Extracted Internal Standards (Isotope Dilution Analytes)

Problematic analytes (e.g. PFBA, PFPeA, fluorotelomer sulfonates) can have wider recoveries without qualification. Qualify corresponding native compounds with a J flag if outside of the range.

Recovery <50% or >150%	Apply J qualifier
Recovery <25% or >150% for poor responding analytes	Apply J qualifier
Isotope Dilution Analyte (IDA) Recovery <10%	Reject results

Signal to Noise Ratio

The signal to noise ratio for the quantifier ion should be at least 3:1. If the ratio is less than 3:1, the peak is discernable from the baseline noise and symmetrical, the result can be reported. If the peak appears to be baseline noise and/or the shape is irregular, qualify the result as tentatively identified.

Reporting Limits

If project-specific reporting limits were not met, please indicate that in the report along with the reason (e.g. over dilution, dilution for non-target analytes, high sediment in aqueous samples).

Peak Integrations

Target analyte peaks should be integrated properly and consistently when compared to standards. Ensure branched isomer peaks are included for PFAS where standards are available. Inconsistencies should be brought to the attention of the laboratory or identified in the data review summary report.

Method 1633 Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, Oil and Tissue Samples by LC-MS/MS

References: Method 1633 - Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, Oil and Tissue Samples by LC-MS/MS (2nd Draft -June 2022)

DOD QSM (US Department of Defense Quality Systems Manual for Environmental Laboratories, version 5.4, 20221)

1. Scope and Application

Matrices: Drinking water, Non-potable Water, Tissues, Oils, Biosolids and Solid Matrices

Definitions: Refer to Alpha Analytical Quality Manual.

- 1.1** Method 1633 is for use in the Clean Water Act (CWA) for the determination of the per- and polyfluoroalkyl substances (PFAS) in Table 1 in aqueous, solid (soil, biosolids, sediment) and tissue samples by liquid chromatography/mass spectrometry (LC-MS/MS).
- 1.2** The method calibrates and quantifies PFAS analytes using isotopically labeled standards. Where linear and branched isomers are present in the sample and either qualitative or quantitative standards containing branched and linear isomers are commercially available, the PFAS analyte is reported as a single analyte consisting of the sum of the linear and branched isomer concentrations
- 1.3** 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, tissue soil and biosolid Matrices. Accuracy and precision data have been generated for the compounds listed in Table 1.
- 1.4** 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.
- 1.5** 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** Environmental samples are prepared and extracted using method-specific procedures. Sample extracts are subjected to cleanup procedures designed to remove interferences. Analyses of the sample extracts are conducted by LC-MS/MS in the multiple reaction monitoring (MRM) mode. Sample concentrations are determined by isotope dilution or

extracted internal standard quantification using isotopically labeled compounds added to the samples before extraction.

- 2.2 Aqueous samples are spiked with isotopically labeled standards, extracted using solid-phase extraction (SPE) cartridges and undergo cleanup using carbon before analysis.
- 2.3 Solid and Oil samples are spiked with isotopically labeled standards, extracted into basic methanol, and cleaned up by carbon and SPE cartridges before analysis
- 2.4 Tissue samples are spiked with isotopically labeled standards, extracted in potassium hydroxide and acetonitrile followed by basic methanol, and cleaned up by carbon and SPE cartridges before analysis.
- 2.5 A sample extract is injected 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.

2.6 Method Modifications from Reference

N/A

3. Reporting Limits

The reporting limit for PFAS's are listed in Table 8.

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 1/2 the RL for each method analyte) under the conditions of the analysis by analyzing laboratory reagent blanks as described in Section 9.1. 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) 500-mL or 250-mL high density polyethylene (HDPE) container with an unlined plastic screw cap. All sample containers must have linerless HDPE or polypropylene caps.
- 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** Maintain all aqueous samples protected from light at 0 - 6 °C from the time of collection until shipped to the laboratory. Samples must be shipped as soon as practical with sufficient ice to maintain the sample temperature below 6 °C during transport and be received by the laboratory within 48 hours of collection. The laboratory must confirm that the sample temperature is 0 - 6 °C upon receipt.

Once received by the laboratory, the samples must be stored at ≤ -20 °C until sample preparation.

6.2 Sample Collection for Solid and Oil samples.

- 6.2.1 Grab samples are collected in polypropylene containers. Sample containers and contact surfaces containing PTFE shall be avoided. Samples should fill no more than $\frac{3}{4}$ full.
- 6.2.2 Maintain solid samples protected from light (in HDPE containers) at 0 - 6 °C from the time of collection until receipt at the laboratory. The laboratory must confirm that the sample temperature is 0 - 6 °C upon receipt. Once received by the laboratory, the samples must be stored at ≤ -20 °C until sample preparation.

6.3 Sample Collection for fish and other tissue samples

- 6.3.1 If the time of collection to the time of receipt at the laboratory is expected to exceed 24 hours, the tissue samples must be frozen upon collection and shipped to the laboratory on dry ice.
- 6.3.2 Once received by the laboratory, the samples must be maintained protected from light at ≤ -20 °C until prepared. Store unused samples in HDPE containers or wrapped in aluminum foil at ≤ -20 °C.
- 6.3.3 The nature of the tissues of interest may vary by project. Field sampling plans and protocols should explicitly state the samples to be collected and if any processing will be conducted in the field (e.g., filleting of whole fish or removal of organs). All field procedures must involve materials and equipment that have been shown to be free of PFAS.

6.4 Sample Preservation

Not applicable.

6.5 Sample Shipping

Samples must be chilled during shipment and must not exceed 0 – 6 °C during the first 48 hours after collection. Sample temperature must be confirmed to be at or below 0 – 6 °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 0 – 6 °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.

6.6 Sample Handling

- 6.6.1 Aqueous samples (including leachates) should be analyzed as soon as possible; however, samples may be held in the laboratory for up to 90 days from collection, when stored at ≤ -20 °C and protected from the light. When stored at 0 - 6 °C and protected from the light, aqueous samples may be held for up to 28 days, with the caveat that issues were observed with certain perfluorooctane sulfonamide ethanols and perfluorooctane sulfonamidoacetic acids after 7 days. These issues are more likely to elevate the observed concentrations of other PFAS compounds via the transformation of these precursors if they are present in the sample.

- 6.6.2** Solid samples (soils and sediments), Oil and tissue samples may be held for up to 90 days, if stored by the laboratory in the dark at either 0 - 6 °C or ≤ -20 °C, with the caveat that samples may need to be extracted as soon as possible if NFDHA is an important analyte.
- 6.6.3** Biosolids samples may be held for up to 90 days, if stored by the laboratory in the dark at 0 - 6 °C or at -20 °C. Because microbiological activity in biosolids samples at 0 - 6 °C may lead to production of gases which may cause the sample to be expelled from the container when it is opened, as well as producing noxious odors, EPA recommends that samples be frozen if they need to be stored for more than a few days before extraction. Store sample extracts in the dark at less than 0 - 4 °C until analyzed. If stored in the dark at less than 0 - 4 °C, sample extracts may be stored for up to 90 days, with the caveat that issues were observed for some ether sulfonates after 28 days. These issues may elevate the observed concentrations of the ether sulfonates in the extract over time. Samples may need to be extracted as soon as possible if NFDHA is an important analyte.

7. Equipment and Supplies

- 7.1** SAMPLE CONTAINERS – 500-mL or 250-mL high density polyethylene (HDPE) bottles fitted with unlined screw caps. Sample bottles must be discarded after use.
- 7.2** SAMPLE JARS – 8-ounce wide mouth high density polyethylene (HDPE) bottles fitted with unlined screw caps. Sample bottles must be discarded after use.
- 7.3** POLYPROPYLENE BOTTLES – 4-mL narrow-mouth polypropylene bottles.
- 7.4** CENTRIFUGE TUBES – 50-mL conical polypropylene tubes with polypropylene screw caps for storing standard solutions and for collection of the extracts.
- 7.5** AUTOSAMPLER VIALS – Polypropylene 0.7-mL autosampler vials with polypropylene caps.
- 7.5.1** 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.
- 7.6** POLYPROPYLENE GRADUATED CYLINDERS – Suggested sizes include 25, 50, 100 and 1000-mL cylinders.
- 7.7** Auto Pipets – Suggested sizes include 5, 10, 25, 50, 100, 250, 500, 1000, 5000 and 10,000-µLs.
- 7.8** PLASTIC PIPETS – Polypropylene or polyethylene disposable pipets.
- 7.9** Silanized glass wool (Sigma-Aldrich, Cat # 20411 or equivalent) – store in a clean glass jar and rinsed with methanol (2 times) prior to use.
- 7.10** Disposable syringe filter, 25-mm, 0.2-µm Nylon membrane, PALL/Acrodisc or equivalent
- 7.11** Variable volume pipettes with disposable HDPE or polypropylene tips (10 µL to 5 mL) used for preparation of calibration standards and spiked samples.
- 7.12** ANALYTICAL BALANCE – Capable of weighing to the nearest 0.0001 g.

7.13 ANALYTICAL BALANCE – Capable of weighing to the nearest 0.1 g.

7.14 SOLID PHASE EXTRACTION (SPE) APPARATUS FOR USING CARTRIDGES

7.14.1 SPE CARTRIDGES – (Phenomenex WAX 150 or 250mg or equivalent). The SPE sorbent must have a pKa above 8 so that it remains positively charged during the extraction.

7.14.1.1 Note: SPE cartridges with different bed volume (e.g., 500 mg) may be used; however, the laboratory must demonstrate that the bed volume does not negatively affect analyte absorption and elution, by performing the initial demonstration of capability analyses described in Section 13.

7.14.2 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.

7.14.3 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 and LCS QC requirements.

7.15 EXTRACT CONCENTRATION SYSTEM – Extracts are concentrated by evaporation with nitrogen using a water bath set no higher than 55 °C.

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

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

7.17.1 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.

7.17.2 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.

7.17.3 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.

7.17.4 INSTRUMENT COLUMNS

7.17.4.1 ANALYTICAL: C18 column, 1.7 μ m, 50 x 2.1 mm (Waters Acquity UPLC® BEH or equivalent)

7.17.4.2 OPTIONAL GUARD COLUMN: (Phenomenex Kinetex® Evo C18 or equivalent)

8. Reagents and Standards

8.1 GASES, REAGENTS, AND SOLVENTS – Reagent grade or better chemicals must 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 1/2 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 (CH₃OH, CAS#: 67-56-1) – High purity, demonstrated to be free of analytes and interferences.

8.1.3 AMMONIUM ACETATE (NH₄C₂H₃O₂, CAS#: 631-61-8) – High purity, demonstrated to be free of analytes and interferences. Store at 2-8° and replace 2 years after opening date.

8.1.4 ACETIC ACID (H₃CCOOH, CAS#: 64-19-7) - High purity, demonstrated to be free of analytes and interferences and stored at room temperature.

8.1.4.1 Acetic Acid (0.1%) – Dissolve acetic acid (1 mL) in reagent water (1 L), store at room temperature, replace after 3 months.

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 1 Liter of REAGENT WATER.

8.1.7 ACETONITRILE – UPLC grade or equivalent, store at room temperature

8.1.8 TOLUENE – HPLC grade or equivalent.

8.1.9 ACETONE – pesticide grade or equivalent

8.1.10 AMMONIUM HYDROXIDE (NH₃, CAS#: 1336-21-6) – High purity, demonstrated to be free of analytes and interferences, and stored at room temperature.

- 8.1.11 AQUEOUS AMMONIUM HYDROXIDE (3%) – Add ammonium hydroxide (10 mL, 30%) to reagent water (90 mL), store at room temperature, replace after 3 months.
- 8.1.12 METHANOLIC AMMONIUM HYDROXIDE (0.3%) - add ammonium hydroxide (1 mL, 30%) to methanol (99 mL), store at room temperature, replace after 1 month
- 8.1.13 METHANOLIC AMMONIUM HYDROXIDE (1%) - add ammonium hydroxide (3.3 mL, 30%) to methanol (97 mL), store at room temperature, replace after 1 month
- 8.1.14 METHANOLIC AMMONIUM HYDROXIDE (2%) - add ammonium hydroxide (6.6 mL, 30%) to methanol (93.4 mL), store at room temperature, replace after 1 month
- 8.1.15 METHANOLIC POTASSIUM HYDROXIDE (0.05 M) – add 3.3 g of potassium hydroxide to 1 L of methanol, store at room temperature, replace after 3 months
- 8.1.16 METHANOL WITH 4% WATER, 1% AMMONIUM HYDROXIDE AND 0.625% ACETIC ACID - add ammonium hydroxide (3.3 mL, 30%), reagent water (1.7 mL) and acetic acid (0.625 mL) to methanol (92 mL), store at room temperature, replace after 1 month. This solution is used to prepare the instrument blank and calibration standards (Section 8.3.2).
- 8.1.17 FORMIC ACID – (greater than 96% purity or equivalent). Store at room temperature and replace after 2 years.
- 8.1.18 FORMIC ACID (aqueous, 0.1 M) - dissolve formic acid (4.6 g) in reagent water (1 L), store at room temperature, replace after 2 years.
- 8.1.19 FORMIC ACID (aqueous, 0.3 M) - dissolve formic acid (13.8 g) in reagent water (1 L), store at room temperature, replace after 2 years.
- 8.1.20 FORMIC ACID (aqueous, 5% v/v) - mix 5 mL formic acid with 95 mL reagent water, store at room temperature, replace after 2 years.
- 8.1.21 FORMIC ACID (methanolic 1:1, 0.1 M formic acid/methanol) - mix equal volumes of methanol and 0.1 M formic acid, store at room temperature, replace after 2 years.
- 8.1.22 FORMIC ACID (aqueous, 50% v/v) - mix 50 mL formic acid with 50 mL reagent water, store at room temperature, replace after 2 years.
- 8.1.23 POTASSIUM HYDROXIDE – certified ACS or equivalent, store at room temperature, replace after 2 years.
- 8.1.24 CARBON - – EnviCarb® 1-M-USP or equivalent, verified by lot number before use, stored at room temperature. Loose carbon allows for better adsorption of interferent organics. Note: The single-laboratory validation laboratory achieved better performance with loose carbon than carbon cartridges. Loose carbon will be used for the multi-laboratory validation to set statistically based method criteria.

- 8.1.25** 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).
- 8.1.26** ARGON – Used as collision gas in some 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** REFERENCE MATRICES - Matrices in which PFAS and interfering compounds are not detected by this method. These matrices are to be used to prepare the batch QC samples, LOQ/MDL, and IDOC samples.
- 8.2.1** Reagent water - purified water, Type I
- 8.2.2** Solid reference matrix Ottawa Sand or equivalent
- 8.2.3** Tissue Reference matrix – Cod loin or other animal tissue demonstrated to be PFAS free.
- 8.3** 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 and are stored at ≤ 4 °C. 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.
- 8.3.1** Stock standards and diluted stock standards are stored at ≤ 4 °C. Prepare a spiking solution, containing the method analytes listed in Table 1, in methanol from prime stocks. The solution is used to prepare the calibration standards and to spike the known reference QC samples that are analyzed with every batch. Quantitative standards containing a mixture of branched and linear isomers must be used for method analytes if they are commercially available. Currently, these include PFOS, PFHxS, NEtFOSAA, and NMeFOSAA.
- 8.3.2** Calibration standard solutions – A series of calibration solutions containing the target analytes and the Labeled extracted internal standards (EIS) and non-extracted internal standards (NIS) is used to establish the initial calibration of the analytical instrument. Table 4 represents the concentrations of the native, EIS and NIS analytes of the calibration curve. Calibration standard solutions are made using the solution described in section 8.1.16.
- 8.3.3** ISOTOPE DILUTION EXTRACTED INTERNAL STANDARD (EIS) – Isotopically labelled analogs of the target analytes to be used for the quantification of target analytes. EIS stock standard solutions are purchased in glass ampoules and are stored in accordance with the manufacturer's recommendations. The EIS stock solution to be used for the fortification of samples and QC in accordance with the isotope dilution procedure. Table 2 represents the EIS concentrations and nominal sample amounts added to each field sample and QC element.

- 8.3.4 ISOTOPE DILUTION NON-EXTRACTED INTERNAL STANDARDS (NIS) – Isotopically labelled analogs to be added post extraction for the measurement of EIS extraction efficiency and is added to the final volume of all extractions. Table 3 represents the EIS concentrations and nominal sample amounts added to each field sample and QC element.

9. Quality Control

9.1 Method Blank

- 9.1.1 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. An aliquot of reagent water that is treated exactly as a sample including exposure to all glassware, equipment, solvents, reagents and standards. 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.

9.2 Laboratory Control Sample (LCS)

- 9.2.1 Low Level LCS or OPR (Ongoing Precision Recovery) sample is required with each extraction batch. A LLCS or OPR samples is a method blank spiked with known quantities of analytes. The fortified concentration of the LCS is spiked at 2X the LOQ. Default limits of 70-130% 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:
- 9.2.2 An LCS or OPR (Ongoing Precision Recovery) sample is required with each extraction batch. A LCS or OPR samples is a method blank spiked with known quantities of analytes. The fortified concentration of the LCS is spiked at the midpoint of the calibration curve. Default limits of 70-130% 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.

- 9.1.1 Where applicable, in the absence of additional sample volume required to perform matrix specific QC, 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 $\leq 30\%$ of the true value for medium and high-level replicates, and $\leq 50\%$ for low level replicates. Calculate the relative percent difference (RPD) for duplicate MSs (MS and MSD) using the equation:

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

- 9.1.2 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.

9.3 Non-extracted Internal Standard Area (NIS)

Each time an initial calibration is performed, use the data from all the initial calibration standards used to meet the linearity test in Section 10.3.3.3 to calculate the mean area response for each of the NIS compounds, using the equation below.

$$\text{Mean Area}_{\text{NISi}} = \sum \text{Area}_{\text{NISi}} / n$$

where:

Area_{NISi} = Area counts for the ith NIS, where i ranges from 1 to 7, for the seven NIS compounds listed in Table 1

n = The number of ICAL standards (the default value is n = 6). If a different number of standards is used for the ICAL, for example, to increase the calibration range or by dropping a point at either end of the range to meet the linearity criterion, change 6 to match the actual number of standards used)

Record the mean areas for each NIS for use in evaluating results for sample analyses. There is no acceptance criterion associated with the mean NIS area data.

9.4 Extracted Internal Standards (EIS)

- 9.4.1 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.

- 9.4.2 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.

9.5 Matrix Spike (MS/MSD)

- 9.5.1 Analysis of an MS is prepared one per preparation batch (if required).
- 9.5.2 Aliquots of field samples that have been fortified with a known concentration of target compounds, prior to sample preparation and extraction, and analyzed to measure the effect of matrix interferences. The use of MS/MSD samples is generally not required in isotope dilution methods because the labeled compounds added to every sample provide more performance data than spiking a single sample in each preparation batch. Aliquots of field samples
- 9.5.3 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.

9.6 Laboratory Duplicate

- 9.6.1 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.
- 9.6.2 Calculate the relative percent difference (RPD) for duplicate measurements (FD1 and FD2) using the equation:

$$RPD = \frac{|FD1 - FD2|}{(FD1 + FD2) / 2} \times 100$$

- 9.6.3 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.
- 9.6.4 If an MSD is analyzed instead of a FD, calculate the relative percent difference (RPD) for duplicate MSs (MS and MSD) using the equation:

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

(MS + MSD) / 2

- 9.6.5** RPDs for duplicate MSs should be $\leq 30\%$ 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 $\leq 50\%$ 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.

9.7 Bile Salt Interference Check

- 9.7.1** The laboratory must analyze a TDCA standard after the initial calibration, prior to the analysis of tissue samples, to check for interferences caused by bile salts. If an interference is present, the chromatographic conditions must be modified to eliminate the interference from TDCA (e.g., changing the retention time of TDCA such that it falls outside the

9.8 Initial Calibration Verification (ICV)

- 9.8.1** 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 $\pm 30\%$ of the expected value. If measured analyte concentrations are not of acceptable accuracy, check the entire analytical procedure to locate and correct the problem.

9.9 Instrument Sensitivity Check (ISC)

- 9.9.1** At the start of each 12-hour shift, analyze a standard at the LOQ. The signal-to-noise ratio of the ISC standard must be greater than or equal to 3:1. If the requirements cannot be met, the problem must be corrected before analyses can proceed.

9.10 Continuing Calibration Verification (CCV)

- 9.10.1** CCV Standards must be analyzed at the beginning of each analysis batch, after every 10 Field Samples, and at the end of the analysis batch.
- 9.10.2** The recovery of native and isotopically labeled compounds for the CVs must be within 70 - 130%

9.11 Method-specific Quality Control Samples

- 9.11.1** Instrument Blank – During the analysis of a batch of samples, a solvent blank is analyzed after samples containing high level of target compounds (e.g., calibration, CV) to monitor carryover from the previous injection. The injection blank consists of the solution in Section 8.1.16 fortified with the EIS and NIS for quantitation purposes.

9.12 Example Method Sequence

- INSTRUMENT BLANK
- INSTRUMENT SENSITIVITY CHECK
- CALIBRATION VERIFICATION STANDARD
- QUALITATIVE IDENTIFICATION STANDARDS
- TDCA STANDARD (only if analyzing tissues)
- INSTRUMENT BLANK
- METHOD BLANK
- LOW-LEVEL LCS/OPR
- OPR/LCS
- SAMPLE (10 or fewer)
- CALIBRATION VERIFICATION STANDARD
- INSTRUMENT BLANK
- SAMPLE (10 or fewer)
- CALIBRATION VERIFICATION STANDARD
- INSTRUMENT BLANK

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.
- 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 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.
- 10.1.3** 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.
- 10.1.4** All SPE apparatus, including manifolds, tubing and sample ports must be thoroughly rinsed following each use with 1% methanolic ammonium hydroxide, followed by Methanol and then DI water. Additionally, sample manifold ports and transfer tubing should be inspected regularly for signs of wear and/or

discoloration. When such observations are made, the associated components should be replaced.

- 10.1.5** Prior to the start of any extraction, sample site information must be evaluated for any potentially high level PFAS concentrations or sample matrix irregularities that may impact the extraction process. If such samples are identified, aqueous samples may be pre-screened via direct aqueous injection prior to analysis to estimate the potential PFAS concentrations present.
- 10.1.6** To perform a direct aqueous injection (DAI) screen, the sample should be inverted several times to try and evenly disperse any organic matter present. A 1 ml aliquot (or less depending on the matrix) is to be taken from the parent sample, volume adjusted to 1 ml with reagent water if less than 1ml, fortified with EIS and NIS spiking solutions to match the concentrations of an extracted sample (typically 5 µl per 1 ml DAI), and then analyzed under the same analytical conditions as field samples.

10.2 Sample Preparation of Aqueous Samples

- 10.2.1** Samples are preserved, collected, and stored as presented in Section 6.
- 10.2.2** Determine sample volume. Weigh all samples to the nearest 1g. If visible sediment is present, centrifuge and decant into a new 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 reagent water with a polypropylene graduated cylinder or filling an HDPE sample bottle near the top.
- 10.2.4** Check that the pH is 6.5 ± 0.5 . If necessary, adjust pH with 50% formic acid or ammonium hydroxide and 3% aqueous ammonium hydroxide. The extract is now ready for solid-phase extraction (SPE) and cleanup.
- 10.2.5** Add 20 µL of the EIS 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. Cap and invert each sample to mix.

10.3 Sample Prep and Extraction Protocol for Solids.

- 10.3.1** Homogenize and weigh 5 grams of sample (measured to the nearest hundredth of a gram) into a 50 ml polypropylene centrifuge tube. For laboratory control blanks and spikes, 5 grams of clean sand is used.
- 10.3.1.1** For Biosolids and other complex matrices, a small aliquot may be required due to co-extracted matrix interferences.
- 10.3.1.2** For batch QC samples using 5 g of reference solid, add 2.5 g of reagent water. The addition of reagent water to the sand provides a matrix closer in composition to real-world samples.
- 10.3.2** Add 20 µL of the EIS to each sample and QC.
- 10.3.3** If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS. Cap and invert each sample to mix.

- 10.3.4** Vortex the samples to evenly disperse the spiking solutions and allow to equilibrate for 30 minutes.
- 10.3.5** To all samples, add 10 ml of 0.3% methanolic ammonium hydroxide, cap, vortex for 25 seconds.
- 10.3.6** Following mixing, shake each sample for 30 minutes on a shaker table.
- 10.3.7** Centrifuge each sample at 2800RPM for 10 minutes.
- 10.3.8** Remove the supernatant and transfer to a clean 50 ml polypropylene centrifuge tube.
- 10.3.9** Repeat steps 10.3.4 to 10.3.7, with 15 ml of 0.3% methanolic ammonium hydroxide, combining the supernatants.
- 10.3.10** Add 5ml of 0.3% methanolic ammonium hydroxide to the sample, vortex for 25 seconds and centrifuge each sample at 2800RPM for 10 minutes.
- 10.3.11** Remove the supernatant and transfer to the same 50 ml polypropylene centrifuge tube containing eluates from the previous cycles.
- 10.3.12** Add 10 mg of carbon to the combined extract, mix by occasional hand shaking for no more than five minutes and then centrifuge at 2800 rpm for 10 minutes. Immediately decant the extract into a 50 ml polypropylene centrifuge tube.
- 10.3.13** Dilute to approximately 35 mL with reagent water. Samples containing more than 50% water may yield extracts that are greater than 35 mL in volume; therefore, do not add water to these. Determine the water content in the sample as follows (percent moisture is determined from the % solids):
- $$\text{Water Content in Sample} = (\text{Sample Weight} * \text{Percent moisture}) / 100$$
- 10.3.14** Concentrate each extract at approximately 55 °C with a gentle N2 flow to a final volume that is based on the water content of the sample (see table below). Allow extracts to concentrate for 10 minutes, then mix (by vortex if the volume is < 20. Continue concentrating and mixing every 5 minutes until the extract has been reduced to the required volume as specified in the table below. If the extract volume appears to stop dropping, the concentration must be stopped and the volume at which it was stopped recorded.

Water Content in Sample	Concentrated Final Volume
< 5 grams	15 ml
5-8 grams	15-20 ml
8-9 grams	20-22.5 ml
9-10 grams	22.5-25 ml

- 10.3.15** Add 40 - 50 mL of reagent water to the extract and vortex. Check that the pH is 6.5 ±0.5 and adjust as necessary with 50% formic acid or 30% ammonium hydroxide, or with 5% formic acid and 3% aqueous ammonium hydroxide. The extracts are ready for SPE and cleanup.

10.4 Sample Prep and Extraction Protocol for Oils.

- 10.4.1** Weigh 1-2 grams of sample (measured to the nearest hundredth of a gram) into a 50 ml polypropylene centrifuge tube. For laboratory control blanks and spikes, 1 grams of mineral oil is used.
- 10.4.1.1** For batch QC samples use 1 g of reference oil.
- 10.4.2** Add 20 µL of the EIS 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. Cap and invert each sample to mix.
- 10.4.4** Vortex the samples to evenly disperse the spiking solutions and allow to equilibrate for 30 minutes.
- 10.4.5** To all samples, add 10 ml of 0.3% methanolic ammonium hydroxide, cap, vortex for 25 seconds.
- 10.4.6** Following mixing, shake each sample for 30 minutes on a shaker table.
- 10.4.7** Centrifuge each sample at 2800RPM for 10 minutes.
- 10.4.8** Remove the supernatant and transfer to a clean 50 ml polypropylene centrifuge tube.
- 10.4.9** Repeat steps 10.3.4 to 10.3.7, with 15 ml of 0.3% methanolic ammonium hydroxide, combining the supernatants.
- 10.4.10** Add 5ml of 0.3% methanolic ammonium hydroxide to the sample, vortex for 25 seconds and centrifuge each sample at 2800RPM for 10 minutes.
- 10.4.11** Remove the supernatant and transfer to the same 50 ml polypropylene centrifuge tube containing eluates from the previous cycles.
- 10.4.12** Add 10 mg of carbon to the combined extract, mix by occasional hand shaking for no more than five minutes and then centrifuge at 2800 rpm for 10 minutes. Immediately decant the extract into a 50 ml polypropylene centrifuge tube.

10.5 Sample Prep and Extraction Protocol for Tissues.

- 10.5.1** Homogenize and weigh 2 grams of sample (measured to the nearest hundredth of a gram) into a 50 ml polypropylene centrifuge tube. For laboratory control blanks and spikes, 2 grams of clean tissue is used.
- 10.5.2** Add 20 µL of the EIS PDS to each sample and QC.
- 10.5.3** If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS. Cap and invert each sample to mix.
- 10.5.4** Add 10 mL of 0.05M KOH in methanol to each sample. Vortex to disperse the tissue then place tubes on a mixing table to extract for at 16 hours. Centrifuge at 2800 rpm for 10 minutes and collect the supernatant in a 50-mL polypropylene centrifuge tube.
- 10.5.5** Add 10 mL of acetonitrile to remaining tissue in the 50-mL centrifuge tube, vortex to mix and disperse the tissue. Sonicate for 30 minutes. Centrifuge at 2800 rpm for 10 minutes and collect the supernatant, adding it to the 50-mL centrifuge tube containing the initial extract.
- 10.5.6** Add 5 mL of 0.05M KOH in methanol to the remaining sample in each centrifuge tube. Vortex to disperse the tissue and hand mix briefly. Centrifuge at 2800 rpm

for 10 minutes and collect the supernatant, adding it to the 50-mL centrifuge tube containing the first two extracts.

- 10.5.7 Add 10 mg of carbon to the combined extract, mix by occasional hand shaking over a period of no more than five minutes and then centrifuge at 2800 rpm for 10 minutes. Immediately decant the extract into a 50-mL centrifuge tube.
- 10.5.8 Add 1 mL of reagent water to each tube and concentrate each extract at approximately 55 °C with a gentle N₂ flow to a final volume of 2.5 mL.
- 10.5.9 Add reagent water to each evaporation/concentrator tube to dilute the extracts to 50 mL. Check that the pH = 6.5 ± 0.5 and adjust as needed with 50% formic acid, or ammonium hydroxide or with 5% formic acid and 3% aqueous ammonium hydroxide. The extracts are ready for SPE and cleanup.

10.6 SPE Extract: All matrices

- 10.6.1 Pack clean silanized glass wool to half the height of the WAX SPE cartridge barrel.
- 10.6.2 Pre-condition the cartridges by washing them with 3 X 5 mL of 1% methanolic ammonium hydroxide, discarding the wash volumes.
- 10.6.3 Rinse the cartridge with 5 mL of 0.3M formic acid, allowing the cartridge to drain using gravity only, discarding the rinse volume. Do not allow the cartridge to go dry
- 10.6.4 Adjust the vacuum so that the approximate flow rate is ~5 mL/min and load the sample across the cartridge. Do not allow the cartridge to go dry before all the sample has passed through.
- 10.6.5 Once all the sample has passed across the cartridge, rinse the walls of the reservoir with 2 X 5 mL reagent water, loading the rinse across the cartridge.
- 10.6.6 Rinse the walls of the reservoir with 5 mL of 1:1 0.1M formic acid/methanol and pass the rinse through the cartridge using vacuum. Dry the cartridge by pulling air through for 15 seconds.
- 10.6.7 Rinse the inside of the sample bottle with 5 mL of 1% methanolic ammonium hydroxide. Use vacuum to pull the elution solvent through the cartridge and into the collection tubes. When the cartridge bed and glass wool are submerged, stop the cartridge flow by closing the valve, keeping the sorbent bed and wool submerged.
- 10.6.8 Let the wetted sorbent bed and wool soak for 1 minute.
- 10.6.9 Open the cartridge valve and collect the eluate into a 15 mL polypropylene collection tube.
- 10.6.10 Add 25 µL of concentrated acetic acid to each sample eluted in the collection tubes and vortex to mix.
- 10.6.11 Add 10 mg of carbon to each sample and batch QC extract, using a 10-mg scoop. Handshake occasionally for no more than 5 minutes. It is important to minimize the time the sample extract is in contact with the carbon. Immediately vortex (30 seconds) and centrifuge at 2800 rpm for 10 minutes.
- 10.6.12 Add NIS solution to a clean collection tube. Place a syringe filter (25-mm filter, 0.2-µm nylon membrane) on a 5-mL polypropylene syringe. Take the plunger out and carefully decant the sample supernatant into the syringe barrel. Replace the

plunger and filter the entire extract into the new collection tube containing the NIS.

- 10.6.13** Vortex to mix and transfer a portion of the extract into a .7-mL polypropylene LC vial for LC-MS/MS analysis. Cap the collection tube containing the remaining extract and store at 4 °C

10.7 Sample Volume Determination

- 10.7.1** If using weight to determine volume, weigh the empty bottle to the nearest 1 g and determine the sample weight by subtraction of the empty bottle weight from the original sample weight. 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.

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]⁻ or [M-CO₂]⁻ 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 (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.

The Mass spec conditions found in Table 7 show the Sciex Triple Quad 5500+ operation conditions used in this method.

- 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.

The conditions found on table 5 are representative of expected tune optimizations for each analyte. If conditions other than the ones close to the values provided in table 5 are achieved, the process should be re-performed and/or instrument maintenance performed to resolve the problem.

- 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.

Table 6 represents the operation conditions of a Sciex Exion LC system when running this method.

10.8.3 Inject 2 μ l of a mid-level CAL standard under LC/MS conditions to obtain the retention times of each method analyte. 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.

NOTE: PFHxS, PFOS, NMeFOSAA, and NeFOSAA have multiple chromatographic peaks using the LC conditions in Table 7 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 outlined in table 5. The lowest concentration CAL standard must be at or below the LOQ.

10.8.6 The LC/MS/MS system is calibrated using the isotope dilution technique. Target analytes are quantitated against their isotopically labeled analog (Extracted Internal Standard) where commercially available. If a labeled analog is not commercially available, the extracted internal standard with the closest retention time and /or closest chemical similarity is to be used. 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 6 calibration points are required for a linear or quadratic calibration model.

10.8.7 CALIBRATION ACCEPTANCE CRITERIA – A linear fit is acceptable if the calculated RSD or RSE for each target analyte is $\leq 20\%$. If linear or Quadratic regressions are used, coefficient of determination (r^2) values must be greater than 0.99. When quantitated using the initial calibration curve, each calibration point at or above the LOQ for each analyte must calculate to be within 70-130% of its true value. The calculate value of each EIS analyte must be within 50-150% of its true value. If these criteria cannot be met, corrective action is taken to reanalyze the CAL standards, restrict the range of calibration.

10.8.8 Bile salts interference check - The laboratory must analyze a TDCA standard after the initial calibration, prior to the analysis of tissue samples, to check for interferences caused by bile salts. If an interference is present, the chromatographic conditions must be modified to eliminate the interference from TDCA (e.g., changing the retention time of TDCA such that it falls outside the

retention window for PFOS by at least one minute), and the initial calibration repeated.

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 native and EIS analyte for medium level CCVs must be within $\pm 30\%$ of the true. If these conditions do not exist, then all data for the problem analyte must be considered invalid, and remedial action should be taken 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% 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 and verification of sensitivity by analyzing a CCV at or below the LOQ.

10.10 EXTRACT ANALYSIS

10.10.1 The same operating conditions used for the initial calibration and summarized in Tables 6 and 7 are to be used.

10.10.2 Prior to analysis of sample extracts, the Instrument mass calibration verification must be performed using standards whose mass range brackets the masses of interest and performed in the negative ion mode. The mass calibration is verified if the calculated mass is within $\pm .2$ daltons of the specified mass.

10.10.3 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 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.

- 10.10.4** Calibrate the system by either the analysis of a calibration curve or by confirming the initial calibration is still valid by analyzing a CCV.
- 10.10.5** 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.
- 10.10.6** For concentrations at or above the method LOQ, the total (branched and linear isomer) quantification ion response to the total (branched and linear isomer) confirmation ion response ratio must fall within $\pm 50\%$ of the ratio observed in the midpoint initial calibration standard.
- 10.10.7** 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.
- 10.10.7.1** Method analyte, EIS analyte, and NIS analyte RTs must fall within 0.4 minutes of the predicted retention times from the midpoint standard of the ICAL or initial daily CV, whichever was used to establish the RT window position for the analytical batch. All branched isomer peaks identified in either the calibration standard or the qualitative (technical grade) standard must fall within in the retention time window for that analyte.
- 10.10.7.2** For all method analytes with exact corresponding isotopically labeled analogs, method analytes must elute within 0.1 minutes of the associated EIS.
- 10.10.8** 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 ensure 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.³
- 10.10.9** In instances where re-extraction is not an option, dilute a subsample of the sample extract with 0.1% acetic acid by a factor no greater than 10x adjust the amount of the NIS in the diluted extract, and analyze the diluted extract. If the responses for each EIS in the diluted extract meet the S/N and retention time, and the EIS recoveries from the analysis of the diluted extract are greater than 5%, then the compounds associated with those EISs may be quantified using isotope dilution. Use the EIS recoveries from the original analysis to select the dilution factor, with the objective of keeping the EIS recoveries in the dilution above that 5% lower limit. If the adjusted EIS recoveries are below 5%, the dilution is assumed invalid. If the adjusted EIS recoveries are greater than 5%, adjust the compound concentrations, detection limits, and minimum levels to account for the dilution.

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 9.

11.2 Calculate analyte concentrations using the multipoint calibration established in Section 10.9. 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 10.8

$$C_{\text{ex}} = (\text{Area of target analyte} * \text{Concentration of Labeled analog}) / (\text{area of labeled analog} * \text{CF})$$

$$C_{\text{s}} = (C_{\text{ex}} / \text{sample volume in ml}) * 1000$$

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 7 due to the linear and branch isomers of these compounds (Sect. 10.10.4.). 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)

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- 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 Refer to Alpha SOP ID 1739 for further information regarding IDC/DOC Generation.
- 13.2.2 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 1: Names, Abbreviations, and CAS Registry Numbers for Target PFAS, Extracted Internal Standards and Non-extracted Internal Standards

Parameter	Acronym	CAS
PER- and POLYFLUOROALKYLETHER CARBOXYLIC ACIDS (PFECAs)		
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid	HFPO-DA	13252-13-6
4,8-dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6
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	PFDaA	307-55-1
Perfluorotridecanoic acid	PFTTrDA	72629-94-8
Perfluorotetradecanoic acid	PFTeDA	376-06-7
PERFLUOROALKYL SULFONIC ACIDS (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
CHLORO-PERFLUOROALKYLSULFONATE		
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9

Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	9Cl-PF3ONS	756426-58-1
FLUOROTELOMER CARBOXYLIC ACIDS		
3-Perfluoropropyl propanoic acid	3:3FTCA	356-02-5
2H,2H,3H,3H-Perfluorooctanoic acid	5:3FTCA	914637-49-3
Perfluoroheptyl propanoic acid	7:3FTCA	812-70-4
PERFLUOROOCTANESULFONAMIDES		
Perfluorooctanesulfonamide	PFOSA	754-91-6
N-methylperfluoro-1-octanesulfonamide	NMeFOSA	31506-32-8
N-ethylperfluoro-1-octanesulfonamide	NEtFOSA	4151-50-2
PERFLUOROOCTANE SULFONAMIDE ETHANOLS		
N-Methyl perfluorooctanesulfonamidoethanol	NMeFOSE	24448-09-7
N-ethyl perfluorooctanesulfonamidoethanol	NEtFOSE	1691-99-2
TELOMER SULFONIC ACIDS		
1H,1H,2H,2H-perfluorohexanesulfonic acid (4:2)	4:2FTS	757124-72-4
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2)	6:2FTS	27619-97-2
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2)	8:2FTS	39108-34-4
PERFLUOROOCTANESULFONAMIDOACETIC ACIDS		

N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6
PERFLUOROETHER AND POLYETHER CARBOXYLIC ACIDS		
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6

Table 2: Stock and Nominal Extracted Internal Standard Concentrations

Isotope Labeled Standard	Conc. of EIS Stock (ng/mL)	Nominal amount of EIS added to extracts (ng)
M4PFBA	2000	40
M5PFPeA	1000	20
M5PFHxA	500	10
M4PFHpA	500	10
M8PFOA	500	10
M9PFNA	250	5
M6PFDA	250	5
M7PFUdA	250	5
MPFDoA	250	5
M2PFTeDA	250	5
M3PFBS	466	9.32
M3PFHxS	474	9.48
M8PFOS	479	9.58
M2-4:2FTS	938	18.8
M2-6:2FTS	951	19
M2-8:2FTS	960	19.2
M8FOSA	500	10
d3-N-MeFOSA	500	10
d5-N-EtFOSA	500	10
d3-N-MeFOSAA	1000	20
d5-N-EtFOSAA	1000	20
d7-N-MeFOSE	5000	100
d9-N-EtFOSE	5000	100
M3HFPO-DA	2000	40

Table 3: Stock and Nominal Non-Extracted Internal Standard Concentrations

Isotope Labeled Standard	Conc. of EIS Stock (ng/mL)	Nominal amount of EIS added to extracts (ng)
M3PFBA	1000	40
M2PFHxA	500	10
M4PFOA	500	10
M5PFNA	250	5
M2PFDA	250	5
18O2PFHxS	474	9.48
M4PFOS	479	9.58

Table 4: Initial Calibration levels and Concentrations

Analyte	Cal A	Cal B (LOQ)	CAL C	Cal D	Cal E (CCV)	Cal F	Cal G	Cal H	Cal I
PFBA	.4	.8	2	5	10	20	50	250	500
PFPeA	.2	.4	1	2.5	5	10	25	125	250
PFHxA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFHpA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFOA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFNA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFDA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFUnA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFDaA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFTTrDA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFTA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFBS	0.089	0.177	0.444	1.11	2.22	4.44	11.1	55.4	111
PFPeS	0.094	0.188	0.471	1.18	2.35	4.71	11.8	58.8	118
PFHxS	0.091	0.183	0.457	1.14	2.29	4.57	11.4	57.1	114
PFHpS	0.095	0.191	0.477	1.19	2.38	4.77	11.9	59.6	119
PFOS	0.093	0.186	0.464	1.16	2.32	4.64	11.6	58	116
PFNS	0.096	0.192	0.481	1.20	2.41	4.81	12	60.1	120
PFDS	0.097	0.193	0.483	1.21	2.41	4.83	12.1	60.3	121
PFDOS	0.097	0.194	0.485	1.21	2.43	4.85	12.1	60.6	121.
4:2FTS	0.375	0.75	1.88	4.69	9.38	18.8	46.9	234	469
6:2FTS	0.38	0.76	1.9	4.75	9.5	19	47.5	238	475
8:2FTS	0.384	0.768	1.92	4.8	9.6	19.2	48	240	480
PFOSA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125

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NMeFOSA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
NEtFOSA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
NMeFOSAA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
NEtFOSAA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
NMeFOSE	1	2	5	12.5	25	50	125	625	1250
NEtFOSE	1	2	5	12.5	25	50	125	625	1250
HFPO-DA	.4	.8	2	5	10	20	50	250	500
ADONA	0.378	0.756	1.89	4.73	9.45	18.9	47.3	236	473
9CI-PFONS	0.374	0.748	1.87	4.68	9.35	18.7	46.8	234	468
11CI-PFOUdS	0.378	0.756	1.89	4.73	9.45	18.9	47.3	236	473
PFMPA	.2	.4	1	2.5	5	10	25	125	250
PFMBA	.2	.4	1	2.5	5	10	25	125	250
PFEESA	0.178	0.356	0.89	2.23	4.45	8.9	22.3	111	223
NFDHA	.2	.4	1	2.5	5	10	25	125	250
3:3FTCA	.5	1	2.5	6.25	12.5	25	62.5	312	624
5:3FTCA	2.5	5	12.5	31.3	62.5	125	312	1560	3120
7:3FTCA	2.5	5	12.5	31.3	62.5	125	312	1560	3125
M4PFBA	10	10	10	10	10	10	10	10	10
M5PFPeA	5	5	5	5	5	5	5	5	5
M5PFHxA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
M4PFHpA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
M8PFOA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
M9PFNA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
M6PFDA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
M7PFUdA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
MPFDdA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
M2PFTeDA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
M3PFBS	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33
M3PFHxS	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37
M8PFOS	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
M2-4:2FTS	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69
M2-6:2FTS	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76
M2-8:2FTS	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
M8FOSA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
d3-N-MeFOSA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
d5-N-EtFOSA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5

d3-N-MeFOSAA	5	5	5	5	5	5	5	5	5
d5-N-EtFOSAA	5	5	5	5	5	5	5	5	5
d7-N-MeFOSE	25	25	25	25	25	25	25	25	25
d9-N-EtFOSE	25	25	25	25	25	25	25	25	25
M3HFPO-DA	10	10	10	10	10	10	10	10	10
M3PFBA	5	5	5	5	5	5	5	5	5
M2PFHxA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
M4PFOA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
M5PFNA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
M2PFDA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
18O2PFHxS	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37
M4PFOS	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4

Table 5: Expected Mass Transitions and instrument conditions.

Q1	Q2	Analyte	DP Volts	CE Volts
213.032	169.022	PFBA	-50	-14
263.039	219.03	PFPeA	-55	-12
263.039	68.9	PFPeA_2	-55	-55
313.047	269.037	PFHxA	-45	-12
313.047	119	PFHxA_2	-45	-28
363.055	319.045	PFHpA	-60	-12
363.055	169.022	PFHpA_2	-60	-24
413.063	369.053	PFOA	-65	-14
413.063	169.022	PFOA_2	-65	-23
463.071	419.061	PFNA	-70	-14
463.071	219.03	PFNA_2	-70	-24
513.078	469.069	PFDA	-80	-16
513.078	219.03	PFDA_2	-80	-30
563.086	519.076	PFUnA	-85	-18
563.086	269.037	PFUnA_2	-85	-25
613.094	569.084	PFDaA	-85	-18
613.094	319.045	PFDaA_2	-85	-28
663.102	619.092	PFTTrDA	-85	-20
663.102	169.022	PFTTrDA_2	-85	-36
713.11	669.1	PFTA	-70	-22
713.11	169.022	PFTA_2	-70	-38
299.092	80.062	PFBS	-100	-65

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299.092	99.061	PFBS_2	-100	-40
349.1	80.062	PFPeS	-100	-75
349.1	99.061	PFPeS_2	-100	-60
399.107	80.062	PFHxS	-120	-75
399.107	99.061	PFHxS_2	-120	-80
449.115	80.062	PFHpS	-140	-95
449.115	99.061	PFHpS_2	-140	-80
499.113	80.062	PFOS	-145	-108
499.113	99.061	PFOS_2	-145	-85
549.131	80.062	PFNS	-180	-100
549.131	99.061	PFNS_2	-180	-100
599.139	80.062	PFDS	-170	-110
599.138	99.061	PFDS_2	-170	-100
699.154	80.062	PFDoS	-160	-150
699.154	99.061	PFDoS_2	-160	-130
327.146	307.139	4:2FTS	-100	-28
327.146	81.07	4:2FTS_2	-100	-50
427.161	407.155	6:2FTS	-120	-33
427.161	81.07	6:2FTS_2	-120	-65
527.177	507.17	8:2FTS	-140	-39
527.177	81.07	8:2FTS_2	-140	-85
498.146	78.07	FOSA	-150	-90
498.146	478	FOSA_2	-150	-35
512.163	219.03	NMeFOSA	-130	-35
512.163	169.022	NMeFOSA_2	-130	-40
526.192	219.03	NEtFOSA	-140	-35
526.192	169.022	NEtFOSA_2	-140	-35
570.202	419.061	NMeFOSAA	-100	-28
570.202	483	NMeFOSAA_2	-100	-22
584.229	419.061	NEtFOSAA	-100	-28
584.229	526.192	NEtFOSAA_2	-100	-38
616.1	58.9	NMeFOSE	-90	-70
630	58.9	NEtFOSE	-80	-75
285.035	169.022	HFPO-DA	-60	-12
285.035	184.9	HFPO-DA_2	-60	-18
377.06	251.028	ADONA	-65	-18
377.06	84.8	ADONA_2	-65	-48
530.8	351.05	9CI-PFONS	-130	-38
532.8	353	9CI-PFONS_2	-130	-38

630.9	451.031	11Cl-PFOUdS	-145	-41
632.9	452.9	11Cl-PFOUdS_2	-145	-41
241.085	177.069	3:3FTCA	-60	-12
241.085	117	3:3FTCA_2	-60	-50
341.101	237.072	5:3FTCA	-70	-20
341.101	217	5:3FTCA_2	-70	-35
441.117	316.9	7:3FTCA	-85	-30
441.117	337.088	7:3FTCA_2	-85	-20
315.093	135.013	PFEESA	-100	-35
315.093	82.9	PFEESA_2	-100	-25
229.032	85.006	PFMPA	-40	-25
279.042	85.006	PFMBA	-45	-25
295.032	201	NFDHA	-30	-15
295.032	84.9	NFDHA_2	-30	-40
217.001	171.999	MPFBA	-50	-14
268.001	222.999	M5PFPeA	-55	-12
318.009	273.007	M5PFHxA	-45	-12
367.024	322.022	M4PFHpA	-60	-12
421.002	376	M8PFOA	-65	-14
472.002	427	M9PFNA	-70	-14
519.033	474.03	M6PFDA	-80	-16
570.033	525.031	M7-PFUDa	-85	-18
615.079	570.033	MPFDoA	-85	-18
715.094	670.092	M2PFTeDA	-70	-22
302.069	80.062	M3PFBS	-100	-65
402.084	80.062	M3PFHxS	-120	-74
507.062	80.062	M8PFOS	-145	-85
329.13	81.07	M2-4:2FTS	-100	-50
429.162	81.07	M2-6:2FTS	-120	-65
529.162	81.07	M2-8:2FTS	-140	-85
506.077	78.07	M8FOSA	-150	-90
515.183	219.03	d3-NMeFOSA	-130	-35
531.222	219.03	d5-NEtFOSA	-140	-35
573.22	419.061	d3-NMeFOSAA	-75	-28
589.259	419.061	d5-NEtFOSAA	-90	-28
623.2	58.9	d7-NMeFOSE	-100	-28
639.2	58.9	d9-NEtFOSE	-100	-28
287.02	169.022	M3HFPO-DA	-60	-12
216.009	171.999	M3PFBA	-50	-14

315.032	270.03	M2PFHxA	-45	-12
417.032	372.03	M4PFOA	-65	-14
468.032	423.03	M5PFNA	-70	-14
515.063	470.061	M2PFDA	-80	-16
403.107	84.062	18O2-PFHxS	-120	-74
503.093	80.062	M4PFOS	-145	-85

Table 6: LC Method Conditions

Time (min)	2 mM Ammonium Acetate (5:95 CH ₃ /H ₂ O)	100% Acetonitrile	Gradient Curve
Initial	100.0	0.0	0
.2	100.0	0.0	2
4	70	30	7
7	45	55	8
9	25	80	8
10	5	95	6
10.4	98	2	10
11.8	100	0	7
12	100	0	1
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 µL injection			

Table 7: ESI-MS Method Conditions

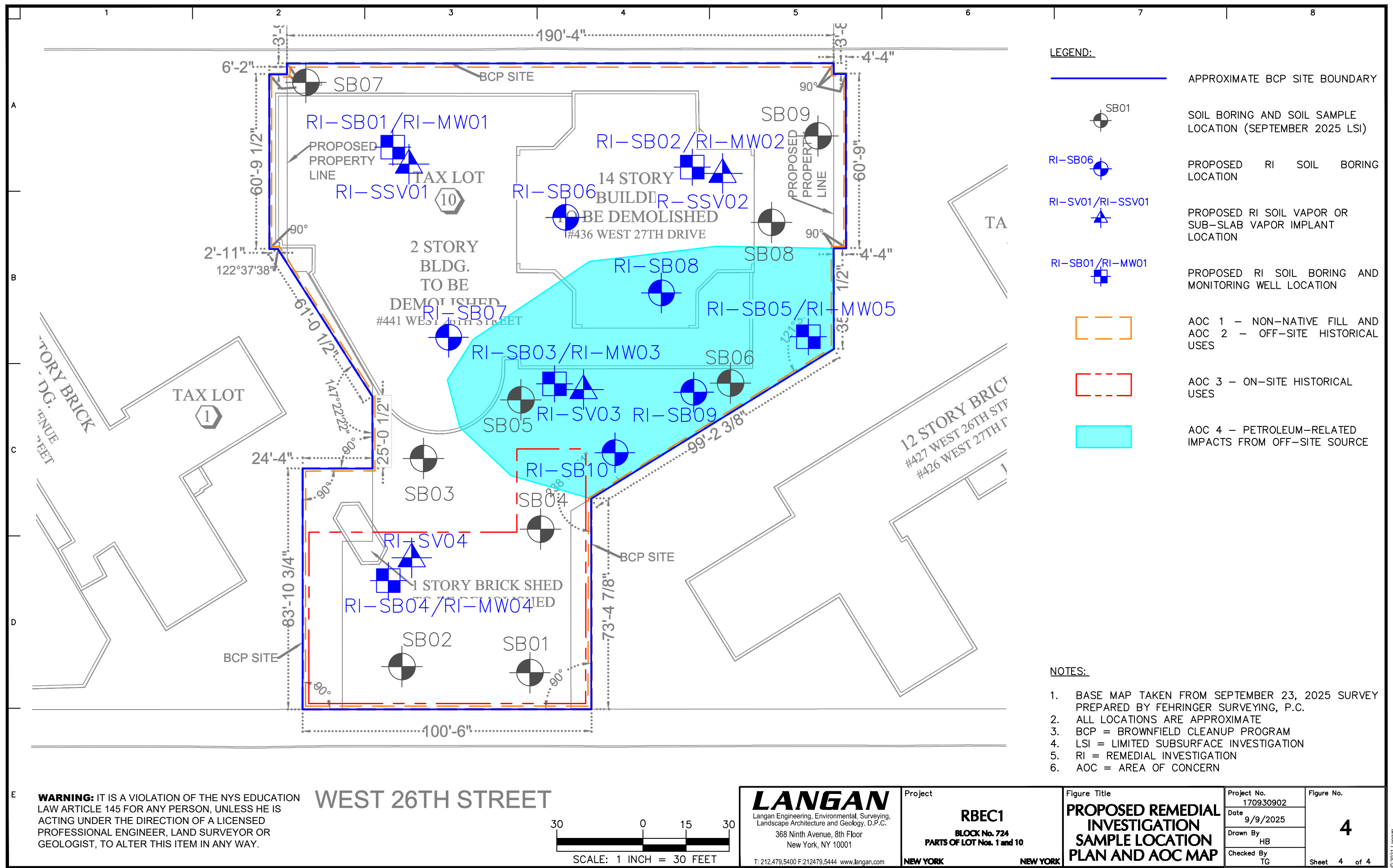
ESI Conditions	
Polarity	Negative ion
Curtain Gas	30
Collision gas	9
Ion Spray Voltage	-4500
Desolvation gas temp.	500 °C
Ion Source Gas 1	30
Ion Source Gas 2	50
Entrance Poitential	-10
Exic Cell Potential	-11

Table 8. Reporting limits by Matrix

Compound	Aqueous (ng/L)	Solid (ng/g)	Tissue (ng/g)
PFBA	6.4	0.8	2
PFPeA	3.2	0.4	1
PFHxA	1.6	0.2	0.5
PFHpA	1.6	0.2	0.5
PFOA	1.6	0.2	0.5
PFNA	1.6	0.2	0.5
PFDA	1.6	0.2	0.5
PFUnA	1.6	0.2	0.5
PFDoA	1.6	0.2	0.5
PFTTrDA	1.6	0.2	0.5
PFTA	1.6	0.2	0.5
PFBS	1.6	0.2	0.5
PFPeS	1.6	0.2	0.5
PFHxS	1.6	0.2	0.5
PFHpS	1.6	0.2	0.5
PFOS	1.6	0.2	0.5
PFNS	1.6	0.2	0.5
PFDS	1.6	0.2	0.5
PFDoS	1.6	0.2	0.5
4:2FTS	6.4	0.8	2
6:2FTS	6.4	0.8	2
8:2FTS	6.4	0.8	2
FOSA	1.6	0.2	2
NMeFOSA	1.6	0.2	0.5
NEtFOSA	1.6	0.2	0.5
NMeFOSAA	1.6	0.2	0.5
NEtFOSAA	1.6	0.2	0.5
NMeFOSE	16	2	5
NEtFOSE	16	2	5
HFPO-DA	6.4	0.8	2
ADONA	6.4	0.8	2
9Cl-PFONS	6.4	0.8	2
11Cl-PFOUdS	6.4	0.8	2
3:3FTCA	8	1	2.5
5:3FTCA	40	5	12.5

7:3FTCA	40	5	12.5
PFEESA	3.2	0.4	1
PFMPA	3.2	0.4	1
PFMBA	3.2	0.4	1
NFDHA	3.2	0.4	1

Proposed RI Sample Location Plan and AOC Map



LEGEND:

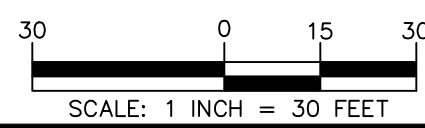
- APPROXIMATE BCP SITE BOUNDARY
- SOIL BORING AND SOIL SAMPLE LOCATION (SEPTEMBER 2025 LSI)
- PROPOSED RI SOIL BORING LOCATION
- PROPOSED RI SOIL VAPOR OR SUB-SLAB VAPOR IMPLANT LOCATION
- PROPOSED RI SOIL BORING AND MONITORING WELL LOCATION
- AOC 1 - NON-NATIVE FILL AND AOC 2 - OFF-SITE HISTORICAL USES
- AOC 3 - ON-SITE HISTORICAL USES
- AOC 4 - PETROLEUM-RELATED IMPACTS FROM OFF-SITE SOURCE

NOTES:

- BASE MAP TAKEN FROM SEPTEMBER 23, 2025 SURVEY PREPARED BY FEHRINGER SURVEYING, P.C.
- ALL LOCATIONS ARE APPROXIMATE
- BCP = BROWNFIELD CLEANUP PROGRAM
- LSI = LIMITED SUBSURFACE INVESTIGATION
- RI = REMEDIAL INVESTIGATION
- AOC = AREA OF CONCERN

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

WEST 26TH STREET



LANGAN Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C. 368 Ninth Avenue, 8th Floor New York, NY 10001 T: 212.479.5400 F: 212.479.5444 www.langan.com	Project RBEC1 BLOCK No. 724 PARTS OF LOT Nos. 1 and 10 NEW YORK NEW YORK	Figure Title PROPOSED REMEDIAL INVESTIGATION SAMPLE LOCATION PLAN AND AOC MAP	Project No. 170930902	Figure No. 4 Sheet 4 of 4
			Date 9/9/2025	
			Drawn By HB	
			Checked By TG	

APPENDIX C

Health and Safety Plan

HEALTH AND SAFETY PLAN

FOR

**RBEC1
441 WEST 26TH STREET
NEW YORK, NEW YORK
Manhattan Borough Tax Map
Block 724, Part of Lots 1 and 10**

Prepared for

**RBEC1, LLC
30 Hudson Yards
New York, New York**

Prepared by:

**Langan Engineering, Environmental, Surveying
Landscape Architecture and Geology
368 Ninth Avenue, 8th Floor
New York, New York 10001**

LANGAN

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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 Code of Federal Regulation (CFR) 1910.120(b)(4), Hazardous Waste Operations and Emergency Response during anticipated site work for the property located at 441 East 26th Street in the Chelsea neighborhood of New York City (the Site). The site is identified on the Manhattan Borough Tax Map as Block 724, part of Lots 1 and 10.

This HASP provides the minimum requirements for implementing site operations during future remedial measures. All contractors performing work on this site must 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 content of this HASP may change or undergo revision based upon additional information made available to health and safety personnel, monitoring results, or changes in the work plan.

1.2 Site Location and Background

The site is located at 441 West 26th Street, New York, NY (Manhattan Block 724, parts of Lots 1 and 10) and is in the Elliott-Chelsea New York City Housing Authority (NYCHA) housing complex. The site is a 33,150± square feet and is bordered by a park to the north, 12-story residential buildings to the east and west, and West 25th Street followed by two 11-story residential buildings to the south. Surface grades around the site are relatively flat at about elevation (el.) 16± North American Vertical Datum of 1988 (NAVD88). As site location map is provided as Figure 1.

The development will include the demolition of an existing 2-story commercial building (Elliot Center) and 14-story residential building (Chelsea Elliott Addition) at the northern part of the lot, and the construction of a new multi-family residential building. The proposed new building is a 21,000±-square-foot, 39-story affordable housing building with a 19,000±-square-foot cellar. Outdoor amenity areas will also be constructed adjoining the building to the southeast and southwest.

1.3 Summary of Work Tasks

1.3.1 Geophysical Investigation - Underground Utility Clearance Policy

Prior to the commencement of intrusive field activities (i.e., all soil borings, test pits, or excavations); Langan field engineers will follow the Langan Underground Utility Clearance Policy including the retaining one or more geophysical consultants, if required, to conduct geophysical surveys using ground penetrating radar (GPR) and electromagnetic detection equipment. The application of the Langan Underground Utility Clearance policy is mandatory unless a site wide or a specific location exemption has been granted in writing by the principal-in-charge (PIC).

The objective of a geophysical survey is to identify any underground storage tank (UST) structures, drains, underground utilities, and other subsurface anomalies that may be encountered during an intrusive investigation. Langan personnel will observe the geophysical survey of each location and confirm the locations are both accessible and free of potential utility or other known or suspected subsurface structures. There will be no exemption to this section unless granted by written approval by the PIC.

1.3.2 “Soft-Dig” Clearance of Borehole Locations

In accordance with Langan’s Underground Utility Clearance Policy, Langan will instruct the drilling or excavation contractor to “Soft-Dig” each target soil boring, test pit, or excavation location as specified in Section 1.3.1. Soft dig is defined as using a vacuum system (with or without an air knife) or hand auger to clear soil from the proposed soil boring location to a depth of 5-feet. When excavating a test pit or larger excavation, the excavation contractor will “peel” away thin layers of soil with their excavator or shovel to daylight potential underground structures until achieving the required 5-feet depth. If using an excavator, the contractor must have a worker observing the excavator bucket/shovel warning the excavator operator when the bucket/shovel encounters a possible underground structure. At which point, the potential structure must be hand shoveled until it is fully daylighted. Langan personnel will confirm that the “soft dig” activities are completed to these specifications.

1.3.3 Day Lighting Excavation and Soil Screening

Langan may retain one or more excavation contractors to daylight buried unidentified structures. The purpose of the daylighting is to confirm if these structures are subsurface structures of concern including USTs, utilities sewer lines, storm water drains, electrical, gas or other utility line as well as other artifacts pertinent to the work plan. The excavation contractors will contact the appropriate utility mark-out authority and make available to their staff the verification number

and effective dates.

The excavation contractor will employ “soft dig” methods as defined in Section 1.3.2. Langan may screen excavated soil for visual, olfactory, and instrumental indicators suggestive of a potential chemical or petroleum release. Instrument screening for the presence of volatile organic compounds (VOC) may be performed with a duly calibrated photoionization detector (PID). Contractors will notify Langan personnel if they identify indications suggestive of a potential chemical or petroleum release. Contaminated material shall be handled, and property disposed in accordance with federal, state and city regulations, criteria, and guidelines.

1.3.4 Soil Investigation and Sampling

Langan may 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 VOC may be performed with a duly field calibrated 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 specific lab per the work plan or to a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified laboratory and analyzed in accordance with work plan specifications.

1.3.5 Groundwater Investigation and Sampling

Langan may complete a groundwater investigation. Langan may sample existing monitoring wells, or those soil investigation borings converted into groundwater monitoring wells. 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 the work plan. 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 Groundwater/Product Gauging

Langan may gauge one or more of the observation/monitoring wells to collect synoptic head data or determine the presence of product. When gauging, Langan may also survey head space VOCs within the well using a duly calibrated PID. When collected, gauging data will be based on the northernmost point at top of casing (TOC) using an interface probe (IP) capable of determining the presence of free product in the monitoring well as light non-aqueous phase liquid (LNAPL) at the top of the water column. If gauging for dense non-aqueous phase liquid (DNAPL) at the base of the monitoring well, the IP may not be appropriate. The field engineer will coordinate with the project team to devise an alternative method to gauge the thickness of DNAPL at base of the well. Langan will decontaminate gauging equipment between wells as required by the work plan.

1.3.7 Product Bailing

If free product is observed in any of the monitoring wells, Langan may bail or contract a 3rd party to remove free product from on-site monitoring wells as part of the work plan. Langan or its contractor may use a dedicated bailer or similar device, peristaltic pump or submersible to extract the observed free product. Langan will record the volume of product and groundwater recovered. Recovered product and groundwater will be drummed and handled in accordance with procedures outlined in the work plan.

1.3.8 Sub Slab or Soil Vapor Point Installation and Sampling

Langan (or its contractor) may install one or more sub-slab or soil vapor points at selected locations. If installed, 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) may 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 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 New York State Department of Health (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.

1.3.9 Observation/Monitoring Well Plugging and Abandonment

While not scheduled, existing observation/monitoring wells may be plugged or abandoned as specified in the work plan. 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.

1.3.10 QA/QC Sampling

Samples for quality assurance/quality control [QA/QC] 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.

1.3.11 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.

1.3.12 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.

1.3.13 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.

1.3.14 Surveying

Surveying activities 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 on the proposed site activities.

2.1 Langan Project Manager

The Langan Environmental Project Manager (PM) is Greg Wyka, his responsibilities include:

- Ensuring that this HASP is developed, current, and approved prior to on-site activities.
- Ensuring that 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 Construction Health and Safety Manager

The Langan Corporate Construction Health and Safety Manager is Tony Moffa. His responsibilities include:

- Updating the *Health and Safety Program for Hazardous Waste Operations*.
- Assisting the site Construction Health and Safety Officer (HSO) with the development of the HASP, updating HASP as dictated by changing conditions, job site inspection results, etc., and approving changes to this HASP.
- Assisting the HSO in the implementation of this HASP and conducting Jobsite Safety Inspections and assisting with communication of results and correction of shortcomings found.
- Maintaining records on personnel (medical evaluation results, training and certifications, accident investigation results, etc.).

2.3 Langan Site Health & Safety Officer

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

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

2.4 Langan Field Team Leader Responsibilities

The Langan Field Team Leader (FTL) is to be determined prior to the start of 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 maintain community air monitoring activities and instruct the responsible contractor to implement organic vapor or dust mitigation when necessary.

2.5 Contractor Responsibilities

2.5 Contractor Responsibilities

The contractor must develop and implement their own HASP for their employees, their subcontractors, and consultants. The contractor is responsible for their own health and safety and that of their subcontractors. Contractors operating on the site must designate their own FTL, HSO, and Health and Safety Manager (HSM). The contractor's HASP will be at least as stringent as this 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 if 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 safety data sheet (SDS) for the material.
- Have knowledge of, understand, and abide by all current federal, state, and local health and safety regulations pertaining 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 of respirator they will wear.
- Ensure all air monitoring is in place pertaining to the health and safety of their employees as required by OSHA 1910.120; and
- All contractors must adhere 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 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. The Safety Data Sheets for each potential contaminant listed in Table 2 is included in Attachment E.

3.1 Specific Task Safety Analysis

3.1.1 Geophysical Survey

Langan personnel are not permitted to operate or otherwise handle the geophysical equipment including GPR/electromagnetic detection equipment used for surface utility clearance contractor. When conducting surface utility clearance surveys, the locations of the borings, test pits, and other excavations must be fully marked out. In addition, possible detections by the utility clearance contractor of utilities and other artifacts must also be marked out. Markings should include paint, flags, or color tape (when marking indoor locations that the client has specifically requested not be marked with paint). This information must also be added to the site map.

3.1.2 “Soft Dig” Clearance of Borehole Locations

“Soft-Dig” clearance will be completed by the contractors. Langan personnel are not permitted to operate or otherwise handle the contractor’s equipment. Langan will update the site map to include the locations of the cleared borehole locations as well as utilities and other artifacts that may interfere with the subsurface investigation.

3.1.3 Daylighting Test Pit

Excavation daylighting must abide by OSHA excavation standards (Part 1926.651) and conform to the Langan Underground Utility Clearance Policy. Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person for evidence of a situation that could result in cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rainstorm or other hazard increasing occurrence.

No one is to enter an excavation deeper than 5-feet unless the excavation walls are properly sloped in accordance with OSHA regulations. If sampling is required, the sample for excavations deeper than 5-feet without protective systems (sloping) as defined by OSHA are to be collect using suitable mechanical excavation equipment (backhoe or equivalent). When collecting soil samples, Langan will don chemical resistant gloves in addition to the standard PPE. Langan personnel are not to operate excavation equipment. This task is to be completed by an authorized excavation contractors approved by the contractor.

3.1.4 Indoor Drilling and Excavation

The work scope may require indoor excavation 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 for 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.

3.1.5 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.

3.1.6 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.

1.3.7 Groundwater/Product Gauging

Gauging product requires additional safety considerations including the presence of VOCs and protection of both field cloths and property. Langan will monitor air for VOCs using a duly calibrated PID. Langan will don protective clothing including Tyvek® over-cloths, as necessary. To protect property, Langan will work set a plastic barrier to protect floors or protect landscaping and use absorbent pads as necessary to collect pooled product. If sampling for PFAS from the same well, Langan will complete the product check first, if the well can be sampled without including product, Langan will remove the Tyvek® material from the well head vicinity.

3.1.8 Product Recovery Well Bailing

Langan may bail free product from monitoring wells. Free product bailing requires the donning of Tyvek™ suits, Tyvek™ boots and chemical resistant gloves in addition to the standard PPE and cut resistant gloves when cutting sampling-tubing to length. In addition, Langan will place plastic sheeting around the recovery well head to control spillage during product recovery. Langan will also keep on hand and readily available product absorbing pads to use as needed.

3.1.9 Electrical Pumps

Langan may use an electric pump to collect product from the recovery wells or to sample groundwater. Langan will inspect the electric pump and control box prior to use and specifically note the condition of the electrical connectors, pump, control box and the electrical cord. The electrical connection 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.

3.1.10 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.

3.1.11 Additional Vapor Screening

Langan personnel may prescreen vapor samples for volatile organic compounds (VOCs), methane, hydrogen sulfide and lower explosion limit (LEL) conditions using duly calibrated devices design to screen vapor for these parameters. Langan personnel may also perform atmospheric screening for LEL. Results of the screening may be used in determining which soil vapor samples will be submitted for analysis.

Work activities will immediately cease, and the work area is to be evacuated if the MultiRAE returns a reading of 10% of the LEL (an alarm will sound). Langan personnel will contact the Langan PM. Instrument action levels for monitored gases are provided in Table 4.

3.1.12 Plugging and Abandonment of Observation/Monitoring Wells

Langan personnel are not to operate equipment nor assist in the plugging and abandonment of the observation/monitoring wells. These tasks are to be completed by the contractor.

3.1.13 Drum Sampling

Drilling fluid, rinse water, grossly contaminated soil samples, and cuttings will be containerized in 55-gallon drums for disposal off-site. Each drum must be labeled in accordance with the Langan Drum Labeling Standard Operating Procedure (SOP09). Sampling drums requires the donning of work gloves when opening the drums and chemical resistant gloves when sampling in addition to standard PPE.

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 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 must 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 spasms 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 a 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 illnesses. 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 equal the amount of water lost in sweat, i.e., eight fluid ounces (0.23 liters) of water must be ingested for

every eight ounces (0.23 kilograms [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 liters).
- 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 called frostbite.

- **Hypothermia** - Hypothermia is defined as a decrease in the patient core temperature below 96°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 an 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 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 the supervisor and tag and remove equipment out of service. Ground Fault Circuit Interrupters (GFCIs) are required for all power tools requiring direct electrical service.

3.3.6 Slips, Trips, and Fall Hazards

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

3.3.7 Utilities (Electrocution and Fire Hazards)

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 a review of available utility drawings and by notification of the subsurface work to N.Y. One –Call–Center.

3.3.7.2 Lockout-Tagout

The potential adverse effects of electrical hazards include burns, arc flashes, and electrocution, which could result in serious injury including death. Therefore, there is a procedure that establishes the requirements for the lockout/tag out (LOTO) of energy isolating devices in accordance with the OSHA electrical lockout and tagging requirements as specified in 29CFR1910.147 and 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 performs work activities.

The facility owner/operator/representative is to be the authorized person that will initiate and perform the LOTO in accordance with applicable rules and practices. Inerting of electrical power sources is to be completed by an authorized and licensed electrician. Langan personnel will follow LOTO protocols and practices including adding a separate lock/signature to the LOTO chain in accordance with said protocols and practices.

SPECIAL NOTE: Project personnel will assume that all electrical equipment at the surface, subsurface, and overhead locations are 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 near energized electrical lines or equipment.

The FTL shall accompany the designated facility owner/operator/representative or authorized/licensed electrician in surveying to locate and identify all energy-isolating devices. Langan will note which switches, valves or other isolating devices are used for inerting the equipment and how they are set assuring LOTO. 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 Adequate Lighting

Indoor or night activities must be done under adequate lighting conditions. The Langan field engineer must be able to clearly see the equipment, all controls and have sufficient lighting to detail color labels. Battery operated lights are sufficient provided they cast a wide enough field to provide the required lighting and there are back-up batteries and emergency flashlights available. Electrically powered lights are suitable provided the electrical source is equipped with a ground fault interrupt circuit (GFIC) and the extensions cords are visually inspected prior to each

use, and not used if they show cracked, damaged, or missing insulation. If a generator is supplying the electricity, it must be located outdoors and properly grounded and vented.

3.3.9 Physical Hazard Considerations for Material Handling

There are moderate to severe risks associated with moving heavy objects at the Site. The best method of reducing back injuries is to reduce or eliminate manual lifting. Mechanical lifting devices should be used whenever possible.

- Size up the load before attempting to lift it. Heavy objects will be lifted and moved by mechanical devices rather than manual effort whenever possible. Never overexert when lifting.
 - When using a mechanical device, the devices should be appropriate for the lifting of moving tasks and 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
- If manual lifting cannot be avoided the following lifting procedures are recommended.
 - If the load is thought to be more than one person can handle, get another person to help with the job.
 - Make sure you can carry the load where you need to go before attempting to lift it. Make sure your path is clear of equipment, materials, debris, holes, etc.
 - Place your feet close to the object, spread about 12 inches apart.
 - Bend your knees and get a good hand hold.
 - Lift straight up smoothly, allowing your legs not your back to do the work.
 - Keep the load close to the body with your elbows and arms tucked in.
 - Do not twist or turn your body once you have made the lift.
 - Set the load down properly:
 - Lower the load slowly by bending at your knees, letting your legs do most

of the work.

- Don't let go of the load until it's secure on the surface.

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.

3.3.10 Hearing Conservation

Under the construction industry standard, the maximum permissible occupational noise exposure is 90 A-weighted decibels (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.

3.3.11 Open Water

Employees working over or near water, where the danger of drowning exists, must 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 must be inspected for defects that would alter their strength or buoyancy. Defective units must 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 the line must be provided and readily available for emergency rescue operations. The distance between ring buoys must 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 must 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 always operate the skiff 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 always staffed or have someone remain in the immediate area such that the operator can quickly reach the skiff and perform rescue services.
- The skiff operator may be 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.

Regarding 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 H&S 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. Langan personnel are to avoid interacting with any wildlife.

3.4.2 Insects

Ticks and other biting or stinging insects may be encountered during site operations. Langan personnel should take necessary precautions including donning long sleeve shirts and insecticide to prevent bites and stings. After fieldwork, 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 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 the effects of exposure. If after fieldwork, 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 Mold

This section is restricted to subsurface investigations where sampling soil, groundwater, soil or

sub-slab vapor or ambient air in an indoor environment with slight to moderate mold impact. Mold exposure symptoms include nasal stuffiness, eye irritation, or wheezing.

The Langan field engineer is required to don a ½ face respirator with a minimum p-100 particulate filter and Tyvek™ type overclothing before entering mold impacted indoor work area. The Langan field engineer must be medically cleared and have been properly fitted for a respirator before donning one.

3.5 Additional Safety Analysis

3.5.1 Presence of Non-Aqueous Phase Liquids (NAPL)

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 always use disposable nitrile gloves 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 workday, 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 at a minimum the following:

- Work plan for the day.
- Review of safety information relevant to planned tasks and environmental conditions.
- New activities/tasks being conducted.
- Driving conditions/hazards/designated parking areas.
- 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 fieldwork 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.

5.1 Mercury Monitoring

Langan includes medical monitoring for mercury during the initial baseline and annual physical.

5.2 Coronavirus

General Preventative Measures

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

- Avoid touching eyes, nose, and mouth.
- Cover coughs or sneezes with tissue and throw in the trash.
- Wash hands often with soap and water for 20 seconds after going to the 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 six feet from other people (social distancing).
- Wear face coverings when around other workers to minimize the spread of COVID-19. (May be required in certain states or locations.)

Construction Trailers

Employees should avoid the 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 personnel, restrict use from any workers who are ill or showing symptoms of being ill, use face coverings and ensure a safe distance of six feet can be established between workers.

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, use of face coverings, and other potential exposure issues/concerns.

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, shortness of breath chills, repeated shaking with chills, muscle pain, headache, sore throat, or new loss of taste or smell. 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, notify their project manager, and site manager or safety officer. Work should resume when the safety and health of Langan and subcontractors is adequately addressed.

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. Directly 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.

Human exposure to contaminants found in the subsurface can occur through three primary routes:

- Inhalation of gases, vapors, dust, or mists is a common route of exposure. Chemicals can enter and irritate the airways and the lungs. They can become deposited in the airways or can be absorbed through the lungs into the bloodstream.
- Direct contact of contaminants with the skin or eyes is a common route of exposure. Some substances are absorbed through the skin and can enter the bloodstream. Broken, cut, or cracked skin will allow substances to enter the body more easily.
- Ingestion or swallowing of food, drink, or other substances is the third route of exposure. Chemicals that get in or on food, utensils, or hands can be ingested. Substances can be absorbed into the blood.

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 side shields or chemical splash goggles
- Safety boots/shoes (toe-protected)
- Disposable chemical-resistant boot covers.
- Coveralls (poly-coated 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 ft of the water)
- Reflective traffic vest

Level C Protection (as needed)

- Full or Half face, air-purifying respirator, with NIOSH approved High-Efficiency Particulate Air (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 must be in possession of a full or half face piece air-purifying respirator and have been successfully fit-tested within the past year. Fit-test records are maintained by the HSM.

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 to comply with 29 CFR 1910.134. The respirator cartridge change-out schedule for this project is as follows:

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

Respirators must not be stored at the end of the shift with contaminated cartridges left on. Cartridges must 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 ACTIONS 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 that 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 methane and VOCs. A MultiRAE LEL/Oxygen (O₂) meter and FID will be used to monitor the LEL of methane, and a PID and/or 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 to or more stringent than 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 Areas of Concern (AOCs). Colorimetric Indicator Tubes for benzene may be used as a backup for the PID if measurements remain above background monitor every 2 hours. The HSO will monitor the employee's 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 AOC 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 historic fill, there is a potential for the soils to contain Polycyclic Aromatic Hydrocarbons (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's 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 milligrams per cubic meter (mg/m³) 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 AOC every 30 minutes in addition to the employee breathing zone. Instrument action levels for dust monitoring are provided in Table 4.

7.1.3 Methane

During soil excavation or other intrusive activities, direct reading air monitoring may be performed in the excavation area to determine exposure to workers. Monitoring with an LEL/O₂ meter and FID may occur during intrusive work in the AOCs. The HSO will monitor the employee's breathing zone at least hourly during intrusive activities. If LEL levels are observed above 20% the professional engineer (PE) or their designee will stop work and evacuate the area; warn others; and determine source of readings and take corrective actions. The Contractor will be responsible for mitigating explosive gas levels.

7.2 Monitoring Equipment Calibration and Maintenance

Instrument calibration must be documented and included in a dedicated safety and health logbook or on separate calibration pages of the field book. All instruments must 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 responses.

All instruments must be operated in accordance with the manufacturers' specifications. Manufacturers' literature, including an operation 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, dust and methane will be established prior to intrusive activities within the AOC 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. If conducted, Langan will implement the generic CAMP outlined below amended to comply with local conditions or standards:

Monitoring for dust and odors will be conducted during all ground intrusive activities by the FTL. Continuous monitoring of 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 is 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 ($\mu\text{g}/\text{m}^3$) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed

leaving the work area, then dust suppression must be employed. Work may continue with dust suppression techniques provided that downwind particulate matter less than 10 microns (PM10) levels do not exceed $150 \mu\text{g}/\text{m}^3$ 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 $150 \mu\text{g}/\text{m}^3$ above the background level, work must be stopped, and a re-evaluation of activities initiated. Work can resume if dust suppression measures and other controls are successful in reducing the downwind PM10 concentration to within $150 \mu\text{g}/\text{m}^3$ 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 a 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 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. Specific

zones will be established on the work site by the Contractor when operations begin for each task requiring such delineation. Maps depicting the zones will be available at the Site.

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 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 must 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 the 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 another physical contact with contamination as PPE is intended to minimize accidental contact. This may minimize the degree of decontamination required and the generation of waste materials from site operations.

Field procedures will be developed to control 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 must 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 exists, such as with open excavation, this area will be covered with polyethylene sheeting to eliminate any potential inhalation hazards. All emergency personnel should be immediately informed of the injured person's condition, and 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 (including equipment storage and maintenance areas) will be 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 must be used by field teams, along with the buddy system. The entire field team must 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 your partner's wrists or place both hands around the waist	Leave immediately without debate
Hands on top of head	Need assistance
Thumbs up	OK; I am all right; 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:

Mount Sinai West
1000 10th Avenue
New York, New York

212-523-4000

A map with directions to the hospital is shown in Figure 2. This information will either be posted prominently at the site or will be available to all personnel all 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 always made available to all personnel. Those who do not abide by these safe work practices will be removed from the site.

12.0 SITE SECURITY

No unauthorized personnel must 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 ten feet from all equipment performing subsurface work.
- Ensure that the one-call (811) system or state utility hotline in your area has been notified. Private mark-outs may require the use of ground penetrating radar (GPR).
- Attempt to stay at least 15 feet from subsurface electrical lines and at least 10 feet from all other utility lines or mark-outs. Minimum clearance distances may increase as per chart below.

- Hand auger subsurface boreholes and test pits to 5 feet below ground surface.

TABLE A--MINIMUM CLEARANCE DISTANCES

Voltage (nominal, kV, alternating current)	Minimum clearance distance (feet)
up to 50	10
over 50 to 200	15
over 200 to 350	20
over 350 to 500	25
over 500 to 750	35
over 750 to 1,000	45
over 1,000	(as established by the utility owner/operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution).

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 must 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 must be maintained in a safe operating condition. All electric-power tools must be inspected before initial use. Damaged tools must be removed immediately from service or repaired. Tools must 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 WorkCare - Incident Intervention@ at 1-888-479-7787 to report their injuries. For all other communications, contact the Langan Incident Hotline at **973-560-4699** 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.

Also, in the event of an incident where a team member becomes exposed or suffers from an acute symptom from contact with site materials and must be taken to a hospital, a short medical data sheet (Attachment C) for that individual will be made available to the attending physician. The medical data sheet will include the following:

- Name, address, home phone
- Age, height, weight
- Name of person to be notified in case of an accident.
- Allergies
- Sensitivities
- Does he/she wear contact lenses?
- Short checklist of previous illness
- Name of personal physician and phone
- Name of company physician and phone
- Prescription and non-prescription medications currently used.

An incident reporting form is included in Attachment C.

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 is 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 limit.

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 is 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 must locate emergency phone numbers and identify hospital routes prior to beginning work on the sites. The Emergency Coordinator must 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. All 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 has been stabilized, the injured Langan personnel should contact *WorkCare - Incident Intervention@* at 1-888-479-7787 to report their injuries. For all other communications, contact the Langan Incident Hotline at **973-560-4699** as soon as possible.

16.4 Local Emergency Support Units

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 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 each site vehicle.

16.6 Emergency Medical Treatment

The procedures and rules in this HASP are designed to prevent employee injury. However, if an injury occurs, no matter how slight, it will be reported to the HSO immediately. 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. First-aid instructions provided from off-site 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. 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, an emergency may develop. Emergencies 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.

If an emergency 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 if 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 emergency must 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 the 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 must 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 must evacuate.
- Upgrade to Level C Respiratory Protection.
- Downwind perimeter locations must be monitored for volatile organics.
- If the release poses a potential threat to human health or the environment in the community, the Emergency Coordinator must 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 must also be rinsed for 15 minutes if contact with caustics, acids, or hydrogen peroxide occurs. Affected items of clothing must 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 lifesaving 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 advise on matters involving decontamination when necessary. The outer garments can be removed if they do not cause delays, interfere with treatment, or aggravate the problem. Respiratory equipment must always be removed.

Protective clothing can be cut away. If the outer contaminated garments cannot be safely removed 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, normal decontamination procedures will be followed.

16.13 Adverse Weather Conditions

In the event of adverse weather conditions, the HSO will determine if work continues 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 must be contained as close to the source as possible. Whenever possible, the SDS 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 of. 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 must have spill kits on them with enough material to contain and absorb the worst-case spill from that vehicle. All vehicles and equipment must be inspected prior to being 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 must 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 the 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 field personnel must notify the project manager when they observe a spill or encounter conditions suggesting one might have occurred.

16.15 Emergency Equipment

The following minimum emergency equipment must 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 (extension 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 Construction 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 Construction Health and Safety Plan (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 alerted to changes in site conditions.

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

17.3 Procedures

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

17.3.1 Ladders

Langan safety procedures must be used to ensure employee safety when using ladders in the office or work sites. All ladders must 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 must only use ladders for the purposes they were designed for and must not be used as scaffolding. Ladders will be maintained and inspected prior to use for slip hazards including oil and grease. Employees must use ladders only on stable and level surfaces unless the ladder is secured to prevent 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 must 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 must 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 must 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 length of the ladder, then the top of the ladder must be secured at its top to a rigid support.

17.3.1.3 Step Stools

Rungs, cleats, and steps of step stools must 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 must 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 must not be less than 6 inches nor more than 12 inches, as measured between the center lines of the rungs, cleats and steps. Ladders must 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 defects 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 components must 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 site work, the Langan employees certified in first aid and CPR will be identified in the site-specific HASP. Langan will endeavor 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 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 for 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 must 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 physicians, hospitals, or ambulances must 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 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 must be provided within the work area for immediate emergency use including eye wash.

First aid kits will be weatherproof with individually sealed packages of each item. All portable first aid kits must be inspected by Langan employees before and after use to ensure all used items are replaced. When out in the field, employees must 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 must have training in hydrogen sulfide awareness. The training will include the identification of areas where employees could be exposed to hydrogen sulfide, health effects, permissible exposure limits, 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 a 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 must 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 must 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.

17.3.4 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 the initial assignment for field work and annually thereafter.

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

17.3.5 Overhead lines

When field work is performed near overhead lines, the lines must be de-energized and grounded, or other protective measures must be provided before the work commences. If overhead lines are to be de-energized, arrangements must be made with the client, property owner, or organization that operates or controls the electric circuits involved to de-energize and ground them. If protective measures, such as guarding, isolating, or insulating, are provided, these precautions must 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 must 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 50 kilovolts (kV) 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 must be operated so that a clearance of 10 feet is maintained. If the voltage of the overhead lines is higher than 50kV, the clearance must be increased by 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 must be increased to 4 inches 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, must 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 allows the employer 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 confidentiality agreement with the client.

17.3.7 Bloodborne Pathogens

Langan employees that can anticipate exposure to blood or other potentially infectious material while at work sites must 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 the 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 must 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 how 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 the 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 determining whether 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 must 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 regard to the use of PPE, which could eliminate or minimize exposure.

Universal precautions must 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. When differentiation between body fluid types is difficult or impossible, all body fluids must be considered potentially infectious materials.

Work practice controls must be used to eliminate or minimize employee exposure, if applicable. Since Langan employees will have occupational exposure only during the 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 must 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, must be placed in a container, which prevents leakage during collection, handling, processing, storage, transport, or shipping. All PPE will be disposed 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 must be maintained for 3 years from the date on which the training occurred. Medical records 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 the Director of the National Institute for Occupational Safety and Health Director of OSHA for examination and copying. Medical records must have written consent from the employee before releasing.

If Langan ceases to do business, all records must be transferred to the successor employer. The successor employer must 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 are not included in the HASP 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 on-the-job training (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 (Attachment H) will be maintained by the HSO or FTL.

18.5 Exposure Records

All personal monitoring results, laboratory reports, calculations, and air sampling 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 - SDS

Safety Data Sheets (SDS) have been obtained for applicable substances and are included in this HASP (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 973-560-4699, 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, the 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, must 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 must 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 nonrestricted areas to be readily accessible to all on the site.

18.7.1.2 First Aid Treatment Record

The 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. Forms for recording OSHA work-related injuries and illnesses are included in Attachment C.

19.0 CONFINED SPACE ENTRY

Confined spaces are not anticipated at the Site during planned 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.

[illegible]

TABLES

TABLE 1
TASK HAZARD ANALYSES

Task	Hazard	Description	Control Measures	First Aid
1.3.1 – 1.3.14	Contaminated Soil or Groundwater- Dermal Contact	Contaminated water spills on skin, splashes in eyes; contact with contaminated soil/fill during activities or sampling.	Wear proper PPE; follow safe practices, maintain safe distance from activities	See Table 2, seek medical attention as required
1.3.1 – 1.3.14	Lacerations, abrasions, punctures	Cutting bailer twine, pump tubing, acetate liners, etc. with knife; cuts from sharp site objects or previously cut piles, tanks, etc.; Using tools in tight spaces	Wear proper PPE; follow safe practices	Clean wound, apply pressure and/or bandages; seek medical attention as required.
1.3.1 – 1.3.14	Contaminated Media Inhalation	Opening drums, tanks, wells; vapors for non-aqueous phase liquids or other contaminated site media; dust inhalation during excavation; vapor accumulation in excavation	Follow air monitoring plan; have quick access to respirator, do not move or open unlabeled drums found at the site, maintain safe distance from activities	See Table 2, seek medical attention as required
1.3.1 – 1.3.14	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 – 1.3.14	Slips, trips, and falls	Slips, trips, and falls due to uneven surfaces, cords, steep slopes, debris, and equipment in work areas	Good housekeeping at site; constant awareness and focus on the task; avoid climbing on stockpiles; maintain safe distance from activities and excavations; avoid elevated areas over six feet unless fully accredited in fall protection and wearing an approved fall protection safety apparatus	Rest, ice, compression, elevation; seek medical attention as required
1.3.1 – 1.3.14	Noise	Excavation equipment, hand tools, drilling equipment.	Wear hearing protection; maintain safe distance from activities	Seek medical attention as required
1.3.1 – 1.3.14	Falling objects	Soil material, tools, etc. dropping from drill rigs, front-end loaders, etc.	Hard hats to be worn at all times while in work zones; maintain safe distance from activities and excavations	Seek medical attention as required
1.3.1 – 1.3.14	Underground/ overhead utilities	Excavation equipment, drill rig auger contacts underground object; boom touches overhead utility	"One Call" before dig; follow safe practices; confirm utility locations with contractor; wear proper PPE; maintain safe distance from activities and excavations	Seek medical attention as required
1.3.1 – 1.3.14	Insects (bees, wasps, hornet, mosquitoes, and spider)	Sings, bites	Insect Repellent; wear proper protective clothing (work boots, socks, and light-colored pants); field personnel who may have insect allergies (e.g., bee sting) should provide this information to the HSO or FSO prior to commencing work and will have allergy medication on site.	Seek medical attention as required
1.3.1 – 1.3.14	Vehicle traffic / Heavy Equipment Operation	Vehicles unable to see workers on site, operation of heavy equipment in tight spaces, equipment failure, malfunctioning alarms	Wear proper PPE, especially visibility vest; use a buddy system to look for traffic; rope off area of work with cones and caution tape or devices at points of hazard, maintain safe distance from 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 – 1.3.14	1,1,2-Trichloroethane 1,1,2-TCA 1,1,2-Trichloroethane Ethane trichloride β-Trichloroethane Vinyl trichloride	79-00-5	PID	10 ppm 100 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation eyes, nose; central nervous system depression; liver, kidney damage; dermatitis	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention
1.3.1 – 1.3.14	1,1'-Biphenyl 1,1-Biphenyl Biphenyl Phenyl benzene Diphenyl	92-52-4	None	1 mg/m ³ 100 mg/m ³	Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, throat; headache, nausea, lassitude (weakness, exhaustion), numb limbs; liver damage	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	1,1-Dichloroethane Asymmetrical dichloroethane Ethylidene chloride 1,1-Ethylidene dichloride 1,1-DCA	75-34-3	PID	100 ppm 3000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin, and/or eye contact	irritation to the skin; central nervous system depression; liver, kidney, lung damage	Eye: Irrigate immediately Skin: Soap 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 – 1.3.14	1,2,4-Trimethylbenzene	95-63-6	PID	None None	Groundwater Soil Vapor	inhalation, ingestion, skin, and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	1,2-Dichlorobenzene o-DCB	95-50-1	PID	50 ppm 200 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eye, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	1,2-Dichloroethane Ethylene dichloride 1,2-DCA DCE[1] Ethane dichloride Dutch liquid, Dutch oil Freon 150 Glycol dichloride	107-06-2	PID	1 ppm 50 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin absorption, skin, and/or eye contact	irritation to the eyes, corneal opacity; central nervous system depression; nausea, vomiting; dermatitis; liver, kidney, cardiovascular system damage; [potential occupational carcinogen]	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 – 1.3.14	1,3,5-Trimethylbenzene Mesitylene sym-Trimethylbenzene	108-67-8	PID	None None	Groundwater Soil Vapor	inhalation, ingestion, skin, and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	1,3-Dichlorobenzene m-Dichlorobenzol; m-Phenylene dichloride m-dichlorobenzene m-DCB	541-73-1	PID	None None	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	1,4-Dichlorobenzene para- Dichlorobenzene p-Dichlorobenzene 1,4-Dichlorobenzene 1,4-DCB para-Dichlorobenzene p-Dichlorobenzene p-DCB PDB Paramoth Para crystals Paracide Dichlorocide	106-46-7	PID	75 ppm 150 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury; [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 – 1.3.14	1,4-Dioxane 1,4-Dioxacyclohexane [1,4]Dioxane p-Dioxane [6]-crown-2 Diethylene dioxide Diethylene ether Dioxan Dioxane 1,4-Dioxane	123-91-1	PID	100 ppm 500 ppm	Groundwater Soil Vapor	Inhalation, ingestion, skin, and/or eye contact	Irritant to eyes, skin, mucous membranes, and respiratory system. May be harmful by ingestion, skin absorption and inhalation	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	2-Butanone Ethyl methyl ketone MEK Methyl acetone Methyl ethyl ketone	78-93-3	PID	200 ppm 3000 ppm	Soil Groundwater Vapor	inhalation, ingestion, skin, and/or eye contact	irritation to the eyes, skin, nose; headache; dizziness; vomiting; dermatitis	Eye: Irrigate immediately Skin: Water wash immediately Breathing: Fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.14	2-Methylnaphthalene β-methylnaphthalene	91-57-6	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion or skin, absorption, eye contact	irritation to the skin, eyes, mucous membranes, and upper respiratory tract. It may also cause headaches, nausea, vomiting, diarrhea, anemia, jaundice, euphoria, dermatitis, visual disturbances, convulsions and comatose	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	4,4'-DDD Dichlorodiphenyldichloroethane 1,1'-(2,2-Dichloroethylidene)bis (4-chlorobenzene) p,p'-DDD	72-54-8	None	NA NA	Groundwater Soil	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; vomiting; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Acenaphthene 1,2-Dihydroacenaphthylene 1,8-Ethylenenaphthalene peri-Ethylenenaphthalene Naphthyleneethylene Tricyclododecapentaene	83-32-9	PID	NA NA	Soil	inhalation, ingestion, skin, and/or eye contact,	irritation to the skin, eyes, mucous membranes, and upper respiratory tract; If ingested, it can cause vomiting	Eye: Irrigate immediately Skin: Soap wash immediately, if redness or irritation develop, seek medical attention immediately Breathing: Move to fresh air Swallow: do not induce vomiting, seek medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	Acenaphthylene Cyclopental(de)naphthalene, Acenaphthalene	208-96-8	PID	NA NA	Soil	inhalation, ingestion, skin, and/or eye contact	irritation to the skin, eyes, mucous membranes, and upper respiratory tract	Eye: Irrigate immediately, seek medical attention immediately, Skin: Soap wash immediately, if redness or irritation develop, seek medical attention immediately Breathing: Move to fresh air Swallow: do not induce vomiting, seek medical attention immediately
1.3.1 – 1.3.14	Acetone Dimethyl ketone Ketone propane 2-Propanone 3-Hexen-2-one	67-64-1	PID	1000 ppm 2500 ppm	Groundwater Soil	inhalation, ingestion, skin, and/or eye contact	irritation to the eyes, nose, throat; headache, dizziness, central nervous system depression; dermatitis	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Aldrin 1,2,3,4,10,10-Hexachloro- 1,4,4a,5,8,8a-hexahydro-endo- 1,4-exo-5,8- dimethanonaphthalene HHDN Octalene	309-00-2	PID	0.25 ppm 5 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	headache, dizziness; nausea, vomiting, malaise (vague feeling of discomfort); myoclonic jerks of limbs; colonic, tonic convulsions; coma; hematuria (blood in the urine), azotemia; [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 – 1.3.14	Alpha-BHC alpha-Hexachlorocyclohexane -alpha,2-alpha,3-beta,4-alpha,5-beta,6-beta- Hexachlorocyclohexane alpha-1,2,3,4,5,6- Hexachlorocyclohexane alpha-Benzenehexachloride α -1,2,3,4,5,6- hexachlorocyclohexane α -HCH α -Benzenehexachloride alpha-hexacloran(e) alpha-Lindane Alpha Hexachlorocyclohexane	319-84-6	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin, mucous membrane possible carcinogenic, effects to liver, blood, and central nervous system	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Alpha-Chlordane Alpha Chlordane a-Chlordane	5103-71-9	None	0.5 mg/m ³ 100 mg/m ³	Groundwater Soil	inhalation, skin absorption, ingestion, skin, and/or eye contact	Blurred vision; confusion; ataxia, delirium; cough; abdominal pain, nausea, vomiting, diarrhea; irritability, tremor, convulsions; anuria	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Aluminum	7429-90-5	None	0.5 mg/m ³ 50 mg/m ³	Soil	inhalation, skin, and/or eye contact	irritation to the eyes, skin, respiratory system	Eye: Irrigate immediately Breathing: Fresh air
1.3.1 – 1.3.14	Anthracene	120-12-7	PID	0.2 mg/m ³ 80 mg/m ³ (Coal Pitch Tar)	Soil	inhalation, skin, or eye contact, ingestion	irritation to the skin, eyes, mucous membranes, and upper respiratory tract, abdominal pain if ingested.	Eye: Irrigate immediately, seek medical attention immediately, Skin: Soap wash immediately, Breathing: Move to fresh air, refer to medical attention. Swallow: refer to medical attention

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	Antimony	7440-36-0	None	0.5 mg/m ³ 50 mg/m ³	Groundwater Soil	inhalation, ingestion, skin, and/or eye contact	irritation skin, 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 – 1.3.14	Aroclor 1254	11097-69-1	None	0.5 mg/m ³ 5 mg/m ³	Groundwater Soil	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, chloracne	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Arsenic	NA	None	0.5 mg/m ³ NA	Groundwater Soil	inhalation, ingestion, skin, and/or eye contact	irritation skin, 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 – 1.3.14	Barium	10022-31-8	None	0.5 mg/m ³ 50 mg/m ³	Groundwater Soil	inhalation, ingestion, skin, and/or eye contact	irritation to the eyes, skin, upper respiratory system; skin, burns; gastroenteritis; muscle spasm; slow pulse	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	Benzaldehyde Benzoic aldehyde Benzenecarbonal Benzenecarboxaldehyde Phenylmethanal	100-52-7	PIF	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin, nose, respiratory system	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Benzene Benzol Phenyl hydride Alkyl benzene isomers	71-43-2	PID	3.19 mg/m ³ 1,595 mg/mg ³	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; lassitude (weakness, exhaustion) [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Benzo(a)anthracene Benzanthracene Benzanthrene 1,2-Benzanthracene Benzo[b]phenanthrene Tetraphene	56-55-3	PID	0.2 mg/m ³ 80 mg/m ³ (Coal Pitch Tar)	Groundwater Soil	inhalation, skin, or eye contact, ingestion	dermatitis, bronchitis, [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	Benzo(a)pyrene	50-32-8	PID	0.2 mg/m ³ 80 mg/m ³ (Coal Pitch Tar)	Soil	inhalation, skin, or eye contact, ingestion	dermatitis, bronchitis, [potential occupational carcinogen]	Eye: Irrigate immediately, seek medical attention Skin: Soap wash immediately. Breathing: move to fresh air. Swallow: Induce vomiting if conscious, seek medical attention immediately
1.3.1 – 1.3.14	Benzo(b)fluoranthene	205-99-2	PID	0.2 mg/m ³ 80 mg/m ³ (Coal Pitch Tar)	Soil	inhalation, skin, or eye contact, ingestion	irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.14	Benzo(g,h,i)fluoranthene Benzo[ghi]fluoranthene 203-12-3 BENZO(GHI)FLUORANTHENE pentacyclo[8.8.0.0.2,7.0.3,17.0.1 3,18]octadeca-1(10),2(7),3,5,8,11,13(18),14,16-nonaene 2,13-Benzofuranthene 2,13-Benzofluoranthene	203-12-3	NA	NA NA	Soil	inhalation, skin, or eye contact, ingestion	dermatitis, bronchitis, [potential occupational carcinogen]	Eye: Irrigate immediately, seek medical attention Skin: Soap wash immediately. Breathing: move to fresh air. Swallow: Induce vomiting if conscious, seek medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	Benzo(g,h,i)perylene Benzo(ghi)perylene	191-24-2	PID	0.2 mg/m ³ 80 mg/m ³ (Coal Pitch Tar)	Soil	inhalation, skin, or eye contact, ingestion	irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.14	Benzo(k)fluoranthene	207-08-9	PID	0.2 mg/m ³ 80 mg/m ³ (Coal Pitch Tar)	Soil	inhalation, skin, or eye contact, ingestion	irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.14	Beryllium	7440-41-7	None	0.002 mg/m ³ 4 mg/m ³	Soil	inhalation, skin, and/or eye contact	berylliosis (chronic exposure): anorexia, weight loss, lassitude (weakness, exhaustion), chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation to the eyes; dermatitis; [potential occupational carcinogen]	Eye: Irrigate immediately Breathing: Fresh air

Task	Contaminant	CAS Number	Monitoring Device	PEL/IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	Beta BHC Beta Hexachlorocyclohexane 1-alpha,2-beta,3-alpha,4-beta,5-alpha,6-beta- Hexachlorocyclohexane beta-1,2,3,4,5,6- Hexachlorocyclohexane Beta-BHC	319-85-7	None	NA NA	Groundwater Soil	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; vomiting; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Beta-Endosulfan Beta Endosulfan Endosulfan II (beta) Endosulfan II	33213-65-9	None	None	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation skin; nausea, confusion, agitation, flushing, dry mouth, tremor, convulsions, headache; in animals: kidney, liver injury; decreased testis weight
1.3.1 – 1.3.14	Bis(2-ethylhexyl)phthalate Bis(2-Ethylhexyl) Phthalate Di-sec octyl phthalate DEHP Di(2-ethylhexyl)phthalate Octyl phthalate bis(2-ethylexyl)phthalate	117-81-7	None	5 mg/m ³ 5000 mg/m ³	Groundwater Soil Vapor	inhalation, ingestion, skin, and/or eye contact	irritation to the eyes, mucous membrane; in animals: liver damage; teratogenic effects; [potential occupational carcinogen]	Eye: Irrigate immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	Cadmium	7440-43-9	None	0.005 mg/m ³ 9 mg/m ³	Soil	inhalation, ingestion	pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Calcium	7440-70-2	None	NA	Groundwater Soil	inhalation, ingestion, skin, and/or eye contact	irritation to the eyes, skin, upper resp tract; ulcer, perforation nasal septum; pneumonitis; dermatitis	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Carbazole 9-azafluorene Dibenzopyrrole Diphenylenimine diphenyleneimide	86-74-8	None	NA NA	Soil	inhalation, skin absorption (liquid), skin, and/or eye contact	irritation to eyes and skin, respiratory irritation	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	Carbon disulfide	75-15-0	PID	20 ppm 500 ppm	Soil Groundwater Vapor	inhalation, skin, or eye contact, ingestion	irritation to the eyes, skin, respiratory system	Eye: Irrigate immediately (liquid) Skin: Water flush immediately (liquid) Breathing: Respiratory support
1.3.1 – 1.3.14	Carbon tetrachloride Carbon chloride Carbon tet Freon® 10 Halon® 104 Tetrachloromethane	56-23-5	PID	10 ppm 200 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin; central nervous system depression; nausea, vomiting; liver, kidney injury; drowsiness, dizziness, incoordination; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Chlorobenzene benzene chloride monochlorobenzene Phenyl chloride Chlorobenzol MCB	108-90-7	PID	75 ppm 1000 ppm	Groundwater Soil Vapor	inhalation, skin, or eye contact, ingestion	irritation to the eyes, skin, nose; drowsiness, incoordination; central nervous system depression; in animals: liver, lung, kidney injury	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Chloroform Methane trichloride Trichloromethane Chloro-3-methyl phenol	67-66-3	None	50 ppm 500 ppm	Groundwater Soil	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin; dizziness, mental dullness, nausea, confusion; headache, lassitude (weakness, exhaustion); anesthesia; enlarged liver; [potential occupational carcinogen]	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 – 1.3.14	Chromium Total Chromium Chromium, Total	7440-47-3	None	1.0 mg/m ³ 250 mg/m ³	Groundwater Soil	inhalation absorption ingestion	irritation to eye, skin, and respiratory	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Chrysene Benzo[a]phenanthrene 1,2-Benzphenanthrene	218-01-9	PID	0.2 mg/m ³ 80 mg/m ³ (Coal Pitch Tar)	Groundwater Soil	inhalation, absorption, ingestion, consumption	irritation to eye, skin, and respiratory, gastrointestinal irritation nausea, vomit, diarrhea [potential occupational carcinogen]	Eyes: Irrigate immediately Skin: Soap wash promptly. Breath: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	cis-1,2-Dichloroethylene cis-1,2-Dichloroethene	156-59-2	NA	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin, and/or eye contact	Irritant to eyes, skin, mucous membranes, and respiratory system. May be harmful by ingestion, skin absorption and inhalation	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Cobalt	7440-48-4	None	0.1 mg/m ³ 20 mg/m ³	Soil	inhalation, ingestion, skin, and/or eye contact	Cough, dyspnea (breathing difficulty), wheezing, decreased pulmonary function; weight loss; dermatitis; diffuse nodular fibrosis; resp hypersensitivity, asthma	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	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 – 1.3.14	Cumene Cumol Isopropylbenzene 2-Phenyl propane 1-methylethylbenzene Isopropyl Benzene	98-82-8	PID	50 ppm 900 ppm	Groundwater Soil	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin, mucous membrane; dermatitis; headache, narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	Cyanide	57-12-5	None	5 mg/m ³ 25 mg/m ³	Groundwater Soil	inhalation, ingestion, skin, and/or eye contact	Exposure to cyanide can cause weakness, headaches, confusion, dizziness, fatigue, anxiety, sleepiness, nausea and vomiting. Breathing can speed up then become slow and gasping. Coma, and convulsions also occur. If copious amounts of cyanide have been absorbed by the body, the person usually collapses, and death can occur very quickly. Long-term exposure to lower levels of cyanide can cause skin, and nose irritation, itching, rashes and thyroid changes.	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Cyclohexane Benzene hexahydride Hexahydrobenzene Hexamethylene Hexanaphthene	110-82-7	PID	300 ppm 1300 ppm	Soil Vapor	inhalation, ingestion, skin, and/or eye contact	irritation to the eyes, skin, respiratory system; drowsiness; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	DDE 4,4-DDE 4,4'-DDE 1,1-bis-(4-chlorophenyl)-2,2-dichloroethene Dichlorodiphenyldichloroethene p,p'-DDE	72-55-9	None	NA NA	Soil	inhalation, skin absorption, ingestion, skin, and/or eye contact	Oral ingestion of food is the primary source of exposure for the general population. Acute and chronic ingestion may cause nausea, vomiting, diarrhea, stomach pain, headache, dizziness, disorientation, tingling, sensation, kidney damage, liver damage, convulsions, coma, and death. 4,4' DDE may cross the placenta and can be excreted in breast milk	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	DDT 4,4-DDT 4,4'-DDT p,p'-DDT Dichlorodiphenyltrichloroethane 1,1,1-Trichloro-2,2-bis(p-chlorophenyl)ethane	50-29-3	None	1 mg/m ³ 500 mg/m ³	Groundwater Soil	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; vomiting; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Delta BHC Delta-BHC Delta-hexachlorocyclohexane Delta Hexachlorocyclohexane	319-86-8	None	0.5 mg/m ³ 50 mg/m ³	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin, nose, throat; headache; nausea; colonic convulsions; resp difficulty; cyanosis; aplastic anemia; muscle spasm; in animals: liver, kidney damage	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 – 1.3.14	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)	Groundwater Soil	inhalation, absorption, ingestion, consumption	irritation to eyes, skin, respiratory, and digestion [potential occupational carcinogen]	Eyes: Irrigate immediately Skin: Soap wash promptly. Breath: Respiratory support PID Swallow: Medical attention immediately
1.3.1 – 1.3.14	Dibenzofuran	132-64-9	None	NA NA	Soil	inhalation, absorption	irritation to eyes, and skin	Eyes: Irrigate immediately Skin: Soap wash promptly.
1.3.1 – 1.3.14	Dibutyl phthalate Di-n-butyl phthalate Butyl phthalate n-Butyl phthalate 1,2-Benzenedicarboxylic acid dibutyl ester o-Benzenedicarboxylic acid dibutyl ester DBP Palatinol C, Elaol Dibutyl-1,2-benzene-dicarboxylate Di-n-butylphthalate	84-74-2	None	5 mg/m ³ 4000 mg/m ³	Groundwater Soil Vapor	inhalation, ingestion, skin, and/or eye contact	irritation to the eyes, upper respiratory system, stomach	Eye: Irrigate immediately Skin: Wash regularly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Dieldrin HEOD 1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo-exo-5,8-dimethanonaphthalene	60-57-1	PID	0.25 mg/m ³ 50 mg/m ³	Groundwater Soil Water	inhalation, skin absorption, ingestion, skin, and/or eye contact	headache, dizziness; nausea, vomiting, malaise (vague feeling of discomfort), sweating; myoclonic limb jerks; colonic, tonic convulsions; coma; [potential occupational carcinogen]; in animals: liver, kidney 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 – 1.3.14	Diesel Fuel automotive diesel fuel oil No. 2 distillate diesel diesel oil diesel oil light diesel oil No. 1-D summer diesel	68334-30-5	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin, and/or eye contact	irritation to the eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Endosulfan I Alpha Endosulfan	959-98-8	None	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation skin; nausea, confusion, agitation, flushing, dry mouth, tremor, convulsions, headache; in animals: kidney, liver injury; decreased testis weight	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Endosulfan sulfate 1,4,5,6,7,7-Hexachloro-5-norbornene-2,3-dimethanol, cyclic sulfate 6,7,8,9,10,10-hexachloro-1,5,5a,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3,3-dioxide	1031-07-8	None	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin, and/or eye contact	Hypersensitive to stimulation, sensation of prickling, tingling, or creeping on skin. Headache, dizziness, nausea, vomiting, incoordination, tremor, mental confusion, hyperexcitable state. In severe cases: convulsions, seizures, coma, and respiratory depression.	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 – 1.3.14	Endrin 1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo,endo-5,8-dimethanonaphthalene; Hexadrin	72-20-8	None	0.1 mg/m ³ 2 mg/m ³	Soil	inhalation, skin absorption, ingestion, skin, and/or eye contact	epileptiform convulsions; stupor, headache, dizziness; abdominal discomfort, nausea, vomiting; insomnia; aggressiveness, confusion; drowsiness, lassitude (weakness, exhaustion); anorexia; in animals: liver damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Endrin aldehyde	7421-93-4	None	0.1 mg/m ³ 2 mg/m ³	Groundwater Soil	inhalation, skin absorption, ingestion, skin, and/or eye contact	epileptiform convulsions; stupor, headache, dizziness; abdominal discomfort, nausea, vomiting; insomnia; aggressiveness, confusion; drowsiness, lassitude (weakness, exhaustion); anorexia; in animals: liver damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Ethyl benzene Ethylbenzene Ethylbenzol Phenylethane	100-41-4	PID	435 mg/m ³ 3,472 mg/m ³	Groundwater Soil Vapor	inhalation, ingestion, skin, and/or eye contact	irritation to the eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	Fluoranthene Benzo(j,k)fluorene	206-44-0	PID	0.2 mg/m ³ 80 mg/m ³ (Coal Pitch Tar)	Groundwater Soil	inhalation, skin, or eye contact, ingestion	irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.14	Fluorene	86-73-7	PID	0.2 mg/m ³ 80 mg/m ³ (Coal Pitch Tar)	Soil	inhalation, skin, or eye contact, ingestion	irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention
1.3.1 – 1.3.14	Fuel Oil No. 2	68476-30-2	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin, and/or eye contact	irritation to the eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	gamma-Chlordane Gamma Chlordane y-Chlordane	5566-34-7	None	0.5 mg/m ³ 100 mg/m ³	Groundwater Soil	inhalation, skin absorption, ingestion, skin, and/or eye contact	Blurred vision; confusion; ataxia, delirium; cough; abdominal pain, nausea, vomiting, diarrhea; irritability, tremor, convulsions; anuria	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Gasoline	8006-61-9	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin, mucous membrane; dermatitis; headache, lassitude (weakness, exhaustion), blurred vision, dizziness, slurred speech, confusion, convulsions; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Helium	7440-59-7	Helium Detector	NA NA	NA	inhalation	dizziness, headache, and nausea	Breathing: Respiratory support
1.3.1 – 1.3.14	Heptachlor	76-44-8	None	0.5 mg/m ³ 35 mg/m ³	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	In animals: tremor, convulsions; liver damage; [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 – 1.3.14	Heptane n-Heptane	142-82-5	PID	500 ppm 750 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin, and/or eye contact	dizziness, stupor, incoordination; loss of appetite, nausea; dermatitis; chemical pneumonitis (aspiration liquid); unconsciousness	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Hexachlorobenzene Perchlorobenzene Pentachlorophenylchloride Benzene hexachloride Phenyl perchloryl HCB BHC	118-74-1	NA	NA NA	Groundwater Soil	inhalation, ingestion, skin, and/or eye contact	Irritating to eyes, skin, and mucous membranes. Prolonged periods of ingestion may cause cutaneous porphyria	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Hexavalent Chromium Chromium VI Chromium, Hexavalent	18540-29-9	None	1.0 mg/m ³ 250 mg/m ³	Groundwater Soil	inhalation absorption ingestion	irritation to eye, skin, and respiratory	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Indeno(1,2,3-cd)pyrene Indeno(1,2,3-c,d)Pyrene Indeno[1,2,3-cd]Pyrene	193-39-5	None	0.2 mg/m ³ 80 mg/m ³ (Coal Pitch Tar)	Groundwater Soil	inhalation, absorption, ingestion, consumption	irritation to eyes, skin, respiratory, and digestion [potential occupational carcinogen]	Eyes: Irrigate immediately Skin: Soap wash promptly. Breath: Respiratory support Swallow: Medical attention immediately, wash mouth with water

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	Iron	7439-89-6	None	10 mg/m ³ NA	Groundwater Soil	inhalation, ingestion, skin, and/or eye contact	irritation to the eyes, skin, mucous membrane; abdominal pain, diarrhea, vomiting	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Isophorone 1,1,3-Trimethyl-3-cyclohexene-5-one Isoforone Isoacetophorone	78-59-1	None	25 ppm 200 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin, nose, respiratory system	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Lead	7439-92-1	None	0.050 mg/m ³ 100 mg/m ³	Groundwater Soil	inhalation, ingestion, skin, and/or eye contact	lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation to the eyes; hypertension	Eye: Irrigate immediately Skin: Soap flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	Lindane Gamma BHC HCH α-Hexachlorocyclohexane gamma isomer of 1,2,3,4,5,6-Hexachlorocyclohexane gamma-Hexachlorocyclohexane	58-89-9	None	0.5 mg/m ³ 50 mg/m ³	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin, nose, throat; headache; nausea; colonic convulsions; resp difficulty; cyanosis; aplastic anemia; muscle spasm; in animals: liver, kidney damage	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Magnesium	7439-95-4	None	15 mg/m ³ NA	Soil	inhalation, skin, and/or eye contact	irritation to the eyes, skin, respiratory system; cough	Eye: Irrigate immediately Breathing: Fresh air
1.3.1 – 1.3.14	Manganese	7439-96-5	None	5 mg/m ³ 500 mg/m ³	Groundwater Soil	inhalation, ingestion	aerosol is irritating to the respiratory tract	Eye: Irrigate immediately Skin: Soap flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	m-Cresol meta-Cresol 3-Cresol m-Cresylic acid 1-Hydroxy-3-methylbenzene 3-Hydroxytoluene 3-Methylphenol 3-Methylphenols	108-39-4	PID	5 ppm 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin, mucous membrane; central nervous system effects: confusion, depression, resp failure; dyspnea (breathing difficulty), irregular rapid respiration, weak pulse; eye, skin, burns; dermatitis; lung, liver, kidney, pancreas damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	Mercury	7439-97-6	None	0.1 mg/m ³ 10 mg/m ³	Groundwater Soil	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Methyl chloroform Chloroethene 1,1,1-Trichloroethane 1,1,1-Trichloroethane- (stabilized) 1,1,1-TCA 1,1,1-Trichloroethane TCA	71-55-6	PID	350 ppm 700 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin, and/or eye contact	irritation to the eyes, skin; headache, lassitude (weakness, exhaustion), central nervous system depression, poor equilibrium; dermatitis; cardiac arrhythmias; liver damage	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention
1.3.1 – 1.3.14	Methyl <i>tert</i> -butyl ether MTBE Methyl tertiary-butyl ether Methyl t-butyl ether <i>tert</i> -Butyl methyl ether tBME <i>tert</i> -BuOMe Methyl <i>tert</i> butyl ether	1634-04-4	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin, and/or eye contact	irritation to the eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	Methylcyclohexane Methyl cyclohexane Methylcyclohexane Hexahydrotoluene Cyclohexylmethane Toluene hexahydride	108-87-2	PID	500 ppm 1200 ppm	Soil Vapor	inhalation, ingestion, skin, and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, drowsiness; in animals: narcosis	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Methylene Chloride Dichloromethane Methylene dichloride	75-09-2	PID	25 ppm 2300 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin; lassitude (weakness, exhaustion), drowsiness, dizziness; numb, tingle limbs; nausea; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	m-Xylenes 1,3-Dimethylbenzene m-Xylol Metaxylene	108-38-3 179601-23-1	PID	100 ppm 900 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	Naphthalene Naphthalin Tar camphor White tar	91-20-3	PID	50 mg/m ³ 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; hematuria (blood in the urine); dermatitis, optical neuritis	Eye: Irrigate immediately Skin: Molten flush immediately/solid- liquid soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	n-Butylbenzene Butylbenzene 1-phenylbutane	104-51-8	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin, and/or eye contact	irritation to the eyes, skin; dry nose, throat; headache; low blood pressure, tachycardia, abnormal cardiovascular system stress; central nervous system, hematopoietic depression; metallic taste; liver, kidney injury	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	n-Hexane Hexane, Hexyl hydride, normal-Hexane	110-54-3	PID	500 ppm 1100 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin, and/or eye contact	irritation to the eyes, nose; nausea, headache; peripheral neuropathy: numb extremities, muscle weak; dermatitis; dizziness; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Nickel	7440-02- 0	None	NA 10 mg/m ³	Groundwater Soil	ion, ingestion, skin, and/or eye contact	sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]	Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	Nitrobenzene Essence of mirbane Nitrobenzol Oil of mirbane	98-95-3	None	1 ppm 200 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation eyes, skin; anoxia; dermatitis; anemia; methemoglobinemia; In Animals: liver, kidney damage; testicular effects	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	N-Nitrosodiphenylamine NDFA	86-30-6	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin, nose, respiratory system	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Non-Flammable Gas Mixture CALGAS (Equipment Calibration Gas : Oxygen Methane Hydrogen Sulfide Carbon Monoxide Nitrogen	7782-44-7 74-82-8 7783-08-4 830-08-0 7727-37-9	Multi-Gas PID	NA/NA NA/NA 10/100 ppm 50/1200 ppm NA/NA	NA	inhalation	dizziness, headache, and nausea	Breathing: Respiratory support
1.3.1 – 1.3.14	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 – 1.3.14	n-Propylbenzene Isocumene Propylbenzene 1-Phenylpropane 1-Propylbenzene Phenylpropane Propylbenzene-n	103-65-1	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin, and/or eye contact	irritation to the eyes, skin; dry nose, throat; headache; low blood pressure, tachycardia, abnormal cardiovascular system stress; central nervous system, hematopoietic depression; metallic taste; liver, kidney injury	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	o-Cresol ortho-Cresol 2-Cresol o-Cresylic acid 1-Hydroxy-2-methylbenzene 2-Hydroxytoluene 2-Methyl phenol 2-Methylphenol	95-48-7	PID	5 ppm 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin, mucous membrane; central nervous system effects: confusion, depression, resp failure; dyspnea (breathing difficulty), irregular rapid respiration, weak pulse; eye, skin, burns; dermatitis; lung, liver, kidney, pancreas damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	o-Xylenes 1,2-Dimethylbenzene ortho-Xylene o-Xylol	95-47-6 179601-23-1	PID	100 ppm 900 ppm	Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	p-Cresol para-Cresol 4-Cresol p-Cresylic acid 1-Hydroxy-4-methylbenzene 4-Hydroxytoluene 4-Methylphenol 4-Methylphenols	106-44-5	PID	5 ppm 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin, mucous membrane; central nervous system effects: confusion, depression, resp failure; dyspnea (breathing difficulty), irregular rapid respiration, weak pulse; eye, skin, burns; dermatitis; lung, liver, kidney, pancreas damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Pentachlorophenol PCP; Penta; 2,3,4,5,6-Pentachlorophenol	87-86-5	PID	0.5 mg/m ³ 2.5 mg/m ³	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, nose, throat; sneezing, cough; lassitude (weakness, exhaustion), anorexia, weight loss; sweating; headache, dizziness; nausea, vomiting; dyspnea (breathing difficulty), chest pain; high fever; dermatitis	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Phenanthrene	85-01-8	PID	0.2 mg/m ³ 80 mg/m ³ (Coal Pitch Tar)	Groundwater Soil	inhalation, skin, or eye contact, ingestion	irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	Phenol Carbolic acid Hydroxybenzene, Monohydroxybenzene Phenyl alcohol Phenyl hydroxide	108-95-2	PID	5 ppm 250 ppm	Groundwater Soil	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, nose, throat; anorexia, weight loss; lassitude (weakness, exhaustion), muscle ache, pain; dark urine, skin, burns; dermatitis; tremor, convulsions, twitching	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Potassium	7440-09-7	None	NA NA	Soil	inhalation, skin absorption, ingestion, skin, and/or eye contact inhalation, ingestion, skin, and/or eye contact	eye: Causes eye burns. Skin: Causes skin, burns. Reacts with moisture in the skin, to form potassium hydroxide and hydrogen with heat. ingestion: Causes gastrointestinal tract burns. inhalation: May cause irritation of the respiratory tract with burning pain in the nose and throat, coughing, wheezing, shortness of breath and pulmonary edema. Causes chemical burns to the respiratory tract. inhalation may be fatal because of spasm, inflammation, edema of the larynx and bronchi, chemical pneumonitis, and pulmonary edema.	Eyes: Get medical aid immediately Skin: Get medical aid immediately. Immediately flush skin with water for at least 15 minutes while removing contaminated clothing and shoes. Ingestion: If victim is conscious and alert, give 2-4 full cups of milk or water. Get medical aid immediately. inhalation: Get medical aid immediately.

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	p-Xylenes 1,4-Dimethylbenzene para-Xylene p-Xylol	106-42-3	PID	100 ppm 900 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Pyrene benzo[def]phenanthrene	129-00-0	PID	0.2 mg/m ³ 80 mg/m ³ (Coal Pitch Tar)	Groundwater Soil	inhalation, skin, or eye contact, ingestion	irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.14	sec-Butylbenzene 2-phenylbutane	135-98-8	PID	10 ppm 100 ppm	Groundwater Soil	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, nose, throat. inhalation: nausea or vomiting	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	Selenium	7782-49-2	None	1 mg/m ³ 0.2 mg/m ³	Soil	inhalation, ingestion, skin, and/or eye contact	irritation to the eyes, skin, nose, throat; visual disturbance; headache; chills, fever; dyspnea (breathing difficulty), bronchitis; metallic taste, garlic breath, gastrointestinal disturbance; dermatitis; eye, skin, burns; in animals: anemia; liver necrosis, cirrhosis; kidney, spleen damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Silver	7440-22-4	None	0.01mg/ m ³ 10 mg/m ³	Soil	inhalation, ingestion, skin, and/or eye contact	blue-gray eyes, nasal septum, throat, skin; irritation, ulceration skin; gastrointestinal disturbance	Eye: Irrigate immediately Skin: Water flush Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Silvex 2-(2,4,5-Trichlorophenoxy)propionic acid Fenoprop 2,4,5-TP Acid 2,4,5-TP	93-72-1	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, nose, respiratory system; headache, lassitude (weakness, exhaustion), dizziness, confusion, malaise (vague feeling of discomfort), drowsiness, unsteady gait; narcosis; defatting dermatitis; liver injury; reproductive effects	Eye: Irrigate immediately Skin: Water flush Breathing: Respiratory support Swallow: Medical attention

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	Sodium	7440-23-5	None	NA NA	Groundwater Soil	ion, ingestion, skin, and/or eye contact	sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]	Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Styrene Ethenyl benzene Phenylethylene Styrene monomer Styrol Vinyl benzene	100-42-5	PID	100 ppm 700 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, nose, respiratory system; headache, lassitude (weakness, exhaustion), dizziness, confusion, malaise (vague feeling of discomfort), drowsiness, unsteady gait; narcosis; defatting dermatitis; liver injury; reproductive effects	Eye: Irrigate immediately Skin: Water flush Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Tert-Butyl Alcohol Tertiary Butyl Alcohol Tert-Butanol Butyl alcohol 2-Methyl-2-propanol Trimethyl carbinol Tert-Butyl Alcohol TBA	75-65-0	PID	100 ppm 1600 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin, and/or eye contact	irritation to the eyes, skin, nose, throat; drowsiness, narcosis	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Tetrachloroethylene Perchloroethylene Perchloroethylene PCE Perk Tetrachloroethylene Tetrachloroethene	127-18-4	PID	100 ppm 150 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin, erythema (skin, redness); liver damage; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	Toluene Methyl benzene Methyl benzol Phenyl methane Toluol	108-88-3	PID	200 ppm 500 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, paresthesia; dermatitis	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Total PCBs Chlorodiphenyl (42% chlorine) Aroclor® 1242 PCB Polychlorinated biphenyl	53469-21-9	None	0.5 mg/m ³ 5 mg/m ³	Groundwater Soil	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, chloracne	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Total Xylenes Dimethylbenzene Xylol	1330-20-7	PID	100 ppm 900 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Trans-1,2-Dichloroethene trans-1,2-Dichloroethylene tDEC trans-Acetylene dichloride	156-60-5	PID	200 ppm 4000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin, and/or eye contact	Irritant to eyes, skin, mucous membranes, and respiratory system. May be harmful by ingestion, skin absorption and inhalation	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 – 1.3.14	Trichloroethylene Trichloroethenylenes Ethylene trichloride TCE Trichloroethene Trilene	79-01-6	PID	100 ppm 1000 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Trichlorofluoromethane Fluorotrichloromethane Freon® 11 Monofluorotrichloromethane Refrigerant 11 Trichloromonofluoromethane Freon 11	75-69-4	PID	1000 ppm 2000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin, and/or eye contact	incoordination, tremor; dermatitis; cardiac arrhythmias, cardiac arrest; asphyxia; liquid: frostbite	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Trivalent Chromium Chromium III Chromium, Trivalent	NA	None	1.0 mg/m ³ 250 mg/m ³	Groundwater Soil	inhalation absorption ingestion	irritation to eye, skin, and respiratory	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.14	Vanadium	7440-62-2	None	0.1 mg/m3 15 mg/m3	Groundwater Soil	inhalation, skin absorption, ingestion, skin, and/or eye contact	nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peri neuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Vinyl Chloride Chloroethene Chloroethylen Ethylene monochloride Monochloroethene Monochloroethylene VC Vinyl chloride monomer (VCM)	75-01-4	PID	1 ppm NA	Groundwater Soil Vapor	inhalation, skin, and/or eye contact (liquid)	lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen]	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support
1.3.1 – 1.3.14	Vinylidene chloride 1,1-DCE 1,1-Dichloroethene 1,1-Dichloroethylene VDC Vinylidene chloride monomer Vinylidene dichloride	75-35-4	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin, throat; dizziness, headache, nausea, dyspnea (breathing difficulty); liver, kidney disturbance; pneumonitis; [potential occupational carcinogen]	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 – 1.3.14	Volatile Organic Compounds VOCs	NA	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin, and/or eye contact	irritation to the eyes, skin, throat; dizziness, headache, nausea, dyspnea (breathing difficulty); liver, kidney disturbance; pneumonitis; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.14	Zinc	7440-62-2	None	15 mg/m ³ 500 mg/m ³	Groundwater Soil	inhalation	chills, muscle ache, nausea, fever, dry throat, cough; lassitude (weakness, exhaustion); metallic taste; headache; blurred vision; low back pain; vomiting; malaise (vague feeling of discomfort); chest tightness; dyspnea (breathing difficulty), rales, decreased pulmonary function	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

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/m³ = milligrams per cubic meter

500 mg/m³

TABLE 3
SUMMARY OF MONITORING EQUIPMENT

Instrument	Operation Parameters
Photoionization Detector (PID)	Hazard Monitored: Many organic and some inorganic gases and vapors. Application: Detects total concentration of many organic and some inorganic gases and vapors. Some identification of compounds is possible if more than one probe is measured. Detection Method: Ionizes molecules using UV radiation; produces a current that is proportional to the number of ions. General Care/Maintenance: Recharge or replace battery. Regularly clean lamp window. Regularly clean and maintain the instrument and accessories. Typical Operating Time: 10 hours. 5 hours with strip chart recorder.
Oxygen Meter	Hazard Monitored: Oxygen (O₂). Application: Measures the percentage of O₂ in the air. Detection Method: Uses an electrochemical sensor to measure the partial pressure of O₂ in the air and converts the reading to O₂ concentration. General Care/Maintenance: Replace detector cell according to manufacturer's recommendations. Recharge or replace batteries prior to expiration of the specified interval. If the ambient air is less than 0.5% C O₂, replace the detector cell frequently. Typical Operating Time: 8 – 12 hours.
Additional equipment (if needed, based on site conditions)	
Combustible Gas Indicator (CGI)	Hazard Monitored: Combustible gases and vapors. Application: Measures the concentration of combustible gas or vapor. Detection Method: A filament, usually made of platinum, is heated by burning the combustible gas or vapor. The increase in heat is measured. Gases and vapors are ionized in a flame. A current is produced in proportion to the number of carbon atoms present. General Care/Maintenance: Recharge or replace battery. Calibrate immediately before use. Typical Operating Time: Can be used for as long as the battery lasts, or for the recommended interval between calibrations, whichever is less.
Flame Ionization Detector (FID) with Gas Chromatography Option (i.e., Foxboro Organic Vapor Analyzer (OVA))	Hazard Monitored: Many organic gases and vapors (approved areas only). Application: In survey mode, detects the concentration of many organic gases and vapors. In gas chromatography (GC) mode, identifies and measures specific compounds. In survey mode, all the organic compounds are ionized and detected at the same time. In GC mode, volatile species are separated. General Care/Maintenance: Recharge or replace battery. Monitor fuel and/or combustion air supply gauges. Perform routine maintenance as described in the manual. Check for leaks. Typical Operating Time: 8 hours; 3 hours with strip chart recorder.
Potable Infrared (IR) Spectrophotometer	Hazard Monitored: Many gases and vapors. Application: Measures concentration of many gases and vapors in air. Designed to quantify one or two component mixtures. Detection Method: Passes different frequencies of IR through the sample. The frequencies absorbed are specific for each compound. General Care/Maintenance: As specified by the manufacturer.

Instrument	Operation Parameters
Direct Reading Colorimetric Indicator Tube	Hazard Monitored: Specific gas and vapors. Application: Measures concentration of specific gases and vapors. Detection Method: The compound reacts with the indicator chemical in the tube, producing a stain whose length or color change is proportional to the compound's concentration. General Care/Maintenance: Do not use a previously opened tube even if the indicator chemical is not stained. Check pump for leaks before and after use. Refrigerate before use to maintain a shelf life of about 2 years. Check expiration dates of tubes. Calibrate pump volume at least quarterly. Avoid rough handling which may cause channeling.
Aerosol Monitor	Hazard Monitored: Airborne particulate (dust, mist, fume) concentrations. Application: Measures total concentration of semi-volatile organic compounds, PCBs, and metals. Detection Method: Based on light-scattering properties of particulate matter. Using an internal pump, air sample is drawn into the sensing volume where near infrared light scattering is used to detect particles. General Care/Maintenance: As specified by the mfr. Also, the instrument must be calibrated with particulates of a size and refractive index similar to those to be measured in the ambient air.
Monitox	Hazard Monitored: Gases and vapors. Application: Measures specific gases and vapors. Detection Method: Electrochemical sensor 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 parts per million (ppm) ¹	No respirator needed; no further action
>5ppm but ≤ 15 ppm at the perimeter 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 perimeter 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 or commercial structure, 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 parameter of the hot zone	Activities will shut down

Particulate Monitoring Action Levels	Action Required
Background to 100 micrograms per cubic meter (µg/m³) ² , no dust observed	No further action
Background to 100 µg/m³, dust observed leaving the work area	Dust suppression must be employed.
100 to 150 µg/m³ at the downwind parameter 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 µg/m³ of the upwind level and in preventing visible dust migration.
>150 µg/m³ at the parameter 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	Mount Sinai West	911 or 212-523-4000
Langan Incident Hotline		973-560-4699
Medical Treatment Hotline	WorkCare™	911 or 888-449-7757
Langan Environmental Project Manager	Greg Wyka	347-267-2679 (cell)
Langan Construction Health and Safety Manager (HSM)	Tony Moffa	215-756-2523 (cell)
Langan Health & Safety Officer (HSO)	William Bohrer	410-984-3068 (cell)
Langan Field Team Leader (FTL)	To Be Determined	
Client's Representative	Hailey Sarage	212-320-9699
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 WorkCare - 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 973-560-4699.

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: $ta\ adj\ ^\circ F = ta\ ^\circ F + (13 \times \% \text{ sunshine})$. 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

RELATIVE HUMIDITY	ENVIRONMENTAL TEMPERATURE (Fahrenheit)										
	70	75	80	85	90	95	100	105	110	115	120
	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

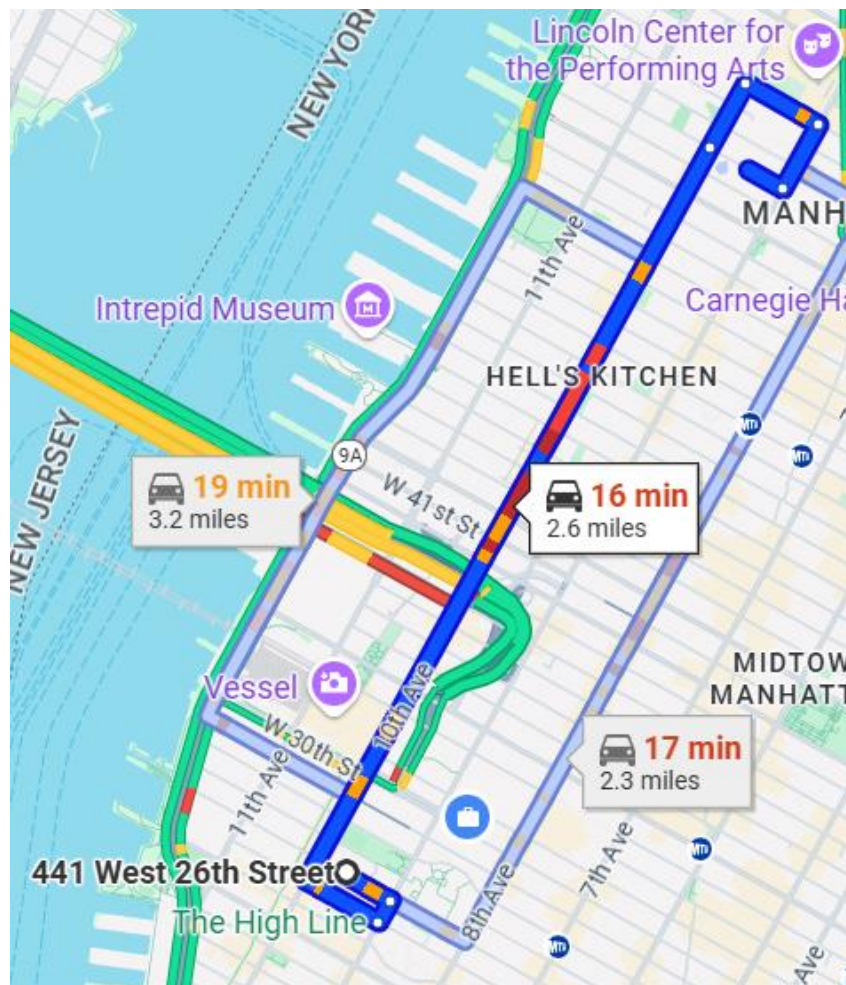
HOSPITAL ROUTE PLAN

Hospital Location: **Mount Sinai West**
 1000 10th Avenue
 New York, New York
 212-523-4000

START: 441 West 26th Street, New York, New York

1. Head southeast on West 26th St toward 9th Ave
2. Turn right onto 9th Ave
3. Turn right onto W 25th St
4. Follow 10th Ave toward W 62nd St
5. Run right onto W 62nd St
6. Turn right onto Columbus Ave
7. Turn right onto West 60th St, destination will be on the left

END: Mount Sinai West, 1000 10th Avenue, New York, New York



ATTACHMENTS

ATTACHMENT A

STANDING ORDERS

STANDING ORDERS

GENERAL

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

TOOLS AND HEAVY EQUIPMENT

- Do not, under any circumstances, enter or ride in or on any backhoe bucket, materials hoist, or any other device not specifically designed to carry 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 ensure 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 signal operator 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, backhoes 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 bucket, tub, or other containers. 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 many 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 of 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 the incident was reported (Time and Date):

List the names of other persons affected during this incident:

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

Weather conditions during incident:

MEDICAL CARE INFORMATION

Did affected employee receive medical care? Yes ☐ No ☐

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

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

Length of stay at the facility.

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

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

Has the employee returned to work? Yes ☐ No ☐

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

If Yes, please describe:

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

If Yes, please describe:

HEALTH & SAFETY INFORMATION

Was the operation being conducted under an established site-specific Construction Health and Safety Plan?
Yes ☐ No ☐ Not Applicable: ☐

Describe protective equipment and clothing used by the employee:

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

Employee Signature

Date

Langan Representative

Date

ATTACHMENT D

CALIBRATION LOG

DATE: _____

PROJECT:_____

CALIBRATION LOG

[illegible]

ATTACHMENT E

SAFETY DATA SHEETS

ATTACHMENT F

JOB SITE 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 logbook?				
16. Subcontract workers have received 40-hr./8-hr./Spvsr. HAZWOPER training, as appropriate?				
17. Subcontract workers medically cleared to work on site, and fit-tested for respirator wear?				
18. Subcontract workers have respirators readily available?				
19. Mark outs of underground utilities done prior to initiating any subsurface activities?				
20. Decontamination procedures being followed as outlined in HASP?				
21. Are tools in good condition and properly used?				
22. Drilling performed in areas free from underground objects including utilities?				

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

Unsafe Acts:

Notes:

ATTACHMENT G

JOB SAFETY ANALYSIS FORM



Job Safety Analysis (JSA) Construction Health and Safety

JSA TITLE:

JSA NUMBER:

DATE CREATED:

CREATED BY:

REVISION DATE:

REVISED BY:

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

PERSONAL PROTECTIVE EQUIPMENT REQUIRED: (PPE): ☐ Required ☒ As Needed

☐ Steel-toed boots	☐ Nitrile gloves	☐ Dermal Protection (Specify)
☐ Long-sleeved shirt	☐ Leather/ Cut-resistant gloves	☐ High visibility vest/clothing
☐ Safety glasses	☐ Face Shield	☐ Hard hat

ADDITIONAL PERSONAL PROTECTIVE EQUIPMENT NEEDED (Provide specific type(s) or descriptions)

☐ Air Monitoring:	☐ Respirators:	☐ Other:
☐ Dermal Protection:	☐ Cartridges:	☐ Other:

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

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

LANGAN

Job Safety Analysis (JSA) Construction 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.



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 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 keypad, 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 crosswind 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
		- 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. - 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.	- Avoid use of shared trailers, if possible. Minimize trailer use to essential personnel. - Practice social distancing; maintaining 6 feet of distance between yourself and others in trailer. - 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.	- To the extent possible, bring your own food. - 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 <u>Job Step #8: Purchasing Supplies at Retail/Shipping Centers</u>. - Wash hands before and after eating.
7. Smoking Cigarettes	1. Transmittal/exposure of COVID-19 by touching mouth with hands	- Cigarette smokers are 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. - Wash hands thoroughly before and after smoking. - 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.	- 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. - Use the front door, and not peripheral entrances. Front doors of hotels are usually automatic. - Request ground floor room to avoid elevator use and a room that has not be utilized in 48-72 hours. - 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. - 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. - Place the "Do Not Disturb" Sign on your door to prevent people (housekeeping) from entering your room. - Avoid common spaces and hotel sponsored events where crowds will be present. - 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.	- Plan your travel to limit the need to visit retail/shipping centers. - 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. - 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

LANGAN

Job Safety Analysis (JSA) Construction 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.



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 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 where 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.)		

<u>Print Name</u>	<u>Sign Name</u>	<u>Date</u>
<u>Prepared by:</u>		
<u>Reviewed by:</u>		

LANGAN

Job Safety Analysis (JSA) Construction 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.



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 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 where 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.)		

<u>Print Name</u>	<u>Sign Name</u>	<u>Date</u>
<u>Prepared by:</u>		
<u>Reviewed by:</u>		

LANGAN

Job Safety Analysis (JSA) Construction 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.



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 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 where 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.)		

<u>Print Name</u>	<u>Sign Name</u>	<u>Date</u>
<u>Prepared by:</u>		
<u>Reviewed by:</u>		

LANGAN

Job Safety Analysis (JSA) Construction 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.



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 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 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)
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 where 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.)		

<u>Print Name</u>	<u>Sign Name</u>	<u>Date</u>
<u>Prepared by:</u>		
<u>Reviewed by:</u>		

LANGAN

Job Safety Analysis (JSA) Construction Health and Safety

JSA Title: 55-gallon Drum Sampling
JSA Number: JSA043-01

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 preventative/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 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/goggles 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 where 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.)		

<u>Print Name</u>	<u>Sign Name</u>	<u>Date</u>
<u>Prepared by:</u>		
<u>Reviewed by:</u>		

LANGAN

Job Safety Analysis (JSA) Construction 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)
30. Remove and open acetate liner.	41. Pinched fingers while removing macrocore.	1. Wear proper PPE (nitrile gloves, cut-resistant or leather gloves) 2. Wear proper PPE (cut-resistant or leather gloves)

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
5. Remove and open acetate liner (cont'd)	42. Cuts/lacerations when cutting acetate liner open. 43. Exposure to hazardous vapors 44. Skin contacts with contaminated soil	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 Construction 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 contacts 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	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	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 where 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
9. All activities (cont'd)	10. Eye Injuries	
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

<u>Print Name</u>	<u>Sign Name</u>	<u>Date</u>

[illegible]

LANGAN

Job Safety Analysis (JSA) Construction Health and Safety

JSA Title: Geophysical Investigation
JSA Number: JSA023-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. 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 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
33. Transport equipment to work area	24. Back/strain 25. Slip/Trip/Falls 26. Traffic 27. Cuts/abrasions/contusions from equipment	18. Use proper lifting techniques/Use wheeled transport 19. Minimize distance to work area/unobstructed path to work area/follow good housekeeping procedures 20. Wear proper PPE (high visibility vest or clothing) 21. Wear proper PPE (leather gloves, long sleeves, Langan approved safety shoes)
34. Supervision of subcontractor and all other activities	12. Slip/Trips/Falls 13. Hand injuries 14. Foot injuries 15. Back injuries/Strains 16. Traffic 17. Wildlife a. Wildlife b. Mice/rats c. Vectors (i.e., mosquitoes, bees, etc.) 7. Heat/Cold Stress	10. Be aware of potential trip hazards/follow good housekeeping procedures/mark significant below-grade hazards (i.e., holes, trenches, wires, ropes) with safety cones or spray paint. 11. Wear proper PPE (leather gloves)/watch wear you place your hands/inspect material or equipment for jagged, rough, or slippery surfaces/ watch for pinch points/ wipe off slippery, wet, or dirty items prior to handling. 12. Wear proper PPE (Langan approved safety shoes)/ Be aware of uneven terrain) 13. Use proper lifting techniques/ Buddy system when lifting/ use wheeled transport. 14. Wear proper PPE (high-visibility shirts and vests)/ use cones if appropriate/ notify equipment operators of work area. 15. Be aware of surroundings at all times for the presence of wildlife. a. Do not approach stray animals. b. Carry animal repellent/ use if situation arises. c. Use bug spray when needed. 7. Wear proper attire for weather conditions (sunscreen, protective clothing in

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		sunlight or layer clothing in cold weather)/ drink plenty of fluids/ take regular breaks.
35. 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.) 51. High Noise levels 52. Overhead hazards 53. Heat Stress/ Cold Stress 54. Eye Injuries	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. 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 proper hearing protection. 60. Wear hard hat / Avoid areas where 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.)		

<u>Print Name</u>	<u>Sign Name</u>	<u>Date</u>
<u>Prepared by:</u>		
<u>Reviewed by:</u>		

LANGAN

Job Safety Analysis (JSA) Health and Safety

JSA Title: Ladder Use
JSA Number: JSA056

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.



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T – Think about the task
E – Evaluate potential hazards
P – Plan safe approach
S – Start task / Stop & regroup

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
36. Use of Ladders and Inspection of Ladders Before Use	1. Ladders (portable, fixed) 2. Rolling or pinching objects 3. Sharp objects	22. Inspect all ladders for structural defects prior to each use. Decals, weight restrictions, non painted surfaces. 23. Use the correct type and size of ladder to safely work. 24. . Do not use metal or wooden ladders
37. Use of Ladder(s)	18. Ladders (portable, fixed) 19. Elevated work platform or stairs 20. Slippery surfaces (water, ice, snow) 21. Rolling or pinching objects 22. Sharp objects 23. Poor Housekeeping 24. Repetitive motion or other ergonomic concerns 25. Airborne dust	16. Maintain three points of contact when ascending and descending ladders. 17. Insure area at bottom of ladder is free of obstructions and tripping hazards. 18. Never carry tools in your hands while ascending or descending a ladder. 19. Utilize rope buckets to pull tools up to you or tool belts. Extension ladders will extend up to 36 inches above the landing that is being accessed and be tied off and secured to prevent them from moving or falling. 20. A spotter must hold the ladder if the employee needs to climb the ladder to tie the ladder off. When using an extension ladder, for every 4' of rise, the base must come out 1' (4 to 1 ratio)

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		21. If working from a ladder 6 ft. or higher, fall protection is required. Fall protection is not required for climbing ladders less than 20 ft. in height. 22. Use the proper ladder for the job at all times. 23. The belt buckle may never extend past either rail on the side of the ladder. 24. Do not climb higher than the second tread from the top on a stepladder or the third rung 25. Before ascending or descending a ladder, wait until other workers have completely cleared the ladder. Do not stand directly below a person who is climbing or descending a ladder to avoid falling objects.
38. All activities	55. Slips/ Trips/ Falls 56. Hand injuries, cuts or lacerations during manual handling of materials 57. Foot injuries 58. Back injuries 59. Eye Injuries	63. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 64. 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 65. Wear proper PPE (Langan approved safety shoes) 66. 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 67. Wear high visibility clothing & vest / Use cones or signs to designate work area 68. Wear hard hat / Avoid areas where overhead hazards exist. 69. 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 70. Wear safety glasses

<u>Print Name</u>	<u>Sign Name</u>	<u>Date</u>
<u>Prepared by:</u>		
<u>Reviewed by:</u>		

LANGAN

Job Safety Analysis (JSA) Health and Safety

JSA Title: Mechanical Connection Oversight
JSA Number: JSA027-01

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?
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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
39. Transport equipment to work area	28. Back Strain 29. Slips/ Trips/ Falls 30. Traffic 31. Cuts/abrasions from equipment 32. Contusions from dropped equipment	6. Use proper lifting techniques / Use wheeled transport 7. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures 8. Wear proper PPE (high visibility vest or clothing) 9. Wear proper PPE (leather gloves, long sleeves) 10. Wear proper PPE (Langan approved safety shoes)
40. Piping and connections	6. Pinch Hazard 7. Cuts/abrasions to knuckles/hands 8. Back Strain 9. High pressure water spray	1. Wear proper PPE (leather gloves) 2. Wear proper PPE (leather gloves or cut resistant gloves) 3. Use proper lifting techniques / Use wheeled transport 4. Ensure connections are tight and secure/ Wear proper PPE (face shield and safety glasses)
41. All activities	60. Slips/ Trips/ Falls 61. Hand injuries, cuts or lacerations during manual handling of materials 62. Foot injuries 63. Back injuries 64. Traffic 65. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 66. High Noise levels 67. Overhead hazards 68. Heat Stress/ Cold Stress 69. Eye Injuries	71. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 72. Inspect for jagged/sharp edges, rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather and/or cut-resistant gloves 73. Wear Langan approved safety shoes 74. Use proper lifting techniques / Consider load location, task repetition, and load weight / Obtain assistance when possible 75. Wear high visibility clothing & vest / Use cones or signs to designate work area 76. Be aware of surroundings for presence of wildlife/ Do not approach stray animals / Carry or use animal repellent / Use bug spray when needed

LANGAN

Job Safety Analysis (JSA) Health and Safety

JSA Title: Soil Sampling from Excavator Bucket
JSA Number: JSA057

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 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
42. Drive to site and/or sample location.	33. Rough/Off-Road terrain; 34. Low-light or other hazardous environmental conditions.	1. Pay attention to road conditions such as road erosion, unprotected embankments, and soft road conditions; 2. Ensure vehicle is properly equipped and outfitted for the terrain and all environmental conditions.
43. Initial Site Arrival Site Assessment.	1. Unsafe driving conditions including personnel walking within driving areas, open excavation or pits, steep slopes etc.; 2. Biological hazards (snakes, poison oak, bees).	1. Maintain situational awareness upon arriving to the work site (be alert of your surroundings). Secure the work area from through traffic.
44. Unpack and transport equipment to work area.	1. Back Strains; 2. Slip/Trips/Falls; 3. Cuts/Abrasions from equipment; 4. Contusions from dropped equipment.	1. Use proper lifting techniques and use wheeled transport; 2. Minimize distance to work area and create unobstructed path to work area. Follow good housekeeping procedures. Mark slip/trip/fall hazards with orange safety cones and/or caution tape; 3. Wear proper PPE (gloves, long sleeves, etc.); 4. Wear proper PPE (Langan-approved safety shoes, hardhat, etc.).
45. Earth Moving Equipment.	1. Equipment striking, crushing, running over employee etc.	1. Place traffic cones and use caution tape to clearly delineate the excavators front and rear swing radius. Do not enter the excavators or other heavy equipment swing radius/travel paths while in operation; 2. Ensure all employees working in the vicinity of the excavator/heavy equipment maintain direct line of sight with the operator at all times; don't walk behind equipment or within the operators blind spots; maintain a safe distance away from the equipment; 3. Designate one employee as the "spotter" to communicate with the excavator operator, and establish a shut-down signal that, when

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		sounded, instructs the excavator operator to freeze/stop all movement of the equipment; - Direct operator to completely power down the excavator before approaching (i.e. breaking the swing radius plane) the excavator bucket to collect a sample; - Direct the operator keep the equipment completely powered-down until all employees are at a safe distance, and it is safe to continue work. The designated spotter should be the only person directing the operator to power the equipment back on. - Conduct a planned pause anytime there is a change in procedure or before beginning a new task; - Wear proper PPE (high vis vest/clothing).
46. Icing of Samples & Transporting coolers/equipment from work area.	- Back Strains - Slips/Trips/Falls - Cuts/Abrasions from equipment - Pinch/Crushing Hazards.	- Drain coolers of water. Use proper lifting techniques. Use wheeled transport whenever possible; - Plan for and utilize a safe and unobstructed path of travel to and from work area. Maintain situational awareness when traveling to and from work area; - Wear proper PPE (Leather gloves, long sleeves); - Wear proper PPE (Leather gloves, long sleeves, hard hat, Langan approved safety shoes).
47. Excavated soil.	Hazardous substances.	- Use proper equipment to monitor excavated soil for contaminants; - Ensure levels do not exceed PEL's for contaminants; - Wear proper PPE.
48. Changing site conditions.	- Stockpiles and/or excavations/trenches/pits creating unsafe paths of travel. - Unforeseen conditions	- Take time to plan out stockpile, excavation, trench, and/or test pit locations, ensuring that the planned work will not create unsafe conditions or paths of travel once performed; - Maintain situational awareness throughout the work day (be alert of the evolving site conditions); - If stockpile, excavation, trench, and/or test pit locations create pinch points, site constraints, or unsafe paths of travel or other unsafe site conditions, stop work immediately and direct the excavator operator to correct the unsafe conditions by moving stockpiles, backfilling excavations, trenches, and/or test pits etc.; - Use stop work and conduct a planned pause to address changed site conditions.
49. All activities.	- Slips/ Trips/ Falls; - Hand injuries, cuts or lacerations during manual handling of materials; - Foot injuries; - Back injuries; - Traffic; - Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.); - High Noise levels; - Overhead hazards; - Heat Stress/ Cold Stress; - Eye Injuries.	- Be aware of potential trip hazards. Follow good housekeeping procedures. Mark significant hazards; - 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 proper PPE (leather/ cut-resistant gloves); - Wear proper PPE (Langan approved safety shoes); - 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; - Wear high visibility clothing & vest / Use cones or signs to designate work area;

[illegible]

LANGAN

Job Safety Analysis (JSA) Health and Safety

JSA Title: Site Inspection
JSA Number: JSA024-01

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 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
50. Jobsite Pre-briefing	35. None	25. Review JSA, SOP's, and discuss hazards that may be present and control measures for present hazards while on-site.

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
2. Working near railroads	1. Passing Trains. 2. Slip/Trips/Falls.	1. Wear reflective vest/ Stay away from tracks/ Do not cross tracks within 10 ft. of train car or when there is a train within view/listen for train horn. 2. Be aware of tripping hazards/ Follow good housekeeping procedures/ Mark significant hazards with spray paint or cones.
3. Walking around site	10. Uneven terrain 11. Wildlife: Stray animals, mice/rats, vectors (i.e. mosquitoes, bees, etc.) 12. Weather: Heat/cold stress 13. Slip/Trips/Falls 14. Foot injuries 15. Eye injuries	9. Pay attention to surrounding area (puddles, wet, frozen, uneven areas); Mark with cones or spray paint. 10. Use bug spray/ Avoid stray animals/Use repellant when needed. 11. Dress for the correct weather situation/ Use sunscreen or protective clothing in sunlight, layers in cold weather/ Drink plenty of fluids/ Take breaks when needed. 4. Be aware of tripping hazards/ Follow good housekeeping procedures/ Mark significant hazards with spray paint or cones. 5. Wear proper PPE (Langan approved safety shoes)/ Change wet socks during cold weather. 6. Wear proper PPE (safety glasses/goggles).
4. Working near road	1. Passing vehicles 2. Slip/Trips/Falls	1. Wear reflective vest/ Stay away from roadway/ Use buddy system/ Place signage or cones when needed. 2. Be aware of tripping hazards/ Follow good housekeeping procedures/ Mark significant hazards with spray paint or cones.
5. All activities	70. Slips/ Trips/ Falls 71. Hand injuries, cuts or lacerations during manual handling of materials 72. Foot injuries 73. Back injuries 74. Traffic 75. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 76. High Noise levels 77. Overhead hazards 78. Heat Stress/ Cold Stress 79. Eye Injuries	81. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 82. 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 83. Wear Langan approved safety shoes 84. 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 85. Wear high visibility clothing & vest / Use cones or signs to designate work area 86. 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 87. Wear hearing protection 88. Wear hard hat / Avoid areas where overhead hazards exist. 89. 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 90. Wear safety glasses
Additional items.		

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.



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 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
51. Transport equipment to work area	- Back Strain - Slips/ Trips/ Falls - Traffic - Cuts/abrasions from equipment - Contusions from dropped equipment	- Use proper lifting techniques / Use wheeled transport. - Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures. - Wear proper PPE (high visibility vest or clothing) - Wear proper PPE (leather gloves, long sleeves) - Wear proper PPE (safety shoes)
52. Remove well cover	- Scrape knuckles/hand - Strain wrist/bruise palm - Pinch fingers or hand	- Wear proper PPE (leather gloves) - Using a hammer, tap the end of the wrench to loosen grip of bolts. - Wear proper PPE (leather gloves)
53. Remove well cap and lock	- Well can pops from pressure. - Exposure to hazardous substances through inhalation or dermal exposure - Scrape knuckles/hand - Strain write/bruise palm	- Remove cap slowly to relieve pressure / Do not place face over well when opening / Wear proper PPE (safety glasses) - Use direct air monitoring/reading instrument (i.e., PID) / Be familiar with and follow actions prescribed in the HASP / Wear proper PPE (nitrile gloves) - Wear proper PPE (leather gloves) - Using hammer, tap the end of the wrench to loosen grip
54. Measure head-space vapor levels	Exposure to hazardous substances through inhalation	Do not place face over well when collecting measurement
55. Remove dedicated tubing (if necessary)	- Exposure to hazardous substances through inhalation or dermal exposure - Tubing swings around after removal	- Wear proper PPE (nitrile gloves, Tyvek sleeves) - Wear proper PPE (safety glasses)
56. Set-up plastic sheeting for work site around the well	Lacerations when cutting plastic sheeting.	Use scissors to cut plastic sheeting / Cut motions should always be away from body and body parts

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
57. 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)
58. 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
59. 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	- Contact with potentially contaminated groundwater. - Back strain from lifting buckets of water - Tripping potential on sample discharge lines and pump electric lines	- Wear proper PPE (safety glasses, nitrile gloves) - Use proper lifting techniques / Use wheeled transport. - 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	- Contact with potentially contaminated groundwater through dermal exposure. - Contact with and burns from acid used for sample preservation. - Tripping potential on sample discharge lines and pump electric lines - Lacerations from broken sample bottles - Back strain when transporting coolers full of collected samples. - Slips/ Trips/ Falls	- Wear proper PPE (safety glasses, nitrile gloves) - Wear proper PPE (safety glasses, nitrile gloves) / Ensure sample bottle lids are secure before use and after sample collection. - Organize line to keep out of the way as much as possible / Mark potential tripping hazards with caution tape or safety cones. - Do not over-tighten bottle caps / Handle bottles safely to prevent breakage / Wrap glass bottles in bubble wrap, if possible - Use proper lifting techniques / Use wheeled transport / Seek assistance if coolers weight exceeds 50lbs. / Minimize distance to vehicle. - 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	Back strain when removing pump or lifting heavy equipment	Use proper lifting technique / Use wheeled transport for heavy equipment
13. Replace well cap and lock	- Scrape fingers/hand - Strain wrist/bruise palm	- Wear proper PPE (leather gloves) - Using hammer, tap the end of the well cap to tighten grip
14. Replace well cover	- Scrape knuckles/hand - Strain wrist/bruise palm. - Pinch fingers or hand	- Wear proper PPE (leather gloves) - Using hammer, tap the end of the wrench to tighten the grip of the bolts. - Wear proper PPE (leather gloves)
15. Transport drums to disposal staging location	- Back, arm or shoulder strain from moving drums. - Pinch hazard - Contact with potentially contaminated groundwater when moving improperly sealed drums. - Slips/ Trips/ Falls when moving drum. - Drop drum on feet/toes	- Use drum cart for moving drums / Use proper lifting techniques / Obtain assistance, if needed - Wear proper PPE (leather gloves) - Wear proper PPE (nitrile gloves under leather gloves) / Properly seal drum to prevent leak. - Ensure route to move drum to storage space is dry and free from obstructions. - Wear proper PPE (safety shoes)
16. Place used PPE in designated disposal drum	- Pressure build-up inside drum - Pinch hazard	- Remove cap from bung hole in drum to relieve pressure. - Wear proper PPE (leather gloves)
17. Decontaminate equipment	- Splashing water/soap from decontamination - Contact with potentially contaminated groundwater through dermal exposure. - Electrical shock from broken electric cords	- Wear proper PPE (safety glasses) - Wear proper PPE (safety glasses, dermal protection) - 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	- Slips/ Trips/ Falls - Hand injuries, cuts, or lacerations during manual handling of materials - Foot injuries - Back injuries - Traffic - Wildlife: Stray dogs, Mice/rats, Vectors (i.e., mosquitoes, bees, etc.)	- Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards. - 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. - Wear Langan approved safety shoes.

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
	86. High Noise levels 87. Overhead hazards 88. Heat Stress/ Cold Stress 89. Eye Injuries	94. 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. 95. Wear high visibility clothing & vest / Use cones or signs to designate work area. 96. 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. 97. Wear hearing protection 98. Wear hard hat / Avoid areas where overhead hazards exist. 99. 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. 100. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

<u>Print Name</u>	<u>Sign Name</u>	<u>Date</u>
<u>Prepared by:</u>		
<u>Reviewed by:</u>		

LANGAN

Job Safety Analysis (JSA) Health and Safety

JSA Title: Well Installation
JSA Number: JSA019-01

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.



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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: PID, Tyvek sleeves				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
60. Move equipment to work site	36. Back strain when lifting equipment. 37. Slips/ Trips/ Falls while moving equipment. 38. Traffic (if applicable) 39. Pinched fingers or running over toes during GeoProbe set-up. 40. Overturn drilling rig while transporting to loading dock on flat-bed tow truck	26. 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 27. 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 28. Wear high visibility safety vests or clothing / Exercise caution 29. Wear proper PPE (cut-resistant gloves) / Stay alert, be aware of geoprobe rig at all times 30. 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
61. Calibration of monitoring equipment	29. Skin or eye contact with calibration chemicals 30. Pinch fingers in monitoring equipment	26. Wear proper PPE (safety glasses/ goggles) 27. Wear proper PPE (leather gloves)
28. 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
29. Advance GeoProbe rods below ground surface to desired depth	16. Underground utilities 17. High noise levels	12. Clean all subsurface soil borings to a minimum of 5 feet below grade. 13. 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)	90. Pinched fingers while removing macrocore. 91. Cuts/lacerations when cutting acetate liner open. 92. Exposure to hazardous vapors 93. Skin contacts 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 contacts 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 contacts 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	101. Use drum cart for moving drums / Use proper lifting techniques / Do not lift heavy loads without assistance. 102. Wear proper PPE (cut-resistant or leather gloves) 103. Wear proper PPE (cut-resistant or leather gloves) 104. Wear proper PPE (nitrile gloves underneath work gloves) 105. Follow good housekeeping procedures / Ensure route to move drum and storage space is free from obstructions. 106. Wear proper PPE (safety shoes) / Work in a safe manner to prevent dropped drum

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
13. All activities	11. Slips/ Trips/ Falls	11. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards.
13. All activities (cont'd)	12. Hand injuries, cuts, or lacerations during manual handling of materials	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. Foot injuries	13. Wear Langan approved safety shoes.
	14. Back injuries	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. Traffic	15. Wear high visibility clothing & vest / Use cones or signs to designate work area.
	16. Wildlife: Stray dogs, Mice/rats, Vectors (i.e., mosquitoes, bees, etc.)	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. High Noise levels	17. Wear hearing protection
	18. Overhead hazards	18. Wear hard hat / Avoid areas where overhead hazards exist.
	19. Heat Stress/ Cold Stress	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. Eye Injuries	20. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

<u>Print Name</u>	<u>Sign Name</u>	<u>Date</u>
<u>Prepared by:</u>		
<u>Reviewed by:</u>		

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.



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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
62. Transport equipment to work area	41. Back Strains 42. Slips/Trips/Falls 43. Traffic 44. Cuts/Abrasions/Contusions from equipment	31. Use proper lifting techniques/ Use wheeled transport/ use buddy system when lifting equipment. 32. Minimize distance from work area/ unobstructed path to collection points and vehicle/ Follow good housekeeping procedures. 33. Wear high-visibility vest or clothing/Exercise caution/ Use traffic cones or signage if needed. 34. Wear proper PPE (leather gloves, long sleeves, Langan approved safety shoes).
63. Measure depth of water	31. Exposure to hazardous substances 32. Pinched fingers	31. Wear proper PPE (Nitrile gloves, Safety glasses/Face shield). 32. Wear proper PPE (cut-resistant gloves).
64. 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 those connections are tight and secure/ Use proper PPE (face shield and safety glasses).
65. 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	18. Hand injuries during pump installation and sample tubing cutting. 19. Back strain 20. Electric shock 21. Exhaust gases from generator 22. Burns from hot equipment	14. Wear proper PPE when installing pump and cutting sample tubing (Nitrile and cut-resistant gloves)/ Use tubing cutter. 15. 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. 16. Ensure equipment is (LO/TO: locked out/tagged out) prior to performing 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)		17. Position generator so that exhaust is flowing away from work area. 18. 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)
66. 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.	94. Hand injuries 95. Face injuries 96. Contaminated spray from water	107. Wear proper PPE (cut-resistant gloves and nitrile gloves). 108. Wear proper PPE (face shield and safety glasses)/do not stand over well opening. 109. 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.
67. 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.
68. 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. 110. Wear proper PPE (leather gloves, long sleeves, Langan approved safety shoes).
69. All activities	1. Slips/ Trips/ Falls 2. Hand injuries, cuts, or lacerations during manual handling of materials 3. Foot injuries 97. Back injuries 98. Traffic 99. Wildlife: Stray dogs, Mice/rats, Vectors (i.e., mosquitoes, bees, etc.) 100. High Noise levels 101. Overhead hazards 102. Heat Stress/ Cold Stress 103. 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 repellent / Use bug spray when needed 7. Wear hearing protection 8. Wear hard hat / Avoid areas where overhead hazards exist. 9. Wear proper attire for weather conditions (sunscreen or protective clothing)

LANGAN

Job Safety Analysis (JSA) Health and Safety

JSA Title: Groundwater/Product Purging/Sampling with Bailer
JSA Number: JSA053

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 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, absorbent pads				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
70. Transport equipment to work area	6. Back Strain 7. Slips/ Trips/ Falls 8. Traffic 9. Cuts/abrasions from equipment 10. Contusions from dropped equipment	6. Use proper lifting techniques / Use wheeled transport. 7. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures. 8. Wear proper PPE (high visibility vest or clothing) 9. Wear proper PPE (leather gloves, long sleeves) 10. Wear proper PPE (safety shoes)
71. Remove well cover	33. Scrape knuckles/hand 34. Strain wrist/bruise palm 35. Pinch fingers or hand	6. Wear proper PPE (leather gloves) 7. Using a hammer, tap the end of the wrench to loosen grip of bolts. 8. Wear proper PPE (leather gloves)
72. Remove well cap and lock	19. Well can pops from pressure. 20. Exposure to hazardous substances through inhalation or dermal exposure 21. Scrape knuckles/hand 22. Pinch points 23. Strain wrist/bruise palm	9. Remove cap slowly to relieve pressure / Do not place face over well when opening / Wear proper PPE (safety glasses, face shield, hand protection) 10. Use direct air monitoring/reading instrument (i.e., PID) / Be familiar with and follow actions prescribed in the HASP / Wear proper PPE (nitrile gloves) 11. Wear proper PPE (leather gloves) 12. Using hammer, tap the end of the wrench to loosen grip
73. Measure head-space vapor levels	2. Exposure to hazardous substances through inhalation	2. Do not place face over well when collecting measurement
74. Set-up plastic sheeting/absorbent pads	2. Lacerations when cutting plastic sheeting/absorbent pads.	2. Use scissors to cut plastic sheeting/absorbent pads / Cut motions should always be away from body and body parts

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
for work site around the well		
75. Lower Bailer sleeve into well	7. Repetitive motion injury (pulled arm/back muscles) 8. Dehydration	7. Take breaks while lowering bailer into well/ Use a mechanical device to lower bailer into well/ Rotate employees (take turns conducting the manual labor portion) 8. Take breaks and drink water.

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
7. Purge/Sample water/product collection	1. Contact with potentially contaminated groundwater or product through dermal exposure 2. Contact with and burns from acid used for sample preservation 9. Tripping potential on sampling lanyard 10. Lacerations from broken sample bottles 11. Back strain when transporting coolers full of collected samples. 12. Slips/ Trips/ Falls	1. Wear proper PPE (safety glasses, nitrile gloves, safety shield, Tyvek) 2. Ensure sample bottle lids are secure before use and after sample collection 3. Organize lanyard to keep out of the way as much as possible / Mark potential tripping hazards with caution tape or safety cones 9. Do not over-tighten bottle caps / Handle bottles safely to prevent breakage / Wrap glass bottles in bubble wrap, if possible 10. Use proper lifting techniques / Use wheeled transport / Seek assistance if coolers weight exceeds 50lbs. / Minimize distance to vehicle. 11. 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
8. Retrieval of bailer	9. Repetitive motion injury (pulled arm/back muscles) 10. Dehydration	9. Take breaks while retrieving bailer out of the well/ Use a mechanical device to raise bailer out of well/ Rotate employees (take turns conducting the manual labor portion) 10. Take breaks and drink water.
9. Pack-up equipment	2. Back strain when removing or lifting heavy equipment	2. Use proper lifting technique / Use wheeled transport for heavy equipment
10. Replace well cap and lock	3. Scrape fingers/hand 4. Strain wrist/bruise palm	3. Wear proper PPE (leather gloves) 4. Using hammer, tap the end of the well cap to tighten grip
11. Replace well cover	4. Scrape knuckles/hand 5. Strain wrist/bruise palm. 6. Pinch fingers or hand	4. Wear proper PPE (leather gloves) 5. Using hammer, tap the end of the wrench to tighten the grip of the bolts. 6. Wear proper PPE (leather gloves)
12. Place used PPE in designated disposal drum	3. Pressure build-up inside drum 4. Pinch hazard	3. Remove cap from bung hole in drum to relieve pressure. 4. Wear proper PPE (leather gloves) 5. Product drums may require additional spill protection/electrical grounding, check local regulations
13. Decontaminate equipment	4. Splashing water/soap from decontamination 5. Contact with potentially contaminated groundwater through dermal exposure.	4. Wear proper PPE (safety glasses) 5. Wear proper PPE (safety glasses, dermal protection)

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
14. All activities	104.Slips/ Trips/ Falls 105.Hand injuries, cuts, or lacerations during manual handling of materials 106.Foot injuries 107.Back injuries 108.Traffic 109.Wildlife: Stray dogs, Mice/rats, Vectors (i.e., mosquitoes, bees, etc.) 110.High Noise levels 111.Overhead hazards 112.Heat Stress/ Cold Stress 113.Eye Injuries	111.Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards. 112.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. 113.Wear Langan approved safety shoes. 114.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. 115.Wear high visibility clothing & vest / Use cones or signs to designate work area. 116. 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. 117.Wear hearing protection 118.Wear hard hat / Avoid areas where overhead hazards exist. 119.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. 120. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

<u>Print Name</u>	<u>Sign Name</u>	<u>Date</u>
<u>Prepared by:</u>		
<u>Reviewed by:</u>		

LANGAN

Job Safety Analysis (JSA) Health and Safety

JSA Title: Hammer Drill
JSA Number: JSA049

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 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
76.Transport equipment to work area	45.Back Strain 46.Slips/ Trips/ Falls 47.Traffic 48.Cuts/abrasions from equipment 49.Contusions from dropped equipment	11. Use proper lifting techniques / Use wheeled transport. 12. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures. 13. Wear proper PPE (high visibility vest or clothing) 14. Wear proper PPE (leather gloves, long sleeves) 15. Wear proper PPE (safety shoes)
77.Electrical Connection	36.Inspect electrical cord to drill. 37.Inspect hammer drill. 38.Inspect extension cord. 39.Test GFCI	9. Check the plug, ensure all connections are in place, check cord for frayed sections. If plug or cord are worn, do not use equipment until repaired. 10. Inspect chuck for proper grasping and holding of bit, check that plastic housing is not cracked or missing pieces. Do not use if chuck does not work properly or housing is compromised. 11. Inspect extension cord, if worn or stripped pull from service and replace 12. Test GFCI, replace if GFCI fails
78.Drill Bit	1. Inspect drill bit	1. Replace if worn. 2. Wear proper PPE (leather gloves) when installing and removing drill bit. 3. Ensure equipment is unplugged from electrical power when removing and installing drill bit.
79.Use of Hammer Drill	1. Hazards associated with using hammer drill, flying objects, heavy equipment, ground level hazards and dust. 2. Slips/ Trips/ Falls 3. Hazards associated drilling into concrete slab	1. Maintain a safe distance from other site operations / Wear proper PPE (hard hat, safety glasses, safety shoes, safety vest, ear protection and leather gloves) 2. Be aware of potential trip hazards / Follow good housekeeping procedures / Mark extension cord pathway with safety cones. 3. Do not push hammer drill during use.

LANGAN

Job Safety Analysis (JSA) Health and Safety

JSA Title: Test Pits
JSA Number: JSA016-01

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 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
81. Transport equipment to work area	50. Back Strain 51. Slips/ Trips/ Falls 52. Traffic 53. Cuts/abrasions from equipment 54. Contusions from dropped equipment	16. Use proper lifting techniques / Use wheeled transport 17. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures 18. Wear proper PPE (high visibility vest or clothing) 19. Wear proper PPE (leather gloves, long sleeves) 20. Wear proper PPE (safety shoes)
82. Digging Test Pit	40. Back Strain 41. Unstable walls of excavation	13. Observe proper digging technique. Ensure spoil pile and equipment are at least 2 feet from edge of excavation. 14. Excavate test pit in a stepped manor.
83. All activities	124. Slips/ Trips/ Falls 125. Hand injuries, cuts, or lacerations during manual handling of materials 126. Foot injuries 127. Back injuries 128. Traffic 129. Wildlife: Stray dogs, Mice/rats, Vectors (i.e., mosquitoes, bees, etc.) 130. High Noise levels 131. Overhead hazards 132. Heat Stress/ Cold Stress 133. Eye Injuries	131. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 132. 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 133. Wear Langan approved safety shoes 134. 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 135. Wear high visibility clothing & vest / Use cones or signs to designate work area

LANGAN

Job Safety Analysis (JSA) Health and Safety

JSA Title: Hand Auger Soil Sampling
JSA Number: JSA003-01

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
84.Unpack equipment	55.Slips/ Trips/ Falls 56.Physical hazards including strains and hand injury	1. Be aware of hazards in area/ Place safety cones in areas of potential slips/trips/falls 2. Use proper lifting techniques / Do not lift heavy loads without assistance / Avoid putting hands near pinch points / Wear proper PPE (leather gloves)
85.Calibration of monitoring equipment	42.Skin or eye contact with calibration chemicals 43.Pinch fingers in monitoring equipment	33. Wear proper PPE (safety glasses/ goggles) 34. Wear proper PPE (leather gloves)
86.Advancing and removing hand auger	24. Physical hazards including back strain and hand injury	13. Twist auger using arms and shoulders/ Do not over exert / Keep back in neutral position, bend at the knees / Request assistance when needed / Remove auger from ground keeping back in neutral position and lift using legs
87.Sample collections a) Monitor parameters b) Prepare sample containers and labels c) Collect soil sample d) Securely cap containers, label and store in sample cooler until shipping e) Deliver cooler to lab or courier to lab	23. Contact with potentially contaminated soil 24. Lacerations from broken sample bottles 25. Back strain with transporting coolers 26. Internal exposure to contaminants through inhalation of dust 27. Slips/ Trips/ Falls	19. Use monitoring devices / Wear proper PPE (safety glasses, nitrile gloves) 20. Do not over-tighten bottles caps / Handle bottles safely to prevent breakage 21. Use proper lifting techniques / Do not lift heavy loads without assistance 22. Avoid creating dust / If necessary, wear a half-face respirator with applicable dust cartridges / Inspect respirator for damage and cleanliness prior to use / Clean respirator after each use and store in a clean, secure location 23. Be alert / Follow good housekeeping procedures
88. Decontamination of equipment	134.Splashing water/soap from decontamination 135.Contact with potentially contaminated soil	141.Wear proper PPE (safety glasses, gloves) 142.Wear proper PPE (safety glasses, gloves)

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
89. All activities 6. 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.)		

<u>Print Name</u>	<u>Sign Name</u>	<u>Date</u>
<u>Prepared by:</u>		
<u>Reviewed by:</u>		

LANGAN

Job Safety Analysis (JSA) Health and Safety

JSA Title: Groundwater/Product Purgeing/Sampling with Bailer
JSA Number: JSA053

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?
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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, absorbent pads				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
90. Transport equipment to work area	11. Back Strain 12. Slips/ Trips/ Falls 13. Traffic 14. Cuts/abrasions from equipment 15. Contusions from dropped equipment	11. Use proper lifting techniques / Use wheeled transport 12. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures 13. Wear proper PPE (high visibility vest or clothing) 14. Wear proper PPE (leather gloves, long sleeves) 15. Wear proper PPE (safety shoes)
91. Remove well cover	44. Scrape knuckles/hand 45. Strain wrist/bruise palm 46. Pinch fingers or hand	15. Wear proper PPE (leather gloves) 16. Using a hammer, tap the end of the wrench to loosen grip of bolts 17. Wear proper PPE (leather gloves)
92. Remove well cap and lock	25. Well can pops from pressure 26. Exposure to hazardous substances through inhalation or dermal exposure 27. Scrape knuckles/hand 28. Pinch points 29. Strain wrist/bruise palm	13. Remove cap slowly to relieve pressure / Do not place face over well when opening / Wear proper PPE (safety glasses, face shield, hand protection) 14. Use direct air monitoring/reading instrument (i.e. PID) / Be familiar with and follow actions prescribed in the HASP / Wear proper PPE (nitrile gloves) 15. Wear proper PPE (leather gloves) 16. Using hammer, tap the end of the wrench to loosen grip
93. Measure head-space vapor levels	3. Exposure to hazardous substances through inhalation	3. Do not place face over well when collecting measurement
94. Set-up plastic sheeting/absorbent pads for work site around the well	3. Lacerations when cutting plastic sheeting/absorbent pads	3. Use scissors to cut plastic sheeting/absorbent pads / Cut motions should always be away from body and body parts

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
95. Lower Bailer sleeve into well	12. Repetitive motion injury (pulled arm/back muscles) 13. Dehydration	13. Take breaks while lowering bailer into well/ Use a mechanical device to lower bailer into well/ Rotate employees (take turns conducting the manual labor portion) 14. Take breaks and drink water.

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
7. Purge/Sample water/product collection	1. Contact with potentially contaminated groundwater or product through dermal exposure 2. Contact with and burns from acid used for sample preservation 15. Tripping potential on sampling lanyard 16. Lacerations from broken sample bottles 17. Back strain when transporting coolers full of collected samples 18. Slips/ Trips/ Falls	1. Wear proper PPE (safety glasses, nitrile gloves, safety shield, Tyvek) 2. Ensure sample bottle lids are secure before use and after sample collection 3. Organize lanyard to keep out of the way as much as possible / Mark potential tripping hazards with caution tape or safety cones 14. Do not over-tighten bottle caps / Handle bottles safely to prevent breakage / Wrap glass bottles in bubble wrap, if possible 15. Use proper lifting techniques / Use wheeled transport / Seek assistance if coolers weight exceeds 50lbs. / Minimize distance to vehicle 16. 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
8. Retrieval of bailer	11. Repetitive motion injury (pulled arm/back muscles) 12. Dehydration	11. Take breaks while retrieving bailer out of the well/ Use a mechanical device to raise bailer out of well/ Rotate employees (take turns conducting the manual labor portion) 12. Take breaks and drink water.
9. Pack-up equipment	3. Back strain when removing or lifting heavy equipment	3. Use proper lifting technique / Use wheeled transport for heavy equipment
10. Replace well cap and lock	5. Scrape fingers/hand 6. Strain wrist/bruise palm	5. Wear proper PPE (leather gloves) 6. Using hammer, tap the end of the well cap to tighten grip
11. Replace well cover	7. Scrape knuckles/hand 8. Strain wrist/bruise palm 9. Pinch fingers or hand	7. Wear proper PPE (leather gloves) 8. Using hammer, tap the end of the wrench to tighten the grip of the bolts 9. Wear proper PPE (leather gloves)
12. Place used PPE in designated disposal drum	5. Pressure build-up inside drum 6. Pinch hazard	6. Remove cap from bung hole in drum to relieve pressure 7. Wear proper PPE (leather gloves) 8. Product drums may require additional spill protection/electrical grounding, check local regulations
13. Decontaminate equipment	6. Splashing water/soap from decontamination 7. Contact with potentially contaminated groundwater through dermal exposure	6. Wear proper PPE (safety glasses) 7. Wear proper PPE (safety glasses, dermal protection)

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
14. All activities	136.Slips/ Trips/ Falls 137.Hand injuries, cuts or lacerations during manual handling of materials 138.Foot injuries 139.Back injuries 140.Traffic 141.Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 142.High Noise levels 143.Overhead hazards 144.Heat Stress/ Cold Stress 145.Eye Injuries	143.Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 144.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 145.Wear Langan approved safety shoes 146.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 147.Wear high visibility clothing & vest / Use cones or signs to designate work area 148. 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 149.Wear hearing protection 150.Wear hard hat / Avoid areas were overhead hazards exist. 151.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 152. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

<u>Print Name</u>	<u>Sign Name</u>	<u>Date</u>
<u>Prepared by:</u>		
<u>Reviewed by:</u>		

LANGAN

Job Safety Analysis (JSA) Health and Safety

JSA Title: Sub-slab soil gas temporary point installation and sampling
JSA Number: JSA037-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. 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 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
96. Transport equipment to work site	57. Back injuries 58. Slips/Trips/Falls 59. Traffic 60. Hand injuries	35. Use proper lifting techniques/ Use wheeled transport/ Get assistance when need with moving equipment/ Minimize distance from vehicle 36. Minimize distance from vehicle/ Have unobstructed pathway to vehicle and collection points/ Mark tripping hazards with spray paint, cones, or caution tape/ Observe good housekeeping procedures. 37. Wear proper PPE (High Visibility vest and clothing)/ Exercise caution (stay alert-stay alive) 38. Wear proper PPE (leather gloves)/ Keep finger and hands clear of pinch points.
97. Mark area for drilling	47. Slips/Trips/Falls	35. Minimize distance from vehicle/ Have unobstructed pathway to vehicle and collection points/ Mark tripping hazards with spray paint, cones, or caution tape/ Observe good housekeeping procedures
98. Drill sampling points with hammer drill	30. Eye injuries 31. Dust exposure 32. Hand injuries 33. Catch items (clothing) 34. Electric shock 35. Chemical atmosphere hazard (vapor) 36. Slips/Trips/Falls	14. Wear proper PPE (safety glasses) 15. Wear proper PPE (dust mask) 16. Wear proper PPE (leather gloves)/ Keep hands and fingers out of pinch points/ Avoid drill catching on ground and twisting wrist or hand/ Release drill grip if drill becomes caught/ Ensure drill is unplugged prior to inserting bit. 17. Tie up or tuck-in all loose clothing/ Maintain distance from drill 18. Inspect power cable for cuts or nicks before use/ Use GFCI outlet on power cord/ Do not use in wet conditions 19. Monitor air, vapors with Photo-ionization detector (PID)

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		20. Minimize distance from vehicle/ Have unobstructed pathway to vehicle and collection points/ Mark tripping hazards with spray paint, cones, or caution tape/ Observe good housekeeping procedures
99. Measure vapor content and depth to bottom of hole	1. Chemical atmosphere hazard (vapors)	1. Monitor air, vapors with Photo-ionization detector (PID)/ Keep face away from opening of hole while collecting measurements
100. Set-up of shroud and sampling canister system	1. Hand injuries 2. Chemical atmosphere hazard (vapors) 3. Slips/Trips/Falls	1. Wear proper PPE (leather gloves, nitrile gloves)/ Keep fingers away from pinch points when installing pump/ Do not use open blades, use tubing cutter 2. Monitor air, vapors with Photo-ionization detector (PID)/ Keep face away from opening of hole while collecting measurements 3. Minimize distance from vehicle/ Have unobstructed pathway to vehicle and collection points/ Mark tripping hazards with spray paint, cones, or caution tape/ Observe good housekeeping procedures
101. Purge soil gas	1. Chemical atmosphere hazard (vapors)	1. Monitor air, vapors with Photo-ionization detector (PID)/ Keep face away from exhaust port of pump
102. Sample collection (opening and closing valves)	1. Hand injuries	1. Wear proper PPE (leather gloves)/ Keep fingers away from pinch points
103. Sealing sampling holes	1. Back injuries 2. Concrete dust 3. Eye injuries	1. Use proper lifting techniques for lifting of cement bags 2. Wear proper PPE (dust mask) 3. Wear proper PPE (safety glasses)
104. All activities	146. Slips/ Trips/ Falls 147. Hand injuries, cuts or lacerations during manual handling of materials 148. Foot injuries 149. Back injuries 150. Traffic 151. Wildlife: Stray animals, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 152. High Noise levels 153. Overhead hazards 154. Heat or cold injuries 155. Eye Injuries	153. Be aware of potential trip hazards/ Follow good housekeeping procedures/ Mark significant hazards 154. 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 Wear proper PPE (Langan approved safety shoes) 155. 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 156. Wear high visibility clothing & vest/ Use cones or signs to designate work area 157. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray animals/ Carry and use animal repellant when needed/ Use bug spray when needed 158. Wear hearing protection 159. Wear hard hat/ Avoid areas where overhead hazards exist. 160. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather)/ Drink plenty of fluids to avoid dehydration/ Take breaks as necessary to avoid heat/cold stress 161. Wear safety glasses

LANGAN

Job Safety Analysis (JSA) Health and Safety

JSA Title: Indoor Air Sampling
JSA Number: JSA007-01

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 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: PID, Respiratory Protection (if necessary)				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
105. Building walkthrough and background contaminant removal	61. Slips / Trips/ Falls 62. Exposure to substances/vapors during removal	21. Be aware of potential trip hazards / Follow good housekeeping procedures / Mark significant below-grade hazards (i.e. holes, trenches) with safety cones or spray paint 22. Monitor indoor air concentrations with a PID / Wear proper PPE (nitrile gloves) / Wear proper respiratory protection if necessary
106. Transport equipment to work area	16. Back Strain 17. Slips/ Trips/ Falls 18. Traffic 19. Cuts/abrasions from equipment 20. Contusions from dropped equipment	16. Use proper lifting techniques / Use wheeled transport 17. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures 18. Wear proper PPE (high visibility vest or clothing) 19. Wear proper PPE (leather gloves, long sleeves) 20. Wear proper PPE (safety shoes)
107. Mark out areas for indoor air sampling	48. Slips/ Trips/ Falls	18. Be aware of potential trip hazards / Follow good housekeeping procedures / Mark significant below-grade hazards (i.e. holes, trenches) with safety cones or spray paint
108. Set-up canisters and begin indoor air sampling	37. Dropping crates or canisters 38. Pinch hazard	17. Exercise caution when moving crates and canisters / Use proper housekeeping of materials during sample events / Do not carry too many items at one time / Perform several trips, if necessary 18. Wear proper PPE (leather gloves)
109. Sample collection	4. Dropping crates or canisters 5. Pinched fingers from opening valves	4. Exercise caution when moving crates and canisters / Use proper housekeeping of materials during sample events / Do not carry too many items at one time / Perform several trips, if necessary 5. Wear proper PPE (leather gloves) / Keep fingers away from pinch points
110. Pack up equipment	3. Back strain	3. Use proper lifting techniques / Use wheeled transport

LANGAN

Job Safety Analysis (JSA) Health and Safety

JSA Title: Geotechnical Drilling

JSA Number: JSA014-01

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 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: NomeX (as needed)				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
112. Transport equipment to work area	63.Back Strain 64.Slips/ Trips/ Falls 65.Traffic 66.Cuts/abrasions from equipment 67.Contusions from dropped equipment	23. Use proper lifting techniques / Use wheeled transport. 24. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures. 25. Wear proper PPE (high visibility vest or clothing) 26. Wear proper PPE (leather gloves, long sleeves) 27. Wear proper PPE (safety shoes)
113.Set-up HSA/SPT rig	49.Slips/ Trips/ Falls 50.Pinch Hazards 51.High noise levels 52.Clothing entanglement 53.Electrocution/falling equipment and debris from raising HSA/SPT rig mast. 54.Carbon monoxide poisoning 55.HSA/SPT rig roll-over 56.HSA/SPT rig movement	19. Be aware of potential trip hazards / Follow good housekeeping procedures / Mark significant below-grade hazards (i.e., holes, trenches) with safety cones or spray paint 20. Wear proper PPE (leather gloves) 21. Wear proper PPE (hearing protection) 22. Wear proper attire for HSA/SPT rig (no loose clothing, strings, etc.) 23. Wear proper PPE (hard hats) / Be aware of locations at all times / Look up, down and around before raising mast / Check HSA/SPT drill rig mast for loose objects/debris before raising 24. Stand upwind of rig engine 25. Do not move rig with mast raised / Set stabilizers prior to raising mast / Inspect work area / If area appears unstable, the boring locations should be moved. 26. All field personnel should stay clear of rig while moving / Use a spotter when backing up the rig
114. Advance HSA/SPT rods, augers, and casing below ground surface	39. Strain wrist/bruise palm 40. Pinched fingers 41. Back strain	19. Wear proper PPE (leather gloves) / Use proper technique for preparing rods / Use second person, if necessary 20. Wear proper PPE (leather gloves)

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
115. Advance HSA/SPT rods, augers, and casing below ground surface (cont'd)	42. Clothing entanglement 43. Carbon monoxide poisoning 44. Bruised/Broken toes/feet 45. High noise levels	21. Use proper lifting techniques / Obtain assistance if needed 22. Wear proper attire for HSA/SPT rig (no loose clothing, strings, etc.) 23. Stand upwind of the rig 24. Wear proper PPE (safety shoes) 25. Wear proper PPE (hearing protection)
116. Remove and open split spoon	28. Pinched fingers 29. Cuts/lacerations 30. Skin contact with contaminated soil and groundwater	1. Wear proper PPE (nitrile and leather gloves) 2. Wear proper PPE (leather gloves) 3. Wear proper PPE (nitrile gloves, safety glasses)
117. Repeat steps 3 and 4 until desired depth is reached	5. See steps 3 and 4	1. See steps 3 and 4
118. Remove HSA/SPT rods, augers and casing and place in storage rack	1. Clothing entanglement 2. Back strain 3. Pinched fingers 4. Carbon monoxide poisoning 5. High noise levels	1. Wear proper attire for HSA/SPT rig (no loose clothing, strings, etc.) 2. Use proper lifting techniques / Obtain assistance if needed 3. Wear proper PPE (leather gloves) 4. Stand upwind of rig engine 5. Wear proper PPE (hearing protection)
119. Tremie-grout borehole with a cement-bentonite grout mixture	1. Splash cement/bentonite grout on face/eyes 2. Back strain 3. Pinched fingers	1. Wear proper PPE (safety glasses) 2. Use proper lifting techniques / Obtain assistance if needed 3. Wear proper PPE (nitrile gloves, leather gloves)
120. Decontaminate equipment	1. Contact with potentially impacted material 2. Contact with sharp pieces of equipment	1. Wear proper PPE (safety glasses, nitrile gloves) 2. Wear proper PPE (leather gloves)
121. Patch soil boring location to return to pre-existing conditions (i.e. concrete, asphalt, grass)	1. Cuts/lacerations 2. Splashed concrete on face/eyes 3. Hammer fingers/hands when patching asphalt	1. Wear proper PPE (leather gloves) / Use scissors for cutting 2. Use proper PPE (safety glasses) 3. Be aware of hands/fingers during hammering / Wear proper PPE (leather gloves)
122. All activities	166. Slips/ Trips/ Falls 167. Hand injuries, cuts, or lacerations during manual handling of materials 168. Foot injuries 169. Back injuries 170. Traffic 171. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 172. High Noise levels 173. Overhead hazards 174. Heat Stress/ Cold Stress 175. Eye Injuries	172. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 173. 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 174. Wear Langan approved safety shoes 175. Use proper lifting techniques / Consider load location, task repetition, and load weight when evaluating what is safe or unsafe to lift / Obtain assistance when possible 176. Wear high visibility clothing & vest / Use cones or signs to designate work area 177. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellent / Use bug spray when needed 178. Wear hearing protection 179. Wear hard hat / Avoid areas where overhead hazards exist.

LANGAN

Job Safety Analysis (JSA) Health and Safety

JSA Title: Test Pits
JSA Number: JSA016-01

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 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
123. Transport equipment to work area	68.Back Strain 69.Slips/ Trips/ Falls 70.Traffic 71.Cuts/abrasions from equipment 72.Contusions from dropped equipment	28. Use proper lifting techniques / Use wheeled transport 29. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures 30. Wear proper PPE (high visibility vest or clothing) 31. Wear proper PPE (leather gloves, long sleeves) 32. Wear proper PPE (safety shoes)
124. Digging Test Pit	57.Back Strain 58.Unstable walls of excavation	27. Observe proper digging technique. Ensure spoil pile and equipment are at least 2 feet from edge of excavation. 28. Excavate test pit in a stepped manor.
125.All activities	176.Slips/ Trips/ Falls 177.Hand injuries, cuts, or lacerations during manual handling of materials 178.Foot injuries 179.Back injuries 180.Traffic 181.Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 182.High Noise levels 183.Overhead hazards 184.Heat Stress/ Cold Stress 185.Eye Injuries	182.Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 183.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 184.Wear Langan approved safety shoes 185.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 186.Wear high visibility clothing & vest / Use cones or signs to designate work area 187. 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.

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 D

Community Air Monitoring Plan

New York State Department of Health Generic Community Air Monitoring Plan

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area and when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with New York State Department of Health (NYSDOH) to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for volatile organic compounds (VOCs) and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate New York State Department of Environmental Conservation (NYSDEC)/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a **continuous** bases or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

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

All 15-minute readings must be recorded and available for State (NYSDEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored **continuously** at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m³) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m³ above the upwind level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m³ above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m³ of the upwind level and in preventing visible dust migration.

All readings must be recorded and be available for State (NYSDEC and NYSDOH) personnel to review.

Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures

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

- If total VOC concentrations at the site exceed 1 ppm, monitoring should occur within the occupied structure(s). Background readings must be taken prior to commencement of the planned work. Any unusual background readings should be discussed with NYSDOH prior to commencement of the work. Response levels and actions should be pre-determined for the site.
- If total particulate concentrations next to the site exceed 150 mcg/m³, work activities should be suspended until controls are implemented and are successful in reducing the total particulate concentration to 150 mcg/m³ or less at the monitoring point.

Special Requirements for Indoor Work with Co-Located Residences or Facilities

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

APPENDIX E

Environmental Footprint Summary

SITE INFORMATION	
User Name and Date	
Site Name	RBEC1
Remedial Alternative Name	
Alternative File Name	
Choose electricity profile	NY

Component	Component Alias
Component 1	Boring Advancemet
Component 2	Sampling
Component 3	Monitoring Well Survey and Synoptic Gauging
Component 4	Removal of IDW

Do you want to reload a previously saved remedial alternative in the SiteWise input sheet?

Yes

Refresh List

Reset all input values on all worksheets to default

Reset All Values on All Sheets

-- Status --

Reset complete.



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Version 3.2

Instructions

Boring Advancement

This worksheet allows the user to define material production, transportation, equipment use, and residual handling variables for the remedial alternative

Yellow cells require the user to choose an input from a drop down menu

White cells require the user to type in a value

BASELINE INFORMATION

COMPONENT 1 DURATION AND COST	Entire Site
Input duration of the component (unit time)	1
Input component cost per unit time (\$)	

MATERIAL PRODUCTION

WELL MATERIALS	Well Type 1	Well Type 2	Well Type 3	Well Type 4	Well Type 5	Well Type 6	Well Type 7	Well Type 8	Well Type 9	Well Type 10	Well Type 11	Well Type 12
Input number of wells	4	4										
Input depth of wells (ft)	20	13										
Choose specific casing material schedule from drop down menu	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC
Choose well diameter (in) from drop down menu	2	3/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
Input total quantity of Sand (kg)	90	5										
Input total quantity of Gravel (kg)												
Input total quantity of Bentonite (kg)	6	1										
Input total quantity of Typical Cement (kg)												
Input total quantity of General Concrete (kg)	19											
Input total quantity of Steel (kg)												

TREATMENT CHEMICALS & MATERIALS	Treatment 1	Treatment 2	Treatment 3	Treatment 4	Treatment 5	Treatment 6	Treatment 7	Treatment 8	Treatment 9	Treatment 10	Treatment 11	Treatment 12
Input number of injection points												
Choose material type from drop down menu	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide
Input amount of material injected at each point (pounds dry mass)												
Input number of injections per injection point												

TREATMENT MEDIA	Treatment 1	Treatment 2	Treatment 3	Treatment 4	Treatment 5	Treatment 6	Treatment 7	Treatment 8	Treatment 9	Treatment 10	Treatment 11	Treatment 12
Input weight of media used (lbs)												
Choose media type from drop down menu	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC

CONSTRUCTION MATERIALS	Material 1	Material 2	Material 3	Material 4	Material 5	Material 6	Material 7	Material 8	Material 9	Material 10	Material 11	Material 12
Choose material type from drop down menu	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner
Input area of material (ft2)												
Input depth of material (ft)												

WELL DECOMMISSIONING	Well Type 1	Well Type 2	Well Type 3	Well Type 4	Well Type 5	Well Type 6	Well Type 7	Well Type 8	Well Type 9	Well Type 10	Well Type 11	Well Type 12
Input number of wells												
Input depth of wells (ft)												
Input well diameter (in)												
Choose material from drop down menu	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil

SILT CURTAIN MATERIALS	Curtain 1	Curtain 2	Curtain 3	Curtain 4	Curtain 5	Curtain 6	Curtain 7	Curtain 8	Curtain 9	Curtain 10	Curtain 11	Curtain 12
Input length or perimeter of silt curtain (ft)												
Input depth of silt curtain (ft)												

BULK MATERIAL QUANTITIES	Material 1	Material 2	Material 3	Material 4	Material 5	Material 6	Material 7	Material 8	Material 9	Material 10	Material 11	Material 12
Choose material from drop down menu	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid
Choose units of material quantity from drop down menu	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds
Input material quantity												

TRANSPORTATION

PERSONNEL TRANSPORTATION - ROAD	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
Will DIESEL-run vehicles be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
Choose vehicle type from drop down menu*	Light truck	Cars	Cars	Cars	Cars	Cars	Cars	Cars	Cars	Cars	Cars	Cars
Choose fuel used from drop down menu	Diesel	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Input distance traveled per trip (miles)	48											
Input number of trips taken	10											
Input number of travelers	2											
Input estimated vehicular fuel economy (mi/gal) (Input only if known for the vehicle selected, otherwise a default will be used by the tool)												

*For vehicle type "Other" please enter values in Table 2b in the Look Up Table tab.

PERSONNEL TRANSPORTATION - AIR	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
Input distance traveled (miles)												
Input number of travelers												
Input number of flights taken												

PERSONNEL TRANSPORTATION - RAIL	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
Choose vehicle type from drop down menu	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail
Input distance traveled (miles)	8											
Input number of trips taken	10											
Input number of travelers	1											

EQUIPMENT TRANSPORTATION - DEDICATED LOAD ROAD	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
Will DIESEL-run vehicles be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
Choose fuel used from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Account for an empty return trip?	No	No	No	No	No	No	No	No	No	No	No	No
Input one-way distance traveled (miles) with a given load. If applicable, impact for an empty return trip will be accounted for (no additional input is needed).												
Input weight of equipment transported per truck load (tons)												

EQUIPMENT TRANSPORTATION - SHARED LOAD ROAD	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12

	Input distance traveled (miles)	62											
	Input weight of equipment transported (tons)	0.1											
EQUIPMENT TRANSPORTATION - AIR		Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
	Input distance traveled (miles)												
	Input weight of equipment transported (tons)												
EQUIPMENT TRANSPORTATION - RAIL		Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
	Input distance traveled (miles)												
	Input weight of load (tons)												
EQUIPMENT TRANSPORTATION - WATER		Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
	Input distance traveled (mile)												
	Input weight of load (tons)												
EQUIPMENT USE													
EARTHWORK		Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
	Choose earthwork equipment type from drop down menu	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer
	Choose fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input volume of material to be removed (yd3)												
	Will DIESEL-run equipment be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
DRILLING		Event 1	Event 2	Event 3	Event 4	Event 5	Event 6	Event 7	Event 8	Event 9	Event 10	Event 11	Event 12
	Input number of drilling locations	6											
	Choose drilling method from drop down menu	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push
	Input time spent drilling at each location (hr)	2.50											
	Choose fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
TRENCHING		Trencher 1	Trencher 2	Trencher 3	Trencher 4	Trencher 5	Trencher 6	Trencher 7	Trencher 8	Trencher 9	Trencher 10	Trencher 11	Trencher 12
	Choose fuel type from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
	Choose horsepower range from drop down menu	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3
	Input operating hours (hr)												
SEDIMENT DREDGING		Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
	Choose dredge equipment type from drop down menu	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical
	Choose dredge fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input volume of material to be dredged (yd3)												
	Choose dredge equipment size	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1
	Suggested dredge equipment size	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1
	Input number of dredge tenders (default already present, user override possible)	1	1	1	1	1	1	1	1	1	1	1	1
	Choose dredge tender fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input operating time for dredge tenders (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Input number of scow tenders (default already present, user override possible)	2	2	2	2	2	2	2	2	2	2	2	2
	Choose scow tender fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input operating time for scow tenders (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Choose size of research vessel from drop down menu	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)
	Choose research vessel fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input number of research vessels (default already present, user override possible)	1	1	1	1	1	1	1	1	1	1	1	1
	Input operating time for research vessels (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Will DIESEL-run equipment be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
SEDIMENT MANAGEMENT (STAGING AND DRYING)		Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
	Choose earthwork equipment type from drop down menu	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane
	Choose fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input volume of material to be removed (yd3)												
	Is volume input that of saturated sediment?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Will the sediment be dry when this work is performed?	No	No	No	No	No	No	No	No	No	No	No	No
	Will DIESEL-run equipment be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
SEDIMENT CAPPING		Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
	Choose capping method from drop down menu	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release
	Choose capping equipment fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input volume of capping material to be placed (yd3)												
	Choose capping equipment size/type	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge
	Suggested capping equipment size/type	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge
	Input number of dredge tenders (hr) (default already present, user override possible)	1	1	1	1	1	1	1	1	1	1	1	1
	Choose tender fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input operating time for dredge tenders (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Input number of scow tenders (default already present, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Choose scow tender fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input operating time for scow tenders (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Choose size of research vessel from drop down menu	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)
	Choose research vessel fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input number of research vessels (default already present, user override possible)	1	1	1	1	1	1	1	1	1	1	1	1
	Input operating time for research vessels (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Will DIESEL-run equipment be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
WATERCRAFT OPERATION		Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
	Choose size of research vessel from drop down menu	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)
	Choose research vessel fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input number of vessels												
	Input operating time (hours)												
	Will DIESEL-run equipment be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
For each pump, select only one of the three methods to calculate energy and GHG emissions Enter "0" for all user input values for unused pump columns or unused methods													
PUMP OPERATION		Pump 1	Pump 2	Pump 3	Pump 4	Pump 5	Pump 6	Pump 7	Pump 8	Pump 9	Pump 10	Pump 11	Pump 12
	Choose method from drop down	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1
Method 1 - ELECTRICAL USAGE IS KNOWN													

Input pump electrical usage (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Method 2 - PUMP HEAD IS KNOWN												
Input flow rate (gpm)	0	0	0	0	0	0	0	0	0	0	0	0
Input total head (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Input number of pumps operating	0	0	0	0	0	0	0	0	0	0	0	0
Input operating time for each pump (hrs)	0	0	0	0	0	0	0	0	0	0	0	0
Pump efficiency (default already present, user override possible)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Pump motor efficiency (default already present, user override possible)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Input specific gravity (default already present, user override possible)	1	1	1	1	1	1	1	1	1	1	1	1
Method 3 - NAME PLATE SPECIFICATIONS ARE KNOWN												
Input pump horsepower (hp)	0	0	0	0	0	0	0	0	0	0	0	0
Input number of pumps operating	0	0	0	0	0	0	0	0	0	0	0	0
Input operating time for each pump (hrs)	0	0	0	0	0	0	0	0	0	0	0	0
Percent of max speed for pump motor (Optional input for variable speed motor)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Pump load if max motor speed draws full nameplate horsepower	1	1	1	1	1	1	1	1	1	1	1	1
Input pump load (default already present, user override possible, consider above value)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pump motor efficiency (default already present, user override possible)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Region												
Electricity Region	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY
DIESEL AND GASOLINE PUMPS												
	Pump 1	Pump 2	Pump 3	Pump 4	Pump 5	Pump 6	Pump 7	Pump 8	Pump 9	Pump 10	Pump 11	Pump 12
Choose fuel type from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Choose horsepower range from drop down menu	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1
Equipment operating hours (hrs)												
Input estimated fuel consumption rate (gal/hr) (Input only if known for the pump selected, otherwise a default will be used by the tool)												
For each type of equipment, select only one of the methods to calculate energy and GHG emissions Enter "0" for user input values for unused equipment columns or unused methods												
BLOWER, COMPRESSOR, MIXER, AND OTHER EQUIPMENT												
Choose type of equipment from drop down	Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
Choose method from drop down	Blower	Blower	Blower	Blower	Blower	Blower	Blower	Blower	Blower	Blower	Blower	Blower
Method 1 - NAME PLATE SPECIFICATIONS ARE KNOWN	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1
Input equipment horsepower (hp)	0	0	0	0	0	0	0	0	0	0	0	0
Input number of equipments operating	0	0	0	0	0	0	0	0	0	0	0	0
Input operating time for each equipment (hrs)	0	0	0	0	0	0	0	0	0	0	0	0
Percent of max speed for motor (Optional input for variable speed motor)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Equipment load if max motor speed draws full nameplate horsepower	1	1	1	1	1	1	1	1	1	1	1	1
Input equipment load (default already present, user override possible, consider above value)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Equipment motor efficiency (default already present, user override possible)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Method 2 - ELECTRICAL USAGE IS KNOWN												
Input equipment electrical usage, if known (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Region												
Electricity Region	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY
GENERATORS												
	Generator 1	Generator 2	Generator 3	Generator 4	Generator 5	Generator 6	Generator 7	Generator 8	Generator 9	Generator 10	Generator 11	Generator 12
Choose fuel type from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Choose horsepower range from drop down menu	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1
Input operating hours (hr)												
AGRICULTURAL EQUIPMENT												
	Tillage Tractor 1	Tillage Tractor 2	Tillage Tractor 3	Tillage Tractor 4	Tillage Tractor 5	Tillage Tractor 6	Tillage Tractor 7	Tillage Tractor 8	Tillage Tractor 9	Tillage Tractor 10	Tillage Tractor 11	Tillage Tractor 12
Choose fuel type from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Input area to till (acre)												
Choose soil condition from drop down menu	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil
Choose soil type from drop down menu	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil
Input time available (work days)												
Input depth of tillage (in)												
CAPPING EQUIPMENT												
	Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
Choose stabilization equipment type from drop down menu	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller
Choose fuel type from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Input area (ft2)												
Input time available (work days)												
MIXING EQUIPMENT												
	Mixer 1	Mixer 2	Mixer 3	Mixer 4	Mixer 5	Mixer 6	Mixer 7	Mixer 8	Mixer 9	Mixer 10	Mixer 11	Mixer 12
Choose fuel type from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Choose horsepower range from drop down menu	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3
Input volume (yd3)												
Input production rate (yd3/hr)												
Input estimated fuel consumption rate (gal/hr) (Input only if known for the mixer selected, otherwise a default will be used by the tool)												
INTERNAL COMBUSTION ENGINES												
	Engine 1	Engine 2	Engine 3	Engine 4	Engine 5	Engine 6	Engine 7	Engine 8	Engine 9	Engine 10	Engine 11	Engine 12
Choose fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
Input fuel consumption rate (gal/hr or scf/hr)												
Input operating hours (hr)												
OTHER FUELED EQUIPMENT												
	Fuel 1	Fuel 2	Fuel 3	Fuel 4	Fuel 5	Fuel 6	Fuel 7	Fuel 8	Fuel 9	Fuel 10	Fuel 11	Fuel 12
Choose fuel type from drop down menu	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas
Input volume (scf for Natural gas, gallons for all others)												
DIESEL EQUIPMENT OPERATION (PER HOUR BASIS)												
	Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
Choose equipment type from drop down menu	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer
Choose equipment size for Dozer (HP)	65	65	65	65	65	65	65	65	65	65	65	65

Sampling

This worksheet allows the user to define material production, transportation, equipment use, and residual handling variables for the remedial alternative

Yellow cells require the user to choose an input from a drop down menu

White cells require the user to type in a value

BASELINE INFORMATION

COMPONENT 2 DURATION AND COST	Entire Site
Input duration of the component (unit time)	1
Input component cost per unit time (\$)	

MATERIAL PRODUCTION

WELL MATERIALS	Well Type 1	Well Type 2	Well Type 3	Well Type 4	Well Type 5	Well Type 6	Well Type 7	Well Type 8	Well Type 9	Well Type 10	Well Type 11	Well Type 12
Input number of wells												
Input depth of wells (ft)												
Choose specific casing material schedule from drop down menu	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC
Choose well diameter (in) from drop down menu	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
Input total quantity of Sand (kg)												
Input total quantity of Gravel (kg)												
Input total quantity of Bentonite (kg)												
Input total quantity of Typical Cement (kg)												
Input total quantity of General Concrete (kg)												
Input total quantity of Steel (kg)												

TREATMENT CHEMICALS & MATERIALS	Treatment 1	Treatment 2	Treatment 3	Treatment 4	Treatment 5	Treatment 6	Treatment 7	Treatment 8	Treatment 9	Treatment 10	Treatment 11	Treatment 12
Input number of injection points												
Choose material type from drop down menu	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide
Input amount of material injected at each point (pounds dry mass)												
Input number of injections per injection point												

TREATMENT MEDIA	Treatment 1	Treatment 2	Treatment 3	Treatment 4	Treatment 5	Treatment 6	Treatment 7	Treatment 8	Treatment 9	Treatment 10	Treatment 11	Treatment 12
Input weight of media used (lbs)												
Choose media type from drop down menu	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC

CONSTRUCTION MATERIALS	Material 1	Material 2	Material 3	Material 4	Material 5	Material 6	Material 7	Material 8	Material 9	Material 10	Material 11	Material 12
Choose material type from drop down menu	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner
Input area of material (ft2)												
Input depth of material (ft)												

WELL DECOMMISSIONING	Well Type 1	Well Type 2	Well Type 3	Well Type 4	Well Type 5	Well Type 6	Well Type 7	Well Type 8	Well Type 9	Well Type 10	Well Type 11	Well Type 12
Input number of wells												
Input depth of wells (ft)												
Input well diameter (in)												
Choose material from drop down menu	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil

SILT CURTAIN MATERIALS	Curtain 1	Curtain 2	Curtain 3	Curtain 4	Curtain 5	Curtain 6	Curtain 7	Curtain 8	Curtain 9	Curtain 10	Curtain 11	Curtain 12
Input length or perimeter of silt curtain (ft)												
Input depth of silt curtain (ft)												

BULK MATERIAL QUANTITIES	Material 1	Material 2	Material 3	Material 4	Material 5	Material 6	Material 7	Material 8	Material 9	Material 10	Material 11	Material 12
Choose material from drop down menu	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid
Choose units of material quantity from drop down menu	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds
Input material quantity												

TRANSPORTATION

PERSONNEL TRANSPORTATION - ROAD	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
Will DIESEL-run vehicles be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
Choose vehicle type from drop down menu*	Light truck	Cars	Cars	Cars	Cars	Cars	Cars	Cars	Cars	Cars	Cars	Cars
Choose fuel used from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Input distance traveled per trip (miles)	35											
Input number of trips taken	10											
Input number of travelers	1											
Input estimated vehicular fuel economy (mi/gal) (Input only if known for the vehicle selected, otherwise a default will be used by the tool)												

*For vehicle type "Other" please enter values in Table 2b in the Look Up Table tab.

PERSONNEL TRANSPORTATION - AIR	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
Input distance traveled (miles)												
Input number of travelers												
Input number of flights taken												

PERSONNEL TRANSPORTATION - RAIL	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
Choose vehicle type from drop down menu	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail
Input distance traveled (miles)												
Input number of trips taken												
Input number of travelers												

EQUIPMENT TRANSPORTATION - DEDICATED LOAD ROAD	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
Will DIESEL-run vehicles be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
Choose fuel used from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Account for an empty return trip?	No	No	No	No	No	No	No	No	No	No	No	No
Input one-way distance traveled (miles) with a given load. If applicable, impact for an empty return trip will be accounted for (no additional input is needed).												
Input weight of equipment transported per truck load (tons)												

EQUIPMENT TRANSPORTATION - SHARED LOAD ROAD	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12

	Input distance traveled (miles)												
	Input weight of equipment transported (tons)												
EQUIPMENT TRANSPORTATION - AIR		Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
	Input distance traveled (miles)												
	Input weight of equipment transported (tons)												
EQUIPMENT TRANSPORTATION - RAIL		Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
	Input distance traveled (miles)												
	Input weight of load (tons)												
EQUIPMENT TRANSPORTATION - WATER		Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
	Input distance traveled (mile)												
	Input weight of load (tons)												
EQUIPMENT USE													
EARTHWORK		Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
	Choose earthwork equipment type from drop down menu	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer
	Choose fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input volume of material to be removed (yd3)												
	Will DIESEL-run equipment be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
DRILLING		Event 1	Event 2	Event 3	Event 4	Event 5	Event 6	Event 7	Event 8	Event 9	Event 10	Event 11	Event 12
	Input number of drilling locations												
	Choose drilling method from drop down menu	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push
	Input time spent drilling at each location (hr)												
	Choose fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
TRENCHING		Trencher 1	Trencher 2	Trencher 3	Trencher 4	Trencher 5	Trencher 6	Trencher 7	Trencher 8	Trencher 9	Trencher 10	Trencher 11	Trencher 12
	Choose fuel type from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
	Choose horsepower range from drop down menu	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3
	Input operating hours (hr)												
SEDIMENT DREDGING		Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
	Choose dredge equipment type from drop down menu	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical
	Choose dredge fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input volume of material to be dredged (yd3)												
	Choose dredge equipment size	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1
	Suggested dredge equipment size	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1
	Input number of dredge tenders (default already present, user override possible)	1	1	1	1	1	1	1	1	1	1	1	1
	Choose dredge tender fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input operating time for dredge tenders (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Input number of scow tenders (default already present, user override possible)	2	2	2	2	2	2	2	2	2	2	2	2
	Choose scow tender fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input operating time for scow tenders (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Choose size of research vessel from drop down menu	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)
	Choose research vessel fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input number of research vessels (default already present, user override possible)	1	1	1	1	1	1	1	1	1	1	1	1
	Input operating time for research vessels (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Will DIESEL-run equipment be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
SEDIMENT MANAGEMENT (STAGING AND DRYING)		Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
	Choose earthwork equipment type from drop down menu	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane
	Choose fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input volume of material to be removed (yd3)												
	Is volume input that of saturated sediment?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Will the sediment be dry when this work is performed?	No	No	No	No	No	No	No	No	No	No	No	No
	Will DIESEL-run equipment be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
SEDIMENT CAPPING		Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
	Choose capping method from drop down menu	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release
	Choose capping equipment fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input volume of capping material to be placed (yd3)												
	Choose capping equipment size/type	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge
	Suggested capping equipment size/type	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge
	Input number of dredge tenders (default already present, user override possible)	1	1	1	1	1	1	1	1	1	1	1	1
	Choose tender fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input operating time for dredge tenders (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Input number of scow tenders (default already present, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Choose scow tender fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input operating time for scow tenders (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Choose size of research vessel from drop down menu	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)
	Choose research vessel fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input number of research vessels (default already present, user override possible)	1	1	1	1	1	1	1	1	1	1	1	1
	Input operating time for research vessels (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Will DIESEL-run equipment be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
WATERCRAFT OPERATION		Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
	Choose size of research vessel from drop down menu	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)
	Choose research vessel fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input number of vessels												
	Input operating time (hours)												
	Will DIESEL-run equipment be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
For each pump, select only one of the three methods to calculate energy and GHG emissions Enter "0" for all user input values for unused pump columns or unused methods													
PUMP OPERATION		Pump 1	Pump 2	Pump 3	Pump 4	Pump 5	Pump 6	Pump 7	Pump 8	Pump 9	Pump 10	Pump 11	Pump 12
	Choose method from drop down	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1
Method 1 - ELECTRICAL USAGE IS KNOWN													

Input pump electrical usage (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Method 2 - PUMP HEAD IS KNOWN												
Input flow rate (gpm)	0	0	0	0	0	0	0	0	0	0	0	0
Input total head (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Input number of pumps operating	0	0	0	0	0	0	0	0	0	0	0	0
Input operating time for each pump (hrs)	0	0	0	0	0	0	0	0	0	0	0	0
Pump efficiency (default already present, user override possible)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Pump motor efficiency (default already present, user override possible)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Input specific gravity (default already present, user override possible)	1	1	1	1	1	1	1	1	1	1	1	1
Method 3 - NAME PLATE SPECIFICATIONS ARE KNOWN												
Input pump horsepower (hp)	0	0	0	0	0	0	0	0	0	0	0	0
Input number of pumps operating	0	0	0	0	0	0	0	0	0	0	0	0
Input operating time for each pump (hrs)	0	0	0	0	0	0	0	0	0	0	0	0
Percent of max speed for pump motor (Optional input for variable speed motor)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Pump load if max motor speed draws full nameplate horsepower	1	1	1	1	1	1	1	1	1	1	1	1
Input pump load (default already present, user override possible, consider above value)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pump motor efficiency (default already present, user override possible)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Region												
Electricity Region	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY
DIESEL AND GASOLINE PUMPS												
	Pump 1	Pump 2	Pump 3	Pump 4	Pump 5	Pump 6	Pump 7	Pump 8	Pump 9	Pump 10	Pump 11	Pump 12
Choose fuel type from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Choose horsepower range from drop down menu	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1
Equipment operating hours (hrs)												
Input estimated fuel consumption rate (gal/hr) (Input only if known for the pump selected, otherwise a default will be used by the tool)												
For each type of equipment, select only one of the methods to calculate energy and GHG emissions Enter "0" for user input values for unused equipment columns or unused methods												
BLOWER, COMPRESSOR, MIXER, AND OTHER EQUIPMENT												
Choose type of equipment from drop down	Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
Choose method from drop down	Blower	Blower	Blower	Blower	Blower	Blower	Blower	Blower	Blower	Blower	Blower	Blower
Method 1 - NAME PLATE SPECIFICATIONS ARE KNOWN	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1
Input equipment horsepower (hp)	0	0	0	0	0	0	0	0	0	0	0	0
Input number of equipments operating	0	0	0	0	0	0	0	0	0	0	0	0
Input operating time for each equipment (hrs)	0	0	0	0	0	0	0	0	0	0	0	0
Percent of max speed for motor (Optional input for variable speed motor)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Equipment load if max motor speed draws full nameplate horsepower	1	1	1	1	1	1	1	1	1	1	1	1
Input equipment load (default already present, user override possible, consider above value)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Equipment motor efficiency (default already present, user override possible)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Method 2 - ELECTRICAL USAGE IS KNOWN												
Input equipment electrical usage, if known (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Region												
Electricity Region	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY
GENERATORS												
	Generator 1	Generator 2	Generator 3	Generator 4	Generator 5	Generator 6	Generator 7	Generator 8	Generator 9	Generator 10	Generator 11	Generator 12
Choose fuel type from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Choose horsepower range from drop down menu	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1
Input operating hours (hr)												
AGRICULTURAL EQUIPMENT												
	Tillage Tractor 1	Tillage Tractor 2	Tillage Tractor 3	Tillage Tractor 4	Tillage Tractor 5	Tillage Tractor 6	Tillage Tractor 7	Tillage Tractor 8	Tillage Tractor 9	Tillage Tractor 10	Tillage Tractor 11	Tillage Tractor 12
Choose fuel type from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Input area to till (acre)												
Choose soil condition from drop down menu	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil
Choose soil type from drop down menu	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil
Input time available (work days)												
Input depth of tillage (in)												
CAPPING EQUIPMENT												
	Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
Choose stabilization equipment type from drop down menu	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller
Choose fuel type from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Input area (ft2)												
Input time available (work days)												
MIXING EQUIPMENT												
	Mixer 1	Mixer 2	Mixer 3	Mixer 4	Mixer 5	Mixer 6	Mixer 7	Mixer 8	Mixer 9	Mixer 10	Mixer 11	Mixer 12
Choose fuel type from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Choose horsepower range from drop down menu	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3
Input volume (yd3)												
Input production rate (yd3/hr)												
Input estimated fuel consumption rate (gal/hr) (Input only if known for the mixer selected, otherwise a default will be used by the tool)												
INTERNAL COMBUSTION ENGINES												
	Engine 1	Engine 2	Engine 3	Engine 4	Engine 5	Engine 6	Engine 7	Engine 8	Engine 9	Engine 10	Engine 11	Engine 12
Choose fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
Input fuel consumption rate (gal/hr or scf/hr)												
Input operating hours (hr)												
OTHER FUELED EQUIPMENT												
	Fuel 1	Fuel 2	Fuel 3	Fuel 4	Fuel 5	Fuel 6	Fuel 7	Fuel 8	Fuel 9	Fuel 10	Fuel 11	Fuel 12
Choose fuel type from drop down menu	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas
Input volume (scf for Natural gas, gallons for all others)												
DIESEL EQUIPMENT OPERATION (PER HOUR BASIS)												
	Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
Choose equipment type from drop down menu	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer
Choose equipment size for Dozer (HP)	65	65	65	65	65	65	65	65	65	65	65	65

Monitoring Well Survey and Synoptic Gauging

This worksheet allows the user to define material production, transportation, equipment use, and residual handling variables for the remedial alternative

Yellow cells require the user to choose an input from a drop down menu

White cells require the user to type in a value

BASELINE INFORMATION

COMPONENT 3 DURATION AND COST	Entire Site
Input duration of the component (unit time)	1
Input component cost per unit time (\$)	

MATERIAL PRODUCTION

WELL MATERIALS	Well Type 1	Well Type 2	Well Type 3	Well Type 4	Well Type 5	Well Type 6	Well Type 7	Well Type 8	Well Type 9	Well Type 10	Well Type 11	Well Type 12
Input number of wells												
Input depth of wells (ft)												
Choose specific casing material schedule from drop down menu	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC
Choose well diameter (in) from drop down menu	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
Input total quantity of Sand (kg)												
Input total quantity of Gravel (kg)												
Input total quantity of Bentonite (kg)												
Input total quantity of Typical Cement (kg)												
Input total quantity of General Concrete (kg)												
Input total quantity of Steel (kg)												

TREATMENT CHEMICALS & MATERIALS	Treatment 1	Treatment 2	Treatment 3	Treatment 4	Treatment 5	Treatment 6	Treatment 7	Treatment 8	Treatment 9	Treatment 10	Treatment 11	Treatment 12
Input number of injection points												
Choose material type from drop down menu	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide
Input amount of material injected at each point (pounds dry mass)												
Input number of injections per injection point												

TREATMENT MEDIA	Treatment 1	Treatment 2	Treatment 3	Treatment 4	Treatment 5	Treatment 6	Treatment 7	Treatment 8	Treatment 9	Treatment 10	Treatment 11	Treatment 12
Input weight of media used (lbs)												
Choose media type from drop down menu	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC

CONSTRUCTION MATERIALS	Material 1	Material 2	Material 3	Material 4	Material 5	Material 6	Material 7	Material 8	Material 9	Material 10	Material 11	Material 12
Choose material type from drop down menu	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner
Input area of material (ft2)												
Input depth of material (ft)												

WELL DECOMMISSIONING	Well Type 1	Well Type 2	Well Type 3	Well Type 4	Well Type 5	Well Type 6	Well Type 7	Well Type 8	Well Type 9	Well Type 10	Well Type 11	Well Type 12
Input number of wells												
Input depth of wells (ft)												
Input well diameter (in)												
Choose material from drop down menu	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil

SILT CURTAIN MATERIALS	Curtain 1	Curtain 2	Curtain 3	Curtain 4	Curtain 5	Curtain 6	Curtain 7	Curtain 8	Curtain 9	Curtain 10	Curtain 11	Curtain 12
Input length or perimeter of silt curtain (ft)												
Input depth of silt curtain (ft)												

BULK MATERIAL QUANTITIES	Material 1	Material 2	Material 3	Material 4	Material 5	Material 6	Material 7	Material 8	Material 9	Material 10	Material 11	Material 12
Choose material from drop down menu	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid
Choose units of material quantity from drop down menu	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds
Input material quantity												

TRANSPORTATION

PERSONNEL TRANSPORTATION - ROAD	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
Will DIESEL-run vehicles be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
Choose vehicle type from drop down menu*	Cars	Cars	Cars	Cars	Cars	Cars	Cars	Cars	Cars	Cars	Cars	Cars
Choose fuel used from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Input distance traveled per trip (miles)	8											
Input number of trips taken	2											
Input number of travelers	2											
Input estimated vehicular fuel economy (mi/gal) (Input only if known for the vehicle selected, otherwise a default will be used by the tool)												

*For vehicle type "Other" please enter values in Table 2b in the Look Up Table tab.

PERSONNEL TRANSPORTATION - AIR	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
Input distance traveled (miles)												
Input number of travelers												
Input number of flights taken												

PERSONNEL TRANSPORTATION - RAIL	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
Choose vehicle type from drop down menu	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail
Input distance traveled (miles)	8											
Input number of trips taken	2											
Input number of travelers	1											

EQUIPMENT TRANSPORTATION - DEDICATED LOAD ROAD	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
Will DIESEL-run vehicles be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
Choose fuel used from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Account for an empty return trip?	No	No	No	No	No	No	No	No	No	No	No	No
Input one-way distance traveled (miles) with a given load. If applicable, impact for an empty return trip will be accounted for (no additional input is needed).												
Input weight of equipment transported per truck load (tons)												

EQUIPMENT TRANSPORTATION - SHARED LOAD ROAD	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12

	Input distance traveled (miles)												
	Input weight of equipment transported (tons)												
EQUIPMENT TRANSPORTATION - AIR		Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
	Input distance traveled (miles)												
	Input weight of equipment transported (tons)												
EQUIPMENT TRANSPORTATION - RAIL		Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
	Input distance traveled (miles)												
	Input weight of load (tons)												
EQUIPMENT TRANSPORTATION - WATER		Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
	Input distance traveled (mile)												
	Input weight of load (tons)												
EQUIPMENT USE													
EARTHWORK		Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
	Choose earthwork equipment type from drop down menu	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer
	Choose fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input volume of material to be removed (yd3)												
	Will DIESEL-run equipment be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
DRILLING		Event 1	Event 2	Event 3	Event 4	Event 5	Event 6	Event 7	Event 8	Event 9	Event 10	Event 11	Event 12
	Input number of drilling locations												
	Choose drilling method from drop down menu	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push
	Input time spent drilling at each location (hr)												
	Choose fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
TRENCHING		Trencher 1	Trencher 2	Trencher 3	Trencher 4	Trencher 5	Trencher 6	Trencher 7	Trencher 8	Trencher 9	Trencher 10	Trencher 11	Trencher 12
	Choose fuel type from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
	Choose horsepower range from drop down menu	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3
	Input operating hours (hr)												
SEDIMENT DREDGING		Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
	Choose dredge equipment type from drop down menu	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical
	Choose dredge fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input volume of material to be dredged (yd3)												
	Choose dredge equipment size	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1
	Suggested dredge equipment size	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1
	Input number of dredge tenders (default already present, user override possible)	1	1	1	1	1	1	1	1	1	1	1	1
	Choose dredge tender fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input operating time for dredge tenders (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Input number of scow tenders (default already present, user override possible)	2	2	2	2	2	2	2	2	2	2	2	2
	Choose scow tender fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input operating time for scow tenders (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Choose size of research vessel from drop down menu	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)
	Choose research vessel fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input number of research vessels (default already present, user override possible)	1	1	1	1	1	1	1	1	1	1	1	1
	Input operating time for research vessels (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Will DIESEL-run equipment be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
SEDIMENT MANAGEMENT (STAGING AND DRYING)		Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
	Choose earthwork equipment type from drop down menu	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane
	Choose fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input volume of material to be removed (yd3)												
	Is volume input that of saturated sediment?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Will the sediment be dry when this work is performed?	No	No	No	No	No	No	No	No	No	No	No	No
	Will DIESEL-run equipment be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
SEDIMENT CAPPING		Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
	Choose capping method from drop down menu	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release
	Choose capping equipment fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input volume of capping material to be placed (yd3)												
	Choose capping equipment size/type	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge
	Suggested capping equipment size/type	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge
	Input number of dredge tenders (default already present, user override possible)	1	1	1	1	1	1	1	1	1	1	1	1
	Choose tender fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input operating time for dredge tenders (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Input number of scow tenders (default already present, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Choose scow tender fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input operating time for scow tenders (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Choose size of research vessel from drop down menu	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)
	Choose research vessel fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input number of research vessels (default already present, user override possible)	1	1	1	1	1	1	1	1	1	1	1	1
	Input operating time for research vessels (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Will DIESEL-run equipment be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
WATERCRAFT OPERATION		Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
	Choose size of research vessel from drop down menu	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)
	Choose research vessel fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input number of vessels												
	Input operating time (hours)												
	Will DIESEL-run equipment be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
For each pump, select only one of the three methods to calculate energy and GHG emissions Enter "0" for all user input values for unused pump columns or unused methods													
PUMP OPERATION		Pump 1	Pump 2	Pump 3	Pump 4	Pump 5	Pump 6	Pump 7	Pump 8	Pump 9	Pump 10	Pump 11	Pump 12
	Choose method from drop down	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1
Method 1 - ELECTRICAL USAGE IS KNOWN													

[illegible]

[illegible]

Removal of IDW

This worksheet allows the user to define material production, transportation, equipment use, and residual handling variables for the remedial alternative

Yellow cells require the user to choose an input from a drop down menu

White cells require the user to type in a value

BASELINE INFORMATION

COMPONENT 4 DURATION AND COST	Entire Site
Input duration of the component (unit time)	1
Input component cost per unit time (\$)	

MATERIAL PRODUCTION

WELL MATERIALS	Well Type 1	Well Type 2	Well Type 3	Well Type 4	Well Type 5	Well Type 6	Well Type 7	Well Type 8	Well Type 9	Well Type 10	Well Type 11	Well Type 12
Input number of wells												
Input depth of wells (ft)												
Choose specific casing material schedule from drop down menu	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC
Choose well diameter (in) from drop down menu	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
Input total quantity of Sand (kg)												
Input total quantity of Gravel (kg)												
Input total quantity of Bentonite (kg)												
Input total quantity of Typical Cement (kg)												
Input total quantity of General Concrete (kg)												
Input total quantity of Steel (kg)												

TREATMENT CHEMICALS & MATERIALS	Treatment 1	Treatment 2	Treatment 3	Treatment 4	Treatment 5	Treatment 6	Treatment 7	Treatment 8	Treatment 9	Treatment 10	Treatment 11	Treatment 12
Input number of injection points												
Choose material type from drop down menu	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide	Hydrogen Peroxide
Input amount of material injected at each point (pounds dry mass)												
Input number of injections per injection point												

TREATMENT MEDIA	Treatment 1	Treatment 2	Treatment 3	Treatment 4	Treatment 5	Treatment 6	Treatment 7	Treatment 8	Treatment 9	Treatment 10	Treatment 11	Treatment 12
Input weight of media used (lbs)												
Choose media type from drop down menu	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC	Virgin GAC

CONSTRUCTION MATERIALS	Material 1	Material 2	Material 3	Material 4	Material 5	Material 6	Material 7	Material 8	Material 9	Material 10	Material 11	Material 12
Choose material type from drop down menu	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner	HDPE Liner
Input area of material (ft2)												
Input depth of material (ft)												

WELL DECOMMISSIONING	Well Type 1	Well Type 2	Well Type 3	Well Type 4	Well Type 5	Well Type 6	Well Type 7	Well Type 8	Well Type 9	Well Type 10	Well Type 11	Well Type 12
Input number of wells												
Input depth of wells (ft)												
Input well diameter (in)												
Choose material from drop down menu	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil

SILT CURTAIN MATERIALS	Curtain 1	Curtain 2	Curtain 3	Curtain 4	Curtain 5	Curtain 6	Curtain 7	Curtain 8	Curtain 9	Curtain 10	Curtain 11	Curtain 12
Input length or perimeter of silt curtain (ft)												
Input depth of silt curtain (ft)												

BULK MATERIAL QUANTITIES	Material 1	Material 2	Material 3	Material 4	Material 5	Material 6	Material 7	Material 8	Material 9	Material 10	Material 11	Material 12
Choose material from drop down menu	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid	Acetic Acid
Choose units of material quantity from drop down menu	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds	pounds
Input material quantity												

TRANSPORTATION

PERSONNEL TRANSPORTATION - ROAD	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
Will DIESEL-run vehicles be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
Choose vehicle type from drop down menu*	Cars	Cars	Cars	Cars	Cars	Cars	Cars	Cars	Cars	Cars	Cars	Cars
Choose fuel used from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Input distance traveled per trip (miles)												
Input number of trips taken												
Input number of travelers												
Input estimated vehicular fuel economy (mi/gal) (Input only if known for the vehicle selected, otherwise a default will be used by the tool)												

*For vehicle type "Other" please enter values in Table 2b in the Look Up Table tab.

PERSONNEL TRANSPORTATION - AIR	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
Input distance traveled (miles)												
Input number of travelers												
Input number of flights taken												

PERSONNEL TRANSPORTATION - RAIL	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
Choose vehicle type from drop down menu	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail	Intercity rail
Input distance traveled (miles)	8											
Input number of trips taken	2											
Input number of travelers	1											

EQUIPMENT TRANSPORTATION - DEDICATED LOAD ROAD	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
Will DIESEL-run vehicles be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
Choose fuel used from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Account for an empty return trip?	No	No	No	No	No	No	No	No	No	No	No	No
Input one-way distance traveled (miles) with a given load. If applicable, impact for an empty return trip will be accounted for (no additional input is needed).												
Input weight of equipment transported per truck load (tons)												

EQUIPMENT TRANSPORTATION - SHARED LOAD ROAD	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12

	Input distance traveled (miles)												
	Input weight of equipment transported (tons)												
EQUIPMENT TRANSPORTATION - AIR		Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
	Input distance traveled (miles)												
	Input weight of equipment transported (tons)												
EQUIPMENT TRANSPORTATION - RAIL		Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
	Input distance traveled (miles)												
	Input weight of load (tons)												
EQUIPMENT TRANSPORTATION - WATER		Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11	Trip 12
	Input distance traveled (mile)												
	Input weight of load (tons)												
EQUIPMENT USE													
EARTHWORK		Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
	Choose earthwork equipment type from drop down menu	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer
	Choose fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input volume of material to be removed (yd3)												
	Will DIESEL-run equipment be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
DRILLING		Event 1	Event 2	Event 3	Event 4	Event 5	Event 6	Event 7	Event 8	Event 9	Event 10	Event 11	Event 12
	Input number of drilling locations												
	Choose drilling method from drop down menu	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push	Direct Push
	Input time spent drilling at each location (hr)												
	Choose fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
TRENCHING		Trencher 1	Trencher 2	Trencher 3	Trencher 4	Trencher 5	Trencher 6	Trencher 7	Trencher 8	Trencher 9	Trencher 10	Trencher 11	Trencher 12
	Choose fuel type from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
	Choose horsepower range from drop down menu	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3
	Input operating hours (hr)												
SEDIMENT DREDGING		Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
	Choose dredge equipment type from drop down menu	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical
	Choose dredge fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input volume of material to be dredged (yd3)												
	Choose dredge equipment size	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1
	Suggested dredge equipment size	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1	Crawler Crane, 25 ton, 1
	Input number of dredge tenders (default already present, user override possible)	1	1	1	1	1	1	1	1	1	1	1	1
	Choose dredge tender fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input operating time for dredge tenders (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Input number of scow tenders (default already present, user override possible)	2	2	2	2	2	2	2	2	2	2	2	2
	Choose scow tender fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input operating time for scow tenders (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Choose size of research vessel from drop down menu	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)
	Choose research vessel fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input number of research vessels (default already present, user override possible)	1	1	1	1	1	1	1	1	1	1	1	1
	Input operating time for research vessels (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Will DIESEL-run equipment be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
SEDIMENT MANAGEMENT (STAGING AND DRYING)		Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
	Choose earthwork equipment type from drop down menu	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane	Crawler Crane
	Choose fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input volume of material to be removed (yd3)												
	Is volume input that of saturated sediment?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Will the sediment be dry when this work is performed?	No	No	No	No	No	No	No	No	No	No	No	No
	Will DIESEL-run equipment be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
SEDIMENT CAPPING		Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
	Choose capping method from drop down menu	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release	Surface Release
	Choose capping equipment fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input volume of capping material to be placed (yd3)												
	Choose capping equipment size/type	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge
	Suggested capping equipment size/type	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge	Hopper Barge
	Input number of dredge tenders (default already present, user override possible)	1	1	1	1	1	1	1	1	1	1	1	1
	Choose tender fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input operating time for dredge tenders (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Input number of scow tenders (default already present, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Choose scow tender fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input operating time for scow tenders (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Choose size of research vessel from drop down menu	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)
	Choose research vessel fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input number of research vessels (default already present, user override possible)	1	1	1	1	1	1	1	1	1	1	1	1
	Input operating time for research vessels (hr) (default calculated value, user override possible)	0	0	0	0	0	0	0	0	0	0	0	0
	Will DIESEL-run equipment be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
WATERCRAFT OPERATION		Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
	Choose size of research vessel from drop down menu	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)	Research Vessel (large)
	Choose research vessel fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
	Input number of vessels												
	Input operating time (hours)												
	Will DIESEL-run equipment be retrofitted with a particulate reduction technology?	No	No	No	No	No	No	No	No	No	No	No	No
For each pump, select only one of the three methods to calculate energy and GHG emissions Enter "0" for all user input values for unused pump columns or unused methods													
PUMP OPERATION		Pump 1	Pump 2	Pump 3	Pump 4	Pump 5	Pump 6	Pump 7	Pump 8	Pump 9	Pump 10	Pump 11	Pump 12
	Choose method from drop down	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1
Method 1 - ELECTRICAL USAGE IS KNOWN													

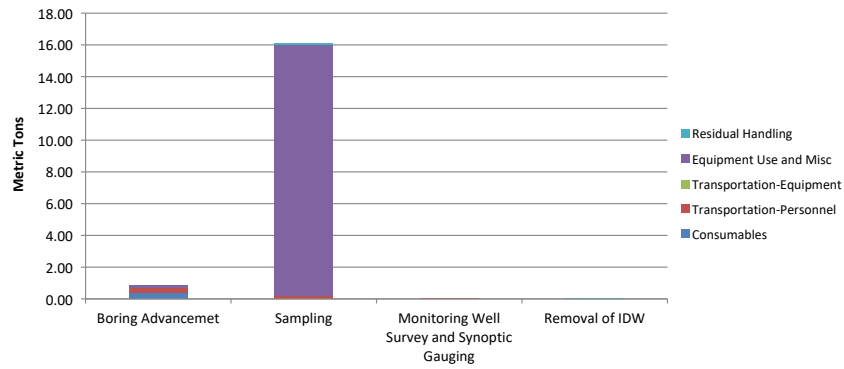
Input pump electrical usage (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Method 2 - PUMP HEAD IS KNOWN												
Input flow rate (gpm)	0	0	0	0	0	0	0	0	0	0	0	0
Input total head (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Input number of pumps operating	0	0	0	0	0	0	0	0	0	0	0	0
Input operating time for each pump (hrs)	0	0	0	0	0	0	0	0	0	0	0	0
Pump efficiency (default already present, user override possible)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Pump motor efficiency (default already present, user override possible)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Input specific gravity (default already present, user override possible)	1	1	1	1	1	1	1	1	1	1	1	1
Method 3 - NAME PLATE SPECIFICATIONS ARE KNOWN												
Input pump horsepower (hp)	0	0	0	0	0	0	0	0	0	0	0	0
Input number of pumps operating	0	0	0	0	0	0	0	0	0	0	0	0
Input operating time for each pump (hrs)	0	0	0	0	0	0	0	0	0	0	0	0
Percent of max speed for pump motor (Optional input for variable speed motor)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Pump load if max motor speed draws full nameplate horsepower	1	1	1	1	1	1	1	1	1	1	1	1
Input pump load (default already present, user override possible, consider above value)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Pump motor efficiency (default already present, user override possible)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Region												
Electricity Region	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY
DIESEL AND GASOLINE PUMPS												
	Pump 1	Pump 2	Pump 3	Pump 4	Pump 5	Pump 6	Pump 7	Pump 8	Pump 9	Pump 10	Pump 11	Pump 12
Choose fuel type from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Choose horsepower range from drop down menu	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1	2-Stroke: 0 to 1
Equipment operating hours (hrs)												
Input estimated fuel consumption rate (gal/hr) (Input only if known for the pump selected, otherwise a default will be used by the tool)												
For each type of equipment, select only one of the methods to calculate energy and GHG emissions Enter "0" for user input values for unused equipment columns or unused methods												
BLOWER, COMPRESSOR, MIXER, AND OTHER EQUIPMENT												
Choose type of equipment from drop down	Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
Choose method from drop down	Blower	Blower	Blower	Blower	Blower	Blower	Blower	Blower	Blower	Blower	Blower	Blower
Method 1 - NAME PLATE SPECIFICATIONS ARE KNOWN	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1	Method 1
Input equipment horsepower (hp)	0	0	0	0	0	0	0	0	0	0	0	0
Input number of equipments operating	0	0	0	0	0	0	0	0	0	0	0	0
Input operating time for each equipment (hrs)	0	0	0	0	0	0	0	0	0	0	0	0
Percent of max speed for motor (Optional input for variable speed motor)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Equipment load if max motor speed draws full nameplate horsepower	1	1	1	1	1	1	1	1	1	1	1	1
Input equipment load (default already present, user override possible, consider above value)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Equipment motor efficiency (default already present, user override possible)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Method 2 - ELECTRICAL USAGE IS KNOWN												
Input equipment electrical usage, if known (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Region												
Electricity Region	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY	NY
GENERATORS												
	Generator 1	Generator 2	Generator 3	Generator 4	Generator 5	Generator 6	Generator 7	Generator 8	Generator 9	Generator 10	Generator 11	Generator 12
Choose fuel type from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Choose horsepower range from drop down menu	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1	0 to 1
Input operating hours (hr)												
AGRICULTURAL EQUIPMENT												
	Tillage Tractor 1	Tillage Tractor 2	Tillage Tractor 3	Tillage Tractor 4	Tillage Tractor 5	Tillage Tractor 6	Tillage Tractor 7	Tillage Tractor 8	Tillage Tractor 9	Tillage Tractor 10	Tillage Tractor 11	Tillage Tractor 12
Choose fuel type from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Input area to till (acre)												
Choose soil condition from drop down menu	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil	Firm untilled soil
Choose soil type from drop down menu	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil	Clay Soil
Input time available (work days)												
Input depth of tillage (in)												
CAPPING EQUIPMENT												
	Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
Choose stabilization equipment type from drop down menu	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller
Choose fuel type from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Input area (ft2)												
Input time available (work days)												
MIXING EQUIPMENT												
	Mixer 1	Mixer 2	Mixer 3	Mixer 4	Mixer 5	Mixer 6	Mixer 7	Mixer 8	Mixer 9	Mixer 10	Mixer 11	Mixer 12
Choose fuel type from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Choose horsepower range from drop down menu	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3
Input volume (yd3)												
Input production rate (yd3/hr)												
Input estimated fuel consumption rate (gal/hr) (Input only if known for the mixer selected, otherwise a default will be used by the tool)												
INTERNAL COMBUSTION ENGINES												
	Engine 1	Engine 2	Engine 3	Engine 4	Engine 5	Engine 6	Engine 7	Engine 8	Engine 9	Engine 10	Engine 11	Engine 12
Choose fuel type from drop down menu	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
Input fuel consumption rate (gal/hr or scf/hr)												
Input operating hours (hr)												
OTHER FUELED EQUIPMENT												
	Fuel 1	Fuel 2	Fuel 3	Fuel 4	Fuel 5	Fuel 6	Fuel 7	Fuel 8	Fuel 9	Fuel 10	Fuel 11	Fuel 12
Choose fuel type from drop down menu	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas
Input volume (scf for Natural gas, gallons for all others)												
DIESEL EQUIPMENT OPERATION (PER HOUR BASIS)												
	Equipment 1	Equipment 2	Equipment 3	Equipment 4	Equipment 5	Equipment 6	Equipment 7	Equipment 8	Equipment 9	Equipment 10	Equipment 11	Equipment 12
Choose equipment type from drop down menu	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer	Dozer
Choose equipment size for Dozer (HP)	65	65	65	65	65	65	65	65	65	65	65	65

Sustainable Remediation - Environmental Footprint Summary

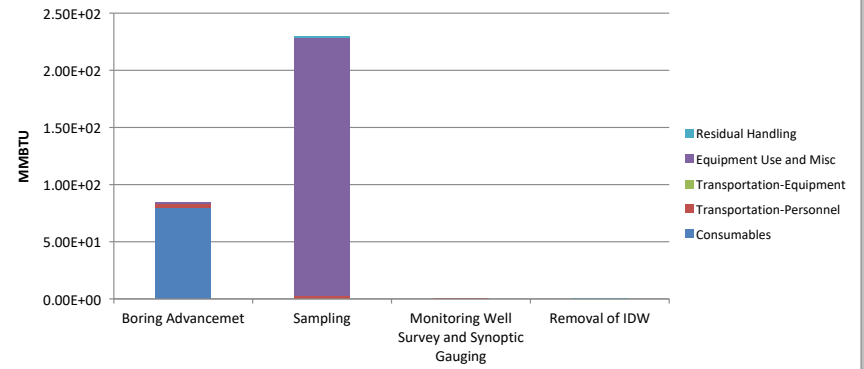
Phase	Activities	GHG Emissions	Total Energy Used	Water Consumption	Electricity Usage	Onsite NOx Emissions	Onsite SOx Emissions	Onsite PM10 Emissions	Total NOx Emissions	Total SOx Emissions	Total PM10 Emissions	Accident Risk Fatality	Accident Risk Injury
		metric ton	MMBTU	gallons	MWH	metric ton	metric ton	metric ton	metric ton	metric ton	metric ton		
Boring Advancement	Consumables	0.41	8.0E+01	NA	NA	NA	NA	NA	6.4E-04	9.0E-04	1.2E-04	NA	NA
	Transportation-Personnel	0.28	3.4E+00	NA	NA	NA	NA	NA	1.4E-04	1.5E-05	1.7E-05	7.5E-06	6.1E-04
	Transportation-Equipment	0.00	2.0E-02	NA	NA	NA	NA	NA	4.8E-07	8.5E-09	4.2E-08	4.8E-07	3.9E-05
	Equipment Use and Misc	0.14	1.6E+00	1.0E+02	0.0E+00	1.3E-03	1.3E-04	1.2E-04	1.4E-03	1.7E-04	1.3E-04	5.0E-06	1.3E-03
	Residual Handling	0.00	0.0E+00	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	0.83	8.46E+01	1.00E+02	0.00E+00	1.29E-03	1.32E-04	1.16E-04	2.15E-03	1.09E-03	2.63E-04	1.30E-05	1.91E-03
Sampling	Consumables	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	NA	NA
	Transportation-Personnel	0.19	2.4E+00	NA	NA	NA	NA	NA	8.0E-05	2.5E-06	1.1E-05	2.7E-06	2.2E-04
	Transportation-Equipment	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	15.88	2.3E+02	5.0E+01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.6E-02	5.7E-02	6.4E-03	4.6E-06	1.2E-03
	Residual Handling	0.00	2.2E-02	NA	NA	0.0E+00	0.0E+00	0.0E+00	6.4E-06	3.4E-06	1.8E-05	0.0E+00	0.0E+00
	Sub-Total	16.07	2.30E+02	5.00E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.63E-02	5.72E-02	6.38E-03	7.31E-06	1.37E-03
Monitoring Well Survey and Synoptic Gauging	Consumables	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	NA	NA
	Transportation-Personnel	0.01	1.0E-01	NA	NA	NA	NA	NA	2.4E-06	2.8E-06	4.9E-07	2.6E-07	2.1E-05
	Transportation-Equipment	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.3E-07	1.8E-04
	Residual Handling	0.00	0.0E+00	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	0.01	1.01E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.45E-06	2.80E-06	4.86E-07	9.88E-07	2.05E-04
Removal of IDW	Consumables	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	NA	NA
	Transportation-Personnel	0.00	2.4E-02	NA	NA	NA	NA	NA	1.9E-07	2.7E-06	2.9E-08	6.4E-09	8.3E-07
	Transportation-Equipment	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Residual Handling	0.06	7.6E-01	NA	NA	0.0E+00	0.0E+00	0.0E+00	1.8E-05	7.3E-07	1.4E-06	3.1E-07	2.5E-05
	Sub-Total	0.06	7.81E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.80E-05	3.45E-06	1.47E-06	3.18E-07	2.59E-05
Total		1.7E+01	3.2E+02	1.5E+02	0.0E+00	1.3E-03	1.3E-04	1.2E-04	7.8E-02	5.8E-02	6.6E-03	2.2E-05	3.5E-03

Remedial Alternative Phase	Non-Hazardous Waste Landfill Space	Hazardous Waste Landfill Space	Topsoil Consumption	Costing	Lost Hours - Injury	Percent electricity from renewable sources	Total Cost with Footprint Reduction
	tons	tons	cubic yards	\$		%	
Boring Advancement	0.0E+00	0.0E+00	0.0E+00	0	1.5E-02	0.0%	\$0
Sampling	1.0E-01	0.0E+00	0.0E+00	0	1.1E-02	0.0%	
Monitoring Well Survey	0.0E+00	0.0E+00	0.0E+00	0	1.6E-03	0.0%	
Removal of IDW	0.0E+00	0.0E+00	0.0E+00	0	2.1E-04	0.0%	
Total	1.0E-01	0.0E+00	0.0E+00	\$0	2.8E-02	0.0%	

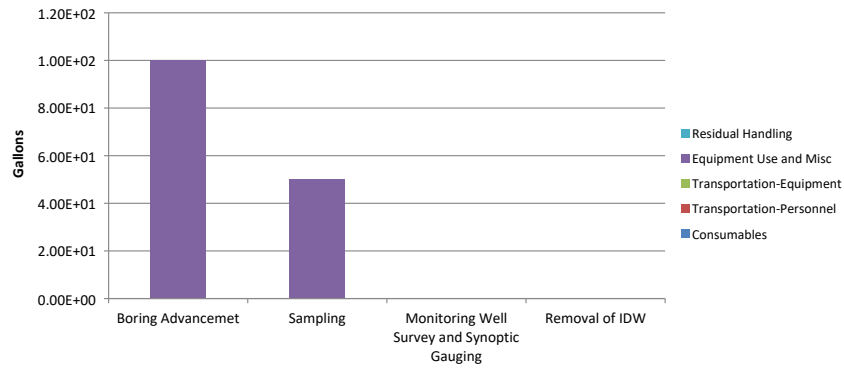
GHG Emissions



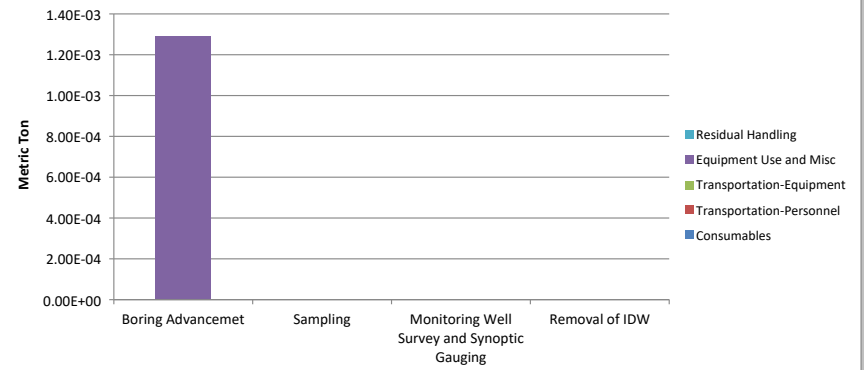
Total Energy Used



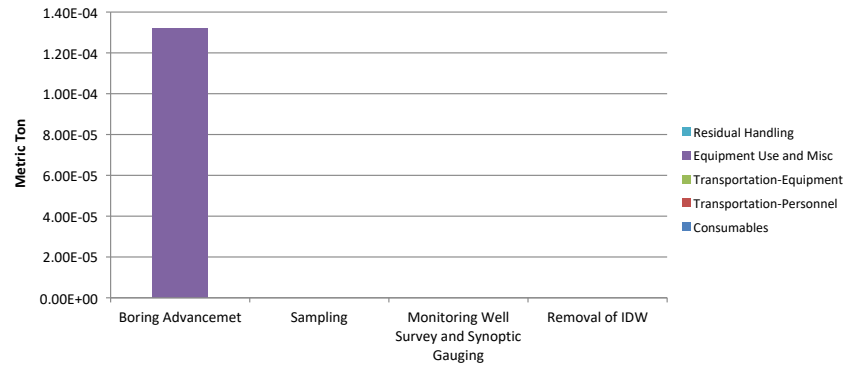
Water Consumption



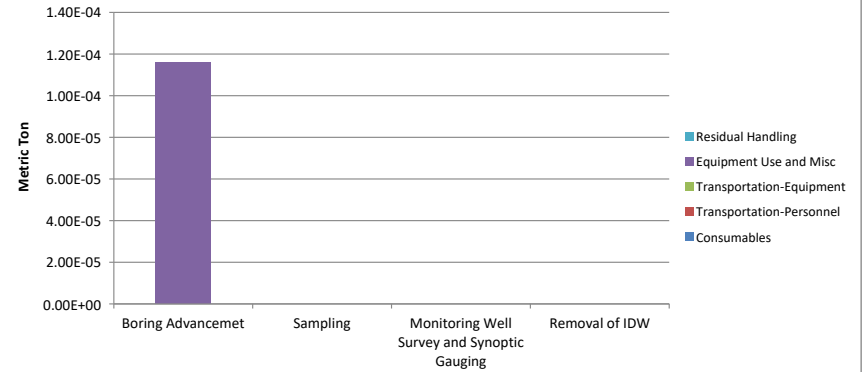
Onsite NOx Emissions



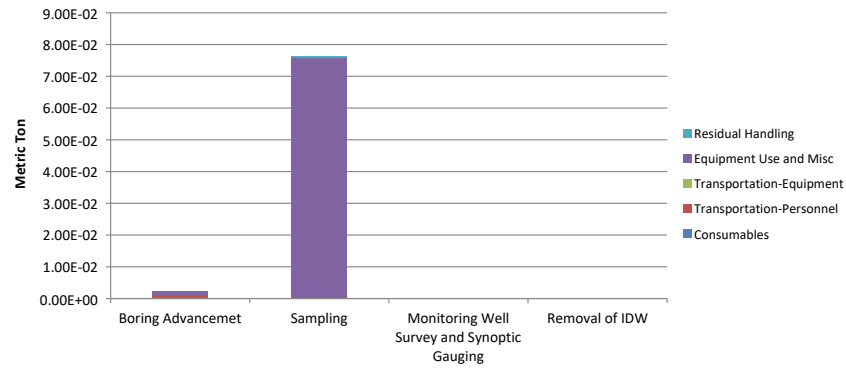
Onsite SOx Emissions



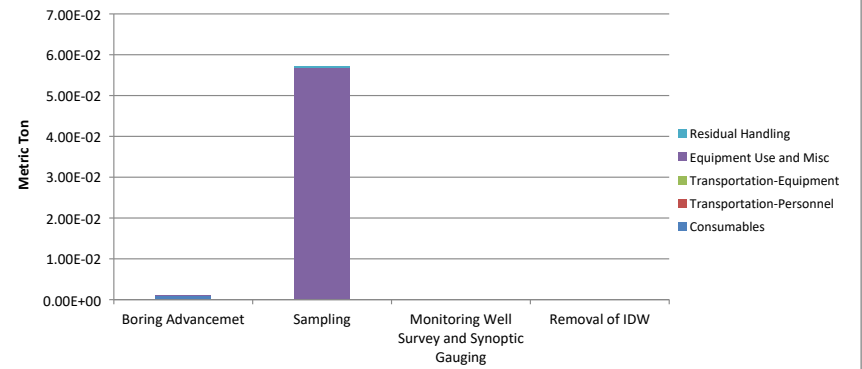
Onsite PM₁₀ Emissions



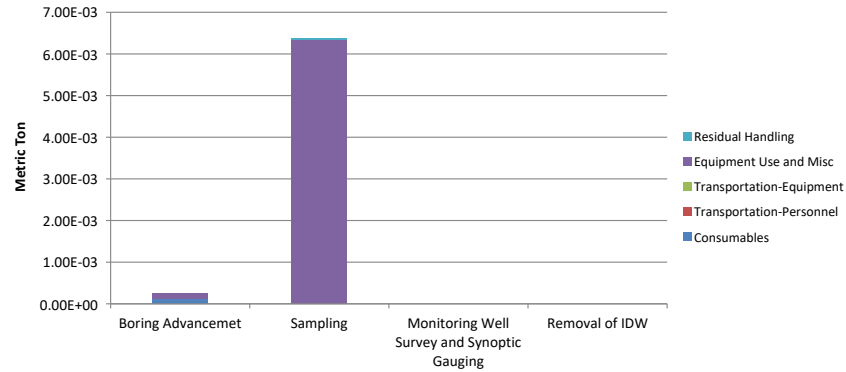
Total NOx Emissions



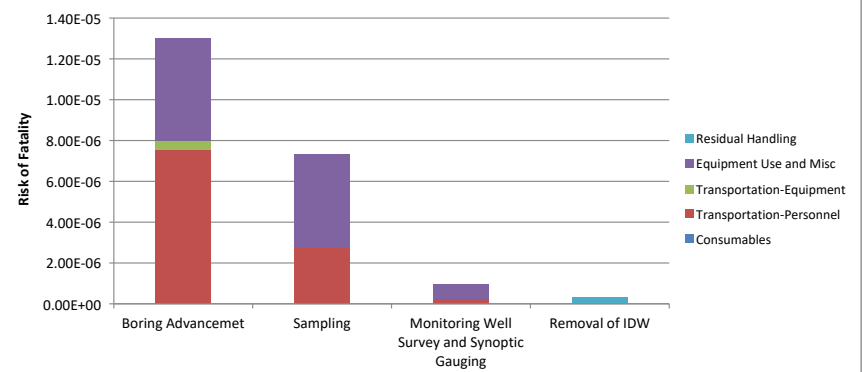
Total SOx Emissions



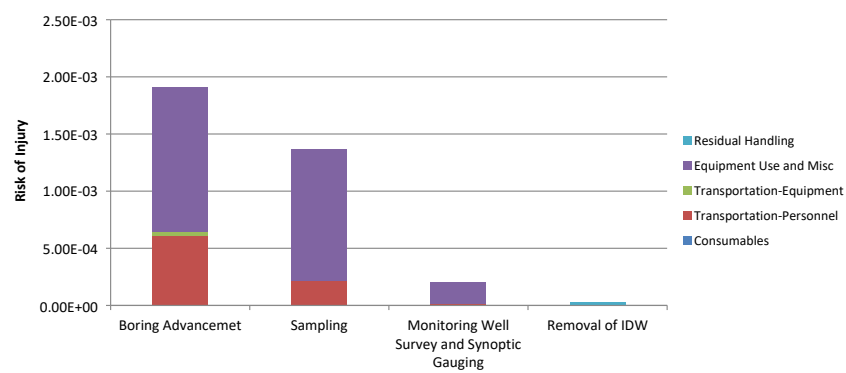
Total PM₁₀ Emissions



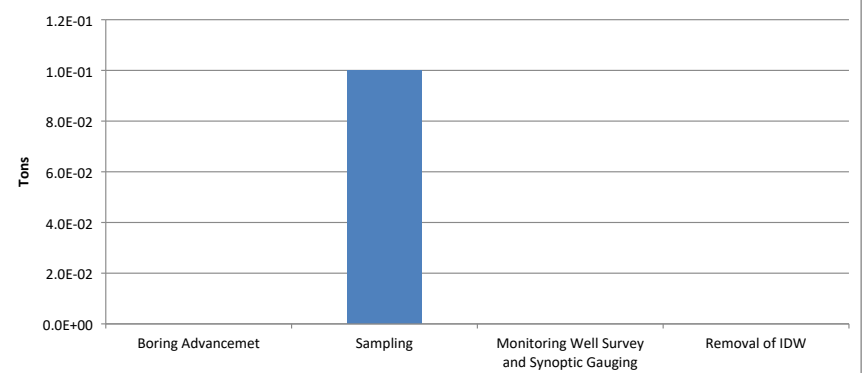
Accident Risk - Fatality



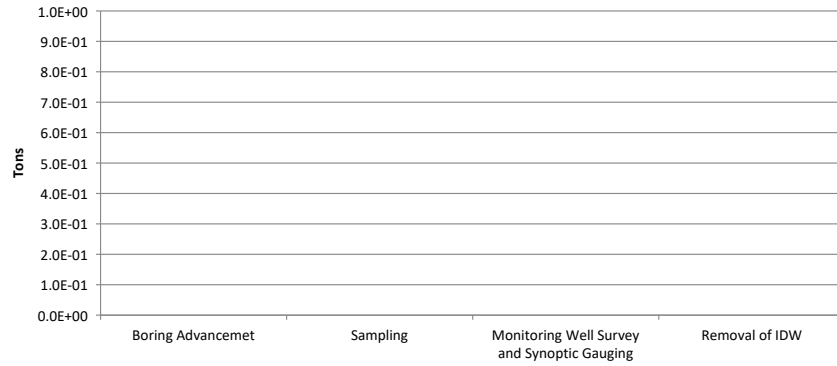
Accident Risk - Injury



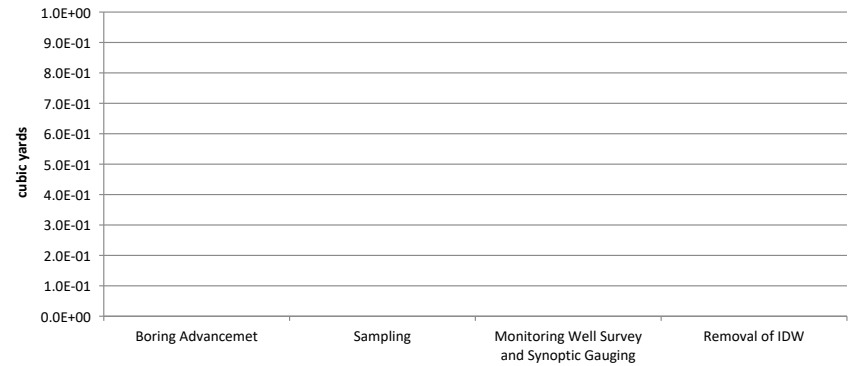
Non-Hazardous Waste Landfill Space



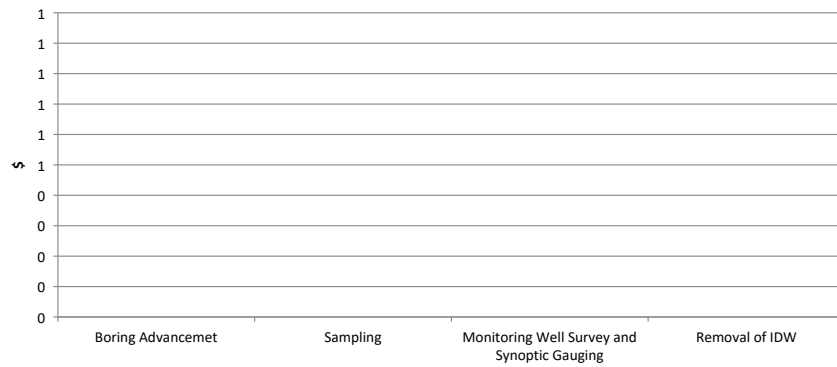
Hazardous Waste Landfill Space



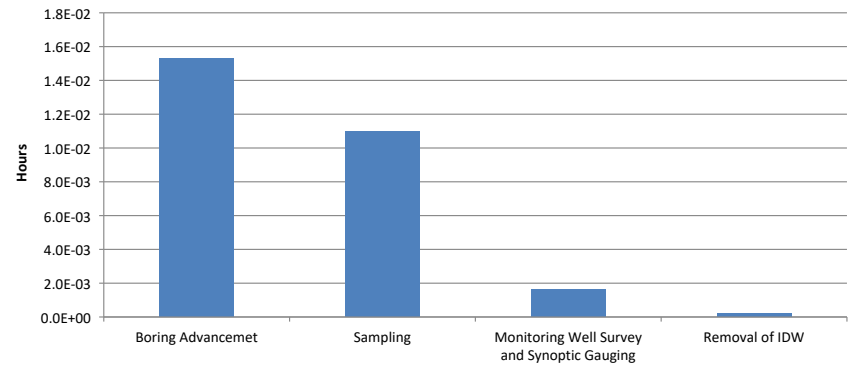
Topsoil Consumption



Costing



Lost Hours - Injury



APPENDIX F

Climate Screening Checklist

Climate Screening Checklist

Background Information

- **Project Manager:** Gregory Wyka, P.G.
- **Site Name:** RBEC1
- **Site Number:** CXXXXX
- **Site Location:** 441 West 26th Street, New York, NY
- **Site Elevation (average above sea level):** According to the 2017 United States Geological Survey (USGS) 7.5-minute quadrangle topographic map for Manhattan, the site is at an elevation of approximately 16 feet above mean sea level (msl) with a gentle slope downward toward the west. The regional topography slopes downward to the west toward the Hudson River, which is located approximately 1,750 feet to the north-northwest of the site.
- **ClimAID Region:** Region 4 – New York City and Long Island



- **Remedial Stage/Site Classification:** Remedial Design Stage, Class A
- **Contamination - Media Impacted/ Contaminants of Concern:**

Based on the source, concentration, frequency, and locations of contaminants identified in soil across the site, the contaminants of concern for the site are semivolatile organic compounds (SVOCs), pesticides, and metals in soil; volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), and metals in groundwater; and chlorinated volatile organic compounds (CVOCs) in soil vapor. Contaminants of concern will be further identified following implementation of the Remedial Investigation Work Plan (RIWP).
- **Proposed/Current Remedy:**

The site will be undergoing a remedial investigation to develop a remedy. The remedy will be identified in a forthcoming Remedial Action Work Plan.

- **What is the predicted timeframe of the remedy? Will components of the remedy still be in place in 10+ years?**

The site will be undergoing a remedial investigation to develop a remedy. The remedy will be identified in a forthcoming Remedial Action Work Plan.

- **Is the site in proximity to any sensitive receptors? (e.g. wetlands, waterbodies, residential properties, hospitals, schools, drinking water supplies, etc.)**

Land use within a half-mile radius includes residential, commercial, industrial and manufacturing, institutional uses, and parks. Sensitive receptors, as defined in DER-10, located within a half mile of the site are listed below:

Number	Name (Approximate distance from site)	Address
1	P.S. 33 Chelsea Prep (about 0.07 mile east of the site)	281 Ninth Avenue New York, NY 10001
2	Manhattan Schoolhouse (about 0.2 mile northwest of the site)	507 West 28 th Street #1412 New York, NY 10001
3	Avenues: The World School Science/Design/Arts and Early Learning Center (about 0.20 mile northwest of the site)	536 West 26 th Street New York, NY 10001
4	Penn South Social Services (about 0.20 mile east of the site)	290A Ninth Avenue New York, NY 10001
5	Church of the Holy Apostles (about 0.20 mile northeast of the site)	296 Ninth Avenue New York, NY 10001
6	Manor Community Church (about 0.20 mile east of the site)	350 West 26 th Street New York, NY 10001
7	St. Eleftherios' Greek Orthodox Church (about 0.20 mile southeast of the site)	359 West 24 th Street #361 New York, NY 10011
8	Bright Horizons at Chelsea (about 0.30 mile southeast of the site)	258 West 26 th Street New York, NY 10001
9	Chelsea Nanny (about 0.30 mile southeast of the site)	341 West 24 th Street New York, NY 10011
10	Guardian Angel Roman Catholic Church (about 0.30 mile south of the site)	Church of the Guardian Angel 193 Tenth Avenue New York, NY 10011
11	CityMD Chelsea Urgent Care – Manhattan (about 0.30 mile south of the site)	400 West 23 rd Street New York, NY 10011
12	Neighborhood Church of Greenwich Village (about 0.40 mile southeast of the site)	315 West 22 nd Street New York, NY 10011
13	Mount Sinai Doctors – West 23 rd Street (about 0.40 mile southeast of the site)	309 West 23 rd Street New York, NY 10011
14	San Jose Day Nursery Inc. (about 0.40 mile south of the site)	432 West 20 th Street New York, NY 10011
15	P.S. 11 Sarah J. Garnet School (about 0.50 mile southeast of the site)	320 West 21 st Street New York, NY 10011
16	High School of Fashion Industries (about 0.50 mile southeast of the site)	225 West 24 th Street New York, NY 10011
17	Atlas School/Atlas Foundation for Autism (about 0.50 mile east of the site)	252 West 29 th Street New York, NY 10001

Number	Name (Approximate distance from site)	Address
18	Go Beyond Family Day Care (about 0.50 mile east of the site)	178 West 27 th Street, Suite 527 New York, NY 10012

- Is the site in a disadvantaged community (DAC) or potential environmental justice area (PEJA) (Use DECinfoLocator: [DECinfo Locator \(ny.gov\)](https://decinfo.locator.ny.gov/))?

☒ Yes ☐ No

The site is located in a DAC and a PEJA as shown below (map taken from the DECInfo Locator)



If the site is in a DAC or PEJA, will climate impacts be magnified? If yes, list how and why.

☐ Yes ☒ No

- Should thresholds of concern be lowered to account for magnification of impacts? If yes, indicate how lower thresholds will be used in the screening.

☐ Yes ☒ No

Climate Screening Table*

Potential Climate Hazards	Relevant to the Site Location (Y/N/NA) ¹	Projected Change (Reference data source/Model) ³	Potential to Impact Remedy (Y/N)	Is remedy/site already resilient? (Y/N) ⁴
Precipitation	Potentially - Based on the Resilience Analysis and Planning Tool (RAPT)	N/A – Based on RAPT	N	Y – Stormwater managed by existing infrastructure.
Temperature ² (Extreme Heat or Cold Weather Impacts)	Potentially – Based on RAPT	N/A – Based on RAPT	N	Y
Sea Level Rise	N – Based on Sea Level Rise Viewer	N/A	N/A	N/A
Flooding	N – Based on FEMA National Flood Hazard Layer	N/A	N/A	N/A
Storm Surge	N – Based on Storm Surge Hazard Maps	N/A	N/A	N/A
Wildfire	N – Based on RAPT	N/A	N/A	N/A
Drought	N – Based on US Drought Portal	N/A	N/A	N/A
Storm Severity	N – Based on RAPT	N/A	N/A	N/A
Landslides	N – Based on RAPT	N/A	N/A	N/A
Other Hazards:	N – Based on RAPT	N/A	N/A	N/A

* Links to potential data sources can be found on the following page

¹ If the first column is N --> The rest of the columns will be N/A, the hazard is not applicable to the site.

² Extreme Heat: periods of three or more days above 90°F- Extreme Cold: Individual days with minimum temperatures at or below 0 degrees F (NYSERDA ClimAID report)

³ List the projected change in specific terms or units e.g. inches of rain fall, feet of sea level rise, etc.

⁴ If final column is Y, provide reasoning, if the final column is N --> Climate Vulnerability Assessment (CVA) required.

Required Next Steps (If no further action is required, provide justification):

No further actions are required.

Potential Data Sources (not an exhaustive list)- from [Superfund Climate Resilience: Vulnerability Assessment](#) | [US EPA](#)

NYSERDA ClimAID report- [Responding Climate Change in New York State \(ClimAID\)](#) - NYSERDA

FEMA- [National Flood Hazard Layer](#) | [FEMA.gov](#)

NOAA- [National Storm Surge Risk Maps - Version 3](#) ([noaa.gov](#))

Department of Agriculture Forest Service [Wildfire Risk to Communities](#)

EPA [Climate Change Indicators in the United States](#)

EPA [Climate Resilience Evaluation & Awareness Tool \(CREAT\)](#) | [U.S. Climate Resilience Toolkit](#)

EPA [National Stormwater Calculator](#)

National Integrated Drought Information System [U.S. Drought Portal](#)

National Interagency Coordination Center [National Interagency Fire Center](#)

National Oceanic and Atmospheric Administration Coastal Services [Digital Coast](#)

- Resources to help communities assess coastal hazards, such as the [Sea Level Rise Viewer](#) for visualizing community-level impacts of flooding or sea level rise and [downloadable LIDAR data](#)
National Oceanic and Atmospheric Administration [National Centers for Environmental Information](#) website

National Oceanic and Atmospheric Administration [Sea Level Trends](#)

National Weather Service [Climate Prediction Center](#)

National Weather Service [National Hurricane Center](#)

National Weather Service [Sea, Lake, and Overland Surges from Hurricanes \(SLOSH\)](#)

National Weather Service [Storm Surge Hazard Maps](#)

U.S. Federal Government Climate Resilience Toolkit: [The Climate Explorer](#)

U.S. Army Corps of Engineers [Climate Preparedness and Resilience](#)

U.S. Geological Survey [Coastal Change Hazards Portal](#)

U.S. Geological Survey [Landslide Hazards Program](#)

U.S. Geological Survey [National Ground-water Monitoring Network Data Portal](#)

U.S. Geological Survey [National Climate Change Viewer](#)

U.S. Geological Survey [National Water Dashboard](#)

U.S. Geological Survey [StreamStats](#)

NYS Department of State- [Assess](#) | [Department of State \(ny.gov\)](#)

NYSERDA NY Costal Floodplain Mapper- [Home Page \(ny.gov\)](#)

NYSDEC Costal Erosion Hazards- [Coastal Areas Regulated By The CEHA Permit Program](#) - NYDEC

NYSDOH Heat Index- [health.ny.gov/environmental/weather/vulnerability_index/county_maps.htm](#)

APPENDIX G

BCP Schedule

**Appendix G - BCP Schedule
Remedial Investigation Work Plan**

**RBEC1
441 West 26th Street
New York, NY
Langan Project No.: 170930902**

Item	Action	2025						2026											
		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	BCP Eligibility Investigation and Report																		
2	Pre-Application Meeting with NYSDEC (Optional)																		
3	BCP Application and RIWP - Preparation and Submission																		
4	BCP Application - NYSDEC Review/Completeness Determination																		
5	BCP Application - Public Comment Period (30 Days)																		
6	Execute BCA Agreement																		
7	Existing Building Demolition																		
8	RIWP - NYSDEC Review and Approval																		
9	RI - Implementation																		
10	RIR - Preparation and Submission																		
11	RIR - NYSDEC Review and Approval																		
12	RAWP - Preparation and Submission																		

Notes:

1. This is an estimated schedule; all items are subject to change, based on agency review.
BCP schedule shown through RAWP preparation. NYSDEC approval of RAWP, implementation of the RAWP, and closure reporting schedules will be determined at a future
2. BCP = Brownfield Cleanup Program
3. NYSDEC = New York State Department of Environmental Conservation
4. RIWP = Remedial Investigation Work Plan
5. RI = Remedial Investigation
6. RIR = Remedial Investigation Report
7. RAWP = Remedial Action Work Plan
8. SMP = Site Management Plan
9. FER = Final Engineering Report
10. EE = Environmental Easement
11. BCA = Brownfield Cleanup Agreement
12. A Certificate of Completion (COC) is anticipated for December 2027.

	Completed
	Anticipated Schedule
	Anticipated Demolition Schedule