SUPPLEMENTAL REMEDIAL INVESTIGATION WORK PLAN

for

Former ACME Steel/Brass Foundry
72 Anthony Street/498 Porter Avenue
Brooklyn, New York
NYSDEC Site No. 224132

Prepared For:

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LANGAN

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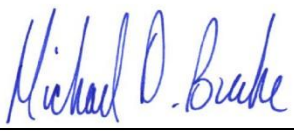
CERTIFICATION

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



Michael D. Burke, CHMM

1.0 INTRODUCTION

This Supplemental Remedial Investigation Work Plan (SRIWP) was prepared on behalf of Whitehead Company for the property located at 72 Anthony Street/498 Porter Avenue in the Greenpoint section of Brooklyn, New York (the "Site"). Pursuant to the December 2010 Consent Order, the Site is a New York State Department of Environmental Conservation (NYSDEC) Class 2 Inactive Hazardous Waste Disposal Site (IHWDS), Site No. 224132. This SRIWP details proposed investigation activities designed to supplement the work detailed in Langan's June 2013 Remedial Investigation Report (RIR), revised January 22, 2016. The NYSDEC approved the revised RIR in an email dated February 26, 2016.

The objective of this SRIWP is to further investigate and characterize the nature and extent of environmental impacts on the Site to support evaluation of potential remedial actions. This SRIWP was prepared in accordance with the process identified in the NYSDEC Division of Environmental Remediation Technical Guidance for Site Investigation and Remediation (DER-10). Potential off-site investigation work is pending the results of this supplemental remedial investigation (RI) and the reconstruction of the Kosciusko Bridge.

2.0 SITE BACKGROUND

2.1 Site Description

The Site occupies an approximate area of 52,860 square feet at 72-90 Anthony Street and 498 Porter Avenue (Tax Block 2820, Lots 1 and 5) in Brooklyn, New York. Adjoining properties include Porter Avenue to the west, a warehouse building to the east, Lombardy Street to the south, and Anthony Street to the north. The Site is owned by the Whitehead Company, LLC and contains one one-story building, a truck maintenance yard, a storage shed, and a bus parking lot. The one-story building is occupied by a custom carpentry company and a produce distribution warehouse. To the east, a storage shed and truck parking lot abut the produce distribution warehouse. A bus parking lot abuts the truck parking lot, further to the east. The truck maintenance yard located within the southern half of the Site is operated by City Wide Container Service and includes an office trailer and a maintenance shop within a corrugated metal enclosure. A Site Location Map is provided as Figure 1. A Site Plan is presented on Figure 2.

2.2 Site Environmental History

The Site, located within the Meeker Avenue Plume Trackdown (Trackdown) site in the Greenpoint/East Williamsburg Industrial Area section of Brooklyn, New York, operated as a brass foundry from the 1960s to approximately 1993 and as a steel door finishing facility from 1993 to around 2009. The Trackdown site is located within a region of historic petroleum refining and storage operations that occupied a significant part of the Greenpoint neighborhood.

The Trackdown site straddles the Brooklyn-Queens Expressway and extends southwest to northeast from Kingsland Avenue to the Newtown Creek. Northern borders of the study area include Meserole and Norman Avenues and Bridgewater Street. The main southern border of the study area is Lombardy Street, with the exception of two blocks between Kingsland and Morgan Avenues where the area extends to Frost Street and one block between Morgan and Vandervoort Avenues where the area extends to Withers Street. Part of the Trackdown site is underlain by a petroleum free-phase product plume that originates at the British Petroleum (BP) bulk storage terminal north of the Site.

Investigations conducted by the URS Corporation (URS) on behalf of the NYSDEC and others within the Trackdown site identified chlorinated volatile organic compounds (CVOCs), including tetrachloroethene (PCE) and trichloroethene (TCE), in soil, soil vapor, and groundwater. In response to these findings, the NYSDEC initiated several investigations to identify the sources of chlorinated solvents. Based on the findings of their investigations and the historic generation of F001 waste (i.e., spent halogenated solvents used in degreasing), URS and NYSDEC identified the Site as a source of CVOCs in the subsurface.

2.2.1 Remedial Investigation

Langan conducted an RI on behalf of the Whitehead Company between September 18, 2012 and January 16, 2013. The RI identified historic fill to depths of up to about 9 feet below grade surface (bgs), underlain by the Upper Glacial Aquifer (i.e. Upper Pleistocene deposits). The Upper Glacial Aquifer consists of glacial outwash deposits consisting of interbedded layers of sand/gravel, clay/silty clay, and fine to coarse sand units and extends to the maximum RI soil boring depth of 95 feet bgs. This unit is underlain by the deep clay of the Raritan Formation, which was encountered in a previous URS soil boring advanced near the southeast corner of the Site. A clay/silty clay unit exists within the Upper Glacial Aquifer and overlies groundwater across the Site, with the exception of the northern Site boundary. Groundwater was present at depths of between about 52 and 59 feet bgs; shallow and deep overburden groundwater flows in a northeasterly direction toward Newtown Creek.

The RI identified CVOCs and 1,4-dioxane in soil at concentrations greater than their NYSDEC Unrestricted Use Soil Cleanup Objectives (SCOs). The RI identified chlorinated ethenes, including PCE, TCE, their degradation products (1,1-dichloroethene [DCE] and cis-1,2-dichloroethene [cDCE]) and chlorinated ethanes, including 1,1,1-trichloroethane [TCA], 1,1-dichloroethane [DCA], and 1,2-dichloroethane [DCA] – in shallow and deep overburden groundwater at concentrations exceeding their respective NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values (AWQS). PCE and TCE were detected in subslab soil vapor at concentrations greater than their respective New York State Department of Health (NYSDOH) Air Guideline Values (AGVs). The

NYSDOH AGVs for PCE (30 micrograms per cubic meter [µg/m^3]) and TCE (2 µg/m^3) are intended for comparison to concentrations in air; NYSDOH AGVs are used for comparison in the RI due to the absence of guidance values for soil vapor. TCE was detected in one indoor air sample at a concentration that marginally exceeded that recommended by NYSDOH for residential communities; PCE was not.

The occurrence of PCE in groundwater coincided with PCE-impacted soil, suggesting that Site soil may be a source of groundwater impacts; however, the impact of Site soil on groundwater is likely limited by interbedded clay and silty clay that underlies the Site. PCE and TCE concentrations in upgradient monitoring wells were greater than those at the Site, suggesting that the Site was impacted by an upgradient off-site PCE source. PCE concentrations in Site groundwater were lower than concentrations at downgradient perimeter monitoring wells, indicating that a former soap manufacturer and lacquer storage at 171 Lombardy Street and 514 Varick Avenue may contribute to CVOC impacts in Site groundwater. The extent of TCE in groundwater was delineated, originating at an off-site source to the west and attenuating across the Site from west to east.

2.3 Surrounding Property Land Use

The Site is located in an urban setting that is characterized by industrial and manufacturing developments. The following is a summary of surrounding property usage:

DIRECTION	ADJACENT PROPERTIES	SURROUNDING PROPERTIES
North	City Wide truck bin storage area and a trucking company at 91-95 Anthony Street Trucking company at 521 Varick Avenue	Various one-story manufacturing/warehouse buildings and the Brooklyn-Queens Expressway
South	National Grid Major Oil Storage Facility (MOSF) (Former Brooklyn Union Gas Company) Facility	Recreational fields, various multi-story commercial and residential buildings
East	One-story manufacturing/warehouse buildings at 157-169 Lombardy Street used as truck and bus repair facilities	Various one-story manufacturing/warehouse buildings
West	One-story manufacturing/warehouse buildings at 115-117 Lombardy Street and 46 Anthony Street (NYSDEC IHWDS No. 224131; ACME Steel/Metal Works)	Various one-story industrial and manufacturing/warehouse buildings

Land use within a half mile of the Site is densely urbanized. Surrounding land use within a half-mile radius includes numerous industrial and manufacturing facilities, Newtown Creek, cross streets and avenues, residential neighborhoods, park land, and school facilities.

The nearest ecological receptor is Newtown Creek, which is approximately a half mile to the north and east of the Site. The nearest sensitive receptor is a temporarily closed playground located approximately 250 feet northwest of the Site. Sensitive receptors within a half mile of the Site include the following:

Number	NAME	ADDRESS
1	Sargent William Dougherty Playground (currently closed because of Kosciusko Bridge reconstruction)	Anthony Street and Vandervoort Avenue
2	The Monitor School – P.S. 110	124 Monitor Street
3	Monsignor McGolrick Park	Monitor Street and Driggs Avenue
4	Frost Playground	Frost Street and Debevoise Avenue
5	Red Shed Garden	Kingsland Avenue and Skillman Avenue
6	Lentol Garden	Humboldt Street and Meeker Avenue
7	Cooper Park	Maspeth Avenue and Morgan Avenue
8	Greenpoint Little League Ball Field	Division Place and Vandervoort Avenue

Major infrastructure systems (i.e., storm drains, sewers, and underground utility lines) exist within the streets surrounding the Site.

2.4 Summary of Previous Environmental Investigations

The following environmental reports exist for the Site:

- Phase I Environmental Site Assessment (ESA) – Acme Architectural Products, 72 Anthony Street, prepared by Impact Environmental Consulting (IEC), March 30, 1998;
- Phase I Site Characterization Data Summary Report, prepared by URS, October 2007;
- Phase II Site Characterization Data Summary Report, prepared by URS, April 2008;
- Phase III Site Characterization Data Summary Report, prepared by URS, October 2008;
- Phase IV Site Characterization Data Summary Report, prepared by the URS Corporation, dated May 2009;
- Site Characterization; Public Version – Soil Vapor Intrusion Data Summary Report, 2008-2009 Heating Season, Greenpoint/East Williamsburg Industrial Area, prepared by URS, dated July 2009;
- Phase V Site Characterization Data Summary Report, prepared by URS, dated October 2009;
- Letter Report – November 2009 Groundwater Sampling Event; Meeker Avenue Plume Trackdown – Greenpoint/East Williamsburg Industrial Area, prepared by URS, dated January 2010;
- Chlorinated Solvent Plume – Meeker Avenue, prepared by Zymax Forensics, dated October 29, 2009;

- Groundwater Split Sampling Letter Report, prepared by URS, February 2010;
- Phase VI Site Characterization Data Summary Report, prepared by URS, April 2012; and
- Remedial Investigation Report, prepared by Langan, June 2013 (revised January 22, 2016).

Previous environmental reports were reviewed in detail in a Records Search Report, dated May 27, 2011, and summarized in Langan's RIR.

2.5 Areas of Concern

The following AOCs were identified in the Records Search Report, based on a review of the previous environmental reports, site observations, and development history. The locations and extent of the AOCs were further refined during the RI. The locations of the AOCs and RI sample locations are shown on Figure 3. A discussion of the proposed supplemental investigation of these AOCs is presented in Section 3.

AOC 1: Former Chemical Consolidation and Storage Area

AOC 1 represents the area in which drums containing primers, cutting oils, hydraulic oils, waste water, xylene, waste paints, adhesives, waste degreasers, steam cleaners and waste oil were managed and stored. This former drum storage area was used as a chemical transfer station to consolidate chemical waste from the surrounding ACME facilities and is located in the bus parking lot near the northeast corner of the Site. Surficial staining was apparent throughout this area during the RI. The AOC 1 boundaries previously shown in the RIWP were roughly approximated based on the 1998 IEC Phase I ESA, showing a general area labeled "Drum storage". The current understanding of the AOC 1 area is based on Site observations and a survey of a concrete pad, which was documented in the Phase I ESA as being part of the previous drum storage area.

AOC 1 was investigated during the RI with one deep soil boring (ACME-EB-5), one monitoring well couplet (ACME-MW-5 and ACME-MW-5D), and one subslab soil vapor point (ACME-SV-5). AOC 1 will be further investigated during SRIWP implementation by advancing at least four soil borings to groundwater, with two additional contingency soil borings to be advanced if further delineation is required, based on field observations.

AOC 2: Sanitary Sewer Cleanout

Based on Langan field observations, a sanitary sewer cleanout is located in the northwest corner of the Site building at 72 Anthony Street. This cleanout was described as a "dry well/underground injection well" in IEC's Phase I ESA, which also noted the presence of a second dry well nearby. No dry wells were identified during multiple Site inspections and a

geophysical survey performed by Langan. IEC's use of the term "dry well" was found to be inconsistent with the nature of Site features, including the observed sanitary sewer cleanout.

The sanitary sewer cleanout comprising AOC 2 was investigated during the RI with one shallow soil boring (ACME-GP-7), one deep soil boring (ACME-EB-7), one monitoring well couplet (ACME-MW-7 and ACME-MW-7D), and one subslab soil vapor point (ACME-SV-7). No further investigation at AOC 2 is proposed.

AOC 3: PCE-Impacted Soil

Soil sampling performed by the NYSDEC in 2007 revealed a PCE concentration of 200 milligrams per kilogram (mg/kg) in shallow soil (5-6 feet bgs) on the northern Site sidewalk. This soil coincides with NYSDEC monitoring wells DEC-016 and DEC-016D.

AOC 3 was investigated during the RI with three delineation soil borings (ACME-EB-10 to ACME-EB-12). No further investigation at AOC 3 is proposed as part of this SRIWP.

AOC 4: Drum Storage Area

A drum storage area with open drums and stained soil was identified between the Site building at 72 Anthony Street and the City Wide vehicle maintenance area during a Site inspection prior to the RI.

AOC 4 was investigated during the RI with one soil boring (ACME-EB-6) and one monitoring well (ACME-MW-6). AOC 4 will be further investigated during SRIWP implementation by advancing one soil boring to groundwater.

AOC 5: Historic Painting/Degreasing Operations

Historic painting and degreasing operations with documented uses of 1,1,1-TCA were performed inside the building at 72 Anthony Street. The AOC 5 area was revised and expanded in the January 2016 RIR; the former AOC 5 location was within the building labeled as a produce distribution warehouse on Figure 2, was based on Site observations of a concrete patch that was believed to be indicative of a former paint booth, and was agreed upon by Langan and the NYSDEC during a site walk. A subsequent site walk on July 29, 2015 confirmed that the likely location of the historic paint storage, spray booths, and drying ovens is within the building currently used by a custom carpentry company and depicted on Figure 2. Figure 3 shows the expanded location of AOC 5.

AOC 5 was investigated during the RI with one shallow soil boring (ACME-GP-9), one deep soil boring (ACME-EB-9), one monitoring well couplet (ACME-MW-9 and ACME-MW-9D), and one subslab soil vapor point (ACME-SV-9). The expanded AOC 5 will be further investigated during

SRIWP implementation by advancing four soil borings to groundwater, with a fifth soil boring to be advanced to about 95 feet bgs and completed with a shallow/deep monitoring well couplet.

3.0 SCOPE OF WORK

The SRIWP objective, in conjunction with the existing RI data, is to prepare a scope of work for the "investigation and characterization of the nature and extent of the contamination within the boundary of the Site", per Environmental Conservation Law Article 27, Title 14 (Brownfield Legislation). This section presents the sampling rationale in relation to the AOCs and details the proposed investigation scope of work.

- Geophysical Survey
    - The survey will attempt to identify potential underground storage tanks (USTs), underground utilities, and other subsurface anomalies in areas that were inaccessible for screening during the RI. The findings of the geophysical survey will inform the placement of sample locations.
- Soil Borings and Sampling
    - Advancement of 10 soil borings (ACME-GP-15 through ACME-GP-23 and ACME-EB-14) to a maximum depth of about 95 feet bgs, with 2 contingency soil borings (ACME-GP-24 and ACME-GP-25) to be advanced if additional delineation is required at AOC 1.
    - Collection of at least 3 soil samples from each soil boring, with additional contingency soil sample(s) to be collected based on field observations. At least 31 soil samples (plus quality assurance/quality control [QA/QC] sampling) will be collected.
- Monitoring Well Installation and Sampling
    - Installation of a shallow and deep monitoring well couplet (ACME-MW-14/14D) at one soil boring location.
    - Collection of 1 groundwater sample from each newly-installed monitoring well, 7 existing on-site monitoring wells, and 11 existing off-site monitoring wells for a total of 20 groundwater samples (plus QA/QC sampling).
    - Survey and synoptic gauging of on-site and off-site monitoring wells to evaluate groundwater flow direction.

Modifications to this scope of work may be required: 1) due to site operations, equipment limitations or restrictions; 2) due to geophysical survey results or if unexpected contamination is encountered and additional analytical data is needed; and 3) to adequately characterize and

delineate AOCs in compliance with applicable regulations and investigation guidance documents (e.g., DER-10).

The field investigation work will be completed in accordance with the procedures specified in Langan's Health and Safety Plan (HASP) and Quality Assurance Project Plan (QAPP) provided in Appendices A and B, respectively.

Names, contact information, and roles of the personnel who will participate in the investigation including the NYSDEC/NYSDOH personnel, project manager, contractor and subcontractor contacts are listed below. Resumes for each Langan employee are provided in the QAPP (Appendix B).

Personnel	Investigation Role	Contact Information
David K. Harrington, P.E. NYSDEC	NYSDEC Point of Contact	Phone – 518-402-9768 Email – david.harrington@dec.ny.gov
Henry Wilkie NYSDEC	Hazardous Waste Disposal Coordination	Phone – 518-402-9622 Email – henry.wilkie@dec.ny.gov
Dawn E. Hettrick, PE NYSDOH	NYSDOH Point of Contact	Phone – 518-402-4860 Email – dawn.hettrick@health.ny.gov
Michael D. Burke, CHMM Langan Engineering	Project Director	Phone – 212-479-5413 Email – mburke@langan.com
Jason Hayes, P.E. Langan Engineering	Project Engineer	Phone – 212-479-5427 Email – jhayes@langan.com
Gerald Nicholls, P.E. Langan Engineering	Project Manager	Phone – 212-479-5559 Email – gnicholls@langan.com
Tony Moffa, CHMM Langan Engineering	Langan Health & Safety Officer	Phone – 215-491-6500 Email – tmoffa@langan.com
Bill Bohrer Langan Engineering	Field Safety Officer	Phone – 410-984-3068 Email – wbohrer@langan.com
Patrick Farnham, P.E. Langan Engineering	Field Team Leader	Phone – 212-479-5578 Email – pfarnham@langan.com
Michael Skirka, CHMM Langan Engineering	Quality Assurance Manager	Phone – 201-240-0652 Email – mskirka@langan.com
Steve Plofker AARCO	Drilling Contractor	Phone – 631-586-8900 Email – splofker@aarcoenvironmental.com
Richard August York Analytical Laboratories	Laboratory Contractor	Phone – 203-325-1371, ext. 834 Email – raugust@Yorklab.com
Emily Strake Langan Engineering	Data Validator	Phone – 215-491-6500 Email – estrake@langan.com

3.1 Soil Investigation

3.1.1 Drilling and Logging

An environmental drilling subcontractor will advance 10 soil borings (ACME-GP-15 through ACME-GP-23 and ACME-EB-14), with 2 additional contingency borings (ACME-GP-24 and ACME-GP-25) to be advanced within AOC 1 if additional delineation is needed. The purpose of these borings is to supplement the RI by further investigating the AOCs identified in Section 2.5; soil boring location rationale is provided in the following table:

AOC	Proposed Soil Boring ID	Rationale
AOC 1	ACME-GP-20	Four soil borings to groundwater to investigate potential impacts beneath a former chemical consolidation and storage area.
	ACME-GP-21	
	ACME-GP-22	
	ACME-GP-23	
	ACME-GP-24 (Contingency)	Contingency soil borings to groundwater to delineate any impacts to soil and/or groundwater observed in ACME-GP-20 through ACME-GP-23.
	ACME-GP-25 (Contingency)	
AOC 2	None	No further investigation proposed in this SRIWP
AOC 3	None	No further investigation proposed in this SRIWP
AOC 4	ACME-GP-15	Soil boring to groundwater to investigate potential impacts southeast of a drum storage area with stained soil.
AOC 5	ACME-GP-16	Soil boring to groundwater to investigate potential impacts south of a former drying oven.
	ACME-MW-14D/MW-14/EB-14	Deep soil boring and monitoring well couplet to investigate potential impacts within AOC 5.
	ACME-GP-17	Soil boring to groundwater to investigate potential impacts south of a former paint storage area.
	ACME-GP-18	Soil boring to groundwater to better define impacts east of AOC-5, between RI soil boring locations ACME-EB-11 and ACME-EB-9.
	ACME-GP-19	Soil boring to groundwater to investigate potential impacts from a former degreasing dip tank.

A Langan engineer will document the work, screen the soil samples for environmental impacts, and collect environmental samples for laboratory analyses. Work will comply with the safety guidelines outlined in the HASP (Appendix A). Nine soil borings (and the two potential contingency borings) will be advanced to at least five feet below the observed water table (about 55 to 65 feet bgs) using a direct-push sampler (Geoprobe®). One soil boring will be

advanced below the observed groundwater depth to about 95 feet bgs using sonic drilling methodologies.

Soil will be screened continuously to the boring termination depth for organic vapors with a photoionization detector (PID) equipped with a 10.6 or 11.7 electron volt (eV) bulb, with OilScreenSoil (Indigo Blue)® non-SUDAN-based dye (to evaluate for the presence of dense non-aqueous phase liquid (DNAPL), and for visual and olfactory indications of environmental impacts (e.g., staining and odor). Soil descriptions will be recorded in field boring logs. Dye test product information is included within Appendix C.

Down-hole geophysics may be utilized to collect qualitative information about soil permeability, hydraulic conductivity, and stratigraphy. Gamma ray logging, which uses natural gamma radiation to identify soil type, may be used within open boreholes or permanent groundwater monitoring wells to determine the depths and thicknesses of observed strata. Data collected using gamma ray logging or other down-hole geophysical methods may be used in conjunction with soil boring logs to identify potential shallow and/or deep confining units. Additional information about gamma ray logging and example data are included in Appendix C.

Geotechnical information, including particle size distribution (ASTM D6913 – 04[2009]e1) and organic content (ASTM D2974-14) may be collected from soil sample(s) collected from impacted interval(s) in soil boring ACME-EB-14 using sonic drilling in conjunction with an undisturbed soil sampler(s). Undisturbed saturated soil samples may also be tested for permeability of granular soil (ASTM D2434-68 [2006]) or hydraulic conductivity (ASTM D5084-10), depending on the observed soil type. ASTM D2434-68 (2006) was withdrawn in 2015, with no recommended method replacement. If permeability of granular soil analysis is performed and a replacement method has not been issued by ASTM at the time of the analysis, the withdrawn standard will be used.

3.1.2 Soil Sampling

At a minimum, three grab soil samples will be collected for laboratory analysis from each boring location. For ACME-GP-15 through ACME-GP-23 (and contingency borings ACME-GP-24 and ACME-GP-25, if completed), one sample will be collected from the two foot interval directly beneath the existing building slabs, a second sample will be collected from the interval exhibiting the greatest degree of impacts based on field screening (i.e., visual observations, dye test results, odors, and PID readings above background), and a third sample will be collected at the groundwater interface. In the event that environmental impacts are apparent at the groundwater table, the boring will be advanced until refusal, impacts are no longer observed, or a confining layer is encountered. A fourth contingency sample may be collected from each soil boring if a second distinct depth interval exhibits impacts based on field screening (i.e., visual

observations, odors, PID readings above background, and positive dye test results). For ACME-EB-14, at least three soil samples will be collected from at or above the groundwater interface using the same criteria as ACME-GP-15 through ACME-GP-25. At least one additional soil sample will be collected to characterize observed impacts beneath the groundwater table, soil conditions above any observed confining layers, and/or conditions at soil boring termination depth.

Non-disposable down-hole drilling equipment and sampling apparatus will be decontaminated between locations with Alconox® and water. Following sampling, each soil boring that is not completed with a groundwater monitoring well will be backfilled beneath the groundwater table using bentonite followed by a bentonite-grout slurry between the water table and grade surface.

The samples will be collected in laboratory-supplied containers and will be sealed, labeled, and placed in a cooler containing ice (to maintain a temperature of approximately 4 degrees Celsius) for delivery to York Analytical Laboratory (York), a NYSDOH Environmental Laboratory Approval Program (ELAP)-certified analytical laboratory. Soil samples will be analyzed for Target Compound List (TCL) VOCs and tentatively-identified compounds (TICs), including 1,4-dioxane, via United States Environmental Protection Agency (USEPA) Method 8260C. If DNAPL is encountered, a representative sample(s) of the product will be collected for laboratory analysis. QA/QC procedures to be followed are described in the QAPP provided as Appendix B. Table 1 summarizes the proposed soil samples, including QA/QC samples.

3.2 Groundwater Investigation

3.2.1 Installation of Monitoring Wells

The proposed monitoring well location is shown on Figure 3. Soil boring ACME-EB-14 will be initially advanced using direct-push methods to termination depth or refusal. After the maximum depth is reached using direct push methods, a sonic drill will be used to over drill the boring and, if necessary, complete the boring to depth. Upon completion, the soil boring will be converted into a permanent shallow and deep monitoring well couplet. Both monitoring wells will be constructed with 10- or 15-foot screens and terminate with 2-foot sumps. The shallow well, ACME-MW-14, will be constructed such that the well screen will straddle the observed water table. The deep monitoring well, ACME-MW-14D, will either be set at about 95 feet bgs or at the top of the confining Raritan clay unit, if encountered. In the absence of gross impacts or free product, the shallow and deep wells will be installed within the same borehole using a minimum 4-foot hydrated bentonite seal overlain by a bentonite-grout slurry, installed vertically between the screens via the tremie method.

The shallow well will be constructed using 2-inch diameter, Schedule 40 polyvinyl chloride (PVC) riser pipe with 15 feet of Schedule 40 0.01-inch slotted screen. The deep well will be constructed using 2-inch diameter, schedule-80 PVC riser pipe with 10 feet of 0.01-inch slotted screen. The deep well will include a two-foot sump at the bottom of the well for the collection of DNAPL, if any. Clean sand will be used to fill the annulus around each screened interval to a height of about 2 feet above the screen, followed by a transition sand (e.g., Morie #00). Both wells will be backfilled to 1 foot bgs using bentonite-grout slurry installed via the tremie method. The wells will be finished with locking J-plugs and flush-mounted steel manhole covers set into concrete.

Following installation, the wells will be developed using a surge block across the well screen to agitate and remove fines. The surge block will be moved within the well screen in 2- to 3-foot increments for approximately 2 minutes per increment. After surging, the well will be purged via pumping until the water becomes clear (having turbidity less than 50 Nephelometric Turbidity Units [NTU]). The well will then be allowed to sit for a minimum of one week prior to collecting groundwater samples (Section 3.2.3).

3.2.2 Monitoring Well Survey

Langan will survey the location and elevation of the new and existing groundwater monitoring wells (top of casing elevations). This data will be used with groundwater well gauging data collected during SRIWP implementation to prepare an updated groundwater contour map and document the direction of groundwater flow. Vertical control will be established by surveying, performed relative to the NAVD88[1] datum by a NYS-licensed land surveyor. Elevations of the top of monitoring well casings and protective well casings will be surveyed to the nearest 0.01 foot.

3.2.3 Groundwater Sampling

One groundwater sample will be collected from each of the 20 on-site and off-site wells. Prior to sampling, static water levels will be surveyed in all wells via a synoptic gauging event and each well will be purged. Purging will consist of pumping, at minimum, the stabilized drawdown volume plus the pump's tubing volume, and waiting until the physical and chemical parameters (e.g., temperature, dissolved oxygen, oxygen reduction potential, turbidity) stabilize within the ranges specified in the United States Environmental Protection Agency (USEPA) Low Stress Purging and Sampling Procedure for the Collection of Groundwater Samples From Monitoring Wells, Dated July 30, 1996 and Revised January 19, 2010. Samples will be

[1] National Vertical Datum of 1988. Datum refers to the National Vertical Datum of 1988 (NAVD88) 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).

collected with a submersible pump or peristaltic pump and dedicated polyethylene tubing. The pump will be decontaminated with Alconox® and water between each sample location. Development and purge water will be containerized for off-site disposal.

Groundwater samples will be analyzed for TCL VOCs plus TICs and 1,4-dioxane by York. Per direction from the NYSDEC and NYSDOH, three groundwater samples from on-site monitoring wells will also be analyzed for TCL semivolatile organic compounds (SVOCs) via USEPA Method 8270D, polychlorinated biphenyls (PCBs) via USEPA Method 8082A, pesticides via USEPA Method 8081B, Target Analyte List (TAL) metals by USEPA Method 6010C/7000 series, and total cyanide by USEPA Method 9010C. QA/QC procedures are described in the QAPP provided as Appendix B. Table 2 summarizes the proposed groundwater sample summary, including QA/QC samples.

3.3 Management of Investigation-Derived Waste

Soil cuttings and purged groundwater generated during drilling, monitoring well development, and groundwater sampling will be containerized in 55-gallon drums. Containerized wastes generated from activities associated with this site will be segregated from waste generated from the adjacent site (224131 – 46 Anthony Street/95 Lombardy Street). Due to the known historical use of degreasing solvents, excess soil and groundwater generated during SRIWP implementation will be initially managed as Resource Conservation and Recovery Act (RCRA)/NYSDEC Part 371 F-listed hazardous waste (F001) for spent halogenated solvent/solvent mixtures from degreasing operations. The existing EPA Generator ID for 72 Anthony Street (NYD001281823) will be used unless a new generator ID is obtained.

After SRIWP implementation activities are complete, a waste characterization will be performed to determine whether the excess soil and groundwater can be considered non-hazardous waste through a contained-in policy demonstration. Waste characterization samples will be analyzed for VOCs and toxicity characteristic leaching procedure (TCLP) VOCs to comply with the requirements of the NYSDEC contained-in demonstration. The sampling frequency of the contained-in demonstration will be presented to and approved by NYSDEC prior to the collection of samples.

Waste characterization samples will also be analyzed for parameters that are typically required by disposal facilities, including TCL SVOCs, RCRA metals, PCBs, pesticides, herbicides, 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 material will be

transported off-site and disposed of at a permitted facility. Waste characterization samples will be submitted to York for analysis in accordance with the QAPP provided in Appendix B.

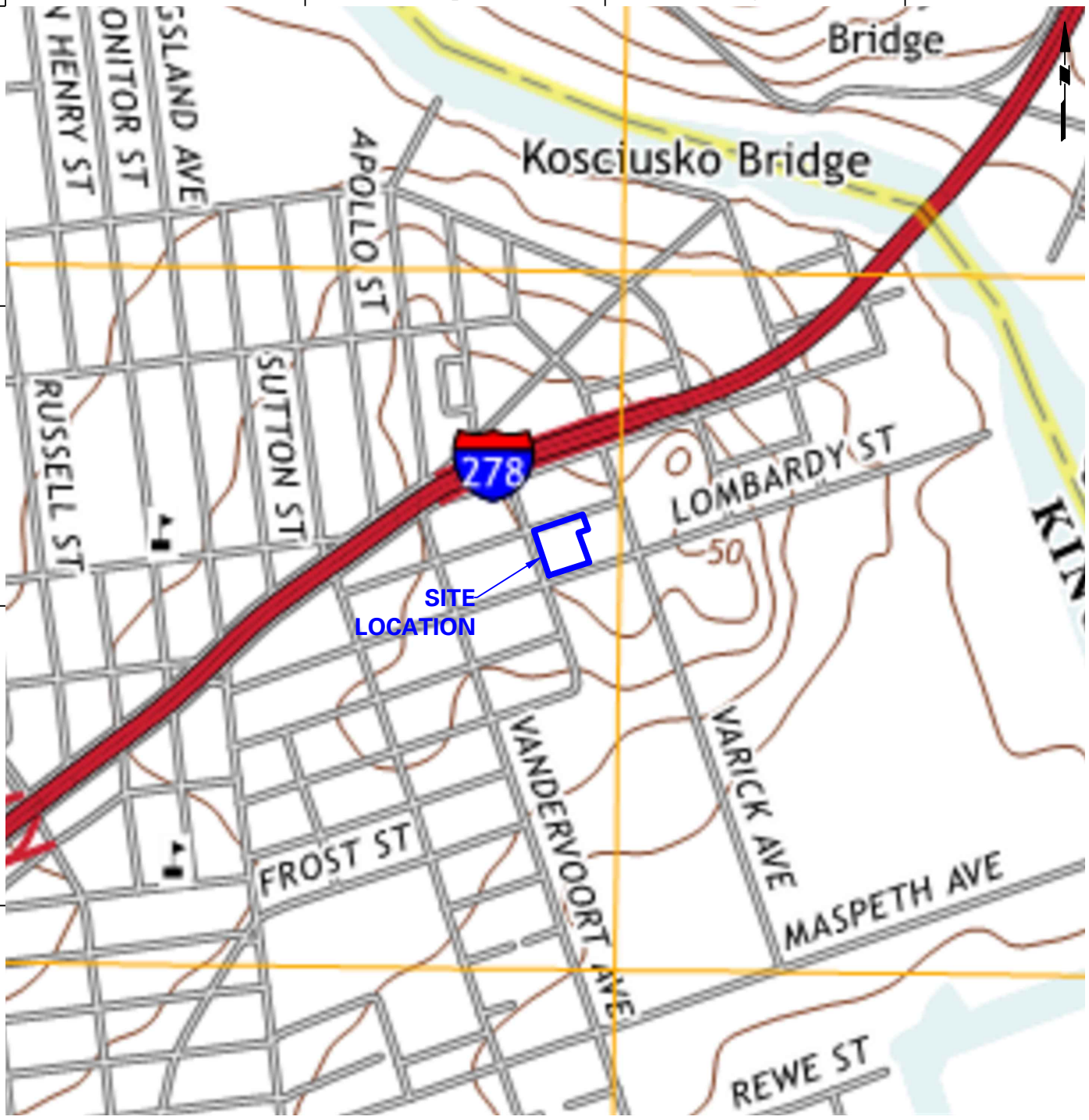
4.0 SUPPLEMENTAL REMEDIAL INVESTIGATION REPORT

Following completion of the supplemental remedial investigation and receipt of analytical data, a Supplemental Remedial Investigation Report (SRIR) will be prepared. The SRIR will compile the remedial investigation activities completed to date.

The SRIR will include: 1) a summary of the site history and previous investigations; 2) description of site conditions, the 2012-2013 RI, and implementation of this SRIWP; 3) evaluation of the results and findings; and 4) conclusions and recommendations. Additionally, the Standards, Criteria, and Guidance (SCGs) which pertain to the site location and contaminants, as well as potential remedial action objectives, will be identified in the report. Daily site observation reports (with photographs and a record of site activities), soil boring and monitoring well construction logs, sampling logs, and laboratory analytical reports will be appended to the report. Conclusions and recommendations will be provided that: 1) summarize the nature and extent of potential impact for each area of concern; 2) identify unacceptable exposure pathways (as determined through a Qualitative Human Health Exposure Assessment); and 3) recommend future work or remedial actions, as required.

The sampling results that exceed unrestricted use, restricted commercial use, and protection of groundwater soil SCGs, the groundwater standards or other applicable unrestricted SCGs will be summarized in tables. The tables will include sample location, media sampled, sample depth, field/laboratory identification numbers, analytical results, and the applicable SCGs for comparison. Scaled site maps will be used to show soil boring, monitoring well, and soil vapor point locations, SCG exceedances, groundwater elevation contours, groundwater flow direction, and groundwater contaminant concentration contours.

FIGURES



MAP REFERENCE: USGS BROOKLYN, N.Y. TOPOGRAPHIC QUADRANGLE

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Langan International LLC

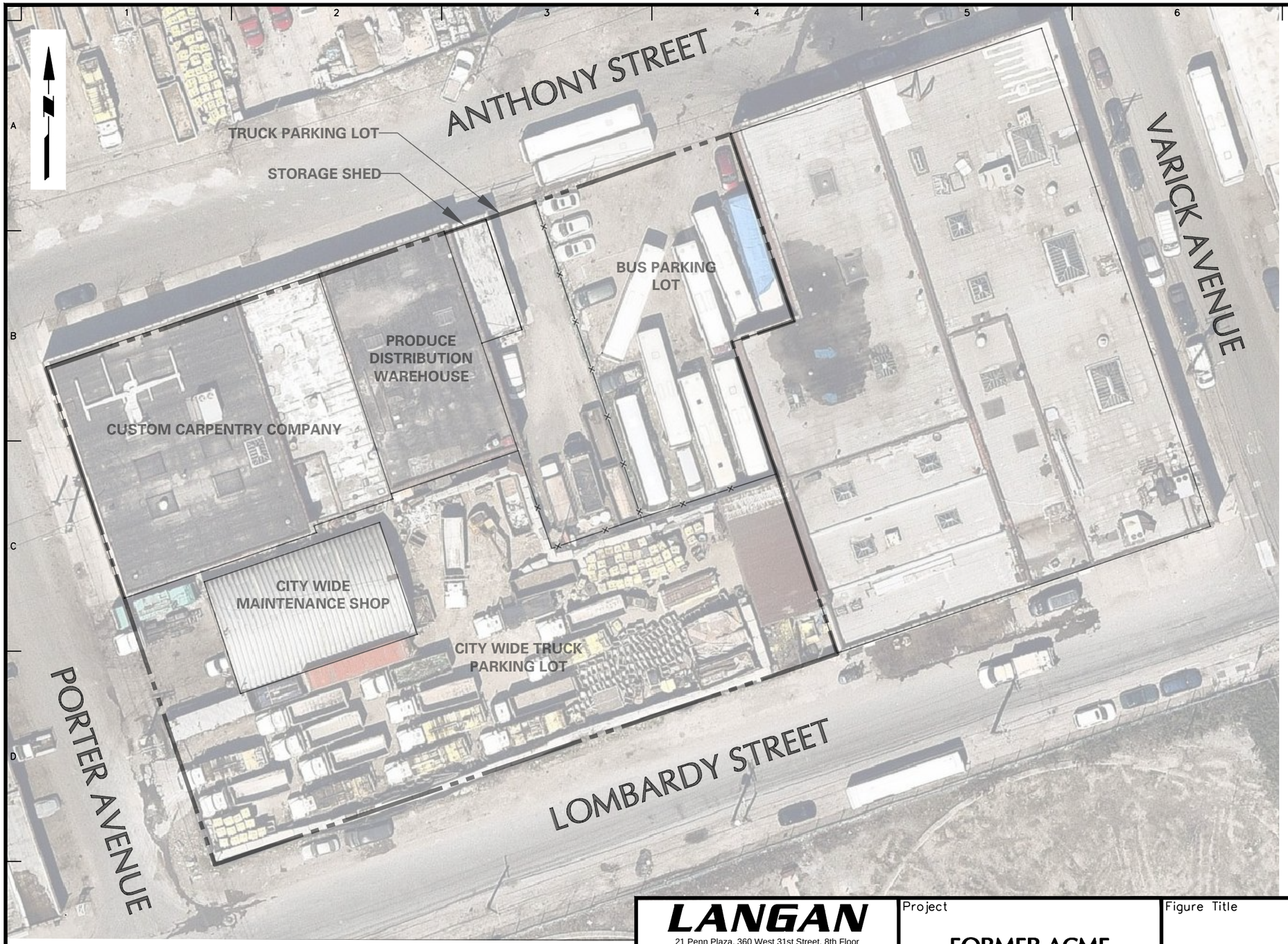
Collectively known as Langan

Project
FORMER ACME STEEL/BRASS FOUNDRY
NYSDEC SITE No. 224132
72 ANTHONY STREET / 498 PORTER AVENUE
BROOKLYN NEW YORK

Figure Title
SITE LOCATION MAP

Project No. 170157201	Figure 1
Date 05/06/2016	
Scale NTS	
Drawn By PTF / Checked By GN	
Submission Date	Sheet 1 of 3

Filename: \\Langan.com\data\NY\data2\170157201\Cadd Data - 170157201\SRIWP\224132\Figure 1 - Site Location Map.dwg Date: 6/10/2016 Time: 10:04 User: pfarnham Style Table: Langan.stb Layout: ANSIA-BP



LEGEND:

- SITE BOUNDARY
- BUILDING OUTLINE
- FENCE

NOTES:

1. BASE MAP SOURCE: NEARMAP.COM AERIAL PHOTO DATED APRIL 16, 2016

40 0 10 25 40
SCALE IN FEET

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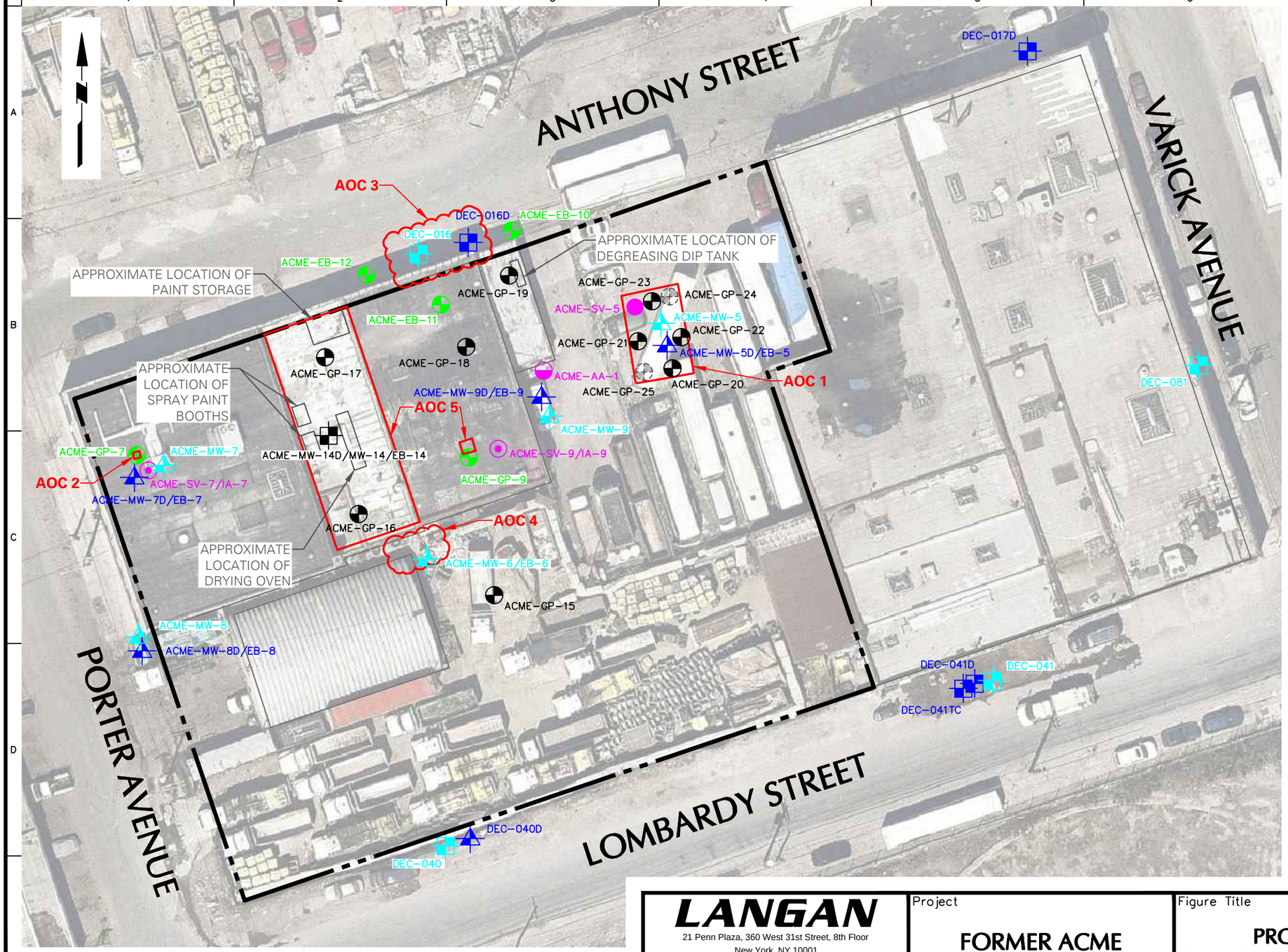
72 ANTHONY STREET/
498 PORTER STREET
BROOKLYN NEW YORK

Figure Title
SITE PLAN

Project No. 170157201	Figure No. 2
Date 05/06/2016	
Scale 1" = 40'	
Drawn By PTF / Checked By GN	
Submission Date	Sheet 2 OF 3

Filename: \\langan.com\data\NY\data2\170157201\Cadd Data - 170157201\SRIWP\224132\Figure 2 - Site Plan.dwg Date: 6/15/2016 Time: 08:56 User: pfarnham Style Table: Langan.stb Layout: ANSIB-BLI



LEGEND:

- SITE BOUNDARY
- SITE FEATURE
- ACME-EB-10 — RI SOIL BORING LOCATION
- ACME-MW-5D/EB-5 — RI SOIL BORING AND DEEP GROUNDWATER MONITORING WELL LOCATION
- ACME-MW-5 — RI SOIL BORING AND SHALLOW GROUNDWATER MONITORING WELL LOCATION
- DEC-017D — EXISTING DEEP GROUNDWATER MONITORING WELL LOCATION
- DEC-017 — EXISTING SHALLOW GROUNDWATER MONITORING WELL LOCATION
- ACME-SV-7/IA-7 — RI SOIL VAPOR AND INDOOR AIR SAMPLING COUPLET LOCATION
- ACME-SV-5 — RI SOIL VAPOR SAMPLING LOCATION
- ACME-AA-1 — RI AMBIENT AIR LOCATION
- ACME-GP-18 — PROPOSED SUPPLEMENTAL RI BORING LOCATION TO GROUNDWATER
- ACME-GP-24 — PROPOSED SUPPLEMENTAL RI CONTINGENCY BORING TO GROUNDWATER
- ACME-MW-14D/MW-14/EB-14 — PROPOSED SUPPLEMENTAL RI SHALLOW AND DEEP BORING/MONITORING WELL LOCATION

NOTES:

1. BASE MAP SOURCE: NEARMAP.COM AERIAL PHOTO DATED APRIL 16, 2016
2. THE REMEDIAL INVESTIGATION (RI) WAS CONDUCTED BY LANGAN BETWEEN SEPTEMBER 2012 AND JANUARY 2013.
3. AREA OF CONCERN (AOC) 1 - FORMER CHEMICAL CONSOLIDATION AND STORAGE AREA
4. AOC 2 - SANITARY SEWER CLEANOUT
5. AOC 3 - TETRACHLOROETHENE (PCE)-IMPACTED SOIL
6. AOC 4 - DRUM STORAGE AREA
7. AOC 5 - HISTORIC PAINTING/DEGREASING OPERATIONS

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NYSDEC SITE No. 224132
72 ANTHONY STREET/ 498 PORTER AVENUE
BROOKLYN NEW YORK

Figure Title
PROPOSED SUPPLEMENTAL REMEDIAL INVESTIGATION SAMPLE LOCATION PLAN

Project No. 170157201	Figure No. 3
Date 6/10/2016	
Scale 1"=40'	
Drawn By PTF / Checked By GN	
Submission Date	Sheet 3 of 3

Filename: \\langan.com\data\NY\data2\170157201\Cadd Data - 170157201\SRIWP\224132\Figure 3 - Proposed Supplemental Remedial Investigation Sample Location Plan.dwg Date: 6/15/2016 Time: 09:00 User: pfarnham Style Table: Langan.stb Layout: ANSIB-BL

TABLES

Table 1
Proposed Soil Sample Summary
Supplemental Remedial Investigation Work Plan
Former ACME Steel/Brass Foundry
72 Anthony Street/498 Porter Avenue
Brooklyn, New York
NYSDEC Site No. 224132

Area of Concern (AOC)	Soil Boring Location	Sample ID (Depth Interval [feet bgs])	Sample Matrix	Duplicate Sample ID	Analysis
AOC 1	ACME-GP-20	ACME-GP-20 (X-X)	Soil	-	TCL VOC plus TIC via EPA Method 8260C
		ACME-GP-20 (X-X)		-	
		ACME-GP-20 (X-X)		-	
		ACME-GP-20 (X-X)		-	
	ACME-GP-21	ACME-GP-21 (X-X)	Soil	-	TCL VOC plus TIC via EPA Method 8260C
		ACME-GP-21 (X-X)		-	
		ACME-GP-21 (X-X)		-	
		ACME-GP-21 (X-X)		-	
	ACME-GP-22	ACME-GP-22 (X-X)	Soil	-	TCL VOC plus TIC via EPA Method 8260C
		ACME-GP-22 (X-X)		SODUP03_XXXXXX	
		ACME-GP-22 (X-X)		-	
		ACME-GP-22 (X-X)		-	
	ACME-GP-23	ACME-GP-23 (X-X)	Soil	-	TCL VOC plus TIC via EPA Method 8260C
		ACME-GP-23 (X-X)		-	
		ACME-GP-23 (X-X)		-	
		ACME-GP-23 (X-X)		-	
	ACME-GP-24 (CONTINGENCY)	ACME-GP-24 (X-X)	Soil	-	TCL VOC plus TIC via EPA Method 8260C
		ACME-GP-24 (X-X)		-	
		ACME-GP-24 (X-X)		-	
		ACME-GP-24 (X-X)		-	
	ACME-GP-25 (CONTINGENCY)	ACME-GP-25 (X-X)	Soil	-	TCL VOC plus TIC via EPA Method 8260C
		ACME-GP-25 (X-X)		-	
		ACME-GP-25 (X-X)		-	
		ACME-GP-25 (X-X)		-	
AOC 2	No Further Investigation Proposed at AOC 2				
AOC 3	No Further Investigation Proposed at AOC 3				

Notes:

VOC = Volatile organic compounds
TCL = Target compound list
AOC - Area of Concern
TIC = Tentatively identified compounds
bgs = below grade surface
EPA = Environmental Protection Agency
Shaded soil borings and soil samples are included as contingency and may be completed based on field observations.

Table 1
Proposed Soil Sample Summary
Supplemental Remedial Investigation Work Plan
Former ACME Steel/Brass Foundry
72 Anthony Street/498 Porter Avenue
Brooklyn, New York
NYSDEC Site No. 224132

Area of Concern (AOC)	Soil Boring Location	Sample ID (Depth Interval [feet bgs])	Sample Matrix	Duplicate Sample ID	Analysis
AOC 4	ACME-GP-15	ACME-GP-15 (X-X)	Soil	-	TCL VOC plus TIC via EPA Method 8260C
		ACME-GP-15 (X-X)		-	
		ACME-GP-15 (X-X)		-	
		ACME-GP-15 (X-X)		-	
AOC 5	ACME-MW-14D/EB-14	ACME-EB-14 (X-X)	Soil	-	TCL VOC plus TIC via EPA Method 8260C
		ACME-EB-14 (X-X)		-	
		ACME-EB-14 (X-X)		-	
		ACME-EB-14 (X-X)		-	
		ACME-EB-14 (X-X)		-	
	ACME-GP-16	ACME-GP-16 (X-X)	Soil	SODUP04_XXXXXX	TCL VOC plus TIC via EPA Method 8260C
		ACME-GP-16 (X-X)		-	
		ACME-GP-16 (X-X)		-	
		ACME-GP-16 (X-X)		-	
	ACME-GP-17	ACME-GP-17 (X-X)	Soil	-	TCL VOC plus TIC via EPA Method 8260C
		ACME-GP-17 (X-X)		-	
		ACME-GP-17 (X-X)		-	
		ACME-GP-17 (X-X)		-	
	ACME-GP-18	ACME-GP-18 (X-X)	Soil	-	TCL VOC plus TIC via EPA Method 8260C
		ACME-GP-18 (X-X)		-	
		ACME-GP-18 (X-X)		-	
		ACME-GP-18 (X-X)		-	
	ACME-GP-19	ACME-GP-19 (X-X)	Soil	-	TCL VOC plus TIC via EPA Method 8260C
		ACME-GP-19 (X-X)		-	
		ACME-GP-19 (X-X)		-	
		ACME-GP-19 (X-X)		-	
-	-	ACME-SOTB04-XXXXXX	Trip Blank	-	TCL VOC plus TIC via EPA Method 8260C
-	-	ACME-SOTB05-XXXXXX		-	
-	-	ACME-SOTB06-XXXXXX		-	
-	-	ACME-SOFB04-XXXXXX	Field Blank	-	TCL VOC plus TIC via EPA Method 8260C
-	-	ACME-SOFB05-XXXXXX		-	
-	-	ACME-SOFB06-XXXXXX		-	

Notes:

VOC = Volatile organic compounds
TCL = Target compound list
AOC - Area of Concern
TIC = Tentatively identified compounds
bgs = below grade surface
EPA = Environmental Protection Agency
Shaded soil borings and soil samples are included as contingency and may be completed based on field observations.

Table 2
Proposed Groundwater Sample Summary
Supplemental Remedial Investigation Work Plan
Former ACME Steel/Brass Foundry
72 Anthony Street/498 Porter Avenue
Brooklyn, New York
NYSDEC Site No. 224132

Area of Concern (AOC)	Monitoring Well Location	Sample ID	Sample Matrix	Duplicate Sample ID	Analysis
AOC 1	ACME-MW-5	ACME-MW-5-XXXXXX	Groundwater	-	TCL VOC plus TIC via EPA Method 8260C TCL SVOC via EPA method 8270D PCB via EPA method 8082A Pesticides via EPA method 8081B TAL metals by EPA method 6010C/7000 series Total cyanide via EPA method 9010C
	ACME-MW-5D	ACME-MW-5D-XXXXXX		-	TCL VOC plus TIC via EPA Method 8260C
AOC 2	ACME-MW-7	ACME-MW-7-XXXXXX	Groundwater	-	TCL VOC plus TIC via EPA Method 8260C
	ACME-MW-7D	ACME-MW-7D-XXXXXX		-	TCL VOC plus TIC via EPA Method 8260C TCL SVOC via EPA method 8270D PCB via EPA method 8082A Pesticides via EPA method 8081B TAL metals by EPA method 6010C/7000 series Total cyanide via EPA method 9010C
AOC 3	DEC-016R	DEC-016-XXXXXX	Groundwater	-	TCL VOC plus TIC via EPA Method 8260C
	DEC-016D	DEC-016D-XXXXXX		-	
AOC 4	ACME-MW-6	ACME-MW-6-XXXXXX	Groundwater	-	TCL VOC plus TIC via EPA Method 8260C
AOC 5	ACME-MW-9	ACME-MW-9-XXXXXX	Groundwater	-	TCL VOC plus TIC via EPA Method 8260C
	ACME-MW-9D	ACME-MW-9D-XXXXXX		-	
	ACME-MW-14	ACME-MW-14-XXXXXX	Groundwater	-	TCL VOC plus TIC via EPA Method 8260C
	ACME-MW-14D	ACME-MW-14D-XXXXXX		GWDUP02_XXXXXX	TCL VOC plus TIC via EPA Method 8260C TCL SVOC via EPA method 8270D PCB via EPA method 8082A Pesticides via EPA method 8081B TAL metals by EPA method 6010C/7000 series Total cyanide via EPA method 9010C
ACME Site Perimeter Wells	ACME-MW-8	ACME-MW-8-XXXXXX	Groundwater	-	TCL VOC plus TIC via EPA Method 8260C
	ACME-MW-8D	ACME-MW-8D-XXXXXX		-	
NYSDEC Site Perimeter Wells	DEC-017D	DEC-017D-XXXXXX	Groundwater	-	TCL VOC plus TIC via EPA Method 8260C
	DEC-040	DEC-040-XXXXXX		GWDUP03_XXXXXX	
	DEC-040D	DEC-040D-XXXXXX		-	
	DEC-041	DEC-041-XXXXXX		-	
	DEC-041D	DEC-041D-XXXXXX		-	
	DEC-041TC	DEC-041TC-XXXXXX			
	DEC-081	DEC-081-XXXXXX		-	
-	-	ACME-GWTB05-XXXXXX	Trip Blank	-	TCL VOC plus TIC via EPA Method 8260C
-	-	ACME-GWTB06-XXXXXX		-	
-	-	ACME-GWTB07-XXXXXX		-	
-	-	ACME-GWTB08-XXXXXX		-	
-	-	ACME-GWFB03-XXXXXX	Field Blank	-	TCL VOC plus TIC via EPA Method 8260C
-	-	ACME-GWFB04-XXXXXX		-	

Notes:

TCL = Target compound list
VOC = Volatile organic compounds
SVOC = Semivolatile organic compounds
TIC = Tentatively identified compounds
PCB = Polychlorinated biphenyls
TAL = Target analyte list
EPA = Environmental Protection Agency
NYSDEC = New York State Department of Environmental Conservation

APPENDIX A

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

FOR

SUPPLEMENTAL REMEDIAL INVESTIGATION WORK PLAN

FORMER ACME STEEL/BRASS FOUNDRY
72 ANTHONY STREET/498 PORTER AVENUE
Tax Block 2820, Lots 1 and 5
Brooklyn, New York

Prepared For

Whitehead Company
251 Lombardy Street
Brooklyn, New York 11222

Prepared By:

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

September 2016
Langan Project No. 170157201

LANGAN

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Page No.

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LIST OF FIGURES

LIST OF APPENDICES

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

1.0 INTRODUCTION

1.1 General

This Health and Safety Plan (HASP) was developed to address disturbance of known and reasonably anticipated subsurface contaminants and comply with Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1910.120(b) (4), *Hazardous Waste Operations and Emergency Response* during anticipated supplemental remedial investigation activities at the 72 Anthony Street/498 Porter Avenue site, Block 2820, Lots 1 and 5 ("Site") in Brooklyn, New York. This HASP provides the minimum requirements for implementing site operations during pending subsurface investigation activities. All contractors performing work on this Site shall implement their own health and safety plans that, at a minimum, adhere to this HASP. The contractor is solely responsible for their own health and safety and that of their subcontractors. Langan personnel will implement this HASP while on-site.

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

1.2 Site Location and Background

The Site occupies an approximate area of 52,860 square feet at 72-90 Anthony Street and 498 Porter Avenue (Tax Block 2820, Lots 1 and 5) in the Greenpoint section of the borough of Brooklyn, New York. Adjoining properties include Porter Avenue to the west, a warehouse building to the east, Lombardy Street to the south, and Anthony Street to the north. The Site is owned by Whitehead Realty Company Corp. and contains one one-story building, a truck maintenance yard, a storage shed, and a bus parking lot.

The Site was used as a brass foundry and civilian observation patrol from the 1960s through around 1993. After 1993, until around 2009, the Site was operated by Acme Steel as a door finishing facility. The former Acme Steel facility that operated at the Site was reportedly a generator of F001 waste, which indicates that the following spent halogenated solvents were likely used in degreasing: PCE, TCE, methylene chloride, 1,1,1-trichloroethane (1,1,1-TCA), carbon tetrachloride, and chlorinated fluorocarbons. According to a review of the Phase I Environmental Site Assessment (ESA) prepared by Impact Environmental Consulting, the site was historically used for industrial and manufacturing purposes. A site location map is included as Figure 1.

The objective of this SRIWP is to further investigate and characterize the nature and extent of environmental impacts on the Site to support evaluation of potential remedial actions. The subsurface investigation will include the following activities:

- Geophysical survey
- Advancement and sampling of soil borings; and
- Installation, gauging, surveying, and sampling of monitoring wells.

1.3 Summary of Work Tasks

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

1.3.1 Geophysical Surveying

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

Where possible shallow and/or deep confining units are observed, down-hole geophysics may be utilized to collect information about soil permeability, hydraulic conductivity, and stratigraphy.

1.3.2 Soil Investigation and Sampling

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

Langan personnel will screen soil for visual, olfactory, and instrumental indicators suggestive of a potential chemical or petroleum release. Instrument screening for the presence of volatile organic compounds (VOCs) may be performed with a calibrated photoionization detector (PID) or OilScreenSoil (Indigo Blue)® non-SUDAN-based dye (to evaluate for the presence of dense non-aqueous phase liquid [DNAPL] in grossly-contaminated soil intervals). Langan personnel will collect soil samples from the two-foot interval exhibiting the greatest degree of visual, olfactory, or instrumental impacts, and as otherwise specified in the work plan. Soil samples will be submitted to a New York State Department of Health (NYSDOH) Environmental

Laboratory Approval Program (ELAP)-certified laboratory and analyzed in accordance with work plan specifications.

1.3.3 Groundwater Investigation, Surveying, and Sampling

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

1.3.4 Drum Sampling

Excess or impacted soil and water are to be drummed separately in approved 55-gallon sealed drums, as required. Each drum must be labeled in accordance with the Langan Drum Labeling Standard Operating Procedure (SOP-#9). Langan field personnel will collect drum samples, as required, prior to off-site drum disposal and according to NYSDEC contained-in policy. Samples will be placed into laboratory-supplied batch-certified clean glassware and submitted to a NYSDOH ELAP-certified laboratory.

2.0 IDENTIFICATION OF KEY PERSONNEL/HEALTH AND SAFETY PERSONNEL

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

2.1 Langan Project Manager

The Langan Project Manager (PM) is Gerald Nicholls. His responsibilities include:

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

2.2 Langan Corporate Health and Safety Manager

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

- Updating the *Health and Safety Program for Hazardous Waste Operations*.

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

2.3 Langan Site Health & Safety Officer

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

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

2.4 Langan Field Team Leader Responsibilities

The Langan Field Team Leader (FTL) is Patrick Farnham. His responsibilities include:

- The management of the day-to-day site activities and implementation of this HASP in the field.
- Participating in and/or conducting Tailgate Safety Meetings and Jobsite Safety

Inspections and correcting any shortcomings in a timely manner.

- When a Community Air Monitoring Operating Program (CAMP) is part of the scope, the FTL will set up and maintaining community air monitoring activities and instructing the responsible contractor to implement organic vapor or dust mitigation when necessary.
- Overseeing the implementation of activities specified in the work plan.

2.5 Contractor Responsibilities

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

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

3.0 TASK/OPERATION SAFETY AND HEALTH RISK ANALYSES

A Task-Hazard Analysis (Table 1) was completed for general construction hazards that may be

encountered at the Site. Known and suspected chemical contaminant hazards that could be encountered during site operations are included in Table 2. A complete inventory of MSDS/SDS for chemical products used on site is included as Attachment E.

3.1 Specific Task Safety Analysis

3.1.1 Geophysical Survey

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

3.1.2 Soil Investigation and Sampling

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

3.1.3 Groundwater Investigation and Sampling

Sampling groundwater requires the donning of chemical resistant gloves in addition to standard PPE. Langan personnel are not to operate drilling equipment nor assemble or install monitoring well equipment. These tasks are to be completed by the drilling contractor.

3.1.4 Drum Sampling

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

3.2 Radiation Hazards

No radiation hazards are known or expected at the site.

3.3 Physical Hazards

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

3.3.1 Explosion

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

3.3.2 Heat Stress

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

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

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

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

To monitor the worker, measure:

- **Heart rate:** Count the radial pulse during a 30-second period as early as possible in the rest period. If the heart rate exceeds 100 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same. If the heart rate still exceeds 100 beats per minute at the next rest period, shorten the following work cycle by one-third. A worker cannot return to work after a rest period until their heart rate is below 100 beats per minute.
- **Oral temperature:** Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking). If oral temperature exceeds 99.6^{o}F (37.6^{o}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^{o}F. If oral temperature still exceeds 99.6^{o}F (37.6^{o}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^{o}F (38.1^{o}C).

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

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

3.3.3 Cold-Related Illness

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

- **Hypothermia -** Hypothermia is defined as a decrease in the patient core temperature below 96^{O}F. The body temperature is normally maintained by a combination of central (brain and spinal cord) and peripheral (skin and muscle) activity. Interference with any of these mechanisms can result in hypothermia, even in the absence of what normally is

considered a "cold" ambient temperature. Symptoms of hypothermia include: shivering, apathy, listlessness, sleepiness, and unconsciousness.

- **Frostbite -** Frostbite is both a general and medical term given to areas of local cold injury. Unlike systemic hypothermia, frostbite rarely occurs unless the ambient temperatures are less than freezing and usually less than 20^{O}F. Symptoms of frostbite are: a sudden blanching or whitening of the skin; the skin has a waxy or white appearance and is firm to the touch; tissues are cold, pale, and solid.

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

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

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

3.3.4 Noise

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

3.3.5 Hand and Power Tools

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

3.3.6 Slips, Trips and Fall Hazards

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

3.3.7 Utilities (Electrocution and Fire Hazards)

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

3.4 Biological Hazards

3.4.1 Animals

No animals are expected to be encountered during site operations.

3.4.2 Insects

Insects are not expected to be encountered during site operations.

3.5 Additional Safety Analysis

3.5.1 Presence of Non-Aqueous Phase Liquids (NAPL)

There is potential for exposure to NAPL at this site. Special care and PPE should be considered when NAPL is observed as NAPL is a typically flammable fluid and releases VOCs known to be toxic and/or carcinogenic. If NAPL is present in a monitoring well, vapors from the well casing may contaminate the work area breathing zone with concentrations of VOCs potentially exceeding health and safety action levels. In addition, all equipment used to monitor or sample NAPL (or 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 field staffers are required to use disposable nitrile gloves at all

times to prevent skin contact with contaminated materials. They should also consider having available a respirator and protective clothing (Tyvek® overalls), especially if NAPL is in abundance and there are high concentrations of VOCs.

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

3.6 Job Safety Analysis

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

4.0 PERSONNEL TRAINING

4.1 Basic Training

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

4.2 Initial Site-Specific Training

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

4.3 Tailgate Safety Briefings

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

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

5.0 MEDICAL SURVEILLANCE

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

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

6.0 COMMUNITY AIR MONITORING PROGRAM

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

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

A portion of the work performed as part of SRIWP implementation will occur inside on-site buildings. Indoor work may limit the ability to ventilate work areas; therefore, modifications to work practices may be necessary to limit exposure of building occupants to site-related

contamination.

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

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

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

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

6.1 Vapor Emission Response Plan

This section applies if VOC monitoring is required. If the ambient air concentration of organic vapors exceeds 5 ppm above background at the perimeter of the hot zone, boring and well installation, and excavation activities will be halted or odor controls will be employed, and monitoring continued. When work shut-down occurs, downwind air monitoring as directed by

the HSO or FTL will be implemented to ensure that vapor emission does not impact the nearest residential or commercial structure at levels exceeding those specified in the Major Vapor Emission section.

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

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

6.2 Major Vapor Emission

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

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

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

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

6.3 Major Vapor Emission Response Plan

Upon activation, the following activities will be undertaken:

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

6.4 Dust Suppression Techniques

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

Work practices to minimize odors and vapors include limiting the time that the excavations remain open, minimizing stockpiling of contaminated-source soil, and minimizing the handling of contaminated material. Offending odor and organic vapor controls may include the application of foam suppressants or tarps over the odor or VOC source areas. Foam suppressants may include biodegradable foams applied over the source material for short-term control of the odor and VOCs.

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

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

7.0 PERSONAL PROTECTIVE EQUIPMENT

7.1 Levels of Protection

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

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

Level D Protection (as needed)

- Safety glasses with side shields or chemical splash goggles

- Safety boots/shoes
- Coveralls (Tyvek® or equivalent)
- Hard hat
- Long sleeve work shirt and work pants
- Nitrile gloves
- Hearing protection
- Reflective safety vest

Level C Protection (as needed)

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

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

7.2 Respirator Fit-Test

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

8.0 SITE CONTROL

8.1 Site Communications Plan

Verbal communications will be the primary method of communication used at the site during the remedial action/remedial investigation and routine groundwater monitoring work. Cell phones shall be used to the extent practical. In the instances where verbal communication

cannot be used, such as when working in respiratory protective equipment, hand signals will be used. Hand signals will be covered during site-specific training. Hand signals and their messages:

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

8.2 Work Zones

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

8.2.1 Exclusion Zone

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

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

8.2.2 Contamination Reduction Zone

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

8.2.3 Support Zone

The support zone or cold zone will include the remaining areas of the job site. Break areas and support facilities (include equipment storage and maintenance areas) will be located in this zone. No equipment or personnel will be permitted to enter the cold zone from the hot zone

without passing through the decontamination station in the warm zone (if necessitated). Eating, smoking, and drinking will be allowed only in this area.

8.3 The Buddy System

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

- Provide his/her partner with assistance.
- Observe his/her partner for signs of chemical or heat exposure.
- Periodically check the integrity of his/her partner's PPE.
- Notify the HSO or other site personnel if emergency service is needed.

9.0 NEAREST MEDICAL ASSISTANCE

The address and telephone number of the nearest hospital:

Woodhull Medical and Mental Health Center

760 Broadway Street

Brooklyn, NY

718-963-8000

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

10.0 STANDING ORDERS/SAFE WORK PRACTICES

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

11.0 SITE SECURITY

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

12.0 UNDERGROUND UTILITIES

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

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

13.0 SITE SAFETY INSPECTION

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

14.0 HAND AND POWER TOOLS

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

15.0 DECONTAMINATION PLAN

15.1 General

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

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

15.2 Decontamination Procedures

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

15.3 Disposal of Decontamination Wastes

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

16.0 EMERGENCY RESPONSE

16.1 General

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

16.2 Responsibilities

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

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

16.3 Evacuation

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

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

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

16.4 Emergency Contacts/Notification System

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

16.5 Emergency Medical Treatment

Personnel Injury - In case of injury to personnel, the HSO or his/her alternate will immediately administer emergency first aid. The ambulance/rescue squad will also be contacted as necessary. Some situations may require transport of the injured parties by automobile. Therefore, maps/directions to the nearest hospital are provided as Figure 2. Figure 2 will either be posted at the site, or will be made readily available to all personnel all of the time.

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

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

16.6 Fire or Explosion

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

16.7 Spills/Leaks

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

16.8 Adverse Weather Conditions

In the event of severe weather (rain, snow, sleet, heat, etc.), conditions will be assessed on site to determine if the work can proceed safely. If it is determined that the weather poses a significant hazard, site operations will be stopped and rescheduled. Some of the items to be considered prior to determining if work should continue include:

- Potential for heat stress and heat-related injuries.
- Potential for cold stress and cold-related injuries.
- Treacherous weather-related working conditions including thunder storms. When thunderstorms do occur, work is to cease immediately while personnel seek shelter. Work cannot resume until 30 minutes after the last thunder clap.
- Limited visibility.

16.9 Underground Utilities

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

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

16.10 Documentation

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

17.0 CONFINED SPACE ENTRY

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

18.0 HASP ACKNOWLEDGEMENT FORM

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

Printed Name	Signature	Company	Date

TABLES

TABLE 1
TASK HAZARD ANALYSES

Task	Hazard	Description	Control Measures	First Aid
1.3.1 – 1.3.5	Contaminated Soil or Groundwater-Dermal Contact	Contaminated water spills on skin, splashes in eyes; contact with contaminated soil/fill during construction activities or sampling.	Wear proper PPE; follow safe practices, maintain safe distance from construction activities	See Table 2, seek medical attention as required
1.3.1 – 1.3.5	Lacerations, abrasions, punctures	Cutting bailer twine, pump tubing, acetate liners, etc. with knife; cuts from sharp site objects or previously cut piles, tanks, etc.; Using tools in tight spaces	Wear proper PPE; follow safe practices	Clean wound, apply pressure and/or bandages; seek medical attention as required.
1.3.1 – 1.3.5	Contaminated Media Inhalation	Opening drums, tanks, wells; vapors for non-aqueous phase liquids or other contaminated site media; dust inhalation during excavation; vapor accumulation in excavation	Follow air monitoring plan; have quick access to respirator, do not move or open unlabeled drums found at the site, maintain safe distance from construction activities	See Table 2, seek medical attention as required
1.3.1 – 1.3.5	Lifting	Improper lifting/carrying of equipment and materials causing strains	Follow safe lifting techniques; Langan employees are not to carry contractor equipment or materials	Rest, ice, compression, elevation; seek medical attention as required
1.3.1 – 1.3.5	Slips, trips, and falls	Slips, trips and falls due to uneven surfaces, cords, steep slopes, debris and equipment in work areas	Good housekeeping at site; constant awareness and focus on the task; avoid climbing on stockpiles; maintain safe distance from construction activities and excavations; avoid elevated areas over six feet unless fully accredited in fall protection and wearing an approved fall protection safety apparatus	Rest, ice, compression, elevation; seek medical attention as required
1.3.1 – 1.3.5	Noise	Excavation equipment, hand tools, drilling equipment.	Wear hearing protection; maintain safe distance from construction activities	Seek medical attention as required
1.3.1 – 1.3.5	Falling objects	Soil material, tools, etc. dropping from drill rigs, front-end loaders, etc.	Hard hats to be worn at all times while in work zones; maintain safe distance from construction activities and excavations	Seek medical attention as required
1.3.1 – 1.3.6	Underground/ overhead utilities	Excavation equipment, drill rig auger makes contact with underground object; boom touches overhead utility	"One Call" before dig; follow safe practices; confirm utility locations with contractor; wear proper PPE; maintain safe distance from construction activities and excavations	Seek medical attention as required
1.3.1 – 1.3.5	Insects (bees, wasps, hornet, mosquitoes, and spider)	Sings, bites	Insect Repellent; wear proper protective clothing (work boots, socks and light colored pants);field personnel who may have insect allergies (e.g., bee sting) should provide this information to the HSO or FSO prior to commencing work, and will have allergy medication on Site.	Seek medical attention as required
1.3.1 – 1.3.5	Vehicle traffic / Heavy Equipment Operation	Vehicles unable to see workers on site, operation of heavy equipment in tight spaces, equipment failure, malfunctioning alarms	Wear proper PPE, especially visibility vest; use a buddy system to look for traffic; rope off area of work with cones and caution tape or devices at points of hazard, maintain safe distance from construction activities and equipment	Seek medical attention as required

TABLE 2
CONTAMINANT HAZARDS OF CONCERN

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	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 – 1.3.10	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 – 1.3.10	1,2-Dibromo-3-chloropropane	96-12-8	PID	None None	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, skin, nose, throat; drowsiness; nausea, vomiting; pulmonary edema; liver, kidney injury; sterility; [potential occupational carcinogen]	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 – 1.3.10	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
1.3.1 – 1.3.10	2,6-dimethyl octane	2051-30-1	PID	NA NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, respiratory system, Blue lips or finger nails. Blue skin. Headache. Dizziness. Nausea. Confusion. Convulsions. Unconsciousness	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	2,6-dimethyl undecane	17301-23-4	PID	NA NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, respiratory system, Blue lips or finger nails. Blue skin. Headache. Dizziness. Nausea. Confusion. Convulsions. Unconsciousness	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Butylcyclohexane	1678-93-9	PID	NA NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, respiratory system, Blue lips or finger nails. Blue skin. Headache. Dizziness. Nausea. Confusion. Convulsions. Unconsciousness	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 – 1.3.10	p-Dichlorobenzene p-DCB 1,4-Dichlorobenzene para-Dichlorobenzene 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
1.3.1 – 1.3.10	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 – 1.3.10	4-Methyl-2-Pentanone Hexone Isobutyl methyl ketone Methyl isobutyl ketone MIBK	108-10-1	PID	100 ppm 500 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; headache, narcosis, coma; dermatitis; in animals: liver, kidney damage	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
	4,6-dimethyl Dodecane	61141-72-8						

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	2,4-Dichlorophenol	120-83-2	PID	NA NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact, in	irritation to the eyes, skin, mucous membrane, nose, throat, respiratory system; ingestion: burning sensation, abdominal pain, tremor, weakness, convulsion, labored breathing, shock or collapse	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Acetone Dimethyl ketone Ketone propane 2-Propanone	67-64-1	PID	1000 ppm 2500 ppm	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; headache, dizziness, central nervous system depression; dermatitis	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	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 – 1.3.10	Benzene Benzol Phenyl hydride	71-43-2	PID	3.19 mg/m^3 1,595 mg/mg^3	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; lassitude (weakness, exhaustion) [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Benzo(a)anthracene Benzanthracene Benzanthrene 1,2-Benzanthracene Benzo[b]phenanthrene Tetraphene	56-55-3	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, skin or eye contact, ingestion	dermatitis, bronchitis, [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Benzo(a)pyrene	50-32-8	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	dermatitis, bronchitis, [potential occupational carcinogen]	Eye: Irrigate immediately, seek medical attention Skin: Soap wash immediately; Breathing: move to fresh air; Swallow: Induce vomiting if conscious, seek medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	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 – 1.3.10	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	NA	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.10	Benzo (j) fluoranthene	205-82-3	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	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 – 1.3.10	Methyl Bromide Bromomethane Monobromomethane	74-83-9	PID	20 ppm 250 ppm	Soil Groundwater Vapor	inhalation, skin absorption (liquid), skin and/or eye contact (liquid)	irritation to the eyes, skin, respiratory system; muscle weak, incoordination, visual disturbance, dizziness; nausea, vomiting, headache; malaise (vague feeling of discomfort); hand tremor; convulsions; dyspnea (breathing difficulty); skin vesiculation; liquid: frostbite; [potential occupational carcinogen]	Eye: Irrigate immediately (liquid) Skin: Water flush immediately (liquid) Breathing: Respiratory support
1.3.1 – 1.3.10	Carbon disulfide Carbon bisulfide	75-15-0	PID	20 ppm 500 ppm	Soil Groundwater Vapor	inhalation, skin or eye contact, ingestion	irritation to the eyes, skin, respiratory system	Eye: Irrigate immediately (liquid) Skin: Water flush immediately (liquid) Breathing: Respiratory support

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Chloroform Methane trichloride Trichloromethane	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
1.3.1 – 1.3.10	Chlordane Chlordan Chlordano 1,2,4,5,6,7,8,8-Octachloro-3a,4,7,7a-tetrahydro-4,7-methanoindane	57-74-9	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 – 1.3.10	Methyl Chloride Chloromethane Monochloromethane	74-87-3	NA	100 ppm 2000 ppm	Groundwater Soil	inhalation, skin and/or eye contact	dizziness, nausea, vomiting; visual disturbance, stagger, slurred speech, convulsions, coma; liver, kidney damage; liquid: frostbite; reproductive, teratogenic effects; [potential occupational carcinogen]	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support
1.3.1 – 1.3.10	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	1,2-Dichloroethylene 1,2-DCE mixture of cis and trans Acetylene dichloride cis-Acetylene dichloride trans-Acetylene dichloride sym-Dichloroethylene cis- 1,2-Dichloroethene Trans-1,2-Dichloroethylene, tDCE cDCE	540-59-0	PID	200 ppm 1000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, respiratory system; central nervous system depression	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Dioxane Diethylene dioxide Diethylene ether Dioxan p-Dioxane 1,4-Dioxane	123-91-1	PID	100 ppm 500 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; drowsiness, headache; nausea, vomiting; liver damage; kidney failure; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Water wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	o-Cresol ortho-Cresol 2-Cresol o-Cresylic acid 1-Hydroxy-2-methylbenzene 2-Hydroxytoluene 2-Methyl phenol	95-48-7	PID	5 ppm 250 pppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; central nervous system effects: confusion, depression, resp failure; dyspnea (breathing difficulty), irreg rapid resp, weak pulse; eye, skin burns; dermatitis; lung, liver, kidney, pancreas damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	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
1.3.1 – 1.3.10	1,3-Dimethylnaphthalene	575-41-7	NA	NA NA	Groundwater Soil	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 – 1.3.10	1,4,5-Trimethylnaphthalene	2245-38-7	NA	NA NA	Soil	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 – 1.3.10	1,6,7-Trimethylnaphthalene 2,3,5-Trimethylnaphthalene	2245-38-7	NA	NA NA	Soil	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	1,7-Dimethylnaphthalene	575-37-1	NA	NA NA	Soil	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 – 1.3.10	2-Methylundecane	7045-71-8	NA	NA NA	Soil	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 – 1.3.10	Nonane n-Nonane	111-84-2	PID	NA NA	Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation eyes, skin, nose, throat; headache, drowsiness, dizziness, confusion, nausea, tremor, incoordination; chemical pneumonitis (aspiration liquid)	Eye:Irrigate immediately Skin:Soap wash immediately Breathing:Respiratory support Swallow:Medical attention immediately
1.3.1 – 1.3.10	Decane n-decane	124-18-5	PID	NA NA	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Dodecane; n-Dodecane	112-40-3	PID	NA NA	Groundwater Soil	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 – 1.3.10	Tridecane n-Tridecane	629-50-5	PID	NA NA	Groundwater Soil Vapor	ingestion, inhalation, skin and/or eye contact	Causes series injury to eyes and skin May be fatal if swallowed and enters airways, may cause drowsiness or dizziness	Eye: Irrigate immediately Skin: Water flush promptly Breathing, Remove to fresh air, Swallow: Medical attention immediately
1.3.1 – 1.3.10	Undecane n-Undecane	1120-21-4	PID	NA NA	Groundwater Soil Vapor	ingestion, inhalation, skin and/or eye contact	Causes series injury to eyes and skin May be fatal if swallowed and enters airways, may cause drowsiness or dizziness	Eye: Irrigate immediately Skin: Water flush promptly Breathing, Remove to fresh air, Swallow: Medical attention immediately
1.3.1 – 1.3.10	Octamethylcyclotetrasiloxane	556-67-2	PID	NA NA	Groundwater Soil Vapor	ingestion, inhalation, skin and/or eye contact	Irritant to eyes , skin mucous membranes and respiratory system, irritant to digestive track	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 – 1.3.10	Pulegone	89-82-7	PID	NA NA	Soil	ingestion, inhalation, skin and/or eye contact	Irritant to eyes , skin mucous membranes and respiratory system, irritant to digestive track	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	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 – 1.3.10	Bis(2-chloroethoxy)methane Dichloroethylformal 2,2-Dichloroethylformal Di-2-chloroethyl formal	111-91-1	None	NA NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	Toxic by inhalation and ingestion; Strong irritation	Eye: Irrigate immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	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	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Dichlorodifluoromethane Difluorodichloromethane, Fluorocarbon 12, Freon® 12, Genetron® 12, Halon® 122, Propellant 12, Refrigerant 12	75-71-8	None	1000 pp, 15,000 ppm	Groundwater Soil Vapor	inhalation, skin and/or eye contact (liquid)	dizziness, tremor, asphyxia, unconsciousness, cardiac arrhythmias, cardiac arrest; liquid: frostbite	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support
1.3.1 – 1.3.10	Ethyl acetate Acetic ester Acetic ether Ethyl ester of acetic acid Ethyl ethanoate	141-78-6	PID	400 ppm 2000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation eyes, skin, nose, throat; narcosis; dermatitis	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Ethylbenzene Ethylbenzol Phenylethane	100-40-4	PID	435 mg/m^3 3,472 mg/m^3	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Ethylene dichloride 1,2-Dichloroethane Ethylene chloride Glycol dichloride 1,2-DCA	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 – 1.3.10	p-Ethyltoluene 4-Ethyltoluene 1-ethyl-4-methyl-benzene	622-96-8	NA	NA NA	Soil	ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	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 – 1.3.10	Heptane n-Heptane	142-82-5	PID	500 ppm 750 ppm	Goundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	dizziness, stupor, incoordination; loss of appetite, nausea; dermatitis; chemical pneumonitis (aspiration liquid); unconsciousness	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Hexachlorocyclopentadiene	77-47-4	PID	NA NA	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, respiratory system; eye, skin burns; lacrimation (discharge of tears); sneezing, cough, dyspnea (breathing difficulty), salivation, pulmonary edema; nausea, vomiting, diarrhea; In Animals: liver, kidney injury	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	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
1.3.1 – 1.3.10	Isopropyl alcohol Carbinol IPA Isopropanol 2-Propanol sec-Propyl alcohol Rubbing alcohol	67-63-0	PID	400 ppm 2000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; drowsiness, dizziness, headache; dry cracking skin; in animals: narcosis	Eye: Irrigate immediately Skin: Water flush Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Methoxychlor p,p'-Dimethoxydiphenyltrichloroethane DMDT Methoxy-DDT 2,2-bis(p-Methoxyphenyl)-1,1,1-trichloroethane 1,1,1-Trichloro-2,2-bis-(p-methoxyphenyl)ethane	72-43-5	None	15 mg/m^3 5000 mg/m^3	Groundwater Soil Vapor	inhalation, ingestion	fasciculation, trembling, convulsions; kidney, liver damage; [potential occupational carcinogen]	Skin: Soap wash Breathing: Fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.10	Methyl *tert*-butyl ether MTBE Methyl tertiary-butyl ether Methyl t-butyl ether tert-Butyl methyl ether tBME tert-BuOMe	1634-04-4	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Methyl chloroform Chlorothene 1,1,1-Trichloroethane 1,1,1-Trichloroethane (stabilized) 1,1,1-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 – 1.3.10	1,1,2-Trichloroethane 1,1,2-TCA 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 – 1.3.10	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 – 1.3.10	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	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 – 1.3.10	Phenanthrene	85-01-8	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.10	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	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 – 1.3.10	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 – 1.3.10	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; possible liver injury; reproductive effects	Eye: Irrigate immediately Skin: Water flush 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 – 1.3.10	Tetrachloroethylene Perchlorethylene Perchloroethylene PCE Perk Tetrachlorethylene Tetrachloroethene	127-18-4	PID	100 ppm 150 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	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 – 1.3.10	Trichloroethylene Ethylene trichloride TCE Trichloroethene Trilene	79-01-6	PID	100 ppm 1000 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Trichlorofluoromethane Fluorotrichloromethane Freon® 11 Monofluorotrichloromethane Refrigerant 11 Trichloromonofluoromethane	75-69-4	PID	1000 ppm 2000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	incoordination, tremor; dermatitis; cardiac arrhythmias, cardiac arrest; asphyxia; liquid: frostbite	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	1,1,2-Trichloro-1,2,2-trifluoroethane Chlorofluorocarbon-113 CFC-113 Freon® 113 Genetron® 113 Halocarbon 113 Refrigerant 113 TTE	76-13-1	PID	1000 ppm 2000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation skin, throat, drowsiness, dermatitis; central nervous system depression; in animals: cardiac arrhythmias, narcosis	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	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 – 1.3.10	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 – 1.3.10	Total PCBs Chlorodiphenyl (42% chlorine) Aroclor® 1242 PCB Polychlorinated biphenyl	53469-21-9	None	0.5 mg/m³ 5 mg/m³	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 – 1.3.10	o-Xylene 1,2-Dimethylbenzene ortho-Xylene o-Xylol	95-47-6	PID	100 ppm 900 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	m-Xylene 1,3-Dimethylbenzene m-Xylol Metaxylene	108-38-3	PID	100 ppm 900 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	p-Xylene 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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	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 – 1.3.10	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 – 1.3.10	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 – 1.3.10	Diesel Fuel automotive diesel fuel oil No. 2 distillate diesoline diesel oil diesel oil light diesel oil No. 1-D summer diesel	68334-30-5	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Aluminum	7429-90-5	None	0.5 mg/m3 50 mg/m3	Soil	inhalation, skin and/or eye contact	irritation to the eyes, skin, respiratory system	Eye: Irrigate immediately Breathing: Fresh air
1.3.1 – 1.3.10	Antimony	7440-36-0	None	0.5 mg/m^3 50 mg/m^3	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation skin, possible dermatitis; resp distress; diarrhea; muscle tremor, convulsions; possible gastrointestinal tract	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Arsenic	NA	None	0.5 mg/m^3 NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation skin, possible dermatitis; resp distress; diarrhea; muscle tremor, convulsions; possible gastrointestinal tract	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Barium	10022-31-8	None	0.5 mg/m³ 50 mg/m³	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, upper respiratory system; skin burns; gastroenteritis; muscle spasm; slow pulse	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Beryllium	7440-41-7	None	0.002 mg/m³ 4 mg/m³	Soil	inhalation, skin and/or eye contact	berylliosis (chronic exposure): anorexia, weight loss, lassitude (weakness, exhaustion), chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation to the eyes; dermatitis; [potential occupational carcinogen]	Eye: Irrigate immediately Breathing: Fresh air
1.3.1 – 1.3.10	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 – 1.3.10	Chromium Hexavalent- Trivalent-	7440-47-3	None	1.0 mg/m³ 250 mg/m³	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 – 1.3.10	Cobalt	7440-48-4	None	0.1mg/m³ 20 mg/m³	Soil	inhalation, ingestion, skin and/or eye contact	Cough, dyspnea (breathing difficulty), wheezing, decreased pulmonary function; weight loss; dermatitis; diffuse nodular fibrosis; resp hypersensitivity, asthma	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Copper	7440-50-8	None	1.0 mg/m³ 100 mg/m³	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 – 1.3.10	Cyanide	57-12-5	None	5 mg/m³ 25 mg/m³	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	Exposure to cyanide can cause weakness, headaches, confusion, dizziness, fatigue, anxiety, sleepiness, nausea and vomiting. Breathing can speed up then become slow and gasping. Coma and convulsions also occur. If large amounts of cyanide have been absorbed by the body, the person usually collapses and death can occur very quickly. Long-term exposure to lower levels of cyanide can cause skin and nose irritation, itching, rashes and thyroid changes.	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	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 – 1.3.10	Lead	7439-92-1	None	0.050 mg/m^3 100 mg/m^3	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation to the eyes; hypertension	Eye: Irrigate immediately Skin: Soap flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	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 – 1.3.10	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	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
1.3.1 – 1.3.10	Potassium	7440-09-7	None	NA NA	Soil	inhalation, skin absorption, ingestion, skin and/or eye contact inhalation, ingestion, skin and/or eye contact	eye: Causes eye burns. Skin: Causes skin burns. Reacts with moisture in the skin to form potassium hydroxide and hydrogen with much heat. ingestion: Causes gastrointestinal tract burns. inhalation: May cause irritation of the respiratory tract with burning pain in the nose and throat, coughing, wheezing, shortness of breath and pulmonary edema. Causes chemical burns to the respiratory tract. inhalation may be fatal as a result of spasm, inflammation, edema of the larynx and bronchi, chemical pneumonitis and pulmonary edema.	Eyes: Get medical aid immediately Skin: Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. ingestion: If victim is conscious and alert, give 2-4 full cups of milk or water. Get medical aid immediately. inhalation: Get medical aid immediately.

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	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 – 1.3.10	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 – 1.3.10	Vanadium	7440-62-2	None	0.1 mg/m3 15 mg/m3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peri neuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Zinc	7440-62-2	None	15 mg/m^3 500 mg/m^3	Groundwater Soil	inhalation	chills, muscle ache, nausea, fever, dry throat, cough; lassitude (weakness, exhaustion); metallic taste; headache; blurred vision; low back pain; vomiting; malaise (vague feeling of discomfort); chest tightness; dyspnea (breathing difficulty), rales, decreased pulmonary function	Breathing: Respiratory support
1.3.1 – 1.3.10	OilScreenSoil (Indigo Blue)® non-SUDAN-based dye	17354-14-2	None	NA NA	NA	inhalation, skin absorption, ingestion, skin and/or eye contact	NA	Eye: Irrigate immediately Skin: Water flush promptly Breathing: move into fresh air, provide respiratory support , if required Swallow: Rinse with water
1.3.1 – 1.3.10	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 – 1.3.10	Helium	7440-59-7	Helium Detector	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 – 1.3.10	Potassium hydrogen phthalate	877-24-7	NA	NA NA	NA	skin absorption, ingestion, skin and/or eye contact	nausea, diarrhea, abdominal pain, vomiting;	Skin: Water flush promptly Swallow: Medical attention immediately
1.3.1 – 1.3.10	Non-Flammable Gas Mixture CALGAS (Equipment Calibration Gas : Oxygen Isobutylene Nitrogen	 7782-44-7 115-11-7 7727-37-9	PID	 NA/NA NA/NA NA/NA	NA	inhalation	dizziness, headache, and nausea	Breathing: Respiratory support

EXPLANATION OF ABBREVIATIONS

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

TABLE 3
Summary of Monitoring Equipment

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

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

TABLE 4
INSTRUMENTATION ACTION LEVELS

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

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

TABLE 5
EMERGENCY NOTIFICATION LIST

ORGANIZATION	CONTACT	TELEPHONE
Local Police Department	NYPD	911
Local Fire Department	NYFD	911
Ambulance/Rescue Squad	NYFD	911
Hospital	Woodhull Medical and Mental Health Center	911 or 718-963-8000
Langan Incident / Injury Hotline		800-952-6426 ex 4699
Langan Project Manager	Gerald Nicholls	609-933-5330 (cell)
Langan Health and Safety Manager (HSM)	Tony Moffa	215-756-2523 (cell)
Langan Health & Safety Officer (HSO)	William Bohrer	410-984-3068 (cell)
Langan Field Team Leader (FTL)	Patrick Farnham	646-593-0849 (cell)
Client's Representative	Jack Teich	914-536-3880 (cell)
National Response Center (NRC)		800-424-8802
Chemical Transportation Emergency Center (Chemtrec)		800-424-9300
Center for Disease Control (CDC)		404-639-3534
EPA (RCRA Superfund Hotline)		800-424-9346
TSCA Hotline		202-554-1404
Poison Control Center		800-222-1222

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

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

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

a For work levels of 250 kilocalories/hour.

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

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

TABLE 7

HEAT INDEX

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

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

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

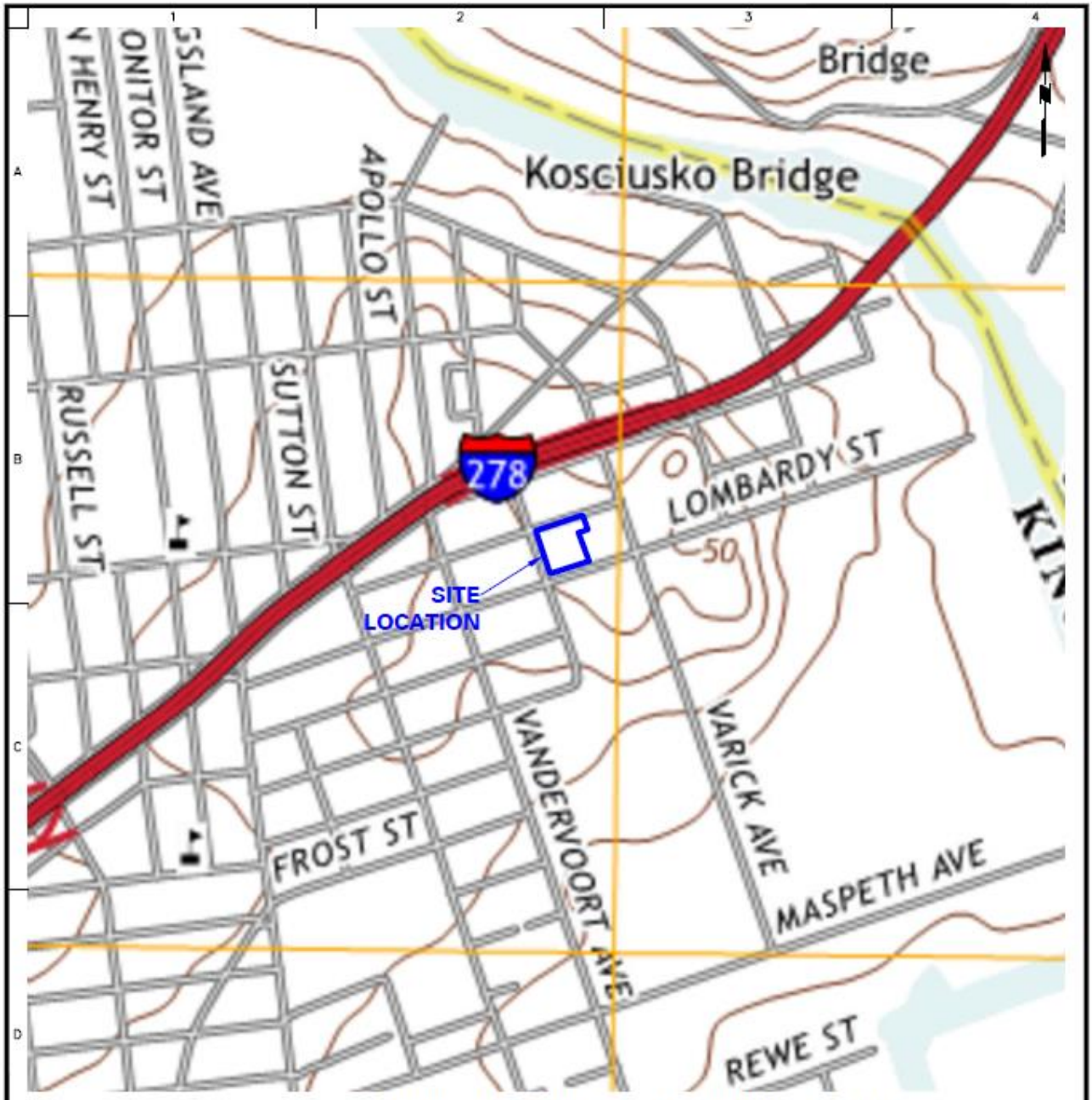
Note: Exposure to full sunshine can increase Heat Index values by up to 15 degrees F.

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

FIGURES

FIGURE 1

Site Location Map



MAP REFERENCE: USGS BROOKLYN, N.Y. TOPOGRAPHIC QUADRANGLE

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

LANGAN
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Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C.
Langan Engineering and Environmental Services, Inc.
Langan CT, Inc.
Langan International LLC
Collectively known as Langan

Project
FORMER ACME STEEL/BRASS FOUNDRY
NYSDEC SITE No. 224132
72 ANTHONY STREET / 498 PORTER AVENUE
BROOKLYN NEW YORK

Figure Title
SITE LOCATION MAP

Project No. 170157201	Figure 1
Date 05/06/2016	
Scale NTS	
Drawn By PTF / Checked By GN	
Submission Date	Sheet 1 of 3

Filename: \\Langan.com\data\NY\data2\170157201\Cadd Data - 170157201SRIWP\224132\Figure 1 - Site Location Map.dwg Date: 6/10/2016 Time: 10:04 User: pfernham Style Table: Langan.stb Layout: ANSI-BP

FIGURE 2

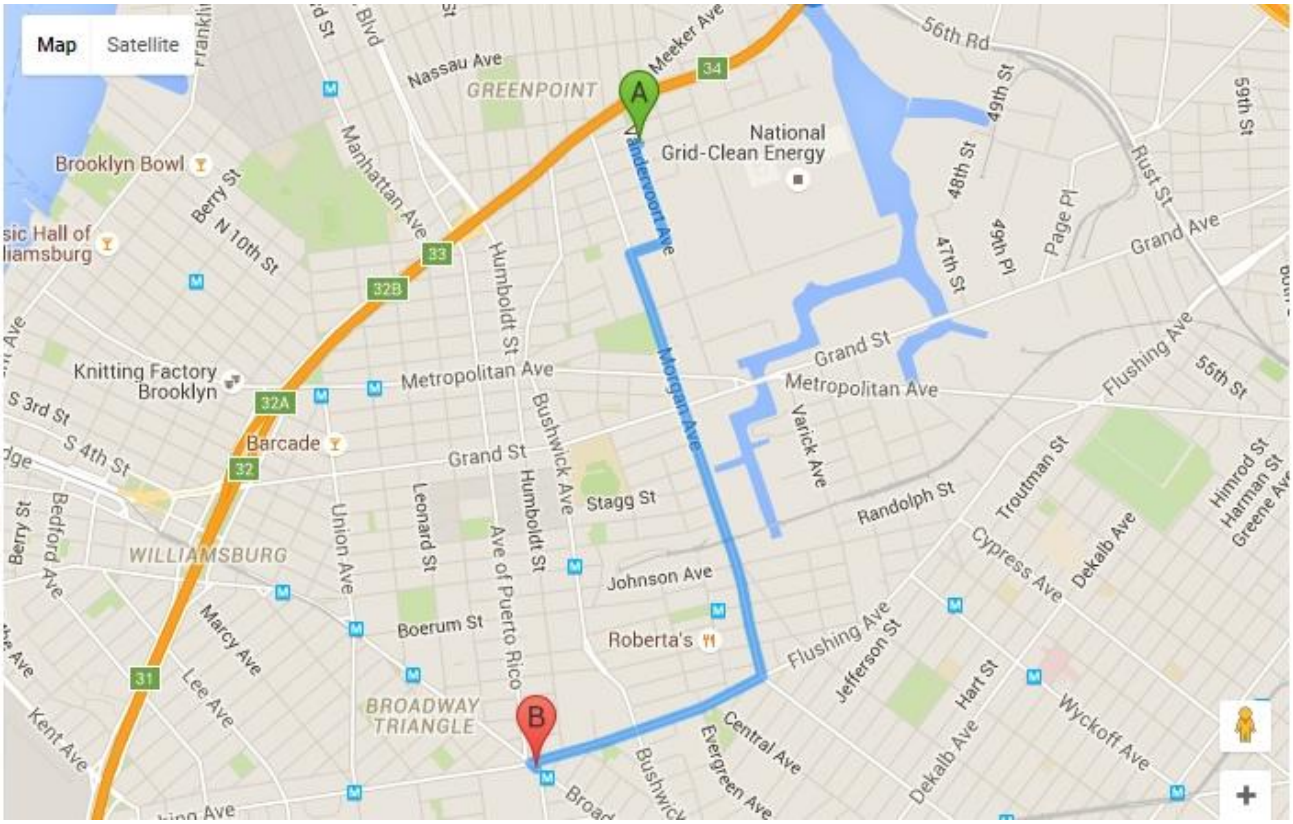
HOSPITAL ROUTE PLAN

Hospital Location: **Woodhull Medical and Mental Health Center**
760 Broadway Street
Brooklyn, New York
718-963-8000

START: 72 Anthony Street, Brooklyn, NY

1. Head west on Anthony Street toward Porter Avenue
2. Turn left onto Porter Avenue
3. Turn right onto Lombardy Street
4. Head west on Lombardy Street toward Vandervoort Avenue
5. Turn left onto Vandervoort Avenue
6. Turn right onto Withers Street
7. Turn left onto Morgan Avenue
8. Turn right onto Flushing Avenue
9. Turn left onto Broadway Street, medical center in on the right.

END: Woodhull Medical and Mental Health Center, 760 Broadway Street, Brooklyn, NY



ATTACHMENT A

STANDING ORDERS

STANDING ORDERS

GENERAL

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

TOOLS AND HEAVY EQUIPMENT

- Do not, under any circumstances, enter or ride in or on any backhoe bucket, materials hoist, or any other device not specifically designed to 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 insure that the equipment operator has lowered all blades and buckets to the ground before shutting off the vehicle.
- If the equipment has an emergency stop device, have the operator show all personnel its location and how to activate it.
- Help the operator ensure adequate clearances when the equipment must negotiate in tight quarters; serve as a signalman to direct backing as necessary.
- Ensure that all heavy equipment that is used in the Exclusion Zone is kept in that zone until the job is done, and that such equipment is completely decontaminated before moving it into the clean area of the work zone.
- Samplers must not reach into or get near rotating equipment such as the drill rig. If personnel must work near any tools that could rotate, the equipment operator must completely shut down the rig prior to initiating such work. It may be necessary to use a remote sampling device.

ATTACHMENT B

DECONTAMINATION PROCEDURES

PERSONNEL DECONTAMINATION

LEVEL C DECONTAMINATION

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

LEVEL D DECONTAMINATION

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

EQUIPMENT DECONTAMINATION

GENERAL:

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

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

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

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

MONITORING EQUIPMENT:

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

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

RESPIRATORS:

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

ATTACHMENT C

EMPLOYEE EXPOSURE/ INJURY INCIDENT REPORT

EMPLOYEE INCIDENT/INJURY REPORT
LANGAN ENGINEERING & ENVIRONMENTAL SERVICES

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

Affected Employee Name: _____ Date: _____

Incident type: ☐ Injury ☐ Report Only/No Injury

☐ Near Miss ☐ Other: _____

EMPLOYEE INFORMATION (Person completing Form)

Employee Name: _____ Employee No: _____

Title: _____ Office Location: _____

Length of time employed or date of hire: _____

Mailing address: _____

_____

Sex: M ☐ F ☐ Birth date: _____

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

ACCIDENT INFORMATION

Project: _____ Project #: _____

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

Site location: _____

Incident Type: Possible Exposure ☐ Exposure ☐ Physical Injury ☐

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

_____

Exact location incident occurred: _____

_____

Describe work being done: _____

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

Describe in detail how the incident occurred: _____

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

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

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

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

Weather conditions during incident: _____

MEDICAL CARE INFORMATION

Did affected employee receive medical care? Yes ☐ No ☐

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

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

Length of stay at the facility? _____

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

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

Has the employee returned to work? Yes ☐ No ☐

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

If Yes, please describe: _____

_____

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

If Yes, please describe: _____

HEALTH & SAFETY INFORMATION

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

Describe protective equipment and clothing used by the employee:

_____

_____

_____

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

_____

_____

_____

_____ _____

Employee Signature Date

_____ _____

Langan Representative Date

ATTACHMENT D

CALIBRATION LOG

DATE:________________ **PROJECT:____________________**

CALIBRATION LOG

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

ATTACHMENT E

MATERIAL SAFETY DATA SHEETS

SAFETY DATA SHEETS

All Langan Field Personnel Completing This Work Plan Are To Have Real Time Accessibility To Material Safety Data Sheet (MSDs) or Safety Data Sheet (SDSs) Through Their Smart Phone. If They Are Unable To Use the Smart Phone App, They Are To Bring Printed Copies of the MSDs/SDSs to The Site

ATTACHMENT F

JOBSITE SAFETY INSPECTION CHECKLIST

Jobsite Safety Inspection Checklist

Date: _____ **Inspected By:** _____

Location: _____ **Project #:** _____

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

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

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

Unsafe Acts:

Notes:

ATTACHMENT G

JOB SAFETY ANALYSIS FORM

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

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

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

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

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

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 B

QUALITY ASSURANCE PROJECT PLAN

Quality Assurance Project Plan

for

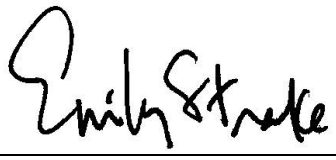
Former ACME Steel/Brass Foundry
72 Anthony Street/498 Porter Avenue
Brooklyn, New York
NYSDEC Site No. 224132

Prepared For:

Whitehead Company
251 Lombardy Street
Brooklyn, New York 11222

Prepared By:

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



Emily Strake
Senior Project Chemist

June 2016
170157201

LANGAN

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1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) is for the 52,860 square-foot property at 72-90 Anthony Street and 498 Porter Avenue (Tax Block 2820, Lots 1 and 5) in Brooklyn, New York (the "Site"). The Site is a New York State Department of Environmental Conservation (NYSDEC) Class 2 Inactive Hazardous Waste Disposal Site (IHWDS), Site No. 224132.

This QAPP specifies analytical methods to be used to ensure that data collected during Site management are precise, accurate, representative, comparable, complete, and meet the sensitivity requirements of the project.

1.2 PROJECT OBJECTIVES

The objective of this investigation is to further investigate and characterize the nature and extent of environmental impacts on the Site to support evaluation of potential remedial actions. Assessment and characterization of the Site began in 1998; Langan began remedial investigation (RI) activities as of September 2012 on behalf of the Whitehead Company (Whitehead). The RI identified chlorinated volatile organic compounds (CVOCs) and 1,4-dioxane in soil at concentrations greater than their NYSDEC Unrestricted Use Soil Cleanup Objectives (SCOs). The RI identified chlorinated ethenes, including tetrachloroethene (PCE), trichloroethene (TCE), their degradation products (1,1-dichloroethene [DCE] and cis-1,2-dichloroethene [cDCE]) and chlorinated ethanes, including 1,1,1-trichloroethane [TCA], 1,1-dichloroethane [DCA], and 1,2-dichloroethane [DCA] – in shallow and deep overburden groundwater at concentrations exceeding their respective NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values (AWQS). PCE and TCE were detected in subslab soil vapor at concentrations greater than their respective New York State Department of Health (NYSDOH) Air Guideline Values (AGVs). TCE was detected in one indoor air sample at a concentration that marginally exceeded that recommended by NYSDOH for residential communities; PCE was not.

Based on the results above, further delineation is necessary for three areas of concern, with contingent sampling to be performed if further soil characterization is required. Potential off-site investigation work is pending the results of this supplemental RI and the reconstruction of the Kosciusko Bridge.

1.3 SCOPE OF WORK

A geophysical survey will be performed to identify potential subsurface conditions (underground storage tanks [USTs], underground utilities, etc.). Soil borings will be advanced to a maximum depth of about 95 feet below grade surface (bgs); a minimum of three soil samples will be taken from each soil boring based on field observations and analyzed for volatile organic compounds (VOCs). In addition, a new groundwater monitoring well couplet will be installed as part of SRI activities; groundwater will be sampled at the newly installed and existing wells for VOCs, with three wells also sampled for semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), metals, and total cyanide. A complete list of parameters and their associated quantitation limits can be found in Appendix B. The sampling plan for SRI activities can be found in Tables 1 and 2 of the SRI Work Plan (SRIWP). The results of soil groundwater and sampling will be used to further characterize the degree and extent of contamination.

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 supplemental remedial investigation. The overall objective is to delineate the extent of contamination in soil and groundwater. The SRIWP 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.
- Required Analytical Level: The level of data quality, data precision, and quality assurance/quality control (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

Any future remedial activities and investigations will be overseen by Langan or another environmental consultant for Whitehead or a future owner. The environmental consultant will also arrange data analysis and reporting tasks. 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).

For the required sampling as stated in the SRIWP, sampling will be conducted by Langan; the analytical services will be performed by York Analytical Laboratories, Inc. of Stratford, Conn. (NYSDOH ELAP certification number 10854). Data validation services will be performed by Emily Strake of Langan.

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

Whitehead Company:	Mr. Jack Teich Telephone: (718)-384-7800 ext. 3202
Langan Project Manager:	Mr. Gerald Nicholls, P.E. Telephone: (212)-479-5559
Langan Health & Safety Officer (HSO):	Mr. Tony Moffa, CHMM Telephone: (215)-491-6500
Langan Quality Assurance Manager (QAM):	Mr. Michael Skirka, CHMM Telephone: (201)-240-0652
Langan Data Validator:	Ms. Emily Strake Telephone: (215) 491-6526
Laboratory Representative:	York Analytical Laboratories, Inc. Richard August Telephone: (203)-325-1371 ext. 834

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

- 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

- 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 $\leq 2X \pm$RL.

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

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 blanks and through compliance to all sample handling, preservation, and holding time requirements. All field 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, surrogate compound recoveries, and the results of method preparation blanks. MS/MSD, LCS, 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 and groundwater 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 QA personnel, sampling and analytical procedures that achieve the required levels of detection and QC acceptance limits that meet established performance criteria. Concurrently, the project manager will select the level of data assessment to ensure that only data meeting the project 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. The concentration of the lowest level check standard in a multi-point calibration curve will represent the reporting limit.

Analytical methods and quality assurance parameters associated with the sampling program are presented in Attachment C. The frequency of associated field 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. Additional sample volume is not required by the laboratory for this purpose. An MS/MSD analysis will be analyzed at a rate of 1 out of every 20 samples, or one per analytical batch. MS/MSD samples are only required for soil and groundwater samples.

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). 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
- Date and time of activity
- Sample identification numbers
- Geographical location of sampling points with references to the site, other facilities or a map coordinate system. Sketches will be made in the field logbook when appropriate

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

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

5.1.2 Sample Labeling

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

5.2 EQUIPMENT CALIBRATION AND PREVENTATIVE MAINTENANCE

A 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 HSO, 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 (YSI 6820 or similar) will be used during purging of groundwater to measure pH, specific conductance, temperature, dissolved oxygen, turbidity and oxidation-reduction-potential (ORP), every ten minutes. 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 VOCs and for health and safety monitoring. In addition, OilScreenSoil (Indigo Blue) ® non-SUDAN-based dye will be used to test for the presence of dense non-aqueous phase liquid (DNAPL) in grossly contaminated soil intervals. 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. 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 soil samples will meet the holding times required for each analyte as specified in Attachment C. In addition, analysis of collected soil sample will meet all quality assurance criteria set forth by this QAPP and DER-10.

Groundwater Samples

Groundwater sampling will be conducted using low-flow sampling procedures following United States Environmental Protection Agency (USEPA) guidance ("Low Stress [low flow] Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells", EQASOP-GW 001, January 19, 2010).

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 ten 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, ±3% for conductivity and temperature, ±10 millivolts for ORP, and ±10% for turbidity and dissolved oxygen. Purge rates should be adjusted to keep the drawdown in the well to less than 0.3 feet, as practical. Additionally, an attempt should be made to achieve a stable turbidity reading of less than 10 Nephelometric Turbidity Units (NTU) prior to sampling. If the

turbidity reading does not stabilize at reading of less than 10 NTU for a given well, then both filtered and unfiltered samples should be collected from that well. If necessary, field filtration should be performed using a 0.45 micron disposable in-line filter. Groundwater samples should be collected after parameters have stabilized as noted above or the readings are within the precision of the meter. Deviations from the stabilization and drawdown criteria, if any, should be noted on the sampling logs.

Samples should be collected directly into 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 sample will meet all quality assurance criteria set forth by this QAPP and DER-10.

Sample Field 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 off of 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. Trip blanks will be collected at a rate of one per day if groundwater samples are analyzed for VOCs during that day.

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 or groundwater samples 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° ±2° 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°±2°C while on-site and during sample shipment to the analytical laboratory.

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

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 SRIWP. 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

5.8 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 and purged groundwater generated during drilling, monitoring well development, and groundwater sampling will be containerized in 55-gallon drums. Due to the known historical use of degreasing solvents, excess soil and groundwater generated during SRIWP implementation will be initially managed as Resource Conservation and Recovery Act (RCRA)/NYSDEC Part 371 F-listed hazardous waste (F001) for spent halogenated solvent/solvent mixtures from degreasing operations.

After SRIWP implementation activities are complete, a waste characterization will be performed to determine whether the excess soil and groundwater can be considered non-hazardous waste through a contained-in policy demonstration. Waste characterization samples will be analyzed for VOCs and toxicity characteristic leaching procedure (TCLP) VOCs to comply with the requirements of the NYSDEC contained-in demonstration. The sampling frequency of the contained-in demonstration will be presented to and approved by NYSDEC prior to the collection of samples.

Waste characterization samples will also be analyzed for parameters that are typically required by disposal facilities, including, TCL SVOCs, Resource Conservation and Recovery Act (RCRA) metals, PCBs, pesticides, herbicides, 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 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.,

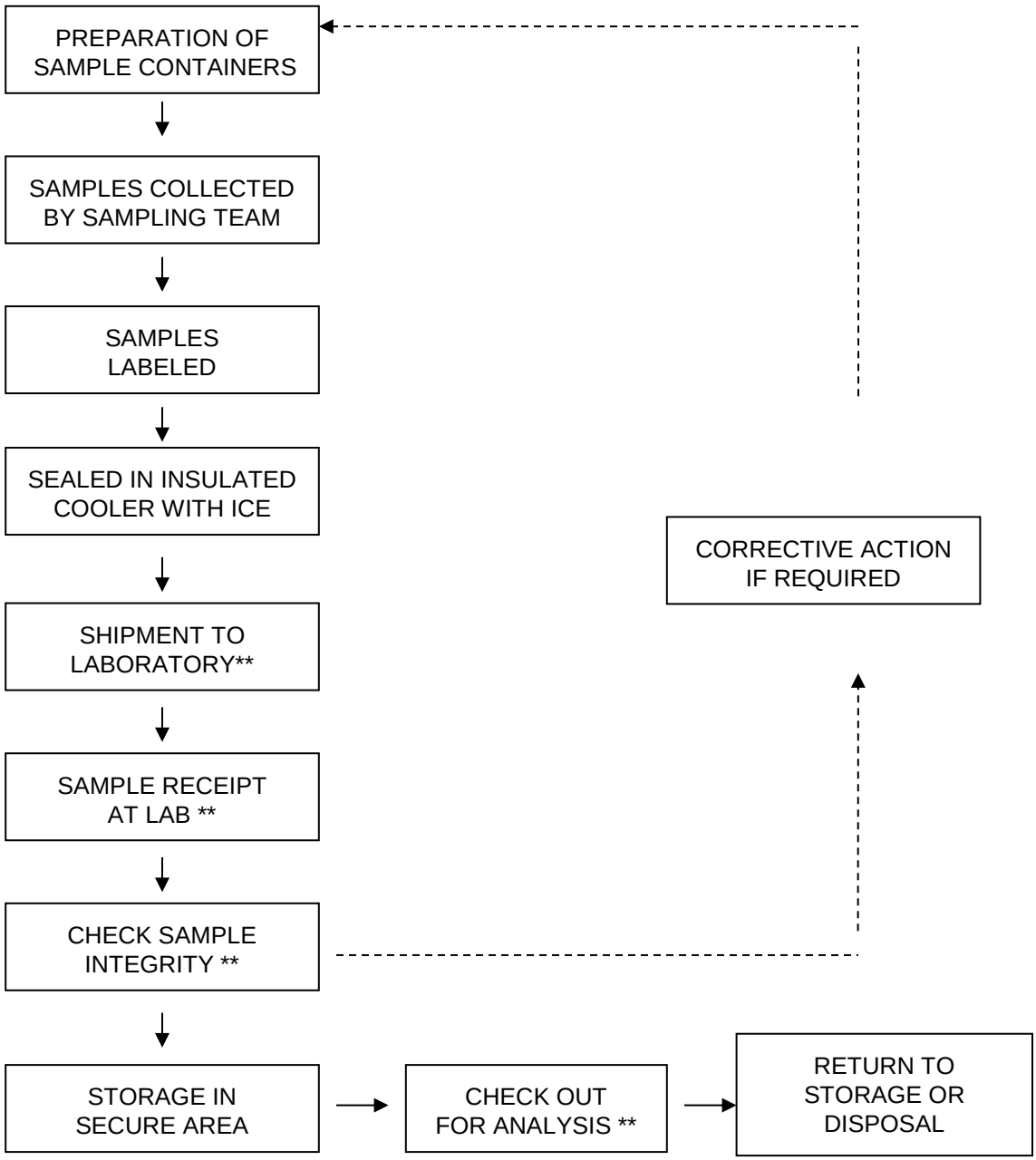
preservatives) will be recorded on the form. All entries will be made in waterproof, permanent blue or black ink.

- 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.

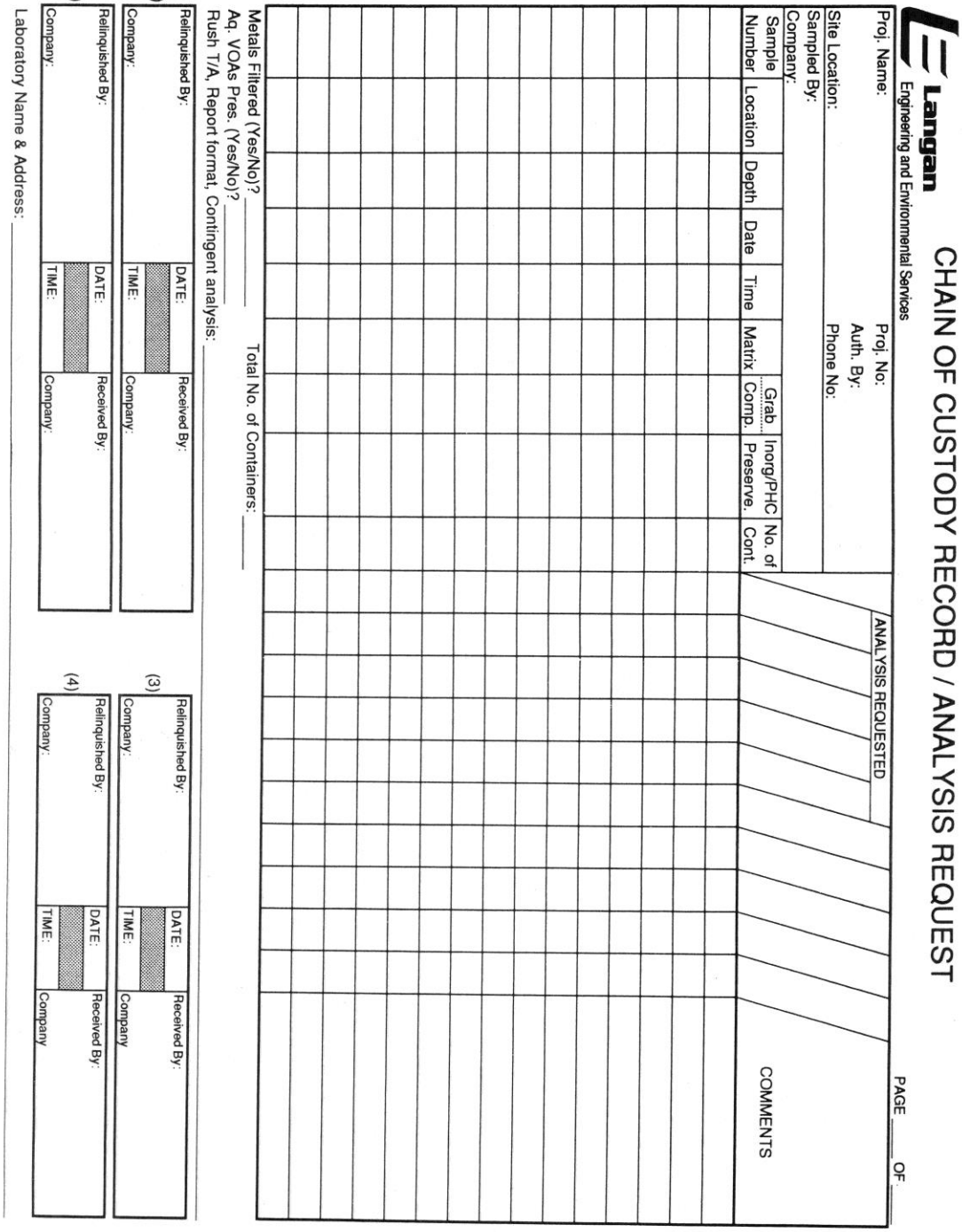
Samples will be packaged for shipment to the laboratory with the appropriate chain-of-custody form. A copy of the form will be retained by the sampling team for the project file and the original will be sent to the laboratory with the samples. Bills of lading will also be retained as part of the documentation 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 a chain-of-custody form is included as Figures 5.2.

Figure 5.1 Sample Custody



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

Figure 5.2 Sample Chain-of-Custody Form – Soil and Groundwater



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CHAIN OF CUSTODY RECORD / ANALYSIS REQUEST

PAGE ____ OF ____

Proj. Name:
Proj. No:
Auth. By:
Phone No:
Site Location:
Sampled By:
Company:

ANALYSIS REQUESTED

Sample Number	Location	Depth	Date	Time	Matrix	Grab / Comp.	Inorg/PHC Preserve.	No. of Cont.	COMMENTS

Metals Filtered (Yes/No)? _____ Total No. of Containers: ____
Aq. VOAs Pres. (Yes/No)? _____
Rush T/A, Report format, Contingent analysis: _____

	Relinquished By:	DATE:	Received By:
(1)	Company:	TIME:	Company:
(2)	Relinquished By:	DATE:	Received By:
	Company:	TIME:	Company:
(3)	Relinquished By:	DATE:	Received By:
	Company:	TIME:	Company
(4)	Relinquished By:	DATE:	Received By:
	Company:	TIME:	Company

Laboratory Name & Address: _____

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

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

6.0 DATA REDUCTION, VALIDATION, AND REPORTING

6.1 INTRODUCTION

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

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

6.2 DATA REDUCTION

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

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

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

6.3 DATA VALIDATION

Data validation will be performed in accordance with the USEPA Region 2 validation guidelines for organic and inorganic data review. Validation will include the following:

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

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

- Holding times;
- Instrument tuning;
- Instrument calibrations;
- Blank results;
- System monitoring compounds or surrogate recovery compounds (as applicable);
- Internal standard recovery results;
- MS and MSD recoveries and RPDs
- LCS recoveries and RPDs
- Endrin/DDT Breakdown (if applicable);
- Dual Column Analysis (if applicable);
- Target compound identification;
- Chromatogram quality;
- Pesticide cleanup (if applicable);

- Compound quantitation and reported detection limits;
- Overall system performance; and
- Results verification.

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

- Holding times;
- Calibrations;
- Blank results;
- Interference check sample;
- Laboratory check samples;
- Laboratory Duplicates;
- Matrix Spike;
- Furnace atomic absorption analysis QC;
- ICP serial dilutions; and
- Results verification and reported detection limits.

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

- "U" - Not detected. The associated number indicates the approximate sample concentration necessary to be detected significantly greater than the level of the highest associated blank;
- "UJ" - Not detected. Quantitation limit may be inaccurate or imprecise;
- "J" - 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 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. However, if conditions adverse to quality are detected or if the Project Manager requests, additional audits may occur.

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 QA group. These audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that quality assurance requirements 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 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 and staff such as field investigation teams, remedial response planning personnel, and laboratory groups, monitor on-going work performance in the

normal course of daily responsibilities. Work may be audited at the 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 12.1 or similar). The CAR identifies the out-of-compliance condition, reference document(s), and recommended corrective action(s) to be administered. The CAR is issued to the personnel responsible for the affected item or activity. A copy is also submitted to the Project Manager. The individual to whom the CAR is addressed returns the requested response promptly to the QA personnel, affixing his/her signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The QA personnel maintain the log for status of CARs, confirms the adequacy of the intended corrective action, and verifies its implementation. CARs will be retained in the project file for the records.

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

FIGURE 8.1

CORRECTIVE ACTION REQUEST

Number: _____ Date: _____

TO: _____

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

CONDITION:

REFERENCE DOCUMENTS:

RECOMMENDED CORRECTIVE ACTIONS:

_____ _____ _____ _____ _____ _____

Originator Date Approval Date Approval Date

RESPONSE

CAUSE OF CONDITION

CORRECTIVE ACTION

(A) RESOLUTION

(B) PREVENTION

(C) AFFECTED DOCUMENTS

C.A. FOLLOWUP:

CORRECTIVE ACTION VERIFIED BY: _____ DATE:_____

9.0 REFERENCES

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

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

USEPA, 1986. SW-846 "Test Method for Evaluating Solid Waste," dated November 1986. U.S. Environmental Protection Agency, Washington, D.C.

USEPA, 1987. Data Quality Objectives for Remedial Response Actions Activities: Development Process, EPA/540/G-87/003, OSWER Directive 9355.0-7- U.S. Environmental Protection Agency, Washington, D.C.

USEPA, 2015. Low/Medium Volatile Data Validation. SOP No. HW-33A, Revision 0, dated July 2015. USEPA Region II.

USEPA, 2015. PCB Aroclor Data Validation. SOP No. HW-37A, Revision 0, dated July 2015. USEPA Region II.

USEPA, 2015. ICP-AES Data Validation. SOP No. HW-3a, Revision 0, dated July 2015. USEPA Region II.

USEPA, 2015. Mercury and Cyanide Data Validation. SOP No. HW-3c, Revision 0, dated July 2015. USEPA Region II.

USEPA, 2015. Pesticide Data Validation. SOP No. HW-36A, Revision 0, dated June 2015. USEPA Region II.

USEPA, 2015. Semivolatile Data Validation. SOP No. HW-35A, Revision 0, dated June 2015. USEPA Region II.

ATTACHMENT A – RÉSUMÉS

Emily G. Strake

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

15 years in the industry ~ 2 years with Langan

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

Ms. Strake has over nine years of experience assessing potential adverse health effect to humans from exposure to hazardous contaminants in soil, sediment, groundwater, surface water, ambient and indoor air, and various types of animal, fish, and plant materials. She understands and applies environmental cleanup guidance and policies associated with multiple federal and state agencies. Additionally, she has broad experience in the development of preliminary remediation goals and site-specific action levels. She is proficient with the USEPA and Cal/EPA Johnson and Ettinger Model for Subsurface Vapor Intrusion into Buildings, USEPA's Adult Lead Methodology, DTSC's Leadspread 7 and 8, and statistical evaluation of data using USEPA's ProUCL software.

Ms. Strake has extensive experience in environmental data validation, focused on ensuring laboratory deliverables follow specific guidelines as described by regulatory agencies and the analytical methods employed. In addition, she has experience in EQuIS chemical database management. She also has a broad range of environmental field experience and maintains current OSHA HAZWOPER certification.

Ms. Strake is experienced in auditing laboratory and field-sampling activities for compliance with Quality Assurance Project Plans (QAPPs), the National Environmental Laboratory Accreditation Conference Standards Quality Systems manual, and applicable USEPA Guidance. Ms. Strake has also audited on-site laboratories in support of groundwater treatment operations and implemented corrective actions. Her responsibilities include writing reports on the value of laboratory work, writing/editing QAPPs for clients and project-specific sites, peer reviewing colleague's work, and mentoring staff within the office. She has also served as the Quality Assurance officer for several long-term projects, responsible for the achievement of all forms of Quality Control/Quality Assurance by onsite personnel relating to sampling, analysis, and data evaluation.

Ms. Strake has several years' experience analyzing investigative samples, writing laboratory Standard Operating Procedures (SOPs), and managing all

Education

M.B.A., Business Administration
The University of Scranton

B.S., Chemistry
Cedar Crest College

Memberships

Interstate Technology and Regulatory Council

Society for Risk Analysis

Training

Candidate, Certified Industrial Environmental Toxicologist. National Registry of Environmental Professionals.

40 hr. OSHA HAZWOPER Training/Nov 2002

8 hr. HAZWOPER Supervisor/June 2004

8 hr. OSHA HAZWOPER Refresher/Oct 2012

American Red Cross First Aid & CPR certified

Publications/Presentations

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

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

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

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

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aspects of procedures and analyses for Optical Emission Spectrometry, X-Ray Fluorescence, Ignition analysis, and Atomic Absorption. Her experience also includes operating and performing routine instrument maintenance for GC/MS and IR. Ms. Strake has worked extensively on developing rapid soil characterization programs for PCB and pesticide analyses utilizing enzyme-linked immunosorbent assays, and was also involved in efforts to develop new instrumentation to quantify microbial nitrification of ammonium.

Selected Project Experience

Human Health Risk Assessment

- Major League Soccer's San Jose Earthquakes Stadium – Utilized the Johnson and Ettinger advanced soil gas model to calculate risk and hazard associated with inhalation of chlorinated solvents for the redevelopment of a public soccer stadium. Soil gas data was modeled assuming three soil stratum and site-specific soil, building, and exposure parameters. The Earthquakes' stadium is set to open in 2015.
- Exelon - Developed a human health risk assessment for a utility-owned former Manufactured Gas Plant (MGP) site in Pennsylvania, under Pennsylvania's Act 2 Program. Used ProUCL 4.0 statistical software to determine upper limits for full data sets and non-detect data. Conducted vapor intrusion modeling (via the Johnson & Ettinger model) and prepared vapor intrusion reports showing that risks to volatile organic compounds in soils and groundwater were not impacting indoor air quality.
- Texas Instruments – Participated in a collaboration with Robert Ettinger and Geosyntec Consulting to develop comments to USEPA Region IX and the San Francisco Regional Water Quality Control Board regarding vapor intrusion at South Bay Superfund Sites. The focus of the response was to outline scientific and policy objections to EPA's recommended TCE interim short-term indoor air response action levels and guidelines, and to clarify the use of California-modified indoor air screening levels for assessing and responding to TCE and PCE subsurface vapor intrusion into indoor air.
- DuPont - Worked as a key participant in the human health risk evaluation of mercury associated with legacy contamination of the South River located in Waynesboro, Virginia.
- Veteran's Affairs - Completed a human health risk evaluation of the potential future risk associated with inhalation of indoor air for the Veteran's Administration. Soil, soil gas, and groundwater samples were collected as part of the site characterization. Achieved DTSC approval of the risk assessment approach and conclusions.
- Santa Clara Landfill – Developed a human health risk assessment to characterize risk associated with exposure to landfill gas at the Santa Clara All Purpose Landfill. The risk assessment evaluated specific compounds in landfill gas, their concentrations, spatial patterns, and extent throughout the site, and assessed the potential for vapor intrusion associated with a proposed future redevelopment.
- Avon - Completed a human health risk assessment in accordance with NYSDEC guidance for a redevelopment property located in Rye, New York. The objective of the evaluation was to characterize the risks associated with potential future human

exposures to soil and groundwater affected by a release from the Site's former No. 2 fuel oil UST. The intended future use of the Site was a playground to be utilized by the general public for open play on commercial recreational equipment.

- Golden Gate National Parks Conservancy – Peer reviewed a Preliminary Endangerment Assessment Report for the Battery East Trail. The assessment included a human health risk evaluation that estimated carcinogenic risk from exposure to PAHs and dioxin/furans in soil using toxic equivalency to benzo(a)pyrene and 2,3,7,8-TCDD.
- Sunoco Refineries – Derived site-specific soil PRGs for lead using the EPA's adult lead model for two former Sunoco refineries. Completed receptor evaluations in accordance with USEPA risk assessment guidance to develop exposure parameters under current and reasonably anticipated future land use scenarios.
- Honeywell - Completed a focused human health risk evaluation of PAH contaminants for under NJDEP's Site Remediation Program. Applied a blended approach of qualitative risk characterization and quantitative risk calculation to propose closure of AOCs following the remedial investigation.
- Delaware City Refinery - Performed comprehensive human health risk assessment for a petroleum refinery in Delaware City, Delaware. The risk assessment was the basis for a thorough characterization and assessment of potential risks posed by site-specific conditions. Developed various human exposure scenarios by using both Federal and State-Specific guidance for soil, groundwater, and surface water exposure.
- Occidental Chemical - Completed multiple AOC-specific risk assessments utilizing and applying the guidance set forth by the DTSC's Human Health Risk Assessment Note 1 (Default Exposure Factors for Use in Risk Assessment), Note 3 (Recommended Methodology for Use of USEPA Regional Screening Levels, and Note 4 (Screening Level Human Health Risk Assessments).
- Floreffe Terminal - Performed human health risk assessment for contamination resulting from a 3.9 million gallon diesel oil tank collapse along the Monongahela River. Evaluated potential impacts to human health via exposure to soil, groundwater, and surface water. Calculated site-specific standards for soil remediation.
- DOW Chemical - Calculated Medium Specific Concentrations (MSCs) for unregulated contaminants using the PADEP protocols to assist in the clean-up of a monomer tank explosion in Bristol, Pennsylvania. Selected appropriate surrogate toxicity data and evaluated novel on-site constituents by analogy.
- Ryder – Developed Alternative Direct Exposure Criteria for PAH-impacted fill material at a commercial facility. Site-specific soil screening levels for incidental ingestion of soil were calculated following a forward risk evaluation for current on-site receptors.
- Rohm and Haas - Prepared an Act 2 site-specific human health risk assessment for the oldest industrial facility in the United States, located in southeast Philadelphia. The objective of the risk assessment was to determine achievable possible future land-use options under Pennsylvania's Land Recycling Program. The risk assessment included evolution of multiple site-COPCs and constituent suites: VOCs, SVOCs, PCBs, pesticides, and metals

(including lead). Evaluated the potential for indoor air inhalation through J&E modeling of soil gas and groundwater.

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

Chemical Data Quality

- Audited multiple accredited laboratories in New Jersey and Pennsylvania on behalf of clients using USEPA Guidance on Technical Audits and Related Assessments for Environmental Data Operations. The audits included full-suite USEPA and SW-846 methodology; and included reviewing staff experience and training records, equipment and facilities, policies, practices, procedures, and documentation for sample receipt, analysis, instrument maintenance, standard preparation, calibration and traceability, control charting, corrective actions, data reduction and review, report generation, and waste disposal.
- Reviewed and validated data packages for RCRA Facilities Investigation at a Philadelphia-area chemical site; issued data validation reports to project personnel and regulatory agencies. The reviews included evaluation of quarterly groundwater, soil, and soil vapor matrices. Participated in RCRA groundwater sampling, developed and executed the investigation's QAPP, and coordinated with the laboratory to schedule and perform field-sampling events.
- Completed Data Usability Summary Reports in accordance with NYSDEC DER-10 guidance for soil, groundwater, sediment surface water, soil gas, ambient air and indoor air analytical results.
- Acted as the Quality Assurance Officer for several long-term projects in Pennsylvania, Maryland, and New Jersey, Delaware, responsible for the achievement of all forms of QA/QC as it related to sampling, analysis, and data evaluation.
- Participated in a CERCLA site investigation; assessed the usability of sample results for numerous matrices including dust, sediment, soils, and various aqueous matrices for a remedial investigation under the Contract Laboratory Program. Implemented an on-site pesticide immunoassay program to delineate soil contamination in real-time.
- EQuIS data manager for database migration of historical groundwater results associated with remediation activities; assisted with natural attenuation data evaluation and gained experience in geochemical trends associated with intrinsic biodegradation.
- Coordinated the collection of fish tissue samples and determined the validity of the analytical results associated with CERCLA and RCRA site characterizations. Assessed duck blood analytical results for the Connecticut Department of Energy and Environmental Protection Bureau of Natural Resources.

Anthony Moffa Jr, CHMM

Corporate Health and Safety Manager

Health & Safety Coordinator, Contingency Planning, Compliance Auditing

19 years in the industry ~ 12 years with Langan

Mr. Moffa has over nineteen years experience in providing environmental compliance assistance to both commercial and industrial facilities. His compliance auditing experience includes facility and process specific including the areas of waste management, stormwater and wastewater issues and air emissions. He has an extensive background in the areas of hazardous, non-hazardous and universal waste management. His level of experience includes working with federal, state and local authorities to ensure clients environmental compliance status on all levels. His compliance reporting includes federal and state specific reports. Completed federal reports include the Tier II, Toxic Chemical Release Inventories under SARA Title III and Biennial Hazardous Waste Reporting. Completed state specific reporting includes the Pennsylvania Form 26R and the New Jersey Release Pollution Prevention Report. He is experienced in the preparation, submittal and compliance monitoring of NPDES & stormwater applications and permits. He has developed site specific contingency plans for both industrial and commercial facilities for facilities throughout Pennsylvania and New Jersey.

Selected Projects

Verizon - Pennsylvania, Inc. Philadelphia Naval Yard, PA
Confidential Client, Philadelphia, PA
Penn Color, Doylestown, PA
Verizon - Pennsylvania, Inc., Phase I Environmental Assessment, Lansdowne, PA
Verizon - Pennsylvania, Inc. (formerly Bell Atlantic Corporation), Various Locations, PA
Kinder Morgan Bulk Terminals, Inc. Fairless Hills, PA
PP&L – Martins Creek, Bangor, PA
Concord Beverage Company, Concordville, PA
Penn Color, Hatfield, PA
National Starch & Chemical Company, Bloomfield, NJ
Air Products and Chemicals, Inc.., Middlesex, NJ
PSEG Services Corporation, Jersey City, NJ
Sampson Coatings, Richmond, VA
Custom Chemicals Corporation, Elmwood Park, NJ

Education

M.E., Science
Penn State University

B.S., Physics
West Chester University

Professional Registration

Certified Hazardous Material Manager (CHMM)

Professional Affiliations

Pennsylvania Chamber of Business & Industry

Chemical Council of New Jersey

New Jersey Business & Industry Association

Professional Training

OSHA 40-Hour Hazardous Waste Site Training Course

National Safety Council – CPR, Bloodborne Pathogen and First Aid Training

Steel Tank Institute Certified AST Inspector

PADEP Pollution Prevention & Energy Efficiency Qualified Assessor

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Gerald F. Nicholls, PE, CHMM

Senior Project Manager

Environmental Engineering & Hazardous Materials Management

11 years in the industry

Mr. Nicholls has 11 years of experience in environmental engineering and project management. His expertise includes management of remediation and site investigations, brownfield cleanups, remedial design, industrial hygiene, air monitoring and environmental health and safety projects including data collection, inspection and reporting for projects throughout New York and New Jersey. Mr. Nicholls has relevant work experience serving private, Department of Defense, state, commercial, industrial, and municipal clients.

Selected Projects

140 6th Avenue, New York, NY
23-01 42nd Road, Queens, NY
23-10 Queens Plaza South, Queens, NY
170 Amsterdam Avenue, New York, NY
Urban Health Plan, 1095 Southern Boulevard, Bronx, NY
Whitehead Realty, Acme Sites, Brooklyn, NY
Second Avenue Subway, New York, NY
West 17th Street Development, New York, NY
New York University Spill Sites for 4 Washington Square Village, 7-13 Washington Square North, and 251 Mercer Street, 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
Surfactant Remediation Project, 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, 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

Selected Publications, Reports, and Presentations

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

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

City of Jersey City Environmental Commission, Chair

Alliance of Hazardous Materials Professionals (AHMP)

Academy of Hazardous Materials Managers (ACHMM), NJ Chapter

American Chemical Society

Association of NJ Environmental Commissions (ANJEC)

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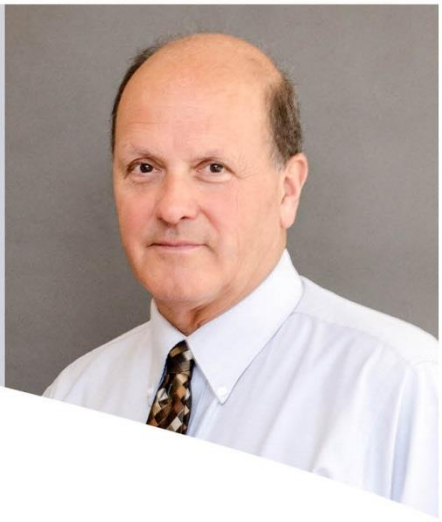
Michael A. Skirka, CHMM

Senior Project Manager
Environmental Engineering



30 years in the industry

Mr. Skirka has comprehensive experience in planning and managing sampling/investigations for industrial hazardous waste sites. His services have included the preparation and implementation of cleanup and closure plans; evaluation and design of safety plans, and quality assurance/quality control plans. Mr. Skirka has extensive experience managing multi-million dollar remediation projects involving site investigations, and remediation and redevelopment under the New York Voluntary Cleanup Program.

Selected Projects

Hatco Site Remediation, Fords, NJ
Real Estate Remediation/Acquisition Program, Northeast Division Manager, Various Locations
Hurricane Sandy Damage Response National Park Service, Various Locations, NY Metropolitan Area
Confidential Client, First Avenue Properties, New York, NY
Industrial Manufacturing Facility, Staten Island, NY
Environmental Restoration, Various Locations, NY, NJ, and MA
Former Raritan Arsenal (Remedial Investigation [RI]/Feasibility Study [FS]/Remedial Design [RD]/Title II Construction Project, Edison, NJ
Technical Assistance, Various Locations in NY, NJ Puerto Rico, and Virgin Islands
Preliminary Assessment and Engineering Evaluation/Cost Analysis (EE/CA), Post Farm Drum Disposal Area, USACE Picatinny Arsenal, Huntsville Division, Wharton, NJ
Industrial Site Recovery Act (ISRA)/Environmental Cleanup Responsibility Act (ECRA) Investigation, Central NJ
Preparation of Discharge Prevention, Containment, and Countermeasure (DPCC) Discharge Cleanup and Removal (DCR) Plans, Various Locations, Multiple Industrial Facilities
Implementation of Resource Conservation and Recovery Act (RCRA) Closures, Various Locations
Oversight Services, Federal Reserve Bank of NY, Northern NJ
Confidential Client, Remedial Investigation (RI) Report, Northern New Jersey

Education

B.S., Biology
Rutgers University

Professional Registration

40-Hour Hazardous Waste Site Training

10-Hour OSHA
Construction Safety Training

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ATTACHMENT B – LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS

Quantitation Limits

Method	Matrix	Analyte	LOQ	RL	Units
		Volatile Organic Compounds (VOCs)			
EPA 8260C	Groundwater	1,1,1,2-Tetrachloroethane	0.20	0.50	µg/L
EPA 8260C	Groundwater	1,1,1-Trichloroethane	0.20	0.50	µg/L
EPA 8260C	Groundwater	1,1,2,2-Tetrachloroethane	0.20	0.50	µg/L
EPA 8260C	Groundwater	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	0.20	0.50	µg/L
EPA 8260C	Groundwater	1,1,2-Trichloroethane	0.20	0.50	µg/L
EPA 8260C	Groundwater	1,1-Dichloroethane	0.20	0.50	µg/L
EPA 8260C	Groundwater	1,1-Dichloroethylene	0.20	0.50	µg/L
EPA 8260C	Groundwater	1,1-Dichloropropylene	0.20	0.50	µg/L
EPA 8260C	Groundwater	1,2,3-Trichlorobenzene	0.20	0.50	µg/L
EPA 8260C	Groundwater	1,2,3-Trichloropropane	0.20	0.50	µg/L
EPA 8260C	Groundwater	1,2,4-Trichlorobenzene	0.20	0.50	µg/L
EPA 8260C	Groundwater	1,2,4-Trimethylbenzene	0.20	0.50	µg/L
EPA 8260C	Groundwater	1,2-Dibromo-3-chloropropane	0.20	0.50	µg/L
EPA 8260C	Groundwater	1,2-Dibromoethane	0.20	0.50	µg/L
EPA 8260C	Groundwater	1,2-Dichlorobenzene	0.20	0.50	µg/L
EPA 8260C	Groundwater	1,2-Dichloroethane	0.20	0.50	µg/L
EPA 8260C	Groundwater	1,2-Dichloropropane	0.20	0.50	µg/L
EPA 8260C	Groundwater	1,3,5-Trimethylbenzene	0.20	0.50	µg/L
EPA 8260C	Groundwater	1,3-Dichlorobenzene	0.20	0.50	µg/L
EPA 8260C	Groundwater	1,3-Dichloropropane	0.20	0.50	µg/L
EPA 8260C	Groundwater	1,4-Dichlorobenzene	0.20	0.50	µg/L
EPA 8260C	Groundwater	1,4-Dioxane	40	40	µg/L
EPA 8260C	Groundwater	2,2-Dichloropropane	0.20	0.50	µg/L
EPA 8260C	Groundwater	2-Butanone	0.20	0.50	µg/L
EPA 8260C	Groundwater	2-Chlorotoluene	0.20	0.50	µg/L
EPA 8260C	Groundwater	2-Hexanone	0.20	0.50	µg/L
EPA 8260C	Groundwater	4-Chlorotoluene	0.20	0.50	µg/L
EPA 8260C	Groundwater	4-Methyl-2-pentanone	0.20	0.50	µg/L
EPA 8260C	Groundwater	Acetone	1.0	2.0	µg/L
EPA 8260C	Groundwater	Acrolein	0.20	0.50	µg/L
EPA 8260C	Groundwater	Acrylonitrile	0.20	0.50	µg/L
EPA 8260C	Groundwater	Benzene	0.20	0.50	µg/L
EPA 8260C	Groundwater	Bromobenzene	0.20	0.50	µg/L
EPA 8260C	Groundwater	Bromochloromethane	0.20	0.50	µg/L
EPA 8260C	Groundwater	Bromodichloromethane	0.20	0.50	µg/L
EPA 8260C	Groundwater	Bromoform	0.20	0.50	µg/L
EPA 8260C	Groundwater	Bromomethane	0.20	0.50	µg/L
EPA 8260C	Groundwater	Carbon disulfide	0.20	0.50	µg/L
EPA 8260C	Groundwater	Carbon tetrachloride	0.20	0.50	µg/L
EPA 8260C	Groundwater	Chlorobenzene	0.20	0.50	µg/L
EPA 8260C	Groundwater	Chloroethane	0.20	0.50	µg/L
EPA 8260C	Groundwater	Chloroform	0.20	0.50	µg/L
EPA 8260C	Groundwater	Chloromethane	0.20	0.50	µg/L
EPA 8260C	Groundwater	cis-1,2-Dichloroethylene	0.20	0.50	µg/L
EPA 8260C	Groundwater	cis-1,3-Dichloropropylene	0.20	0.50	µg/L
EPA 8260C	Groundwater	Cyclohexane	0.20	0.50	µg/L
EPA 8260C	Groundwater	Dibromochloromethane	0.20	0.50	µg/L
EPA 8260C	Groundwater	Dibromomethane	0.20	0.50	µg/L
EPA 8260C	Groundwater	Dichlorodifluoromethane	0.20	0.50	µg/L
EPA 8260C	Groundwater	Ethyl Benzene	0.20	0.50	µg/L
EPA 8260C	Groundwater	Hexachlorobutadiene	0.20	0.50	µg/L
EPA 8260C	Groundwater	Isopropylbenzene	0.20	0.50	µg/L
EPA 8260C	Groundwater	Methyl acetate	0.20	0.50	µg/L
EPA 8260C	Groundwater	Methyl tert-butyl ether (MTBE)	0.20	0.50	µg/L
EPA 8260C	Groundwater	Methylcyclohexane	0.20	0.50	µg/L

Quantitation Limits

Method	Matrix	Analyte	LOQ	RL	Units
EPA 8260C	Groundwater	Methylene chloride	1.0	2.0	µg/L
EPA 8260C	Groundwater	Naphthalene	1.0	2.0	µg/L
EPA 8260C	Groundwater	n-Butylbenzene	0.20	0.50	µg/L
EPA 8260C	Groundwater	n-Propylbenzene	0.20	0.50	µg/L
EPA 8260C	Groundwater	o-Xylene	0.20	0.50	µg/L
EPA 8260C	Groundwater	p- & m- Xylenes	0.50	1.0	µg/L
EPA 8260C	Groundwater	p-Isopropyltoluene	0.20	0.50	µg/L
EPA 8260C	Groundwater	sec-Butylbenzene	0.20	0.50	µg/L
EPA 8260C	Groundwater	Styrene	0.20	0.50	µg/L
EPA 8260C	Groundwater	tert-Butyl alcohol (TBA)	0.50	1.0	µg/L
EPA 8260C	Groundwater	tert-Butylbenzene	0.20	0.50	µg/L
EPA 8260C	Groundwater	Tetrachloroethylene	0.20	0.50	µg/L
EPA 8260C	Groundwater	Toluene	0.20	0.50	µg/L
EPA 8260C	Groundwater	trans-1,2-Dichloroethylene	0.20	0.50	µg/L
EPA 8260C	Groundwater	trans-1,3-Dichloropropylene	0.20	0.50	µg/L
EPA 8260C	Groundwater	Trichloroethylene	0.20	0.50	µg/L
EPA 8260C	Groundwater	Trichlorofluoromethane	0.20	0.50	µg/L
EPA 8260C	Groundwater	Vinyl acetate	0.20	0.50	µg/L
EPA 8260C	Groundwater	Vinyl Chloride	0.20	0.50	µg/L
EPA 8260C	Groundwater	Xylenes, Total	0.60	1.5	µg/L
		Semi-Volatile Organic Compounds (SVOCs)			
EPA 8270C	Groundwater	1,1'-Biphenyl	2.50	5.00	µg/L
EPA 8270C	Groundwater	1,2,4,5-Tetrachlorobenzene	2.50	5.00	µg/L
EPA 8270C	Groundwater	1,2,4-Trichlorobenzene	2.50	5.00	µg/L
EPA 8270C	Groundwater	1,2-Dichlorobenzene	2.50	5.00	µg/L
EPA 8270C	Groundwater	1,2-Diphenylhydrazine (as Azobenzene)	2.50	5.00	µg/L
EPA 8270C	Groundwater	1,3-Dichlorobenzene	2.50	5.00	µg/L
EPA 8270C	Groundwater	1,4-Dichlorobenzene	2.50	5.00	µg/L
EPA 8270C	Groundwater	2,3,4,6-Tetrachlorophenol	2.50	5.00	µg/L
EPA 8270C	Groundwater	2,4,5-Trichlorophenol	2.50	5.00	µg/L
EPA 8270C	Groundwater	2,4,6-Trichlorophenol	2.50	5.00	µg/L
EPA 8270C	Groundwater	2,4-Dichlorophenol	2.50	5.00	µg/L
EPA 8270C	Groundwater	2,4-Dimethylphenol	2.50	5.00	µg/L
EPA 8270C	Groundwater	2,4-Dinitrophenol	2.50	5.00	µg/L
EPA 8270C	Groundwater	2,4-Dinitrotoluene	2.50	5.00	µg/L
EPA 8270C	Groundwater	2,6-Dinitrotoluene	2.50	5.00	µg/L
EPA 8270C	Groundwater	2-Chloronaphthalene	2.50	5.00	µg/L
EPA 8270C	Groundwater	2-Chlorophenol	2.50	5.00	µg/L
EPA 8270C	Groundwater	2-Methylnaphthalene	2.50	5.00	µg/L
EPA 8270C	Groundwater	2-Methylphenol	2.50	5.00	µg/L
EPA 8270C	Groundwater	2-Nitroaniline	2.50	5.00	µg/L
EPA 8270C	Groundwater	2-Nitrophenol	2.50	5.00	µg/L
EPA 8270C	Groundwater	3- & 4-Methylphenols	2.50	5.00	µg/L
EPA 8270C	Groundwater	3,3'-Dichlorobenzidine	2.50	5.00	µg/L
EPA 8270C	Groundwater	3-Nitroaniline	2.50	5.00	µg/L
EPA 8270C	Groundwater	4,6-Dinitro-2-methylphenol	2.50	5.00	µg/L
EPA 8270C	Groundwater	4-Bromophenyl phenyl ether	2.50	5.00	µg/L
EPA 8270C	Groundwater	4-Chloro-3-methylphenol	2.50	5.00	µg/L
EPA 8270C	Groundwater	4-Chloroaniline	2.50	5.00	µg/L
EPA 8270C	Groundwater	4-Chlorophenyl phenyl ether	2.50	5.00	µg/L
EPA 8270C	Groundwater	4-Nitroaniline	2.50	5.00	µg/L
EPA 8270C	Groundwater	4-Nitrophenol	2.50	5.00	µg/L
EPA 8270C	Groundwater	Acenaphthene	0.0500	0.0500	µg/L
EPA 8270C	Groundwater	Acenaphthylene	0.0500	0.0500	µg/L
EPA 8270C	Groundwater	Acetophenone	2.50	5.00	µg/L
EPA 8270C	Groundwater	Aniline	2.50	5.00	µg/L

Quantitation Limits

Method	Matrix	Analyte	LOQ	RL	Units
EPA 8270C	Groundwater	Anthracene	0.0500	0.0500	µg/L
EPA 8270C	Groundwater	Atrazine	0.500	0.500	µg/L
EPA 8270C	Groundwater	Benzaldehyde	2.50	5.00	µg/L
EPA 8270C	Groundwater	Benzidine	10.0	20.0	µg/L
EPA 8270C	Groundwater	Benzo(a)anthracene	0.0500	0.0500	µg/L
EPA 8270C	Groundwater	Benzo(a)pyrene	0.0500	0.0500	µg/L
EPA 8270C	Groundwater	Benzo(b)fluoranthene	0.0500	0.0500	µg/L
EPA 8270C	Groundwater	Benzo(g,h,i)perylene	0.0500	0.0500	µg/L
EPA 8270C	Groundwater	Benzo(k)fluoranthene	0.0500	0.0500	µg/L
EPA 8270C	Groundwater	Benzoic acid	25.0	50.0	µg/L
EPA 8270C	Groundwater	Benzyl alcohol	2.50	5.00	µg/L
EPA 8270C	Groundwater	Benzyl butyl phthalate	2.50	5.00	µg/L
EPA 8270C	Groundwater	Bis(2-chloroethoxy)methane	2.50	5.00	µg/L
EPA 8270C	Groundwater	Bis(2-chloroethyl)ether	2.50	5.00	µg/L
EPA 8270C	Groundwater	Bis(2-chloroisopropyl)ether	2.50	5.00	µg/L
EPA 8270C	Groundwater	Bis(2-ethylhexyl)phthalate	0.500	0.500	µg/L
EPA 8270C	Groundwater	Caprolactam	2.50	5.00	µg/L
EPA 8270C	Groundwater	Carbazole	2.50	5.00	µg/L
EPA 8270C	Groundwater	Chrysene	0.0500	0.0500	µg/L
EPA 8270C	Groundwater	Dibenzo(a,h)anthracene	0.0500	0.0500	µg/L
EPA 8270C	Groundwater	Dibenzofuran	2.50	5.00	µg/L
EPA 8270C	Groundwater	Diethyl phthalate	2.50	5.00	µg/L
EPA 8270C	Groundwater	Dimethyl phthalate	2.50	5.00	µg/L
EPA 8270C	Groundwater	Di-n-butyl phthalate	2.50	5.00	µg/L
EPA 8270C	Groundwater	Di-n-octyl phthalate	2.50	5.00	µg/L
EPA 8270C	Groundwater	Fluoranthene	0.0500	0.0500	µg/L
EPA 8270C	Groundwater	Fluorene	0.0500	0.0500	µg/L
EPA 8270C	Groundwater	Hexachlorobenzene	0.0200	0.0200	µg/L
EPA 8270C	Groundwater	Hexachlorobutadiene	0.500	0.500	µg/L
EPA 8270C	Groundwater	Hexachlorocyclopentadiene	2.50	5.00	µg/L
EPA 8270C	Groundwater	Hexachloroethane	0.500	0.500	µg/L
EPA 8270C	Groundwater	Indeno(1,2,3-cd)pyrene	0.0500	0.0500	µg/L
EPA 8270C	Groundwater	Isophorone	2.50	5.00	µg/L
EPA 8270C	Groundwater	Naphthalene	0.0500	0.0500	µg/L
EPA 8270C	Groundwater	Nitrobenzene	0.250	0.250	µg/L
EPA 8270C	Groundwater	N-Nitrosodimethylamine	0.500	0.500	µg/L
EPA 8270C	Groundwater	N-nitroso-di-n-propylamine	2.50	5.00	µg/L
EPA 8270C	Groundwater	N-Nitrosodiphenylamine	2.50	5.00	µg/L
EPA 8270C	Groundwater	Pentachlorophenol	0.250	0.250	µg/L
EPA 8270C	Groundwater	Phenanthrene	0.0500	0.0500	µg/L
EPA 8270C	Groundwater	Phenol	2.50	5.00	µg/L
EPA 8270C	Groundwater	Pyrene	0.0500	0.0500	µg/L
EPA 8270C	Groundwater	Pyridine	2.50	5.00	µg/L
		Polychlorinated Biphenyls (PCBs)			
EPA 8082A	Groundwater	Aroclor 1016	0.0500	0.0500	µg/L
EPA 8082A	Groundwater	Aroclor 1221	0.0500	0.0500	µg/L
EPA 8082A	Groundwater	Aroclor 1232	0.0500	0.0500	µg/L
EPA 8082A	Groundwater	Aroclor 1242	0.0500	0.0500	µg/L
EPA 8082A	Groundwater	Aroclor 1248	0.0500	0.0500	µg/L
EPA 8082A	Groundwater	Aroclor 1254	0.0500	0.0500	µg/L
EPA 8082A	Groundwater	Aroclor 1260	0.0500	0.0500	µg/L
EPA 8082A	Groundwater	Aroclor 1262	0.0500	0.0500	µg/L
EPA 8082A	Groundwater	Aroclor 1268	0.0500	0.0500	µg/L
EPA 8082A	Groundwater	Total PCBs	0.0500	0.0500	µg/L
		Pesticides			
EPA 8081B	Groundwater	4,4'-DDD	0.00400	0.00400	µg/L

Quantitation Limits

Method	Matrix	Analyte	LOQ	RL	Units
EPA 8081B	Groundwater	4,4'-DDE	0.00400	0.00400	µg/L
EPA 8081B	Groundwater	4,4'-DDT	0.00400	0.00400	µg/L
EPA 8081B	Groundwater	Aldrin	0.00400	0.00400	µg/L
EPA 8081B	Groundwater	alpha-BHC	0.00400	0.00400	µg/L
EPA 8081B	Groundwater	alpha-Chlordane	0.00400	0.00400	µg/L
EPA 8081B	Groundwater	beta-BHC	0.00400	0.00400	µg/L
EPA 8081B	Groundwater	Chlordane, total	0.0400	0.0400	µg/L
EPA 8081B	Groundwater	delta-BHC	0.00400	0.00400	µg/L
EPA 8081B	Groundwater	Dieldrin	0.00200	0.00200	µg/L
EPA 8081B	Groundwater	Endosulfan I	0.00400	0.00400	µg/L
EPA 8081B	Groundwater	Endosulfan II	0.00400	0.00400	µg/L
EPA 8081B	Groundwater	Endosulfan sulfate	0.00400	0.00400	µg/L
EPA 8081B	Groundwater	Endrin	0.00400	0.00400	µg/L
EPA 8081B	Groundwater	Endrin aldehyde	0.0100	0.0100	µg/L
EPA 8081B	Groundwater	Endrin ketone	0.0100	0.0100	µg/L
EPA 8081B	Groundwater	gamma-BHC (Lindane)	0.00400	0.00400	µg/L
EPA 8081B	Groundwater	gamma-Chlordane	0.0100	0.0100	µg/L
EPA 8081B	Groundwater	Heptachlor	0.00400	0.00400	µg/L
EPA 8081B	Groundwater	Heptachlor epoxide	0.00400	0.00400	µg/L
EPA 8081B	Groundwater	Methoxychlor	0.00400	0.00400	µg/L
EPA 8081B	Groundwater	Toxaphene	0.100	0.100	µg/L
		Inorganics			
EPA 6010C	Groundwater	Aluminum	0.050	0.050	mg/L
EPA 6010C	Groundwater	Antimony	0.005	0.005	mg/L
EPA 6010C	Groundwater	Arsenic	0.004	0.004	mg/L
EPA 6010C	Groundwater	Barium	0.010	0.010	mg/L
EPA 6010C	Groundwater	Beryllium	0.001	0.001	mg/L
EPA 6010C	Groundwater	Cadmium	0.003	0.003	mg/L
EPA 6010C	Groundwater	Calcium	0.050	0.050	mg/L
EPA 6010C	Groundwater	Chromium	0.005	0.005	mg/L
EPA 6010C	Groundwater	Cobalt	0.005	0.005	mg/L
EPA 6010C	Groundwater	Copper	0.003	0.003	mg/L
EPA 6010C	Groundwater	Iron	0.020	0.020	mg/L
EPA 6010C	Groundwater	Lead	0.003	0.003	mg/L
EPA 6010C	Groundwater	Magnesium	0.050	0.050	mg/L
EPA 6010C	Groundwater	Manganese	0.005	0.005	mg/L
EPA 6010C	Groundwater	Nickel	0.005	0.005	mg/L
EPA 6010C	Groundwater	Potassium	0.050	0.050	mg/L
EPA 6010C	Groundwater	Selenium	0.010	0.010	mg/L
EPA 6010C	Groundwater	Silver	0.005	0.005	mg/L
EPA 6010C	Groundwater	Sodium	0.100	0.100	mg/L
EPA 6010C	Groundwater	Thallium	0.005	0.005	mg/L
EPA 6010C	Groundwater	Vanadium	0.010	0.010	mg/L
EPA 6010C	Groundwater	Zinc	0.010	0.010	mg/L
EPA 7473	Groundwater	Mercury	0.0002	0.0002	mg/L
EPA 9014/9010C	Groundwater	Cyanide, total	0.0100	0.0100	mg/L
		Volatile Organics			
EPA 8260C	Soil	1,1,1,2-Tetrachloroethane	2.5	5	µg/kg
EPA 8260C	Soil	1,1,1-Trichloroethane	2.5	5	µg/kg
EPA 8260C	Soil	1,1,2,2-Tetrachloroethane	2.5	5	µg/kg
EPA 8260C	Soil	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	2.5	5	µg/kg
EPA 8260C	Soil	1,1,2-Trichloroethane	2.5	5	µg/kg
EPA 8260C	Soil	1,1-Dichloroethane	2.5	5	µg/kg
EPA 8260C	Soil	1,1-Dichloroethylene	2.5	5	µg/kg
EPA 8260C	Soil	1,1-Dichloropropylene	2.5	5	µg/kg
EPA 8260C	Soil	1,2,3-Trichlorobenzene	2.5	5	µg/kg

Quantitation Limits

Method	Matrix	Analyte	LOQ	RL	Units
EPA 8260C	Soil	1,2,3-Trichloropropane	2.5	5	µg/kg
EPA 8260C	Soil	1,2,4-Trichlorobenzene	2.5	5	µg/kg
EPA 8260C	Soil	1,2,4-Trimethylbenzene	2.5	5	µg/kg
EPA 8260C	Soil	1,2-Dibromo-3-chloropropane	2.5	5	µg/kg
EPA 8260C	Soil	1,2-Dibromoethane	2.5	5	µg/kg
EPA 8260C	Soil	1,2-Dichlorobenzene	2.5	5	µg/kg
EPA 8260C	Soil	1,2-Dichloroethane	2.5	5	µg/kg
EPA 8260C	Soil	1,2-Dichloropropane	2.5	5	µg/kg
EPA 8260C	Soil	1,3,5-Trimethylbenzene	2.5	5	µg/kg
EPA 8260C	Soil	1,3-Dichlorobenzene	2.5	5	µg/kg
EPA 8260C	Soil	1,3-Dichloropropane	2.5	5	µg/kg
EPA 8260C	Soil	1,4-Dichlorobenzene	2.5	5	µg/kg
EPA 8260C	Soil	1,4-Dioxane	50	100	µg/kg
EPA 8260C	Soil	2,2-Dichloropropane	2.5	5	µg/kg
EPA 8260C	Soil	2-Butanone	2.5	5	µg/kg
EPA 8260C	Soil	2-Chlorotoluene	2.5	5	µg/kg
EPA 8260C	Soil	2-Hexanone	2.5	5	µg/kg
EPA 8260C	Soil	4-Chlorotoluene	2.5	5	µg/kg
EPA 8260C	Soil	4-Methyl-2-pentanone	2.5	5	µg/kg
EPA 8260C	Soil	Acetone	5	10	µg/kg
EPA 8260C	Soil	Acrolein	5	10	µg/kg
EPA 8260C	Soil	Acrylonitrile	2.5	5	µg/kg
EPA 8260C	Soil	Benzene	2.5	5	µg/kg
EPA 8260C	Soil	Bromobenzene	2.5	5	µg/kg
EPA 8260C	Soil	Bromochloromethane	2.5	5	µg/kg
EPA 8260C	Soil	Bromodichloromethane	2.5	5	µg/kg
EPA 8260C	Soil	Bromoform	2.5	5	µg/kg
EPA 8260C	Soil	Bromomethane	2.5	5	µg/kg
EPA 8260C	Soil	Carbon disulfide	2.5	5	µg/kg
EPA 8260C	Soil	Carbon tetrachloride	2.5	5	µg/kg
EPA 8260C	Soil	Chlorobenzene	2.5	5	µg/kg
EPA 8260C	Soil	Chloroethane	2.5	5	µg/kg
EPA 8260C	Soil	Chloroform	2.5	5	µg/kg
EPA 8260C	Soil	Chloromethane	2.5	5	µg/kg
EPA 8260C	Soil	cis-1,2-Dichloroethylene	2.5	5	µg/kg
EPA 8260C	Soil	cis-1,3-Dichloropropylene	2.5	5	µg/kg
EPA 8260C	Soil	Cyclohexane	2.5	5	µg/kg
EPA 8260C	Soil	Dibromochloromethane	2.5	5	µg/kg
EPA 8260C	Soil	Dibromomethane	2.5	5	µg/kg
EPA 8260C	Soil	Dichlorodifluoromethane	2.5	5	µg/kg
EPA 8260C	Soil	Ethyl Benzene	2.5	5	µg/kg
EPA 8260C	Soil	Hexachlorobutadiene	2.5	5	µg/kg
EPA 8260C	Soil	Isopropylbenzene	2.5	5	µg/kg
EPA 8260C	Soil	Methyl acetate	2.5	5	µg/kg
EPA 8260C	Soil	Methyl tert-butyl ether (MTBE)	2.5	5	µg/kg
EPA 8260C	Soil	Methylcyclohexane	2.5	5	µg/kg
EPA 8260C	Soil	Methylene chloride	5	10	µg/kg
EPA 8260C	Soil	Naphthalene	2.5	10	µg/kg
EPA 8260C	Soil	n-Butylbenzene	2.5	5	µg/kg
EPA 8260C	Soil	n-Propylbenzene	2.5	5	µg/kg
EPA 8260C	Soil	o-Xylene	2.5	5	µg/kg
EPA 8260C	Soil	p- & m- Xylenes	5	10	µg/kg
EPA 8260C	Soil	p-Isopropyltoluene	2.5	5	µg/kg
EPA 8260C	Soil	sec-Butylbenzene	2.5	5	µg/kg
EPA 8260C	Soil	Styrene	2.5	5	µg/kg
EPA 8260C	Soil	tert-Butyl alcohol (TBA)	2.5	5	µg/kg

Quantitation Limits

Method	Matrix	Analyte	LOQ	RL	Units
EPA 8260C	Soil	tert-Butylbenzene	2.5	5	µg/kg
EPA 8260C	Soil	Tetrachloroethylene	2.5	5	µg/kg
EPA 8260C	Soil	Toluene	2.5	5	µg/kg
EPA 8260C	Soil	trans-1,2-Dichloroethylene	2.5	5	µg/kg
EPA 8260C	Soil	trans-1,3-Dichloropropylene	2.5	5	µg/kg
EPA 8260C	Soil	Trichloroethylene	2.5	5	µg/kg
EPA 8260C	Soil	Trichlorofluoromethane	2.5	5	µg/kg
EPA 8260C	Soil	Vinyl acetate	2.5	5	µg/kg
EPA 8260C	Soil	Vinyl Chloride	2.5	5	µg/kg
EPA 8260C	Soil	Xylenes, Total	7.5	15	µg/kg

ATTACHMENT C – ANALYTICAL METHODS/QUALITY ASSURANCE SUMMARY TABLES

Method 8260C -VOCs in Groundwater	
Quality Control	**Criteria**
Bottleware	Three 40 mL glass vials with PTFE-lined cap
Preservation	Cooled to 4°C ±2°C and preserved with HCL (pH < 2)
Holding Times	Unpreserved - 7 days from sample collection Preserved - 14 days from sample collection
Instrument Tunes	Bromofluorobenzene tune criteria are outlined in Table 4 of USEPA-SW8846 Method 8260C.
Initial Calibrations	See Table 2 of Region 2 Low-Medium Volatile Data Validation - Minimum RRF and Maximum %RSD must be met for all compounds.
Continuing Calibration Verifications	Must be run every 12 hours. See Table 2 of Region 2 Low-Medium Volatile Data Validation - Minimum RRF and Maximum %D must be met for all compounds.
Internal Standards	Area counts for all internal standards must be between 50-200% and retention time differences must be < 30.0 seconds between 12-hour standard.
Surrogates	All system monitoring compounds must meet the recovery limits in Table 6 of Region 2 Low-Medium Volatile Data Validation.
Blanks	All method, trip and field blank concentrations must be <RL. Field blanks affect all samples taken on the same date and trip blank samples affect all samples shipped with the trip blank.
LCS/LCSDs	%Recoveries and %RPDs must meet in-house laboratory control limits.
MS/MSDs	Must be site sample. %Recoveries and %RPDs must meet in-house laboratory control limits. Refer to other QC criteria to make professional judgement for qualifications.
Field Duplicates	%RPDs between field duplicate and parent sample results must be <30% for results greater than 5x the RL. If the original sample result is less than 5x the RL then the absolute difference between the two results must be ≤ ±RL.
Method 8270C -SVOCs in Groundwater	
Quality Control	**Criteria**
Bottleware	Four 1L amber bottles
Preservation	Cooled 4°C ±2°C
Holding Times	Samples must be extracted within 7 days of sample collection; sample extracts must be analyzed within 40 days of extraction
Instrument Tunes	DFTPP tune criteria are outlined in Table 4 of USEPA-SW8846 Method 8270C.
Initial Calibrations	See Table 2 of Region 2 Semi-Volatile Data Validation - Minimum RRF and Maximum %RSD must be met for all compounds.
Continuing Calibration Verifications	Must be run every 12 hours. See Table 2 of Region 2 Semi-Volatile Data Validation - Minimum RRF and Maximum %D must be met for all compounds.
Internal Standards	Area counts for all internal standards must be between 50-200% and retention time differences must be < 10.0 seconds between 12-hour standard.
Surrogates	All system monitoring compounds must meet the recovery limits in Table 6 of Region 2 Semi-Volatile Data Validation.
Blanks	All method, trip and field blank concentrations must be <RL. Field blanks affect all samples taken on the same date.
LCS/LCSDs	%Recoveries and %RPDs and must meet in-house laboratory control limits.
MS/MSDs	Must be a site sample. %Recoveries and %RPDs must meet in-house laboratory control limits. Refer to other QC criteria to make professional judgement for qualifications.
Field Duplicates	%RPDs between field duplicate and parent sample results must be <30% for results greater than 5x the RL. If the original sample result is less than 5x the RL then the absolute difference between the two results must be ≤ ±RL.

Method 8081B - Pesticides in Groundwater	
Quality Control	**Criteria**
Bottleware	Four 1L amber bottles
Preservation	Cooled 4°C ±2°C
Holding Times	Samples must be extracted within 7 days of sample collection; sample extracts must be analyzed within 40 days of extraction
Initial Calibrations	%RSD for all compounds must be ≤20.0%. %RSDs for alpha-BHC and delta-BHC must ≤25.0% and %RSD for both surrogates and toxaphene must be ≤ 30.0%
Continuing Calibration Verifications	CCVs will be analyzed every 12 hours. RTs must be within their respective RT windows; %Ds for all compounds must be within ±25%.
Surrogates	All system monitoring compounds must be recovered within the 30-150% control limits.
Blanks	All method, trip and field blank concentrations must be <RL. Field blanks affect all samples taken on the same date.
LCS/LCSDs	%Recoveries must be met for compounds given in Table 10 of Region 2 Pesticide Data Validation. Compounds which are not included in this table must meet in-house laboratory control limits.
MS/MSDs	Must be a site sample. %Recoveries and %RPDs must meet in-house laboratory control limits. Refer to other QC criteria to make professional judgement for qualifications.
Dual Column Precision	The %D between the primary and secondary columns must be ±25%.
DDT/Endrin Breakdown	Individual 4,4'-DDT and Endrin breakdowns must be <20.0% each; combined breakdown for both compounds must be <30.0%.
Florisil Cartridge	The performance check for each compound must be within 80-120%
Field Duplicates	%RPDs between field duplicate and parent sample results must be <30% for results greater than 5x the RL. If the original sample result is less than 5x the RL then the absolute difference between the two results must be ≤ ±RL.
Method 8082A -PCBs in Groundwater	
Quality Control	**Criteria**
Bottleware	Four 1L amber bottles
Preservation	Cooled 4°C ±2°C
Holding Times	Samples must be extracted within 7 days of sample collection; sample extracts must be analyzed within 40 days of extraction
Initial Calibrations	%RSD for all compounds must be ≤20.0%.
Continuing Calibration Verifications	CCVs will be analyzed every 12 hours. RTs must be within their respective RT windows; %Ds for all compounds in opening calibration must be within ±25% and must be within ±50% for closing calibration.
Surrogates	All system monitoring compounds must be recovered within the 30-150% control limits.
Blanks	All method, trip and field blank concentrations must be <RL. Field blanks affect all samples taken on the same date.
LCS/LCSDs	Aroclor-1016 and Aroclor-1260 must be spiked and recovered within the 50-150% control limits
MS/MSDs	Must be site sample. %Recoveries and %RPDs must meet in-house laboratory control limits. Refer to other QC criteria to make professional judgement for qualifications.
Dual Column Precision	The %D between the primary and secondary columns must be ±25%.
Field Duplicates	%RPDs between field duplicate and parent sample results must be <30% for results greater than 5x the RL. If the original sample result is less than 5x the RL then the absolute difference between the two results must be ≤ ±RL.

Method 6010B - Metals in Groundwater	
Quality Control	**Criteria**
Bottleware	600mL plastic bottle
Preservation	Preserve with HNO_3 (pH < 2)
Holding Times	180 Days
Initial Calibrations	The initial calibration must include five calibration standards. The %Ds must be within the ±30% or the correlation coefficient must be >0.995
Continuing Calibration Verifications	Recoveries must be within 90-110%
Interference Check Sample	Recoveries must be within 80-120%
Blanks	All method, calibration, trip and field blank concentrations must be <RL. Field blanks affect all samples taken on the same date.
LCS/LCSDs	All spike recoveries must be within 70-130%
MS/MSDs	Must be a site sample. Matrix spike and post-digestion spike recoveries must be within 75-125%. If the original sample result was greater than 4x the spiked amount then professional judgement may be used.
Laboratory Duplicates	The RPD between the parent and duplicate results must be ≤20%. If the original sample result is <5x the RL then professional judgement may be used.
Serial Dilutions	The %D between the original and serial dilution result must be ≤ 10%. If the original sample result is less than 50x the MDL then professional judgement may be used.
Field Duplicates	%RPDs between field duplicate and parent sample results must be <30% for results greater than 5x the RL. If the original sample result is less than 5x the RL then the absolute difference between the two results must be ≤ ±RL.
Method 9013A/9010C - Cyanide in Groundwater	
Quality Control	**Criteria**
Bottleware	500 mL plastic bottle
Preservation	Cooled 4°C ±2°C and preserved with NaOH (pH > 12)
Holding Times	14 Days
Initial Calibrations	The initial calibration must include five calibration standards. The %Ds must be within the ±30% or the correlation coefficient must be >0.995
Continuing Calibration Verifications	Recovery must be within 85-115%
Blanks	All method, trip and field blank concentrations must be <RL. Field blanks affect all samples taken on the same date.
LCS/LCSDs	All spike recoveries must be within 75-125%
MS/MSDs	Must be a site sample. Matrix spike and post-distillation spike recoveries must be within 75-125%. If original sample results are >4x the spiked amount then professional judgement may be used.
Laboratory Duplicates	The RPD between the parent and duplicate results must be ≤20%. If the original sample result is <5x the RL then professional judgement may be used.
Field Duplicates	%RPDs between field duplicate and parent sample results must be <30% for results greater than 5x the RL. If the original sample result is less than 5x the RL then the absolute difference between the two results must be ≤ ±RL.

Method 8260C - VOCs in Soil	
Quality Control	**Criteria**
Bottleware	EnCore™
Preservation	Cooled 4°C ±2°C
Holding Times	48 hours from sample collection
Instrument Tunes	Bromofluorobenzene tune criteria are outlined in Table 4 of USEPA-SW8846 Method 8260C
Initial Calibrations	See Table 2 of Region 2 Low-Medium Volatile Data Validation - Minimum RRF and Maximum %RSD must be met for all compounds
Continuing Calibration Verifications	Must be run every 12 hours. See Table 2 of Region 2 Low-Medium Volatile Data Validation - Minimum RRF and Maximum %D must be met for all compounds
Internal Standards	Area counts for all internal standards must be between 50-200% and retention time differences must be < 30.0 seconds between 12-hour standard
Surrogates	All deuerated monitoring compounds must meet the recovery limits in Table 6 of Region 2 Low-Medium Volatile Data Validation.
Blanks	All method, trip and field blank concentrations must be <RL. Field blanks affect all samples taken on the same date and trip blank samples affect all samples that were shipped with it
LCS/LCSDs	Recoveries must meet in-house laboratory control limits
MS/MSDs	Recoveries must meet in-house laboratory control limits. Refer to other QC criteria to make professional judgement for qualifications.
Field Duplicates	%RPDs between field duplicate and parent sample results must be <50% if original sample result is greater than 5x the RL. If the original sample result is less than 5x the RL then the absolute difference between the two results must be ≤ ±2x RL.

ATTACHMENT D – SAMPLE NOMENCLATURE

Sample Nomenclature	
GP	GeoProbe®
MW	Monitoring Well
TB	Trip Blank
FB	Field Blank
SO	Soil
DUP	Field Duplicate
DEC	Department of Environmental Conservation
EB	Environmental Boring
(X-X)	Depth Interval
XXXXXX	Date of Sampling

APPENDIX C

DYE TEST PRODUCT INFORMATION

Cheiron Resources Ltd develops and manufactures high quality, easy to use, cost effective field tests for the "instant" detection of petroleum hydrocarbons and chlorinated solvents in soil.

The **OilScreenSoil™** tests are field presence/absence indicators of non-volatile petroleum hydrocarbons and chlorinated solvents.

The kits:

- Produce "instant" results (under two minutes)
- Detect oils as low as 500 ppm of TPH (total petroleum hydrocarbon) in soil
- Screen for DNAPLs (dense non-aqueous phase liquid), and LNAPLs (light non-aqueous phase liquid)
- Can be used with salt-water, or on frozen soils with the addition of hot water
- Do not require specialized training, or additional instrumentation
- Are non-hazardous to human health and the environment

NOTE: Esters (detergents) are the only "known" substances to interfere with the dye's ability to stain petroleum hydrocarbon products. This may be applicable when screening for Ester based (i.e. synthetic) motor oils.

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MANUFACTURER'S GUARANTEE:

We will replace any broken or defective kits. If you are not satisfied with our product, return any defective kits to Cheiron for a refund. We reserve the right not to provide refunds if the kits have been tampered with in any way, or if not used in accordance with the product MSDS and Instruction Manual.

Cheiron Resources Ltd provides the information contained in this pamphlet in good faith, but makes no representation as to its comprehensiveness or accuracy. The information provided is intended only as a guide to the appropriate handling and use of the **OilScreenSoil™** kits by a professional person who is qualified to use the materials being tested. Individuals reviewing this information must exercise their independent judgment in determining its appropriateness for a particular purpose or application.

OIL screen SOIL

Cost effective "instant" and disposable tests for field screening of petroleum hydrocarbons and chlorinated solvents in soil

Cheiron Resources Ltd.

Success Through A Commitment To Excellence

OilScreenSoil (Sudan IV)™ with Kerosene is shown above

OilScreenSoil™ kits were developed as fast, reliable, easy to use and inexpensive field monitoring tools.

OilScreenSoil™ kits are "non-precision" qualitative tests that screen for petroleum hydrocarbons (aliphatic and aromatic) and chlorinated solvents (TCE, TCA & PCE) in soil, sand, or gravel.

OilScreenSoil™ kits are **NOT** suitable for detection of gases (compounds with 4 carbons or less), or for use with heavy crude oils (Bunker C), or solid bituminous materials like asphalt or waxes.

The following is intended as a general overview of the possible applications for the **OilScreenSoil™** kits. Please contact the manufacturer for more detailed information.

Petroleum products are complex mixtures of multiple hydrocarbon compounds and their composition varies depending upon the source of the crude oil and refining practices used. However:

OilScreenSoil™ test kits are typically used with a wide range of petroleum hydrocarbon products including:

- Automotive Gasolines **(C5-C12)**
- Jet Fuels **(C5-C16)**
- Fuel Oils #1 & 2 **(C9-C20)**
- Mineral Oils **(C15-C29)**
- Petroleum-based Chlorinated Solvents **(C7–C12) i**ncluding: TCE, TCA and PCE (e.g. Dry Cleaning Solvent)

OilScreenSoil™ kits can be used to:

- Quickly and easily determine spill boundaries and depths and to identify spill directions in soil
- Detect chlorinated hydrocarbon compounds (Dense Non Aqueous Phase liquid-DNAPL) in drill/core samples
- Detect direction and depths of spills from leaking underground (LUSTs) and aboveground storage tanks
- Test excavation floor and walls for petroleum hydrocarbons

QUICK AND EASY TO USE – SIMPLY: Add soil, add water - shake!

OilScreenSoil™ tests release specially formulated dyes that stain petroleum hydrocarbons.

The presence of an "expandable polystyrene (EPS) bead" allows users to rapidly identify the presence of free petroleum products as **low as 500ppm TPH**.

Use **OilScreenSoil™** Kits for:

- ✓ Instant delineation of spill depth and direction during response initiatives
- ✓ Cost effective, immediate qualitative field screening/sampling tests for Phase II site assessments and excavations
- ✓ Ease of use - requires no special training, or external instrumentation
- ✓ Working with a safe test containing a "De Minimus" (<0.1%) concentration of test chemicals

Other OilScreenSoil™ test Kits include:

- ***OILSCREENSOIL (INDIGO BLUE)™***
  For use with red soils/clays
- ***OILSCREENSOIL (FLUORESCENT)™***
  For use with black oils
- ***OILSCREENSOIL (SCARLET)™***
  A non-mutagenic red dye

APPENDIX D

GAMMA RAY LOGGING INFORMATION

Description

The natural gamma ray probe measures the amount of gamma radiation occurring naturally within the formations crossed by a borehole. Gamma rays are produced mainly by isotopes of potassium, thorium, and uranium. The gamma log is widely used in the groundwater and mining industries to identify lithology and perform clay content analyses.

Applications

- Bed boundary analysis
- Facies changes
- Coarsening/ Fining Sequences
- Identify Clay Aquitards
- Aquifer Thickness
- Uranium Concentration

Operating Conditions

Borehole Fluid

[X] Water

[X] Mud

[X] Dry

Casing

[X] Uncased

[X] PVC Borehole

[X] Steel

Centralization

[_] Required

[X] Not Necessary

Sensor: Sodium Iodide Crystal

HAGER-RICHTER GEOSCIENCE, INC.

846 Main Street
Fords, NJ 08863
Phone: 732-661-0555
Fax: 732-661-0123

EXAMPLE BOREHOLE GEOPHYSICAL LOGS

DATE(S) LOGGED:

CLIENT:

PROJECT:

CITY, STATE:

LOGGING GEOPHYSICIST(S):

PROJECT REP(S) ON-SITE:

HAGER-RICHTER FILE:

LOG DATUM: Ground Surface

WELL CONSTRUCTION: 4-Inch PVC

LOGS PROCESSED BY:

Example Borehole Geophysical Logs