INTERIM REMEDIAL MEASURES WORK PLAN

for

450 UNION STREET
BROOKLYN, NEW YORK
NYSDEC BCP No. C224219

Prepared For

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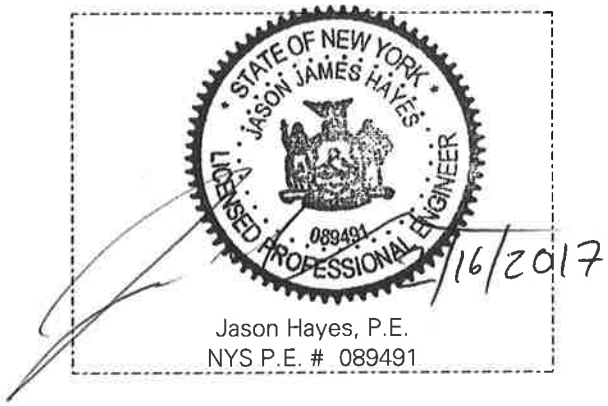
LANGAN

CERTIFICATION

I Jason Hayes, P.E. certify that I am currently a NYS registered professional engineer as defined in 6 NYCRR Part 375 and that this Interim Remedial Measure Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).



Jason Hayes, P.E.
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1.0 INTRODUCTION

1.1 General

450 Union LLC c/o Pilot Real Estate Group (the Volunteer) entered into a Brownfield Cleanup Agreement (BCA) with the New York State Department of Environmental Conservation (NYSDEC) on September 1, 2015, to investigate and remediate a 28,500-square-foot (0.65-acre) property located at 450 Union Street in the Gowanus Neighborhood of Brooklyn, New York (the site). The Volunteer is enrolled in the Brownfield Cleanup Program (BCP Site No. C224219) and is proposing to remediate the property for its intended use with regulatory oversight and guidance by the NYSDEC.

This Interim Remedial Measures Work Plan (IRMWP) was prepared to outline the following proposed interim remedial measures and construction-related excavations within the existing building and in the asphalt-paved exterior of the site. The scope of this Interim Remedial Measures (IRM) Work Plan applies to about the western three-quarters of the site and includes the following:

1. Decommission the suspected underground storage tank (UST) at the southeast corner of the site building in accordance with local, state and federal regulations. Gross petroleum-impacted soil associated with the UST will be excavated to about 12 feet bgs (the extent to which impacts were noted in the remediation investigation in this area) with localized dewatering as needed;
2. Excavation of a hazardous lead soil hotspot near the central part of the site to about 4 feet bgs; the hotspot was horizontally and vertically delineated during the 2016 Remedial Investigation (RI);
3. Limited trench excavations within the site building and in the asphalt-paved exterior for subsurface utilities, footings for a lean-to structure, and landscaping; and
4. Restoration of the site cover system (i.e. building slab, asphalt or concrete) where it is compromised or placement of a demarcation barrier and 2-foot clean soil cover in non-paved, landscaped areas.

This IRM WP does not address contamination identified on about the eastern one-quarter of the site, including coal tar impacts identified by the RI.

It is anticipated that IRMs will be completed in advance of completing a final remedy. Residual contamination not addressed by this IRMWP will be addressed in a forthcoming Remedial Action Work Plan (RAWP).

This IRMWP has been prepared in accordance with requirements of the New York State BCP and NYSDEC's May 2010 Division of Environmental Remediation (DER)-10 - Technical Guidance for Site Investigation and Remediation (May 2010). DER-10 defines an IRM as follows:

> ***"Interim remedial measure" or "IRM"*** *means activities to address both emergency and non-emergency site conditions, which can be undertaken without extensive investigation and evaluation, to prevent, mitigate or remedy environmental damage or the consequences of environmental damage attributable to a site, including, but not limited to, the following activities: construction of diversion ditches; collection systems; drum removal; leachate collection systems; construction of fences or other barriers; installation of water filters; provision of alternative water systems; the removal of source areas; or plume control.*

1.2 Site Description

The site is located at 450 Union Street in the Gowanus Neighborhood of Brooklyn, New York and is identified as Block 438, Lot 7 on the Kings County City Tax Map. The site encompasses an area of about 28,500 square feet (0.65 acres) and is bound by Union Street to the north; the Gowanus Canal to the east; Lot 3 (automobile and bus parking) to the south; and Bond Street, followed by residential buildings, to the west. A Site Location Map is provided as Figure 1.

Zoning for the site is characterized as an M2-1 Manufacturing District. The site is used as a private event space, art gallery, and seasonal outdoor restaurant and is improved with a one-story 9,880-square-foot building (the "Green Building") and two ancillary storage sheds. The exterior portion of the site contains an enclosed area for social events and storage areas. A bulkhead, consisting of a 12-foot high headwall, supported by timber cribbing, separates the property from the Gowanus Canal. The property extents, site features, and interim remedial measures evaluated in this work plan are depicted on the Site Plan (Figure 2).

1.3 Site History

1.3.1 Gowanus Canal History

The site is centered in a historically industrial and manufacturing area along the Gowanus Canal. In the 1840s, the canal was a natural estuary (Gowanus Creek) surrounded by farmland and refineries. In 1849, construction began to convert the estuary into a transportation system to promote industrial growth and commerce. Construction of the canal was completed by 1869, and by 1870 the surrounding areas had become urbanized with manufactured gas plants, coal yards, and factories. As part of construction, land was artificially created by filling in parts of the original Gowanus Creek and over excavated areas for construction of the bulkhead. According to a historical index map of Brooklyn, published in 1874 by J.B. Beers & Co., the site was

partially located within the original creek. This, and its proximity to the Gowanus Canal, suggests it was subject to significant land filling of undocumented quality.

1.3.2 Environmental Site History

Prior to the Volunteer's involvement with the site, several investigations and reports were prepared:

1. *October 2001 Phase I Environmental Site Assessment (ESA), prepared by New York Petroleum & Drilling* [1]
2. *June and July 2001 Phase II Subsurface Investigation Report, prepared by New York Petroleum & Drilling* [1]
3. *February 2002 Due Diligence Review, prepared by AKRF, Inc. (AKRF)*[1]
4. *May 2002 Phase II Site Investigation Report, prepared by AKRF*
5. *May 29, 2014 Phase I ESA, prepared by Langan Engineering, Environmental, Surveying, and Landscape Architecture, D.P.C. (Langan)*[2]
6. *June 5, 2014 Phase II Environmental Site Investigation (ESI), prepared by Langan*
7. *June 25, 2014 Phase I ESA Report, prepared by Hillmann Consulting (Hillmann)*
8. *July 25, 2014 Subsurface Investigation Summary Letter, prepared by Hillmann*

After entering into a BCA with the NYSDEC, the following report was prepared on behalf of the Volunteer:

9. *January 6, 2017 Draft Remedial Investigation Report (RIR), prepared by Langan*

The site was developed as early as 1886 for historical manufacturing and industrial operations that included coal and wood storage, granite works, die casting and electroplating, vehicle repair, fuel storage/vehicle repair, and a foundry. The site is identified in department records as a Toxic Release Inventory Site, an Air Discharge Facility, and a Large Quantity Generator of hazardous waste. The Bayside Fuel Oil Company adjoins the site to the north and is classified as a Major Oil Storage Facility and Petroleum Bulk Storage Facility for containing six mounted tanks ranging in size from 1,000 gallons to 500,000 gallons with No. 2 fuel oil, diesel, and kerosene.

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[1] Summaries of these documents were provided in AKRFs May 2002 Phase II Site Investigation Report. Copies of the documents were not available.

[2] A copy of the document is included as an appendix to Langan's June 2014 Phase II Site Investigation Report.

Subsurface investigations between 2001 and 2016 have identified the following:

- Coal tar impacts to native soil between 23 and 54 feet bgs and accumulation of coal tar DNAPL within an on-site recovery well;
- A potential UST located during geophysical ground surveys and previously identified on historical Sanborn Fire Insurance Maps at the southeast corner of the Green Building. Petroleum impacts to soil associated with the potential UST were identified immediately around its location and up to 12 feet bgs;
- A hazardous lead soil hotspot near the center of the site, extending from surface grade to about 4 feet bgs; and
- A layer of historic fill (below the site cap) with concentrations of VOCs, SVOCs, metals, pesticides, and localized PCBs above 6 NYCRR[3] Part 375 Unrestricted Use (UU) and Restricted Use Restricted-Residential (RRU) Soil Cleanup Objectives (SCOs).

Approximate sampling locations are shown on Figure 3.

1.4 Site Geology

Two distinct geologic types (historic fill and native soils) were observed during the RI, and are described below in depth order (shallow to deep):

1.4.1 Historic Fill

The site is underlain by a layer of historic fill, predominately consisting of brown to grey, fine to coarse sand and silt with varying amounts of gravel, coal ash, brick, wood, glass, plastic, slag, and foam fragments. The depth of fill was variable, observed between about 8 and 14 feet bgs. The historic fill layer appeared shallowest near the western part of the site and thickened toward the southern part of the site.

1.4.2 Native Soils

The fill layer was underlain by brown, reddish-brown to grey, fine- to coarse-grained sand with varying amounts of silt, and gravel. Intermittent clay lenses ranging in thickness of about 8 inches to 22 feet were observed in the southern and eastern part of the site. A secondary deep confining unit consisting of native silt deposits was identified starting at depths between about 38 and 48 feet and extend up to about 56 feet bgs.

[3] Title 6 of the Official Compilation of New York Codes, Rules, and Regulations (6 NYCRR) Part 375 Environmental Remediation Programs.

1.4.3 Hydrogeological Conditions

According to synoptic depth-to-groundwater measurements, water was encountered between about 8.55 feet bgs (el 3.63) to 7.95 (el 3.93). Based on the well gauging results, and consistent with the surrounding area, groundwater appears to flow to the east-southeast toward the Gowanus Canal.

1.5 Contaminant Conditions

The following section presents a summary of contamination identified in soil, groundwater and soil vapor. The areas of environmental contamination are also summarized on Figure 4. The following three primary types of environmental contaminants have been identified:

- Historic Fill
- Petroleum-Contaminated Material
- Coal Tar-Contaminated Material

1.5.1 Historic Fill

The site has a layer of historic fill that extents from surface grade to about 14 feet bgs and contains concentrations of SVOCs, pesticides, and metals above background. PCBs were detected in one area only within surficial fill. PAHs[4] were detected in the majority of soil samples collected from historic fill at concentrations above *Title 6 of the New York Codes, Rules and Regulations (6 NYCRR) Part 375 Unrestricted Use (UU) and/or Restricted Use Restricted-Residential Use (RRU) Soil Cleanup Objectives (SCOs)*. Excluding samples collected from the suspected UST area, total PAH concentrations were as high as 690 parts per million (ppm) in shallow historic fill. Similar PAHs detected in groundwater above *NYSDEC Technical and Operational Guidance Series (TOGS) Ambient Water Quality Standards and Guidance Values (SGVs) for Class GA (drinking water)* and may be attributable to historic fill material and/or known sources of coal tar in the vicinity of the site.

Several metals were detected in shallow fill material above UU and/or RRU SCOs and are attributed to historic fill quality and tidal washing from the Gowanus Canal. A localized area of shallow fill contains hazardous concentrations of lead, as determined by the Toxicity Characteristic Leaching Procedure (TCLP). The area was delineated during the RI and extends to about 4 feet bgs. The hazardous lead hotspot does not appear to have impacted groundwater, based on dissolved metals concentrations.

[4] Polycyclic Aromatic Hydrocarbons (PAHs) are a class of SVOCs produced by incomplete combustion, as defined as defined by the USEPA and Agency for Toxic Substances and Disease Registry (ATSDR).

1.5.2 Petroleum-Contaminated Material

Petroleum-related VOCs and SVOCs were detected in soil borings advanced within the vicinity of the UST during the RI and previous investigations. In addition to analytical evidence, odors, staining, and PID measurements above background were apparent in soil. Based on the findings of the RI and previous investigations, petroleum-contaminated material is limited near the southeast portion of the site, within the vicinity of the suspected UST, at depths ranging from 7 to 12 feet bgs.

The maximum total VOC concentration measured in soil vapor (2,841 µg/m^3) was near the suspected UST location.

1.5.3 Coal Tar-Contaminated Material

Coal tar-related VOCs and SVOCs were detected in soil borings advanced along the eastern perimeter of the site near the Gowanus Canal during the RI and geotechnical/environmental investigation. Impacted material was documented above and below observed shallow clay lenses between 23 and 54 feet bgs. PID measurements above background were generally detected below 23 feet bgs, with the highest (380.7 ppm) measured around 27.5 feet bgs.

Coal tar DNAPL was encountered at about 42 feet bgs in the on-site recovery well. Findings suggest that coal tar is perched on top of and partially within a secondary confining layer/lens, starting at about 38 to 48 feet bgs. Considering the total length of the recovery well (52 feet), about 10 feet of product has accumulated in the well since DNAPL gauging began in September 2016. A drawdown test will be performed to evaluate DNAPL transmissivity and well recharge rates.

1.6 Proposed Development

The site is operated by several tenants whose uses include an event space, art gallery, and seasonal outdoor restaurant. The Volunteer is proposing to repurpose a portion of the Green building as an interior restaurant to complement the outdoor seasonal restaurant and seating area. The restaurant will include dining tables in the center and lining the southern and eastern walls of the building, and a bar built into the north wall. An overhang lean-to structure will be constructed around the southern and eastern exterior walls of the building. Interior construction will require localized trench excavations for utilities (i.e., plumbing and electrical). Outdoor construction includes localized excavations for, subsurface utilities, footings for the lean-to structure, landscaping, and restoration of the site cover with new asphalt or 2 feet of clean fill where the cover system is penetrated. Remedial excavations will be completed prior to or concurrently with construction.

2.0 DESCRIPTION OF INTERIM REMEDIAL MEASURES

This IRMWP addresses hazardous historic fill, nonhazardous contaminated historic fill in areas of proposed utility excavations, and the suspected UST and associated petroleum-contaminated material. The objective of the IRM is to prevent additional environmental impacts to site media (soil, groundwater, and soil vapor) by decommissioning the suspected UST and removing petroleum-contaminated soil, removing historic fill containing hazardous lead, and removing historic fill that will be disturbed as part of construction-related earthwork. The existing composite cover will be restored with a building foundation slab, concrete, asphalt, or a clean soil cover where the cap is to be penetrated pursuant to this IRM. These tasks will facilitate future construction and a comprehensive remediation pursuant to a RAWP.

The BCP requires that a minimum of two remedial alternatives be evaluated to provide a basis for selection of the most appropriate remedial action. This evaluation considers the site-specific interim remedial measures goals and a summary of each interim remedial measures alternative to present the preferred interim remedial actions in terms of remediation effectiveness and feasibility. At a minimum, a Track 1 cleanup must be considered.

At the request of the NYSDEC, a Remedial Alternatives Analysis (RAA) was prepared for this IRMWP to evaluate the following proposed interim remedial measures alternatives for the western part of the site:

- Alternative I – Track 1 Part 375 Unrestricted Use SCOs Cleanup
- Alternative II – Track 4 Part 375 Site-Specific SCOs Cleanup

Track 1 SCOs are Title 6 NYCRR Part 375 UU SCOs, as specified in NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation (2010). Track 4 SCOs are summarized in Table 1.

2.1 Standards, Criteria, and Guidance and Remedial Action Objectives

In accordance with DER-10, Remedial Action Objectives (RAOs) are established to provide medium-specific objectives for the protection of public health and the environment and are developed based on contaminant-specific standards, criteria, and guidance (SCGs). The SCGs used to develop RAOs for this site include:

- NYSDEC Brownfield Cleanup Program Guide (draft 2004);
- NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation (2010);
- NYSDEC TOGS 1.1.1 Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (1998);
- NYSDEC Commissioner Policy 51 (CP-51) Soil Cleanup Guidance (2010).

- NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York (2006);
- 6 NYCRR Part 360 Solid Waste Management Facilities;
- 6 NYCRR Part 364 Waste Transporter Permits;
- 6 NYCRR Part 370 Hazardous Waste Management;
- 6 NYCRR Part 375 Environmental Remediation Programs;
- 40 CFR Part 261 Identification and Listing of Hazardous Waste;
- 29 CFR Part 1910.120 Hazardous Waste Operations and Emergency Response Standard; and
- 29 CFR Part 1926 Safety and Health Regulations for Construction.

The following RAOs were developed for this site and provide the basis of design for each interim remedial alternative.

Soil RAOs

- Prevent ingestion/direct contact with contaminated soil.
- Minimize inhalation of, or exposure to, contaminants volatilizing from contaminated soil or contaminants in particulate form.
- Minimize migration of contaminants that would result in groundwater or surface water contamination.

Groundwater RAOs

- Minimize contact with, or inhalation of, volatiles emanating from contaminated groundwater.
- Remove and minimize potential on-site sources of groundwater contamination.

Soil Vapor RAOs

- Minimize exposure to contaminants in soil vapor.
- Minimize soil vapor intrusion into future occupied structures.

2.2 Summary of Alternative I

The Alternative I, Track 1 cleanup level would be achieved by completing the following tasks:

- Decommission the suspected underground storage tank (UST) at the southeast corner of the site building in accordance with local, state and federal regulations. Grossly-impacted petroleum-contaminated soil associated with the UST would be excavated to about 12 feet bgs with localized dewatering as, as needed;
- Excavation of the hazardous lead soil hotspot near the central part of the site to at least 4 feet bgs;

- Excavation of all soil/fill exceeding Part 375 UU SCOs. Based on the results of the RI, this would include excavation and removal of historic fill within the western part of the site, up to about 14 feet bgs. The existing buildings would need to be demolished to achieve fill removal from the western portion of the site.
- Dewatering as required for excavation below the water table and pre-treatment and discharge of dewatering fluids in accordance with a NYCDEP or State Pollutant Discharge Elimination System (SPDES) permit;
- Continuous screening of excess excavated soil/fill for indications of contamination by visual means, odor, and monitoring with a PID;
- Confirmation soil sampling and analysis, collected from the excavation base and sidewalls, to confirm all contaminated soil/fill has been removed and that residual soil/fill meets Part 375 UU SCOs; and
- Backfilling excavated areas to the original grade using certified-clean fill meeting Part 375 UU SCOs or with virgin, native crushed stone.

2.3 Summary of Alternative II

The Alternative II, Track 4 site-specific cleanup level would be achieved by completing the following tasks:

- Decommission the suspected underground storage tank (UST) at the southeast corner of the site building in accordance with local, state and federal regulations. Grossly-impacted petroleum-contaminated soil associated with the UST would be excavated to about 12 feet bgs (the extent to which petroleum impacts were documented in the RI) with localized dewatering, as needed;
- Excavation of the hazardous lead soil hotspot near the central part of the site to at least 4 feet bgs;
- Limited construction-related trench excavations within the site building and in the asphalt-paved exterior for installation of subsurface utilities, footings for a lean-to structure, and landscaping;
- Continuous screening of excavated soil/fill for indications of residual contamination by visual means, odor, and monitoring with a PID;
- Confirmation soil sampling and analysis, collected from the base and sidewalls of hotspot excavations (UST/petroleum area and hazardous lead area) to verify that source contaminants specific to the area were removed and that residual soil/fill achieves Site-Specific SCOs;

- Documentation soil sampling and analysis, collected from construction-related excavations, to document residual soil/fill exceeding Site-Specific SCOs;
- Surveying of contaminant hotspots, excavation bases, and the top of the composite cover by a New York State Professional Land Surveyor;
- Backfilling excavated areas to the original grade using certified-clean fill meeting Part 375 RRU SCOs, RCA or with virgin, native crushed stone, in accordance with DER-10;
- Restoration of the site cover system (i.e. asphalt or concrete) where it is compromised or placement of a demarcation barrier and 2-foot clean soil cover in non-paved, landscape areas; and
- Preparation of a Construction Completion Report (CCR) to document all remediated areas.
- For any future new construction of occupied spaces, soil vapor intrusion will be reevaluated to determine the need for vapor mitigation (e.g.,, vapor barrier, depressurization system, etc.).

2.4 Evaluation of Remedial Alternatives

The following section presents a summarized comparison between the proposed alternatives based on the NYSDEC BCP remedy evaluation criteria, listed below. The first two criteria are considered "threshold" criteria and must be satisfied for an alternative to qualify as a selection. The remaining criteria are considered "balancing" criteria, which are used to compare the advantages and disadvantages of each alternative. A remedial alternative must satisfy the threshold criteria before qualifying for further evaluation under the balancing criteria.

1. Overall Protection of Human Health and the Environment

   Both Alternatives would eliminate sources of contamination (UST/petroleum impacts and hazardous lead in soil) through hotspot removal. Alternative I would completely remove soil above Track 1 SCOs, rendering exposure pathways to human receptors incomplete. Alternative II would render exposure pathways to human receptors incomplete through engineering controls (capping system). Future Institutional Controls (implemented as part of a RAWP) would also be required to ensure protection to human health and the environment under Alternative I.

2. Standards, Criteria, and Guidance

   Both Alternatives would be in compliance with applicable SCGs by achieving Track 1 (Alternative I) or Track 4 (Alternative II) cleanup criteria and by requiring implementation in accordance with federal, state and local regulations and guidance documents.

3. Short-term Impact and Performance

   Short-term impacts to site workers and the community under both Alternatives would be mitigated through implementation of the site-specific Health and Safety Plan (HASP), including Community Air Monitoring Plan (CAMP) implementation. The volume of material removed in Alternative II would be over 100 times less than in Alternative I, meaning a decrease in the amount of trucks and contaminated soil transportation through the community. Alternative II presents a more eco-friendly remedy that would achieve the SCGs for this site while reducing the volume of material handling, decreasing vehicle traffic and emissions and the amount of contaminated soil potentially being exposed to the public and environment.

4. Long-term Effectiveness and Permanence

   Both Alternatives would provide long-term protection of the public and environment by removing contamination sources. Under Alternative II, historic fill remaining on site in will be capped by an engineered cover system to prevent future contact with contaminated fill. Any future work penetrating the cover system would be controlled by a RAWP or Site Management Plan (SMP).

5. Reduction of Toxicity, Mobility, or Volume of Contaminated Material

   Both Alternatives would equally reduce the toxicity, mobility, and volume of petroleum-contamination and hazardous lead in soil. Alternative I would further reduce the toxicity, mobility and volume of residual historic fill through a complete removal from the western part of the site.

6. Implementability

   Excavation and removal of on-site petroleum-contaminated soil and hazardous lead sources would be feasible under both Alternatives. Extensive support of excavation and dewatering and demolition of the existing buildings would be required to remove the historic fill layer under Alternative I. Based on the excavation depths and construction techniques (including SOE and dewatering) required for both cases, Alternative II presents the more implementable remedy capable of satisfying the RAOs.

7. Cost Effectiveness

   Based on the requirements and assumptions discussed, the estimated remediation costs would be $4,480,000 for Alternative I and $243,000 for Alternative II. Alternative II

presents a more cost effective approach to achieve the RAOs. Tables 2 and 3 detail the individual cost components used to arrive at the cost estimate for Alternative I and Alternative II, respectively.

8. Community Acceptance

   Both Alternatives would be acceptable to the community because the potential exposure pathways to on-site contamination would be managed during construction through implementation of a HASP and CAMP and would be minimized or eliminated following the IRM. Alternative I would require about 535 truck trips through the community, whereas Alternative II would require about 4 percent of those trips. The community would likely prefer Alternative II for this reason.

9. Land Use

   The current commercial land use and reasonably anticipated future land use of the site and its surroundings would be compatible with both IRM Alternatives. The proposed future use is identical to the current use. Rezoning of the site and surrounding area is anticipated to include residential use.

2.5 Selection of the Preferred Remedy

Both Alternatives would be protective of human health and the environment and satisfy the selected remedial goals. In both scenarios, the suspected UST, associated petroleum-contaminated soil, and the hazardous lead hotspot would be removed and appropriately disposed of at off-site facilities permitted to accept the waste. The reasonably anticipated future land use of the site and its surroundings would be compatible with each IRM Alternative.

Alternative I offers a greater and more permanent reduction in toxicity, mobility and volume of contaminants. However, Alternative II offers fewer short-term impacts (fewer truck trips), is more implementable and cost effective and may be more acceptable to the community (less truck traffic).

Based on the nine evaluation factors discussed in Section 2.4, Alternative II is the more feasible and practicable remedy that may be implemented in a cost-effective approach while maintaining the same overall protection to human health and the environment. Alternative II is the recommended remedial Alternative for this site.

2.6 Technical Description of the Preferred Interim Remedial Measures

2.6.1 Fill and Soil Removal

Under the Alternative II remedy, two sources would require removal and off-site disposal: (1) the hazardous lead hotspot and (2) petroleum-contaminated soil associated with a suspected UST. Historic fill removed for development purposes will be managed as regulated solid waste. The estimated excavation depths required to achieve the Alternative II remedy are shown on Figure 5.

UST and Petroleum-Contaminated Soil Removal

If present, the suspected UST will be exposed, the contents removed, cleaned and rendered inert, and the UST carcass disposed of as metal scraps, in accordance with Section 5.5 of DER-10.

About 320 cubic yards of gross petroleum-contaminated soil will be excavated from the suspected UST area to about 12 feet bgs with localized dewatering as needed. Petroleum-contaminated soil will be disposed of at an off-site permitted disposal facility capable of receiving this type of solid waste and transported by 6 NYCRR Part 364-permitted waste haulers. The decommissioned UST registration will be updated with the NYSDEC Petroleum Bulk Storage (PBS) unit. NYSDEC will be notified at least 10 days in advance of any UST decommissioning.

Hazardous Lead Hotspot Removal

The hazardous lead hotspot was horizontally and vertically delineated during the RI, extending up to about 4 feet bgs. An estimated 22 cubic yards of hazardous lead soil will be excavated and appropriately disposed of at an off-site facility permitted to accept the waste. Waste haulers will be 6 NYCRR Part 364 permitted and appropriately placarded per NYS Department of Transportation (NYSDOT) requirements.

Contaminated Historic Fill Removal

About 85 cubic yards of soil/fill will be excavated, to depths up to 4 feet, for the utility trench excavations, footings for a lean-to structure, and outdoor landscaping as part of development. Shallow historic fill excavated as part of development will be managed as a Part 360 regulated solid waste.

2.6.2 Remedial Performance Soil Sampling

An estimated 11 soil samples, plus quality assurance/quality control (QA/QC) samples, will be collected to document or confirm remedial performance. Additional sampling may be required

based on disposal facility requirements. Remedial performance soil sampling is described below.

Documentation Soil Sampling

Documentation soil samples will be collected from non-source contaminant areas. The cumulative utility trench excavations are less than 900 square feet and expected to generate up to 100 cubic yards of waste. The utility trench excavation is about 240 linear-feet; therefore, one soil sample will be collected for every 60 linear-feet of trench excavation base for a total of four samples. If the size of the proposed utility trench changes, the number of soil samples to be collected will be amended to fit the revised area in general accordance with DER-10 requirements and the aforementioned sampling frequency.

Documentation soil samples, plus QA/QC samples, will be analyzed for 6 NYCRR Part 375 and TCL/TAL list of VOCs, SVOCs, metals, PCBs, pesticides, and metals. The results will be summarized in the CCR with all applicable support documentation. Over excavation is not expected for non-source contaminant areas.

Confirmation Soil Sampling

Confirmation soil samples will be collected from the hazardous lead and petroleum-contaminated soil hotspots. One soil sample will be collected from the excavation base and one soil sample will be collected from each sidewall of each excavation (up to 5 total samples per excavation). Confirmation soil samples will be analyzed as follows:

- Petroleum-contaminated Hotspot: NYSDEC CP-51 list[5] of VOCs and SVOCs for Fuel Oil Contaminated Soil. Over-excavation may be required where sidewall confirmation soil sample results exceed Site-Specific SCOs, if practical; and
- Hazardous Lead Hotspot: Total and TCLP lead. Over-excavation may be required where confirmation soil sample results exceed 40 CFR 261 Maximum Concentration of Contaminants for the Toxicity Characteristic.

The hotspot excavations will remain open until soil analytical results are reviewed and verify that residual soil complies with Site-Specfic SCOs for the petroleum-contaminated hotspot and 40 CFR 261 criteria for the hazardous lead hotspot. Once achieved, the results will be communicated to the NYSDEC and summarized in the CCR with all applicable support documentation. After confirmation soil sample results demonstrate that residual soil is in compliance, the excavations will be backfilled in accordance with Section 2.12 (Importation of Backfill and Clean Fill Material).

[5] List of VOCs and SVOCs established in NYSDEC Commissioner Policy 51 (CP-51) Soil Cleanup Guidance.

2.6.3 Excavation Backfill

After development and remedial excavations, backfill will be required to bring localized areas of the site back to the surrounding grade to continue normal operations. The estimated quantity of backfill required for a Track 4 remedy is 600 cubic yards (including 30 percent extra for compaction). A demarcation barrier (i.e., orange snow fence) will be placed between the residual site soil exceeding Track 4 RRU SCOs and the clean backfill to serve as a visual indicator of remedial excavation depths.

Backfill material will be Track 4-compliant soil (meeting Part 375 RRU SCOs) or consist of other acceptable fill material such as virgin, clean stone from a quarry or RCA. Imported fill will be screened and rejected if it contains solid waste such as brick, concrete, glass, ash, wood, or other debris. Non-soil material imported as backfill will comply with the requirements of Section 3.9 – Importation of Backfill and Clean Fill Material.

2.6.4 Site Cover Restoration

The site cover currently consists of the building's concrete slabs and asphalt pavement. Portions of the site cover will be removed or damaged during implementation of the IRMWP. The building foundation will be restored with new concrete above utility trench excavations and the outdoor area will be restored with new asphalt or 2 feet of clean soil placed above a demarcation barrier (for landscaped areas) where the existing asphalt cover is compromised. Restoration of the site cover will constitute a composite cover system that would serve as an engineering control for the protection of human health by establishing an incomplete exposure pathway to residual site soil. The anticipated composite cover system layout and details are presented on Figure 6.

3.0 INTERIM REMEDIAL MEASURES PROGRAM

The proposed IRM consists of the following tasks:

1. Decommission the suspected underground storage tank (UST) at the southeast corner of the site building in accordance with local, state and federal regulations. Petroleum-impacted soil associated with the UST will be excavated to about 12 feet bgs (the extent of petroleum impacts documented during the RI) with localized dewatering as needed;
2. Excavation of the hazardous lead soil hotspot near the central part of the site to at least 4 feet bgs;
3. Limited construction-related trench excavations within the site building and in the asphalt-paved exterior for installation of subsurface utilities, footings for a lean-to structure, and landscaping; and
4. Restoration of the site cover system (i.e. asphalt or concrete) where it is compromised or placement of a demarcation barrier and 2-foot clean soil cover in non-paved, landscaped areas.

The IRM described herein will be performed in accordance with applicable local, state and federal regulations and in general accordance with the IRM construction schedule, provided in Appendix A. Proposed changes, delays or deviations will be promptly communicated to the NYSDEC. Potential worker and public exposure to site contaminants will be minimized by adhering to a site-specific Health and Safety Plan (HASP) and a Community Air Monitoring Plan (CAMP), which are discussed in Sections 2.14 and 2.15. The CAMP is described within the HASP, which is included in Appendix B.

3.1 Site Preparation

Site preparation will be completed by the Contractor prior to implementation of the proposed IRM and will include, but not be limited to, the establishment of work zones, mobilization of support facilities, construction of decontamination facilities, implementation of erosion control measures, and implementation of site security measures (i.e. erection of security fencing around work zones and staging areas). The Contractor will maintain soil erosion control and sediment control measures prior to the commencement of, and during work operations contained in the proposed IRMWP. The Contractor will obtain necessary permits prior to the commencement of any task included in the proposed IRMWP.

Prior to intrusive activities, Dig Safely New York (811) will be contacted by the Contractor a minimum of three business days in advance of the work. Dig Safely New York will be informed of the nature of the work and the intent to perform excavation activities at the site.

3.2 Remedial Activity Oversight

The Remediation Engineer (RE) will oversee IRMWP planning and implementation. The RE is responsible for documenting that the contractor performs the work as specified in the IRMWP and provides the proper documentation required by NYSDEC. These contractor documents will be submitted to the NYSDEC in the CCR, which is described in Section 3.0.

A Langan engineer, geologist, or scientist, with guidance from the RE, will provide full-time oversight of the IRMWP. Activities that occur during the IRM will be properly documented in monthly BCP progress reports and in the CCR.

3.3 Waste Characterization

Waste characterization samples will be collected from the material proposed for excavation and disposal during implementation of the IRM per disposal facility requirements. Soil sample may be collected in situ prior to excavation or from temporary stockpiles. This activity will be coordinated and overseen by a representative of the RE. Samples will be representative of the material requiring disposal at a frequency consistent with disposal facility requirements. Additional samples may be collected as needed to meet disposal requirements.

Waste characterization samples will be submitted to a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-approved laboratory for analysis in accordance with the QAPP provided in Appendix C. Waste characterization samples will be analyzed for parameters that are typically required by disposal facilities, including:

- 6 NYCRR Part 375/TCL/TAL VOCs, SVOCs, PCBs, pesticides, herbicides and metals;
- TCLP VOCs, SVOCs, pesticides, herbicides, and metals;
- Resource Conservation and Recovery Act (RCRA) characteristics, including ignitability, corrosivity, reactivity (sulfide and cyanide); and
- Total cyanide, and
- Paint filter analysis.

3.4 Soil Screening Methods

Visual, olfactory and instrumental soil screening and assessment will be performed under the supervision of a professional engineer licensed in the State of New York during remediation and development excavations into known or potentially impacted material. Instrumental screening will be performed with a PID equipped with a 10.6 electron Volt (eV) bulb and will be calibrated daily.

Primary contaminant sources (including but not limited to tanks and hotspots) identified during the RI and IRM will be surveyed by a surveyor licensed to practice in the State of New York. This information will be provided on maps in the CCR.

3.5 Stockpile Methods

Stockpiles will be limited to the extent practicable, where the preferred method will be direct loading to trucks. Where direct loading is not feasible, soil stockpile areas will be constructed for staging of site soil and, if not pre-characterized, pending waste characterization testing before load out. Separate stockpile areas will be constructed to prevent comingling materials of different waste types. Stockpile areas will meet the following minimum requirements:

- Excavated soil will be placed on top of a low-permeability liner with a minimum thickness of 10-mil and of sufficient strength and thickness to prevent puncture during use; separate stockpiles will be created for each material type. The use of multiple layers of thinner liners is permissible.
- Equipment and procedures will be used to place and remove soil that will preserve the integrity of the liner.
- Stockpiles will be covered at the designated times (see below) with plastic sheeting or tarps (minimum 6 mil), which will be securely anchored to the ground. Stockpiles will be routinely inspected. Broken sheeting covers will be promptly replaced.
- Active stockpiles will be covered at the end of each workday.
- If needed, hay bales will be used near catch basins, surface waters and other discharge points.
- Each stockpile area will be encircled with silt fences and hay bales, as needed, to contain and filter particulates from any rainwater that has drained off the soil, and to mitigate the potential for surface water run-off.
- The stockpile areas will be inspected daily and noted deficiencies will be promptly addressed.

3.6 Material Load Out and Transport

Hazardous lead- and nonhazardous petroleum-impacted material will be handled, transported, and disposed of by a licensed hauler in accordance with applicable 6 NYCRR Part 372 Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities; 6 NYCRR Part 360 General Provisions; and 6 NYCRR Part 364 Waste Transporter Permits regulations and other applicable federal, state and local regulations. Nonhazardous historic fill and contaminated soil taken off site will be handled, at minimum, as a Municipal

Solid Waste per 6 NYCRR Part 360-1.2. Historic fill and contaminated soil from the site are prohibited from being disposed of at Part 360-16 Registration Facilities (also known as Soil Recycling Facilities).

The waste removal contractor will provide the appropriate permits, certifications, and written commitments from disposal facilities to accept the material throughout the duration of the project. Petroleum-impacted material will be transported by a waste removal contactor who possesses a valid New York State Part 364 Waste Transporter Permit. Waste manifests will be used to track the material that is transported off site. Haulers will be appropriately licensed and trucks will be properly placarded.

A representative for the RE will oversee the load-out of excavated material. After the loading of a container, dump truck, or trailer has been completed, the material will be transported to the approved off-site disposal facility. Loaded vehicles leaving the site will be appropriately lined, securely covered, and manifested in accordance with appropriate federal, state, local, and New York State Department of Transportation (NYSDOT) requirements (or other applicable transportation requirements). Loads containing wet material capable of producing free liquid will not be transported off site. A truck wash/cleaning area will be operated on site. The RE will be responsible for documenting that all outbound trucks are washed/cleaned at the truck wash before leaving the site until the interim remedial action is complete. Locations where vehicles enter or exit the site shall be inspected daily for evidence of off-site sediment tracking. Proposed in-bound and out-bound truck routes to the site are shown on Figure 7.

3.7 Materials Disposal Off-Site

The RE will review submittals for proposed disposal facilities before any materials leave the site to verify that the facility has the proper permits and to review their acceptance requirements. Waste characterization will be performed for material to be disposed of off-site in accordance with receiving facility requirements and in conformance with applicable permits. Sampling and analytical methods, sampling frequency, analytical results and QA/QC methods will be reported in the CCR upon completion of the IRM and in the Final Engineering Report (FER) upon completion of the final remedy. Waste characterization data available for soil/material to be disposed of at a given facility will be submitted to the disposal facility with suitable explanation prior to shipment and receipt. A letter from the disposal facility stating it is in receipt of the correspondence and is approved to accept the material shall be provided before any material is transported.

3.8 Material Reuse On-site

Soil excavated during interior or exterior trenching may be reused if the requirements in this section are met. Grossly-impacted or hazardous soil will not be reused. Reused soil placed beneath the composite cover must be nonhazardous in accordance with the predetermined beneficial use determination, listed in 6 NYCRR § 360-1.15(b). If any of the waste materials specified are approved for an end-use specified in Section 360-1.15(b), it will not be considered a solid waste. Soil removed during implementation of the remedy or other purposes will not be reused within a cover soil layer or within landscaped areas. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the site is prohibited for reuse on site. Reuse of soil will be coordinated in advance with the NYSDEC case manager and will follow guidelines described in DER-10 Section 5.4(e).

3.9 Importation of Backfill and Clean Fill Material

Imported soils will meet the lower of the Part 375 Protection of Groundwater and RRU SCOs, as set forth in Table 375-6.8(b) of 6 NYCRR Part 375. Non-compliant soils will not be imported onto the site without prior approval by NYSDEC. Documentation from each facility will be obtained, including the facility name, address, state department permits, and site history, if necessary, in accordance with DER-10 5.4(e)6. Representative samples of imported material will be collected and analyzed based on import volume at a frequency consistent with DER-10 Table 5.4(e)10.

Backfill material will consist of clean fill or other acceptable fill material such as virgin, native 0.75-inch stone from a quarry or recycled concrete aggregate (RCA). If RCA is imported to the site, it will be from NYSDEC-permitted or registered facilities in compliance with 6 NYCRR Part 360 registration and permitting requirements for the period of acquisition of RCA. RCA imported from compliant facilities will not require chemical testing, unless required by NYSDEC under its terms for operation of the facility. RCA imported to the site must be derived from recognizable and uncontaminated concrete. RCA material is not acceptable for, and will not be used as cover material. RCA or virgin stone aggregates must contain less than 10 percent by weight passing a No. 80 sieve to be excluded from DER-10 sampling requirements.

Prior to its placement, imported material will be screened for evidence of contamination (visual, olfactory and instrument). Material from industrial sites, spill sites, other environmental remediation sites or other potentially impacted sites will also not be imported to the site. The imported fill will not include solid waste including brick, concrete, glass, ash, wood, or other debris. Materials proposed for import onto the site will be approved by the RE and will be in compliance with provisions in this IRMWP prior to receipt.

3.10 Fluid Management

As needed, liquids to be removed from the site, including dewatering fluids, will be handled, transported and disposed of in accordance with applicable local, state, and federal regulations. Discharge of liquids into the New York City sewer system will be addressed through an approved NYCDEP permit and conform to pre-treatment stipulations of that permit. Dewatering fluids not suitable for discharge to the NYSDEP sewer system may be collected, characterized, and managed off site.

Untreated dewatering fluids will not be recharged back to the land surface or subsurface of the site. Discharge of water generated during remedial construction to surface waters (i.e. a local pond, stream or river) is prohibited without a SPDES permit.

3.11 Dust, Odor, Vapor and Nuisance Control Plan

The dust, odor, organic vapor and nuisance control plan was developed in accordance with the NYSDOH Generic Community Air Monitoring Plan and OSHA standards for construction (29 CFR 1926). Remediation and construction activities will be monitored for dust and odors by the RE's field inspector. Continuous monitoring on the perimeter of the work zones for odor, VOCs, and dust will be required for ground intrusive activities, such as soil excavation and handling. The work zone is defined as the general area in which machinery is operating in support of remediation activities. A portable PID will be used to monitor the work zone during excavation and UST removal and for periodic monitoring for VOCs during post-excavation soil sampling. The site perimeter will be monitored for fugitive dust emissions by visual observations as well as instrumentation measurements. 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. Action levels for site worker respiratory use and for community protection are set forth in Section 6.0 (CAMP) of the HASP, included in Appendix B.

3.11.1 Dust, Odor and Vapor Control

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

VOCs will be monitored with a handheld PID in accordance with the HASP and CAMP. If the action level is exceeded and adequate ventilation cannot be provided, work will cease and the potential affected portion of the work area will be evacuated until adequate mechanical

ventilation can be implemented to control the hazard. Level C respiratory protection may be donned in accordance with the HASP if untrained personnel are not present and the action level is exceeded. The following actions will be taken based on VOC levels measured:

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

The following actions will be taken based on visual observations and measured dust levels using a quantitative meter following minimum performance standards from DER-10 Appendix 1B:

- If the downwind particulate level is 100 µg/m^3 greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression must be employed. Work may continue with dust suppression techniques provided that downwind PM10 levels do not exceed 150 µg/m^3 above the background level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM10 levels are greater than 150 µg/m^3 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/m^3 of the upwind level and in preventing visible dust migration.

This plan will be implemented to control emissions of VOCs and nuisance odors. Specific VOC and odor control methods to be used on a routine basis will include limiting the time that the excavations remain open, minimizing stockpiling of impacted-source soil, and minimizing the handling of impacted material. If nuisance odors or vapors exceeding action levels set forth in the IRM Work Plan are identified off-site, work will be halted and the source of odors will be

identified and corrected. Work will not resume until all VOCs or nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor and vapor events and of all other complaints about the project. Implementation of all odor and vapor controls, including the halting of work, will be the responsibility of the Remediation Contractor under the oversight of the RE, who is responsible for certifying the CCR.

3.12 Health and Safety Plan

The RE prepared a site-specific HASP for the IRM, which is included as Appendix B. The HASP provides a mechanism for establishing on-site safe working conditions, safety organization, procedures, and personal protective equipment requirements. The HASP meets the requirements of 29 CFR 1910 and 29 CFR 1926 (which includes 29 CFR 1910.120 and 29 CFR 1926.65). The HASP includes, but is not limited to, the following components listed below:

- Organization and Identification of key personnel;
- Training requirements;
- Medical surveillance requirements;
- List of site hazards;
- Excavation safety;
- Work zone descriptions and monitoring procedures;
- Personal safety equipment and protective clothing requirements;
- Decontamination requirements;
- Standard operating procedures;
- Contingency Plan; and
- Material Safety Data Sheets.

3.13 Quality Assurance Project Plan

The RE prepared a QAPP, provided as Appendix C, which includes proposed sampling procedures and analytical methods for documentation and waste characterization samples.

QA/QC samples will be collected at a frequency of one for every 20 soil samples, and will include a blind duplicate, field blank, and matrix spike/matrix spike duplicate. A trip blank sample will be included for aqueous samples intended for VOC analysis.

Analytical Services Protocol (ASP) Category B deliverables will be prepared for all remedial performance samples collected during implementation of this IRMWP. Data Usability

Summary Reports (DUSR) will be prepared by a qualified data validator and the findings reported in the CCR.

3.14 Notification

The NYSDEC will be notified prior to commencement of work related to the IRM. A pre-construction meeting will be coordinated between the RE, the Remediation Contractor, and the NYSDEC. This meeting must take place prior to the implementation of this IRMWP.

4.0 REPORTING

Upon completion of the IRM, a CCR will be prepared and submitted to the NYSDEC. The RE responsible for certifying all reports will be an individual licensed to practice engineering in the State of New York. Jason Hayes, P.E. of Langan will have this responsibility. Should Mr. Hayes become unable to fulfill this responsibility, another suitably qualified New York State professional engineer will take his place. All project reports will be submitted to the NYSDEC electronically as PDFs. Laboratory analytical data for documentation samples will be submitted in an electronic data deliverable (EDD) format that complies with the NYSDEC's electronic data warehouse standards.

4.1 Daily Reports

Daily reports will be prepared for the project file and for review by Project Managers. Daily reports will include:

- An update of progress made during the reporting day;
- Locations of work and quantities of material imported and exported from the site;
- References to map for site activities;
- A summary of any and all complaints with relevant details (names, phone numbers);
- A summary of CAMP findings, including exceedances;
- An explanation of notable site conditions; and
- Actions anticipated for the next reporting day.

Daily reports are not intended to be the mode of communication for notification to the NYSDEC of emergencies (accident, spill), requests for changes to the IRMWP or other sensitive or time critical information; however, such conditions will also be included in the daily reports. Emergency conditions and changes to the IRMWP will be addressed directly to the NYSDEC Project Manager via personal communication. If site conditions warrant, the RE may request to change from daily to weekly reports that include the above information.

4.2 Construction Completion Report

A CCR will be submitted to the NYSDEC Project Managers within 90 days of completing the interim remedial action. The CCR will document the implementation of the remedial action undertaken as an IRM. The CCR will be incorporated into and referenced in the FER for the site when issued. The CCR will provide the following information:

1. The RE will certify that:

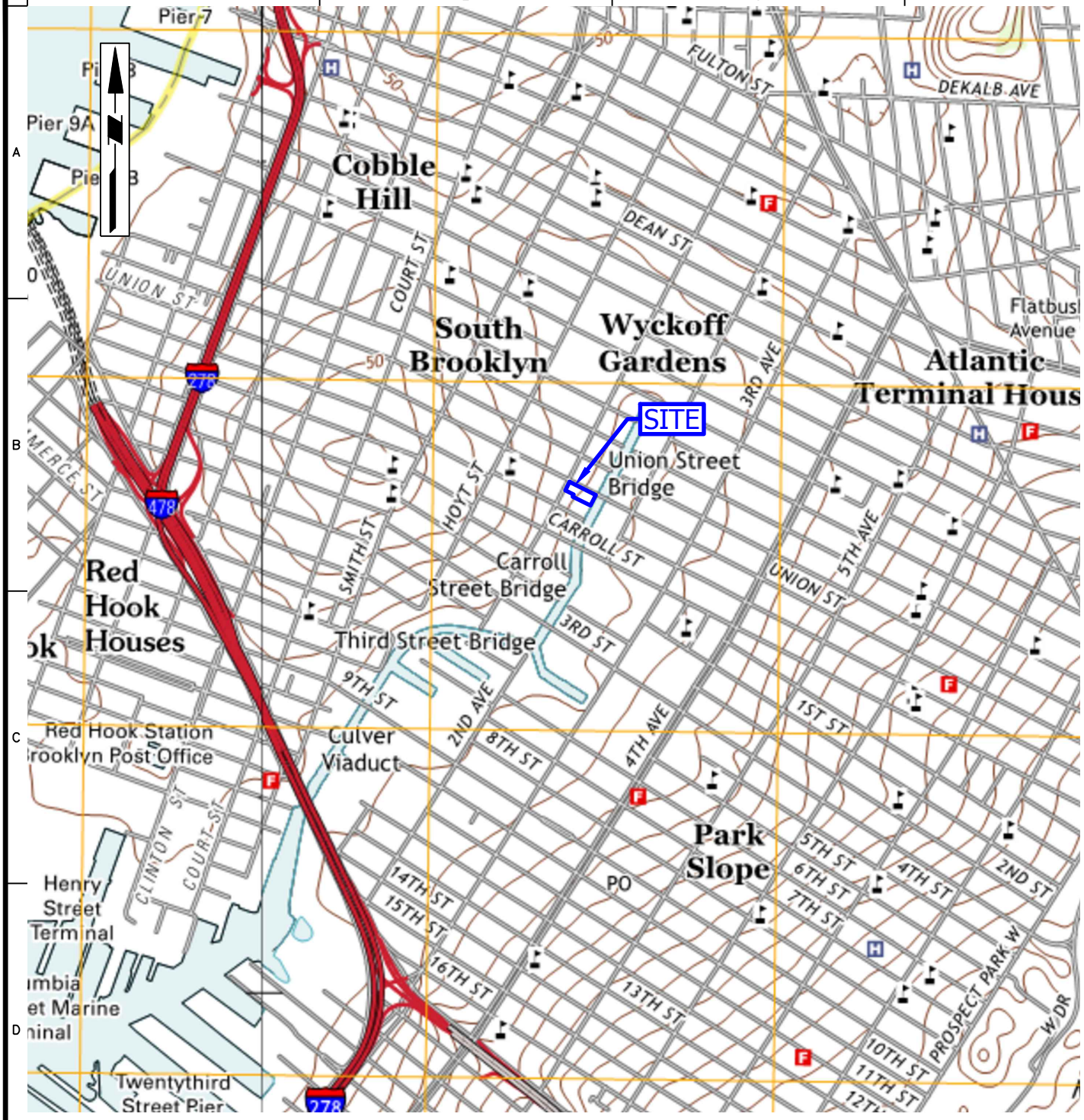
a. Data generated was useable and met the remedial requirements;
b. The remedial work conformed to the IRMWP;
c. Dust, odor, and vapor control measures were implemented during invasive work and conformed with the IRMWP;
d. Remediation waste was transported and disposed in accordance with the IRMWP;
e. Source approval and sampling of imported acceptable fill (not anticipated) was completed in a manner consistent with the methodology of the IRMWP;

2. Description of any problems encountered and their resolutions;
3. Description of changes in the IRM from the elements provided in the IRMWP and associated design documents and the reasons for them;
4. Description of the deviations from the approved IRMWP;
5. "As-built" drawings including remediation areas;
6. Listing of waste streams, quantity of materials disposed, and where they were disposed;
7. List of the remediation standards applied to the remedial actions;
8. Description of source and quality of fill;
9. A summary of all residual impacted material left on the site;
10. A tabular summary of all sampling results and all material characterization results and other sampling and chemical analysis performed as part of the IRM;
11. Written and photographic documentation of all remedial work performed under this remedy;
12. Copies of all the submitted progress reports;
13. Certifications, manifests, and bills of lading for excavated materials transported off-site;
14. An accounting of the destination of all material removed from the site, including excavated impacted soil, historic fill, solid waste, hazardous waste, non-regulated material, and fluids; and
15. Documentation associated with disposal of all material must also include records and approvals for receipt of the material. It will provide an accounting of the origin and chemical quality of all material imported onto the site.

5.0 SCHEDULE

Mobilization for interim remedial measures is expected to take about 1 to 2 days. After mobilizing, remedial activities and construction will begin immediately, and is expected to take 1 to 2 months to complete. Within 90 days after completing all on-site remedial activities, a CCR will be submitted to the NYSDEC as described in Section 4.2. An interim remedial measure construction schedule is included in Appendix A.

FIGURES



LEGEND:

APPROXIMATE BROWNFIELD CLEANUP PROGRAM SITE BOUNDARY

GENERAL NOTES:

1. BASE MAP IS TAKEN FROM UNITED STATES GEOLOGICAL SURVEY (USGS) 7.5 MINUTE TOPOGRAPHIC MAPS FOR THE BROOKLYN, 1980 AND JERSEY CITY, 1982 QUADRANGLES.

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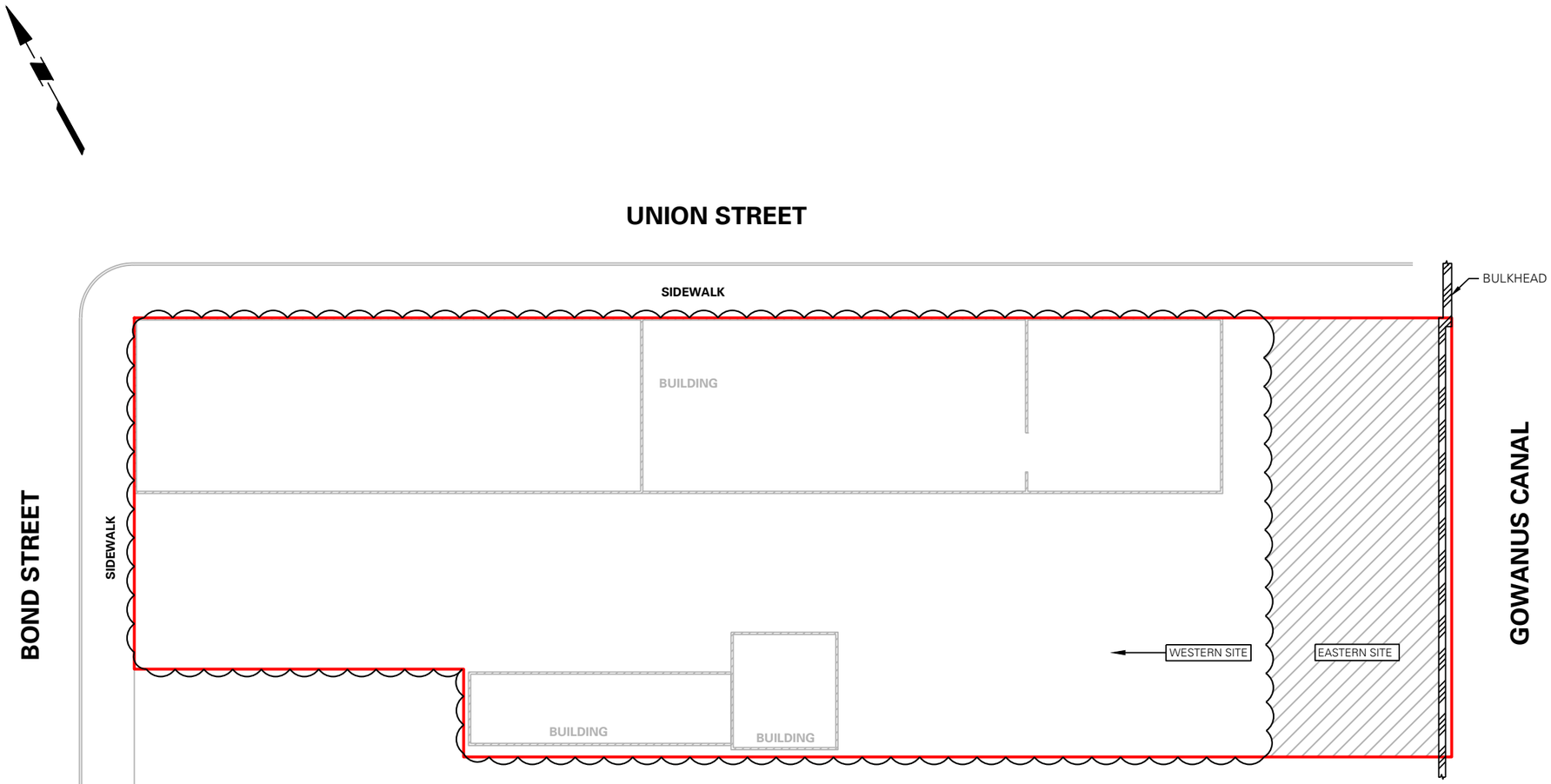
Collectively known as Langan

Project	450 UNION STREET BLOCK No. 438, LOT No. 7 BROOKLYN NEW YORK
Figure Title	SITE LOCATION MAP
Project No.	170301202
Date	1/27/2017
Scale	1"=1500'
Drawn By	AGT
Checked By	MSR
Submission Date	JANUARY 2017
Figure No.	1
Sheet	1 of 7

Filename: \\langan.com\data\NYC\data2\170301202\Cadd Data - 170301202\2D-DesignFiles\Environmental\IRMWP\Figure 1 - Site Location Map.dwg Date: 1/31/2017 Time: 12:20 User: atashji Style Table: Langan.stb Layout: SLM



LEGEND:

APPROXIMATE BROWNFIELD CLEANUP PROGRAM SITE BOUNDARY

GENERAL NOTES:

1. BASE MAP IS REFERENCED FROM SITE SURVEY, PREPARED BY BORO LAND SURVEYING, P.C., DATED MARCH 25, 2011.
2. ALL LOCATIONS ARE APPROXIMATE.

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SCALE IN FEET

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Project

450 UNION STREET

BLOCK No. 438 LOT No. 7

BROOKLYN NEW YORK

Figure Title

SITE PLAN

Project No. 170301202	Figure No. 2
Date 1/27/2017	
Scale 1"=30'	
Drawn By AT / Checked By MSR	
Submission Date JANUARY 2017	Sheet 2 of 7

Filename: \\langan.com\data\NYC\data2\170301202\Cadd Data - 170301202\2D-DesignFiles\Environmental\IRMWP\Figure 2 - Site Plan.dwg Date: 1/31/2017 Time: 12:20 User: atashji Style Table: Langan.stb Layout: Site Plan

UNION STREET

BOND STREET

GOWANUS CANAL

SIDEWALK

BULKHEAD

BUILDING

FORMER VAULT

CLOSED IN-PLACE VAULT

TANK

AK-1 AK-2 AK-3 AK-4 AK-5 AK-6 AK-7

SB-1/MW-1 SB-3/MW-3 SB-4/MW-4 SB-5/MW-5 SB-6/MW-6 SB-7/MW-7 SB-8 SB-9/MW-9

SB/MW11 SB/MW12 SB/MW14 SB/MW15 SB/MW16 SB/MW17

SB10 SB13 SB13R SB18 SB19

SB2N1 SB2N2 SB2W1 SB2W2 SB2E1 SB2E2 SB2R SB2S1 SB2S2

SSV05 SSV07 SSV08

SV04 SV06

AA01 AS01

RGB-1/RW01 RGB-2

S-1/TWP-1 S-2 S-3 S-4/TWP-4 S-5/TWP-5 S-6 S-7/TWP-7

SV-1 SV-2 SV-3

LEGEND:

- APPROXIMATE BROWNFIELD CLEANUP PROGRAM SITE BOUNDARY
- SB10 — RI SOIL BORING LOCATION (FEBRUARY 2016)
- SB2W1 — RI LEAD DELINEATION SOIL BORING LOCATION (FEBRUARY 2016)
- SB/MW11 — RI SOIL BORING/MONITORING WELL LOCATION (FEBRUARY 2016)
- RGB-2 — GEOTECHNICAL/ENVIRONMENTAL SOIL BORING LOCATION (JULY 2016)
- RGB-1/RW01 — GEOTECHNICAL/ENVIRONMENTAL SOIL BORING/RECOVERY WELL LOCATION (JULY 2016)
- SV04 — RI SOIL OR SUB-SLAB VAPOR SAMPLE LOCATION (FEBRUARY 2016)
  SV = SOIL VAPOR
  SSV = SUB-SLAB VAPOR
- AS01 — RI INDOOR/AMBIENT AIR SAMPLE LOCATION (FEBRUARY 216)
  AS = INDOOR AIR SAMPLE
  AA = AMBIENT AIR SAMPLE
- AK-4 — AKRF BORING LOCATION (APRIL 2002)
- AK-3 — AKRF BORING AND MONITORING WELL LOCATION (APRIL 2002)
- SB-8 — LANGAN BORING LOCATION (MAY 2014)
- SB-7/MW-7 — LANGAN BORING AND MONITORING WELL LOCATION (MAY 2014)
- SV-3 — LANGAN SOIL VAPOR SAMPLE LOCATION (MAY 2014)
- S-2 — HILLMAN BORING LOCATION (JULY 2014)
- S-5/TWP-5 — HILLMAN BORING AND MONITORING WELL LOCATION (JULY 2014)

GENERAL NOTES:

1. BASE MAP IS REFERENCED FROM SITE SURVEY, PREPARED BY BORO LAND SURVEYING, P.C., DATED MARCH 25, 2011.
2. SOIL BORING AND VAPOR SAMPLE LOCATIONS ARE APPROXIMATE. MONITORING WELLS WERE SURVEYED ON MARCH 9, 2016.
3. RI = REMEDIAL INVESTIGATION
4. LEAD DELINEATION BORINGS ARE SPACED ABOUT 5 FEET APART WITH THE EXCEPTION OF SB2N2.

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450 UNION STREET

BLOCK No. 438 LOT No. 7

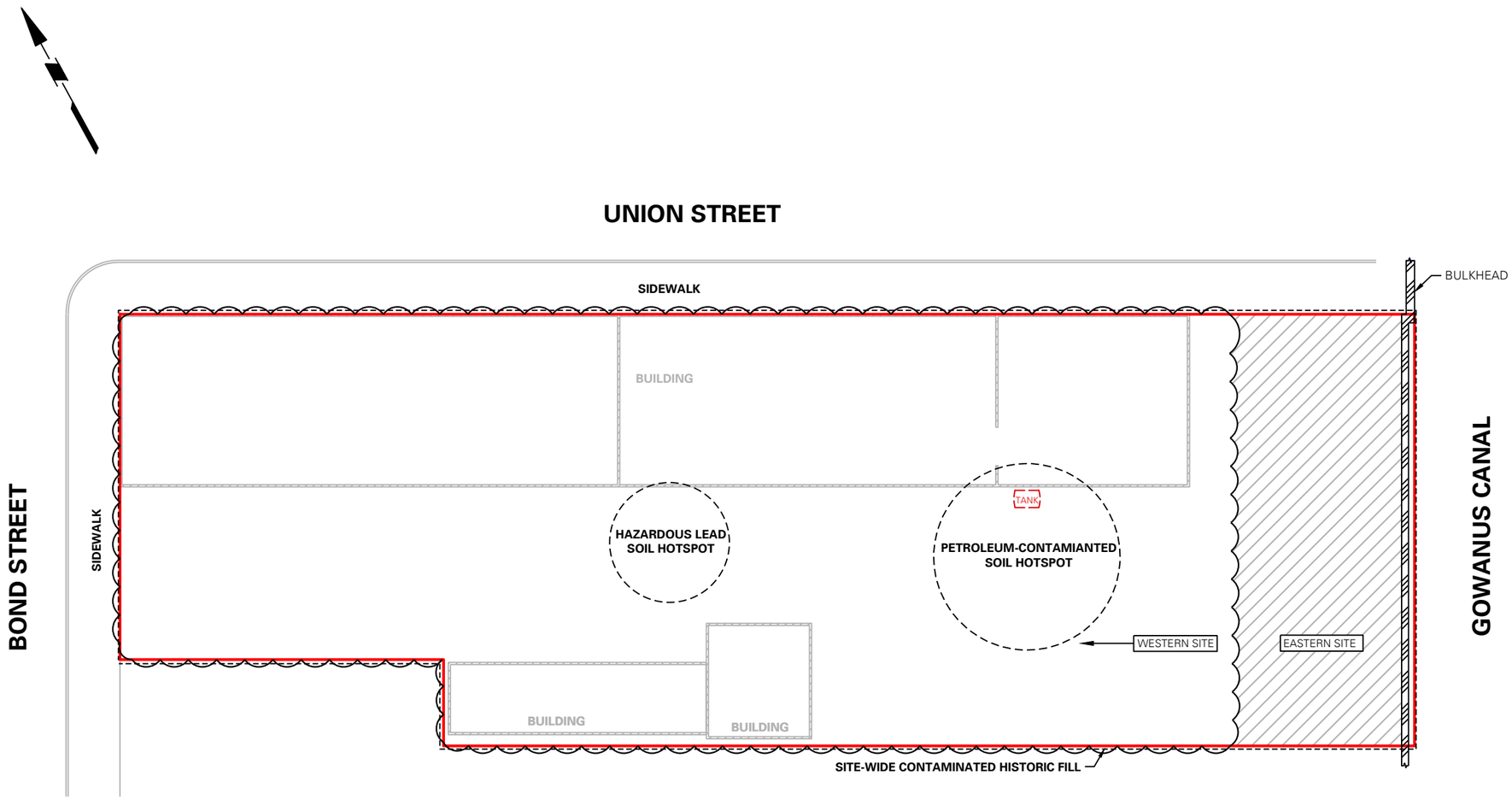
BROOKLYN NEW YORK

Figure Title

SAMPLE LOCATION MAP

Project No. 170301202	Figure No. 3
Date 1/27/2017	
Scale 1"=30'	
Drawn By AGT / Checked By MSR	
Submission Date JANUARY 2017	Sheet 3 of 7

Filename: \\langan.com\data\NYC\data2\170301202\Cadd Data - 170301202\2D-DesignFiles\Environmental\IRMWP\Figure 3 - Sample Location Plan.dwg Date: 1/31/2017 Time: 12:20 User: atashji Style Table: Langan.stb Layout: Fig 3 - Sample Location Map



LEGEND:

APPROXIMATE BROWNFIELD CLEANUP PROGRAM SITE BOUNDARY

ENVIRONMENTAL CONTAMINATION AREA (AREA DOES NOT REPRESENT CONTAMINATION EXTENTS)

GENERAL NOTES:

1. BASE MAP IS REFERENCED FROM SITE SURVEY, PREPARED BY BORO LAND SURVEYING, P.C., DATED MARCH 25, 2011.
2. ALL LOCATIONS INCLUDING SITE FEATURES AND THE UNDERGROUND TANK ARE APPROXIMATE.
3. THE AREAS SHOWN DO NOT REPRESENT THE ESTIMATED EXTENT OF CONTAMINATION. ENVIRONMENTAL CONTAMINATION AREAS ARE SHOWN FOR LOCATION REFERENCE WITHIN THE SITE.

30 0 15 30

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Project

450 UNION STREET

BLOCK No. 438 LOT No. 7

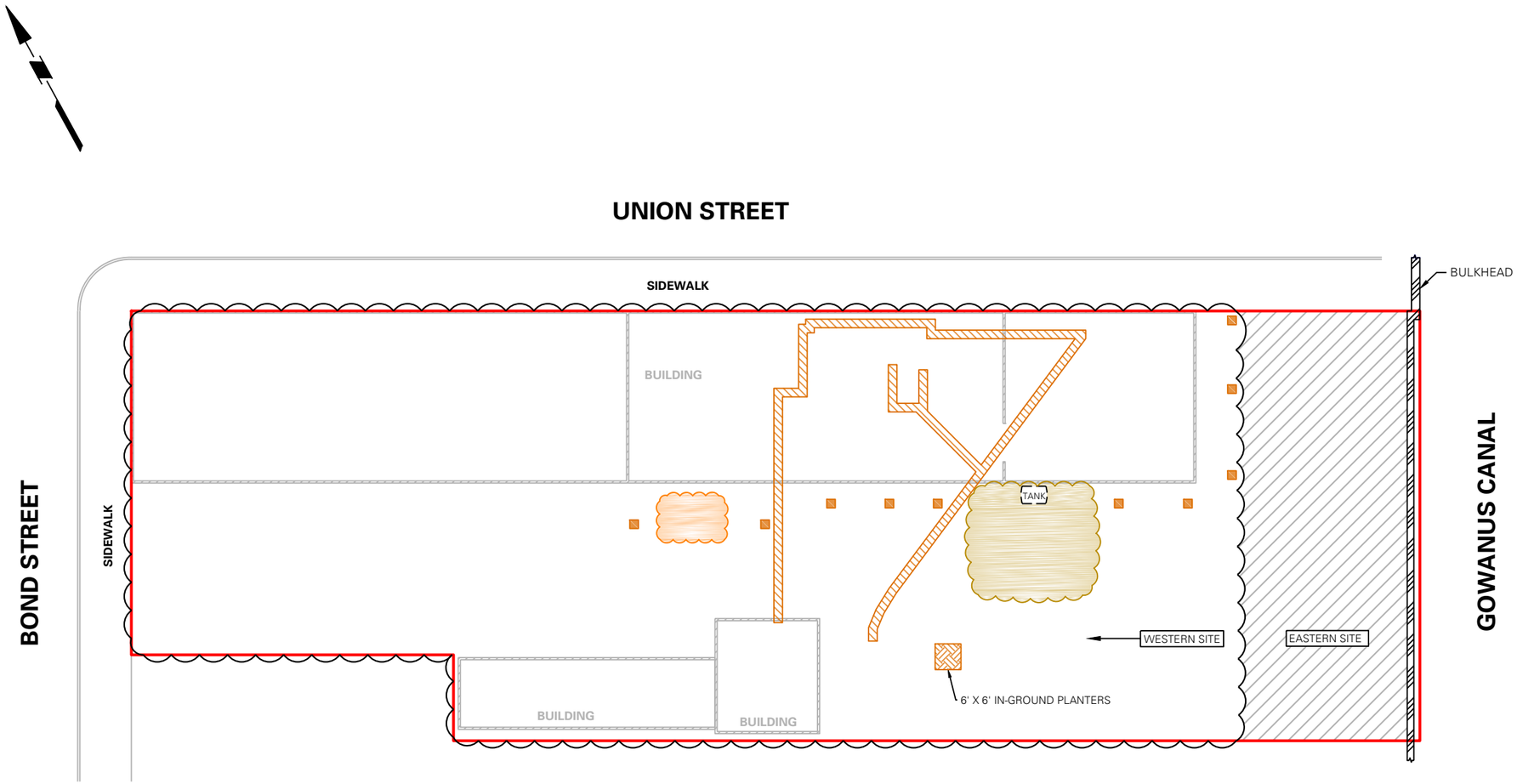
BROOKLYN **NEW YORK**

Figure Title

ENVIRONMENTAL CONTAMINATION SUMMARY

Project No. 170301202	Figure No. 4
Date 1/27/2017	
Scale 1"=30'	
Drawn By AGT / Checked By MSR	
Submission Date JANUARY 2017	Sheet 4 of 7

Filename: \\langan.com\data\NYC\data2\170301202\Cadd Data - 170301202\2D-DesignFiles\Environmental\IRMWP\Figure 4 - Environmental Contamination Summary.dwg Date: 1/31/2017 Time: 12:20 User: atashji Style Table: Langan.stb Layout: Fig 4 - Contamination Summary



LEGEND:

- APPROXIMATE BROWNFIELD CLEANUP PROGRAM SITE BOUNDARY
- APPROXIMATE EXCAVATION EXTENT FOR HAZARDOUS LEAD HOTSPOT (±4 FEET BGS)
- APPROXIMATE EXCAVATION EXTENT PETROLEUM-CONTAMINATED SOIL (±12 FEET BGS)
- APPROXIMATE EXTENT OF UTILITY TRENCH EXCAVATIONS (±2 TO 4 FEET BGS)
- APPROXIMATE LOCATION OF IN-GROUND PLANTER EXCAVATIONS (± 2 FEET BGS)
- APPROXIMATE LOCATION OF LEAN-TO STRUCTURAL FOOTING

GENERAL NOTES:

1. BASE MAP IS REFERENCED FROM SITE SURVEY, PREPARED BY BORO LAND SURVEYING, P.C., DATED MARCH 25, 2011.
2. ALL LOCATIONS ARE APPROXIMATE.
3. THE LOCATION OF UTILITY TRENCH EXCAVATIONS, LEAN-TO FOOTING EXCAVATIONS, AND PLANTERS SHOWN ARE PRELIMINARY. EXCAVATIONS BEYOND WHAT IS SHOWN IN THIS FIGURE WILL BE DOCUMENTED IN THE FIELD AND PRESENTED IN THE CONSTRUCTION COMPLETION REPORT.

30 0 15 30
SCALE IN FEET

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Langan International LLC
Collectively known as Langan

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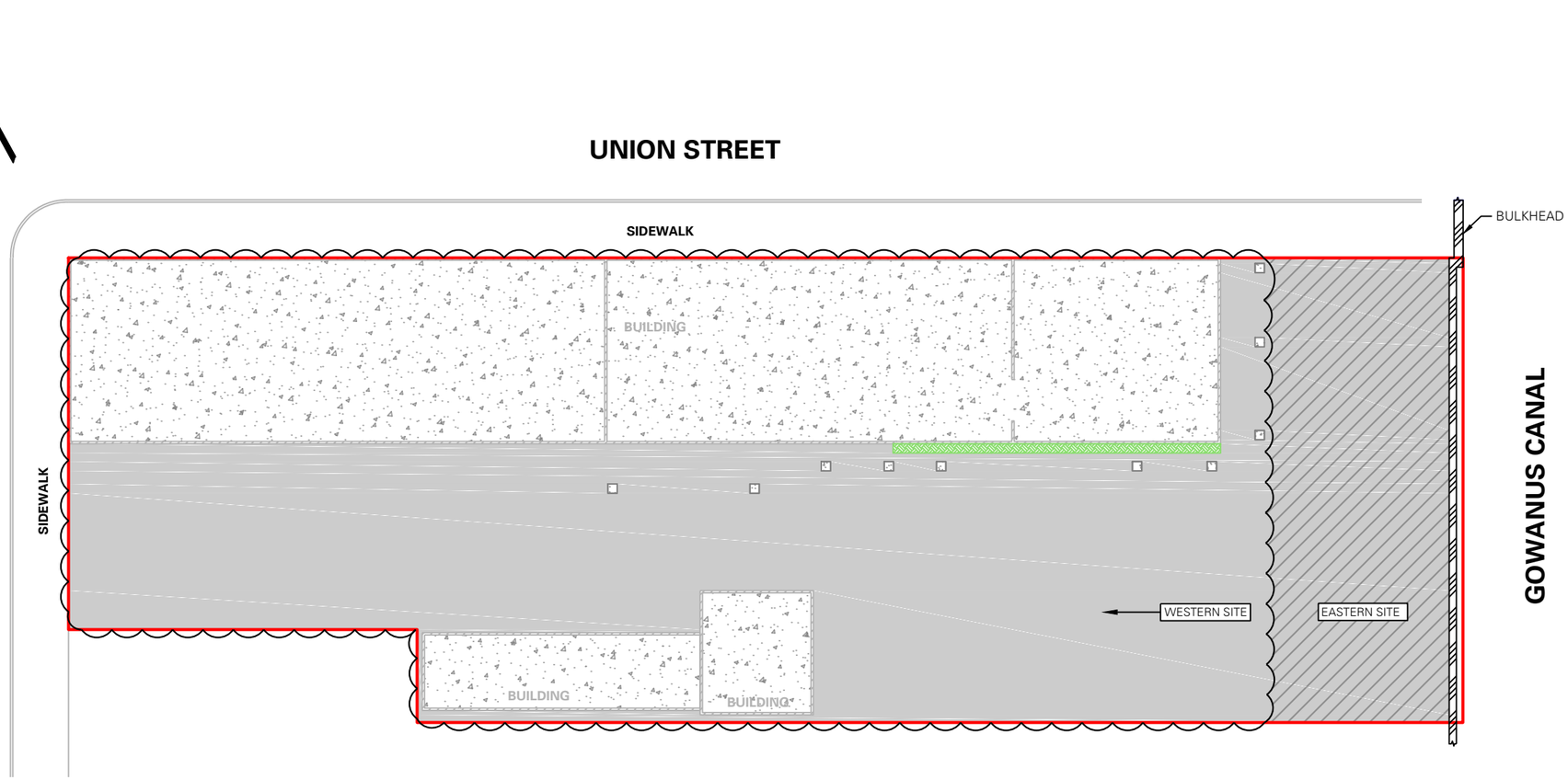
450 UNION STREET
BLOCK No. 438 LOT No. 7
BROOKLYN NEW YORK

Figure Title
PROPOSED EXCAVATION MAP ALTERNATIVE II

Project No. 170301202	Figure No. 5
Date 1/27/2017	
Scale 1"=30'	
Drawn By AGT / Checked By MSR	
Submission Date JANUARY 2017	Sheet 5 of 7

Filename: \\langan.com\data\NYC\data2\170301202\Cadd Data - 170301202\2D-DesignFiles\Environmental\IRMWP\Figure 5 - Alternative II - Track 4 Excavation Plan.dwg Date: 1/31/2017 Time: 12:21 User: atashji Style Table: Langan.stb Layout: Figure 5 - Alt II

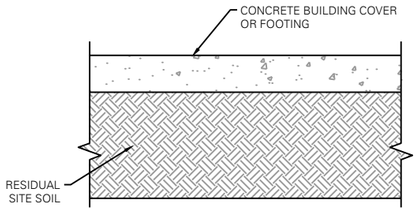


LEGEND:

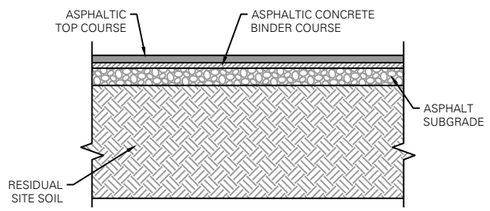
- APPROXIMATE BROWNFIELD CLEANUP PROGRAM SITE BOUNDARY
- CONCRETE BUILDING AND FOOTINGS COVER - TYPE 1 (DETAIL 1)
- ASPHALT COVER - TYPE 2 (DETAIL 2)
- 2 FEET OF CLEAN SOIL COVER - TYPE 3 (DETAIL 3)

GENERAL NOTES:

1. BASE MAP IS TAKEN FROM SURVEY SITE SURVEY, PREPARED BY BORO LAND SURVEYING, P.C., DATED MARCH 25, 2011.
2. THE COMPOSITE COVER TYPES WILL RESTORED FOR THEIR RESPECTIVE AREAS.
3. THE LOCATIONS OF EACH COVER TYPE SHOWN ARE APPROXIMATE AND MAY DIFFER IN LOCATION AND QUANTITY.

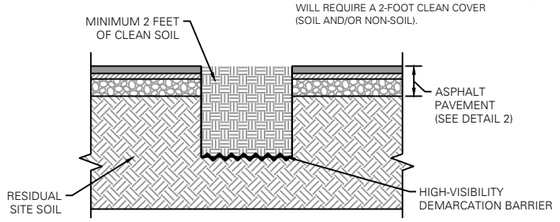


DETAIL 1: COVER TYPE 1 - TYPICAL CONCRETE COVER FOR BUILDING AND FOOTINGS
(NOT TO SCALE)



DETAIL 2: COVER TYPE 2 - TYPICAL ASPHALT COVER
(NOT TO SCALE)

NOTE: DETAIL 3 ILLUSTRATES TYPICAL COVER CONSTRUCTION FOR LANDSCAPED AREAS. HOWEVER, ANY OTHER LOCATIONS THAT WILL NOT BE RESTORED WITH A SURFACE STRUCTURE WILL REQUIRE A 2-FOOT CLEAN COVER (SOIL AND/OR NON-SOIL).



DETAIL 3: COVER TYPE 3 - TYPICAL CLEAN SOIL COVER
(NOT TO SCALE)

30 0 15 30
SCALE IN FEET

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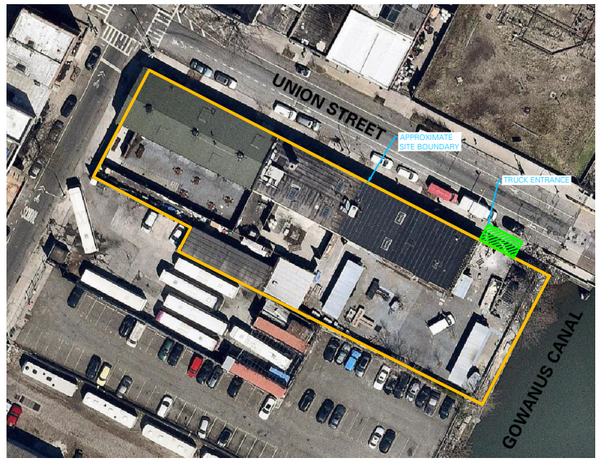
Figure Title
PROPOSED COMPOSITE COVER SYSTEM

Project No. 170301202	Figure No. 6
Date 1/27/2017	
Scale 1"=30'	
Drawn By AGT / Checked By MSR	
Submission Date JANUARY 2017	Sheet 6 of 7

Filename: \\langan.com\data\NYC\data2\170301202\Cadd Data - 170301202\2D-DesignFiles\Environmental\IRMWP\Figure 6 - Composite Covery System Plan.dwg Date: 1/31/2017 Time: 12:21 User: atashji Style Table: Langan.stb Layout: Figure 7 - Composite Cover



AERIAL MAP - SCALE: 1" = 100'

LEGEND:

- APPROXIMATE BCP SITE BOUNDARY
- PROPOSED TRUCK ROUTE

MAP KEY:

Local Truck Route
Trucks with an origin or destination for the purpose of delivery, loading or servicing within the respective Borough, shall only operate on designated local routes, except that an operator may operate on a non-designated street for the purpose of arriving at his/her destination. This shall be accomplished by leaving a designated truck route at the intersection that is nearest to their destination, proceeding by the most direct route, and then returning to the nearest designated truck route by the most direct route. If the operator has additional destinations in the same general area, he/she may proceed by the most direct route to his/her next destination without returning to a designated truck route, provided that the operator's next destination does not require that he/she cross a designated truck route.

Through Truck Route
Trucks having neither an origin nor a destination within the respective Borough shall restrict the operation of such vehicles to those street segments designated as Through Truck Routes.

Through Truck Route on Expressway

Through Truck Route on Tunnel

Exception 53' Trailers Allowed
For definition see information on reverse side.

Industrial Business Zones (IBZ)

Parks and Open Spaces

29A Highway Exit

Commercial Vehicles Prohibited

Low Vertical Clearance Area

GENERAL NOTES:

1. BASE MAP IS TAKEN FROM NEW YORK CITY DEPARTMENT OF TRANSPORTATION (NYCDOT) 2011-2012 NEW YORK CITY TRUCK ROUTE MAP

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SCALE IN FEET

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Figure Title
TRUCK ROUTE MAP

Project No. 170301202	Figure No. 7
Date 1/27/2017	
Scale 1" = 2,500'	
Drawn By AGT / Checked By MSR	
Submission Date JANUARY 2017	Sheet 7 of 7

Filename: \\langan.com\data\NYC\data2\170301202\Cadd Data - 170301202\2D-DesignFiles\Environmental\IRMWP\Figure 7 - Truck Route Map.dwg Date: 1/31/2017 Time: 12:21 User: atashji Style Table: Langan.stb Layout: Figure 6 - Truck Route Map

TABLES

Table 1
Track 4 Site-Specific Soil Cleanup Objectives
450 Union Street, Brooklyn, NY
Langan Project No. 170301202
BCP Site No. C224219

Parameter	Maximum Detected Concentration	Site-Specific SCOs
SVOCs (mg/kg)		
-	-	See Note 2
Metals (mg/kg)		
Arsenic	40	**16**
Cadmium	61	**9.3**
Copper	5,900	**1,720**
Lead	1,300	**1,000**
Total Mercury	4.6	**2.8**

Notes:

1. The Site-Specific Track 4 Soil Cleanup Objectives (SCOs) are the lower of New York State Department of Environmental Conservation (NYSDEC) Title 6 of the Official Compilation of New York Codes, Rules, and Regulations (6 NYCRR) Part 375 Restricted Use Restricted-Residential or Protection of Groundwater SCOs for VOCs, PCBs, pesticides, and metals, except for the Site-Specific SCOs shown in the above table.
2. For SVOCs, Site-Specific Track 4 SCOs will be the lower of Restricted-Residential or Protection of Groundwater, or will be Restricted-Residential only. The governing SCOs for SVOCs will be determined based on filtered and unfiltered groundwater sample results, which will be reviewed and determined by the NYSDEC in a separate amendment letter.
3. VOC: volatile organic compound
4. SVOC: semivolatile organic compound
5. PCB: polychlorinated biphenyl
6. mg/kg: milligram per kilogram

Table 2
Alternative I Interim Remedial Measures Cost Estimate – Track 1 – Unrestricted Use SCOs
450 Union Street, Brooklyn, New York
Langan Project No. 170301202
BCP Site No. C224219

Track 1 – Unrestricted Use

Item No.	Description of Environmental Item	Estimated Quantity		Unit Price		Estimated Cost
A - IRMWP CONTRACTOR FEES						
A-1	Remediation Facilities, Mobilization, Demobilization, and Site Maintenance - Remediation and decontamination facilities, site fencing, trailer, truck cleaning facilities, etc.			Allowance		$100,000
A-2	Demolition of Existing Buildings - Demolition of the three existing buildings will be required to access underlying contaminated soil/fill for western site excavation.	11,000	SF	$ 5	per SF	$55,000
A-3	Removal of Underground Storage Tank (UST) - Includes registration, cleaning, removal and disposal of 1 suspected UST identified during the remedial investigation.	1	Tanks	$ 10,000	per Tank	$10,000
A-4	Unknown UST Contingency - Registration, cleaning, removal and disposal of potential USTs (based on the assumption that up to two additional unknown USTs may be present at the site based on past uses).	2	Tanks	$ 10,000	per Tank	$20,000
A-5	Contaminated Material Excavation - Accounts for excavation of material in the western part of the site containing concentrations exceeding Part 375 Restricted Use, Restricted-Residential Soil Cleanup Objectives to about 14 feet bgs (including historic fill, petroleum and hazardous lead).	11,740	CY	$ 30	per CY	$352,000
A-6	Transport and Disposal of Historic Fill/Native soil - Includes transport vehicles and disposal of historic fill and soil at a registered or permitted facility.	17,100	Tons	$ 45	per Ton	$770,000
A-7	Transport and Disposal of Petroleum Contaminated Material - Includes transport vehicles and disposal of fill material impacted by petroleum, SVOCs, and metals at a permitted facility.	480	Tons	$ 60	per Ton	$29,000
A-8	Transport and Disposal of Hazardous Lead Contaminated Material - Includes transport vehicles and disposal of fill material containing by petroleum, SVOCs, and metals at a permitted facility.	33	Tons	$ 185	per Ton	$6,000
A-9	Dewatering - Assumes at a minimum, a fractionation tank will be needed to remove suspended solids, and accounts for permitting, operation of pumps via excavated sumps or installed wells, regular cleaning, and periodic verification water sampling.	6	Months	$ 100,000	per Month	$600,000
A-10	Dust, Odor and Vapor Control - Includes odor, dust, and organic vapor control during the excavation of petroleum-impacted material and remediation of the Site. Assumes control measures will include, but not be limited to application of odor suppressant, foam or water.	6	Months	$ 10,000	per Month	$60,000
A-11	Support of Excavation - Includes installation of timber lagging along the perimeters of the western excavation area to depths of 14 feet bgs.	9,800	SF	$ 100	per SF	$980,000
A-12	Backfill - Import and placement of clean fill material to bring site to development grade (includes 30 % extra for compaction).	15,270	CY	$ 35	per CY	$534,000
A-13	Asphalt Paving Contingency - Track 1 remediation would not require an engineered cover. Repaving the western part of the site is included as a contingency to be decided by the owner.	23,285	SF	$ 2.50	per SF	$58,000
					SUBTOTAL (without contingency)	**$3,574,000**
					Engineering Design Contingency (15% of Contractor Costs)	**$536,100**
					SUBTOTAL (with contingency)	**$4,110,100**
B - ENGINEERING AND REMEDIATION OVERSIGHT FEES						
B-1	Preliminary Waste Characterization - In situ characterization of soil that will be generated during excavation to 14 feet bgs for off-site disposal in accordance with general disposal facility sampling requirements. Includes field work and reporting. Pre-characterization of the material to be removed as part of development/remedial excavation will assist in obtaining pre-approval from disposal facilities and understanding disposal cost.			Lump Sum		$70,000
B-2	Confirmation Soil Sampling - To confirm source material removal (assumes analysis for Part 375 and TCL/TAL list of VOCs, SVOCs, PCBs, pesticides/herbicides and metals). Assumes collection of 26 samples plus 6 QA/QC samples (@ 1 duplicate, 1 field blank and 1 MS/MSD for every 20 samples)	32	Samples	$ 800	per Sample	$25,600
B-3	Engineering Oversight during IRMWP Implementation, Monthly and Daily Reporting - Full time oversight and office support.	6	Months	$ 35,000	per Month	$210,000
B-4	Community air monitoring program (CAMP) - Includes fulltime equipment rental and operation of perimeter dust and volatile organic compounds monitors and daily reporting.	6	Months	$ 4,000	per Month	$24,000
B-5	Construction Completion Report (CCR)			Lump Sum		$40,000
					SUBTOTAL	**$369,600**
					REMEDIAL ALTERNATIVE 1 - TRACK 1 BCP ESTIMATE - SITE PREPARATION (without contingency)	**$3,943,600**
					REMEDIAL ALTERNATIVE 1 - TRACK 1 BCP ESTIMATE - SITE PREPARATION (with contingency)	**$4,480,000**

General Assumptions and Conditions:
1. Cost estimate is based on Langan's past experience and generalized vendor estimates using 2016 dollars. Estimated costs have been rounded up to the nearest thousand place. This estimate applies to the western part of the site only.
2. This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the interim remedial alternative. Changes in cost elements are likely to occur as a result of new information and data collected during the engineering design of the interim remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual cost. Utilization of this cost estimate information beyond the stated purpose is not recommended. Langan is not licensed to provide financial or legal consulting services; as such, this cost estimate information is not intended to be used for complying with financial reporting requirements associated with liability services.
3. The density used for unit conversion was 1.5 tons per cubic yard.
4. Backfill volume assumes a +30% compaction factor.
5. Excavation depths were calculated using Remedial Investigation soil sample results, field observations, and observed fill depths.
6. It is assumed that Track 1 interim remedial measures will be completed over an 6-month period.

Contractor Cost Assumptions:
Item A-2: Assumes demolition of the existing three buildings would be required to access underlying soil/fill for across western portion of the site.
Item A-4: Assumes up to 2 additional USTs may exist in areas that were not previously accessible during the initial investigation (i.e., below buildings or structures), and would be discovered during western site excavation.
Item A-5: The unit rate provided reflects construction labor to be OSHA certified.
Items A-6 through A-9: All trucks that have come into contact with site contaminated material will need to be decontaminated prior to leaving site.
Items A-9 through A-13: Unit costs include labor and materials.
Item A9: Dewater will require the use of excavated sumps with pumps or a well network to lower the groundwater table. At a minimum, a fractionation tank will be needed to remove suspended soilds prior to discharging to the NYCDEP sewer system in accordance with an approved permit, or discharge to surface waters under a State Pollutant Discharge Elimiation System (SPDES) permit. The estimate includes verification water sampling, which will be defined in frequency and analytical paramters by the approved discharge permit.
Item A-10: Vapor/odor control cost estimate includes equipment, and materials necessary to monitor vapor/odor emission during intrusive site activities. Cost estimate includes application of vapor/odor suppressing foam to open excavations and soil loaded into trucks.
Item A-11: Assumes SOE will be required for western site perimeter to about 14 feet bgs.
Item A-12: Backfill placement and compaction assumes soil handling and management costs for the New York City area. Assumes that the site will have to be structurally backfilled to pre-remediation grade with material that contains no concentrations above Track 1 Unrestricted Use Soil Cleanup Objectives (6NYCRR-Part 375-6.8(a)). The quantity of soil has been increased by 30% to account for compaction.
Item A-13: An engineered cover would not be required with a Track 1 remediation. Repaving the western part of the site is included as a contingency to be decided by the owner.

Engineering Cost Assumptions:
Item B-1: Sampling frequency based on 11,740 cubic yards of material at a conservative rate of one sample per 800 cubic yards, and one total petroleum hydrocarbon samples per 300 cubic yards. A representative suite (not disposal facility specific) of analyses was assumed. Sample collection activities assumed to occur over a three-day, single mobilization. Includes one groundwater sample for NYCDEP discharge parameters. Assumes standard turnaround time for sample analysis.
Item B-2: Confirmation soil sampling frequency based on DER-10, which requires one confirmation sample per 900 square feet of excavation base. Samples assumed to be analyzed for volatile organic compounds (VOC), semivolatile organic compounds (SVOC), polychlorinated biphenyls (PCB), pesticides, and metals. Cost includes labor and materials to collect samples and subcontracted laboratory analysis by a New York State Department of Health (NYSDOH) environmental laboratory approval program (ELAP)-accredited laboratory. Assumes standard turnaround time for sample analysis.
Item B-3: Engineering oversight includes community air monitoring program (CAMP), onsite engineer throughout interim remediation, remediation health and safety including purchase and maintenance of appropriate PPE, periodic office reporting to NYSDEC, and two site meetings per month.
Item B-4: Community air monitoring program (CAMP) assumed duration of 6 months. CAMP scope includes fulltime equipment operation of perimeter dust and VOC monitors and daily reporting.

Table 3
Alternative II Interim Remedial Measures Cost Estimate – Track 4 – Site-Specific SCOs
450 Union Street, Brooklyn, New York
Langan Project No. 170301202
BCP Site No. C224219

Track 4 – Restricted-Residential Use

Item No.	Description of Environmental Item	Estimated Quantity		Unit Price		Estimated Cost
A - IRMWP CONTRACTOR FEES						
A-1	Remediation Facilities, Mobilization, Demobilization, and Site Maintenance - Remediation and decontamination facilities, site fencing, trailer, truck cleaning facilities, etc.			Allowance		$20,000
A-2	Removal of Underground Storage Tank (UST) - Includes registration, cleaning, removal and disposal of 1 suspected UST identified during the remedial investigation.	1	Tanks	$ 10,000	per Tank	$10,000
A-3	Contaminated Material and Development Excavation - Accounts for excavation from petroleum and hazardous lead source hotspots, interior utility trenchs (4 feet bgs), in-ground planters (2 feet bgs).	470	CY	$ 30	per CY	$14,000
A-4	Transport and Disposal of Historic Fill/Native soil - Includes transport vehicles and disposal of historic fill and soil at a permitted facility.	125	Tons	$ 45	per Ton	$6,000
A-5	Transport and Disposal of Petroleum Contaminated Material - Includes transport vehicles and disposal of fill material impacted by petroleum, SVOCs, and metals at a permitted facility.	480	Tons	$ 60	per Ton	$29,000
A-6	Transport and Disposal of Hazardous Lead Contaminated Material - Includes transport vehicles and disposal of fill material containing by petroleum, SVOCs, and metals at a permitted facility.	33	Tons	$ 185	per Ton	$6,000
A-7	Support of Excavation (SOE) - Includes design, labor, and materials for construction of a support of excavation (SOE) system to safely excavate the suspect UST and associated petroleum contamianted soil adjoining the existing building.	1	each	$ 10,000	each	$10,000
A-8	Localized Dewatering - Assumes a fractionation tank may be needed to remove suspended solids, and accounts for permitting and operation of pumps via excavated sumps. Localized dewatering will be used for the petroleum excavation only, therefore one month is used in this estimation.	1	Month	$ 10,000	per Month	$10,000
A-9	Dust, Odor and Vapor Control - Includes odor, dust, and organic vapor control during the excavation of petroleum-impacted material and remediation of the Site. Assumes control measures will include, but not be limited to application of odor suppressant, foam or water.	1	Week	$ 2,500	per Week	$3,000
A-10	Backfill - Import and placement of clean fill material to bring site to development grade (includes 30 % extra for compaction).	600	CY	$ 35	per CY	$21,000
A-11	Asphalt Paving - Repaving for areas where asphalt is penetrated. Assumes restoration of source areas plus 10 percent of the current paved area for utility excavations.	2,520	SF	$ 2.50	per SF	$6,000
A-12	Concrete Slab Replacement - Assumes interior trenched areas will receive new concrete, plus 30 percent contigency for new concrete work in untrenched areas.	520	SF	$ 25	per SF	$13,000
					SUBTOTAL (without contingency)	**$148,000**
					Engineering Design Contingency (15% of Contractor Costs)	**$22,200**
					SUBTOTAL (with contingency)	**$170,200**
B - ENGINEERING AND REMEDIATION OVERSIGHT FEES						
B-1	Preliminary Waste Characterization - In situ characterization of soil that will be generated during development and remediation for off-site disposal in accordance with general disposal facility sampling requirements. Includes field work and reporting. Pre-characterization of the material to be removed as part of remedial excavation will assist in obtaining pre-approval from disposal facilities and understanding disposal cost. Because the extent of development-related excavations may change, material is assumed to be sampled from stockpiles during construction.			Lump Sum		$20,000
B-2	Performance Soil Sampling - Documentation - To document material remaining in utility excavations (assumes analysis for Part 375 and TCL/TAL list of VOCs, SVOCs, PCBs, pesticides/herbicides and metals). Assumes collection of 4 samples plus 3 QA/QC samples (@ 1 duplicate, 1 field blank and 1 MS/MSD for every 20 samples)	7	Samples	$ 800	per Sample	$5,600
	Performance Soil Sampling - Confirmation - To confirm source material removal (assumes analysis for NYSDEC CP-51 list of VOCs and SVOCs for petroleum-contaminated area; and total and TCLP lead for the hazardous lead hotspot). Assumes collection of 10 samples plus 3 QA/QC samples (@ 1 duplicate, 1 field blank and 1 MS/MSD for every 20 samples)	13	Samples	$ 135	per Sample	$1,755
B-3	Engineering Oversight during IRMWP Implementation, Monthly and Daily Reporting - Full time oversight and office support.	1	Months	$ 35,000	per Month	$35,000
B-4	Community air monitoring program (CAMP) - Includes fulltime equipment rental and operation of perimeter dust and volatile organic compounds monitors and daily reporting.	1	Months	$ 4,000	per Month	$4,000
B-5	Construction Completion Report (CCR)			Lump Sum		$20,000
					SUBTOTAL	**$86,355**
					REMEDIAL ALTERNATIVE 1 - TRACK 1 BCP ESTIMATE - SITE PREPARATION (without contingency)	**$234,355**
					REMEDIAL ALTERNATIVE 1 - TRACK 1 BCP ESTIMATE - SITE PREPARATION (with contingency)	**$257,000**

General Assumptions and Conditions:
1. Cost estimate is based on Langan's past experience and generalized vendor estimates using 2016 dollars. Estimated costs have been rounded up to the nearest thousand place. This estimate applies to the western part of the site only.
2. This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the interim remedial alternative. Changes in cost elements are likely to occur as a result of new information and data collected during the engineering design of the interim remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual cost. Utilization of this cost estimate information beyond the stated purpose is not recommended. Langan is not licensed to provide financial or legal consulting services; as such, this cost estimate information is not intended to be used for complying with financial reporting requirements associated with liability services.
3. The density used for unit conversion was 1.5 tons per cubic yard.
4. Backfill volume assumes a +30% compaction factor.
5. Excavation depths were calculated using Remedial Investigation soil sample results, field observations, and observed fill depths.
6. It is assumed that remedial action will occur over a 1-month period.

Contractor Cost Assumptions:
Item A-3: The unit rate provided reflects construction labor to be OSHA certified.
Items A-4 through A-6: All trucks that have come into contact with site contaminated material will need to be decontaminated prior to leaving site.

Item A-8: Localized dewatering will be performed using excavated sumps for the area of work. A fractionation tank may be needed to remove suspended solids prior to discharging to the NYCDEP sewer system in accordance with an approved permit, or discharge to surface waters under a State Pollutant Discharge Elimination System (SPDES) permit. Dewatering will be localized for the petroleum hotspot, therefore this estimate only assumes one month of operation.

Item A-9: Vapor/odor control cost estimate includes equipment, and materials necessary to monitor vapor/odor emission during intrusive site activities. Cost estimate includes application of vapor/odor suppressing foam to open excavations and soil loaded into trucks.
Item A-10: Backfill placement and compaction assumes soil handling and management costs for the New York City area. Assumes hotspot excavations and development trenches/excavations will have to be structurally backfilled to pre-remediation grade with material that contains no concentrations above Restricted-Residential and Protection of Groundwater Soil Cleanup Objectives (6NYCRR-Part 375-6.8(b)). The quantity of soil has been increased by 30% to account for compaction.
Item A-11: Assumes asphalt pavement will be restored at a minimum for contaminant hotspot areas. The extent of utility excavations is not finalized, therefore this estimate includes 10 percent of the existing pavement area to be restored after utility excavations.
Item A-12: Assumes all proposed interior trenched areas will receive new concrete, plus 30 percent contingency for new concrete work in untrenched areas.

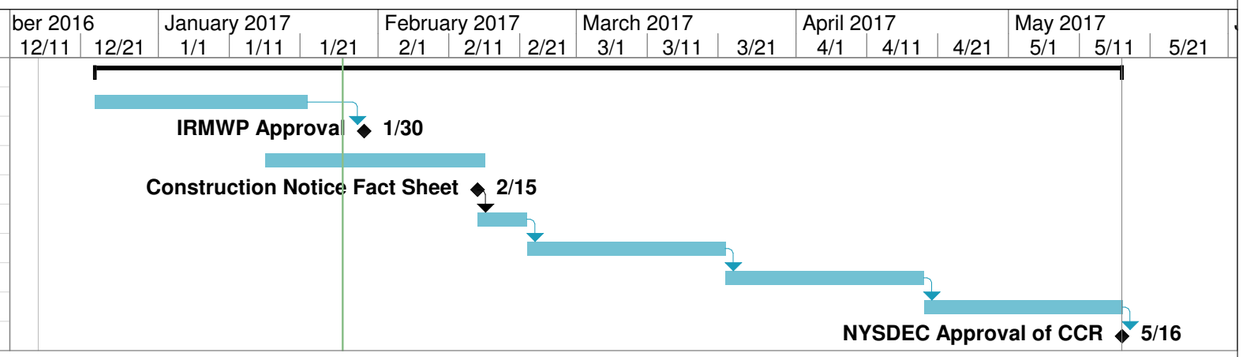
Engineering Cost Assumptions:
Item B-1: Sampling frequency based on 125 cubic yards of development-generated material at a conservative rate of one sample per 800 cubic yards. A representative suite (not disposal facility specific) of analyses was assumed. Sample collection activities assumed to occur over a one-day, single mobilization. Assumes standard turnaround time for sample analysis. Because the extent of utility excavations are not yet known and will be cumulatively less than 800 cubic yards, samples may be collected from stockpiles generated during the work.
Item B-2: Performance soil sampling frequency based on DER-10, which requires one performance soil sample per 900 square feet of excavation base. Documentation and confirmation soil samples will be collected. Documentation soil samples assumed to be analyzed for volatile organic compounds (VOC), semivolatile organic compounds (SVOC), polychlorinated biphenyls (PCB), pesticides, and metals. Confirmation samples in the petroleum-contaminated hotspot area assumed to be analyzed for NYSDEC CP-51 list of VOCs and SVOCs. Confirmation soil samples collected in the hazardous lead hotspot area assumed to be analyzed for total and Toxicity Characteristic Leaching Procedure (TCLP) lead. Cost includes labor and materials to collect samples and subcontracted laboratory analysis by a New York State Department of Health (NYSDOH) environmental laboratory approval program (ELAP)-accredited laboratory. Assumes standard turnaround time for sample analysis.
Item B-3: Engineering oversight includes community air monitoring program (CAMP), onsite engineer throughout interim remediation, remediation health and safety including purchase and maintenance of appropriate PPE, periodic office reporting to NYSDEC, and two site meetings per month.
Item B-4: Community air monitoring program (CAMP) assumed duration of 3 months. CAMP scope includes fulltime equipment operation of perimeter dust and VOC monitors and daily reporting.

APPENDIX A

IRM CONSTRUCTION SCHEDULE

Interim Remedial Measures Schedule
450 Union Street, Brooklyn, NY 11231
NYSDEC BCP Site No. C224219
Langan Project No. 170301202

ID	Task Name	Duration	Start	Finish
1	**450 Union Street - Interim Remedial Measures**	**113 days**	**Fri 12/23/16**	**Tue 5/16/17**
2	IRMWP 30-Day Public Comment Period	30 days	Fri 12/23/16	Sat 1/21/17
3	IRMWP Approval	0 days	Mon 1/30/17	Mon 1/30/17
4	Contractor Biding, Award, and Permitting	5 wks	Mon 1/16/17	Wed 2/15/17
5	Construction Notice Fact Sheet	0 days	Wed 2/15/17	Wed 2/15/17
6	Contractor Mobilization	1 wk	Wed 2/15/17	Tue 2/21/17
7	Interim Remedial Measure Work Plan Implementation	1 mon	Wed 2/22/17	Tue 3/21/17
8	Construction Completion Report (CCR)	1 mon	Wed 3/22/17	Tue 4/18/17
9	NYSDEC Review of CCR	1 mon	Wed 4/19/17	Tue 5/16/17
10	NYSDEC Approval of CCR	0 days	Tue 5/16/17	Tue 5/16/17



Project: 450 Union Street
Date: Fri 1/27/17

Task	Project Summary	Manual Task	Start-only	Deadline			
Split	Inactive Task	Duration-only	Finish-only	Progress			
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress			
Summary	Inactive Summary	Manual Summary	External Milestone				

APPENDIX B

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

FOR

450 UNION STREET
BROOKLYN, NEW YORK
NYSDEC BCP NO.: C224219

Prepared For

450 Union LLC
c/o Pilot Real Estate Group LLC
10 Glenville Street, 1st Floor
Greenwich, Connecticut 06831

Prepared By:

Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C.
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New York, New York 10001

December 2016
Langan Project No. 170301202

LANGAN

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

1.0 INTRODUCTION

1.1 General

This HEALTH AND SAFETY PLAN (HASP) was developed to address disturbance of known and reasonably anticipated subsurface contaminants and comply with Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1910.120(b) (4), *Hazardous Waste Operations and Emergency Response* during anticipated site work at 450 Union Street (Kings County Tax Block 438, Lot 7) ("Site"), Brooklyn, New York. This HASP provides the minimum requirements for implementing site operations during waste classification and interim remedial measure activities. All contractors performing work on this Site shall implement their own Health and Safety Plans that, at a minimum, adhere to this HASP. The contractor is solely responsible for their own health and safety and that of their subcontractors. Langan personnel will implement this HASP while on-site.

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

1.2 Site Location and Background

The Site is located at 450 Union Street in the Gowanus neighborhood of Brooklyn, New York, and is identified as Kings County Tax Block 438, Lot 7. The Site encompasses an area of about 28,500 square feet (0.65 acres), and is bound by Union Street to the north; the Gowanus Canal to the east; Lot 3 to the south (automobile and bus parking); and Bond Street to the west.

The Site is used as a private event space, art gallery, and seasonal outdoor restaurant and is improved with a one-story building (the "Green Building", encompassing an area of about 9,880 square feet) and includes two storage sheds. The exterior portion of the Site contains an enclosed area with a bar for social events and storage areas. A bulkhead consisting of a 12-foot high headwall supported by timber cribbing separates the property from the Gowanus Canal.

The Site and surrounding area are located in an urban setting historically characterized by industrial and commercial development. Historic uses of the property have included the following:

- Coal and wood storage (1886 to 1928)
- Granite works (1915)

- Die casting and electroplating (1922)
- Vehicle repair (1918 to 1930)
- Fuel storage, vehicle repair and office (1931)
- Foundry (1930 to 2007)

The proposed project is in the early stages of master planning and may go through several iterations as the project unfolds. At this time, it is contemplated that the end use of the property will likely be a mix of commercial, retail, residential, light manufacturing and/or community use. Remediation of the Site will occur prior to or concurrently with proposed redevelopment.

The proposed activities will include the following:

- Soil screening;
- Soil stockpiling;
- Characterization of excavated material;
- Soil sampling;
- UST and petroleum impacted soil removal;
- Excavation and disposal of hazardous lead impacted soil; and
- Drum sampling.

1.3 Summary of Work Tasks

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

1.3.1 Soil Screening

As part of excavation activities, the Langan personnel will report when they have observed visual and olfactory indications of possible soil impact. Langan personnel will also report concentrations of volatile organic vapors (VOCs) above background when using a properly calibrated hand held photoionization detector (PID, or equivalent).

1.3.2 Stockpiling

Potentially impacted soil may be stockpiled pending laboratory analysis and determining proper off-site disposal. Langan personnel will coordinate with the contractor in stockpiling soils in accordance with the Soil/Material Management Plan.

1.3.3 Characterization of Excavated Material

When required by the Soil/Materials Management Plan, Langan personnel will characterize excavated (or clean backfill) soil in accordance with Langan standards.

1.3.4 Soil Sampling

Soil samples for excavation endpoint or delineation sampling (along with QA/QC samples) may be collected into laboratory-supplied batch-certified clean glassware and submitted to a New York State Department of Health (NYSDOH) Environmental Laboratory Accreditation.

1.3.5 Underground Storage Tank Excavation and Removal

A properly licensed contractor will excavate and removed underground storage tank(s) found on the site in accordance with the specifications outline in the work plan. The contractor will contact the appropriate utility mark-out system prior to performing excavation activities and work will not commence until the date of the utility mark-out number becomes effective (usually three days). Excavation may include the use of a pneumatic hammer to break concrete or asphalt, as well as an excavator and other equipment required to complete the task as specified in the contractor bid. Consideration should be given to equipping the excavator with a non-sparking loader. Langan personnel will observe the UST excavation and removal.

As part of UST excavation activities, Langan personnel will report when they have observed visual and olfactory indications of possible petroleum impact in soil. Langan personnel will also report concentrations of VOCs in soil above background when using a properly calibrated hand held PID (or equivalent). Visually petroleum impacted soil or soil from the UST excavation having PID concentrations above background will be stockpiled separately pending laboratory analysis.

1.3.6 Lead Impacted Soil Excavation and Disposal

Langan personnel will observe activities associated with the excavation and disposal of lead impacted soil. Langan personnel will coordinate with the excavator contractor so that the boundaries of the lead excavation correspond to with the approved disposal facilities instructions. Langan personnel are not to sign the hazardous waste manifests.

1.3.7 Drum Sampling

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

2.0 IDENTIFICATION OF KEY PERSONNEL/HEALTH AND SAFETY PERSONNEL

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

2.1 Langan Project Manager

The Langan Project Manager (PM) is Nicole Rice for environmental and excavation activities. Their responsibilities include:

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

2.2 Langan Corporate Health and Safety Manager

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

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

2.3 Langan Site Health & Safety Officer

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

- Participating in the development and implementation of this HASP.
- When on-site, assisting the Langan Field Team Leader in conducting Tailgate Safety Meetings and Jobsite Safety Inspections and correcting any shortcomings in a timely manner.
- Ensuring that proper PPE is available, worn by employees and properly stored and maintained.
- Controlling entry into and exit from the site contaminated areas or zones.

- Monitoring employees for signs of stress, such as heat stress, fatigue, and cold exposure.
- Monitoring site hazards and conditions.
- Knowing (and ensuring that all site personnel also know) emergency procedures, evacuation routes, and the telephone numbers of the ambulance, local hospital, poison control center, fire department, and police department.
- Resolving conflicts that may arise concerning safety requirements and working conditions.
- Reporting all incidents, injuries and near misses to the Langan Incident/Injury Hotline immediately and the client representative.

2.4 Langan Field Team Leader Responsibilities

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

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

2.5 Contractor Responsibilities

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

- Ensure their employees are trained in the use of all appropriate PPE for the tasks involved;
- Notify Langan of any hazardous material brought onto the job site or site related area, the hazards associated with the material, and must provide a material safety data sheet (MSDS) or safety data sheet (SDS) for the material;

- Have knowledge of, understand, and abide by all current federal, state, and local health and safety regulations pertinent to the work;
- Ensure their employees handling hazardous materials, if identified at the Site, have received current training in the appropriate levels of 29 CFR 1910.120, *Hazardous Waste Operations and Emergency Response* (HAZWOPER) if hazardous waste is identified at the Site;
- Ensure their employees handling hazardous materials, if identified at the Site, have been fit-tested within the year on the type respirator they will wear; 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 Soil Investigation and Sampling

Sampling the soil requires the donning of chemical resistant gloves in addition to the standard PPE. Only drilling personnel who have been properly training by the drilling contractor are permitted to operate drilling equipment or open sampling devices (split spoon). As one of the boreholes will be advanced from a barge mounted rig, all personnel working on the barge or within 5-feet of the canal must don a suitably sized personal floatation device (PFD).

At the conclusion of the boring, the retrieved casing will be decontaminated using the procedure outline in Appendix B. Drilling fluid, rinse water, grossly-contaminated soils samples and cuttings will be containerized and disposed off-site.

3.1.2 Soil Screening

When conducting soil screening Langan personnel will don chemical resistant gloves in addition to the standard personal protection equipment (PPE).

3.1.3 Stockpiling

The Langan personnel are not to scale or otherwise climb the stockpile. If the soil sampling plan requires sampling from the stockpile above ground level, they are to use suitable excavation equipment operated by the contractor (i.e. front end loader).

3.1.4 Soil Sampling

When collecting soil samples, the Langan personnel will don chemical resistant gloves in addition to the standard PPE.

3.1.5 Underground Storage Tank Excavation and Removal

Langan personnel will observe the UST excavation and removal. However they are prohibited from descending into the UST excavation and from inspecting the interior of the UST if the inspection requires that they insert any part of their body pass the plane defining the limited entrance to the UST.

The contractor will inert or otherwise vent the UST prior to disassembly or transport for disposal. Excavation and inerting of the UST must be monitored using a fully calibrated MultiRAE PID (or equivalent) capable surveying for VOCs and the lower explosion limit (LEL). The excavation is to be monitored by attaching an extension to the PID input such that the open end of the extension can directly monitor the base of the UST excavation. If the PID survey detects VOCs above 5 ppm, work must cease and appropriate VOC suppression should be applied to the excavation. Work can continue when VOC reading in the UST excavation are below 5 ppm and can be maintained below 5 ppm for 15 minutes. If LEL readings exceed 10%, work must cease and all workers must withdraw from the vicinity of the UST excavation. Langan personnel must immediately report the high LEL condition to the PM. Work cannot continue until appropriate actions are taken to maintain the LEL below 10%. The PM is to be contacted if PID or LEL readings interrupt the work schedule.

3.1.6 Drum Sampling

Drilling fluid, rinse water, grossly-contaminated soils samples and cuttings will be containerized in 55-gallon drums for disposed off-site. Each drum must be labeled in accordance with the Langan Drum Labeling Standard Operating Procedure (SOP-#9). Langan personnel may collect drum samples, as required, prior to off-site drum disposal. Samples will be placed into laboratory-supplied batch-certified clean glassware and submitted to a NYSDOH ELAP-certified laboratory.

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

3.2 Radiation Hazards

No radiation hazards are known or expected at the site.

3.3 Physical Hazards

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

3.3.1 Explosion

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

3.3.2 Heat Stress

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

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

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

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

To monitor the worker, measure:

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

  If oral temperature exceeds 99.6^{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°F. If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, shorten the following cycle by one-third. Do not permit a worker to wear a semi-permeable or impermeable garment when oral temperature exceeds 100.6°F (38.1°C).

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

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

3.3.3 Cold-Related Illness

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

- **Hypothermia -** Hypothermia is defined as a decrease in the patient core temperature below 96°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 personnel are required to use disposable nitrile gloves at all

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

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

3.6 Job Safety Analysis

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

4.0 PERSONNEL TRAINING

4.1 Basic Training

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

4.2 Initial Site-Specific Training

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

4.3 Tailgate Safety Briefings

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

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

5.0 MEDICAL SURVEILLANCE

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

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

6.0 COMMUNITY AIR MONITORING PROGRAM

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

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

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

- If total VOC levels exceed 5 ppm above background for the 15-minute average at the perimeter, work activities will be temporarily halted and monitoring continued. If levels readily decrease (per instantaneous readings) below 5 ppm above background, work

activities will resume with continued monitoring.

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

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

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

6.1 Vapor Emission Response Plan

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

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

- The organic vapor level 200 feet downwind of the hot zone or half the distance to the nearest residential or commercial structure, whichever is less, is below 1 ppm over

background, and

- More frequent intervals of monitoring, as directed by the HSO or FTL, are conducted.

6.2 Major Vapor Emission

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

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

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

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

6.3 Major Vapor Emission Response Plan

Upon activation, the following activities will be undertaken:

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

6.4 Dust Suppression Techniques

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

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

control of the odor and VOCs.

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

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

7.0 PERSONAL PROTECTIVE EQUIPMENT

7.1 Levels of Protection

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

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

Level D Protection (as needed)

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

Level C Protection (as needed)

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

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

7.2 Respirator Fit-Test

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

8.0 SITE CONTROL

8.1 Site Communications Plan

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

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

8.2 Work Zones

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

8.2.1 Exclusion Zone

Exclusion 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:

Brooklyn Hospital Center
121 Dekalb Avenue
Brooklyn, NY
718-250-8000

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 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 – 1.3.81.3.1 – 1.3.8	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 – 1.3.8	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 – 1.3.8	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 – 1.3.8	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 – 1.3.8	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 – 1.3.8	Noise	Excavation equipment, hand tools, drilling equipment.	Wear hearing protection; maintain safe distance from construction activities	Seek medical attention as required
1.3.1 – 1.3.8	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 – 1.3.8	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

Task	Hazard	Description	Control Measures	First Aid
1.3.1 – 1.3.8	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 – 1.3.8	1,2,4,5-Tetramethylbenzene	95-93-2	NA	None None	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	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 – 1.3.8	1,3,5-Trimethylbenzene Mesitylene sym-Trimethylbenzene	108-67-8	PID	None None	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	1,3-Butadiene Biethylene Bivinyl Butadiene Divinyl Erythrene Vinylethylene	106-99-0	PID	1 ppm 2000 ppm	Vapor	inhalation, skin and/or eye contact (liquid)	irritation to the eyes, nose, throat; drowsiness, dizziness; liquid: frostbite; teratogenic, reproductive effects; [potential occupational carcinogen]	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support
1.3.1 – 1.3.8	p-Diethylbenzene 1,4-Diethyl benzene	105-05-5	PID	None None	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, respiratory system; skin burns; in animals: central nervous system depression	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	n-Hexane Hexane, Hexyl hydride, normal-Hexane	110-54-3	PID	500 ppm 1100 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose; nausea, headache; peripheral neuropathy: numb extremities, muscle weak; dermatitis; dizziness; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	2-Butanone, Ethyl methyl ketone MEK Methyl acetone Methyl ethyl ketone	78-93-3	PID	200 ppm 3000 ppm	Soil Groundwater Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose; headache; dizziness; vomiting; dermatitis	Eye: Irrigate immediately Skin: Water wash immediately Breathing: Fresh air Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	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
1.3.1 – 1.3.8	2-Hexanone Butyl methyl ketone MBK Methyl butyl ketone Methyl n-butyl ketone	591-78-6	PID	100 ppm 1600 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose; peripheral neuropathy: lassitude (weakness, exhaustion), paresthesia; dermatitis; headache, drowsiness	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	2,4-Dimethylphenol 2,4-Xylenol m-Xylenol 1-Hydroxy-2,4-dimethylbenzene 2,4-Dimethylphenol 4-Hydroxy-1,3-dimethylbenzene 4,6-Dimethylphenol 1,3-Dimethyl-4-hydroxybenze	105-67-9	None	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; headache, narcosis, coma; dermatitis; in animals: liver, kidney damage	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	4-Isopropyltoulene 1-Methyl-4-(1-methylethyl)benzene 4-Isopropyltoluene; 4-Methylcumene; Paracymene p-Cymene p-Isopropyltoluene	99-87-6	PID	NA NA	Soil Groundwater Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; dermatitis; headache, narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	2-Methylnaphthalene β-methylnaphthalene	91-57-6	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion or skin absorption, eye contact	irritation to the skin, eyes, mucous membranes and upper respiratory tract. It may also cause headaches, nausea, vomiting, diarrhea, anemia, jaundice, euphoria, dermatitis, visual disturbances, convulsions and comatose	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	Acenaphthene 1,2-Dihydroacenaphthylene 1,8-Ethylenenaphthalene peri-Ethylenenaphthalene Naphthyleneethylene Tricyclododecapentaene	83-32-9	PID	NA NA	Soil	inhalation, ingestion, skin and/or eye contact,	irritation to the skin, eyes, mucous membranes and upper respiratory tract; If ingested, it can cause vomiting	Eye: Irrigate immediately Skin: Soap wash immediately, if redness or irritation develop, seek medical attention immediately Breathing: Move to fresh air Swallow: do not induce vomiting, seek medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	Acenaphthylene Cycopental(de)naphthalene, Acenaphthalene	208-96-8	PID	NA NA	Soil	inhalation, ingestion, skin and/or eye contact	irritation to the skin, eyes, mucous membranes and upper respiratory tract	Eye: Irrigate immediately, seek medical attention immediately, Skin: Soap wash immediately, if redness or irritation develop, seek medical attention immediately Breathing: Move to fresh air Swallow: do not induce vomiting, seek medical attention immediately
1.3.1 – 1.3.8	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 – 1.3.8	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 – 1.3.8	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 – 1.3.8	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 – 1.3.8	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 – 1.3.8	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 – 1.3.8	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 – 1.3.8	Benzo (k) fluoranthene	207-08-9	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	Carbazole 9-azafluorene Dibenzopyrrole Diphenylenimine diphenyleneimide	86-74-8	None	NA NA	Soil	inhalation, skin absorption (liquid), skin and/or eye contact	irritation to eyes and skin, respiratory irritation	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.8	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
1.3.1 – 1.3.8	Carbon tetrachloride Carbon chloride Carbon tet Freon® 10 Halon® 104 Tetrachloromethane	56-23-5	PID	10 ppm 200 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; central nervous system depression; nausea, vomiting; liver, kidney injury; drowsiness, dizziness, incoordination; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	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/m³ 100 mg/m³	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 – 1.3.8	Cis-Chlordane a-Chlordane cis-Chlordan CIS-CHLORDANE Chlordane cis-Chlordane cis;ALPHA-CHLORDAN Chlordan, cis-;ALPHA-CHLORDANE;alpha(cis)-chlordane α-chlordane solution	5102-71-9	None	0.5 mg/m³ 100 mg/m³	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 – 1.3.8	Trans-Chlordane	5103-74-2	None	0.5 mg/m³ 100 mg/m³	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	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 – 1.3.8	Chrysene Benzo[a]phenanthrene 1,2-Benzphenanthrene	218-01-9	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, absorption, ingestion, consumption	irritation to eye, skin, and respiratory, gastrointestinal irritation nausea, vomit, diarrhea [potential occupational carcinogen]	Eyes: Irrigate immediately Skin: Soap wash promptly. Breath: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	Diethyl phthalate DEP Diethyl ester of phthalic acid Ethyl phthalate	84-66-2	PID	NA NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation eyes, skin, nose, throat; headache, dizziness, nausea; lacrimation (discharge of tears); possible polyneuropathy, vestibular dysfunc; pain, numb, lassitude (weakness, exhaustion), spasms in arms & legs; In Animals: reproductive effects	Eye: Irrigate immediately Skin: Wash regularly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	Dieldrin HEOD 1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo exo-5,8-dimethanonaphthalene	60-57-1	PID	0.25 mg/m^3 50 mg/m^3	Groundwater Soil Water	inhalation, skin absorption, ingestion, skin and/or eye contact	headache, dizziness; nausea, vomiting, malaise (vague feeling of discomfort), sweating; myoclonic limb jerks; clonic, tonic convulsions; coma; [potential occupational carcinogen]; in animals: liver, kidney damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	m-Cresol 3-methylphenol meta-Cresol 3-Cresol m-Cresylic acid 1-Hydroxy-3-methylbenzene 3-Hydroxytoluene 3-Methylphenol	108-39-4	PID	5 ppm 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; central nervous system effects: confusion, depression, resp failure; dyspnea (breathing difficulty), irreg rapid resp, weak pulse; eye, skin burns; dermatitis; lung, liver, kidney, pancreas damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	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 – 1.3.8	p-Cresol para-Cresol 4-Cresol p-Cresylic acid 1-Hydroxy-4-methylbenzene 4-Hydroxytoluene 4-Methylphenol	106-44-5	PID	5 ppm 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; central nervous system effects: confusion, depression, resp failure; dyspnea (breathing difficulty), irreg rapid resp, weak pulse; eye, skin burns; dermatitis; lung, liver, kidney, pancreas damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	Cumene Cumol Isopropylbenzene 2-Phenyl propane	98-82-8	PID	50 ppm 900 ppm	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; dermatitis; headache, narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	Cyclohexane Benzene hexahydride Hexahydrobenzene Hexamethylene Hexanaphthene	110-82-7	PID	300 ppm 1300 ppm	Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, respiratory system; drowsiness; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	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 – 1.3.8	Dibenzofuran	132-64-9	None	NA NA	Soil	inhalation, absorption	irritation to eyes, and skin	Eyes: Irrigate immediately Skin: Soap wash promptly.
1.3.1 – 1.3.8	Bis(2-ethylhexyl) phthalate Di-sec octyl phthalate DEHP Di(2-ethylhexyl)phthalate Octyl phthalate	117-81-7	None	5 mg/m^3 5000 mg/m^3	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, mucous membrane; in animals: liver damage; teratogenic effects; [potential occupational carcinogen	Eye: Irrigate immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	4,4′-DDD Dichlorodiphenyldichloroethane 1,1'-(2,2-Dichloroethylidene)bis (4-chlorobenzene)	72-54-8	None	NA NA	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; vomiting; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	Ethanol Absolute alcohol Alcohol cologne spirit drinking alcohol ethane monoxide ethylic alcohol EtOH ethyl alcohol ethyl hydrate ethyl hydroxide ethylol grain alcohol hydroxyethane methylcarbinol	64 -17-5	PID	1000 ppm 3300 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose; headache, drowsiness, lassitude (weakness, exhaustion), narcosis; cough; liver damage; anemia; reproductive, teratogenic effects	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.8	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	Endosulfan sulfate 1,4,5,6,7,7-Hexachloro-5-norbornene-2,3-dimethanol, cyclic sulfate 6,7,8,9,10,10-hexachloro01,5,5a,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3,3-dioxide	1031-07-8	None	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	Hypersensitive to stimulation, sensation of prickling, tingling or creeping on skin. Headache, dizziness, nausea, vomiting, incoordination, tremor, mental confusion, hyperexcitable state. In severe cases: convulsions, seizures, coma and respiratory depression.	Eye: Irrigate immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	DDT 4,4-DDT p,p'-DDT Dichlorodiphenyltrichloroethane 1,1,1-Trichloro-2,2-bis(p-chlorophenyl)ethane	50-29-3	None	1 mg/m^3 500 mg/m^3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; vomiting; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	DDE 4,4-DDE 1,1-bis-(4-chlorophenyl)-2,2-dichloroethene Dichlorodiphenyldichloroethylene	72-55-9	None	NA NA	Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	Oral ingestion of food is the primary source of exposure for the general population. Acute and chronic ingestion may cause nausea, vomiting, diarrhea, stomach pain, headache, dizziness, disorientation, tingling sensation, kidney damage, liver damage, convulsions, coma, and death. 4,4' DDE may cross the placenta and can be excreted in breast milk	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	Endosulfan Benzoepin; Endosulphan; 6,7,8,9,10-Hexachloro-1,5,5a,6,9,9a-hexachloro-6,9-methano-2,4,3-benzo-dioxathiepin-3-oxide Thiodan	115-29-7	None	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation skin; nausea, confusion, agitation, flushing, dry mouth, tremor, convulsions, headache; in animals: kidney, liver injury; decreased testis weight	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	Endrin, 1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo,endo-5,8-dimethanonaphthalene; Hexadrin	72-20-8	None	0.1 mg/m³ 2 mg/m³	Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	epileptiform convulsions; stupor, headache, dizziness; abdominal discomfort, nausea, vomiting; insomnia; aggressiveness, confusion; drowsiness, lassitude (weakness, exhaustion); anorexia; in animals: liver damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	Endrin aldehyde	7421-93-4	None	0.1 mg/m3 2 mg/m3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	epileptiform convulsions; stupor, headache, dizziness; abdominal discomfort, nausea, vomiting; insomnia; aggressiveness, confusion; drowsiness, lassitude (weakness, exhaustion); anorexia; in animals: liver damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	Endrin ketone	53494-70-5	None	0.1 mg/m3 2 mg/m3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	epileptiform convulsions; stupor, headache, dizziness; abdominal discomfort, nausea, vomiting; insomnia; aggressiveness, confusion; drowsiness, lassitude (weakness, exhaustion); anorexia; in animals: liver damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	Ethylbenzene Ethylbenzol Phenylethane	100-40-4	PID	435 mg/m³ 3,472 mg/m³	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	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 – 1.3.8	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 – 1.3.8	Fluorene	86-73-7	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	Heptachlor	76-44-8	None	0.5 mg/m³ 35 mg/m³	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	In animals: tremor, convulsions; liver damage; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	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 – 1.3.8	Indeno[1,2,3-cd]pyrene	193-39-5	None	0.2 mg/m³ 80 mg/m³ (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 – 1.3.8	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 – 1.3.8	Methyl cyclohexane Hexahydrotoluene Cyclohexylmethane Toluene hexahydride	108-87-2	PID	500 ppm 1200 ppm	Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, drowsiness; in animals: narcosis	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	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 – 1.3.8	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 – 1.3.8	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 – 1.3.8	2-Methylnaphthalene	91-57-6	NA	NA NA	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, nose; skin	Eye: Irrigate immediately , Medical attention Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention
1.3.1 – 1.3.8	2-Chloronaphthalene	91.58-7	NA	NA MA	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, nose; skin	Eye: Irrigate immediately , Medical attention Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention
1.3.1 – 1.3.8	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	n-Butylbenzene	104-51-8	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin; dry nose, throat; headache; low blood pressure, tachycardia, abnormal cardiovascular system stress; central nervous system, hematopoietic depression; metallic taste; liver, kidney injury	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	n-Propylbenzene Isocumene Propylbenzene 1-Phenylpropane 1-Propylbenzene Phenylpropane	103-65-1	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin; dry nose, throat; headache; low blood pressure, tachycardia, abnormal cardiovascular system stress; central nervous system, hematopoietic depression; metallic taste; liver, kidney injury	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	Phenanthrene	85-01-8	PID	0.2 mg/m³ 80 mg/m³ (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 – 1.3.8	Pyrene benzo[def]phenanthrene	129-00-0	PID	0.2 mg/m³ 80 mg/m³ (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 – 1.3.8	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 – 1.3.8	1,1′-Biphenyl, Biphenyl, Phenyl benzene Diphenyl	92-52-4	None	1 mg/m³ 100 mg/m³	Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, throat; headache, nausea, lassitude (weakness, exhaustion), numb limbs; liver damage	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	Sec-Butylbenzene	135-98-8	PID	10 ppm 100 ppm	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; inhalation: nausea or vomiting	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	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
1.3.1 – 1.3.8	Tert-Butyl Alcohol Tertiary Butyl Alcohol 2-Methyl-2-propanol Trimethyl carbinol	75-65-0	PID	100 ppm 1600 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; drowsiness, narcosis	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	Tetrachloroethane 1,1,2,2-Tetrachloroethane Acetylene tetrachloride Symmetrical tetrachloroethane	79-34-5	PID	5 ppm 100 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	nausea, vomiting, abdominal pain; tremor fingers; jaundice, hepatitis, liver tenderness; dermatitis; leukocytosis (increased blood leukocytes); kidney damage; [potential occupational carcinogen]	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 – 1.3.8	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 – 1.3.8	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 – 1.3.8	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 – 1.3.8	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 – 1.3.8	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 – 1.3.8	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 – 1.3.8	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	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
1.3.1 – 1.3.8	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 – 1.3.8	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	Fuel Oil No. 2	68476-30-2	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	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 – 1.3.8	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	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 – 1.3.8	Arsenic	NA	None	0.5 mg/m^3 NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation skin, possible dermatitis; resp distress; diarrhea; muscle tremor, convulsions; possible gastrointestinal tract	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	Barium	10022-31-8	None	0.5 mg/m^3 50 mg/m^3	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, upper respiratory system; skin burns; gastroenteritis; muscle spasm; slow pulse	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	Beryllium	7440-41-7	None	0.002 mg/m^3 4 mg/m^3	Soil	inhalation, skin and/or eye contact	berylliosis (chronic exposure): anorexia, weight loss, lassitude (weakness, exhaustion), chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation to the eyes; dermatitis; [potential occupational carcinogen]	Eye: Irrigate immediately Breathing: Fresh air
1.3.1 – 1.3.8	Cadmium	7440-43-9	None	0.005 mg/m^3 9 mg/m^3	Soil	inhalation, ingestion	pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	Calcium	7440-70-2	None	NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, upper resp tract; ulcer, perforation nasal septum; pneumonitis; dermatitis	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	Chromium Hexavalent- Trivalent-	7440-47-3	None	1.0 mg/m^3 250 mg/m^3	Groundwater Soil	inhalation absorption ingestion	irritation to eye, skin, and respiratory	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	Cobalt	7440-48-4	None	0.1mg/m^3 20 mg/m^3	Soil	inhalation, ingestion, skin and/or eye contact	Cough, dyspnea (breathing difficulty), wheezing, decreased pulmonary function; weight loss; dermatitis; diffuse nodular fibrosis; resp hypersensitivity, asthma	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	Copper	7440-50-8	None	1.0 mg/m^3 100 mg/m^3	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose, metallic taste; dermatitis; anemia	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	Cyanide	57-12-5	None	5 mg/m^3 25 mg/m^3	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	Exposure to cyanide can cause weakness, headaches, confusion, dizziness, fatigue, anxiety, sleepiness, nausea and vomiting. Breathing can speed up then become slow and gasping. Coma and convulsions also occur. If large amounts of cyanide have been absorbed by the body, the person usually collapses and death can occur very quickly. Long-term exposure to lower levels of cyanide can cause skin and nose irritation, itching, rashes and thyroid changes.	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	Iron	7439-89-6	None	10 mg/m^3 NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; abdominal pain, diarrhea, vomiting	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	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 – 1.3.8	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 – 1.3.8	Magnesium	7439-95-4	None	15 mg/m^3 NA	Soil	inhalation, skin and/or eye contact	irritation to the eyes, skin, respiratory system; cough	Eye: Irrigate immediately Breathing: Fresh air
1.3.1 – 1.3.8	Mercury	7439-97-6	None	0.1 mg/m^3 10 mg/m^3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	Nickel	7440-02-0	None	NA 10 mg/m³	Groundwater Soil	ion, ingestion, skin and/or eye contact	sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]	Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	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 – 1.3.8	Selenium	7782-49-2	None	1 mg/m³ 0.2 mg/m³	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 – 1.3.8	Silver	7440-22-4	None	0.01mg/m³ 10 mg/m³	Soil	inhalation, ingestion, skin and/or eye contact	blue-gray eyes, nasal septum, throat, skin; irritation, ulceration skin; gastrointestinal disturbance	Eye: Irrigate immediately Skin: Water flush Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	Thallium	7440-28-0	None	0.1 mg/m³ 15 mg/m³	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peri neuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	Vanadium	7440-62-2	None	0.1 mg/m3 15 mg/m3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peri neuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.8	Zinc	7440-62-2	None	15 mg/m³ 500 mg/m³	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.8	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 – 1.3.8	Helium	7440-59-7	Helium Detector	NA NA	NA	inhalation	dizziness, headache, and nausea	Breathing: Respiratory support
1.3.1 – 1.3.8	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 – 1.3.8	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	Brooklyn Hospital Center	911 or 718-250-8000
Langan Incident / Injury Hotline		800-952-6426 ex 4699
Langan Project Manager	Nicole Rice Kenneth Huber	724-601-2196 (cell) 631-525-6007 (cell)
Langan Health and Safety Manager (HSM)	Tony Moffa	215-756-2523 (cell)
Langan Health & Safety Officer (HSO)	William Bohrer	410-984-3068 (cell)
Langan Field Team Leader (FTL)	To Be Determined	
Client's Representative	Chris Horrigan	917-922-2415
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

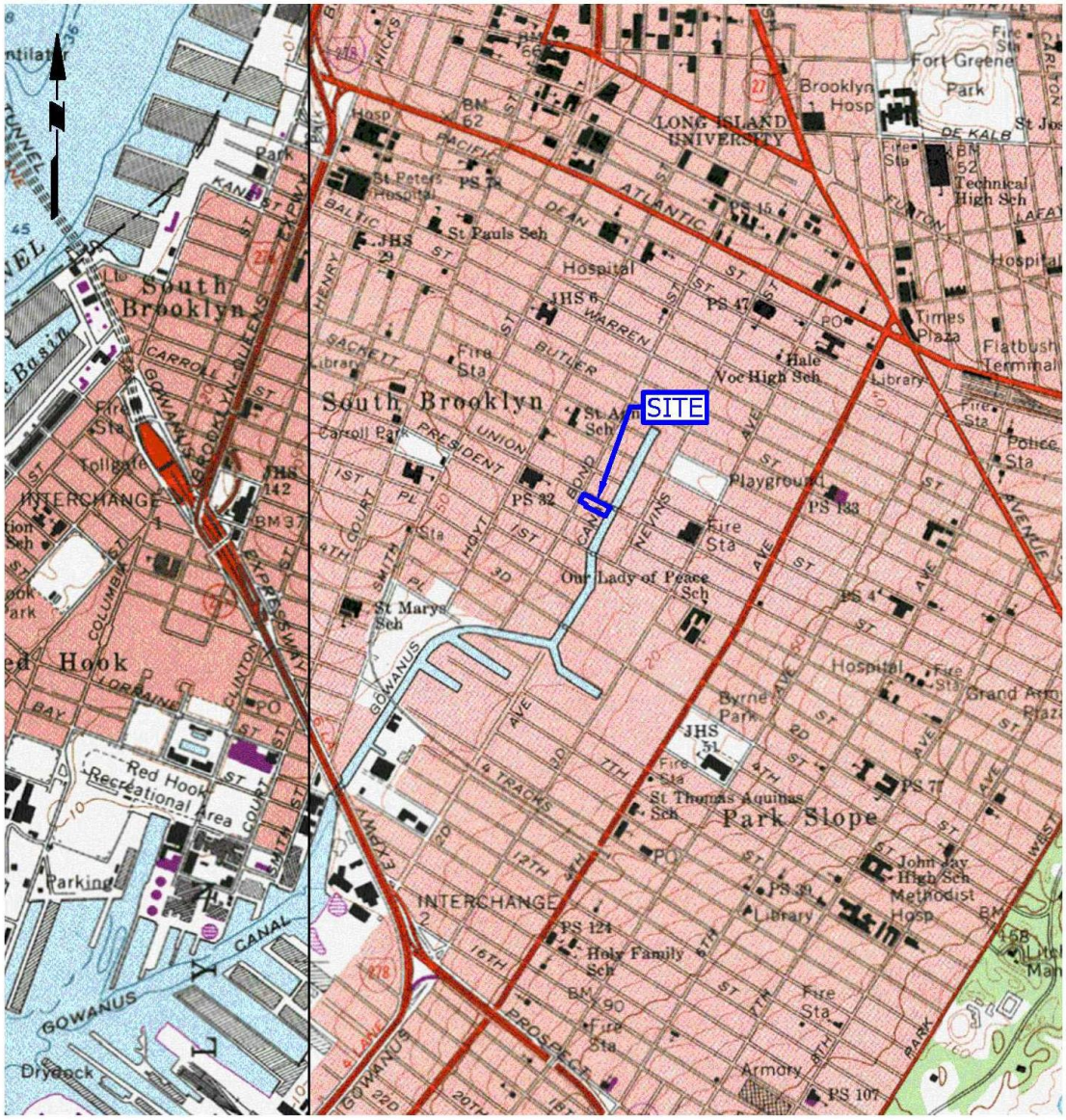
Note: Exposure to full sunshine can increase Heat Index values by up to 15 degrees F.

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



LEGEND:

BCP SITE BOUNDARY

GENERAL NOTES:

1. BASE MAP TAKEN FROM UNITED STATES GEOLOGICAL SURVEY (USGS) TOPOGRAPHIC MAPS FOR BROOKLYN AND JERSEY CITY QUADRANGLES.

LANGAN 21 Penn Plaza, 360 West 31st Street, 8th Floor New York, NY 10001 T: 212.479.5400 F: 212.479.5444 www.langan.com 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** **450 UNION STREET** BLOCK No. 438, LOT No. 7 BROOKLYN NEW YORK	**Figure Title** **SITE LOCATION MAP**	**Project No.** 170301202 **Date** 3/2/2016 **Scale** 1"=1500' **Drawn By** PMM **Checked By** NCR **Submission Date** –	**Figure No.** **1** Sheet 1 of 2

Filename: \\langan.com\data\NY\data2\170301202\Cadd Data - 170301202\2D-DesignFiles\Environmental\BCP RIR\Figure 1 - Site Location Map_BCP RIR.dwg Date: 3/15/2016 Time: 10:45 User: nrice Style Table: Langan.stb Layout: SLM

FIGURE 2

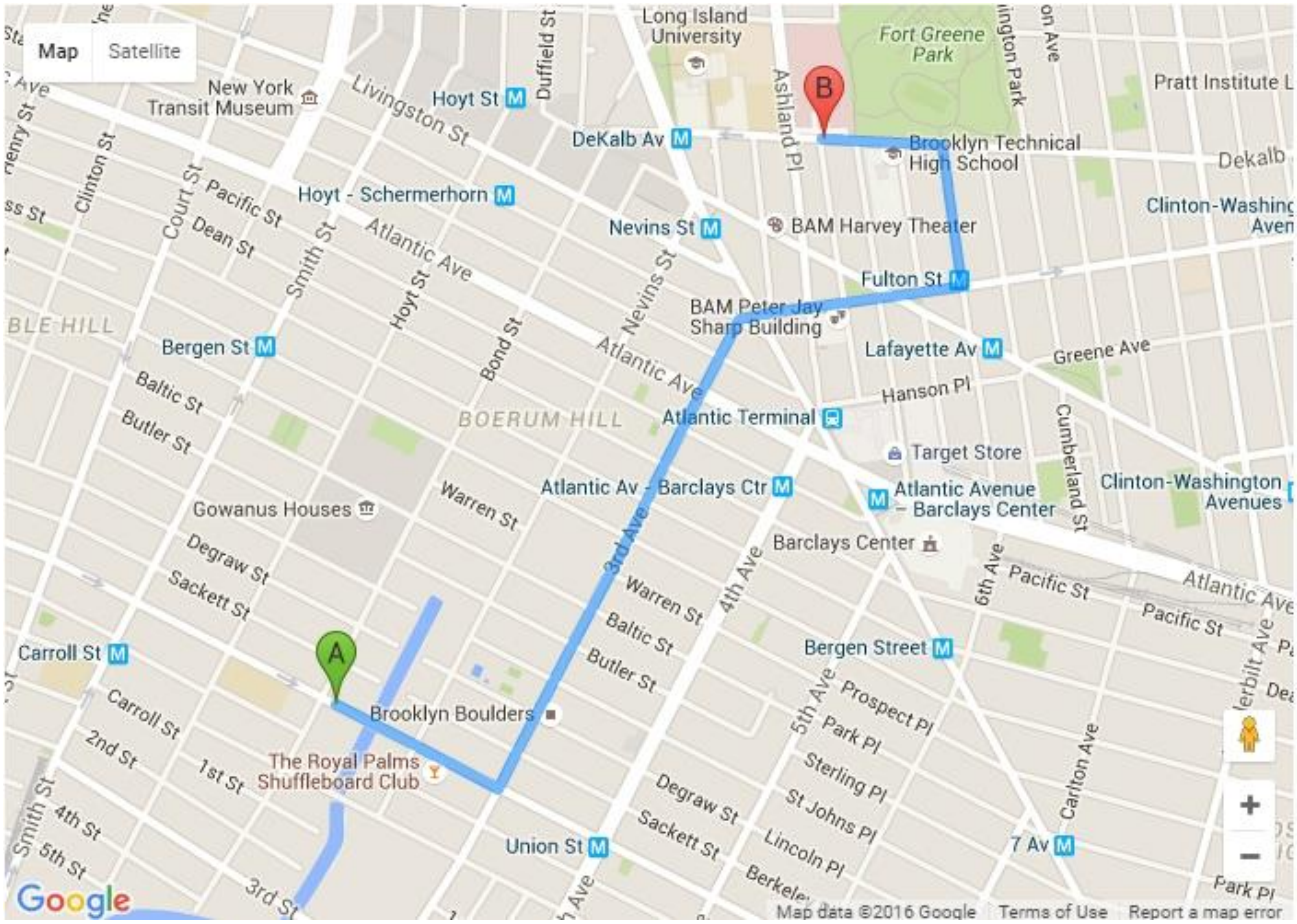
HOSPITAL ROUTE PLAN

Hospital Location: **Brooklyn Hospital Center**
121 Dekalb Avenue
New York, NY
718-250-8000

START: 450 Union Street, Brooklyn, NY

1. Head southeast on Union Street toward Nevins Street
2. Turn left at the 2nd cross street onto 3rd Avenue
3. Slight right onto Lafayette Avenue
4. Turn left onto South Portland Avenue
5. Turn left onto Dekalb Avenue, destination will be on the right.

END: Brooklyn Hospital Center, 121 Dekalb Avenue, 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 carrying passengers.
- Loose-fitting clothing or loose long hair is prohibited around moving machinery.
- Ensure that heavy equipment operators and all other personnel in the work zone are using the same hand signals to communicate.
- Drilling/excavating within 10 feet in any direction of overhead power lines is prohibited.
- The locations of all underground utilities must be identified and marked out prior to initiating any subsurface activities.
- Check to insure that the equipment operator has lowered all blades and buckets to the ground before shutting off the vehicle.
- If the equipment has an emergency stop device, have the operator show all personnel its location and how to activate it.
- Help the operator ensure adequate clearances when the equipment must negotiate in tight quarters; serve as a signalman to direct backing as necessary.
- Ensure that all heavy equipment that is used in the Exclusion Zone is kept in that zone until the job is done, and that such equipment is completely decontaminated before moving it into the clean area of the work zone.
- Samplers must not reach into or get near rotating equipment such as the drill rig. If personnel must work near any tools that could rotate, the equipment operator must completely shut down the rig prior to initiating such work. It may be necessary to use a remote sampling device.

ATTACHMENT B

DECONTAMINATION PROCEDURES

PERSONNEL DECONTAMINATION

LEVEL C DECONTAMINATION

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

LEVEL D DECONTAMINATION

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

EQUIPMENT DECONTAMINATION

GENERAL:

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

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

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

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

MONITORING EQUIPMENT:

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

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

RESPIRATORS:

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

ATTACHMENT C

EMPLOYEE EXPOSURE/
INJURY INCIDENT REPORT

EMPLOYEE INCIDENT/INJURY REPORT
LANGAN ENGINEERING & ENVIRONMENTAL SERVICES

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

Affected Employee Name: _____ Date: _____

Incident type: ☐ Injury ☐ Report Only/No Injury

☐ Near Miss ☐ Other: _____

EMPLOYEE INFORMATION (Person completing Form)

Employee Name: _____ Employee No: _____

Title: _____ Office Location: _____

Length of time employed or date of hire: _____

Mailing address: _____

_____

Sex: M ☐ F ☐ Birth date: _____

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

ACCIDENT INFORMATION

Project: _____ Project #: _____

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

Site location: _____

Incident Type: Possible Exposure ☐ Exposure ☐ Physical Injury ☐

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

_____

Exact location incident occurred: _____

_____

Describe work being done: _____

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

Describe in detail how the incident occurred: _____

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

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

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

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

Weather conditions during incident: _____

MEDICAL CARE INFORMATION

Did affected employee receive medical care? Yes ☐ No ☐

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

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

Length of stay at the facility? _____

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

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

Has the employee returned to work? Yes ☐ No ☐

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

If Yes, please describe: _____

_____

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

If Yes, please describe: _____

HEALTH & SAFETY INFORMATION

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

Describe protective equipment and clothing used by the employee:

_____

_____

_____

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

_____

_____

_____

_____ _____

Employee Signature Date

_____ _____

Langan Representative Date

ATTACHMENT D

CALIBRATION LOG

DATE:________________ **PROJECT:____________________**

CALIBRATION LOG

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

ATTACHMENT E

MATERIAL SAFETY DATA SHEETS
SAFETY DATA SHEETS

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

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

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

ATTACHMENT F

JOBSITE SAFETY INSPECTION CHECKLIST

Jobsite Safety Inspection Checklist

Date: _____ **Inspected By:** _____

Location: _____ **Project #:** _____

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

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

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

Unsafe Acts:

Notes:

ATTACHMENT G

JOB SAFETY ANALYSIS FORM

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

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

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

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

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

ATTACHMENT H

TAILGATE SAFETY BRIEFING FORM

LANGAN TAILGATE SAFETY BRIEFING

Date:_____ Time: _____

Leader:_____ Location:_____

Work Task: _____

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

Chemical Exposure Hazards and Control:_____
_____

Physical Hazards and Control: _____

Air Monitoring: _____

PPE: _____
_____

Communications:_____

Safe Work Practices: _____
_____

Emergency Response: _____

Hospital/Medical Center Location: _____

Phone Nos.: _____

Other: _____

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

_____
_____
_____

ATTENDEES

PRINT NAME	COMPANY	SIGNATURE

APPENDIX C

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

for

450 UNION STREET
Brooklyn, New York

NYSDEC BCP Site No. C224219

Prepared for:

450 Union LLC
c/o Pilot Realestate Group LLC
10 Glenville Street, 1st Floor
Greenwich, Connecticut 06831

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

January 2017
Langan Project No: 170301202

LANGAN

TABLE OF CONTENTS

FIGURES

ATTACHMENTS

1.0 PROJECT DESCRIPTION

This Quality Assurance Project Plan (QAPP) was prepared on behalf of 450 Union LLC c/o Pilot Real Estate Group LLC (the Volunteer), for 450 Union Street (the Site) in Brooklyn, New York. A Site Location map is provided as Attachment A. The Volunteer entered into the New York State Brownfield Cleanup Program (BCP) under the Brownfield Cleanup Agreement (BCA) dated September 1, 2015 (BCP Site ID. C224219). A Site Location Map is provided in Attachment A. Additional site information and data collected previously by Langan and others is provided in the Interim Remedial Measures Work Plan (IRMWP).

This QAPP specifies the sampling procedures to be followed and the analytical methods to be used to ensure that data from the proposed investigation at the site are precise, accurate, representative, comparable, and complete.

1.2 Project Objectives

The scope of this Interim Remedial Measures (IRM) Work Plan includes the following:

- Decommission the suspected underground storage tank (UST) at the southeast corner of the site building in accordance with local, state and federal regulations. Excavation of grossly-impacted petroleum-contaminated soil, associated with the UST, to about 12 feet bgs (the extent to which petroleum impacts were documented in the RI) with localized dewatering as needed;
- Excavation of the hazardous lead soil hotspot near the central part of the site to at least 4 feet bgs;
- Limited construction-related trench excavations within the site building and in the asphalt-paved exterior for installation of subsurface utilities, footings for a lean-to structure, and landscaping;
- Backfilling excavated areas to the original grade using certified-clean fill meeting Part 375 RRU SCOs, RCA or with virgin, native crushed stone, in accordance with DER-10; and
- Restoration of the site cap (i.e. asphalt or concrete) where it is compromised or placement of a 2-foot clean soil cover in non-paved, landscaped areas.

The IRMWP includes collection of endpoint and documentation soil samples following UST, hazardous lead-impacted soil, and historical fill removal, in accordance with Division of Environmental Remediation (DER)-10: Technical Guidance for Site Investigation and Remediation. The IRMWP also includes collection of waste characterization samples as part of soil disposal (if it is encountered). This QAPP addresses sampling and analytical methods that will be necessary in support of IRM activities. These objectives have been established in order to meet standards that will protect public health and the environment for the site.

1.3 Scope of Work

Implementation of the IRM will include handling of hazardous and petroleum-contaminated soil during hotspot excavation and waste characterization of excavated material. Excavated soil will be sampled for laboratory analysis per disposal facility requirements, and visually examined, screened, and characterized to determine whether it is suitable for potential re-use onsite (pending waste characterization analytical sampling results) or will be transported to an approved off-site disposal facility. Dust, odors, and organic vapors will be managed by following a site-specific Health and Safety Plan (HASP) and through an established CAMP.

The following activities will be performed as part of the interim remedial action:

- Soil Hotspot Excavation and Backfill – A hazardous lead soil hotspot and suspected UST with associated petroleum-contaminated soil will be excavated and removed in accordance with DER-10 guidelines and the IRMWP. Remedial performance soil samples will be collected from each excavation and analyzed for contaminants specific to their respective areas. If performance sample results are favorable, the excavations will be backfilled with a clean fill material in accordance with the IRMWP and capped with an impervious cover (i.e., concrete, asphalt) or with 2 feet of clean fill for landscaped areas per DER-10 5.4(e).
- Utility Excavations – Interior and exterior construction-related excavations will be completed for installation of utilities. Surficial historic fill generated during this work will be screened for evidence of anthropogenic impacts and separated accordingly for off-site disposal at an approved facility.
- Waste Characterization Soil Sampling – Soil samples for waste classification and disposal purposes will be collected prior to and/or during the remedial excavation. Soil samples will be collected at a frequency depending on the disposal facility requirements. Laboratory tests for characterization of a waste stream typically include all or a subset of the following list and will be determined by the facility's permit requirements: Total Petroleum Hydrocarbons (TPH); Target Compound List (TCL) volatile organic compounds (VOC) and semi-volatile organic compounds (SVOC); polychlorinated biphenyls (PCB); Target Analyte List (TAL) metals; pesticides and herbicides; the Resource Conservation and Recovery Act (RCRA) hazardous characteristics of ignitability, corrosivity, and reactivity; RCRA toxicity characteristic using the Toxic Characteristics Leaching Procedure (TCLP) for VOCs, SVOCs, metals, pesticides, and herbicides; Diesel Range Organics (DRO); and/or Gasoline Range Organics (GRO).

2.0 DATA QUALITY OBJECTIVES AND PROCESSES

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 overall project objective is to implement interim remedial measures for a portion of the site. The sampling program will provide for collection of soil samples to document soil/fill left in place and to confirm remedial performance in source contamination areas. DQOs for sampling activities are determined by evaluating five factors:

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

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

- **Precision** – an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Field sampling precision will be determined by analyzing coded duplicate samples and analytical precision will be determined by analyzing internal QC duplicates and/or matrix spike duplicates.
- **Accuracy** – a measure of the degree of agreement of a measured value with the true or expected value of the quantity of concern. For soil and groundwater samples, accuracy will be determined through the assessment of the analytical results of field blanks and trip blanks for each sample set. Analytical accuracy will be assessed by examining the percent recoveries of surrogate compounds that are added to each sample (organic analyses only), internal standards, laboratory method blanks, instrument calibration, and the percent recoveries of matrix spike compounds added to selected samples and laboratory blanks. For soil vapor or air samples, analytical accuracy will be assessed by examining the percent recoveries that are added to each sample, internal standards, laboratory method blanks, and instrument calibration.
- **Representativeness** – expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is dependent upon the adequate design of the sampling program and will be satisfied by ensuring that the scope of work is followed and that specified sampling and analysis techniques are used. Representativeness in the laboratory is ensured by compliance to nationally-recognized

analytical methods, meeting sample holding times, and maintaining sample integrity while the samples are in the laboratory's possession. This is accomplished by following all applicable methods, laboratory-issued standard operating procedures (SOPs), the laboratory's Quality Assurance Manual, and this QAPP. The laboratory is required to be properly certified and accredited.

- **Completeness** – the percentage of measurements made which are judged to be valid. Completeness will be assessed through data validation. The QC objective for completeness is generation of valid data for at least 90 percent of the analyses requested.
- **Comparability** – expresses the degree of confidence with which one data set can be compared to another. The comparability of all data collected for this project will be ensured using several procedures, including standard methods for sampling and analysis as documented in the QAPP, using standard reporting units and reporting formats, and data validation.
- **Sensitivity** – the ability of the instrument or method to detect target analytes at the levels of interest. The project manager will select, with input from the laboratory and QA personnel, sampling and analytical procedures that achieve the required levels of detection.

3.0 PROJECT ORGANIZATION

The IRMWP objectives will be documented by Langan on behalf of 450 Union LLC c/o Pilot Real Estate Group LLC. Langan will oversee excavation and off-site disposal of, the hazardous lead soil hotspot, the suspected UST and associated petroleum-contaminated soil, and historic fill generated during construction-related utility and planter excavations. Langan will provide on-site field representatives to screen soil, collect remedial performance and site characterization soil samples, and implement a community air monitoring program (CAMP) in general accordance with New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan.

For the scope of work described in the RIWP, sampling will be conducted by Langan, the analytical services will be performed by Alpha Analytical of Westborough, Massachusetts (NYSDOH ELAP certification number 11148). Data validation services will be performed by Emily Strake; resume attached (Attachment B).

Key contacts for this project are as follows:

Langan Technical Manager:	Mrs. Nicole Rice Telephone: (212) 479-5491 Fax: (212) 479-5444
Langan Project Manager:	Mrs. Mimi Raygorodetsky Telephone: (212) 479-5441
Langan Quality Assurance Officer (QAO):	Mr. Michael D. Burke, CHMM Telephone: (212) 479-5413
Data Validator and Program Quality Assurance Monitor:	Ms. Emily Strake Telephone: (212) 491-6526 Fax: (212) 479-5444
Laboratory Representative:	Alpha Analytical Ben Rao Telephone: (201) 812-2633

4.0 QUALITY ASSURANCE/QUALITY CONTROL OBJECTIVES FOR MEASUREMENT 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 for the remedial investigation at 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 accuracy or bias, sensitivity, completeness, representativeness, 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. For field duplicates, results less than 2x the reporting limit (RL) meet the precision criteria if the absolute difference is less than ±2x the RL and acceptable based on professional judgement. For results greater than 2x the RL, the acceptance criteria is a relative percent difference (RPD) of ≤50% (soil and air), <30% (water). RLs and method detection limits (MDL) are provided in Attachment C.

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. Trip blanks are not required for non-aqueous matrices but are planned for non-aqueous matrices where high concentrations of VOCs are anticipated.

Laboratory accuracy is assessed by evaluating the percent recoveries of matrix spike/matrix spike duplicate (MS/MSD) samples, laboratory control 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 to 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 EPA 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.

Air, soil vapor, 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 director 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 director 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 D. 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 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 observations in field books, tracking contractor progress of the interim remedial measures, logging documentation/confirmation soil samples collected, 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

5.1.2 Sample Labeling

Each sample collected will be assigned a unique identification number in accordance with the sample nomenclature guidance included in Attachment E, 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 and screen soil during excavation/disposal and before collecting performance documentation samples. 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. An air monitor capable of measuring particulate matter up to 10 micrometers (µm) in diameter will be used to evaluate perimeter air quality resulting from the work. 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

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. Soil samples collected for analysis of VOCs will be collected using either EnCore® or Terra Core® sampling equipment. For analysis of non-volatile parameters, samples will be homogenized and placed into glass jars. After collection, all sample jars will be capped and securely tightened, and placed in iced coolers and maintained at 4°C ±2°C until they are transferred to the laboratory for analysis, in accordance with the procedures outlined in Section 5.4. Analysis and/or extraction and digestion of collected soil samples will meet the holding times required for each analyte as specified in Attachment D. In addition, analysis of collected soil 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 for each sample shipment that includes VOC analysis.

Duplicate soil samples will be collected and analyzed for quality assurance purposes. Duplicate samples will be collected at a frequency of 1 per 20 samples 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. For soil and groundwater samples, 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 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 D.

5.6 Sample Shipment

5.6.1 Packaging

Soil 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 efforts will be made to transport environmental samples to the laboratory within 24 hours from the time of collection by a laboratory-provided courier or express delivery company (e.g. FedEx) 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 B of the RIWP. Field sampling equipment that is to be reused will be decontaminated in the field in accordance with the following procedures:

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

5.8 Residuals Management

Debris (e.g., paper, plastic and disposable PPE) will be collected in plastic garbage bags and disposed of as non-hazardous industrial waste. Debris is expected to be transported to a local municipal landfill for disposal.

Residual fluids (such as dewatering fluids) will be collected by pumping into a dedicated DOT-approved (or equivalent) vehicle for transport and off-site disposal. The residual fluids will be disposed of off-site in accordance with applicable federal and state regulations. Residual fluids such as decontamination water may be discharged to the ground surface, however, if gross contamination is observed, the residual fluids will be collected, stored, and transported similar purge water or other residual fluids.

5.9 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:

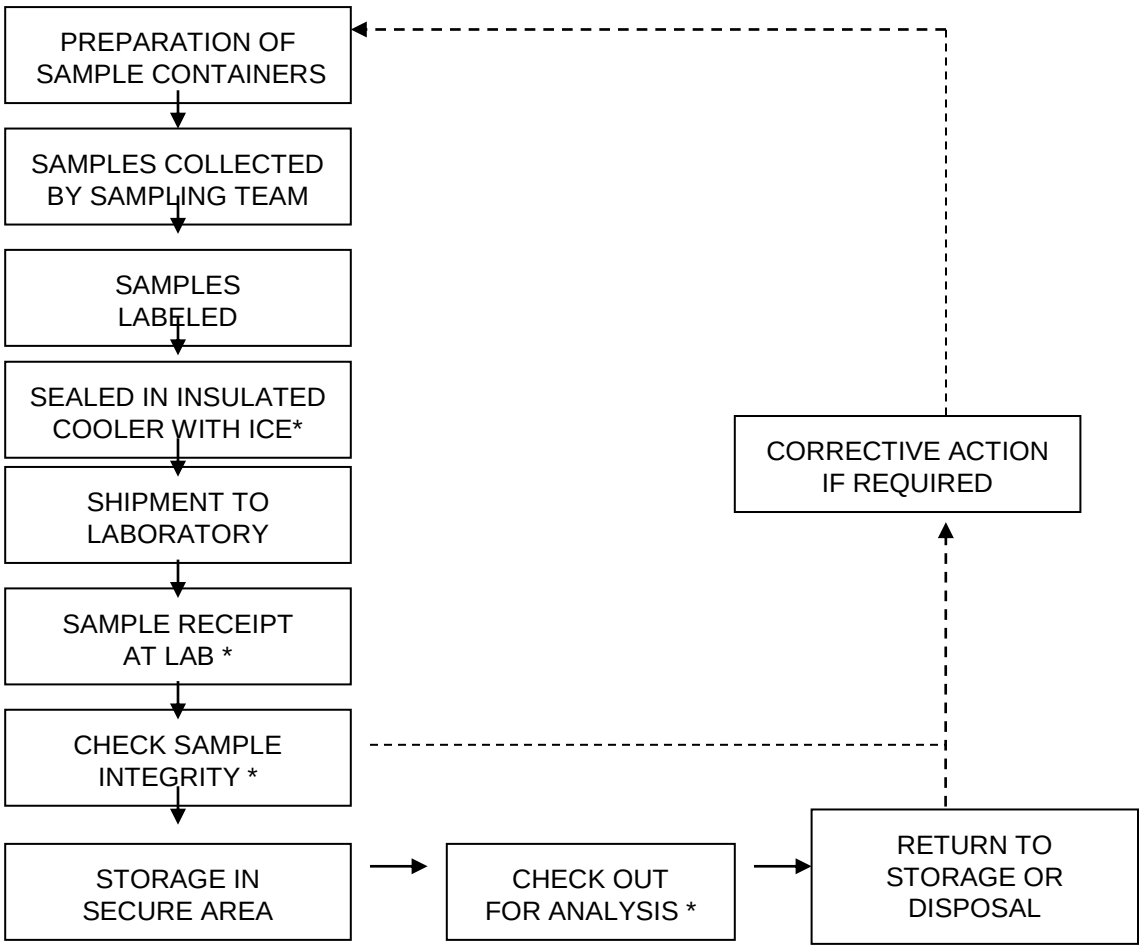
- Chain-of-custody will be initiated by the laboratory supplying the pre-cleaned and prepared sample containers. Chain-of-custody forms will accompany the sample containers.
- Following sample collection, the chain-of-custody form will be completed for the sample collected. The sample identification 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.

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.

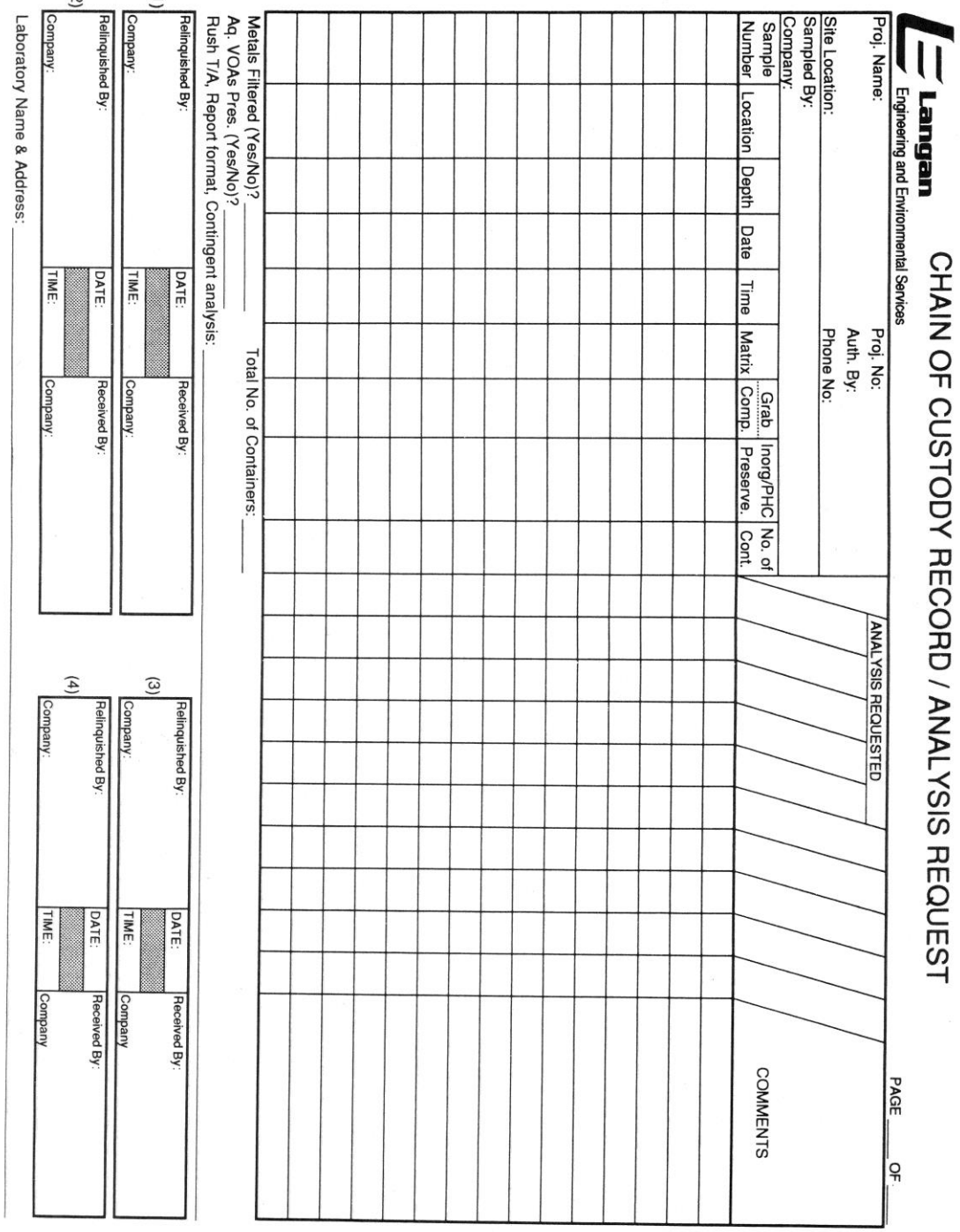
Samples will be packaged for shipment to the laboratory with the appropriate chain-of-custody form. A copy of the form will be retained by the sampling team for the project file and the original will be sent to the laboratory with the samples. Bills of lading will also be retained as part of the documentation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

Figure 5-1 Sample Custody



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

Figure 5.2 Sample Chain-of-Custody Form



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

Data collected as part of the remedial performance sampling 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.

6.1 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.

6.2 Data Validation

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

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

A DUSR will be prepared and reviewed by the QAO 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 results;
- Target compound identification;
- Chromatogram quality;
- Pesticide cleanup (if applicable);
- Compound quantitation and reported detection limits;
- System performance; and
- Results verification.

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

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

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

- "U" - Not detected. The associated number indicates the approximate sample concentration necessary to be detected significantly greater than the level of the highest associated blank;

- "UJ" - Not detected. Quantitation limit may be inaccurate or imprecise;
- "J" - Analyte is present. Reported value may be associated with a higher level of uncertainty than is normally expected with the analytical method
- "N" – Tentative identification. Analyte is considered present in the sample;
- "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

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

7.1 System Audits

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

7.2 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.

7.3 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 QAO 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 QAO 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 QAO, 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.

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

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

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

USEPA, 2012. Mercury and Cyanide Data Validation. SOP No. HW-2c, Revisions 15, dated December 2012, USEPA Region II.USEPA. Hazardous Waste Support Section. Analysis of Volatile Organic Compounds in Air Contained in Canisters by Method TO-15. SOP No. HW-31, Revision #6, dated June 2014.

ATTACHMENT A

SITE LOCATION MAP

LEGEND:

APPROXIMATE BROWNFIELD CLEANUP PROGRAM SITE BOUNDARY

GENERAL NOTES:

1. BASE MAP IS TAKEN FROM UNITED STATES GEOLOGICAL SURVEY (USGS) 7.5 MINUTE TOPOGRAPHIC MAPS FOR THE BROOKLYN, 1980 AND JERSEY CITY, 1982 QUADRANGLES.

LANGAN

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Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C. S.A.
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	450 UNION STREET BLOCK No. 438, LOT No. 7 BROOKLYN NEW YORK
Figure Title	SITE LOCATION MAP
Project No.	170301202
Figure No.	1
Date	12/14/2016
Scale	1"=1500'
Drawn By	AGT
Checked By	MSR
Submission Date	DECEMBER 2016
Sheet	1 of 7

Filename: \\langan.com\data\NYC\data2\170301202\Cadd Data - 170301202\2D-DesignFiles\Environmental\IRMWP\Figure 1 - Site Location Map.dwg Date: 12/14/2016 Time: 10:39 User: atashji Style Table: Langan.stb Layout: SLM

ATTACHMENT B

RESUMES

Nicole C. Rice, PE

Project Engineer
Environmental Engineering

8 years in the industry

Ms. Rice has over eight years of professional experience as an environmental engineer. She has conducted environmental sampling, prepared erosion and sediment control plans, stormwater management plans, and environmental permit reports, each of which required regulatory interaction and were submitted for regulatory review. She has performed annual air emissions calculations for several municipal solid waste (MSW) landfills and has worked on enviromental remediation designs from development through construction oversight. Ms. Rice has also operated and maintained several groundwater pump-and-treat systems for gasoline service stations. Her most recent experience includes the development of Phase I environmental assessments, sampling and analysis plans, site Inspections, environmental baseline surveys, remedial investigations, feasibility studies, engineering evaluations and cost analysis; proposed plans and decision documents.

Education

B.S., Civil Engineering
Pennsylvania State University

Professional Registration

Professional Engineer in New York and Pennsylvania

Selected Projects

Environmental Baseline Survey for United States Coast Guard, Various Locations, US – Project Engineer. Determined and reported environmental liability for the lighthouses owned and previously-owned by the USCG. Twelve lighthouses were selected for visits to assess and collect environmental information regarding the site. A historical research effort (interviews and records search) was conducted to acquire additional information related to the lighthouses. Examples of pertinent records included phase I environmental site assessments, phase II environmental site assessments, remedial design and action reports, closure reports, asbestos and/or lead-based paint surveys, tank (above ground and underground) inspection and removal records, and checklists and questionnaires completed during the interviews and record reviews.

Sites 9 and 21 Site Inspections, Naval Station Great Lakes, IL – Project Engineer. Prepared Site Inspection reports documenting sampling and risk screening of soil and groundwater contamination at the Camp Moffett Disposal Area and Building 1517 Landfill. Also prepared weekly and monthly status reports and financial reports documenting progress on tasks performed at the site.

Data Evaluation Report, Department of the Navy, NAVFAC Mid-Atlantic (CLEAN)/Naval Air Station Brunswick; Branswick, ME - Project Engineer. Work included reviewing investigations, samplings, and analyses, risk assessments completed to date, the ROD, ARARs, post-ROD sample data and conditions at the site in order to conduct a “protectiveness evaluation”. The report included recommendations as to

whether the remedy was still considered protective and recommended any further field sampling/investigations that may be warranted to make that determination and/or characterize the site.

Naval Air Station Brunswick, U.S. Navy CLEAN Mid-Atlantic Division, Brunswick, ME – Project Engineer. Prepared SI for Small Arms Ranges (Machine Gun Boresight Range, Skeet Range, and Topsham Skeet Range). MC sampling was selectively conducted for surface and subsurface soil, surface water/sediment, and groundwater conducted at the 3 small arms ranges were summarized in the SI. The analytical suite included metals (including XRF screening for lead to optimize data collection and reduce costs), PAHs, propellants, and perchlorate.

REMEDIAL INVESTIGATIONS AND FEASIBILITY STUDIES

Remedial Investigation/Feasibility Study/Remedial Action for the United States Coast Guard, Baltimore Yard, Baltimore, MD - Project Engineer. Prepared RI/FS and Remedial Actions for numerous CERCLA sites including: groundwater and soil contamination within a former burn pit; groundwater, soil, surface water, and sediment contamination at a former bilge spoils area; and groundwater and soil contamination at a former incinerator area. The projects include development of work plans, human health and ecological risk assessments, Site Management Plan, Site Inspection, Remedial Investigation Reports, Feasibility Studies, Proposed Plans, Records of Decision, Removal Action Work Plans, and Construction Completion Reports.

Naval Air Station Pensacola, Pensacola, FL - Project Engineer. Prepared Feasibility Study Reports, Remedial Alternatives Analysis Summaries, and evaluate innovative technologies for several contaminated wetlands at NAS Pensacola. Developed possible active and passive remediation strategies for sediment and surface water contamination.

Charleston Naval Complex, Charleston Zone J, RCRA Facility Investigation, SC – Project Engineer. Responsibilities included writing the Environmental Setting, Nature and Extent of Contamination, and Conclusions and Recommendations sections for the RI report. Also responsible for incorporating 10 years of available data into a document that evaluates impacts of storm water effluent, surface runoff, and contaminated groundwater migration. Coordination of report including report review for completeness, meeting with authors to address technical review comments, ensure all modifications are completed, and that report has consistent flow.

Remedial Investigation and Feasibility Study, EO 300 Small Arms Range, Naval Base Kitsap (NBK) at Bangor, WA - Project Engineer. Provided support for evaluation of remedial alternatives and report preparation.

Feasibility Study, Solvent Release Area, NAVFAC Northeast, Former NAS South Weymouth, MA – Project Engineer. Prepared Feasibility Studies for one site that consisted of a large chlorinated solvent plume. Tasks included technology screening, conceptual design, evaluation of alternatives, and comparative analysis.

Naval Activity Puerto Rico (NAPR), U.S. Navy CLEAN Mid-Atlantic Division, Ceiba, Puerto Rico – Project Engineer. Prepared Phase 1 RFI for ecologically sensitive small arms range with six discrete areas of concern, including four areas with MEC/MPPEH concerns. The areas of concern

include pistol ranges, a rifle range, two open detonation areas, and a trench area of unknown contents.

Naval Weapons Station Charleston, South Annex Hardstand Area and Ammunition Renovation Shop, RCRA Facility Investigation, United States Navy Southern Division, Charleston, SC – Project Engineer. Responsibilities included writing the Site History, Environmental Setting, Nature and Extent of Contamination, and Conclusions and Recommendations sections for RFI reports for both sites. Coordination of report including report review for completeness, meeting with authors to address technical review comments, ensure all modifications are completed, and that report has consistent flow.

FIELDWORK

Naval Weapons Station Charleston, United States Navy Southern Division, Charleston, SC – The field activities for several sites included collecting surface soils, sampling of monitoring wells, and installation of monitoring wells. In addition, post fieldwork activities included; data reduction and evaluation, data base preparation, and report generation.

Naval Station Great Lakes, Sites 9 and 21, IL – Site activities including monitoring well installation and development and groundwater sampling.

REMEDIATION

Corrective Measures Implementation Work Plan and Operations and Maintenance Plan; John F. Kennedy Space Center; NASA, FL – Project Engineer. Prepared Corrective Measures Implementation Work Plan and Operations and Maintenance Plan for a CERCLA site contaminated with trichloroethylene. The corrective measures include air sparging for remediation of identified Trichloroethylene (TCE), cis-1,2-dichloroethene (cDCE), and vinyl chloride (VC) plumes and Monitored Natural Attenuation (MNA) for monitoring TCE, cDCE, and VC.

Naval Station Great Lakes, United States Navy NAVFAC Midwest, Great Lakes, IL – Project Engineer. Prepared a UFP-SAP to investigate an area that may contain non-hazardous landfill materials. The UFP-SAP involved planning the soil and groundwater sampling strategy for a CERCLA remedial investigation.

Crossley Farm Superfund Site, Basis of Design Report for Operable Unit-2, EPA Region 3, Berks County, PA – Project Engineer. Prepared a Basis of Design Report for the design of the extraction well network and recharge well network for a groundwater remediation system for a chlorinated solvent plume in a fractured crystalline bedrock aquifer.

GROUNDWATER MONITORING

Confidential Client, Petroleum-Related Remediation, Maryland, Michigan, Ohio, and Pennsylvania) - Project Management and Technical Resource Monitor. Services for natural attenuation for degradation of benzene, toluene, ethylbenzene, and xylene (BTEX) and methyl tert-butyl ether (MTBE) for corrective actions at petroleum retail facilities. Prepared Remedial Action Plans (RAP), Remedial Action Progress Reports (RAPR), and Remedial Action Completion Reports (RACR) for submission to the Pennsylvania Department of Environmental Protection (PADEP) that requires a thorough understanding of Corrective Action Process (CAP) (Chapter 245)

and Pennsylvania Act 2 (Chapter 250) regulations as applicable for underground storage tank (UST) investigations in Pennsylvania. Was responsible for the management of discharge monitoring reporting under various NPDES and POTW pre-treatment permits. Field activities performed included operation and maintenance activities for numerous groundwater remediation systems, groundwater well gauging and sampling, hydrogen peroxide well injections, and well injections using a mixture of sodium sulfate, potassium nitrate, and microbes.

Department of the Navy, Naval Air Station Cecil Field, Natural Attenuation and Groundwater Monitoring Reports, Sites 58 and 59, Jacksonville, FL - Project Engineer. Prepared reports presenting natural attenuation and contaminant data for various sites in the long-term monitoring program. Activities include compilation of field data, interpretation of natural attenuation indicator parameter data, preparation of quarterly, semi-annual, and annual reports including coordination with database management and GIS personnel.

REGULATORY COMPLIANCE

United States Coast Guard Baltimore Yard, Environmental Records Management, Baltimore, MD – Project Management and technical oversight activities on inventorying documents which are directly applicability to EPA and Coast Guard environmental record guidelines.

Five-Year Review for AOCs 2, 4, 10, and 16 and IR Site, Naval Air Warfare Center, Indianapolis, IN – Project Engineer. Work included reviewing investigations, samplings, and analyses, risk assessments completed to date, the ROD, ARARs, post-ROD sample data and conditions at the site in order to conduct a “protectiveness evaluation”. The report included recommendations as to whether the remedy was still considered protective and recommended any further field sampling/investigations that may be warranted to make that determination and/or characterize the site.

Confidential Client, Annual Air Emissions and Plan of Approval, Western PA – Project Engineer. Provided air emissions calculations for landfills, including estimation of landfill gas generation rates utilizing the United States Environmental Protection Agency (USEPA) LandGem model, calculating control equipment emissions and destruction efficiency, and overall site air emissions for permitting and expansion situations. Completed Plan Approval applications for MSW landfill expansion, including an emissions inventory analysis based on site-specific gas curves.

Mimi Raygorodetsky

Senior Associate
Environmental Engineering

16 years in the industry

Ms. Raygorodetsky sources and directs large, complex environmental remediation and redevelopment projects from the earliest stages of pre-development diligence, through the remediation/construction phase, to long-term operation and monitoring of remedial systems and engineering controls. She has a comprehensive understanding of federal, state and local regulatory programs and she uses this expertise to guide her clients through a preliminary cost benefit analysis to select the right program(s) given the clients' legal obligations, development desires and risk tolerance. She is particularly strong at integrating the requirements of selected programs and client development needs to develop and design targeted and streamlined diligence programs and remediation strategies. Ms. Raygorodetsky is also highly skilled in integrating remediation with construction on large urban waterfront projects, which tend to more complex than landside projects.

Selected Projects

25 Kent Avenue, Due Diligence for Purchase of a Brownfields Location, Brooklyn, NY
Ferry Point Waterfront Park, Redevelopment of a Former Landfill into a Park, Bronx, NY
Battery Maritime Building (10 South Street), Phase I ESA, New York, NY
Residential Development at 351-357 Broadway, Phase 1 ESA, New York, NY
450 Union Street, Phase I and Phase II Remediation (NYS DEC Brownfield Cleanup Program), New York, NY
Echo Bay Center, NYS DEC Brownfield Cleanup Program, New York, NY
420 Kent Avenue, NYS DEC Brownfield Cleanup Program, Brooklyn, NY
416 Kent Avenue, NYS DEC Brownfield Cleanup Program, Brooklyn, NY
264 Fifth Avenue, Phase I ESA, New York, NY
262 Fifth Avenue, Phase I ESA, New York, NY
ABC Blocks 25-27 (Mixed-Use Properties), Brownfield Cleanup Program, Long Island City, NY
Residences at 100 Barrow Street, Phase I ESA, New York, NY
Residences at 22-12 Jackson Avenue, Due Diligence for Building Sale, Long Island City, NY
Residences at 2253-2255 Broadway, Phase I and Phase II Services, New York, NY
Prince Point, Phase I ESA, Staten Island, NY
787 Eleventh Avenue (Office Building Renovation), Phase I UST Closure, New York, NY
218 Front Street/98 Gold Street, Planning and Brownfield Consulting, Brooklyn, NY
Mark JCH of Bensonhurst, Phase I and HazMat Renovation, Brooklyn, NY
39 West 23rd Street, E-Designation Brownfield, New York, NY
250 Water Street, Phase I and Phase II Property Transaction, New York, NY

Education

B.A., Biology and Spanish Literature
Colby College

Affiliations

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

Founding Member and Current President – New York City Brownfield Partnership

Committee Member – NYC Office of Environmental Remediation Technical Task Force

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27-19 44th Drive, Residential Redevelopment, Long Island City, NY
515 West 42nd Street, E-Designation, New York, NY
310 Meserole Street, Due Diligence Property Purchase, Brooklyn, NY
Former Georgetown Heating Plant, HazMat and Phase I ESA, Washington D.C.
80-110 Flatbush Avenue, Brooklyn, NY
132 East 23rd Street, New York, NY
846 Sixth Avenue, New York, NY
Greenpoint Landing, Remediation/Redevelopment, Brooklyn, NY
711 Eleventh Avenue, Due Diligence/Owner's Representative, New York, NY
Brooklyn Bridge Park, Pier 1, Waste Characterization and Remediation, Brooklyn, NY
Post-Hurricane Sandy Mold Remediation, Various Private Homes, Far Rockaway, NY
Brooklyn Bridge Park, One John Street Development, Pre-Construction Due Diligence and Construction Administration, Brooklyn, NY
7 West 21st Street, Brownfields Remediation, New York, NY
546 West 44th Street, Brownfields Remediation, New York, NY
Post-Hurricane Sandy Mold Remediation, Various Private Homes, Nassau and Suffolk Counties, Long Island, NY
55 West 17th Street, Brownfield Site Support, New York, NY
Pratt Institute, 550 Myrtle Avenue Renovations, Environmental Remediation, Brooklyn, NY
42-02 Crescent Street Redevelopment, Phase I and II Environmental, Long Island City, NY
IAC Building (555 West 18th Street), New York, NY
Retirement Communities on100-acre Parcels in ME, NJ, MA, CT and NJ
363-365 Bond Street/400 Carroll Street, Brooklyn, NY
160 East 22nd Street, New York, NY
110 Third Avenue, New York, NY
Lycee Francais (East 76th Street & York Avenue), New York, NY
Winchester Arms Munitions Factory, New Haven, CT

Michael D. Burke, CHMM, LEED AP

Senior Associate/Vice President
Environmental Engineering and Remediation

16 years in the industry

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

Selected Projects

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

Education

M.S., Environmental Geology
Rutgers University

B.S., Geological Sciences
Rutgers University

B.S., Environmental Science
Rutgers University

Professional Registration

Certified Hazardous Materials Manager – CHMM No. 15998

OSHA Certification for Hazardous Waste Site Supervisor

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

NJDEP Certification for Community Noise Enforcement

Troxler Certification for Nuclear Densometer Training

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

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

Emily G. Strake

Project Chemist/ Risk Assessor
Environmental Engineering

14 years in the industry ~ 2 years with Langan

Ms. Strake has fourteen 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 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 Models 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 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.

Education

MBA
The University of Scranton

B.S., Chemistry Cedar Crest College

Training

40 hr. OSHA HAZWOPER Training/Nov 2002

8 hr. HAZWOPER Supervisor/June 2004

8 hr. OSHA HAZWOPER Refresher/2013

Selected Projects

•Major League Soccer's San Jose Earthquakes Stadium, Santa Clara, CA
•DuPont, Waynesboro, VA
•PECO/Exelon, Various Locations
•Texas Instruments, San Francisco, CA
•Regency, Philadelphia, PA
•Veteran's Affairs, Palo Alto, CA
•DOW Chemical, Various Locations
•Avon, Rye, NY
•Golden Gate National Parks Conservancy, San Francisco, CA
•Sunoco Refineries, Various Locations
•Honeywell, Highland Park, NJ
•Delaware City Refinery, DE
•Occidental Chemical, Bakersfield, CA
•Floreffe Terminal, Pittsburgh, PA
•Ryder, Hartford, CT
•Rohm and Haas, Philadelphia, PA

ATTACHMENT C

LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS

ATTACHMENT C

LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS

Method	Matrix	CAS Number	Analyte	RL	MDL	Units
Volatile Organic Compounds						
EPA 8260C/5035	Solids/Soil	630-20-6	1,1,1,2-Tetrachloroethane	1	0.318	ug/kg
EPA 8260C/5035	Solids/Soil	71-55-6	1,1,1-Trichloroethane	1	0.1108	ug/kg
EPA 8260C/5035	Solids/Soil	79-34-5	1,1,2,2-Tetrachloroethane	1	0.1008	ug/kg
EPA 8260C/5035	Solids/Soil	76-13-1	1,1,2-Trichloro-1,2,2-Trifluoroethan	20	0.274	ug/kg
EPA 8260C/5035	Solids/Soil	79-00-5	1,1,2-Trichloroethane	1.5	0.304	ug/kg
EPA 8260C/5035	Solids/Soil	75-34-3	1,1-Dichloroethane	1.5	0.0856	ug/kg
EPA 8260C/5035	Solids/Soil	75-35-4	1,1-Dichloroethene	1	0.262	ug/kg
EPA 8260C/5035	Solids/Soil	563-58-6	1,1-Dichloropropene	5	0.1414	ug/kg
EPA 8260C/5035	Solids/Soil	87-61-6	1,2,3-Trichlorobenzene	5	0.1476	ug/kg
EPA 8260C/5035	Solids/Soil	96-18-4	1,2,3-Trichloropropane	10	0.1626	ug/kg
EPA 8260C/5035	Solids/Soil	95-93-2	1,2,4,5-Tetramethylbenzene	4	0.1302	ug/kg
EPA 8260C/5035	Solids/Soil	120-82-1	1,2,4-Trichlorobenzene	5	0.1818	ug/kg
EPA 8260C/5035	Solids/Soil	95-63-6	1,2,4-Trimethylbenzene	5	0.1414	ug/kg
EPA 8260C/5035	Solids/Soil	96-12-8	1,2-Dibromo-3-chloropropane	5	0.396	ug/kg
EPA 8260C/5035	Solids/Soil	106-93-4	1,2-Dibromoethane	4	0.1744	ug/kg
EPA 8260C/5035	Solids/Soil	95-50-1	1,2-Dichlorobenzene	5	0.1532	ug/kg
EPA 8260C/5035	Solids/Soil	107-06-2	1,2-Dichloroethane	1	0.1134	ug/kg
EPA 8260C/5035	Solids/Soil	78-87-5	1,2-Dichloropropane	3.5	0.228	ug/kg
EPA 8260C/5035	Solids/Soil	108-67-8	1,3,5-Trimethylbenzene	5	0.1434	ug/kg
EPA 8260C/5035	Solids/Soil	541-73-1	1,3-Dichlorobenzene	5	0.135	ug/kg
EPA 8260C/5035	Solids/Soil	142-28-9	1,3-Dichloropropane	5	0.1452	ug/kg
EPA 8260C/5035	Solids/Soil	542-75-6	1,3-Dichloropropene, Total	1	0.1176	ug/kg
EPA 8260C/5035	Solids/Soil	542-75-6	1,3-Dichloropropene, Total	1	0.1176	ug/kg
EPA 8260C/5035	Solids/Soil	106-46-7	1,4-Dichlorobenzene	5	0.1384	ug/kg
EPA 8260C/5035	Solids/Soil	105-05-5	1,4-Diethylbenzene	4	0.1598	ug/kg
EPA 8260C/5035	Solids/Soil	123-91-1	1,4-Dioxane	100	14.42	ug/kg
EPA 8260C/5035	Solids/Soil	594-20-7	2,2-Dichloropropane	5	0.226	ug/kg
EPA 8260C/5035	Solids/Soil	78-93-3	2-Butanone	10	0.272	ug/kg
EPA 8260C/5035	Solids/Soil	591-78-6	2-Hexanone	10	0.666	ug/kg
EPA 8260C/5035	Solids/Soil	622-96-8	4-Ethyltoluene	4	0.124	ug/kg
EPA 8260C/5035	Solids/Soil	108-10-1	4-Methyl-2-pentanone	10	0.244	ug/kg
EPA 8260C/5035	Solids/Soil	67-64-1	Acetone	10	1.036	ug/kg
EPA 8260C/5035	Solids/Soil	107-02-8	Acrolein	25	8.06	ug/kg
EPA 8260C/5035	Solids/Soil	107-13-1	Acrylonitrile	10	0.514	ug/kg
EPA 8260C/5035	Solids/Soil	71-43-2	Benzene	1	0.118	ug/kg
EPA 8260C/5035	Solids/Soil	108-86-1	Bromobenzene	5	0.208	ug/kg
EPA 8260C/5035	Solids/Soil	74-97-5	Bromochloromethane	5	0.276	ug/kg
EPA 8260C/5035	Solids/Soil	75-27-4	Bromodichloromethane	1	0.1732	ug/kg
EPA 8260C/5035	Solids/Soil	75-25-2	Bromoform	4	0.236	ug/kg
EPA 8260C/5035	Solids/Soil	74-83-9	Bromomethane	2	0.338	ug/kg
EPA 8260C/5035	Solids/Soil	75-15-0	Carbon disulfide	10	1.102	ug/kg
EPA 8260C/5035	Solids/Soil	56-23-5	Carbon tetrachloride	1	0.21	ug/kg
EPA 8260C/5035	Solids/Soil	108-90-7	Chlorobenzene	1	0.348	ug/kg
EPA 8260C/5035	Solids/Soil	75-00-3	Chloroethane	2	0.316	ug/kg
EPA 8260C/5035	Solids/Soil	67-66-3	Chloroform	1.5	0.37	ug/kg
EPA 8260C/5035	Solids/Soil	74-87-3	Chloromethane	5	0.294	ug/kg
EPA 8260C/5035	Solids/Soil	156-59-2	cis-1,2-Dichloroethene	1	0.1428	ug/kg
EPA 8260C/5035	Solids/Soil	10061-01-5	cis-1,3-Dichloropropene	1	0.1176	ug/kg
EPA 8260C/5035	Solids/Soil	110-82-7	Cyclohexane	20	0.146	ug/kg
EPA 8260C/5035	Solids/Soil	124-48-1	Dibromochloromethane	1	0.1536	ug/kg
EPA 8260C/5035	Solids/Soil	74-95-3	Dibromomethane	10	0.1636	ug/kg
EPA 8260C/5035	Solids/Soil	75-71-8	Dichlorodifluoromethane	10	0.1908	ug/kg
EPA 8260C/5035	Solids/Soil	60-29-7	Ethyl ether	5	0.26	ug/kg
EPA 8260C/5035	Solids/Soil	100-41-4	Ethylbenzene	1	0.1274	ug/kg
EPA 8260C/5035	Solids/Soil	87-68-3	Hexachlorobutadiene	5	0.228	ug/kg
EPA 8260C/5035	Solids/Soil	98-82-8	Isopropylbenzene	1	0.1038	ug/kg
EPA 8260C/5035	Solids/Soil	79-20-9	Methyl Acetate	20	0.27	ug/kg
EPA 8260C/5035	Solids/Soil	108-87-2	Methyl cyclohexane	4	0.1546	ug/kg
EPA 8260C/5035	Solids/Soil	1634-04-4	Methyl tert butyl ether	2	0.0844	ug/kg
EPA 8260C/5035	Solids/Soil	75-09-2	Methylene chloride	10	1.104	ug/kg
EPA 8260C/5035	Solids/Soil	91-20-3	Naphthalene	5	0.1384	ug/kg
EPA 8260C/5035	Solids/Soil	104-51-8	n-Butylbenzene	1	0.1148	ug/kg
EPA 8260C/5035	Solids/Soil	103-65-1	n-Propylbenzene	1	0.1092	ug/kg
EPA 8260C/5035	Solids/Soil	95-49-8	o-Chlorotoluene	5	0.1598	ug/kg
EPA 8260C/5035	Solids/Soil	95-47-6	o-Xylene	2	0.1718	ug/kg
EPA 8260C/5035	Solids/Soil	179601-23-1	p/m-Xylene	2	0.1978	ug/kg
EPA 8260C/5035	Solids/Soil	106-43-4	p-Chlorotoluene	5	0.1328	ug/kg
EPA 8260C/5035	Solids/Soil	99-87-6	p-Isopropyltoluene	1	0.125	ug/kg
EPA 8260C/5035	Solids/Soil	135-98-8	sec-Butylbenzene	1	0.122	ug/kg
EPA 8260C/5035	Solids/Soil	100-42-5	Styrene	2	0.402	ug/kg
EPA 8260C/5035	Solids/Soil	75-65-0	tert-Butyl Alcohol	60	2.92	ug/kg
EPA 8260C/5035	Solids/Soil	98-06-6	tert-Butylbenzene	5	0.1354	ug/kg
EPA 8260C/5035	Solids/Soil	127-18-4	Tetrachloroethene	1	0.1402	ug/kg
EPA 8260C/5035	Solids/Soil	108-88-3	Toluene	1.5	0.1948	ug/kg
EPA 8260C/5035	Solids/Soil	156-60-5	trans-1,2-Dichloroethene	1.5	0.212	ug/kg
EPA 8260C/5035	Solids/Soil	10061-02-6	trans-1,3-Dichloropropene	1	0.1208	ug/kg
EPA 8260C/5035	Solids/Soil	110-57-6	trans-1,4-Dichloro-2-butene	5	0.392	ug/kg
EPA 8260C/5035	Solids/Soil	79-01-6	Trichloroethene	1	0.125	ug/kg
EPA 8260C/5035	Solids/Soil	75-69-4	Trichlorofluoromethane	5	0.388	ug/kg
EPA 8260C/5035	Solids/Soil	108-05-4	Vinyl acetate	10	0.1322	ug/kg
EPA 8260C/5035	Solids/Soil	75-01-4	Vinyl chloride	2	0.1174	ug/kg
EPA 8260C/5035	Solids/Soil	1330-20-7	Xylene (Total)	2	0.1718	ug/kg

ATTACHMENT C

LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS

Method	Matrix	CAS Number	Analyte	RL	MDL	Units
Semivolatile Organic Compounds						
EPA 8270D	Solids/Soil	95-94-3	1,2,4,5-Tetrachlorobenzene	167	17.4348	ug/kg
EPA 8270D	Solids/Soil	120-82-1	1,2,4-Trichlorobenzene	167	19.1048	ug/kg
EPA 8270D	Solids/Soil	95-50-1	1,2-Dichlorobenzene	167	29.9932	ug/kg
EPA 8270D	Solids/Soil	541-73-1	1,3-Dichlorobenzene	167	28.724	ug/kg
EPA 8270D	Solids/Soil	106-46-7	1,4-Dichlorobenzene	167	29.1582	ug/kg
EPA 8270D	Solids/Soil	58-90-2	2,3,4,6-Tetrachlorophenol	167	33.734	ug/kg
EPA 8270D	Solids/Soil	95-95-4	2,4,5-Trichlorophenol	167	31.9972	ug/kg
EPA 8270D	Solids/Soil	88-06-2	2,4,6-Trichlorophenol	100.2	31.6632	ug/kg
EPA 8270D	Solids/Soil	120-83-2	2,4-Dichlorophenol	150.3	26.8536	ug/kg
EPA 8270D	Solids/Soil	105-67-9	2,4-Dimethylphenol	167	55.11	ug/kg
EPA 8270D	Solids/Soil	51-28-5	2,4-Dinitrophenol	801.6	77.822	ug/kg
EPA 8270D	Solids/Soil	121-14-2	2,4-Dinitrotoluene	167	33.4	ug/kg
EPA 8270D	Solids/Soil	606-20-2	2,6-Dinitrotoluene	167	28.6572	ug/kg
EPA 8270D	Solids/Soil	91-58-7	2-Chloronaphthalene	167	16.5664	ug/kg
EPA 8270D	Solids/Soil	95-57-8	2-Chlorophenol	167	19.7394	ug/kg
EPA 8270D	Solids/Soil	91-57-6	2-Methylnaphthalene	200.4	20.1736	ug/kg
EPA 8270D	Solids/Soil	95-48-7	2-Methylphenol	167	25.885	ug/kg
EPA 8270D	Solids/Soil	88-74-4	2-Nitroaniline	167	32.1976	ug/kg
EPA 8270D	Solids/Soil	88-75-5	2-Nitrophenol	360.72	62.792	ug/kg
EPA 8270D	Solids/Soil	91-94-1	3,3'-Dichlorobenzidine	167	44.422	ug/kg
EPA 8270D	Solids/Soil	106-44-5	3-Methylphenol/4-Methylphenol	240.48	26.1522	ug/kg
EPA 8270D	Solids/Soil	99-09-2	3-Nitroaniline	167	31.4962	ug/kg
EPA 8270D	Solids/Soil	534-52-1	4,6-Dinitro-o-cresol	434.2	80.16	ug/kg
EPA 8270D	Solids/Soil	101-55-3	4-Bromophenyl phenyl ether	167	25.4842	ug/kg
EPA 8270D	Solids/Soil	106-47-8	4-Chloroaniline	167	30.394	ug/kg
EPA 8270D	Solids/Soil	7005-72-3	4-Chlorophenyl phenyl ether	167	17.869	ug/kg
EPA 8270D	Solids/Soil	100-01-6	4-Nitroaniline	167	69.138	ug/kg
EPA 8270D	Solids/Soil	100-02-7	4-Nitrophenol	233.8	68.136	ug/kg
EPA 8270D	Solids/Soil	83-32-9	Acenaphthene	133.6	17.3012	ug/kg
EPA 8270D	Solids/Soil	208-96-8	Acenaphthylene	133.6	25.7848	ug/kg
EPA 8270D	Solids/Soil	98-86-2	Acetophenone	167	20.6746	ug/kg
EPA 8270D	Solids/Soil	120-12-7	Anthracene	100.2	32.565	ug/kg
EPA 8270D	Solids/Soil	1912-24-9	Atrazine	133.6	58.45	ug/kg
EPA 8270D	Solids/Soil	122-66-7	Azobenzene	167	16.032	ug/kg
EPA 8270D	Solids/Soil	100-52-7	Benzaldehyde	220.44	45.09	ug/kg
EPA 8270D	Solids/Soil	92-87-5	Benzidine	551.1	181.028	ug/kg
EPA 8270D	Solids/Soil	56-55-3	Benzo(a)anthracene	100.2	18.8042	ug/kg
EPA 8270D	Solids/Soil	50-32-8	Benzo(a)pyrene	133.6	40.748	ug/kg
EPA 8270D	Solids/Soil	205-99-2	Benzo(b)fluoranthene	100.2	28.1228	ug/kg
EPA 8270D	Solids/Soil	191-24-2	Benzo(ghi)perylene	133.6	19.6392	ug/kg
EPA 8270D	Solids/Soil	207-08-9	Benzo(k)fluoranthene	100.2	26.72	ug/kg
EPA 8270D	Solids/Soil	65-85-0	Benzoic Acid	541.08	169.004	ug/kg
EPA 8270D	Solids/Soil	100-51-6	Benzyl Alcohol	167	51.102	ug/kg
EPA 8270D	Solids/Soil	92-52-4	Biphenyl	380.76	38.744	ug/kg
EPA 8270D	Solids/Soil	111-91-1	Bis(2-chloroethoxy)methane	180.36	16.7334	ug/kg
EPA 8270D	Solids/Soil	111-44-4	Bis(2-chloroethyl)ether	150.3	22.6452	ug/kg
EPA 8270D	Solids/Soil	108-60-1	Bis(2-chloroisopropyl)ether	200.4	28.5236	ug/kg
EPA 8270D	Solids/Soil	117-81-7	Bis(2-Ethylhexyl)phthalate	167	57.782	ug/kg
EPA 8270D	Solids/Soil	85-68-7	Butyl benzyl phthalate	167	42.084	ug/kg
EPA 8270D	Solids/Soil	105-60-2	Caprolactam	167	50.768	ug/kg
EPA 8270D	Solids/Soil	86-74-8	Carbazole	167	16.2324	ug/kg
EPA 8270D	Solids/Soil	218-01-9	Chrysene	100.2	17.368	ug/kg
EPA 8270D	Solids/Soil	53-70-3	Dibenzo(a,h)anthracene	100.2	19.3052	ug/kg
EPA 8270D	Solids/Soil	132-64-9	Dibenzofuran	167	15.7982	ug/kg
EPA 8270D	Solids/Soil	84-66-2	Diethyl phthalate	167	15.4642	ug/kg
EPA 8270D	Solids/Soil	131-11-3	Dimethyl phthalate	167	35.07	ug/kg
EPA 8270D	Solids/Soil	84-74-2	Di-n-butylphthalate	167	31.6632	ug/kg
EPA 8270D	Solids/Soil	117-84-0	Di-n-octylphthalate	167	56.78	ug/kg
EPA 8270D	Solids/Soil	206-44-0	Fluoranthene	100.2	19.1716	ug/kg
EPA 8270D	Solids/Soil	86-73-7	Fluorene	167	16.2324	ug/kg
EPA 8270D	Solids/Soil	118-74-1	Hexachlorobenzene	100.2	18.704	ug/kg
EPA 8270D	Solids/Soil	87-68-3	Hexachlorobutadiene	167	24.4488	ug/kg
EPA 8270D	Solids/Soil	77-47-4	Hexachlorocyclopentadiene	477.62	151.302	ug/kg
EPA 8270D	Solids/Soil	67-72-1	Hexachloroethane	133.6	27.0206	ug/kg
EPA 8270D	Solids/Soil	193-39-5	Indeno(1,2,3-cd)Pyrene	133.6	23.2798	ug/kg
EPA 8270D	Solids/Soil	78-59-1	Isophorone	150.3	21.6766	ug/kg
EPA 8270D	Solids/Soil	91-20-3	Naphthalene	167	20.3406	ug/kg
EPA 8270D	Solids/Soil	98-95-3	Nitrobenzene	150.3	24.716	ug/kg
EPA 8270D	Solids/Soil	86-30-6	NitrosoDiPhenylAmine(NDPA)/DPA	133.6	19.0046	ug/kg
EPA 8270D	Solids/Soil	62-75-9	n-Nitrosodimethylamine	334	32.064	ug/kg
EPA 8270D	Solids/Soil	621-64-7	n-Nitrosodi-n-propylamine	167	25.7848	ug/kg
EPA 8270D	Solids/Soil	59-50-7	P-Chloro-M-Cresol	167	24.883	ug/kg
EPA 8270D	Solids/Soil	87-86-5	Pentachlorophenol	133.6	36.74	ug/kg
EPA 8270D	Solids/Soil	85-01-8	Phenanthrene	100.2	20.3072	ug/kg
EPA 8270D	Solids/Soil	108-95-2	Phenol	167	25.217	ug/kg
EPA 8270D	Solids/Soil	129-00-0	Pyrene	100.2	16.5998	ug/kg

ATTACHMENT C

LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS

Method	Matrix	CAS Number	Analyte	RL	MDL	Units
Total Metals						
EPA 6010C	Solids/Soil	7429-90-5	Aluminum, Total	4	1.08	mg/kg
EPA 6010C	Solids/Soil	7440-36-0	Antimony, Total	2	0.152	mg/kg
EPA 6010C	Solids/Soil	7440-38-2	Arsenic, Total	0.4	0.0832	mg/kg
EPA 6010C	Solids/Soil	7440-39-3	Barium, Total	0.4	0.0696	mg/kg
EPA 6010C	Solids/Soil	7440-41-7	Beryllium, Total	0.2	0.0132	mg/kg
EPA 6010C	Solids/Soil	7440-43-9	Cadmium, Total	0.4	0.0392	mg/kg
EPA 6010C	Solids/Soil	7440-70-2	Calcium, Total	4	1.4	mg/kg
EPA 7196A	Solids/Soil	18540-29-9	Chromium, Hexavalent	0.8	0.16	mg/kg
EPA 6010C	Solids/Soil	7440-47-3	Chromium, Total	0.4	0.0384	mg/kg
EPA 6010C	Solids/Soil	7440-48-4	Cobalt, Total	0.8	0.0664	mg/kg
EPA 6010C	Solids/Soil	7440-50-8	Copper, Total	0.4	0.1032	mg/kg
EPA 9010C/9012A	Solids/Soil	57-12-5	Cyanide, Total	1	0.166	mg/kg
EPA 6010C	Solids/Soil	7439-89-6	Iron, Total	2	0.3612	mg/kg
EPA 6010C	Solids/Soil	7439-92-1	Lead, Total	2	0.1072	mg/kg
EPA 6010C	Solids/Soil	7439-95-4	Magnesium, Total	4	0.616	mg/kg
EPA 6010C	Solids/Soil	7439-96-5	Manganese, Total	0.4	0.0636	mg/kg
EPA 7471B	Solids/Soil	7439-97-6	Mercury, Total	0.08	0.016896	mg/kg
EPA 6010C	Solids/Soil	7440-02-0	Nickel, Total	1	0.0968	mg/kg
EPA 6010C	Solids/Soil	7440-09-7	Potassium, Total	100	5.76	mg/kg
EPA 6010C	Solids/Soil	7782-49-2	Selenium, Total	0.8	0.1032	mg/kg
EPA 6010C	Solids/Soil	7440-22-4	Silver, Total	0.4	0.1132	mg/kg
EPA 6010C	Solids/Soil	7440-23-5	Sodium, Total	80	1.26	mg/kg
EPA 6010C	Solids/Soil	7440-28-0	Thallium, Total	0.8	0.126	mg/kg
EPA 6010C	Solids/Soil	7440-62-2	Vanadium, Total	0.4	0.0812	mg/kg
EPA 6010C	Solids/Soil	7440-66-6	Zinc, Total	2	0.1172	mg/kg
Polychlorinated Biphenyls						
EPA 8082A	Solids/Soil	12674-11-2	Aroclor 1016	33.5	2.6465	ug/kg
EPA 8082A	Solids/Soil	11104-28-2	Aroclor 1221	33.5	3.0887	ug/kg
EPA 8082A	Solids/Soil	11141-16-5	Aroclor 1232	33.5	3.9262	ug/kg
EPA 8082A	Solids/Soil	53469-21-9	Aroclor 1242	33.5	4.1004	ug/kg
EPA 8082A	Solids/Soil	12672-29-6	Aroclor 1248	33.5	2.8274	ug/kg
EPA 8082A	Solids/Soil	11097-69-1	Aroclor 1254	33.5	2.7537	ug/kg
EPA 8082A	Solids/Soil	11096-82-5	Aroclor 1260	33.5	2.5527	ug/kg
EPA 8082A	Solids/Soil	37324-23-5	Aroclor 1262	33.5	1.6616	ug/kg
EPA 8082A	Solids/Soil	11100-14-4	Aroclor 1268	33.5	4.8575	ug/kg
EPA 8082A	Solids/Soil	1336-36-3	PCBs, Total	33.5	1.6616	ug/kg
Pesticides						
EPA 8081B	Solids/Soil	72-54-8	4,4'-DDD	0.007992	0.00285	mg/kg
EPA 8081B	Solids/Soil	72-55-9	4,4'-DDE	0.007992	0.001848	mg/kg
EPA 8081B	Solids/Soil	50-29-3	4,4'-DDT	0.014985	0.006427	mg/kg
EPA 8081B	Solids/Soil	309-00-2	Aldrin	0.007992	0.002814	mg/kg
EPA 8081B	Solids/Soil	319-84-6	Alpha-BHC	0.00333	0.000946	mg/kg
EPA 8081B	Solids/Soil	319-85-7	Beta-BHC	0.007992	0.00303	mg/kg
EPA 8081B	Solids/Soil	57-74-9	Chlordane	0.064935	0.026474	mg/kg
EPA 8081B	Solids/Soil	5103-71-9	cis-Chlordane	0.00999	0.002784	mg/kg
EPA 8081B	Solids/Soil	319-86-8	Delta-BHC	0.007992	0.001565	mg/kg
EPA 8081B	Solids/Soil	60-57-1	Dieldrin	0.004995	0.002498	mg/kg
EPA 8081B	Solids/Soil	959-98-8	Endosulfan I	0.007992	0.001888	mg/kg
EPA 8081B	Solids/Soil	33213-65-9	Endosulfan II	0.007992	0.002671	mg/kg
EPA 8081B	Solids/Soil	1031-07-8	Endosulfan sulfate	0.00333	0.001522	mg/kg
EPA 8081B	Solids/Soil	72-20-8	Endrin	0.00333	0.001365	mg/kg
EPA 8081B	Solids/Soil	7421-93-4	Endrin aldehyde	0.00999	0.003497	mg/kg
EPA 8081B	Solids/Soil	53494-70-5	Endrin ketone	0.007992	0.002058	mg/kg
EPA 8081B	Solids/Soil	76-44-8	Heptachlor	0.003996	0.001792	mg/kg
EPA 8081B	Solids/Soil	1024-57-3	Heptachlor epoxide	0.014985	0.004496	mg/kg
EPA 8081B	Solids/Soil	58-89-9	Lindane	0.00333	0.001489	mg/kg
EPA 8081B	Solids/Soil	72-43-5	Methoxychlor	0.014985	0.004662	mg/kg
EPA 8081B	Solids/Soil	8001-35-2	Toxaphene	0.14985	0.041958	mg/kg
EPA 8081B	Solids/Soil	5103-74-2	trans-Chlordane	0.00999	0.002637	mg/kg
Herbicides						
EPA 8151A	Solids/Soil	94-75-7	2,4-D	166.5	10.4895	ug/kg
EPA 8151A	Solids/Soil	93-76-5	2,4,5-T	166.5	5.1615	ug/kg
EPA 8151A	Solids/Soil	93-72-1	2,4,5-TP (Silvex)	166.5	4.4289	ug/kg

ATTACHMENT D

ANALYTICAL METHODS/QUALITY ASSURANCE SUMMARY TABLE

ATTACHMENT D

ANALYTICAL METHODS/QUALITY ASSURANCE SUMMARY TABLE

Matrix Type	Field Parameters	Laboratory Parameters	Analytical Methods	Sample Preservation	Sample Container Volume and Type	Sample Hold Time	Field Duplicate Samples	Equipment Blank Samples	Trip Blank Samples	Ambient Air Samples	MS/MSD Samples
Soil	Total VOCs via PID	Part 375 + TCL VOCs + 10 TICs	EPA 8260C	Cool to 4°C	Two 40-ml VOC vials with 5ml H_2O, one with MeOH or 3 Encore Samplers (separate container for % solids)	14 days	1 per 20 samples (minimum 1)	1 per 20 samples (minimum 1)	1 per shipment of VOC samples	NA	1 per 20 samples
		Part 375 + TCL SVOCs + 20 TICs	EPA 8270D	Cool to 4°C	4 oz. amber glass jar	14 days extract, 40 days after extraction to analysis					
		Part 375 + TAL Metals	EPA 6010C, EPA 7470A, EPA 7196A, EPA 9014/9010C	Cool to 4°C	2 oz. amber glass jar	6 months, except mercury 28 days					
		Part 375 + TCL Pesticides	EPA 8081B	Cool to 4°C	4 oz. amber glass jar	14 days extract, 40 days after extraction to analysis					
		Part 375 + TCL Herbicides	EPA 8151A	Cool to 4°C	4 oz. amber glass jar	14 days extract					
		Part 375 + TCL PCBs	EPA 8082A	Cool to 4°C	4 oz. amber glass jar	14 days extract, 40 days after extraction to analysis					
		Grain Size	ASTM SM2540G	N/A	Quart Ziplock Bag	N/A	N/A	N/A	N/A	N/A	N/A
		Total Organic Carbon	EPA 9060, Lloyd Kahn (LK) Method	Cool to 4°C	4 oz. glass jar	28 days (EPA 9060); 14 days (LK)	N/A	N/A	N/A	N/A	N/A
		Sulfate (SO_4^{3-})	EPA 9038	Cool to 4°C	4 oz. glass jar	28 days to extract	N/A	N/A	N/A	N/A	N/A
		Nitrate (NO_3^{1-})	SM4500NO_3-F	Cool to 4°C	4 oz. amber glass jar	28 days	N/A	N/A	N/A	N/A	N/A
Product	N/A	Petrleum Hydrocarbon Identification (PHI)	EPA 8015D	Cool to 4°C	4 oz. amber glass jar	14 days extract, 40 days after extraction to analysis	N/A	N/A	N/A	N/A	N/A

Notes:
1. PID - Photoionization Detector
2. VOC - Volatile organic compound
3. PCB - Polychlorinated Biphenyl
4. EPA - Environmental Protection Agency
5. TCL - Target compound list
6. TAL - Target analyte list

ATTACHMENT E

SAMPLE NOMENCLATURE

SOP #1 - SAMPLE NOMENCLATURE

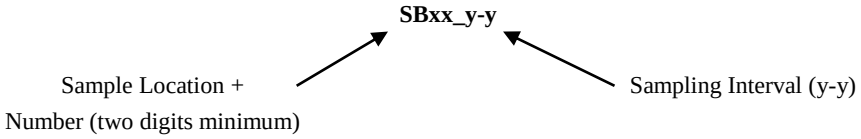
1.0 SAMPLE INVESTIGATION CODES

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

2.0 SAMPLE NOMENCLATURE

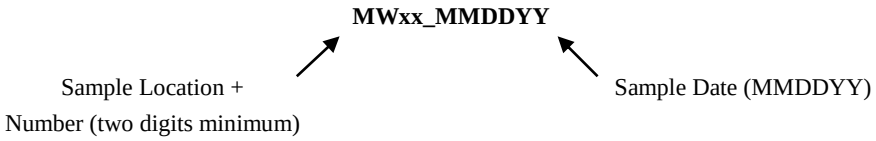
Each sample at a site must have a unique sample ID. Below are recommendations for many popular sample types. Revisions to these recommendations may be required to address specialty matrices, site specific requirements, or agency/client reporting requirements.

Soil and Sediment Samples



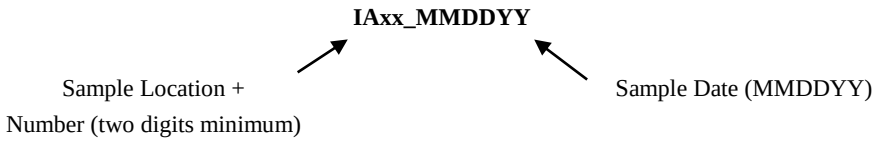
Sample Type	Sample Location	Sample Depth (feet bgs)	Sample Name
Phase II/Remedial Investigation			
Grab	SB01	2 to 4	**SB01_2-4**
	SB02	4	**SB02_4**
Waste Characterization			
Grab	WC01	2 to 4	**WC01_2-4**
	WC02	4	**WC02_4**
Composite	WC01 + WC02	0 to 10	**COMP01_0-10**
Endpoint Sampling			
Grab	EPSW01_N	5	**EPSW01_N_5**
	EPSW01_S	5	**EPSW01_S_5**
	EPSW01_E	5	**EPSW01_E_5**
	EPSW01_W	5	**EPSW01_W_5**
	EPB01	6	**EPB01_6**

Groundwater and Surface Water Samples



Sample Type	Sample Location	Sample Date	Sample Name
Groundwater Sample	MW01	02/21/2013	**MW01_022113**
Surface Water Sample	SW01	02/21/2013	**SW01_022113**

Vapor Investigation Samples



Sample Type	Sample Location	Sample Date	Sample Name
Air Sample	IA01	02/21/2013	**IA01_022113**
Soil Vapor Sample	SV01	02/21/2013	**SV01_022113**
Vapor Extraction Well Sample	SVE01 (Inlet/Midpoint/Outlet)	02/21/2013	**SVE01_IN_022113** **SVE01_ MID_022113** **SVE01_ OUT_022113**

Duplicate Samples

Sample Type	Parent Sample Code	Date	Sample Name
Groundwater Duplicate Sample (DUP)	MW01_022113	02/21/2013	**DUP01_022113**

Field Blanks and Trip Blanks

Sample Type	Date	Sample Name
Field Blank (FB)	02/21/2013	**FB01_022113**
Trip Blank (TB)	02/21/2013	**TB01_022113**

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Sample Type	Sample Location	Parent Sample Name	Sample Name
Matrix Spike (MS)	SB01	SB01_2-4	**SB01_2-4_MS**
Matrix Spike Duplicate (MSD)	SB01	SB01_2-4	**SB01_2-4_MSD**

3.0 NOTES

1. The sample location code should not exceed 20 characters and the sample name should not exceed 40 characters.
2. Sample location code (**SB01, MW01, etc.)** is a sequential number (starting with 01) and should be a minimum of two digits.
3. Sample Interval (SB01_**0-5**) is separated from the sample location code with an underscore, and the top and bottom interval with a dash. Soil and sediment sample intervals should always be in feet. Soil and sediment sample intervals should contain no "/" or "(", ")" or units (e.g., ft, in, etc).
4. Sample date (MW01_**022113**) is separated from the sample location code with an underscore and should be

provided in MMDDYY format [the date should contain no "/" or "-"].

5. If groundwater samples are collected from multiple intervals within one well, you may assign a letter designation (in lower case) to the well ID to differentiate between intervals (i.e., MW01a_022113, MW01b_022113, and MW01c_022113). The letter "a" would indicate the shallowest interval and "c" the deepest. The actual depth intervals should be documented in the project field book or field sheets and the letter designations should be used consistently between sampling events.
6. According to USEPA's Contract Laboratory Program (CLP) Guidance for Field Samplers (January 2011), field duplicate samples should remain "blind" to the laboratory (i.e., they should have separate CLP Sample numbers). Assign two separate (unique) CLP sample numbers (i.e., one number to the field sample and one to the duplicate). Submit blind to the laboratory.

(http://www.epa.gov/superfund/programs/clp/download/sampler/CLPSamp-01-2011.pdf)