Interim Remedial Measure Work Plan

Sendero Verde Redevelopment Project-Parcel B
Block 1617 Lots 20, 125 and 140
New York, New York
NYSDEC BCP Site No. C231128

June 14, 2019

Prepared for:

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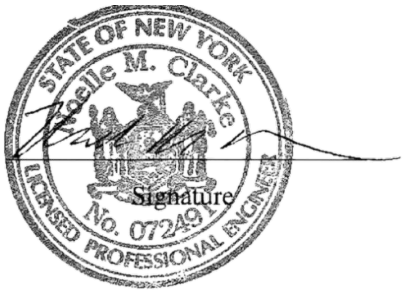
Certification

I, Noelle Clarke, certify that I am currently a NYS registered professional engineer and that this Interim Remedial Measure (IRM) 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) and the BCP Agreement for the Site.



Noelle Clarke, P.E.	June 14, 2019
NYS Professional Engineer #072491	Date

Signature

1. Introduction

Roux Environmental Engineering and Geology, D.P.C. (Roux), on behalf of SV-B Owners LLC (the Volunteer), has prepared this Interim Remedial Measure (IRM) Work Plan (IRM WP) for the Sendero Verde Redevelopment Project – Parcel B (Site). The Site is bounded by Park and Madison Avenues and East 111th Street and East 112th Street, occupying Tax Block 1617, Lots 20, 125 and 140, in the Borough of Manhattan, City and State of New York (Figure 1). It is noted that the tax lot configuration of the Site has changed several times since 2018, as discussed below. As a note, a Brownfield Cleanup Agreement (BCA) amendment is in the process of being filed to address the lot changes that occurred since the BCA was executed. However, all work described in this IRM WP will occur on the current Lot 20, which comprised the majority of the former Lot 20 described in the BCA. No work will be performed on the proposed community gardens (Lots 125 and 140) that were subdivided in 2019. The Site address is collectively referred to as 75 East 111th Street and 60 East 112th Street, New York, New York.

The Site is located in the East Harlem section of Manhattan and is currently vacant. Most recent uses of the Site include a baseball field with community gardens on the eastern and southwestern Site perimeters. The community gardens were vacated in February 2018. There are no permanent structures on the Site. The current Site conditions are shown on Figure 2. The Site encompasses an area of approximately 1.36 acres and is being investigated and will be remediated under the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP). The planned redevelopment of the Site includes the construction of Building B-North, which will consist of a 15-story building with a footprint of approximately 21,364 square feet; most of the of the community facility space will be held within Building B-North. Building B-South will consist of a ten-story building with a footprint of approximately 9,960 square feet. The buildings will be interconnected with a raised courtyard, which will be built over the Building B-North community facility space located in the cellar of Building B-North. Upon construction completion, the aforementioned community gardens will be relocated and reincorporated into the project on the southwest and southeast corners of the Site.

SV-B Owners LLC initially submitted a NYSDEC BCP application on November 28, 2018, as a Volunteer and resubmitted the final application on December 19, 2018 to address NYSDEC comments. A Brownfield Cleanup Agreement (BCA) was executed on February 27, 2019 and BCP Site number C231128 has been assigned to the Site as a volunteer. Application of Restricted Residential use soil cleanup objectives (RRSCOs) as defined in 6 New York Codes, Rules, and Regulations (NYCRR) Part 375-6-8(b) Environmental Remediation Programs are proposed for the Site.

This IRMWP has been prepared in accordance with NYSDEC procedures set forth in the document titled DER 10 Technical Guidance for Site Investigation and Remediation, dated May 2010, and complies with all applicable Federal, State and local laws, regulations and requirements.

1.1 Objectives and Scope of the IRM Work Plan

The proposed Support of Excavation (SOE) IRM outlines the soil handling and disposal procedures resulting from the installation of the SOE for the new building foundation around the perimeter of the Site and the footprints of the proposed Site buildings. Prior to commencing installation of the SOE, preparation activities will occur, including the grading and leveling of the Site for materials staging.

A Community Air Monitoring Plan (CAMP) and Health and Safety Plan (HASP) provided herein will apply to all of the work covered under this IRM. A separate Remedial Investigation Report (RIR) /Remedial Action Work Plan (RAWP) [RIR/RAWP] documenting the proposed site-wide remediation will be submitted to NYSDEC following completion of the Remedial Investigation Report for fieldwork that was completed in April 2019. The RI results are pending.

This IRM covers the SOE installation and related grading and soil excavation, and the separate RAWP will address the future mass excavation and foundation construction.

Though the goal will be to direct load soil for off-Site disposal, it is possible that contaminated soil generated while completing the SOE installation may be stockpiled on-Site for two weeks or less prior to transport and disposal in accordance with the soil and materials management procedures contained within this document.

A Site Plan including the location of the SOE is presented in Figure 2. The IRM is a component of the overall remedy for the Site. This will advance the BCP goals but will not constitute the complete remediation of the Site.

The remainder of this IRM Work Plan is organized as follows:

- Section 2: Site Background
- Section 3: Scope of Work
- Section 4: Soils/Materials Management Plan
- Section 5: Reporting
- Section 6: IRM Work Plan Implementation Schedule

2. Background

This section provides pertinent background information, including a description of the Site and its setting, the history of the Site, and the results of previous environmental work conducted at the Site.

2.1 Site Description and Setting

A Site location map is included as Figure 1.

Property Location	
Property Name:	Sendero Verde Redevelopment Project – Parcel B
Property Address:	75 East 111th Street and 60 East 112th Street, New York, New York 10029
Property Town, County, State:	East Harlem, New York, NY
Property Tax Identification:	Tax Block 1617, Lots 20, 125 and 140 (as a note, a BCA amendment is in the process of being filed to address the lot changes that occurred since the BCA was executed). The original Lot 20 (the entire block 1617 minus lots 21 and 34) was separated into four lots (20, 120, 125 and 140) in 2019. All work to be conducted as part of this IRM will occur on current Lot 20.
Property Topographic Quadrangle:	USGS – Central Park Quadrangle
Nearest Intersection:	The Site is bounded by Park and Madison Avenues and East 111th Street and East 112th Street.
Area Description:	The Site is currently open vacant space. Most recently, the Site was occupied by a baseball field with community gardens surrounding the eastern and southwestern Site perimeter. The Site is located in a mixed-use area of East Harlem, Manhattan, New York. There are multiple high-rise residential buildings to the north; to the west, beyond Lots 21 and 120 and Madison Avenue, is a residential building; to the south are multiple mixed use commercial and residential high-rise buildings; to the east is Park Avenue and the elevated Metro North Railroad Tracks beyond which is a playground belonging to a public school.

Property Information	
Property Acreage:	Approximately 1.36 acres
Property Shape:	Irregular
Property Use:	Tax Lot 20 contains vacant space that was formerly used as a baseball field. Community gardens surrounding the southeastern (current Lot 140) and southwestern (current lot 140) Site perimeter.
Improvements:	None currently.

Information regarding elevation, regional groundwater flow direction(s), Federal United States Geological Survey (USGS) well information, Federal Reporting Data System (FRDS) Public Water Supply system information, and state database well information was derived from an Environmental Data Resources, Inc.

(EDR) GeoCheck® Report that was included as part of the March 2018 Phase I Environmental Site Assessment (ESA) prepared by Roux. As a note, the Roux Phase I ESA was completed before the current tax lot changes were implemented and, therefore, included land that is not part of the proposed BCP Site.

2.1.1 Property Operations

The Site is currently a vacant lot and is currently owned by the City of New York, care of New York City Housing Preservation and Development located at 100 Gold Street in New York, New York. The contact for the Site operator is to be determined. The Volunteer (SV-B Owners LLC) is conducting the investigation/remediation of the Site as a Volunteer in the BCP. A closing on the Site is planned for June 2019, after which the Volunteer will become the Owner.

2.1.2 Utilities

Based on observations made during the Site reconnaissance and the Roux 2018 Phase II ESA, no utilities appear to be in current use at the subject property due to lack of permanent structures. Prior to conducting any excavation on the site, a utility mark-out will be completed.

2.1.3 Topography

The grade at the Site is relatively flat, as shown in the USGS 7.5-Minute Series Topographic Map – Central Park Quadrangle. The elevation of the Site and surrounding area is approximately 18 feet above mean sea level (msl).

2.1.4 Wetland Areas and Surface Water Bodies

According to the EDR report, the Site is not located in, or adjacent to, regulated wetlands. A portion of the Site is located in the 500-year flood zone. The nearest water body is the Harlem River, which is located approximately 0.65 miles to the southeast of the Site.

2.1.5 Soil

Based on the investigations completed on-Site to date, the shallow deposits at the Site are typical of fill material found in urban environments and that of which would be found after building demolition. The depth to the bottom of the fill layer extends to between 13 and 15 feet below current grade across the Site. This urban fill material overlies deeper native deposits consisting of mostly medium to coarse sands and gravel with varying amounts of fine sand and clay. Bedrock was not encountered during the Roux Phase II ESA or the recently completed RI.

2.1.6 Underlying Formation

During geotechnical investigations completed by others in 2017 and 2018, the following native strata were observed beneath the urban fill layer:

- Upper sand and silt generally comprised of brown medium to fine sand and silt with varying amounts of gravel with an estimated thickness of 25 feet;
- Varved silt and clay generally comprised of gray-brown varved silt and clay and little to trace amounts of fine sand with an estimated thickness of 40 feet;
- Lower sand and silt generally comprised of gray-brown coarse to fine sand and silt with varying amounts of gravel with an estimated thickness of 25 feet;

- Soft rock generally comprised of gray coarse to fine-grained schist and other multicolored rock that was highly weathered and highly fractured with near vertical fractures and a variable thickness from three to 18 feet; and
- Intermediate to hard sound rock generally comprised of gray coarse to fine-grained schist that was moderately fractured and slightly weathered. Depth to bedrock varied across the Site from 80 to more than 120 feet below grade.

2.1.7 Groundwater

Based on data from the 2018 Roux Phase II ESA and recently completed RI, the average depth to groundwater ranged from 9 to 13 feet below land surface (bls). A formal groundwater flow direction study will be completed as part of the RIR/RAWP. Groundwater flow direction is likely influenced by subsurface utilities, local dewatering projects, bedrock topography, subway tunnels, and other subsurface features. The direction of groundwater flow in the area of the Site is assumed to be southeast toward the Harlem River.

2.1.8 Neighboring Properties

The Site is located in a highly developed urban area of Manhattan consisting primarily of residential and commercial structures. To the north of the Site, beyond East 112th Street, there are multiple high-rise residential buildings. To the south of the Site, beyond East 111th Street, there are several multiple mixed-use commercial and residential high-rise buildings. To the east of the Site, beyond Park Avenue, there are elevated Metro North Railroad Tracks beyond which is a playground belonging to a public school. To the west of the Site, beyond Lots 21 and 120 and Madison Avenue, there is a residential building.

A review of neighboring properties, public thoroughfares, and research of available information regarding the neighboring properties was performed to identify areas of off-Site environmental concern that could potentially adversely impact the Site. As detailed in the environmental database report, an adjacent property to the north/northwest located within close proximity to the Site operated as a dry-cleaning facility in the past. The immediately adjacent property to the south, operated as an auto service station in the past. As detailed in the City Directory, nearby properties also included dental offices and paint shops. These historical operations may have potentially impacted the quality of the subsurface soil, soil vapor, and/or groundwater beneath the Site through on-Site migration of contaminants.

2.2 Environmental Conditions/Results of Previous Environmental Investigations

This section provides an overview of previous environmental-related activities completed at the Site, based on a review of readily available information and the following environmental reports:

- Phase I ESA, prepared by Roux, dated March 2018.
- Phase II ESA, prepared by Roux, dated June 2018.
- Amendment to the Phase II ESA, prepared by Roux, dated November 13, 2018.
- Field observations made during the RI in April 2019. Analytical results are pending.

Based on the 2018 Roux Phase II ESA, the Site (soil, groundwater, and soil gas) appears to have been impacted by polycyclic aromatic hydrocarbons (PAHs), metals, and pesticides originating from prior Site operations most likely associated with historic urban fill. The presence of these contaminants must be remediated for the proposed residential/commercial use. As a result, the NYSDEC BCP will be an

appropriate program to complete investigation and remediation to ensure the redevelopment is protective of the public health and the environment. As part of the NYSDEC BCP, the Site underwent additional investigations to delineate the nature and extent of contaminants pursuant to the Remedial Investigation Work Plan (RIWP), which was submitted to NYSDEC in November 2018 and revised and resubmitted in April 2019. This RIWP was approved by the NYSDEC in a letter dated May 8, 2019. The RI was competed in April 2019 and results are pending.

2.2.1 Geophysical Survey

As part of the Phase II ESA, to identify and locate suspected existing and former USTs and other Site utilities, a geophysical survey was conducted. Beginning on April 11, 2018, Roux's geophysical subcontractor, Naeva Geophysics, Inc., of Congers, New York (Naeva), utilized an electromagnetic metal-detector and ground penetrating radar (GPR) to detect anomalies, collect GPR data profiles, and mark out any detected underground storage tanks (USTs) and other subsurface utilities. Naeva identified one suspected UST and 51 discrete anomalies, which were marked out accordingly. Based on the results of the GPR, an additional soil boring was installed near the suspected UST during the Phase II and hand clearing near the anomaly and another boring were completed during the RI. A UST was not encountered during the field work.

2.2.2 Soil

Beginning on April 30, 2018, Roux's drilling subcontractor, Trinity, used a GeoProbe™ direct push drill rig to advance ten (10) soil borings to depths between ten ft bls and 20 ft bls as part of the Phase II ESA. Soil was field screened for volatile organic compounds (VOCs) using a photoionization detector (PID). All soils were visually inspected for evidence of impacts (e.g., odors, staining, and visible free-product), and the lithology was recorded according to the Unified Soils Classification System (USCS). Soil samples were collected continuously in five-foot increments for geologic logging and visual inspection. Groundwater was encountered from 10 to 13 ft bls during this investigation.

The Roux 2018 Phase II ESA indicates the primary contaminants of concern in soil are PAHs, metals, and pesticides. A total of ten (10) soil borings were completed during the Phase II ESA. At each soil boring, one (1) soil sample was collected from the 0-2' ft bls interval at each boring location (shallow sample). An additional soil sample was collected from the two-foot interval that exhibited the highest PID reading or the two-foot interval directly beneath the proposed maximum excavation depth. If the groundwater table interface was encountered before the proposed maximum excavation depth was reached and there were no signs of impacts, the soil sample was collected from the two-foot interval above the groundwater table interface (deep sample).

A total of 20 soil samples were collected and the laboratory analytical results for soil samples were compared to the NYSDEC Unrestricted Use Soil Cleanup Objectives (UUSCOs) and the NYSDEC Restricted Residential Use Soil Cleanup Objectives (RRSCOs) as presented in NYSDEC Part 375.6. The results of the soil sampling event (exceedances only) are summarized on Plate 1. Results of the laboratory analysis are discussed below:

- No VOCs were detected at a concentration above their respective UUSCOs or RRSCOs.
- One or more semivolatile organic compounds (SVOCs), including benzo(a)anthracene (maximum of 6,000 micrograms per kilogram [µg/kg] at SB-5, 0-2 ft bls), benzo(a)pyrene (maximum 6,200 µg/kg at SB-5, 0-2 ft bls), benzo(b)fluoranthene (maximum of 10,000 µg/kg at SB-5, 0-2 ft bls), chrysene (maximum of 7,200 µg/kg at SB-5, 0-2 ft bls), dibenzo(a,h)anthracene (maximum of 1,000 µg/kg at

SB-5, 0-2 ft bls) and indeno(1,2,3-c,d)pyrene (maximum of 5,100 µg/kg at SB-5, 0-2 ft bls), were detected at relatively low concentrations slightly above their respective UUSCOs and RRSCOs in shallow samples from six soil borings (SB-1, SB-4, SB-5, SB-6, SB-10, and SB-12) and deep samples from two soil borings (SB-1, SB-4). It should be noted that the UUSCOs and the RRSCOs for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene and indeno(1,2,3-c,d)pyrene are the same value (1,000 ug/kg).

- One or more metals, including arsenic (maximum of 29.5 milligrams per kilogram [mg/kg] at SB-11, 8-10 ft bls), barium (maximum of 564 mg/kg at SB-6, 0-2 ft bls), copper (maximum of 5,060 mg/kg at SB-1, 0-2 ft bls) and lead (maximum of 820 mg/kg at SB-1, 12-14 ft bls), were detected at concentrations above their respective UUSCOs and RRSCOs in shallow samples from nine soil borings (SB-1, SB-4, SB-5, SB-6, SB-7, SB-8, SB-10, SB-11, SB-12) and in deep samples from three soil borings (SB-1, SB-4 and SB-11). Mercury (maximum of 0.466 mg/kg at SB-4, 0-2 ft bls) exceeded the UUSCO in shallow samples from seven soil borings (SB-1, SB-4, SB-5, SB-6, SB-10, SB-11 and SB-12) and in deep samples from three soil borings (SB-1, SB-4, and SB-11), but not the RRSCO. Zinc (maximum of 777 mg/kg at SB-11, 8-10 ft bls) exceeded the UUSCO in shallow samples from seven soil borings (SB-1, SB-4, SB-5, SB-6, SB-9, SB-10, SB-11, SB-12) and in deep samples from three soil borings (SB-1, SB-4, and SB-11), but not the RRSCO.
- Total polychlorinated biphenyls (PCBs) (maximum 355 µg/kg at SB-1, 0-2 ft bls [estimated value]) were detected above their respective UUSCOs in shallow samples from three (3) soil borings (SB-1, SB-4, and SB-12) and in the deep sample from one soil boring (SB-1).
- One or more pesticides including DDD (maximum of 35.1 µg/kg at SB-12, 0-2 ft bls), DDE (maximum of 471 µg/kg at SB-11, 8-10 ft bls) and DDT (maximum of 1,670 µg/kg at SB-11, 8-10 ft bls) were detected above their respective UUSCOs in shallow samples from all soil borings and in deep samples from three soil borings (SB-1, SB-4 and SB-11). Cis-chlordane (maximum of 315 µg/kg at SB-11, 8-10 ft bls) was detected above its respective UUSCO in the deep sample from one soil boring (SB-11). DDD (maximum of 35.1 µg/kg at SB-12, 0-2 ft bls) was detected above its respective UUSCO in shallow samples from six soil borings (SB-4, SB-5, SB-6, SB-7, SB-10 and SB-12) and in deep samples from three soil borings (SB-1, SB-4, SB-11). Dieldrin was detected above its respective UUSCO in nine shallow samples (maximum of 315 µg/kg at SB-11, 8-10 ft bls [SB-1, SB-3, SB-4, SB-5, SB-6, SB-7, SB-8, SB-9, SB-10 and SB-11]). Dieldrin was detected above its respective RRSCO in the deep sample from one soil boring (SB-11).

2.2.3 Groundwater

Following installation of soil borings, a total of five (5) soil borings were converted to temporary groundwater monitoring wells. The temporary groundwater monitoring wells were constructed of 1-inch polyvinyl chloride (PVC) well screen and riser (the well screen intersected the top of the observed water table).

Following installation, the newly installed temporary groundwater monitoring wells were gauged with an oil-water interface probe and were sampled utilizing low-flow sampling techniques. Groundwater grab samples were filtered in the field for metals, SVOCs, pesticides, and PCBs. Following sampling, the temporary groundwater monitoring wells were removed and the boring location was backfilled with soil cuttings to grade.

Laboratory analytical results for groundwater samples were compared to the NYSDEC Ambient Water Quality Standards and Guidance Values (AWQSGVs). The results of the groundwater sampling event (exceedances only) are summarized on Plate 2. Results of the laboratory analysis are discussed below:

- One VOC, chloroform, was detected above its AWQSGV in all samples (maximum concentration of 39 micrograms per liter [µg/L]). Though the source of the chloroform exceedances cannot be confirmed, the exceedances may be attributed to any leaking plumbing related to the former on-Site

structures, leaking water mains and the watering of the community gardens with potable water that was likely chlorinated.

- In general, SVOC concentrations in the filtered groundwater samples were low to non-detect and were lower in the filtered samples than in the unfiltered samples. This indicates that the SVOCs are primarily due to suspended sediments present in the groundwater samples. Concentrations of all SVOCs in the filtered samples were below their respective AWQSGVs, except Bis(2-ethylhexyl)phthalate, a very common laboratory contaminant. Bis(2-ethylhexyl)phthalate (maximum concentration of 9.4 µg/L) was detected above its AWQSGV in one filtered sample (SB-4).
- In general, metals concentrations in the filtered groundwater samples were low to non-detect and were lower than in the unfiltered samples. This indicates that the metals are primarily due to suspended sediments present in the groundwater samples. Concentrations of all metals in the filtered samples were below their respective AWQSGVs, except sodium. Sodium (maximum concentration of 68,300 µg/L) was detected above its AWQSGVs in three filtered groundwater grab samples (SB-4, SB-5, and SB-10). Sodium is naturally occurring in groundwater.
- No PCBs were detected in the groundwater.
- In general, pesticide concentrations in the filtered groundwater samples were low to non-detect and were lower in the filtered samples than in the unfiltered samples. This indicates that the pesticides are primarily due to suspended sediments present in the groundwater samples. Concentrations of all pesticides in the filtered samples were below their respective AWQSGVs, except dieldrin. Dieldrin (maximum concentration of 0.022 [estimated] µg/L) was detected above its AWQSGVs in three (3) filtered groundwater grab samples (SB-1, SB-4 and SB-10).

2.2.4 Soil Vapor

To evaluate the potential for soil vapor intrusion at the Site, seven (7) temporary soil vapor points were installed and sampled. Following utility clearance procedures, and beginning on April 30, 2018, Trinity installed the temporary soil vapor points utilizing a track mounted Geoprobe™ drill rig. In areas where the proposed building foundations are at a shallow depth, the vapor point was installed at five (5) ft bls. In areas where the proposed building foundations are deeper, the vapor point was installed at one-foot above the groundwater table. Following installation of each temporary soil vapor point, the integrity of each sampling point seal was checked in accordance with New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion. This step was conducted as a quality assurance/quality control measure to verify that the soil vapor sample was not compromised by inadvertent introduction of ambient air into the sample. Soil vapor was purged from the point using an air pump calibrated to approximately 0.2 liters per minute while the sampling point was covered at the surface with a small enclosure that is partially filled with helium. The soil vapor discharging from the air pump and the air within the enclosure was continuously monitored for helium during purging. Samples were collected using batch certified vacuum canisters equipped with laboratory-supplied, two-hour regulators. Samples were analyzed for VOCs via USEPA Method TO-15. All samples were collected in accordance with the NYSDOH guidance.

Several petroleum-related VOCs and one chlorinated VOC (Tetrachloroethylene [PCE]) were detected in soil vapor samples throughout the Site during the Roux 2018 Phase II ESA. The results of the soil vapor sampling event are summarized on Plate 3.

- PCE was detected in four (4) soil vapor samples (SV-3, SV-4, SV-6 and SV-7) at concentrations ranging from 8.68 micrograms per cubic meter (µg/m3) to 48.8 µg/m3.

3. Scope of Work

The scope of work for the IRM consists of the following tasks:

- Obtain all necessary permits, insurance, bonds, and licenses to complete all work and pay all necessary fees for the permits obtained;
- Verification of utility locations;
- Site mobilization and Site preparation;
- Provision for all temporary facilities and utilities;
- Provision for site security measures;
- Setup and maintenance of all traffic control measures;
- Setup and maintenance of decontamination areas, staging areas (if required), stockpile areas, erosion control measures, and dust control measures;
- Construction and maintenance (during construction) of signs and perimeter fencing;
- Off-Site disposal of concrete construction and demolition (C&D) debris present at the Site;
- Installation and testing of driven and drilled soldier piles at the deep excavation areas in portions of the Site with cellars;
- Installation of timber lagging and associated excavation to approximately 12 ft bls to allow for installation of walers;
- Excavation of approximately 5,000 cubic yards (CY) of soil from the northern portion of the Site to a depth of approximately six ft bls (the remaining excavation will occur under the approved RIR/RAWP) to facilitate SOE installation as shown on Figure 2. This volume of soil is less than one third of the total volume to be excavated during the redevelopment/remediation under the RIR/RAWP.
- Off-Site transportation and disposal of excavated soil in accordance with all applicable federal, state and local regulations; and
- Documentation.

Implementation of the IRM will be in accordance with the Soils/Materials Management Plan (SoMP) included in Section 4 of this IRM Work Plan.

3.1 Health and Safety

All construction activities will be performed in a manner consistent with 29 CFR 1910 and 1926. The Site-specific HASP defines that all Site workers conducting ground intrusive activities within the exclusion zone will be required to have 40-hour Hazardous Waste Operation Worker (HAZWOPER) training in accordance with the referenced regulations. This HASP will be used to protect all personnel working on the Site, as well as any site visitors. The HASP will be readily available during the work. During all phases of site work, the various contractors shall monitor site conditions and worker activities and enforce all provisions of the HASP. This will include monitoring for general site conditions and safety hazards, as well as the community air monitoring to be performed by Roux. Specifically, monitoring and safety inspections will be

performed to verify that all requirements of the Occupational Safety and Health Administration as outlined in 29 CFR Parts 1910 and 1926 are adhered to.

3.2 Community Air Monitoring Program

The CAMP is established to provide an added level of health and safety protection for the community surrounding the Site. Roux will be responsible for implementing the CAMP during all intrusive work activities at the Site. General CAMP provisions require continuous air monitoring at the Site's downwind perimeter for VOCs and particulates. Specific CAMP action levels are described in the HASP.

3.3 Quality Assurance/Quality Control

Quality assurance/quality control procedures for all construction activities associated with this IRM will be established in the Construction Quality Assurance Plan (CQAP), which is provided in Appendix A. The CQAP includes resumes for key project personnel.

3.4 Erosion and Sediment Control Measures and Storm Water Management

All necessary measures to temporarily control erosion will be employed and will comply with all specifications and requirements in the New York State Guidelines for Urban Erosion and Sediment Control.

As necessary, hay bales will be placed at locations upgradient of excavation areas to control stormwater runoff and surface water from entering or exiting the excavation. Catch basin inlets immediately adjacent to the work area will be protected to prevent disturbed soil from entering. Construction water will be managed in accordance with the SoMP described in section 4.8.

The Site is exempt from the NYSDEC State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activity (Permit No. GP-0-15-002) requirement as it is solely serviced by combined sewers. As such, a stormwater pollution prevention plan (SWPPP) is not required.

3.5 Mobilization and Site Preparation

A project kick-off meeting will be conducted with NYSDEC, the Volunteer, Roux, the Remedial Engineer, and the selected Contractor prior to the commencement of any intrusive activities. The Contractor will supply any labor (HAZWOPER Certified in accordance with OSHA 1910.120) and materials required for the implementation of the IRM scope of work. In addition, necessary permits, insurance, bonds, and licenses required to complete the work will be obtained and fees necessary to obtain these permits will be paid. Mobilization and Site preparation activities include:

1. Mobilization of equipment and materials.
2. Installation of approved perimeter construction fence.
3. Implementation of traffic control measures.
4. Work zone demarcation.
5. Utility location identification and demarcation.
6. Utility relocation or removal, if necessary.
7. Installation of erosion and sediment control devices, including stabilized construction entrance/exit.
8. Installation of perimeter air monitoring system.

9. Installation of sanitary facility of onsite workers.
10. Installation of temporary facilities.
11. Installation, operation and maintenance of decontamination facilities.
12. Installation and testing of driven and drilled soldier piles at the deep excavation areas.
13. Installation of timber lagging and associated excavation.
14. Excavation of approximately 5,000 CY of soil from the northern portion of the Site to a depth of approximately six ft bls (the remaining excavation will occur under the approved RAWP) to facilitate SOE installation. This volume of soil is less than one third of the total volume to be excavated during the redevelopment/remediation under the proposed RAWP.

The Remedial Engineer will review all Contractor submittals to ensure conformance with this IRM WP and all applicable laws, regulations and policies.

3.6 Test Pile Installation

Test piles will be installed and tested in accordance with the geotechnical specifications. Soil resulting from test pile installation, if any, will be managed in accordance with Section 4.

3.7 Soldier Pile and Lagging Installation and Associated Excavation

Soldier piles will either be driven or drilled as indicated on Figure 2 and in Appendix B. For drilled piles, temporary steel casing will be drilled using traditional drill tooling for removal of overburden soil. Overburden soil will be stockpiled on-Site in accordance with Section 4 for future off-Site disposal. Once soldier piles have been installed, timber lagging will be installed to approximately 12 ft bls. Soil will be excavated as needed to allow for lagging and waler installation. This may include soil stockpiling prior to off-site disposal of an estimated 5,000 CY of soil. This volume of soil is less than one third of the total volume to be excavated during the redevelopment/remediation under the RIR/RAWP. Soil, including spoils, generated during drilling and lagging will be managed in accordance with Section 4.

4. Soil/Materials Management Plan

The following sections provide the SoMP to be implemented during the IRM.

4.1 Soil Screening Methods

Visual, olfactory and photoionization detector (PID) soil screening and assessment will be performed by a qualified environmental professional or experienced field geologist/scientist/engineer under the direction of the Remedial Engineer during excavation/pile driving/pile drilling activities. Resumes will be provided for all personnel responsible for field screening (i.e. those representing the Remedial Engineer) of invasive work for unknown contaminant sources during remediation and development work.

4.2 Stockpile Methods

Though direct loading of excavated soil into disposal vehicles is planned, if necessary, soil excavated from SOE installation and from grading/leveling activities of the Site will be stockpiled on, and covered with, polyethylene sheeting for two weeks or less. Stockpiles will be used only when necessary and will be removed as soon as practicable. While stockpiles are in place, they will be routinely inspected, and before and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by NYSDEC. Excavated soils will be stockpiled on, at minimum, double layers of 6-mil minimum poly-sheeting, will be kept covered at all times (except when material is being added or removed) with appropriately anchored polyethylene sheeting, and will be inspected at a minimum once per week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by NYSDEC. Broken or ripped sheeting will be promptly replaced.

Stockpile activities will be compliant with applicable laws and regulations. Stockpiles of excavated soils and other materials will be located a minimum of 20 feet from the property boundaries, where possible. Hay bales or equivalent will surround soil stockpiles as needed, except for areas where access by equipment is required. Silt fencing and hay bales will be used as needed near catch basins, surface waters and other discharge points.

4.3 Characterization of Excavated Materials

In situ soil waste characterization was performed in April 2019 (the data is pending) and data will be used to determine appropriate receiving facilities. Any soil/fill or other excavated media that has not been characterized will not be transported off-Site for disposal and will be sampled in a manner required by the receiving facility, in compliance with applicable laws and regulations.

4.4 Materials Excavation and Load Out

The Remedial Engineer or a qualified environmental professional under his/her supervision will oversee all invasive work and the excavation and load-out of all excavated material.

The Volunteer and its contractors are solely responsible for safe execution of all invasive and other work performed under this Plan. Support of excavation will be provided based upon Site conditions and local regulations.

The presence of easements on the Site has been investigated by the Remedial Engineer. It has been determined that no risk or impediment to the planned work under this IRM Work Plan is posed by easements on the Site. The presence of utilities within/adjacent to the proposed work area will be investigated prior to the work in order to determine if there are any impediments to the proposed scope of work. NYSDEC will be notified of any changes required to the scope of work based on the presence of utilities.

Loaded vehicles leaving the Site will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and all other applicable transportation requirements).

Loaded outbound trucks will be inspected by Roux and cleaned if necessary before leaving the Site. Vehicles leaving the Site will not be overloaded. The Remedial Engineer's representative will make reasonable efforts to ensure that vehicles are not loaded beyond their NYSDOT weight rating and that all material is secured beneath the truck bed cover.

The Remedial Engineer will be responsible for ensuring that all egress points for truck and equipment transport from the Site will be inspected daily for evidence of off-Site sediment tracking. All egress points for truck and equipment transport from the Site will be clean of dirt and other materials derived from the Site during the implementation of the IRM. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to Site-derived materials.

The Volunteer and associated parties preparing the remedial documents submitted to the State, and parties performing this work, are completely responsible for the safe performance of all invasive work, the structural integrity of excavations, and for structures that may be affected by excavations (such as building foundations and bridge footings).

Mechanical processing of historical fill and contaminated soil on-Site is prohibited.

4.5 Materials Transport Off-Site

All transport of materials will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded.

Truck transport routes are presented on Figure 3. This is the most appropriate route, and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off-Site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport.

Trucks will be prohibited stopping and idling in the neighborhood outside the project Site. Queuing of trucks will be performed on-Site, when possible, in order to minimize off-Site disturbance. Off-Site queuing will be minimized.

Egress points for truck and equipment transport from the Site will be kept clean of dirt and other materials during the IRM implementation.

Material transported by trucks exiting the Site will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used.

4.6 Materials Disposal Off-Site

All soil/fill/solid waste excavated and removed from the site will be disposed of in accordance with regulatory requirements based on the levels of contamination found to be present in waste characterization samples collected.

Disposal location will be established at a later date and will be reported to the NYSDEC Project Manager. The following documentation will be obtained and reported by the Remedial Engineer for each disposal location used in this project to demonstrate and document that the disposal of material derived from the Site conforms with all applicable laws: (1) a letter or facility-specific waste profile/application from the Remedial Engineer to the receiving facility describing the material to be disposed and requesting formal written acceptance of the material. This letter/profile/application will state that material to be disposed is contaminated material generated at an environmental remediation Brownfield Cleanup Program Site in New York State. The letter will provide the project identity and the name and phone number of the Remedial Engineer. The letter will include as an attachment a summary of all chemical data for the material being transported (including Site Characterization data); and (2) a letter from all receiving facilities stating it is in receipt of the correspondence (above) and is approved to accept the material. These documents will be included in the FER.

The Final Engineering Report (FER) will include an accounting of the destination of all material removed from the Site during this IRM. This information will also be presented in a tabular form in the FER.

A Bill of Lading system or equivalent will be used for off-Site movement of non-hazardous wastes and contaminated soils. This information will be reported in the FER.

Hazardous wastes (if any) derived from on-Site will be stored, transported, and disposed of in compliance with applicable local, State, and Federal regulations.

Appropriately licensed haulers will be used for material removed from this Site and will be in compliance with all applicable local, State and Federal regulations.

Any additional waste characterization sampling will be performed for off-Site disposal in a manner suitable to the receiving facility and in conformance with applicable permits. All data available for soil/material to be disposed at a given facility must be submitted to the disposal facility with suitable explanation prior to shipment and receipt.

4.7 Materials Reuse On-Site

No material is anticipated to be reused on-Site during construction activities related to the IRM Work Plan.

4.8 Fluids Management

Generation of water is not anticipated to occur during implementation of the IRM as excavation depths will not require dewatering. In the event that water is generated from the construction activities, all liquids to be

removed from the Site will be handled, transported and disposed in accordance with applicable laws and regulations. Any water generated during implementation of the IRM will be collected and pumped into an on-Site water storage tank(s) where it will be containerized pending characterization and transport for off-Site disposal. The Remedial Engineer or a QEP under his/her supervision will collect and analyze waste characterization samples from the containerized water. Based on the results, Contractor will arrange transport and offsite disposal of all containerized water.

4.9 Backfill from Off-Site Sources

No backfill material is anticipated to be imported to the Site during construction activities related to the IRM.

4.10 Stormwater Pollution Prevention

All necessary measures to temporarily control erosion will be employed and will comply with all requirements of the specifications and the requirements in the New York Guidelines for Urban Erosion and Sediment Control.

As necessary, hay bales will be placed at locations upgradient of excavation areas to control stormwater runoff and surface water from entering or exiting the excavation. Catch basin inlets immediately adjacent to the work area will be protected to prevent disturbed soil from entering. Construction water will be managed in accordance with the SoMP described in section 4.8.

The Site is exempt from the NYSDEC State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activity (Permit No. GP-0-15-002) requirement, as it is solely serviced by combined sewers. As such, a stormwater pollution prevention plan (SWPPP) is not required.

4.11 Contingency Plan

This contingency plan is developed for the remedial construction to address the discovery of unknown structures or contaminated media during implementation of the IRM.

If underground tanks or other previously unidentified contaminant sources are found during on-Site remedial excavation, sampling will be performed on potentially contaminated source material and surrounding soils and reported to NYSDEC. Chemical analytical work will be for full suite of parameters (TCL VOCs, TCL SVOCs, TAL metals, TCL PCBs, pesticides, herbicides and emerging contaminants). These analyses will not be limited to CP-51 parameters where tanks are identified without prior approval by NYSDEC. Analyses will not be otherwise limited without NYSDEC approval.

Identification of unknown or unexpected contaminated media identified by screening during invasive Site work will be promptly communicated by phone to NYSDEC's Project Manager. These findings will be also included in daily and periodic electronic media reports.

4.12 Community Air Monitoring Plan

The CAMP will be implemented during all ground intrusive activities, which includes drilling/SOE installation/excavation. The CAMP will be performed in accordance with the HASP (Appendix C) and will include the real-time monitoring of volatile organic compounds (VOCs) and particulates at the upwind and downwind perimeter of the designated work area. Should monitoring results exceed action levels as noted

in the CAMP, work will be immediately stopped, and efforts will be made to mitigate/eliminate the exceedance.

4.13 Odor, Dust and Nuisance Control Plan

4.13.1 Odor Control Plan

Odor controls will be employed to prevent on- and off-Site odor nuisances. At a minimum, procedures will include: (a) limiting the area of open excavations; (b) shrouding open excavations with tarps and other covers; and (c) use of odor suppressants to cover exposed odorous soils. If nuisance odors develop and cannot otherwise be controlled, additional means to eliminate them will include: (d) direct load-out of soils to trucks for off-Site disposal; and (e) use of chemical odorants in spray or misting systems.

This odor control plan is capable of controlling emissions of nuisance odors. If nuisance odors are identified, the source of odors will be identified and corrected. If necessary, to identify or correct a nuisance odor source, work will be temporarily halted and will not resume until such nuisance odors have been identified and abated. NYSDEC will be notified of all odor complaint events.

4.13.2 Dust Control Plan

Dust control will be implemented while the concrete slabs are removed and until the final remedy has been completed, not only during the IRM period. Techniques implemented to control dust will include, but not be limited to, one or more of the following measures:

- Applying water on the ground surface;
- Misting equipment and excavation faces;
- Spraying water (using atomizer) on buckets during excavation and dumping;
- Use of properly anchored tarps to cover stockpiles;
- Exercising extra care during dry and high-wind periods;
- Hauling materials in covered trucks or containers; and
- Covering excavated areas and material with vapor suppression foam or other suitable cover after excavation activity ceases.

Dust control at the work locations will be performed by the Contractor. Perimeter air monitoring for dust and VOCs will be performed by Roux under the supervision of the Remedial Engineer. The Contractor will maintain all excavations, stockpiles, access roads, and all other work areas to minimize dust, which would cause a hazard or nuisance to others. The Contractor will monitor dust in accordance with the requirements of the Site's HASP. Roux will monitor dust at the Site's perimeter in accordance with the Community Air Monitoring Plan (CAMP) for the Site.

This dust control plan is capable of controlling emissions of dust. If nuisance dust emissions are identified, work will be halted, and the source of dusts will be identified and corrected. Work will not resume until all nuisance dust emissions have been abated. NYSDEC will be notified of all dust complaint events.

4.13.3 Other Nuisances

Noise control will be exercised during the remedial program. All remedial work will conform, at a minimum, to NYC noise control standards.

5. Reporting

5.1 Daily Reporting during Site Activities

Daily activity reports will be maintained by the various contractors for all remedial/construction activities. Roux will manage specific project records to facilitate preparing the Final Engineering Report documenting completion of remediation activities. Reports will include:

- Date;
- Weather;
- Personnel;
- Major equipment on-Site;
- Summary of CAMP findings, including excursions and corrective actions;
- Work activities keyed to a site map; and
- Future work activities.

5.2 Monthly Reports

Monthly reports will be submitted to NYSDEC and NYSDOH Project Managers within one week following the end of the month of the reporting period and will include:

- Activities relative to the Site during the previous reporting period and those anticipated for the next reporting period, including a quantitative presentation of work performed (i.e. tons of material exported and imported, etc.);
- Description of approved activity modifications, including changes of work scope and/or schedule;
- Sampling results received following internal data review and validation, as applicable; and
- An update of the remedial schedule including the percentage of project completion, unresolved delays encountered or anticipated that may affect the future schedule, and efforts made to mitigate such delays.

Photographs will be taken of all remedial activities and submitted to NYSDEC in digital format. Photos will illustrate all remedial program elements and will be of acceptable quality. Representative photos of the Site prior to any Remedial Actions will be provided. Representative photos will be provided of each contaminant source, source area, and Site structures before, during, and after remediation. Photos will be included in the daily reports as needed, and a comprehensive collection of photos will be included in the Final Engineering Report.

Job-site record keeping for all remedial work will be appropriately documented. These records will be maintained on-Site at all times during the project and be available for inspection by NYSDEC and NYSDOH staff.

5.3 Final Engineering Report

Detailed information regarding the IRM (e.g., general description of the construction activities, waste disposal documentation, photos, etc.) will be included in the FER. FER will be certified by the Remedial Engineer,

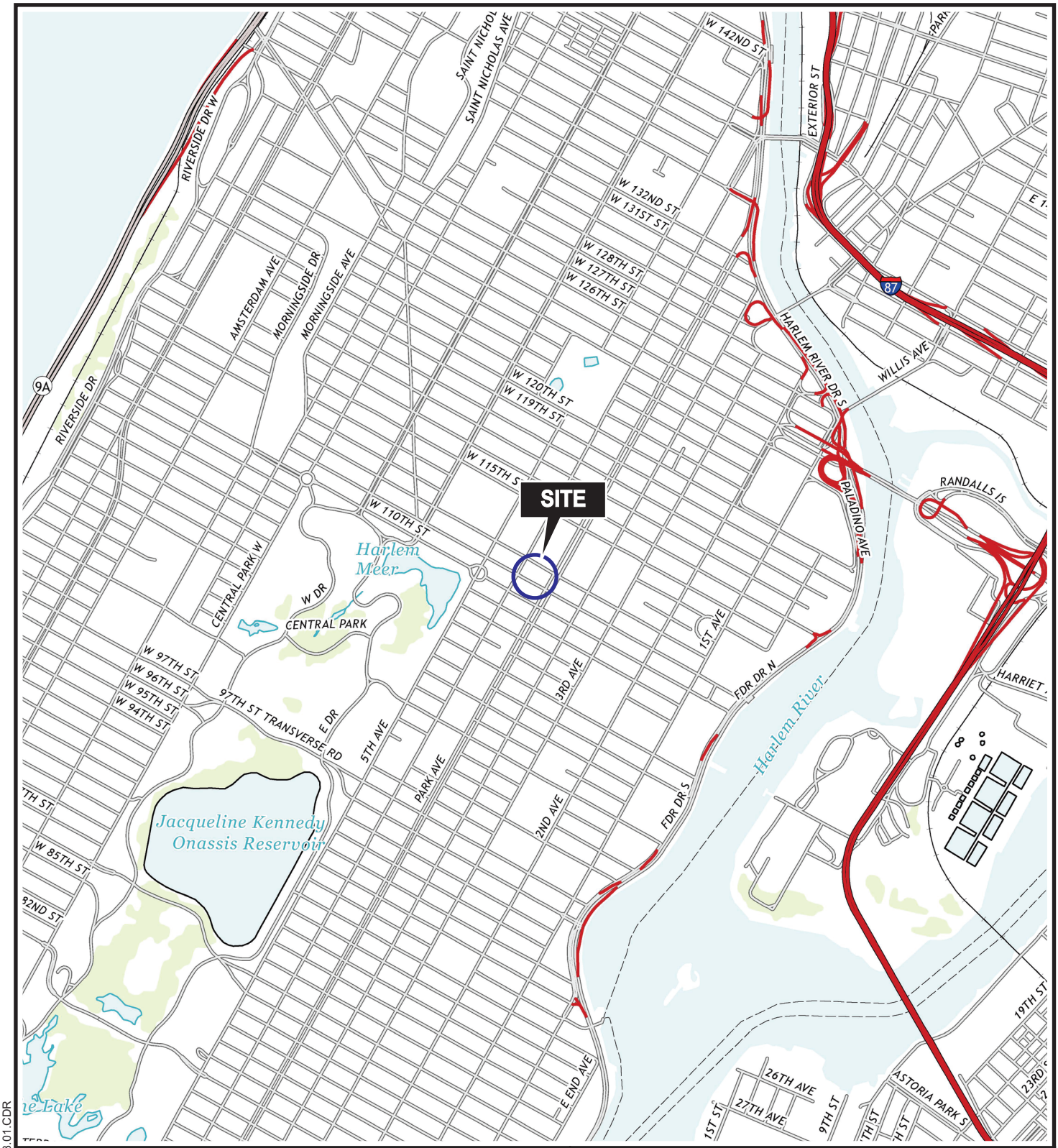
who is a Professional Engineer licensed in the State of New York, that the work was performed in accordance with the approved IRM Work Plan and any approved changes.

6. IRM Implementation Schedule

This IRM Work Plan is anticipated to begin in July 2019 and will require approximately ten weeks to complete.

FIGURES

1. Site Location Map
2. Support of Excavation Plan
3. Truck Routes
4. Proposed Schedule for the IRM



QUADRANGLE LOCATION

SOURCE:
USGS; 2013, Central Park, NY
7.5 Minute Topographic Quadrangle

N

0 2000’

Title:

SITE LOCATION MAP

SENDERO VERDE
REDEVELOPMENT PROJECT - PARCEL B

Prepared for:

SV-B OWNERS LLC

ROUX

Compiled by: D.B.	Date: 15MAY19	FIGURE
Prepared by: G.M.	Scale: AS SHOWN	1
Project Mgr: J.M.	Project: 2984.0003Y000	
File: 2984.0003Y113.01.CDR		

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LEGEND

- LOTS THAT ARE NOT PART OF THE SENDERO VERDE REDEVELOPMENT PROJECT – PARCEL B SITE
- BCP SITE BOUNDARY
- DRILLED SOLDIER PILES
- DRIVEN SOLDIER PILES

N

40’ 0 40’

Title:

SUPPORT OF EXCAVATION PLAN

SENDERO VERDE
REDEVELOPMENT PROJECT - PARCEL B

Prepared for:

SV-B OWNERS LLC

ROUX

Compiled by: D.B.	Date: 15MAY19	FIGURE
Prepared by: G.M.	Scale: AS SHOWN	2
Project Mgr: J.M.	Project: 2984.0003Y000	
File: 2984.0003Y113.02.DWG		

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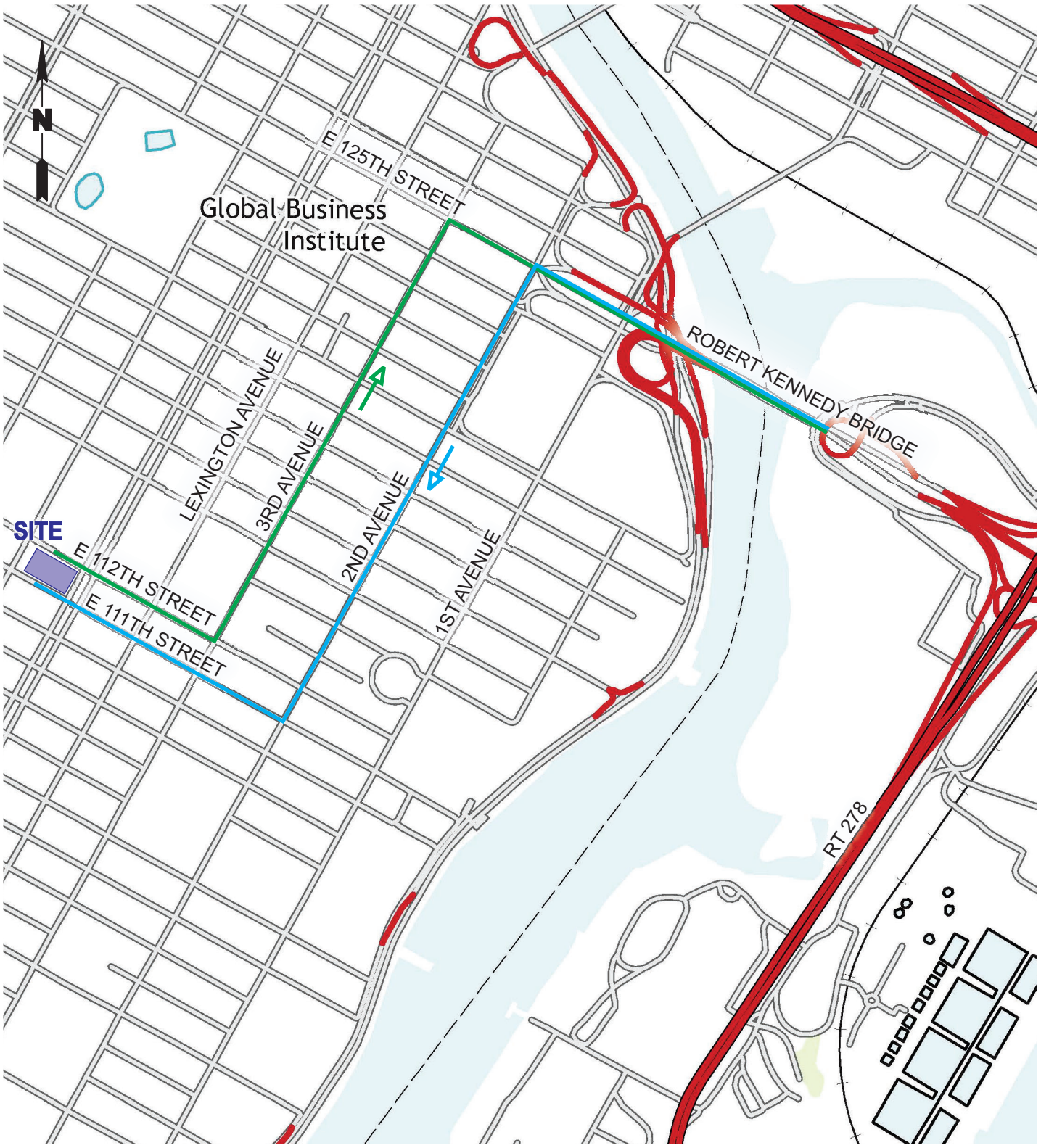

Directions:

From site:
Head south east on E 112th Street
Turn left onto E 125th Street
Take ramp to Robert F. Kennedy Bridge
Continue onto Robert F. Kennedy Bridge and Exit onto I-278

To Site:
From I-278 take Robert F. Kennedy Bridge west
Turn left onto 2nd Avenue
Turn right onto E 111th Street and proceed to Site

0 1000'

Title:

TRUCK ROUTES

SENDERO VERDE
REDEVELOPMENT PROJECT - PARCEL B

Prepared for:

SV-B OWNERS LLC

ROUX

Compiled by: N.C.	Date: 12JUN19	FIGURE
Prepared by: G.M.	Scale: AS SHOWN	3
Project Mgr: N.C.	Project: 2984.0003Y000	
File: 2984.0003Y11.03.CDR		

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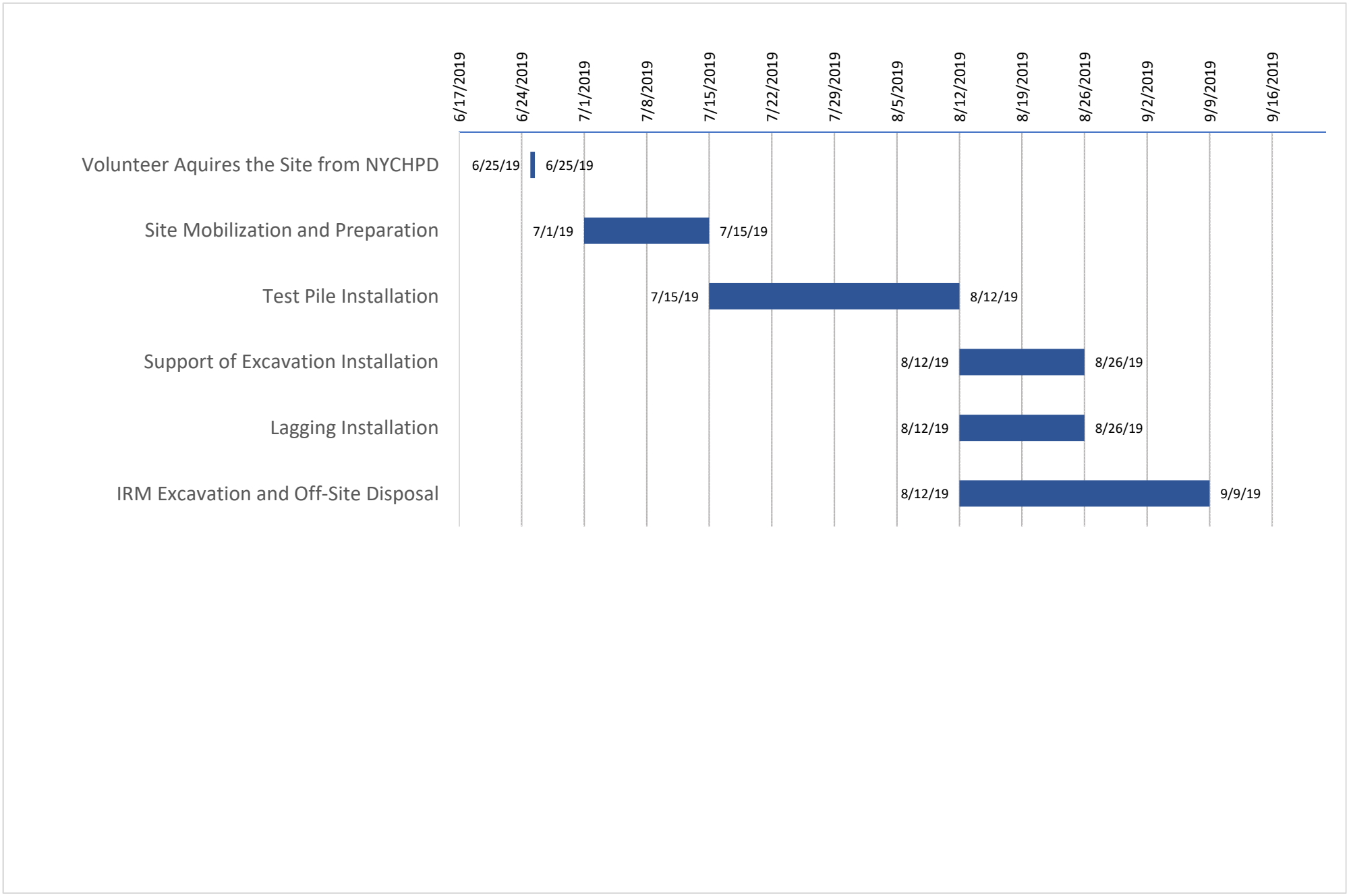
Figure 4. Proposed Schedule for the IRM, Sendero Verde Redevelopment Project - Parcel B



APPENDICES

A. Construction Quality Assurance Plan (CQAP)

B. Support of Excavation Design Drawings

C. Site Specific Health and Safety Plan (HASP)
(*Provided on CD in Bound Copy*)

APPENDIX A

Construction Quality Assurance Plan

Construction Quality Assurance Plan

Sendero Verde Redevelopment Project - Parcel B
Tax Block 1617 of Tax Lots 20, 125 and 140
New York, New York

June 14, 2019

Prepared for:

SV-B Owners LLC
1865 Palmer Avenue
Larchmont, New York 10538

Prepared by:

Roux Environmental Engineering and Geology, D.P.C.
209 Shafter Street
Islandia, New York 11749

2984.0003Y111/CV

Table of Contents

Appendices

1. Introduction

Roux Environmental Engineering and Geology, D.P.C. (Roux), on behalf of SV-B Owners LLC, (the Volunteer), has prepared this Construction Quality Assurance Plan (CQAP) as an appendix to the Interim Remedial Measure Work Plan (IRM WP) for the Sendero Verde Redevelopment Project – Parcel B Site (BCP Number C231128) occupying Tax Block 1617, Lots 20, 125 and 140, New York, New York (Site). The CQAP describes the Site-specific construction quality assurance and control measures that will be performed during remediation and related construction activities that will be implemented at the Site in accordance with the IRM. The CQAP includes a program for construction observation and testing to verify performance of the IRM in accordance with the design specifications. General construction-related Quality Assurance/Quality Control (QA/QC) (e.g., load testing, concrete testing, construction material verification, etc.) will be managed via the overall site development quality control program being implemented by the General Contractor and the Volunteer and is not a component of this CQAP.

In general, the work to be addressed by this CQAP consists of the installation of Support of Excavation (SOE) and management/disposal of excavated soils associated with this task.

2. Organization/ Personnel

The implementation of the IRM will be sequenced based on construction requirements, environmental considerations, and logistic limitations posed by the size of the Site and proximity of adjacent structures. The project team is comprised of the Volunteer (SV-B Owners LLC), contractors, and consultants specializing in one or more critical aspects of the project. It is understood by the project team that close coordination and proper sequencing of all activities occurring on the Site will be crucial to the success of the remediation. The project team and associated responsibilities are discussed below. If changes are made the project team, the CQAP will be amended.

2.1 SV-B Owners LLC - Volunteer

Jessica Yoon, Remediation Oversight and Project Quality Assurance

As Site Volunteer, SV-B Owners LLC's Project Manager for the Site, Jessica Yoon, will coordinate communications with regulatory agencies and will provide general oversight of all aspects of the remediation. Jessica Yoon will be responsible for the review and submission of all documents, reports, correspondence, etc., required by the IRM WP and/or the BCA with the NYSDEC dated February 27, 2019.

SV-B Owners LLC's Project Manager will be responsible for community notifications and addressing concerns with the adjacent property owners and local community on all remediation-related issues and will be immediately notified by the on-Site team of any complaints or concerns regarding the work raised by the adjacent property owners and or the general public.

2.2 L+M Builders Group- General Contractor/ Construction Manager

Matthew Arbeit, Site Superintendent/ Project Quality Control Officer

The General Contractor/ Construction Manager, L+M Builders Group, will be responsible for the quality assurance of all of the tasks being implemented. They will confirm that all components of the Site activities are conducted according to the requirements of the IRM WP. In addition, they will be responsible for verifying that the daily Site construction activities are in compliance with all of the safety requirements and regulations governing the Site activity; however, each subcontractor is responsible for the health and safety of their own personnel.

2.3 Roux Environmental Engineering and Geology, D.P.C., P.C. – IRM and Environmental Monitoring Compliance

Noelle Clarke, P.E. – ***Remedial Engineer/ Quality Assurance Officer***
Joseph Duminuco – ***Principal Hydrogeologist***
Wendy Shen – ***Quality Control Project Manager***
TBD – ***Field Manager***

Roux will coordinate all Site activities being implemented in the IRM WP. Roux will provide continual review of all quality control measures implemented by the contractors to ensure compliance with the Site's remedial objectives and the Site-specific HASP. As such, Roux will provide oversight services for the duration of the IRM activities.

Roux will be responsible for overseeing and documenting the transportation and disposal of contaminated waste and materials generated during the IRM, including:

- fill/soil;
- contamination construction debris;
- personal protective equipment and other miscellaneous debris; and
- construction wastewater.

Roux will implement the Site-specific CAMP. Roux will provide ambient air quality monitoring for VOCs and particulates during all intrusive Site activities. CAMP monitoring data will be reported daily to the SSO and will be maintained on-Site. Action level exceedances will be reported to the SSO, the Volunteer project manager, and appropriate communication and action taken. All CAMP monitoring records will be included in the overall FER that will be submitted to the NYSDEC and NYSDOH and will include all of the CAMP data collected, daily monitoring station location maps, and copies of the action limit reports (if any). If an action limit report is generated due to VOC exceedances, the NYSDEC and NYSDOH will be notified within 24 hours of the exceedance. A brief summary of CAMP activities, including any action limit reports generated, will be provided in the daily report.

All on-Site quality control persons identified in the CQAP will provide daily briefings and/or reports to Roux on-Site personnel, identifying the tasks completed, the remedial measures achieved, and any other issues of concern. Additionally, Ms. Noelle Clarke, the Remedial Engineer, a professional engineer licensed in the State of New York, will be responsible for certifying that the IRM was completed in substantial conformance with the approved IRM WP and/or any NYSDEC-approved field changes. Resumes of key Roux personnel are included in Appendix A.

2.4 TBD – Excavation and Foundation Contractor

Personnel To Be Determined, Construction Quality Control

The Excavation and Foundation Contractor is responsible for the installation of SOE and excavation of portions of the Site to the required depths as described in the IRM WP, coordination with the General Contractor for disposal of the contaminated excavated materials, contaminated construction and demolition debris and all other contaminated wastes generated, transportation and disposal of non-contaminated construction and demolition debris (if any), and decontamination of equipment. The primary environmental obligations of the Excavation and Foundation Contractor include safely managing all excavated materials, preventing the contaminated Site soils from leaving the Site, and decontamination equipment, as necessary.

2.5 Environmental Laboratory

The need for an environmental laboratory is specific to excavated soil waste characterization analysis, end-point sampling and backfill sampling, if any is required during the IRM. Alpha Analytical Laboratories of Westborough, MA and Mansfield, MA, NYSDOH Environmental Laboratory Accreditation Program (ELAP)-certified laboratories (11148 and 11627, respectively) will be utilized for all remediation construction-related analytical requirements. All results will be reported in electronic format deliverables prepared in accordance with NYSDEC requirements. Formal laboratory qualifications and QA/QC information packages for Alpha Analytical and any other analytical laboratories proposed for the project will be submitted to the NYSDEC or disposal facilities, if requested.

2.6 Surveying Firm

A NYS-licensed surveying firm will be contracted by the Volunteer to provide lines, grades, boundaries, benchmarks, topographic surveys, as-built drawings, and any other survey work required for the proper execution and documentation of the work as required by the IRM WP.

2.7 Waste Disposal Facilities

Waste from the Site will be transported to appropriately permitted waste disposal facilities. A supplement to this CQAP will be provided with the names of the facility or facilities, when available. If any is generated, non-impacted construction debris will be transported to a registered construction and demolition disposal facility.

3. Submittals

Submittals will be made to the General Contractor/Construction Manager and Roux in a timely manner for review and approval prior to use. All submittals must be provided electronically. Hard copies may be provided in addition to the electronic deliverables. The following quality control submittals will be required by the identified contractor.

3.1 Waste Transporter and Disposal Facility Qualifications

As required, a qualifications package will be provided by each vendor contracted to transport waste from the Site to the designated soil disposal facilities and each designated disposal facility. The package shall include the following:

- Letters of Commitment from all waste haulers and from all transfer, treatment, storage and disposal facilities to be used for the project. The letters of commitment shall specifically identify the types and quantities of waste that the facility will be able to accept, the permit numbers for all facilities at which the waste will be accepted, and all waste characterization requirements, if additional to waste characterization samples already collected. In the event a facility (such as a privately-owned treatment works) is prohibited from issuing a letter of commitment without a sample of the waste, a conditional-type letter will be acceptable. Such conditional letter shall specifically state what types and quantities of waste(s) the facility will accept.
- Proof of insurance and all current necessary waste transport permits for the waste type(s) being transported.
- For each waste hauler:
    - Name and federal and state identification numbers, as applicable;
    - Address;
    - Name of responsible contact for the hauler;
    - Telephone number for the contact;
    - List of types and sizes of all transport vehicles and equipment to be used;
    - A description of proposed transportation route, method, and procedures for hauling waste material, including type of vehicles that will be used for each type of waste; and
    - Copies of any and all necessary permits and authorizations for each type of waste transported.
- For each transfer, treatment, storage, and disposal facility, the Contractor shall submit the following information:
    - Facility name and federal and state identification numbers;
    - Facility location;
    - Name of responsible contact for the facility;
    - Telephone number for contact;
    - Signed letter of agreement to accept waste;
    - Unit of measure utilized at facility for costing purposes; and
    - Copies of all permits, licenses, letters of approval, and other authorizations to operate, held by the proposed facility as they pertain to receipt, and management of waste derived from this Contract.

4. Construction Quality Control Testing

Implementation of quality control testing and measurement will be performed by the contractors conducting the specific Site tasks. The quality control officers will be responsible for providing documentation of all testing and measurement results to Roux. Roux will be responsible for verifying that all quality control testing has been conducted in compliance with the IRM WP and as specified herein.

Prior to initial quality control testing procedures:

1. Verify the testing procedures are within the manufacturer's recommendations.
2. Verify the facilities' testing equipment are available and comply with testing standards.
3. Check testing instrument calibrations against certified standards.
4. Verify the recording forms, including all the test documentation requirements have been prepared.

Specific task-driven testing/certification obligations as they relate to environmental aspects of the project are as follows:

- A New York State-licensed surveyor will conduct all of the necessary measurements and provide associated documentation to verify the excavation limits are achieved.
- The CAMP requires continuous real-time monitoring of VOCs and particulates during all intrusive Site activities. This monitoring equipment will be inspected periodically throughout each day to check and manually record the concentrations of VOCs and particulates and to ensure the equipment is working properly. The equipment will be repaired, recalibrated, or replaced, as necessary. The periodic measurements will be used to identify any potential risks of off-Site migration. This monitoring data will be collected and logged for review daily by Roux and made available for regulatory agency review. Action Limit Reports will be completed to document any and all action level exceedances, as defined in the CAMP.
- The HASP requires continuous real-time monitoring of VOCs and particulates in the breathing zone of workers that will potentially be exposed to on-Site contaminants during all intrusive Site activities in order to identify and mitigate potential exposure risks to on-Site workers. This monitoring equipment will be inspected periodically throughout each day to ensure that the equipment is working properly. The equipment will be repaired, recalibrated, or replaced, as necessary.
- All testing data will be managed in accordance with the above requirements and will be included in the FER to be prepared by Roux upon completion of all remedial objectives defined in the IRM WP.

5. Project Coordination

During implementation of the IRM, progress meetings/conference calls will be conducted periodically to assess the progress of the work, overall progress to date, quality control requirements, environmental and construction health and safety requirements, and future progress expectations. Those in attendance will include representatives from the Volunteer (as required), Contractor, Roux, and other subcontractors, as necessary. The NYSDEC and NYSDOH will attend the progress meetings at their discretion. This will provide the opportunity for all Site tasks to be integrated and discussed collectively and provide for coordination of all Site activities to maintain the overall construction schedule. Routine task meetings will also be conducted on an as-needed basis to insure proper communication between the contractors, tradesman, and supervisory personnel.

6. Recordkeeping/Reports

The following files will be maintained as part of this IRM:

- document log books;
- drawings;
- specifications;
- addenda;
- contracts;
- written field orders and/or instructions;
- daily activity reports;
- field test records;
- photographs;
- manifest and/or bills of lading;
- safety and accident reports; and
- community air monitoring reports.

Daily activity reports will be maintained by Roux. Daily activity reports will include:

- the date;
- the weather;
- personnel;
- major equipment onsite;
- work activities;
- CAMP exceedances; and
- future work activities.

Comprehensive daily activity reports and other above-referenced forms and documents will be included in the Final Engineering Report.

APPENDIX A

Resumes of Key Roux Personnel

ROUX

PROFESSIONAL PROFILE

Joseph Duminuco, P.G.

Executive Vice President/Principal Hydrogeologist

TECHNICAL SPECIALTIES

Providing environmental consulting services and strategic planning to the real estate industry focused on Brownfield Redevelopment projects. Investigation and remediation of soil, groundwater, and soil vapor at commercial and industrial sites, focusing on the use of innovative solutions.

EXPERIENCE SUMMARY

Thirty-two years of experience: Executive Vice President, Vice President, Practice Area Leader, Office Manager, Principal, Senior, and Project Hydrogeologist at Roux; Staff Hydrogeologist at Geraghty & Miller; and Geologist at Mueser Rutledge Consulting Engineers.

CREDENTIALS

M.S. in Geology, Wright State University, 1990
B.S. in Geology, Hofstra University, 1983
Licensed Professional Geologist, NY (License No. 000119)

EXPERIENCE OVERVIEW

- Principal-in-Charge of multiple dry cleaner remediation project takeovers:
  - Brooklyn, New York – NYSDEC BCP
  - Long Island, New York – NYSDEC BCP
  - Long Island, New York – NYSDEC Inactive Hazardous Waste Site
  - Bernardsville, New Jersey – LSRP Program
  - Enfield, Connecticut – LEP Program

  Sites included a mixed use multifamily affordable housing neighborhood retail complex, a healthcare facility, and retail shopping centers. Impacts included soil, groundwater, vapor, indoor air, and building material contamination from chlorinated VOCs from the former dry cleaner operations. Activities included historical research, re-delineation of contaminant source areas, negotiations with regulatory agencies and remediation including hot spot soil removal, SVE, in situ groundwater treatment, and negative pressure approaches (SSDS) for vapor mitigation in the existing buildings.

- Principal in Charge of multiple NYSDEC BCP/VCP Site Redevelopments:
  - Brooklyn – Former railroad freight yard and dry cleaner solvent distribution plant into mixed use multifamily housing and retail.
  - Brooklyn – Former manufactured gas plant into big box retail.
  - Brooklyn – Mixed use multifamily affordable housing with neighborhood retail complex.
  - Long Island – Former NYSDEC Inactive Hazardous Waste Site into mixed use multifamily housing, retail, hotel, office and community space.
  - Long Island – Former defense contractor manufacturing facility into multifamily waterfront housing.
  - Long Island – Former dry cleaner and auto repair into a healthcare facility.
  - Staten Island – Former gas station into a fast food restaurant.
  - Queens – Former paint and varnish factory into waterfront mixed use multifamily housing, retail and community space.
  - Westchester – Multi-block former auto sales and service, dry cleaner and gas station into mixed use multifamily housing and retail.

  Activities included Pre-Application scoping meetings, agency negotiations, Phase I ESAs, investigation, remedial design and oversight, in-situ waste characterization, CAMP and preparation of: BCP Application; CPP; RIWP; RIR; RAWP; SMP; and FER.

- Principal in Charge of multiple NYCOER/NYCDEP/HPD Site Redevelopments:
  - Bronx – Expansion and renovation of retail center built on former illegal landfill.
  - Bronx – Multi-block redevelopment of former industrial/manufacturing area into mixed use multifamily affordable housing, retail, and community services.
  - Bronx – Redevelopment of an abandoned recreational property into supportive housing.
  - Bronx – Redevelopment of residential and commercial parcels into supportive housing.
  - Brooklyn – Redevelopment of a vacant residential and wooded lot into supportive housing.
  - Manhattan – A full city block redevelopment of former commercial and tenement housing into a mixed use multifamily affordable housing, retail and community services.
  - Manhattan – Expansion and renovation of former auto sales and service center into high-end US auto dealer flagship facility.
  - Manhattan – Former parking lot into mixed use NYC Public School and multifamily luxury tower.
  - Manhattan – The redevelopment of a former garage and auto repair operation and a manufacturing facility on two adjacent lots into a multi-story single-family residence.
  - Queens – Redevelopment of former industrial use parcels on land previously underwater into multifamily affordable housing.

  Activities included Pre-Application scoping meetings, agency negotiations, Phase I ESAs, investigation, remedial design and oversight, in situ waste characterization, CAMP and preparation of: VCP Application; RIWP; RIR; RAP; CHASP: SMP; and Completion Reports.

KEY PROJECTS

- Principal-in-Charge of the 45-acre development of a state of the art sports arena and commercial/retail complex at

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an existing sports venue on Long Island, NY. Responsibilities include: Phase I and Phase II ESAs, EIS support, and Waste Characterization sampling design and implementation.

- Principal-in-Charge of the redevelopment of an entire city block into a mix of public and private open space with community gardens, 655 mixed-income residential units, and community services containing three multi-use buildings in Harlem, NY. The buildings will be certified to Passive House standards. Responsibilities include: Phase I and II ESAs, Remedial Action Plans, waste characterization sampling design, and implementation and reporting to the NYCDEP.
- Principal-in-Charge of the redevelopment of a waterfront Site that will include two high-rise affordable residential towers in Queens, NY. Additionally, the development includes public spaces, including two piers extending into the East River. The Site is being entered into the NYSDEC BCP and is immediately adjacent to the Newtown Creek Federal Superfund Site.
- Principal-in-Charge of the redevelopment of a former garage and auto repair operation and a manufacturing facility on two adjacent lots into a multi-story single-family residence in lower Manhattan, NY. The Site contains an E-Designation and as such is going through the NYCOER VCP. Roux completed a Phase I ESA, an RI, a RAWP, a waste characterization plan, and is providing oversight of waste management, UST removals, and CAMP.
- Principal-in-Charge of a NYSDEC BCP redevelopment of a property adjacent to a dry-cleaning solvent distribution facility in Brooklyn, New York. The Site was a former freight railyard, and offloading spillage on-site and migration from the off-site solvent facility resulted in significant soil, groundwater, and vapor contamination with chlorinated VOCs. The Site was developed into multifamily units with first floor retail use and the remedy consisted of soil hot spot removal, a physical barrier to limit on-site migration, a permeable reactive wall to eliminate off-site migration, hot-spot in situ injections, and a sub-slab depressurization system. The Site contained an E-Designation which was satisfied through the NYCOER simultaneously with the BCP process. Roux was awarded the Big Apple Brownfield Award for Innovation based on our successful cleanup approach.
- Principal-in-Charge of a NYSDEC BCP redevelopment project that also required a RCRA-compliant facility closure. The Site is a former paint factory located in Queens, NY. Historical site operations adversely impacted the subsurface including a LNAPL plume, in addition to petroleum hydrocarbon impacts to the soil and groundwater. Roux completed a RI at the Site which characterized the nature and extent of the impacts. The remedial action included a large excavation that required SOE and was completed under a tent due to odor concerns, multiple ISCO injections, UST removal/abandonment, installation of a LNAPL recovery system, and installation of an SSDS. Additionally, Roux provided oversight of RCRA closure activities at the Site, which included emptying, cleaning, and scrapping 65 ASTs/vessels; decontaminating the ceilings, walls, and floors of the Paint Factory Building; and collection of compliance samples.
- Principal-in-Charge of a NYSDEC VCP redevelopment of a former MGP site into a Big Box retail site in Brooklyn, NY. The project consisted of negotiations with the NYSDEC and Roux limited remediation to former gasholders filled with coal tar, soil hot spots with mobile coal tar, and perimeter containment of coal tar. All the remaining soil at the Site was impacted with MGP waste and most of the Site was underlain by liquid coal tar. Roux negotiated use of institutional/engineering controls to allow significant contamination to remain in place. A sub-slab depressurization system and vapor barrier was installed to address the mobile coal tar left below the retail building.
- Principal-in-Charge for a NYSDEC BCP redevelopment project at a site in White Plains, NY, which consists of 16 separate parcels spanning 4.5 acres and had a variety of former uses including automotive service/repair and multiple dry cleaners. The Site has both chlorinated and petroleum hydrocarbon impacts to the soil and groundwater. The remedy will consist of a site cover system, soil hot spot removals, in situ chemical oxidation for groundwater contamination, and installation of a sub-slab depressurization system.
- Principal-in-Charge for ongoing large and complex mixed use redevelopment of a 92-acre site located in Long Island, NY. The Site was accepted into the NYSDEC BCP. The Site has an extensive environmental history, including former use as a wire and conduit manufacturer (former NYS Inactive Hazardous Waste Site), former landfill (currently a Federal Superfund Site), and town DPW facility. Activities completed included compiling, reviewing, extracting, and summarizing numerous historical environmental reports prepared for the Site; interacting with the NYSDEC, USEPA, and NCDOH; completing a supplemental soil investigation (including extensive use of XRF Technology as metals are the compound of concern); and a groundwater investigation (water is over 100 feet deep). The remedy will likely consist of hot spot removals, a site cover system and a sub-slab depressurization system.
- Principal-in-Charge for a NYSDEC BCP redevelopment in Staten Island, NY of a former retail service station site. There is soil, groundwater, and vapor contamination from petroleum-related constituents in the vicinity of the former gasoline piping and pump island (the petroleum source area), as well as historic fill across the entire Site. The remedy, described in the Remedial Action Work Plan prepared by Roux, will consist of a sheet pile containment wall around the petroleum source area, a Site Cover System across the entire Site comprised of

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concrete building slab/walkways, asphalt parking areas and limited landscaped areas, and site-wide a sub-slab depressurization system to prevent vapor intrusion into the proposed retail building and off-site migration of impacted soil vapor.

- Principal-in-Charge of a mixed-use (public school and residential) Brownfield redevelopment in lower Manhattan, NY. Project consisted of a Phase I and a Phase II ESA to satisfy NYCDEP requirements. Due to the presence of contaminated historic fill, Roux performed in situ waste characterization to assist in the development of NYCDEP-required plans. In addition, Roux provided oversight of the waste removal, completion of waste manifests, and full-time CAMP during all soil moving activities. Roux provided support to the excavation contractor when two previously unknown USTs were discovered during excavation activities.
- Principal-in-Charge of a multi-phased NYSDEC VCP redevelopment of a former Defense Site to water front, upscale housing in Long Island, NY. This investigation included determining the nature and extent of chlorinated VOCs in soil, groundwater, and vapor- phase contamination on-site and off-site. Utilized a risk assessment to argue the level of residual contamination allowed to remain on-site with an intended residential future use. Remedial alternatives were selected in accordance with future development plans and institutional/engineering controls were proposed to limit cleanup costs. Successfully argued the technical impracticability of remediation of the heavily contaminated deeper aquifer beneath the site and off-site.
- Principal-in-Charge of a retail/commercial redevelopment in the Bronx, NY. The Site contained a NYCDEP E-Designation due to a previous on-site service station UST release. In addition, a previous Phase I and Phase II ESA identified a former dry cleaner with a chlorinated VOC release. Roux performed a focused Phase II ESA at the dry cleaner and determined the chlorinated solvent release was not a hazard. Roux obtained closure under the NYSDEC Spills group and the Site was redeveloped with a restaurant, a pharmacy, and reuse of a former supermarket.
- Principal-in-Charge of the redevelopment and expansion of an automobile dealer/service center in New York, NY into the US Flagship dealer for a major European luxury car manufacturer. Supported the client and legal team during lease negotiations. Worked closely with the NYCOER to address NYCDEP "E" designation. Coordination with the NYCOER to implement remedial investigation and develop a Site Materials Management Plan as part of the expansion. Also, worked closely with the NYSDEC to address an on-site spill, as well as coordinate efforts to evaluate whether a 19,000-gallon dielectric fluid release by others impacted the Site.
- Principal-in-Charge for the completion of Phase I and Phase II Environmental Site Assessment activities associated with a proposed mixed use redevelopment located in Westchester, NY waterfront. Work included management of subsurface investigation activities to characterize soil conditions, and working closely with the client's architects and construction contractors to integrate the proposed site remediation into the project development plan (including evaluating multiple potential disposal scenarios). Site contaminants included hydrocarbons (including free-product plume from former USTs) and historic fill constituents.
- Principal-in-Charge of an 80-acre redevelopment in Yonkers, NY. Work included Phase I and Phase II investigations, asbestos surveys and abatement support, and response to a free product impact form an adjacent landowner. Coordinated with the NYSDEC and responsible party to address contamination issue and not impact the client's construction schedule.
- Principal-in-Charge for the redevelopment of a property in Brooklyn, NY into supportive housing. Worked closely with the NYCOER to address the NYCDEP "E" designation. Coordination with the NYCOER to implement remedial investigation and develop RAP/CHASP as part of the NYC VCP.
- Principal-in-Charge for the redevelopment of a property in the Bronx, New York into supportive housing. Worked closely with NYCDEP to address "E" designation. Coordination with NYCDEP to implement remedial investigation and develop RAP/CHASP as part of the redevelopment. Also performed an ASTM VEC to address vapor concerns.
- Principal-in-Charge of a Brownfield Redevelopment for a large vacant parcel (460 acres) on Long Island, NY. The project involved an extensive investigation, UST, and PCB remediation; removal and proper disposal of numerous tanks, drums, abandoned vehicles and transformers; and participation in contentious public meetings. The Site was redeveloped into a golf course and a senior care facility.
- Principal-in-Charge for a property transfer support project at a heavily contaminated (chlorinated volatile organic compounds from an adjacent dry cleaner and on-site MGP waste) distribution facility in the Bronx, NY. The Site was a former MGP being handled under the VCP, in addition to an open petroleum spill under the regional spills group. Roux performed a Phase I for the buyer, a Phase II and remedial cost estimate for the owner, and negotiated with the buyer's consultant and the NYSDEC to limit the scope of the investigation and cleanup.
- Principal-in-Charge of investigation and remediation of a catastrophic heating oil release for a commercial office building in Brooklyn, NY. All work was performed under the oversight of the NYSDEC Spills Group and

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time was of the essence for the initial response as the heating season was fast approaching. Roux performed free product delineation and remediation and indoor air monitoring at adjacent buildings. Site closure was obtained from the NYSDEC.

- Principal-in-Charge of a mixed use (residential, retail, commercial) Brownfield redevelopment in the Bronx, NY. Project consisted of a Phase I and Phase II ESA to satisfy NYCDEP requirements. The media investigated included soil, groundwater, soil vapor, and building materials. During the Phase II ESA, Roux performed preliminary in situ waste characterization.
- Principal-in-Charge of an interior Brownfield Redevelopment of a PCB, metals, and hydrocarbon-contaminated wire manufacturing facility in Westchester County, NY into use as a movie studio. Activities included delineation and characterization of building surfaces, design of a remediation program, and interim cleanups to allow studio use as the project progressed.
- Principal-in-Charge of multiple phases of Brownfield project for construction of a cogeneration facility in Brooklyn, NY. The project consisted of construction oversight; environmental compliance monitoring; asbestos and lead paint abatement oversight; data evaluation and report preparation; soil, offshore sediment, and sewer effluent sampling; PCB-contaminated material remediation; preparation of a waste handling and disposal plan; and permitting.
- Principal-in-Charge of multiple retail developments in Harlem, NY. Work included Phase I and Phase II investigations to satisfy the NYCDEP and lender requirements. Lead-based paint and asbestos surveys were performed as part of due diligence. Extensive asbestos issues were identified in building materials and soil backfill. Worked with asbestos contractors to determine best abatement approaches for the redevelopments.
- Principal-in-Charge of a fast-paced property transfer environmental assessment at an electronics manufacturing facility contaminated with metals and solvents in Bridgeport, CT. The project consisted of the development and implementation of a detailed field sampling plan within a one-week time frame, including indoor and outdoor soil sampling and monitoring well installation; groundwater and sewer effluent sampling; asbestos survey and asbestos sampling; and a tidal influence assessment. Data was evaluated and a summary report was prepared within one week and a remedial alternatives evaluation and cost estimate was prepared in less than one week.
- Principal-in-Charge of a multi-phase RI/FS at a PCB and diesel fuel-contaminated railroad yard in New York City. The Site is on the State Superfund list because PCBs were detected in soil, groundwater, hydrocarbon plume, sewer water, and sewer sediment. Responsibilities included preparation of work plans; delineation of PCB hot spots with immunoassays; sewer investigation including pumpouts, monitoring, flow measurements, and video surveys prior to abandonment; investigation and remediation of numerous USTs including gasoline, solvents, and fuel oils; support of construction activities; report preparation; negotiations with the NYSDEC/NYSDOH; participation in public meetings; and implementation of interim remedial measures to mitigate the PCB-contaminated hydrocarbon plume; interim remedial measures to mitigate PCB, PAH, and lead-contaminated soil hot spots; and agency acceptance of alternate cleanup levels for site soils that resulted in savings of over $80 million.
- Project Coordinator of multi-year environmental consulting contracts with Amtrak and New Jersey Transit. Responsibilities include contract negotiations, workload/resource distribution, compliance with contract requirements including utilization of M/WBE contractors, client-staff liaison, adherence to budgets and schedules, and overall quality assurance.
- Principal-in-Charge of a project to support the construction of a high-speed rail program. Performed Phase I and II Environmental Site Assessments as part of due diligence at three major railyards. Prepared reports and presentations regarding environmental conditions to regulatory agencies and the design-build consortium. Performed pre-construction sampling and hot spot remediation programs. Also, prepared environmental contingency plans for construction contractors to follow.
- Principal-in-Charge of an investigation at a PCB and solvent-contaminated transformer manufacturing/repair facility in North Carolina. Responsibilities included preparation of a work plan and oversight of the project which consists of soil borings and sampling, immunoassay testing, monitoring well installation, groundwater sampling, report preparation, and remedial alternatives evaluation.
- Principal-in-Charge of an NPL Superfund Site in Delaware. Responsibilities include ongoing performance monitoring of a groundwater extraction system. The remedial system was installed to capture a chlorinated solvent plume emanating from a former PVC manufacturing facility. In addition, prepared and implemented an RI work plan for a USEPA-required off-site investigation of adjacent chemical manufacturing facilities and a large petroleum refinery. Also included DNAPL investigation and deep aquifer study.
- Principal-in-Charge of a NJDEP-ECRA/ISRA investigation and cleanup involving groundwater and soil contamination at a pesticide formulation and distribution facility in New Jersey. Responsibilities include delineating the nature and extent of the off-site contaminant plume; determining groundwater flow patterns in a two-aquifer system; using a three-dimensional computer model to

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determine proper location for extraction and injection wells; and preparing work plans and summary reports for NJDEP-required additional delineation of the nature and extent of on-site soil contamination.

- Project Director of all UST investigative and remedial work performed at service station sites in New England for a major oil company. Responsibilities included preparation and negotiation of work orders; coordination of monitoring and sampling; communication with client, regulator, and site owner contacts; management of technical aspects of all projects; strategy evaluation with client; administration of all contracts; and operation and maintenance of remediation systems to mitigate UST releases which included groundwater pump and treat, product recovery, and soil venting systems.
- Project Manager of an RI/FS at a former electronics manufacturing facility in an industrial area of Long Island, NY. Metals and solvents (plating wastes) were detected in on-site leach pools and in soil and groundwater. Responsibilities included reviewing and revising the work plan and providing technical oversight of the project, including Geoprobe® drilling, soil sampling, soil-gas surveys, leach pool sediment sampling, monitoring well installation, groundwater sampling, geophysical mapping, report preparation, and negotiations with the NYSDEC. Convinced the NYSDEC that groundwater remediation was inappropriate in an industrialized area. Focused remediation to a few soil hot spots only.
- Principal-in-Charge of a multi-year quarterly monitoring and reporting program at a municipal landfill complex on Long Island, NY. The complex consists of multiple landfills, leachate containment systems, and leachate holding tanks. The project involves the collection of water level and water quality data from dozens of monitoring wells, sampling of leachate containment systems, coordination with contract laboratory, data validation, data evaluation, and report preparation.
- Provided litigation support for an industrial property owner where a tenant's manufacturing operations had resulted in contamination of the building in addition to soil and groundwater. Without prior notification or consent from the owner, the tenant had conducted a Phase II investigation and remediation activities to address metals and VOCs. Reviewed technical reports and prepared a work plan to address areas for further investigation and perform confirmatory sampling in support of the owner of the property. Provided deposition testimony in connection with the case.

PRESENTATIONS

- Incentives: Programs and Lessons. 2018 Environmental Law Forum – New Jersey State Bar Association; Cape May, NJ; June 2018.
- Environmental Law in Real Estate Transactions – Working with Technical Professionals. Hofstra University Law School; January 13, 2013.
- Duminuco J., Coyle F., Property Redevelopment and Brownfield Sites. Proceedings of the 11th Annual Environmental Law Conference; ISBA Conference; May 2012.
- Duminuco J., Transactions and the Environment: Contaminated Property Issues in Real Estate and Corporate Matters. New York State Bar Association; Tarrytown, NY; June 2006.

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ROUX

PROFESSIONAL PROFILE

Noelle M. Clarke, P.E.

Principal Engineer

TECHNICAL SPECIALTIES

Phase I/Phase II Environmental Site Assessments (ESA), remedial investigations, feasibility studies, pilot testing, remedial design, implementation, construction management, and startup evaluations for remediation of soil, groundwater, and sediment. Extensive experience at brownfields redevelopment sites, former industrial facilities, and public works facilities. Evaluation and design of storm water drainage systems. Evaluation, design, and construction management for new and existing wastewater treatment processes.

EXPERIENCE SUMMARY

Twenty-seven years' experience: Principal Engineer/Senior Engineer at Roux/Remedial Engineering, P.C; Project Engineer at Camp Dresser & McKee

CREDENTIALS

B.S. - Civil Engineering, Manhattan College, 1991

M.E. - Environmental Engineering, Manhattan College, 1994

Professional Engineer, New York, 1995

KEY PROJECTS

- Principal Engineer for a Brownfield redevelopment of a property adjacent to a dry-cleaning solvent distribution facility in Brooklyn, New York under the NYSDEC BCP. The site was previously a warehouse built on a former freight railyard that serviced the dry-cleaning solvent facility. Offloading spillage on site and migration from the offsite facility resulted in significant soil, groundwater, and vapor contamination with chlorinated VOCs. The site was developed into multifamily housing with first floor retail use. Pre-remediation and posts-remediation Phase I ESAs were prepared by Roux. The remedy, as summarized in the Remedial Action Work Plan, consisted of soil hot spot removal to 35 feet below grade, a physical barrier to limit on site migration, a permeable reactive wall to mitigate offsite contaminant migration, and a sub slab depressurization system. In order to reach the target excavation depths of 35 feet, maintain stability of the adjacent aging building, limit VOC emissions and avoid significant dewatering, soil was removed from the hot spots by excavating trenches, which were simultaneously backfilled with a cement /bentonite slurry mix. Roux conducted continuous monitoring of VOCs and dust at the site perimeter and of all personnel working in the excavation exclusion zone. Vapor suppressant foam was used to control VOC emissions and water was used to control dust during excavation and loading of trucks. Implementation of a perimeter community air monitoring plan assured that the public was not exposed to contaminants during the remediation process. Roux, under the direction of Ms. Clarke provided full time oversight of the remediation and prepared the Final Engineering Report and Site Management Plan. The Certificate of Completion for the Site was obtained in October 2015 and Roux is currently providing post-remediation monitoring services.
- Principal Engineer for the alternatives evaluation, remedy selection, regulatory negotiation, preparation of design documents (drawings, specifications and permit applications), permitting, bidding, contractor selection, construction management and regulatory reporting for all remedial components in support of redevelopment at a former metals manufacturing site in Staten Island, New York under the New York State Department of Environmental Conservation Voluntary Cleanup Program. The remedy included dredging, ex *situ* stabilization and onsite disposal of stream sediments; consolidation and capping of fill material across the site; in-place abandonment of the Site's former sewer system; installation of drainage swales for storm water management; and wetland bank stabilization and mitigation/restoration. As part of the remedy selection process, a bench scale testing program for several stabilization reagents was developed and implemented. Roux was responsible for specification, sourcing and testing of multiple types certified clean backfill and capping materials. The work included permitting of remedial activities with multiple federal, state and local agencies. Required permits and regulatory approvals for the project included a Joint Permit from the USACE and NYSDEC for dredging of Mill Creek, bank stabilization and construction activities in the wetlands; a NYSDEC SPDES equivalency permit for discharge of treated water to the Arthur Kill, a New York State Department of State Coastal Management Program Federal Consistency Assessment; a New York City Waterfront Revitalization Program Consistency Assessment, a modification of topography authorization from New York City Department of City Planning; and a New York City Department of Environmental Protection permit for temporary discharge to a combined sewer. Also required by the USACE and National Marine Fisheries, was preparation of an Essential Fish Habitat Study, in support of the Joint Permit application. Permitting activities included preparation of the various permit applications, forms and supporting documentation, as well as follow up meetings and correspondence to finalize the authorizations. Roux was heavily involved in coordinating with the client, regulators and contractor for mobilization to the site in late 2006. During the construction Ms. Clarke provided support to the onsite construction manager regarding field changes, design revisions to account for unexpected conditions and contractor questions. The Final Engineering Report summarizing the construction activities was accepted by NYSDEC.

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Principal Engineer

- Principal-in-Charge of an extensive investigation and remediation project at a former petroleum refinery and current distribution facility located in Buffalo, New York. The site entered the NYSDEC BCP in 2006. Multiple Alternatives Analysis Reports (to document analysis of engineering options and remedy recommendation), Remedial Action Work Plans and remedial design documents have been prepared to address the environmental impacts associated with the five Operable Units (OU) on the Site. Remedial construction for OU-1 was completed in 2007 and included excavation and disposal of impacted soil. The Final Construction Certification Report for OU-1 was accepted by the NYSDEC. The Alternatives Analysis Report and Remedial Design for OU-4 were submitted and approved by NYSDEC. The remedy for OU-4 included stabilization of 1,400 linear feet of river embankment using tiered slopes, rip rap, and reinforced bioengineering, slurry wall groundwater containment, low permeability capping over eight acres, a stormwater collection system and constructed wetland treatment for stormwater. Various vegetative measures were incorporated into the design to promote vegetative growth and enhance wildlife habitats. The Alternatives Analysis Reports for OU-2 and OU-3 were submitted to NYSDEC. For OU-2, bench scale studies of in situ stabilization/solidification reagents were completed and evaluated for treatment of lead and petroleum impacted soil. In addition, field pilot studies of multiple in situ stabilization reagents were completed and evaluated. Design of a stormwater collection system for portions of OU-2 and OU-3 was completed in 2010 and construction was completed in 2014 under the direction of Ms. Clarke. For all projects, Roux was responsible for specification, sourcing and testing of multiple types certified clean backfill and capping materials.
- For the same petroleum terminal in Buffalo, New York, the work also includes performing activities related to the operation of the remediation systems at the Site. These activities have included preparing a feasibility study work plan for improving water management systems at the site; preparing a work plan, directing the field work and preparing an evaluation summary report for startup and testing of a portion of the groundwater extraction system at the Site; and assisting in preparation of plans to upgrade the existing treatment facilities at the Site.
- For the same petroleum terminal in Buffalo, New York, the work also included preparation of design documents and a completion report for in-place closure of the site's former in-ground oil water separator. In addition, a vapor enhanced extraction pilot study work plan was prepared and implemented at the site for recovery of separate-phase product in one portion of the site located adjacent to the Buffalo River. The results of the VER pilot testing, along with the results of chemical oxidation pilot testing conducted at the site, have been summarized in a Remedial Action Selection report, which recommended implementation of chemical oxidation in this portion of the site. A conceptual plan for implementation of chemical oxidation was submitted with the selection document. The work also included maintaining contact with regulatory agencies regarding the status of activities at the Terminal; preparing compliance monitoring reports for submittal to the regulatory agencies; overall project coordination; and budget management and tracking.
- Principal Engineer for a complex dredging project on the Allegheny River in New York to remove petroleum impacted sediments. Included the Site Investigation, Remedial Investigation, Alternative Feasibility Study and regulatory permitting with multiple federal, state and local agencies and for upcoming dredge of 1,000 tons of sediment.
- Principal Engineer providing due diligence support for real estate transactions on multiple projects in the New York metropolitan area. Projects have included multi-family housing (both affordable and market rate), retail/commercial, community services and industrial properties. Services have included Phase I and Phase II ESAs.
- Principal Engineer for a Brownfield redevelopment in Brooklyn, New York at a mixed use multifamily housing/neighborhood retail complex with a former onsite dry cleaner under the NYSDEC BCP. There is soil, groundwater, and vapor contamination from chlorinated VOCs from the former onsite dry cleaner, as well as groundwater contamination from offsite dry cleaners. The remedy, described in the Remedial Action Work Plan prepared by Roux, consisted of hot spot soil removal within the basement of the building, *in situ* groundwater treatment and a sub slab depressurization system for vapor mitigation in the existing buildings. Roux was responsible for specification, sourcing and testing of certified clean backfill material. Remedial construction was completed under the oversight of Roux, including continuous monitoring of VOCs for all personnel working in the basement excavation area. A combination of ventilation, work sequencing and vapor suppressant foam was used to control VOC emissions and allow the work to be completed successfully in this challenging setting. The Final Engineering Report and Site Management Plan were prepared by Roux and the Certificate of Completion for the Site was obtained

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in 2016. Roux is currently providing post-remediation monitoring services.

- Principal Engineer for the investigation, remedial design, construction oversight and operation and maintenance of a bioventing and soil vapor extraction system at the Site of a diesel UST failure in Brooklyn. A free product recovery system was also designed, installed, and operated by Roux. Investigation activities included the use of the sonic drilling technique to advance twelve wells to 85 feet below grade through cobbles and boulders for delineation of separate phase product, soil and groundwater impacts. Eight wells were converted to combination biovent/SVE wells. Design included specification of SVE and biovent blowers, piping, valves, and an automatic control system. Product only pumps were also designed and installed in three wells. Approximately 2,000 gallons of product were recovered to by the two systems and the spill was closed by NYSDEC in 2011.
- Principal Engineer for the investigation, design, and implementation of a soil remediation project at a portion of a former oil terminal in Sag Harbor, New York. The remedy completed included excavation and offsite disposal of approximately 2,000 tons of petroleum contaminated soil from beneath an active public roadway under the NYSDEC spills program. The remedy included extensive traffic control and coordination with Village of Sag Harbor officials, dewatering, water treatment, temporary water discharge of treated water to Sag Harbor and restoration of the public roadway in accordance with the Village of Sag Harbor Department of Public Works requirements. VOC emissions were controlled during the excavation and loading of trucks using vapor suppressant foam. Dust was controlled using water. Implementation of a perimeter community air monitoring plan assured that the public was not exposed to contaminants during the remediation process. Roux prepared a Final Engineering Report, which was accepted by NYSDEC and resulted in the closure of the spill number for the Site.
- Principal engineer for a NYSDEC BCP redevelopment in Staten Island, New York of a former retail service station site. There is soil, groundwater, and vapor contamination from petroleum-related constituents near the former gasoline piping and pump island (the petroleum source area), as well as historic fill across the entire site. An interim remedial measure consisting of removal of four underground gasoline storage tanks, pump island, associated piping and petroleum impacted soil was completed in 2015. VOC emissions were controlled during the excavation and loading of trucks using vapor suppressant foam. Dust was controlled using water. Implementation of a perimeter community air monitoring plan assured that the public was not exposed to contaminants during the work. The Site-wide remedy, described in the Remedial Action Work Plan prepared by Roux, will consist of a sheet pile containment wall around the petroleum source area, a Site Cover System across the entire site (comprised of concrete building slab/walkways, asphalt parking areas and limited landscaped areas) and a sub-slab depressurization system to prevent vapor intrusion into the proposed retail building and offsite migration of impacted soil vapor.
- Principal-in-charge of the hot spot soil removal and final soil capping of a former 7.5-acre petroleum terminal in Hastings on Hudson New York. Roux oversaw the field work which included sourcing and sampling of over 22,000 cubic yards of soil and topsoil that was transported to the Site via barge and truck to backfill the hot spot excavation and implement a two-foot soil cap across the Site. Oversight activities included ensuring compliance with the contract documents, daily oversight and health and safety for subcontractors on land and on barge, implementation of site specific storm water pollution prevention plan and community air monitoring at the Site perimeter to ensure that VOC and dust emissions during construction did not impact the surrounding community.
- Principal Engineer for the investigation, design, and implementation of a soil remediation project at a 4-acre former oil terminal in Cold Spring Harbor, New York under the NYSDEC spills program. The remedy completed included excavation and offsite disposal of approximately 20,000 tons of petroleum contaminated and/or hazardous lead contaminated soil in accordance with the future use of the site under an Environmental Easement. Additional activities completed by Roux at the site included asbestos remediation followed by building demolition, UST removal, and cesspool remediation. Roux was responsible for specification, sourcing and testing of certified clean backfill material. VOC emissions were controlled during the excavation and loading of trucks using vapor suppressant foam. Dust was controlled using water. Implementation of a perimeter community air monitoring plan assured that the public was not exposed to contaminants during the remediation process. Roux prepared a Final Engineering Report, which was accepted by NYSDEC and resulted in the closure of the spill number for the Site.
- Principal Engineer for the design and specification of a large-scale (750 scfm) soil vapor extraction (SVE) pilot system with thermal oxidation off-gas treatment for a client in Brazil. Responsibilities included equipment

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sizing and specification, selection of materials of construction, SVE well and equipment layout, description of general startup procedures and preparation of a pilot test work plan. The pilot test work plan included a description of the pilot test operating procedures to be followed, operating parameters to be monitored and data to be collected and analyzed. The work also included conducting the pilot test activities and generating a report that included plans for expanding the SVE system across the Site. The work currently also included technical support for evaluating and optimizing system performance.

- Project Manager for a storm sewer study at the former metals manufacturing facility in Staten Island, New York as part of the Voluntary Cleanup Program for the Site to identify contaminated infiltration sources, provide an accurate site drainage map, and verify contributing areas to each outfall. The investigation included field inspections, surveying, dye testing, and sampling during varying tidal conditions. The storm sewer map prepared was used for future sewer closure and site redevelopment planning.
- Project Manager for preparation of a work plan, direction the field activities and preparation of a summary report for investigation of the storm-water collection system at a petroleum terminal in Buffalo, New York. The objectives of the storm sewer investigation were to: prepare a detailed map of the Site's sewer system; re-establish connections that may have become blocked by debris; investigate the structural integrity of the storm sewers; locate areas of groundwater infiltration and assess infiltration rate and quality; assess wet and dry-weather flow and quality; and identify areas contributing surface water to the collection system, including hydrologic modeling using TR-55. Based on the results of the investigation, several improvements to the sewer system were recommended, including eliminating inlets to the system in areas of the site where no active operations currently take place and rehabilitation and/or installation of new sewers to restore flow by gravity to the treatment system.
- Principal engineer for the design of a new storm water collection system for a metals manufacturing site in Staten Island, New York under the NYSDEC VCP. The design included evaluation and hydrologic modeling of the system using the U.S. Soil Conservation Service TR-55 hydrologic analysis model, inlet structure and pipe sizing and layout, outfall design and specification of materials and methods of construction for all system components.
- Principal-in-Charge of the operation, maintenance, monitoring and reporting activities at multiple active and former petroleum storage and distribution terminals located in New York for a large petroleum company. The work includes operation, maintenance, and performance/compliance monitoring services at the sites that currently have active remediation system installed and monitoring, sampling, and reporting services at sites without systems. The remediation systems include groundwater extraction and treatment, free product recovery, bio-sparging, and soil vapor extraction/air sparging. At these sites, Roux Associates is responsible for: maintaining and troubleshooting the various system components to reduce downtime to the extent possible; repairing and/or replacing equipment as needed; coordinating the upgrading of the electrical systems, as needed, to meet current building code requirements; expanding systems to meet regulatory requirements, as needed; optimizing system performance; collecting performance monitoring samples and data to track the efficiency of the treatment systems; and collecting compliance monitoring data.
- Principal Engineer for at multiple petroleum terminals in New York State for groundwater quality and surface water quality sampling and monitoring well gauging as required by the New York State Department of Environmental Conservation, as well as quarterly reporting for all sites. The work has also included collection of soil quality data at several sites and performance of an electromagnetic survey to support the divestiture and redevelopment of one of these sites. Based on these results, soil removal activities were performed at one of the former terminals in order to obtain regulatory closure of the site. Roux Associates successfully completed the remedial activities to the satisfaction of the regulator and received closure for the client of the open spill number. Regulatory closure of another of these former terminals was obtained based upon the results of ongoing groundwater monitoring and reporting.
- Project Engineer for design of a 2.6-mgd groundwater treatment system at the Fireman's Training Center for Nassau County Department of Public Works on Long Island. The work included design of air strippers, exhaust stacks, liquid-phase GAC treatment units, and all chemical feed and storage facilities, including unit sizing, selection of materials of construction, equipment layout, and coordination with other disciplines. The work also included development of the "mass balance" for the facility.
- Task leader in charge of overseeing a bioventing pilot study conducted by a subconsultant, to treat contaminated vadose zone soils at the Fireman's Training Center site in Nassau County, New York. The work included development of a preliminary design

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Noelle M. Clarke, P.E.
Principal Engineer

report for the full-scale implementation of bioventing at the site based upon the results of the pilot study.

- Project Engineer for the design, specification, construction and operation of an air sparging and soil vapor extraction pilot at the Long Island terminal of a large petrochemical distributor. The pilot was designed to treat contaminated ground water and vadose zone soils resulting from a one-million-gallon gasoline spill at the site. The work included development of the field sampling program and sampling and evaluation of various parameters to determine the pilot's radius of influence and effectiveness. The work also included performing data analysis and preparation of the pilot study report, which recommended full scale implementation of air sparging at the site. The site-wide implementation of air sparging and expansion of the site's existing vapor extraction system at the same Long Island petrochemical terminal was also part of the work. Responsibilities included design, specification, and layout of all mechanical equipment, vapor extraction, and air sparging wells and new vapor extraction/air sparging piping.
- Task leader responsible for investigating alternatives for the treatment of gasoline contaminated off-gas from air stripping operations a Long Island petrochemical terminal. Based on this evaluation, biofiltration was selected for piloting. Responsibilities included design of a pilot unit; development of sampling and data collection procedures; construction oversight and "troubleshooting" for the unit; coordination of data collection activities; and compilation and analysis of the pilot data.
- Project Engineer for the design of a 0.50-mgd groundwater treatment facility a Long Island petrochemical terminal. Responsibilities included the design, specification, and layout of mechanical equipment, including the air stripping tower, vapor phase granular activated carbon off-gas treatment, centrifugal blowers, ductwork, influent pump, and concrete wet well. Responsible for shop drawing review during the construction phase.
- Project Manager for an investigation at a gasoline service station with soil and groundwater contamination. Responsible for reviewing and evaluating the work of another consultant that performed the soil and groundwater sampling and conducted remedial activities at the site including: investigation summary reports; remedial designs; remediation progress reports; correspondence with regulators; and plans for future work at the Site. The work also included mapping the groundwater flow patterns in the area of the service station and mapping the areal and vertical extent of the groundwater contamination. Responsible for project coordination and budget management and tracking.
- Project Manager for the remedial design at a Superfund Site in Nanuet, New York for the New York State Department of Environmental Conservation. The work included preparation of a preliminary design report, which evaluated two alternatives for handling hazardous soils and sediments at the site contaminated with volatile organic compounds. Each alternative was evaluated on the basis of technical feasibility, cost and schedule for implementation. Based upon this evaluation, off-site disposal was recommended over on-site treatment. The report presented a site-wide conceptual plan for remediation, including: soil/sediment excavation, staging and sampling; stream diversion; excavation dewatering; temporary on-site groundwater treatment; and long term monitoring. Duties also included managing and tracking all project budgets and serving as the main client contact.
- Project Manager for the field investigation, feasibility evaluation, and remedial design at Superfund Site in Spring Valley, New York for the New York State Department of Environmental Conservation. The work included development of a work plan and site operations plan. The field investigations included Geoprobe soil borings; groundwater monitoring well installation; groundwater sampling; aquifer pump testing; and vapor extraction pilot testing. Work also included conducting the field operations for the vapor extraction pilot and producing a summary report of the field investigation results. The report presented an evaluation of the cost and feasibility of several alternatives for remediation of the site. It recommended reducing the level of effort of the remediation presented in the Record of Decision, based on lower levels of contamination encountered during the investigation. Duties also included project coordination; budget management and tracking; and development of subcontract agreements.
- Project Engineer for upgrades to the Spring Creek Auxiliary Water Pollution Control Plant for the City of New York. The work included the evaluation, design and specification of a two-stage odor control system, chemical storage and feed facilities and new effluent disinfection system.
- Project Engineer responsible for preparation of design documents for the replacement of the sodium hypochlorite pumps and piping at the Mamaroneck Wastewater Treatment Plant for Westchester County Department of Environmental Facilities in New York.
- Project Engineer for design of upgrades to the New Rochelle Wastewater Treatment Facility for Westchester County Department of Environmental Facilities in New York. Designed upgrades to the main

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influent pump station, including rehabilitation of the existing influent pumps and replacement of the magnetic drives with new variable frequency drives. Responsibilities also included design of a submersible automatic duplex sump pump system, new primary sludge pumps and piping and new primary and secondary settling tank equipment. The work also included assisting the County during the bidding and contractor selection phase and preparing addenda to the contract documents.

- Project Manager for the construction of upgrades to the New Rochelle Wastewater Treatment Facility. Responsibilities included overseeing the shop drawing logging and distribution process; reviewing mechanical equipment shop drawings; addressing contractor questions regarding the contract documents; and coordinating with the resident engineer in the field and the electrical and general contractors.
- Project Engineer for the performance evaluation of the Harriman Wastewater Treatment Plant for the Orange County Department of Environmental Facilities and Services. Responsibilities included documentation of the existing conditions at the plant and evaluation of the historical and current performance of the plant with respect to its potential for expansion. A summary report was prepared, which included evaluations of the existing plant processes with respect to standard design criteria, typical design practices and receiving water considerations. This summary report served as the basis for the facilities plan prepared as the next phase of the project.
- Project Engineer for the facilities plan for the upgrade of the Harriman Wastewater Treatment Plant. Responsibilities included evaluation of alternatives for expanding the plant's treatment capacity. A report was prepared, which recommended the conversion of the existing oxidation ditches to sequencing batch reactors in order to increase the plant's treatment capacity to 6.0 mgd within the limited space available on the site.
- Project Engineer for the Gates-Chili-Ogden Pump Station and Force main design for Monroe County, New York. The design consisted of a new 36 mgd wet pit/dry pit pump station, influent sewer and force main. Responsibilities included evaluating influent pumping conditions, and design of the influent sewer, manual influent bar racks and a duplex automatic submersible sump pump system for the station.
- Project Engineer for the design of a submersible pump station to handle sewage flow from a proposed dog pound for the City of Waterbury in Connecticut. The design included a concrete manhole pump station with two 100 gpm submersible grinder pumps, a separate valve vault, and a 4-inch force main. The station was designed to operate automatically based upon wet well levels and included monitoring and transmitting of alarm conditions via a telephone interconnection.
- Project Manager for the annual emissions testing of the landfill gas thermal oxidizer at the Oyster Bay Solid Waste Disposal Complex on Long Island. Responsibilities included scheduling the field testing; coordinating with the testing subcontractor, the Town's laboratory, and the site project manager; overseeing the field testing; compiling and analyzing the test data; and preparing a draft and final test report.
- Project Manager for the Flow Augmentation Needs Study (FANS) for Suffolk County Department of Public Works, New York. Responsibilities included coordinating and implementing the annual wetland monitoring effort for collection of data to characterize the vegetation communities and surface water and groundwater conditions at four freshwater wetland sites in Suffolk County. Duties also included maintaining a database of all vegetation data collected; developing and refining equations to characterize the groundwater table and wetlands vegetation in all monitoring areas; evaluating potential impacts of sewering on sensitive wetlands; and evaluating the need for any mitigation of these sites as triggered by vegetation changes correlated to groundwater drawdown. Responsibilities also included coordinating the production of a draft and final annual monitoring report summarizing the findings the program.
- Task leader for two project tasks for the Nassau County Water Management Plan for Nassau County Department of Public Works. The first task included researching, compiling data and describing the County's approximately 50 public water supply systems and mapping their different methods of treatment, storage and pumping. The second task included summarizing all Federal, State and local laws, regulations and programs that relate to the protection of the County's groundwater resources.

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ROUX

PROFESSIONAL PROFILE

Wendy Shen
Senior Engineer

TECHNICAL SPECIALTIES

Management of construction and remediation projects, including Brownfield redevelopment, building construction, excavation and disposal of impacted soil, engineering services for the investigation, design, construction, and operation and maintenance of remedial systems for the treatment of contaminated soil and groundwater.

EXPERIENCE SUMMARY

Seventeen years of experience: Senior Engineer, Project Engineer, Staff Engineer, and Staff Assistant Engineer with Roux.

CREDENTIALS

M.S. in Environmental Engineering, Polytechnic University, Brooklyn, New York, 2001
B.S. in Chemical Engineering, Universidade Federal do Rio Grande do Sul, Brazil, 1997
OSHA 40 Hour Health and Safety Course, 2000
OSHA 8 Hour Refresher Courses

KEY PROJECTS

- Senior Engineer responsible for the management of investigation and remediation various Brownfields redevelopment sites containing hazardous and nonhazardous soils in New York City and surrounding. These projects included the implementation of in situ waste characterization sampling program and a Remedial Action Work Plan, which included excavation of soils below grade and management of soils including transportation and disposal and coordination with various disposal facilities. Most of these sites were accepted into the New York City Office of Environmental Remediation (NYC OER) Brownfield Cleanup Program (BCP) or the New York State BCP.
- Senior Engineer responsible for scheduling at a large petroleum remediation project in Brooklyn, New York. Responsibilities included management of all present and future tasks to be completed including operations and maintenance, remedial investigation, design and construction, facility upgrades, special operations, permitting and compliance tracking, health and safety, audits/assessments, sampling and regulatory reporting.
- Project Engineer for the remediation of soil and groundwater at 100+ facilities owned and/or operated by various city agencies in New York City. Activities included preparation of administrative/contractual requirements, work plans, and monitoring reports, cost estimates, proposals, engineering support, and construction oversight.
- Project Engineer for the design of an air sparge and soil vapor extraction system in Andover, Massachusetts.
- Project Engineer for the remediation of soil and groundwater at a former chemical manufacturing company in Rensselaer, New York. Activities included construction oversight, preparation of reports including Feasibility Study, Interim Remedial Measures, Community Air Monitoring Plans, Sampling Plans, Bid Review, Invoice Review, and various field investigations.
- Project Engineer for an investigation and remediation at a former petroleum refinery in Buffalo, New York. Responsible for assisting in the preparation of multiple work plans and reports of results for field investigations including soil borings and sampling, well installation, and groundwater sampling. Also responsible for reviewing and assisting in the preparation of activities related to the operation of the remediation systems at the Site, including maps, evaluation summaries, plans and compliance monitoring reports.
- Project Engineer for the closure of an underground storage tank (UST) at a shipping facility in Queens, New York. Activities included preparation of cost estimate, work plans, and field management.
- Project and Resident Engineer for the soil remediation of the Captain's Cove Condominiums Site, a federal NPL site, located in Glen Cove, New York. Activities include: supervision of Contractor's activities, regulatory interaction, compile daily field reports, manage laboratory database for excavated and reclaimed soil, shop drawing review, change order preparation, and Health and Safety compliance. Site remediation was completed in September 2001 to accommodate site redevelopment as a commercial waterfront and operating seaport area. Currently managing OM&M groundwater monitoring program at the Site.
- Staff Engineer for a 450-gpm, dual-phase, product recovery system in Greenpoint, Brooklyn, New York. Tasks include: operation and maintenance of groundwater recovery and treatment system and free product recovery system. Also assisted in reviewing drawings and specs related to installation of aboveground storage tanks.
- Staff Engineer for the remediation of soil and groundwater at a former chemical company facility in Brooklyn, New York using a Soil Vapor Extraction and Air Sparging System. Tasks include: review of performance data for air sparge system, operation and maintenance for the SVE/AS System, progress report preparation, and monthly groundwater sampling.
- Staff Engineer for a divestment assessment at a service station in Stratford, Connecticut. Tasks include: oversight, soil sampling, FOIA investigation, coordination with subcontractor and

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Wendy Shen
Senior Engineer

regulatory agencies, and preparation of letters and reports.

- Resident Engineer for the soil remediation at a former chemical company facility in Dayton, New Jersey. Activities include: construction oversight, Health and Safety compliance, field sampling, and completion report preparation.
- Responsible for assisting in preparing cost estimates, proposals, feasibility studies, interim remedial measures, remedial action plans, health and safety plans, and technical specifications for a variety of soil and groundwater remedial objectives.
- Student/Research Assistant at Laboratory of Polymers, Universidade Federal do Rio Grande do Sul, POA, Brazil. Performed experiments on the metalization of plastics using polyaniline.
- Intern/Researcher at Laboratory of Research and Development at a petrochemical company, Ipiranga Petroquimica, Brazil. Conducted laboratory tests involving additives used in polymers and responsible for quality control/assurance of products.

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APPENDIX B

Support of Excavation Design Drawings

NOTES:

1. ALL WORK TO BE PERFORMED IN ACCORDANCE WITH REQUIREMENTS OF NEW YORK CITY BUILDING CODE. CONTRACTOR SHALL GIVE REQUIRED NOTICE TO THE NEW YORK CITY DEPARTMENT OF BUILDINGS BEFORE COMMENCEMENT OF WORK, PER NYCBC 3304.3.1.
2. BASE PLAN COMPILED FROM SURVEY DRAWING PREPARED BY MONTROSE SURVEYING CO., LLP., DATED 08-15-2018, AND FOUNDATION PLAN PREPARED BY DESIMONE CONSULTING ENGINEERS, DATED 05-15-2019.
3. COORDINATE THESE PLANS WITH THE STRUCTURAL PLANS FOR THE NEW BUILDING.
4. ALL ELEVATIONS SHOWN REFER TO NAVD88 DATUM, WHICH IS 1.106 FEET ABOVE MEAN SEA LEVEL AT SANDY HOOK, NEW JERSEY.
5. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS.
6. REFER TO GEOTECHNICAL ENGINEERING REPORT PREPARED BY GEODESIGN, DATED 04-04-2018, FOR ADDITIONAL SUBSURFACE INFORMATION.
7. CONTRACTOR SHALL VERIFY LOCATION OF ALL UNDERGROUND UTILITIES AND VAULTS PRIOR TO DRILLING. CONTRACTOR SHALL CALL FOR A UTILITY MARK-OUT BEFORE COMMENCEMENT OF WORK AND WAIT THE REQUIRED NUMBER OF DAYS. CONTRACTOR SHALL REPORT LOCATIONS AND ELEVATIONS OF UTILITIES, STRUCTURES AND OBSTRUCTIONS WHICH CONFLICT WITH LOCATIONS OF SUPPORT OF EXCAVATION ELEMENTS.
8. CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS.
9. CONTRACTOR SHALL BE RESPONSIBLE FOR SITE SAFETY AND PROVIDE A SAFETY PLAN CONFORMING TO OSHA STANDARDS.
10. SOLDIER PILE AND LAGGING ARE SUBJECT TO SPECIAL INSPECTION AS PER THE NEW YORK CITY BUILDING CODE. SEE STRUCTURAL DRAWINGS FOR A COMPLETE LIST OF REQUIRED SPECIAL INSPECTIONS.
11. UPON INSTALLATION OF THE PERMANENT WALLS, CUT AND REMOVE SOLDIER PILES A MINIMUM 2 FEET FROM THE GRADE LEVEL, OR AS REQUIRED FOR INSTALLATION OF FOUNDATIONS FOR THE PROPOSED BUILDING.
12. ANY PROPOSED REVISION/MODIFICATION TO THE SUPPORT OF EXCAVATION SHOWN SHALL BE SUBMITTED TO GEODESIGN FOR REVIEW.
13. ALL STEEL SHALL CONFORM TO ASTM A572 GRADE 50 (FY=50 KSI), UNLESS OTHERWISE NOTED.
14. A 250 PSF UNIFORM VERTICAL SURCHARGE HAS BEEN INCLUDED AT THE SOLDIER PILE LOCATIONS. IF IT IS DETERMINED THAT THESE LOADS ARE NOT SUFFICIENT, THE VALUE TO BE USED SHOULD BE PROVIDED SO THAT THE DESIGN CAN BE MODIFIED, AS NECESSARY.
15. THE GROUNDWATER LEVEL INSIDE THE EXCAVATION SHALL BE MAINTAINED AT A MINIMUM OF 2 FEET BELOW THE FINAL SUBGRADE LEVEL.
16. WELDING SHALL BE PERFORMED IN ACCORDANCE WITH THE REQUIREMENTS OF THE AMERICAN SOCIETY FOR WELDING IN BUILDING CONSTRUCTION AWS D1.1-88. WELDING ELECTRODES TO BE E7018.
17. THE PROPOSED BUILDING IS SHOWN FOR REFERENCE ONLY. REFER TO STRUCTURAL DRAWINGS FOR REQUIRED INFORMATION.
18. A CONDITION SURVEY OF ADJACENT BUILDINGS SHALL BE PERFORMED BY A COMPANY RETAINED BY THE OWNER PRIOR TO THE START OF CONSTRUCTION.

DRIVEN SOLDIER PILE INSTALLATION PROCEDURE:

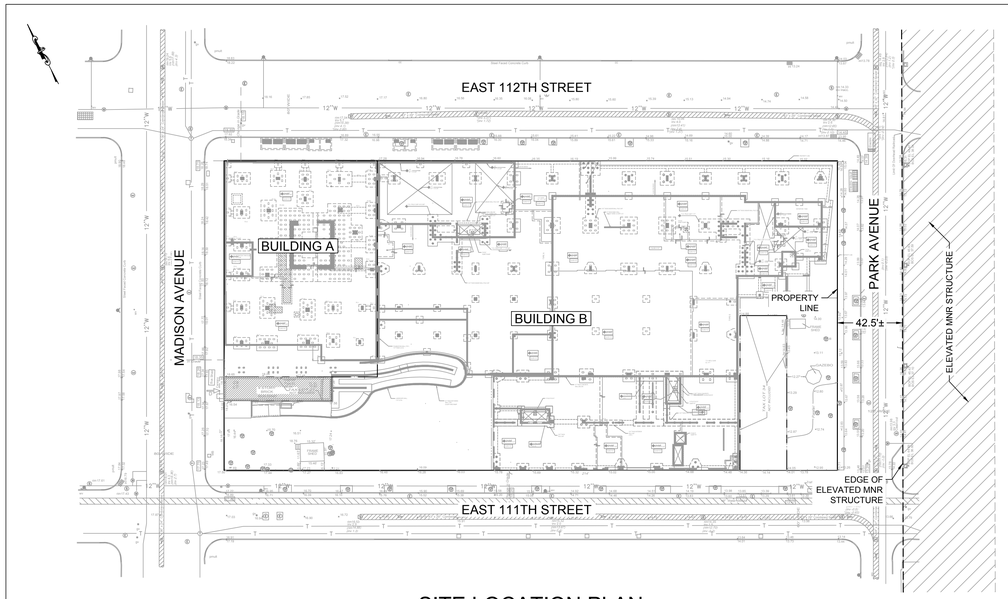
1. PILE DRIVING ACTIVITIES SHOULD BE INSPECTED TO CONFIRM THE PILE SIZE, PILE SPACING AND THE INDICATED MINIMUM TIP ELEVATIONS.
2. MAINTAIN A MINIMUM OF 2% PLUMBNESS DURING THE DRIVING OF THE PILES.
3. PILE SHALL BE INSTALLED WITH A HYDRAULIC IMPACT HAMMER HAVING A MINIMUM ENERGY OF 15,000 FT-LBS.

TIMBER LAGGING NOTES:

1. TIMBER LAGGING SHALL BE 3 INCH THICK. TIMBER SHALL BE STRUCTURAL GRADE WITH MINIMUM ALLOWABLE BENDING CAPACITY (FB) OF 1500 PSI. THE ALLOWABLE SHEAR CAPACITY SHALL BE 150 PSI.
2. LAGGING SHALL BE INSTALLED SUCH THAT GAPS BETWEEN THE LAGGING BOARDS ARE ONE HALF INCH NOMINAL AND ONE INCH MAXIMUM. VOIDS IN THE RETAINED EARTH BEHIND THE TIMBER LAGGING SHALL BE BACKFILLED WITH EXCAVATED GRANULAR SOIL, AND THE GAPS BETWEEN THE TIMBER LAGGING PACKED AS REQUIRED TO PREVENT EROSION OF THE RETAINED SOIL BUT STILL ALLOW GROUNDWATER TO SEEP OUT.
3. LAGGING MUST BE INSTALLED AT EXCAVATION INTERVALS OF 2 FT OR LESS.

DRILLED SOLDIER PILE WITH TEMPORARY CASING INSTALLATION NOTES:

1. ALL PILES SHALL BE INSTALLED IN THE LOCATION SHOWN ON THESE DRAWINGS.
2. PERFORM UTILITY IDENTIFICATION AND EXPLORATION AS NECESSARY.
3. SOLDIER PILES SHALL BE DRILLED AND SHALL BE INSTALLED USING A TEMPORARY STEEL CASING PREDRILLED AT EACH LOCATION.
4. THE DRILL SHALL BE A ROTARY HYDRAULIC DRILL CAPABLE OF DUPLEX DRILLING A 20" DIAMETER CASING.
5. THE TEMPORARY STEEL CASING SHALL CONSIST OF AT LEAST 20" OUTER DIAMETER FLUSH THREADED DRILL CASING WITH A MINIMUM AND MAXIMUM WALL THICKNESS OF 1/4" AND 1/2", RESPECTIVELY.
6. INSTALLATION PROCEDURE:
   a. SET UP RIG ON PROPER LOCATION AND PLUMB THE MAST.
   b. INSTALL FIRST PIECE OF CASING WITH CARBIDE CUTTING TEETH ATTACHED.
   c. DRILL CASING DOWN AND MAINTAIN POSITIVE FLUID HEAD AT ALL TIMES.
   d. DRILLING TO BE PERFORMED USING INTERNAL FLUSH METHOD. OUTSIDE CASING SHALL REMAIN AHEAD OF THE INTERNAL FLUSHING BY A MINIMUM OF 2 FEET. IF OBSTRUCTIONS ARE ENCOUNTERED OR IF THE OUTSIDE CASING GETS STUCK, ADVANCE THE INNER CASING THROUGH OBSTRUCTION OR UNTIL OUTER CASING CAN REVOLVE, AND THEN RESUME STANDARD PROCEDURE OF 2 FOOT LEAD OF THE OUTSIDE CASING.
   e. FOLLOW UP WITH ADDITIONAL CASING TO ELEVATION SHOWN ON THESE DRAWINGS.
   f. REMOVE INNER CASING.
   g. FLUSH INSIDE OF CASING CLEAN OF SPOILS.
   h. INSTALL GROUT.
   i. INSERT THE SOLDIER PILE INTO THE CASING.
   j. START PULLING THE CASING. AS THE CASING IS PULLED, CONTINUE TO FILL THE CASING WITH GROUT AS TO MAINTAIN AT LEAST 10 FEET OF HEAD ABOVE TIP OF CASING. CONTINUE THIS PROCESS UNTIL THE CASING IS COMPLETELY PULLED FROM THE HOLE.
7. ALTERNATE CASING INSTALLATION PROCEDURE USING AUGER DRILLING: SOIL INSIDE THE CASING WILL BE REMOVED WITH AN AUGER. CASING SHALL REMAIN AHEAD OF THE AUGER A DISTANCE OF TWO TIMES THE CASING DIAMETER, BUT NOT LESS THAN 2 FEET. WATER SHALL BE MAINTAINED AT THE TOP OF THE CASING AFTER THE CASING IS SEALED 10 FEET INTO THE SOIL. IF OBSTRUCTIONS ARE ENCOUNTERED, OR IF THE CASING GETS STUCK, ADVANCE THE AUGER THROUGH THE OBSTRUCTION OR UNTIL THE CASING CAN ROTATE, AND THEN RESUME STANDARD PROCEDURE OF KEEPING THE CASING AHEAD OF THE AUGER BY A DISTANCE OF TWO TIMES THE CASING DIAMETER, BUT NOT LESS THAN 2 FEET.



SITE LOCATION PLAN

SCALE 1"= 40'

0 20 40 80

Sendero verde

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B-SOUTH 75E. 111TH STREET
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MEP/FP ENGINEER
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EXTERIOR WALL
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CIVIL ENGINEER
Langan
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VERTICAL TRANSPORTATION
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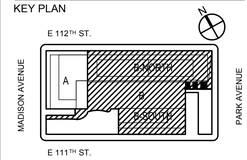
ACOUSTICAL ENGINEER
Cerami Associates
404 5th Avenue, 8th Floor
New York, NY 10018
212.370.1776

NO.	DATE	ISSUANCE
	05/20/2019	FOUNDATION BID PACKAGE

KEY PLAN



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PROJECT NO: 0518-023
SEAL & SIGNATURE NYC DOB NO: 121204721

DRAWING TITLE:
SUPPORT OF EXCAVATION
GENERAL NOTES & PROCEDURES

DRAWING NO:
SOE-001.00

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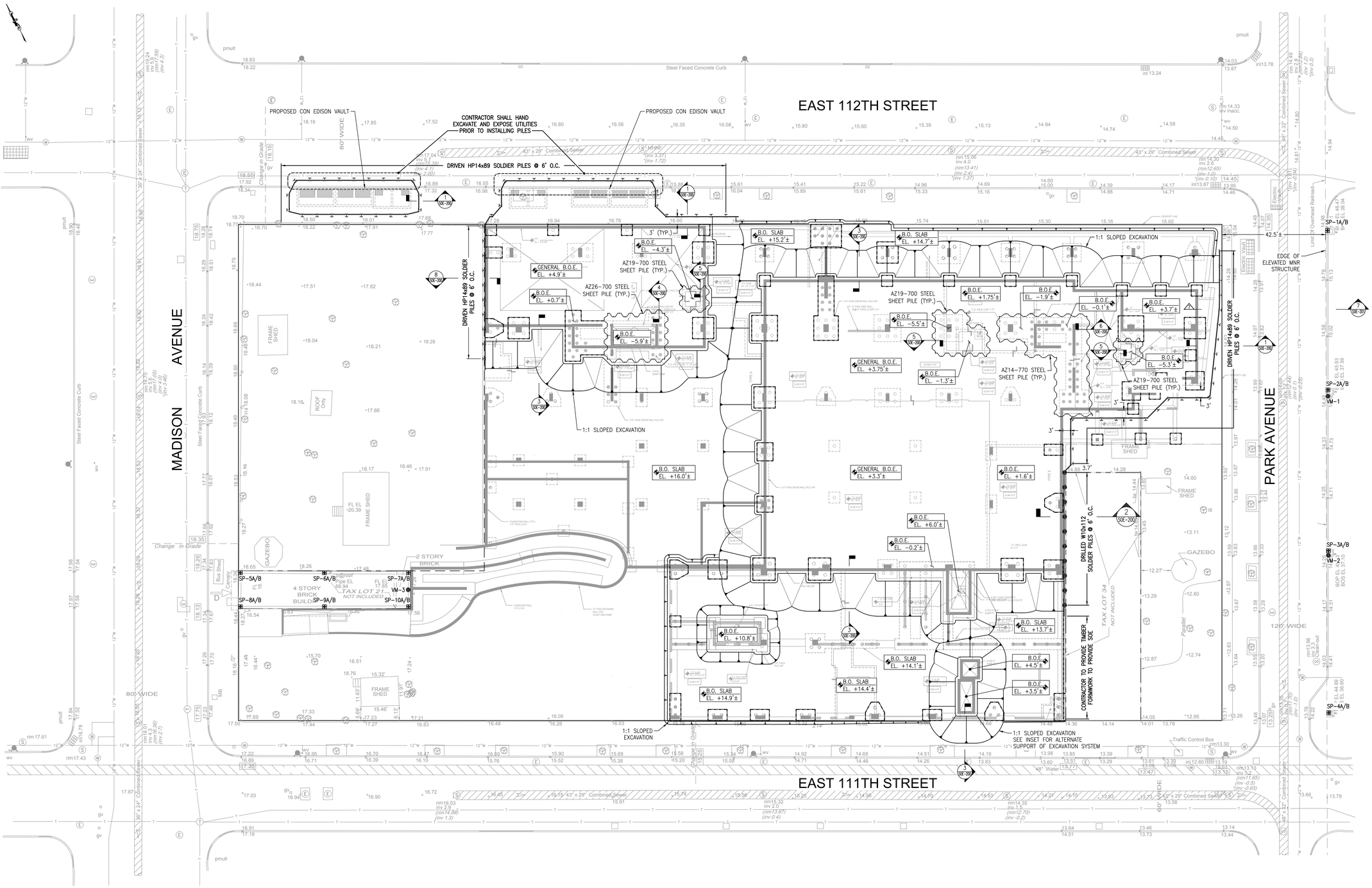


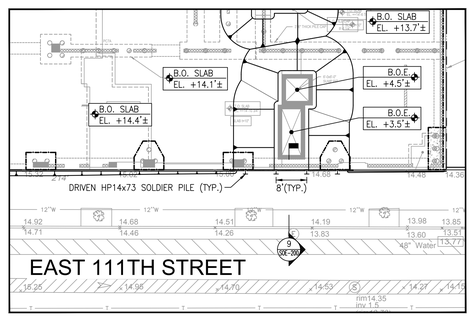
SCALE 1"= 16'
0 8 16 32

LEGEND

- SOLDIER PILES & TIMBER LAGGING
- STEEL SHEET PILES
- 1:1 SLOPED EXCAVATION
- CONTRACTOR TO PROVIDE TIMBER FORMWORK AT THESE PILE CAP LOCATIONS AND AT OTHER LOCATIONS, AS NECESSARY
- SP-1A/B — OPTICAL SURVEY MONITORING POINTS INSTALLED AT TOP AND BOTTOM OF STRUCTURE
- VM-1 — VIBRATION MONITORING POINT

SUMMARY OF CONSTRUCTION MONITORING ACTIVITIES

DURING CONSTRUCTION MONITORING ACTIVITY	DESCRIPTION OF MONITORING SYSTEM	DATA ACQUISITION AND MONITORING FREQUENCY (MIN)	DATA ANALYSIS FREQUENCY FOR THRESHOLD OCCURRENCE (MIN)	THRESHOLD CRITERIA	REQUIRED ACTION IF THRESHOLD IS REACHED	WRITTEN COMPILATION DATA REPORTING FREQUENCY
VIBRATION MONITORING	REMOTE AUTOMATED SEISMIC UNIT MOUNTED IN LOCATIONS SHOWN ON PLAN	SEMI-CONTINUOUS DATA ACQUISITION AND MONITORING DURING CONSTRUCTION OPERATIONS (UNIT PRESET WITH OPERATING TIMER MODE; DATA MEASUREMENTS MADE AT PRESET FREQUENCY)	SEISMIC UNIT CONTINUOUSLY MONITORS READINGS; UNIT TRIGGERS SIGNAL TO THE SERVER AND TRANSMITS INSTANT E-MAIL NOTIFICATION ON PRESET THRESHOLD LIMIT	PEAK PARTICLE VELOCITY = 0.5 IN./SEC. ABOVE TRAIN AND OTHER AMBIENT VIBRATIONS	STOP WORK IF THRESHOLD IS EXCEEDED AND MODIFY CONSTRUCTION PROCEDURES. ANALYSIS BY: OWNER'S DESIGN TEAM	WEEKLY
EXISTING BUILDING MOVEMENT MONITORING	MANUAL OPTICAL SURVEYING EQUIPMENT	MANUAL ONCE A WEEK AND DAILY DURING UNDERPINNING. INCREASE FREQUENCY IF 50% THRESHOLD REACHED. FREQUENCY MAY BE DECREASED AFTER GROUND FLOOR IS REACHED	MONITORING POINT DATA IS IMMEDIATELY PROCESSED UPON ACQUISITION BY THE SURVEYOR; RELATIVE MOVEMENT IS IMMEDIATELY IDENTIFIED AND REPORTED TO RESPONSIBLE PERSON AT SITE.	1/4" HORIZONTAL OR VERTICAL	STOP WORK IF THRESHOLD IS EXCEEDED AND ANALYZE. ANALYSIS BY: OWNER'S DESIGN TEAM	WEEKLY
EXISTING BUILDING CRACK MONITORING	PERMANENTLY MOUNTED "TELLTALE" CRACK GAUGE	MANUAL ONCE A WEEK. INCREASE FREQUENCY IF MOVEMENT IS DETECTED.	RELATIVE MOVEMENT IS IMMEDIATELY IDENTIFIED BY MONITORING TECHNICIAN BY COMPARISON WITH EARLIER READINGS AND REPORTED TO RESPONSIBLE PERSON AT SITE.	ALL MOVEMENT ANALYZED IN CONJUNCTION WITH VIBRATION AND BUILDING MOVEMENT DATA	ACTION BASED ON COMBINED RESULTS WITH VIBRATION AND BUILDING MOVEMENT	WEEKLY



ALTERNATE SUPPORT OF EXCAVATION AT EAST 111TH STREET PIT
SCALE: 1"=16'

Sendero verde

EAST HARLEM | BUILDING B

B-NORTH 60E. 112TH STREET
B-SOUTH 75E. 111TH STREET
NEW YORK, NY 10029

OWNERS
Jonathan Rose Companies
551 Fifth Avenue, 23rd Floor
New York, NY 10176
917.542.3600

L+M Development
1865 Palmer Avenue, Suite 203
Larchmont, NY 10538
212.233.0495

Acacia Network
300 East 175th Street
Bronx, NY 10457
347.649.3295

ARCHITECT
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New York, NY 10271
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212.221.6651

CIVIL ENGINEER
Langan
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New York, NY 10001
212.479.5400

VERTICAL TRANSPORTATION
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Avon, CT 06001
212.696.1818

LANDSCAPE ARCHITECT
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New York, NY 10004
212.377.8400

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404 5th Avenue, 8th Floor
New York, NY 10018
212.370.1776

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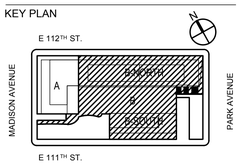
KEY PLAN



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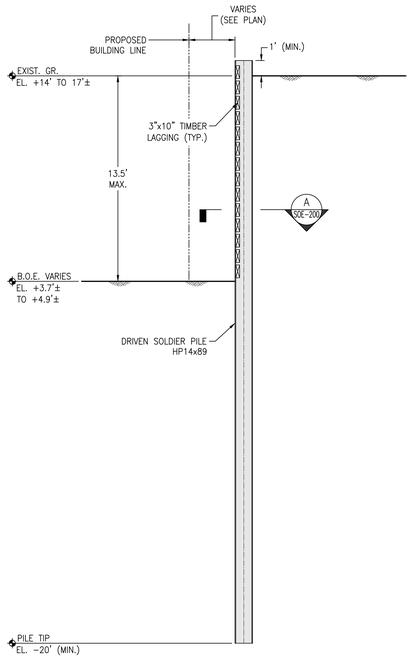
SEAL & SIGNATURE	NYC DOB NO: 121204721

DRAWING TITLE:
SUPPORT OF EXCAVATION PLAN

DRAWING NO:
SOE-100.00



1 SOE-200 DRIVEN SOLDIER PILE WALL

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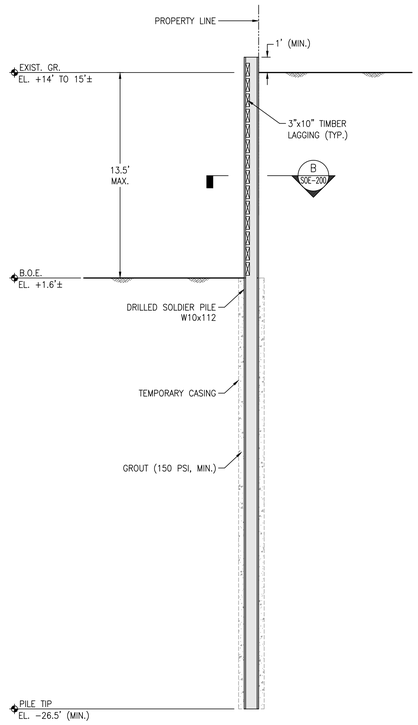

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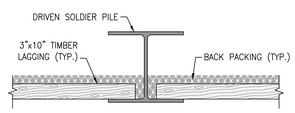

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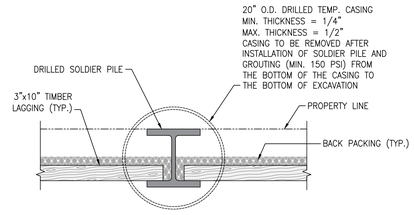
N.T.S.



B SOE-200 SOLDIER PILE-LAGGING DETAIL
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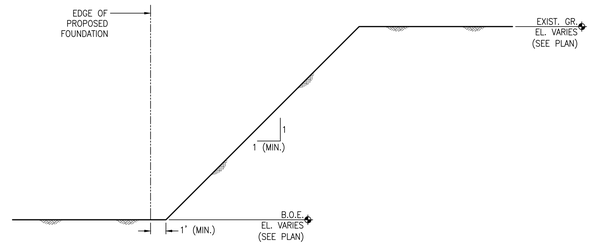

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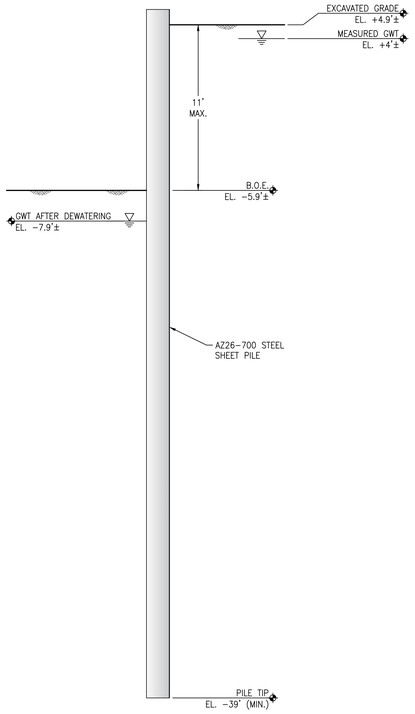
N.T.S.



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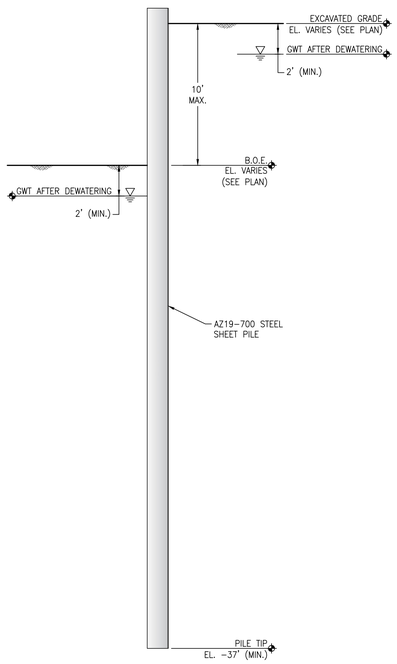

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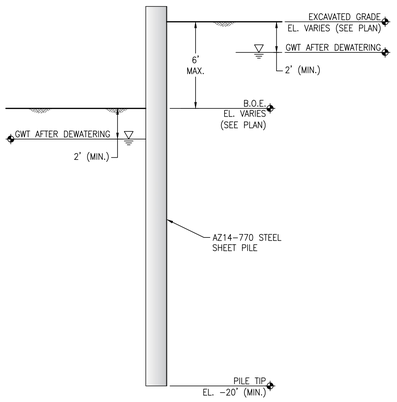

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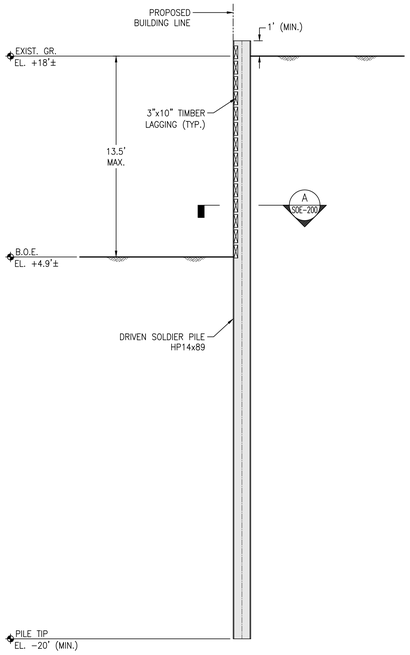

8 SOE-200 DRIVEN SOLDIER PILE WALL

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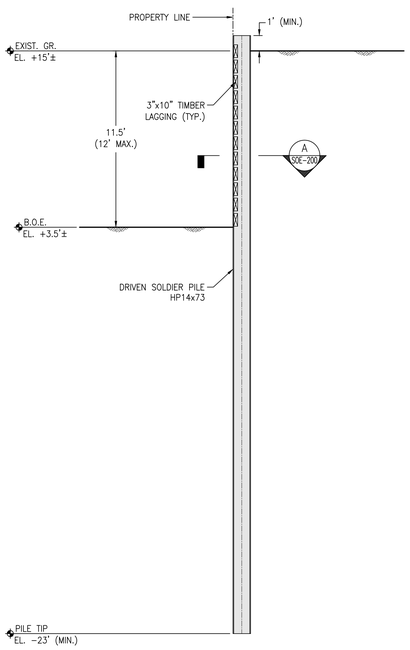

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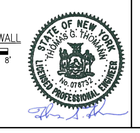

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EAST HARLEM | BUILDING B

B-NORTH 60E. 112TH STREET
B-SOUTH 75E. 111TH STREET
NEW YORK, NY 10029

OWNERS
Jonathan Rose Companies
551 Fifth Avenue, 23rd Floor
New York, NY 10176
917.542.3600

L+M Development
1865 Palmer Avenue, Suite 203
Larchmont, NY 10538
212.233.0495

Acacia Network
300 East 175th Street
Bronx, NY 10457
347.649.3295

ARCHITECT
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120 Broadway, 6th Floor
New York, NY 10271
212.595.4112

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212.479.5400

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212.696.1818

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212.370.1776

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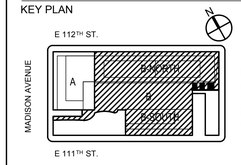

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DRAWING TITLE:
SUPPORT OF EXCAVATION
SECTIONS & DETAILS

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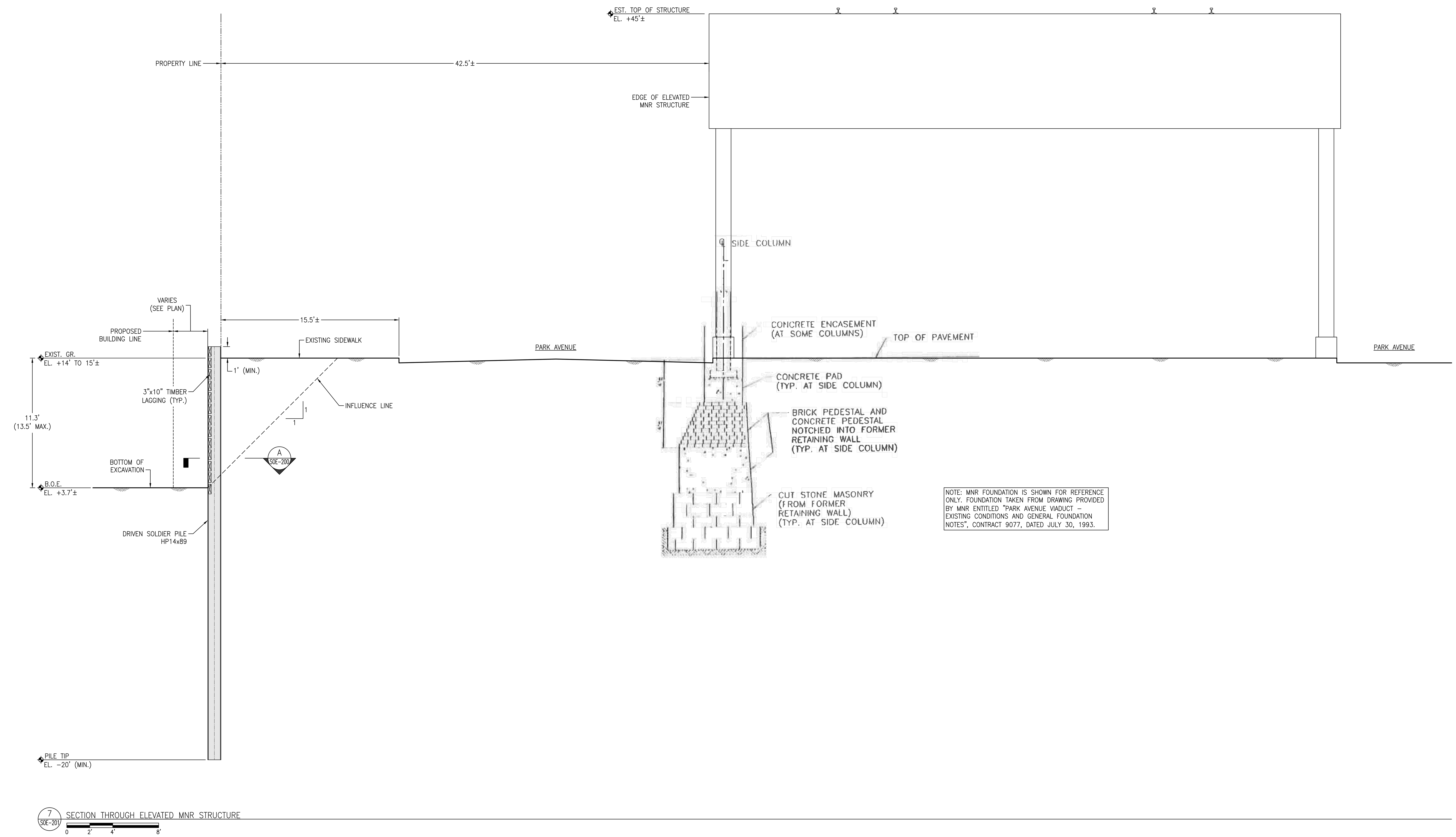

7 SOE-201 SECTION THROUGH ELEVATED MNR STRUCTURE

0 2' 4' 8'

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EAST HARLEM | BUILDING B

B-NORTH 60E. 112TH STREET
B-SOUTH 75E. 111TH STREET
NEW YORK, NY 10029

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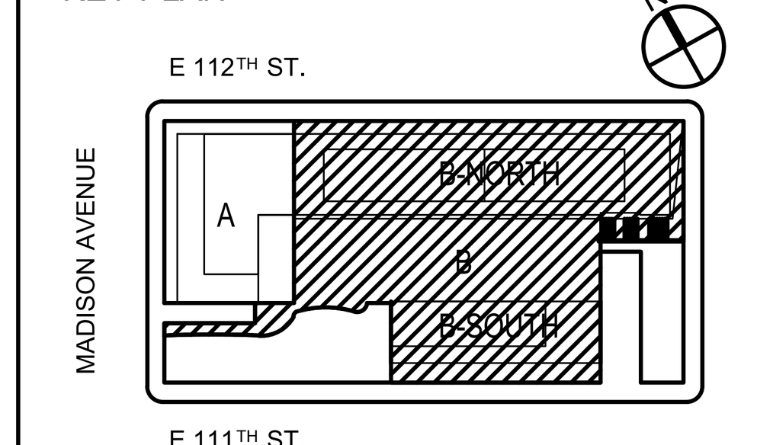

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SEAL & SIGNATURE NYC DOB NO: 121204721

DRAWING TITLE:
SUPPORT OF EXCAVATION SECTIONS

DRAWING NO:
SOE-201.00

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APPENDIX C

Site-Specific Health and Safety Plan (HASP)

(Provided on CD in Bound Copy)

Site-Specific Health and Safety Plan

Sendero Verde Redevelopment Project – Parcel B
Tax Block 1617 of Tax Lots 20, 125 and 140
New York, New York

June 14, 2019

Prepared for:

SV-B Owners LLC
1865 Palmer Avenue
Larchmont, New York 10538

Prepared by:

Roux Environmental Engineering and Geology, D.P.C.
209 Shafter Street
Islandia, New York 11749

2984.0003Y.112/CV

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Figures

Appendices

Site-Specific Emergency Information

Emergency Phone Numbers

Most emergency services can be obtained by calling **911**. Where 911 service is not available, use the telephone numbers provided in the below table. The following is a master emergency phone list for use by the project management personnel. A more condensed version of the emergency numbers listed below will be posted throughout project work areas. Emergencies encountered on the Site will be responded to by a combination of off-Site emergency services and Site personnel.

Emergency Contact Information			
Site Personnel			
Title	Contact		Telephone
Project Manager (PM)	Wendy Shen		631-232-2600
Site Health and Safety Officer (SHSO)	TBD		
Site Supervisor	TBD		
SHSO Alternate	Wendy Shen		631-232-2600
Outside Assistance			
Agency	Contact	Telephone	Address/Location
Ambulance/EMS	911	911	N/A
Police	NYPD	212-860-6411	162 East 102nd Street, New York, NY
Fire	FDNY	212-504-4115	1367 5th Avenue, New York, NY

Route to Mount Sinai Hospital, 1190 5th Avenue, New York, NY (Figure 5):

- Head southeast on East 112th Street (144 feet)
- Turn right onto Park Avenue (0.3 miles)
- Turn right onto East 106th Street (0.2 miles)
- Turn left onto 5th Avenue (0.3 miles)
- Mount Sinai Hospital will be on the left

Route to City MD, 1500 Lexington Avenue, New York, NY (Figure 5):

- Head southeast on East 112th Street (0.1 miles)
- Turn right onto Lexington Avenue (0.8 miles)
- City MD will be on the right

1. Introduction

This Site-specific Health and Safety Plan (HASP) has been prepared by Roux Environmental Engineering and Geology, D.P.C. (Roux) for use during the Interim Remedial Measure (IRM) (e.g., construction/trucking oversight and sampling activities being performed by Roux) at the Sendero Verde Redevelopment Site – Parcel B ("the Site"), located to the west of Park Avenue and to the east of Madison Avenue, between East 111th and East 112th Street (see Figure 1). These activities fall within the scope of operations covered by the Occupational Safety and Health Administration (OSHA) standards promulgated at 29 CFR 1910.120 and 29 CFR 1926.65, both commonly referred to as the Hazardous Waste Operations and Emergency Response (HAZWOPER) Standard. In accordance with the HAZWOPER Standard, this Site-specific HASP was prepared to address the safety and health hazards associated with the RI and RA activities being performed at the Site by Roux and to provide requirements and procedures for the protection of Roux employees, subcontractor personnel, government oversight personnel, Site personnel, and the general public. It also addresses client- and Site-specific requirements for health and safety.

Implementation of this HASP is the joint responsibilities of the project manager, the Site health and safety officer, and all field staff, with assistance from the project principal and the office health and safety manager. The project manager for this project is Wendy Shen, the Site health and safety officer is to be decided and will be communicated prior to the start of any work.

1.1 Roles and Responsibilities

Overall Roles and Responsibilities (R&Rs) of Roux personnel are provided in Roux's Policies and Procedures Manual. Only those R&Rs specific to HASP requirements are listed below.

Project Manager (PM)
The PM has responsibility and authority to direct all work operations. The PM coordinates safety and health functions with the Site Health and Safety Officer (SHSO), has the authority to oversee and monitor the performance of the SHSO, and bears ultimate responsibility for the proper implementation of this HASP. The specific duties of the PM are:

- preparing and coordinating the Site work plan;
- providing Site supervisor(s) with work assignments and overseeing their performance; Coordinating safety and health efforts with the SSHO;
- ensuring effective emergency response through coordination with the Emergency Response Coordinator (ERC); and
- serving as primary Site liaison with public agencies and officials and Site contractors.

Site Health and Safety Officer (SHSO)
The SHSO has full responsibility and authority to develop and implement this HASP and to verify compliance. The SHSO reports to the Project Manager. The SHSO is on-Site or readily accessible to the Site during all work operations and has the authority to halt Site work if unsafe conditions are detected. The specific responsibilities of the SHSO include:

- managing the safety and health functions on this Site;
- serving as the Site's point of contact for safety and health matters;
- ensuring Site monitoring, worker training, and effective selection and use of PPE;

- assessing Site conditions for unsafe acts and conditions and providing corrective action;
- assisting the preparation and review of this HASP;
- maintaining effective safety and health records as described in this HASP; and
- coordinating with the Site Supervisor(s) and others as necessary for safety and health efforts.

Site Supervisor

The Site Supervisor is responsible for field operations and reports to the Project Manager (PM). The Site Supervisor ensures the implementation of the HASP requirements and procedures in the field. The specific responsibilities of the Site Supervisor include:

- executing the work plan and schedule as detailed by the PM;
- coordination with the SHSO on safety and health; and
- ensuring Site work compliance with the requirements of this HASP.

Site Workers

Site workers are responsible for complying with this HASP, using the proper PPE, reporting unsafe acts and conditions, and following the work and safety and health instructions of the Project Manager (PM), SHSO, and Site Supervisor.

2. Background

The Site consists of a full city block, excluding three parcels. The Site was developed since at least 1896 with several low-rise buildings and the use was mixed residential and commercial. Demolition of the Site buildings began in 1979 and was completed by 1986. The Site is currently fenced and contained a baseball field and community gardens surrounding the eastern and southwestern Site perimeter. There are no permanent on-Site structures present. The Site is zoned for residential use with a commercial overlay. Nearby properties include residential and commercial buildings. The proposed future use of the Site includes residential, commercial and community facility spaces.

There are no known releases of hazardous substances at the Site. As indicated in the Phase I Environmental Site Assessment (ESA), past operators of the Site included tailors and shoe companies, dry cleaners, paints shops, a drug company, printers and furriers. In addition, nearby properties operated as dry cleaners, auto services, dental offices and paint shops. These operations may have used hazardous materials. There is also potential that previous on-Site buildings used fuel oil for heat prior to natural gas conversion. Therefore, there is the potential that fuel oil tanks were present on-Site and undocumented removal of tanks may have occurred or underground storage tanks (USTs) may remain on-Site.

A Phase II ESA was conducted by Roux between April and May of 2018. Results of the Phase II ESA are discussed below.

Summary of Previous Sampling Results (2018, Roux)

Soil

- The previous investigation reveals the presence of urban fill soils across the Site with metals and PAHs usually associated with such fill material.
- Exceedances of NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives (RRSCOs) for semivolatile organic compounds (SVOCs), specifically polycyclic aromatic hydrocarbons (PAHs), metals (arsenic, barium, copper, and lead), and/or pesticides were encountered in six (6) sample locations at various depths (from 0 to 14 ft bls).
- The highest SVOC exceedances were in the range of one order of magnitude greater than the RRSCOs and located in the center of the Site near East 112th Street. SVOCs exceeded the RRSCOs in six of the ten soil boring locations.
- Metals exceeded the RRSCOs in five (5) sampling locations. One sample location (SB-1 from 0-2 ft bls) contained copper in concentrations nearly twenty times the RRSCOs.
- One pesticide, dieldrin, exceeded the RRSCO in one sample location. The dieldrin exceedance was less than one order of magnitude greater than the RRSCO.

Metals, SVOCs, and PCBs exceed their respective Unrestricted Use Soil Cleanup Objectives (UUSCOs) across the Site, as shown in Plate 1.

Groundwater

- One VOC, Chloroform, was detected above its Ambient Water Quality Standards and Guidance Values (AWQSGV) in all samples (maximum concentration of 39 micrograms per liter [µg/L]).
- Concentrations of SVOCs exceeded their AWQSGVs in three (3) unfiltered samples. SVOCs in the filtered samples were below their respective AWSWGVs, except Bis(2-ethylhexyl)phthalate. Bis(2-ethylhexyl)phthalate (maximum concentration of 9.4 µg/L) was detected above its AWQSGV in one filtered sample (SB-4).

- Concentrations of metals exceeded their AWQSGVs in all unfiltered samples. Metals in the filtered samples were below their respective AWQSGVs, with the exception of sodium. Sodium (maximum concentration of 68,300 µg/L) was detected above its AWQSGVs in three (3) filtered groundwater grab samples (SB-4, SB-5, and SB-10). Sodium is naturally occurring in groundwater.
- No PCBs were detected in groundwater.
- Concentrations of pesticides exceeded their AWQSGVs in all unfiltered samples. Pesticides in the filtered samples were below their respective AWQSGVs, with the exception of dieldrin. Dieldrin (maximum concentration of 0.022 [estimated] µg/L) was detected above its AWQSGVs in three (3) filtered groundwater grab samples (SB-1, SB-4 and SB-10).

Soil Vapor

- A total of fourteen (14) compounds were detected in the soil vapor samples.
- All soil vapor samples contained detections of VOCs.
- Tetrachloroethylene (PCE) was detected in four of the seven soil vapor samples.
- Petroleum related compounds (i.e., toluene, ethylbenzene, or xylenes) were found in three (3) soil vapor samples.

An overall Site Setting and Site Plan are included as Figures 2 and 3.

3. Scope of Work

The scope of work for the IRM consists of the following tasks:

- Obtain all necessary permits, insurance, bonds, and licenses to complete all work and pay all necessary fees for the permits obtained;
- Verification of utility locations;
- Site mobilization and Site preparation;
- Provision of all temporary facilities and utilities;
- Provision of site security measures;
- Setup and maintenance of all traffic control measures;
- Setup and maintenance of decontamination areas, staging areas (if required), erosion control measures, and dust control measures;
- Construction and maintenance (during construction) of signs and perimeter fencing;
- Off-Site disposal of concrete construction and demolition (C&D) debris present at the Site;
- Installation and testing of driven and drilled soldier piles at the deep excavation areas;
- Installation of timber lagging and associated excavation to approximately 12 ft bls to allow for installation of walers;
- Excavation of approximately 5,000 cubic yards (CY) of soil from the northern portion of the Site to a depth of approximately six ft bls (the remaining excavation will occur under the approved RIR/RAWP) to facilitate SOE installation. This volume of soil is less than one third of the total volume to be excavated during the redevelopment/remediation under the RIR/RAWP.
- Off-Site transportation and disposal of excavated soil in accordance with all applicable federal, state and local regulations; and
- Documentation.

If there are any changes with the scope a revision of the HASP will be required to address any new hazards.

4. Site Control

This Site control program is designed to reduce the spread of hazardous substances from contaminated areas to clean areas, to identify and isolate contaminated areas of the Site, to facilitate emergency evacuation and medical care, to prevent unauthorized entry to the Site, and to deter vandalism and theft.

4.1 Site Map

A map of this Site, showing Site boundaries, designated work zones, and points of entry and exit is provided in Figure 4.

4.2 Site Access

Access to the Site is restricted to reduce the potential for exposure to its safety and health hazards. During hours of Site operation, Site entry and exit is authorized only at the points identified in Figure 4.

4.3 Buddy System

The buddy system is not applicable.

4.4 Site Communications

The following communication equipment is used to support on-Site communication: cell phones.

4.5 Site Work Zones

This section is not applicable.

5. Job Hazard Evaluation

Roux's work at the Site is expected to entail a variety of physical, chemical, and biological hazards, all of which must be sufficiently managed to allow the work to be performed safely. Some of the hazards are Site-specific, i.e., they are associated with the nature, physical characteristics, and/or routine operation of the Site itself, while others are activity-specific, i.e., they are associated with (or arise from) the particular activity being performed. The various hazards can be grouped into the following categories:

Caught/Crushed – the potential to become caught in, under, between, or by an object or parts of an object, such as equipment with parts that open and close or move up and down ("pinch points") or equipment that rotates, and the accompanying potential to have body parts cut, mangled, or crushed thereby.

Contact – the potential to be struck by or against moving or stationary objects that can cause physical injury, such as heavy machinery, overhead piping, moving vehicles, falling objects, and equipment (including tools and hand-held equipment) or infrastructure with the ability to cut or impale.

Energy Sources – the potential for bodily harm associated with energy sources, most notably electricity, but also including latent energy sources such as compressed air and equipment under tension (which when released could cause injurious contact or a fall).

Ergonomics – the potential for musculoskeletal injury associated with lifting/carrying, pushing/pulling, bending, reaching, and other physical activity attributable to poor body position/mechanics, repetitive motion, and/or vibration.

Exposure – the potential for injury/illness due to physical, chemical, or biological exposures in the work environment, including but not limited to temperature extremes, solar radiation, and noise (physical), chemical splashes and hazardous atmospheres (chemical), and animal/insect bites and poisonous plants (biological).

Falls – the potential to slip or trip and thus fall or drop a load, resulting in bodily injury to oneself or others.

The foregoing is intended to provide Roux employees with a general awareness of the hazards involved with Site work. A more detailed review of the potential hazards associated with each specific activity planned for the Site (or ongoing activity, as the case may be) is provided in the activity-specific Job Safety Analysis (JSA) forms in Appendix A. As can be seen in the JSA forms, the hazards are identified by category per the above, and specific measures designed to mitigate/manage those hazards are also identified. In preparing the JSA forms, all categories of hazards were considered, and all anticipated potential hazards were identified to the extent possible based on the experience of the personnel preparing and reviewing the JSA forms. However, there is always the possibility for an unanticipated hazard to arise, potentially as condition change over the course of the workday. Roux personnel must maintain a continual awareness of potential hazards in the work zone, regardless of whether the hazard is identified in the JSA form. Particular attention should be paid to hazards associated with exposure to hazardous substances (see Table 1 for a listing of the hazardous substances most likely to be encountered in environmental media at the Site) and to Site personnel being located "in the line of fire" with respect to moving equipment, pinch points, and latent energy, e.g., being located or having body parts located within the swing radius of an excavator, between two sections of pipe being connected, below a piece of suspended equipment, or adjacent to a compressed air line.

5.1 Employee Notification of Hazards and Overall Site Information Program

The information in the JSAs and safety data sheets is made available to all employees and subcontractors who could be affected by it prior to the time they begin their work activities. Modifications to JSAs are communicated during routine pre-work briefings.

6. Emergency Response Plan

This emergency response plan details actions to be taken in the event of Site emergencies. The PM and SHSO is responsible for the implementation of emergency response procedures on-Site. The SHSO/PM provides specific direction for emergency action based upon information available regarding the incident and response capabilities and initiates emergency procedures and notification of appropriate authorities. In the event of an emergency, Site personnel are evacuated and do not participate in emergency response activities, response is facilitated through external emergency services.

6.1 Emergency Response

The SHSO, after investigating the incident and relevant information, shall determine the level of response required for containment, rescue and medical care. Limited on-Site emergency response activities could occur therefore the SHSO is responsible for notifying external emergency response agencies. The SHSO provides relevant information to the responding organizations, including but not limited to the hazards associated with the emergency incident, potential containment problems, and missing Site personnel.

6.2 Emergency Alerting and Evacuation

If evacuation notice is given, Site workers leave the worksite, if possible, by way of the nearest exit. Appropriate primary and alternate evacuation routes and assembly areas have been identified and are shown on the Emergency Response Site Map Figure 4. The routes and assembly area will be determined by conditions at the time of the evacuation based on wind direction, the location of the hazard source, and other factors as determined by SHSO/PM.

Personnel exiting the Site gather at a designated assembly point. To determine that everyone has successfully exited the Site, personnel will be accounted for at the assembly Site. If any worker cannot be accounted for, notification is given to so that appropriate action can be initiated. Subcontractors on this Site have coordinated their emergency response plans to ensure that these plans are compatible and potential emergencies are recognized, alarm systems are clearly understood, and evacuation routes are accessible to all personnel relying upon them.

6.3 Emergency Medical Treatment and First Aid

In the event of a work-related injury or illness, employees are required to follow procedures outlined below. All work-place injury and illness situations require Roux's Project and Corporate Management Team to be notified when an injury / illness incident occurs, and communication with the contracted Occupational Health Care Management Provider, AllOne Health, is initiated. The Injury/Illness Notification Flowchart is provided below and within Roux's Incident Investigation and Reporting program included as Appendix D.

If on-Site personnel require any medical treatment, the following steps will be taken:

a. If medical emergency requires immediate, professional care, dial 911.

b. Notify Roux's Project and Corporate Management Team for any work-related injury and/or illness occurrence, and communicate with the contracted Occupational Health Care Management Provider, AllOne Health, immediately following the notifications provided above.

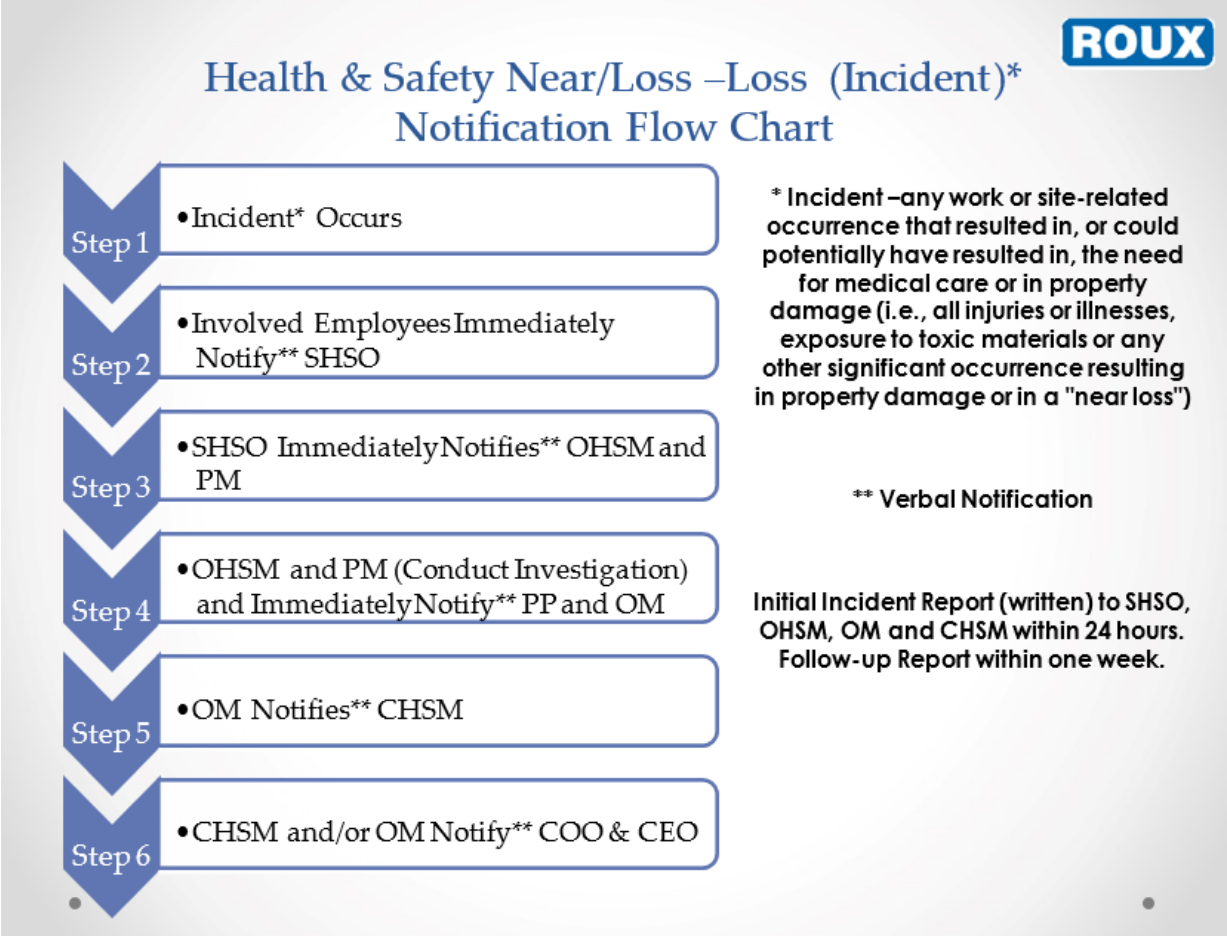
c. Based on discussions with the Project Team, Corporate Management and the AOH evaluation, if medical attention beyond on-Site First Aid is warranted, transport the injured / ill person (IP) to the Urgent Care Center, or notify the Fire Department or Ambulance Emergency service and request an

ambulance or transport the victim to the hospital, and continue communications with Corporate Management Team. An Urgent Care/Hospital Route map with location City MD and Mount Sinai Hospital is included as Figure 5.

d. Decontaminate to the extent possible prior to administration of first aid or movement to medical or emergency facilities.

e. First aid medical support will be provided by on-Site personnel trained and certified in First Aid, Cardio Pulmonary Resuscitation (CPR), Automatic External Defibrillation (AED), and Blood-Borne Pathogens (BBP) Awareness, until relieved by emergency medical services (EMS).

f. The SHSO and Project Manager will perform a Loss Investigation (LI) and the Project Team will complete the final Loss Report. If a Roux employee is involved in a vehicular incident, the employee must also complete the Acord Automobile Loss Notice.



6.4 Adverse Weather Conditions

In the event of adverse weather conditions, the SHSO or project principal will determine if work can continue without sacrificing the health and safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat stress and heat-related injuries.
- Potential for cold stress and cold-related injuries.
- Treacherous weather-related conditions.

- Limited visibility.
- Electrical storm potential.

Site activities will be limited to daylight hours and acceptable weather conditions. Inclement working conditions include heavy rain, fog, high winds, and lightning. Observe daily weather reports and evacuate if necessary in case of inclement weather conditions.

6.5 Electrical Storm Guidelines

In the event that lightning and/or thunder are observed while working on-Site, all on-Site activities shall stop and personnel shall seek proper shelter (e.g., substantial building, enclosed vehicle, etc.). Work shall not resume until the threat of lighting has subsided and no lightning or thunder has been observed for 30 minutes. If the possibility of lightning is forecast for the day, advise the on-Site personnel on the risks and proper procedure at the pre-work safety briefing. Continuously monitor for changing weather conditions and allow enough time to properly stop work if lightning is forecast.

7. Safety Procedures

This section of the HASP presents the specific safety procedures to be implemented during Roux's activities at the Site in order to protect the health and safety of various on-Site personnel. Minimum OSHA-mandated procedures are presented first, followed by client- and Site-specific procedures. Lastly, activity-specific procedures are discussed. These Site- and activity-specific procedures supplement the general safety procedures included in Roux's Corporate Health and Safety Manual, which also must be followed in their entirely.

7.1 Training

At a minimum, Site personnel who will perform work in areas where there exists the potential for toxic exposure will be health and safety-trained prior to performing work on Site per OSHA 29 CFR 1910.120(e) and 29 CFR 1926.65(e). More specifically, all Roux, subcontractor, and other personnel engaged in sampling and remedial activities at the Site and who are exposed or potentially exposed to hazardous substances, health hazards, or safety hazards must have received at a minimum the 40 hour initial HAZWOPER training consistent with the requirements of 29CFR 1910.120(e)(3)(i) training and a minimum of 3 days' actual field experience under the direct supervision of a trained experienced supervisor, plus 8 hours of refresher training on an annual basis. Depending on tasks performed, less training may be permitted. Evidence of such training must be maintained at the Site at all times. Furthermore, all on-Site management and supervisory personnel directly responsible for or who supervise the employees engaged in Site remedial operations, must have received an additional 8 hours of specialized training at the time of job assignment on topics including, but not limited to, the employer's safety and health program and the associated employee training program, personal protective equipment program, spill containment program, and health hazard monitoring procedure and techniques, plus 8 hours of refresher training on an annual basis.

Roux personnel training records are maintained in a corporate database with records available upon request from either the OHSM/SHSO/CHSM or Human Resources Department.

7.2 Site-Specific Safety Briefings for Visitors

A Site-specific briefing is provided to all Site visitors who enter this Site beyond the Site entry point. For visitors, the Site-specific briefing provides information about Site hazards, the Site lay-out including work zones and places of refuge, the emergency alarm system and emergency evacuation procedures, and other pertinent safety and health requirements as appropriate.

7.3 HASP Information and Site-Specific Briefings for Workers

Site personnel review this HASP and are provided a Site-specific tailgate briefing prior to the commencement of work to ensure that employees are familiar with this HASP and the information and requirements it contains as well as relevant JSAs. Additional briefings are provided as necessary to notify employees of any changes to this HASP as a result of information gathered during ongoing Site characterization and analysis. Conditions for which we schedule additional briefings include, but are not limited to: changes in Site conditions, changes in the work schedule/plan, newly discovered hazards, and incidents occurring during Site work.

7.4 Medical Surveillance

The medical surveillance section of the Health and Safety Plan describes how worker health status is monitored at this Site. Medical surveillance is used when there is the potential for worker exposure to hazardous substance at levels above OSHA permissible exposure limits or other published limits. The purpose of a medical surveillance program is to medically monitor worker health to ensure that personnel are not adversely affected by Site hazards. The provisions for medical surveillance at this Site are based on the Site characterization and job hazard analysis found in Section 4 of this HASP and are consistent with OSHA requirements in 29 CFR 1910.120(f).

7.4.1 Site Medical Surveillance Program

Medical surveillance requirements are based on a worker's potential for exposure as determined by the Site characterization and job hazard analysis documented in Section 4 and JSAs within Appendix A of this HASP and in compliance with the requirements of 29 CFR 1910.120(f)(2). Based on Site information and use of direct reading instruments, limited use of respirators (less than 30 days per year), and the absence of an employee-staffed HAZMAT team, a limited medical surveillance program is required and implemented at this Site. The medical surveillance program provides that:

1. Workers assigned to tasks requiring the use of respirators receive medical examinations in accordance with 29 CFR 1910.134(e) to ensure they are physically capable to perform the work and use the equipment, and
2. If a worker is injured, becomes ill, or develops signs or symptoms of possible over-exposure to hazardous substance or health hazards, medical examinations are provided to that worker as soon as possible after the occurrence and as required by the attending physician.
3. These medical examinations and procedures are performed by or under the supervision of a licensed physician and are provided to workers free of cost, without loss of pay, and at a reasonable time and place. In addition, the need to implement a more comprehensive medical surveillance program will be re-evaluated after any apparent over-exposure.

7.4.2 Medical Recordkeeping Procedures

Medical recordkeeping procedures are consistent with the requirements of 29 CFR 1910.1020 and are described in the company's overall safety and health program. A copy of that program is available at our Islandia, NY office.

The following items are maintained in worker medical records:

- Respirator fit test and selection
- Physician's medical opinion of fitness for duty (pre-placement, periodic, termination)
- Physician's medical opinion of fitness for respirator protection (pre-placement, periodic)
- Exposure monitoring results

7.4.3 Program Review

The medical program is reviewed to ensure its effectiveness. The Corporate Health and Safety Manager in coordination with the Human Resources Director is responsible for this review. At minimum, this review consists of:

- Review of accident and injury records and medical records to determine whether the causes of accidents and illness were promptly investigated and whether corrective measures were taken wherever possible,

- Evaluation of the appropriateness of required medical tests based on-Site exposures, and
- Review of emergency treatment procedures and emergency contacts list to ensure they were Site-specific, effective, and current.

7.5 Personnel Protection

Site safety and health hazards are eliminated or reduced to the greatest extent possible through engineering controls and work practices. Where hazards are still present, a combination of engineering controls, work practices and PPE are used to protect employees. Appropriate personal protective equipment (PPE) shall be worn by Site personnel when there is a potential exposure to chemical hazards or physical hazards (e.g., falling objects, flying particles, sharp edges, electricity and noise), as determined by the SHSO. The level of personal protection, type and kind of equipment selected will depend on the hazardous conditions and in some cases cost, availability, compatibility with other equipment, and performance. An accurate assessment of all these factors will be made before work can be safely executed.

Roux maintains a comprehensive written PPE program that addresses proper PPE selection, use, maintenance, storage, fit and inspection. PPE to be used at the Site will meet the appropriate American National Standards Institute (ANSI) standards and the following OSHA (General Industry) standards for minimum PPE requirements.

The minimum level of PPE for entry onto the Site is Level D. The following equipment shall be worn:

- Work uniform (long pants, sleeved shirt)
- Hard hat
- Steel or composite toe work boots
- Safety Glasses (must comply with one of the following ANSI/ISEA Z87.1-2010, ANSI Z87.1-2003, ANSI Z87.1-2003)
- Boot Covers (as needed)
- Hearing Protection (as needed)
- High visibility clothing (shirt/vest)
- Hand Protection (e.g., minimum cut resistance meeting ANSI 105-2000 Level 2)

Note that jewelry shall be removed or appropriately secured to prevent it from becoming caught in rotating equipment or unexpectedly snagged on a fixed object. (e.g., wrist watches bracelets, rings, chains and necklaces, open earrings). Do not wear loose clothing and all shoulder length hair should be tied back.

Site specific PPE ensembles and materials are identified within task specific JSAs located within **Appendix A**, and any upgrades or downgrades of the level of protection (i.e., not specified in the JSA) must be immediately communicated to all Roux personnel and subcontractors as applicable. PPE is used in accordance with manufacturer's recommendations.

7.6 Monitoring

An air monitoring program is important to the safety of on- and off-Site personnel. A preliminary survey, to establish background conditions in the immediate sampling area, may be made prior to the initiation of Site work including, but not limited to, monitoring wind direction and approximate temperature during all invasive

Site activities. This survey will be conducted with the appropriate air monitoring instrument(s) as warranted by the field activity. Once this survey has been complete, any change in the type of PPE will be determined.

Air monitoring may be performed to verify that the proper level of equipment is used and to determine if increased protection or work stoppage is required. The following equipment may be used to monitor conditions:

- Photoionization Detector (PID)

Monitoring equipment will be calibrated in accordance with applicable regulatory requirements and manufacturer specifications. Below are monitoring action levels for Site-specific chemicals of concern. In the event that PID readings above the thresholds identified below are sustained for 5 minutes in the breathing zone, worker protection will require upgrading following notification to the OHSM and applicable parties (e.g., client, board of health, regulators, etc.).

PID Action Levels

Action Levels for Respiratory Protection	
PID Reading in Breathing Zone (ppm)	
<5	No Action
≥5 - <25	Level C
≥25	Cease Field Operations

7.7 Tailgate Safety Meetings

A designated Site worker will provide daily safety briefings (e.g., tailgate meetings) including, but not limited to, the following scenarios:

- When new operations are to be conducted;
- Whenever changes in work practices must be implemented; and
- When new conditions are identified and/or information becomes available.

Daily safety briefings shall be recorded on the Roux Daily Tailgate Health and Safety Meeting Log/Daily Site Safety Checklist, and all completed forms will become a part of the project file.

7.8 Spill Containment

Spill containment equipment and procedures should, at a minimum, meet the requirements of the facility's Spill Prevention, Control and Countermeasure Plan, if applicable. Otherwise, spill containment equipment and procedures must be considered depending on the task including, but no limited to, chemical/product transfer points and handling.

7.8.1 Initial Spill Notification and Response

Any worker who discovers a hazardous substance spill will immediately notify Noelle Clarke, Project Principal. The worker will, to his/her best ability, report the hazardous substance involved, the location of the

spill, the estimated quantity of material spilled, the direction/flow of the spill material, related fire/explosion incidents, and any associated injuries without compromising their own safety.

7.8.2 Spill Evaluation and Response

TDB is responsible for evaluating spills and determining the appropriate response. When this evaluation is being made, the spill area will be isolated and demarcated to the extent possible. If necessary to protect nearby community members, notification of the appropriate authorities is made by the PM as appropriate. On-Site response is limited to small spills (e.g., <10 gallons), large spills require external emergency responders who will be contacted by the SHSO.

7.9 Decontamination

The decontamination section of the HASP describes how personnel and equipment are decontaminated when they leave the Exclusion Zone. This section also describes how residual waste from decontamination processes is disposed. The Site decontamination procedures are designed to achieve an orderly, controlled removal or neutralization of contaminants that may accumulate on personnel or equipment. These procedures minimize worker contact with contaminants and protect against the transfer of contaminants to clean areas of the Site and off-Site. They also extend the useful life of PPE by reducing the amount of time that contaminants contact and can permeate PPE surfaces. Decontamination is facilitated within the contamination reduction zone at this Site.

7.9.1 Decontamination Procedures for Personnel and PPE

The following are general decontamination procedures established and implemented at this Site.

1. Decontamination is required for all workers exiting a contaminated area. Personnel may re-enter the Support Zone only after undergoing the decontamination procedures described below in the next section.
2. Protective clothing is decontaminated, cleaned, laundered, maintained and/or replaced as needed to ensure its effectiveness.
3. PPE used at this Site that requires maintenance or parts replacement is decontaminated prior to repairs or
4. PPE used at this Site is decontaminated or prepared for disposal on the premises. Personnel who handle contaminated equipment have been trained in the proper means to do so to avoid hazardous exposure.
5. This Site uses an off-Site laundry for decontamination of PPE. The Site has informed that facility of the hazards associated with contaminated PPE from this Site.
6. The Site requires and trains workers that if their permeable clothing is splashed or becomes wetted with a hazardous substance, they will immediately exit the work zone, perform applicable decontamination procedures, shower, and change into uncontaminated clothing.
7. Procedures for disposal of decontamination waste meet applicable local, State, and Federal regulations.

7.9.2 Decontamination Procedures for Equipment

All tools, equipment, and machinery from the Exclusion Zone or CRZ are decontaminated in the CRZ prior to removal to the Support Zone. Equipment decontamination procedures are designed to minimize the potential for hazardous skin or inhalation exposure and to avoid cross-contamination and chemical incompatibilities.

General Equipment Decontamination Procedures:

1. Decontamination is required for all equipment exiting a contaminated area. Equipment may re-enter the Support Zone only after undergoing the equipment decontamination procedures.
2. Vehicles that travel regularly between the contaminated and clean areas of the Site are carefully decontaminated each time they exit the Exclusion Zone and the effectiveness of that decontamination is monitored to reduce the likelihood that contamination will be spread to other parts of the Site.
3. Particular attention is given to decontaminating tires, scoops, and other parts of heavy equipment that are directly exposed to contaminants and contaminated soil.

The following items may be used to decontaminate equipment:

- Fresh water rinse;
- Non-phosphorus detergent wash;
- Distilled water rinse;
- Acetone rinse;
- Distilled water rinse; and
- A steam cleaner or pressure washer (heavy equipment only)

7.9.3 Monitoring the Effectiveness of Decontamination Procedures

Visual examination and sampling are used to evaluate the effectiveness of decontamination procedures. Visual examination is used to ensure that procedures are implemented as described and that they appear to control the spread of contaminants under changing site conditions. Visual examination is also used to inspect for signs of residual contamination or for contaminant permeation of PPE.

Personnel who work in contaminated areas of the Site, either the Contamination Reduction Zone (CRZ) or the Exclusion Zone, are trained in the principles and practices of decontamination described in this section of the HASP and in related SOPs. If Site procedures are changed as a result of inspection and monitoring, all affected employees are notified of these changes.

7.10 Confined Space Entry

Confined entry will not be performed at the Site. The following is a list of the safety requirements for confined space entry at the Site.

- **ROUX PERSONNEL ARE NOT AUTHORIZED TO ENTER AN OSHA PERMIT REQUIRED CONFINED SPACE**;
- Currently the scope of work **DOES NOT** require personnel to enter permitted confined space for this project; and
- Any changes to the field activities that may necessitate confined space entry will be reported to the Project Principal and OHSM.

Confined space is defined as any space, depression, or enclosure that:

- Has limited opening for entry and egress;
- Is large enough for and employee to enter and perform assigned work; and
- Is not intended for continuous occupancy.

A permit required confined space is one that meets the definition of a confined space and has one or more of the following characteristics:

- May contain or produce life-threatening atmospheres due to oxygen deficiency the presence of toxic, flammable, or corrosive contaminants;
- Contains a material that has the potential for engulfment;
- Has an internal configuration that may cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section; and
- Contains any other serious safety or health hazards.

Although Roux personnel will not perform confined space entry, it is expected that subcontractors performing cleaning and mitigation and/or remedial measures activities may be required to enter structures that are considered to be a permit required confined space. Permitting of the confined space as well as hazard mitigation for entry will be completed by the subcontractor in accordance with 1910.146.

7.11 Client and Site-Specific

In addition to the OSHA-specific procedures discussed above, there may be client and Site-specific safety procedures that must be adhered to during the performance of remedial activities at the Site.

7.12 Unusual or Significant Risks

Field activities that appear to have unusual or significant risks that cannot be adequately managed with existing risk tools such as LPS, HASPs, traffic safety plans, work permits, design and O&M practices, equipment HAZOPS or other safety tools must be referred to the CHSM to help with the assessment and management of the associated potential safety risks. Examples include the use of explosives for demolition, use of firearms to control wildlife, rappelling, demolition over water, etc.

7.13 Activity-Specific

In addition to the general hazards discussed above, there are activity-specific hazards associated with each work activity planned for the Site. An activity-specific JSA has been completed for each of the activities planned for the Site. JSAs are provided in **Appendix A**. In the event that new work activities or tasks are planned, JSAs will be developed and implemented prior to performing the new activities. In the absence of a JSA, the personnel performing work must prepare a field JSA and receive clearance from a designated competent safety official prior to performing any task with significant risk. In emergency situations where time is critical SPSAs will be utilized to identify the task, associated hazards and mitigative actions to take. For lower risk activities (as deemed by the discretion of a Competent Person) where a JSA is determined to not be needed, the individual(s) conducting the activities must perform SPSAs prior to and during the work.

7.14 Community Air Monitoring Plan

A Community Air Monitoring Plan (CAMP) will be implemented during all intrusive activities. Details of the CAMP is provided in Appendix H.

8. Field Team Review

Each person performing work at or visiting this Site shall sign this section after Site-specific training is completed and before being permitted to access the CRZ or Exclusion Zone.

I have read and understand this Site-Specific Health and Safety Plan. I will comply with the provision contained therein.

Site/Project: Sendero Verde Redevelopment Project – Parcel B

Name Printed	Signature	Date

9. Approvals

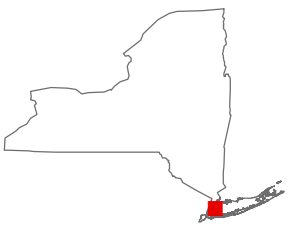
By their signature, the undersigned certify that this HASP is approved and will be utilized at the Sendero Verde Redevelopment Project – Parcel B Site.

TBD – Site Health and Safety Officer	Date
Levi Curnette – Office Health and Safety Manager	Date
Wendy Shen – Project Manager	Date
Noelle Clarke – Project Principal	Date

FIGURES

1. Site Location Map
2. Site Setting Site Plan
3. Site Plan
4. Emergency Meeting Location
5. Emergency Route Map

QUADRANGLE LOCATION



N

750 0 750

Feet

Title:

SITE LOCATION MAP

SENDERO VERDE REDEVELOPMENT
PROJECT – PARCEL B

Prepared For:

SV–B OWNERS LLC

ROUX

Compiled by: J.M.	Date: 21MAY19	FIGURE 1
Prepared by: M.S.R.	Scale: AS SHOWN	
Project Mgr: J.M.	Project: 2984.0003Y000	
File: 2984.0003Y112.1.mxd		

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LEGEND

SITE BOUNDARY

250 0 250

Feet

Title:

SITE SETTING

SENDERO VERDE REDEVELOPMENT
PROJECT – PARCEL B

Prepared For:

SV–B OWNERS LLC

ROUX

Compiled by: J.M.	Date: 21MAY19	FIGURE 2
Prepared by: M.S.R.	Scale: AS SHOWN	
Project Mgr: J.M.	Project: 2984.0003Y000	
File: 2984.0003Y112.2.mxd		

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N

LEGEND

SITE BOUNDARY

20 0 20 40 Feet

Title:

SITE PLAN

SENDERO VERDE REDEVELOPMENT
PROJECT – PARCEL B

Prepared For:

SV–B OWNERS LLC

ROUX

Compiled by: J.M.	Date: 21MAY19
Prepared by: M.S.R.	Scale: AS SHOWN
Project Mgr: J.M.	Project: 2984.0003Y000
File: 2984.0003Y112.3.mxd	

FIGURE 3

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N

LEGEND

EMERGENCY MEETING LOCATION

SITE BOUNDARY

20 0 20 40 Feet

Title:

EMERGENCY MEETING LOCATION

SENDERO VERDE REDEVELOPMENT
PROJECT – PARCEL B

Prepared For:

SV–B OWNERS LLC

ROUX

Compiled by: J.M.	Date: 21MAY19	FIGURE
Prepared by: M.S.R.	Scale: AS SHOWN	4
Project Mgr: J.M.	Project: 2984.0003Y000	
File: 2984.0003Y112.4.mxd		

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DIRECTIONS TO HOSPITAL

1. HEAD SOUTHEAST ON EAST 112TH STREET (144 FEET)
2. TURN RIGHT ONTO PARK AVENUE (0.3 MILES)
3. TURN RIGHT ONTO EAST 106TH STREET (0.2 MILES)
4. TURN LEFT ONTO 5TH AVENUE (0.3 MILES)
5. MOUNT SINAI HOSPITAL WILL BE ON THE LEFT

DIRECTIONS TO CITYMD

1. HEAD SOUTHEAST ON EAST 112TH STREET (0.1 MILES)
2. TURN RIGHT ONTO LEXINGTON AVENUE (0.8 MILES)
3. CITYMD WILL BE ON THE RIGHT

250 0 250 500
Feet

Title:

EMERGENCY ROUTE MAP

SENDERO VERDE REDEVELOPMENT
PROJECT – PARCEL B

Prepared For:

SV–B OWNERS LLC

ROUX

Compiled by: J.M.	Date: 21MAY19
Prepared by: M.S.R.	Scale: AS SHOWN
Project Mgr: J.M.	Project: 2984.0003Y000
File: 2984.0003Y112.5.mxd	

FIGURE 5

V:\GIS\Projects\2984\0003Y\115\2984.0003Y112.5.mxd

APPENDICES

A. Job Safety Analysis (JSA) Forms
B. Site-Specific Emergency Response Plan and Routes to Urgent Care and Emergency Medical Facilities
C. SDSs for Chemicals Used
D. Incident Investigation and Reporting Program
E. Heavy Equipment Exclusion Zone Policy
F. Subsurface Utility Clearance Management Program
G. Personal Protective Equipment Management Program
H. Community Air Monitoring Plan

APPENDIX A

Job Safety Analysis (JSA) Forms

JOB SAFETY ANALYSIS	Ctrl. No. GEN-006	DATE 1/4/2018	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY:	WORK TYPE:	WORK ACTIVITY (Description):	
Generic	**Drilling**	**Direct Push Soil Borings / Well Installation**	
DEVELOPMENT TEAM	**POSITION / TITLE**	**REVIEWED BY:**	**POSITION / TITLE**
Timothy Zei	Project Hydrogeologist	Raymond Olson	Staff Assistant Geologist
		Christine Pietrzyk	Office Health & Safety Manager
		Brian Hobbs	Senior Health & Safety Manager
		Joe Gentile	Corporate Health & Safety Manager

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☒ HEARING PROTECTION: (as needed) ☒ SAFETY SHOES: Composite-toe or steel toe boots	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing, Long Sleeve Shirt	☒ GLOVES: Leather, Nitrile and cut resistant ☒ OTHER: Insect Repellant, sunscreen (as needed)

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Geoprobe or Truck-Mounted Direct Push Drill Rig, Hand Tools, Photoionization Detector, Multi-Gas Meter (or equivalent), Macrocore liners, Liner Opening Tool, 20 lb. Type ABC Fire Extinguisher, 42" Cones & Flags, "Work Area" Signs, Water

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs

EXCLUSION ZONE (EZ) – All non-essential personnel will maintain a distance of 10 feet from drilling equipment while equipment is moving/engaged

"SHOW ME YOUR HANDS"
Driller and helper should show that hands are clear from controls and moving parts

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Mobilization of drilling rig (ensure the Subsurface Clearance Protocol and Drill Rig Checklist are completed)	**1a. CONTACT:** Equipment/property damage.	1a. The drill rig's tower/derrick will be lowered and secured prior to mobilization. 1a. A spotter should be utilized while moving the drill rig. If personnel move into the path of the drill rig, the drill rig will be stopped until the path is again clear. Use a spotter for all required backing operations. 1a. Set-up the work area and position equipment in a manner that eliminates or reduces the need for backing of support trucks and trailers. 1a. When backing up truck rig with an attached trailer use a second spotter if there is tight clearance simultaneously on multiple sides of the equipment or if turning angles limit driver visibility. 1a. Inspect the driving path for uneven terrain. Level or avoid if needed. 1a. Drill rig should have a minimum **exclusion zone of 10 feet** for non-essential personnel (i.e., driller helper, geologist) when the rig is moving/ in operation.
	1b. FALL: Slip/trip/fall hazards.	1b. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment. 1b. Do not climb over stored materials/equipment; walk around. Practice good housekeeping. 1b. Use established pathways and walk on stable, secure ground.
	1c. CONTACT: Crushing from roll-over.	1c Geoprobe should cross all hills/obstructions head on with the mast down to reduce risk of roll-over.
2. Raising tower/derrick of drill rig	**2a. CONTACT:** Overhead hazards.	2a. Prior to raising the tower/derrick, the area above the drilling rig will be inspected for wires, tree limbs, piping, or other structures, that could come in contact with the rig's tower and/or drilling rods or tools. 2a. Maintain a safe distance of 10' from overhead structures.
	2b. CONTACT: Pinch Points/Amputation Points when raising the rig and instability of rig	2b. Inspect the equipment prior to use and avoid pinch/amputation points. 2b. Lower outriggers to ensure stability prior to raising rig tower/derrick. 2b. If the rig needs to be mounted, be sure to use three points of contact.
3. Advancement of drilling equipment and well installation	**3a. CONTACT:** Flying debris	3a. Be aware of and avoid potential lines of fire and wear required PPE such as eye, ear, and hand protection.
	3b. EXPOSURE: Noise and dust.	3b. Wet borehole area with sprayer to minimize dust. 3b. Stand upwind and keep body away from rig. 3b. Dust mask should be worn if conditions warrant. 3b. Wear hearing protection when the drill rig is in operation.

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.
[2] A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.
[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Advancement of drilling equipment and well installation (Continued)	**3a. CONTACT:** Flying debris **3b. EXPOSURE:** Noise and dust. **3c. FALL:** Slip/trip/fall hazards. **3d. CAUGHT:** Limb/extremity pinching; abrasion/crushing. **3e. CONTACT:** Equipment imbalance during advancement of drill equipment. **3f. EXPOSURE:** Inhalation of contamination/vapors. **3g. EXERTION:** Potential for muscle strain/injury while lifting and installing well casings, lifting sand bags, and/or lifting rods.	3c. Contain drill cuttings and drilling water to prevent fall hazards from developing in work area. 3c. See 1b. 3d. Ensure all Emergency Safety Stop buttons function properly. 3d. Always wear leather gloves when making connections and using hand tools; wear cut-resistant (i.e., Kevlar) gloves when handling cutting tools. 3d. Inspect the equipment prior to use for potential pinch/amputation points. Keep hands away from pinch/amputation points and use of tools is preferable compared to fingers and hands. 3d. Inspect drill head for worn surface or missing teeth; replace if damaged or blunt. 3d. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body. 3d. All non-essential personnel should stay away from the immediate work area; position body out of the line-of-fire of equipment. 3d. Drillers and helpers will understand and use the "Show Me Your Hands" Policy. 3d. Spinning rods/casing have an **exclusion zone of 10 feet** while in operation. 3e. Drillers will advance the borehole with caution to avoid causing the rig to become imbalanced and/or tip. 3e. The blocking and leveling devices used to secure the rig will be inspected by drillers and Roux personnel regularly to see if shifting has occurred. 3e. In addition, personnel and equipment that are non-essential to the advancement of the borehole will be positioned away from the rig at a distance that is at least as far as the boom is high (**minimum exclusion zone of 10 feet**). 3f. Monitor ambient air for dangerous conditions using a calibrated photoionization detector (PID) to periodically monitor the breathing zone of the work area. 3f. If a reading of >5ppm is recorded, the Roux field personnel must temporarily cease work, instruct all Site personnel to step away from the area of elevated readings and inform the Roux PM of the condition. The Roux PM will then recommend additional precautions in accordance with the site specific health and safety plan. 3f. Use a multi-gas meter to monitor ambient air for dangerous conditions (i.e. unsafe levels of carbon monoxide when drilling indoors or the presence of explosive vapors). 3g. Keep back straight and bend at the knees. 3g. Utilize team lifting for objects over 50lbs. 3g. Use mechanical lifting device for odd shaped objects.
4. Remove sample liner.	**4a. EXERTION:** Potential for muscle strain/injury while removing liner from probe rod. **4b. CONTACT:** Pinch points and cuts **4c. EXPOSURE:** Inhalation and/or dermal contact with contaminants.	4a Utilize team lifting for objects over 50lbs. 4a. Use hydraulic liner extruder if available. 4b. Place liner on sturdy surface when opening. 4b. Don cut-resistant gloves and use appropriate liner cutter when opening liners. 4b. Always cut away from the body. 4c. Wear chemical-resistant disposable gloves when handling liners. 4c. See 3e.
5. Decontaminate equipment.	**5a. EXPOSURE/CONTACT**: To contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated groundwater, vapors). **5b. EXPOSURE:** To chemicals in cleaning solution including ammonia.	5a. Wear chemical-resistant disposable gloves and safety glasses. 5a. Contain decontamination water so that it does not spill. 5a. Use an absorbent pad to clean spills, if necessary. 5a. Spray equipment from side angle, not straight on, to avoid backsplash. 5a. See 3b. 5b. See 4a. Review SDS to ensure appropriate precautions are taken and understood.

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

JOB SAFETY ANALYSIS	Ctrl. No. GEN-009	DATE: 1/4/2018	☐ NEW ☒ REVISED	PAGE 1 of 1

JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
Generic	**O&M**	**Movement of 55-Gallon Drums/Drum Handling with Mobile Carrier**

DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE
Michael Sarni	Technician	Brian Hobbs	Senior Health & Safety Manager
		Joe Gentile	Corporate Health & Safety Manager

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☒ GLOVES: Cut-resistant gloves
☒ HARD HAT	☐ FACE SHIELD	☐ SUPPLIED RESPIRATOR	☐ OTHER:
☐ LIFELINE / BODY HARNESS	☐ HEARING PROTECTION	☒ PPE CLOTHING: Fluorescent long sleeve shirt or long sleeve shirt and reflective safety vest.	
☒ SAFETY GLASSES	☒ SAFETY SHOES: Steel or composite toe		

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Mobile Drum Carrier, safety cones, and caution tape

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs

EXCLUSION ZONE (EZ): A 10-foot exclusion zone will be maintained around heavy equipment (i.e. forklift).

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Preparing for and Inspection of Drum	**1a. FALL:** Tripping/falling due to uneven surface. Loose debris/garbage in work area.	1a. Clear area of loose garbage and debris. Inspect 55-gal drums for proper condition, labeling, check drum ring and bolts for tightness, inspect mobile drum carrier. 1a. Do a Test Lift to get a general sense of the weight of the drum. 1a. Inspect and use established pathways to avoid uneven terrain, weather-related hazards (i.e., debris, puddles, ice, etc.), and other obstructions. 1a. Secure work area and coordinate and communicate the planned work activities with other personnel working in the area. 1a. Delineate work area with 42" safety cones.
	1b. CONTACT/EXPOSURE: Drums could potentially be damaged or contain hazardous material. Mobile drum carrier could potentially be in poor working condition causing malfunctioning during operation.	1b. Prior to inspecting drums don cut-resistant gloves. If drum is not properly labeled, do not open and cease all drum transport activities. Immediately contact project manager and inform him/her of drum situation. 1b. Do not continue drum transport activities until further actions are determined by the project manager. 1b. If the drum is properly labeled, but leaking, improperly sealed or in poor condition, place drum in an over-pack drum. 1b. Inspect mobile drum carrier to ensure its overall integrity. Look for rust marks or potential weak points where the drum carrier could malfunction. Inspect the wheels to ensure that they easily turn and nothing is impeding their movement.
	1c. EXERTION/CAUGHT: Potential pinching/exertion hazards while securing ring/ tightening bolts	1c. Keep back straight and knees slightly bent while securing drum ring/tightening bolt. Wear cut-resistant gloves.
2. Position drum clamp tightly in between drum ribs, securing drum clamp to drum with chain	**2a. CAUGHT:** Pinching fingers between drum clamp and handle/chain.	2a. Attach drum clamp with chain and tighten until snug. Do not place hands between drum clamp and drum as the chain is tightened; wear cut resistant gloves. Keep face away from drum when handling in case of escaping vapors.

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.
[2] A hazard is a potential danger. Break hazards into six types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy source – electricity, pressure, compression/tension.
[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift." Avoid general statements such as, "be careful."

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Disengage safety latches on handle, pull handle down until drum is lifted off ground and safety latches are reengaged; slightly suspending drum off the ground	**3a. EXERTION/ CONTACT:** Potential muscle strain associated with lifting/engaging drum/handle. Drum could shift/slip downward and crush toes.	3a. Ascertain whether the drum is overweight; if it is, then two people are needed to lower handle while drum is secured with clamp so that safety latches can be engaged. Keep body out of the line of fire of the handle (do not position head above handle) as it is being pushed down. Do not allow feet/toes to be positioned under the drum as it is being lifted; wear steel/composite toe boots.
	3b. CAUGHT: Fingers could be pinched while engaging/disengaging safety latches on handle	3b. Wear cut-resistant gloves while disengaging/reengaging safety latches. 3b. Avoid placing hands in pinch points.
4. Transport drums to designated location and disengage drum clamp (repeat Step 3 in reverse order)	**4a. FALL:** Tripping/ falling due to obstructions and uneven terrain. Potential for drum to fall during transport.	4a. Ensure transport path is free of potential obstructions that may cause the drum/carrier to become unstable. Position drum clamp between the ribs on the drum to prevent possible slipping.

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.
[2] A hazard is a potential danger. Break hazards into six types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy source – electricity, pressure, compression/tension.
[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift." Avoid general statements such as, "be careful."

JOB SAFETY ANALYSIS	Cntrl. No. GEN-009	DATE: 2/11/2015	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
GENERIC	**Hand Tools**	**Pre-Clearing activities, including Air Knifing and Soil Vacuuming**

DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE
Alyssa Lau	Staff Engineer	Daniel Abberton	SHSM
		Mike Ritorto	Senior Hydrogeologist
		Laura Jensen	Staff Hydrogeologist

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☒ GLOVES: Nitrile and cut resistant
☒ HARD HAT	☒ FACE SHIELD (while air knifing)	☐ SUPPLIED RESPIRATOR	
☐ LIFELINE / BODY HARNESS	☒ HEARING PROTECTION (as needed)	☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	☒ OTHER: Dust mask (as needed)
☒ SAFETY GLASSES	☒ SAFETY SHOES: Steel or composite toed		

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Required Equipment: Air Knife, Vactor Truck (Vac Truck), Compressor, Hand Tools, Circular Saw, Dust Mask, Photoionization Detector, Multi-Gas Meter, Traffic Cones, Rigid Barrier, Caution Tape, 20 lb. Fire Extinguisher, "Work Area" and/or "Exclusion Zone" Signs

Commitment to LPS – All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.

EXCLUSION ZONE: A 10 foot exclusion zone will be maintained around air knife and/or soil vacuum operations.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Verify pre-clearance protocol.	1a. **CONTACT**: Underground utility damage; property damage; personal injury. See Site Walk Inspection JSA for potential hazards.	1a. Confirm that local utility companies were contacted prior to drilling. 1a. Walk the Site to evaluate utility markings and review maps (**See Site Walk Inspection JSA for critical actions**). 1a. Review pre-clearing checklist form and sub-surface clearance form. Pre-clearing protocol indicates that clearance must be conducted to a minimum of 5 vertical feet below ground surface or 8 vertical feet below ground surface in the critical zone using hand tools.
2. Mobilize/demobilize and establish work area.	2a. **See Mobilization / Demobilization JSA for potential hazards.**	2a. **See Mobilization / Demobilization JSA for critical actions.**
3. Pre-clear with air knife, water lance, and soil vacuum, and/or clearance with hand tools	3a. **CONTACT**: Flying debris striking face or body 3b. **EXPOSURE/ENERGY SOURCE**: Inhalation/exposure to hazardous vapors; inhalation/exposure to dust; electrocution. 3c. **CONTACT:** Damage to unknown/known utility with air knife. 3d. **ERGONOMICS** Poor body positioning when handling equipment and materials.	3a. **Maintain 10 foot exclusion zone.** Only (air knife/vac truck) operator and designated helper shall remain within exclusion zone while air knife/vac truck is active. Use the required PPE, including (at a minimum), cut resistant gloves, safety glasses with side shields, and long sleeved shirt. 3a. Wear a face shield to protect face from flying debris when using air knife. 3a. Aim air knife tip away from self and others, so to avoid line-of-fire hazards. 3a. Use anti-whip devices on compressor hoses. 3b. Monitor breathing zone with a calibrated PID and multi-gas meter. If vapors sustain levels > 5 ppm, the Roux field personnel must temporarily cease work, instruct all Site personnel to step away from the area of elevated readings and inform the Roux Project Manager of the condition. The Roux Project Manager will then recommend additional precautions. 3b. Wear dust masks as needed 3b. Ensure no open flames/heat sources are present within the work area. 3b. No open flames/heat sources. 3b. Ensure vac truck is properly grounded prior to use. 3b. Do not use metal dig bar; use fiberglass or equivalent. 3c. Avoid contacting utilities directly with the high pressure air stream and using the air knife tip as a physical digging tool. 3c. Keep the air knife tip constantly moving to reduce direct pressure on a potential utility. 3c. increase the distance between air knife tip and soil/utility. 3c. Continually remove soil slurry from hole with vacuum, which may have an abrasive effect on utility casings. 3d. Use proper body positioning and lifting techniques that minimizes muscle strain; keep back straight, lift with legs, keep load close to body, and never reach with a load.

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift." Avoid general statements such as, "be careful."

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Pre-clearing with air knife and soil vacuum, and/or clearance with hand tools (continued)	3d. **ERGONOMICS**: (continued) Poor body positioning when handling equipment and materials.	3d. Ensure that loads are balanced to reduce the potential for muscle strain. 3d. Two people or a mechanical lifting aid are required when lifting objects over 50 lb. or when the shape makes the object difficult to lift.
	3e. **FALL**: Tripping/falling due to uneven terrain, weather conditions, and materials/equipment stored at the Site.	3e. Inspect walking path for uneven terrain, weather-related hazards (e.g., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment. 3e. Walk around any stored materials/equipment; do not climb over. Practice good housekeeping. 3e. Use established pathways and walk on stable, secure ground. 3e. Equipment and tools will be stored at the lowest point of potential energy and out of the walkway and immediate work area (i.e., tools should not be propped against walls or nearby equipment or vehicles). 3e. Equipment and tools that are not anticipated to be used will be returned to a storage area that is out of the immediate work area. 3e. Ensure power cords/hoses are grouped when used within the work area. Mark out cords/hoses that cross pathways with traffic cones. 3e. Ensure all Site personnel and equipment stay a minimum of 2 feet from an open hole. Mark out open holes with traffic cones/caution tape, etc. 3e. Pre-cleared location will be finished flush to grade as to prevent a slip/trip hazard.
	3f. **CAUGHT**: Pinch points or amputation points associated with the equipment and vacuum hose.	3f. Always wear cut-resistant gloves when making connections and using hand tools. 3f. Inspect the equipment prior to use for potential pinch points. 3f. Test all emergency shutdown devices prior to using equipment. 3f. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body. 3f. **All non-essential personnel shall maintain a 10 foot exclusion zone**; position body out of the line-of-fire. 3f. **Drillers and helpers will understand and use the "Show Me Your Hands Policy".**
	3g. **EXPOSURE**: Noise from vac truck and/or air compressor.	3g. Wear hearing protection when vac truck and air compressor are in operation. Otherwise, if sound levels exceed 85 dB, don hearing protection.
4. Move drum to staging area using drum cart.	4a. **EXPOSURE/CONTACT**: Contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated groundwater, soil).	4a. Wear chemically resistant gloves (i.e., Nitrile; worn in addition to cut resistant gloves). 4a. Do not overfill drums. Ensure that the drum lids are attached securely. 4a. Stage all drums in the designated storage area (per Roux Project Manager) and ensure they are labeled.
	4b. **ERGONOMICS**: Muscle strain while maneuvering drums with drum cart/lift gate.	4b. See 3d. Do not overfill drums. Use lift gate on back of truck to load and unload drums or drum cart to transport drums.
	4c. **CAUGHT**: Pinch points or amputation points associated with handling drum lid.	4c. Ensure that fingers are not placed under the lid of the drum. Wear cut-resistant gloves. Use 15/16" ratchet while sealing drum lid.
5. Decontaminate equipment and tools.	5a. **EXPOSURE/CONTACT**: To contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated groundwater, vapors).	5a. See 4a. 5a. Contain decontamination water (closed lid) so that it does not spill. 5a. Use an absorbent pad to clean spills, if necessary. 5a. Store all impacted materials/PPE in a designated storage container (per Roux Project Manager) and ensure the container is labeled.
	5b. **EXPOSURE**: To chemicals in cleaning solution.	5b. See 4a.

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

[2] A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.

[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

JOB SAFETY ANALYSIS Ctrl. No. GEN-013	DATE 1/4/2018	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY	WORK TYPE:	WORK ACTIVITY (Description):
Generic	**Gauging and Sampling**	**Gauging and Sampling**

DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE
Brandon Tufano	Staff Geologist	Brian Hobbs	Senior Health & Safety Manager
		Joe Gentile	Corporate Health & Safety Manager

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☒ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☒ SAFETY SHOES: Composite-toe or steel toe boots	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	☒ GLOVES: Leather, Nitrile and cut resistant ☒ OTHER: Knee pads, Insect Repellant, sunscreen (as needed)

REQUIRED AND / OR RECOMMENDED EQUIPMENT

42-inch Safety Cones, Caution Tape, Interface Probe and/or Water Level Meter, 20-lb., Type ABC Fire Extinguisher, Buckets. Tools as needed: Socket Wrench, Screw Driver, Crow Bar, Mallet, and Wire Brush.

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Mobilization to monitoring well(s).	**1a. FALL:** Personal injury from slip/trip/fall due to uneven terrain and/or obstructions.	1a. Inspect pathway and plan for most suitable designated pathway prior to mobilization. 1a. Use established pathways, walk and/or drive on stable, secure ground and avoid steep hills or uneven terrain. 1a. If working near open water with an unguarded edge, wear life vest.
	1b. CONTACT: With traffic/third parties.	1b. Identify potential traffic sources and delineate work area with 42-inch traffic safety cones. Position vehicle to protect against oncoming traffic. Use caution tape to provide a more visible delineation of the work area if necessary. 1b. Wear appropriate PPE including high visibility clothing or reflective vest. 1b. Face traffic, maintain eye contact with oncoming vehicles, and establish a safe exit route.
	1c. EXERTION: Muscle strain from lifting equipment	1c. Use proper lifting techniques when handling/moving equipment; bend knees and keep back straight. 4c. Use mechanical assistance or team lifting techniques when equipment is 50 lbs. or heavier. 4c. Make multiple trips to carry equipment.
	1d. EXPOSURE: To biological hazards.	1d. Inspect work area for bees and insects. 1d. Use insect/tick repellent as necessary.
2. Open/close well.	**2a. EXERTION:** Muscle strain.	2a. Use proper lifting techniques; keep back straight, lift with legs and bend knees when reaching to open/close well.
	2b. CAUGHT: Pinch/crush points associated with removing/replacing manholes and working with hand tools.	2b. Wear leather gloves or cut resistant gloves when working with well cover and hand tools. 2b. Use proper tools (ratchet and pry bar for well cover) and inspect before use. 2b. Do not put fingers under well cover.
	2c. CAUGHT: Pinch points associated with placing J-plug back onto PVC pipe.	2c. See 2b. 2c. Keep fingers out of line-of-fire when securing cap.
	2d. EXPOSURE: To potential hazardous vapors.	2d. No open flames/heat sources. 2d. To minimize exposure to vapors, allow well to vent after opening it and before sampling activities begin. 2d. Stand up-wind, if possible, to avoid inhaling vapors.
3. Gauge well.	**3a. CONTACT:** With contamination (e.g. contaminated groundwater).	3a. Wear chemical-resistant disposable gloves (over cut-resistant gloves) and safety glasses when gauging well. 3a. Insert and remove probe slowly to avoid splashing. 3a. Use an absorbent pad to clean probe.
	3b. CONTACT: With traffic.	3b. See 1b.

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
4. Purge and sample well	**4a. EXPOSURE/CONTACT:** To contamination (e.g., SPH, contaminated groundwater, vapors) and/or sample preservatives.	4a. Open and fill sample jars slowly to avoid splashing and contact with preservatives. 4a. Wear cut-resistant gloves and chemical-resistant disposable gloves when sampling. 4a. Fill sample containers over purge container to avoid spilling water onto the ground. 4a. Use an absorbent pad to clean spills. 4a. When using a bailer to purge a well, pull the bailer slowly from the well to avoid splash hazards. 4a. When sampling or purging the water using a bailer, pour out water slowly to reduce the potential for splash hazards with groundwater. 4a. When using a tubing valve always remove the valve slowly after sample collection to release any pressure and avoid pressurized splash hazards. 4a. When collecting a groundwater sample always point sampling apparatus (tubing, bailer, etc.) away from face and body.
	4b. CONTACT: Personal injury from cuts, abrasions, or punctures by glassware or sharp objects.	4b. To avoid spills or breakage, place sample ware on even surface. 4b. Do not over tighten caps on glass sample ware. 4b. Wear chemical-resistant nitrile disposable gloves over cut-resistant (i.e., Kevlar) gloves when sampling and handling glassware (i.e., VOA vials) or when using cutting tools.
	4c. EXERTION: Muscle strain while carrying equipment.	4c. Use proper lifting techniques when handling/moving equipment, bend knees and keep back straight. 4c. Use mechanical assistance or team lifting techniques when equipment is 50 lbs. or heavier. 4c. Make multiple trips to carry equipment.
	4d. CONTACT: With traffic.	4d. See 1b.
	4e. CONTACT: Pinch points with groundwater pump components (i.e., wheel, line, clamps).	4e. Wear leather gloves when working with groundwater pumps. 4e. Never place hands on or near pinch points such as the wheel, clamps or other moving parts during pump operations. 4e. Use the correct mechanisms, such as a pump reel, to lower pump into well. 4e. Never attempt to manually stop any moving part of equipment including hose reels and/or tubing.
	4f. EXERTION: Muscle strain from repetitive motion of bailing and sampling a well.	4f. See 4c. 4f. Include a stretch break when repetitive motions are part of the task.
5. Management of purge water.	**5a. EXPOSURE/CONTACT:** To contamination (e.g., SPH, contaminated groundwater, vapors).	5a. Do not overfill container and pour liquids slowly so that they do not splash. 5a. Properly dispose of used materials/PPE in appropriate container in designated storage area.
	5b. EXERTION: Muscle strain from lifting/carrying and moving containers.	5b. Use proper lifting techniques when lifting / carrying or moving container(s) (see 4c.). 5b. Do not overfill container(s).
6. Decontaminate equipment.	**6a. EXPOSURE/CONTACT:** To contamination (e.g., SPH, contaminated groundwater, vapors).	6a. Work on the upwind side, where possible, of decon area. 6a. Wear chemical-resistant disposable gloves and safety glasses. 6a. Use an absorbent pad to clean spills.
	6b. CAUGHT: Pinch points associated with handling hand tools	6b. See 2b. 6b. Inspect hand tools for sharp edges before decontaminating.

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JOB SAFETY ANALYSIS	Ctrl. No. GEN-014	DATE: 1/4/2018	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY:	WORK TYPE:	WORK ACTIVITY (Description):	
Generic	**Drilling**	**Hollow Stem Auger Soil Borings / Well Installation**	
DEVELOPMENT TEAM	**POSITION / TITLE**	**REVIEWED BY:**	**POSITION / TITLE**
Douglas Ferraiolo	Staff Geologist	Brian Hobbs	Senior Health & Safety Manager
		Joe Gentile	Corporate Health & Safety Manager

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☒ GOGGLES: Spoggles required if winds exceed 15 mph. ☐ FACE SHIELD ☒ HEARING PROTECTION: (as needed). ☒ SAFETY SHOES: Steel or Composite Toe.	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent long-sleeve shirt or long-sleeve shirt and reflective safety vest.	☒ GLOVES: Leather, Cut-Resistant, and Nitrile. ☒ OTHER: Insect Repellant, Sunscreen (as needed).

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Truck-Mounted Drilling Rig or Track Rig, Saw, Hand Tools, Photoionization Detector, Multi-Gas Meter (or equivalent), Interface Probe, 20 lb. Type ABC Fire Extinguisher, 42" Cones & Flags, "Work Area" Signs.

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs

EXCLUSION ZONE (EZ) – All non-essential personnel shall maintain a **10 foot** exclusion zone while drill rig is engaged.

"SHOW ME YOUR HANDS"
Driller and helper should show that hands are clear from controls and moving parts

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Mobilization / demobilization and establish a work area.	**1a. See Mobilization/ Demobilization JSA GEN-015.**	1a. See Mobilization / Demobilization JSA GEN-015.
2. Raising tower / derrick of drilling rig.	**2a. CONTACT:** Overhead hazards.	2a. Prior to raising the tower / derrick, the area above the drilling rig will be inspected for overhead hazards (wires, tree limbs, piping or other structures) that may be contacted by the rig's tower or drilling rods. 2a. The tower / derrick must not be raised beneath overhead power lines unless approved by the Roux PM. 2a. Maintain a minimum of 10' from all overhead structures. 2a. Do not move the rig while the tower / derrick is raised.
	2b. CONTACT: Amputation / crush points when raising the rig and instability of rig.	2b. Inspect the equipment prior to use and avoid any potential amputation points. 2b. Lower outriggers to ensure stability prior to raising rig tower derrick. Keep feet and body out of the line of fire when lowering out-riggers. 2b. Inspect the set-up location for uneven terrain. Level or avoid area if needed. 2b. If the rig needs to be mounted, be sure to use three points of contact.
3. Advancement of augers for soil boring installation.	**3a. CONTACT:** Equipment imbalance during advancement of drill equipment.	3a. Drillers will advance the borehole with caution to avoid causing the rig to become imbalanced and / or tip. 3a. The blocking and leveling devices used to secure the rig will be inspected by drillers and Roux personnel regularly to see if shifting has occurred. 3a. Drillers will maintain the "Purple Zone" policy surrounding augers to ensure no personnel come into contact with augers while in use. Workers will spray paint a 3' semi-circle surrounding the augers to visually show that no personnel should enter the "Purple Zone" while drilling activities are being conducted. 3a. In addition, personnel and equipment that are non-essential to the advancement of the borehole will be positioned away from the rig at a distance that is at least as far as the boom is high (minimum exclusion zone of 20 feet).
	3b. CONTACT: Flying / spraying debris.	3b. Wear all required PPE (especially hand, eye, and ear protection). 3b. Maintain minimum 20' EZ distance when rig is in operation to avoid potential line of fire hazards from flying materials or debris.
	3c. CAUGHT: Limb/extremity amputation, abrasion, and crushing.	3c. Inspect the equipment prior to use for potential pinch points. 3c. Test all emergency shutdown devices prior to drilling. 3c. Inspect drill head for worn surface or missing teeth; replace if damaged or blunt. 3c. Inspect augers, do not use if auger flight is damaged or bent.
Assess	**Analyze**	**Act**

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[1]JOB STEPS	[2]POTENTIAL HAZARDS	[3]CRITICAL ACTIONS
3. Advancement of augers for soil boring installation (Continued).		3c. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body. 3c. All non-essential personnel should stay away from the immediate work area; position body out of the line-of-fire of equipment particularly when installing auger flights and steel override casings. 3c. Drillers and helpers will understand and use the "Show Me Your Hands" Policy. 3c. Spinning augers should have an exclusion zone of 20 feet when in operation.
	3d. FALL: Slip/trip/fall hazards.	3d. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment. 3d. Do not climb over stored materials/equipment; walk around. Practice good housekeeping. 3d. Use established pathways and walk on stable, secure ground. 3d. Use three points of contact when mounting or dismounting the rig. 3d. Remove soil cuttings to avoid a tripping hazard from developing near augers.
	3e. EXPOSURE: Inhalation of contamination / vapors.	3e. Air monitoring using a calibrated photoionization detector (PID) to periodically monitor the breathing zone of the work area. 3e. The Action Level for breathing zone air is five parts per million (sustained) as detected by the PID. 3e. If a reading of >5ppm is recorded, the Roux field personnel must temporarily cease work, instruct all Site personnel to step away from the area of elevated readings and inform the Roux PM of the condition. The Roux PM will then recommend additional appropriate precautions in accordance with the site specific health and safety plan.
	3f. EXPOSURE: Noise and dust.	3f. Wet borehole area with sprayer to minimize dust. Stand upwind and keep body positioned away from rig. 3f. Wear hearing protection while drill rig is operating and / or the noise levels exceed 85 dBA.
	3g. EXERTION: Installing well casings and lifting augers.	3g. Keep back straight and bend at the knees. 3g. Utilize team lifting for objects over 50lbs. 3g. Use mechanical lifting device for odd shaped objects.
4. Installation of well materials.	**4a. CONTACT:** Installing well materials while also pulling up augers. **4b. CAUGHT:** Possible pinch or crush hazard assembling PVC and sending down the borehole. **4c. FALL:** Slip/trip/fall hazards with hand tools and materials. **4d. EXPOSURE:** Potential contamination, harmful vapors, dust, and / or noise. **4e. EXERTION:** Lifting heavy bags of materials to backfill borehole.	4a. Potential contact with augers during installation of well materials. 4a. Keep distance from augers and do not place any materials while augers are in motion. 4b. Keep all body parts out of potential pinch points while placing PVC together and sending down borehole. 4c. See 3d. 4d. See 3e and 3f. 4d. Stand upwind to avoid exposure to dust generated from packing materials. 4e. Ergonomic hazard lifting bags of sand and bentonite while packing the well.
5. Cleaning the auger flights	**5a. CONTACT:** Cuts/scrapes or puncture wound from contacting auger.	5a. Follow "Show Me Your Hands" Procedure and make sure auger is out of gear before contacting auger with tool or hand. 5a. Pull cleaning tool across your body with handle away from body; do not push toward the auger. 5a. Do not clean more than ¾ turn around the auger at a time. 5a. Wear cut resistant and leather gloves. 5a. Always use two hands to operate cleaning tool. 5a. Inspect tool before use and remove from service if handle or metal are cracked/fatigued. 5a. Stand out of the line of fire.
6. Decontaminate equipment.	**6a. EXPOSURE / CONTACT:** To contamination (e.g., contaminated groundwater, vapors). **6b. EXPOSURE**: To chemicals in cleaning solution (including ammonia).	6a. Wear chemical-resistant disposable gloves and safety glasses. 6a. Contain decontamination water so that it does not spill. 6a. Use an absorbent pad to clean spills, if necessary. 6b. See 3e. Wear all appropriate PPE and stand upwind of any exposed cleaning solutions.

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JOB SAFETY ANALYSIS	Ctrl. No. GEN-015	DATE: 1/4/2018	☐NEW ☒REVISED	PAGE 1 of 2

JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)	
GENERIC	**Site Recon**	**Mobilization/Demobilization**	
DEVELOPMENT TEAM	**POSITION / TITLE**	**REVIEWED BY:**	**POSITION / TITLE**
Rebecca Lowy	Staff Assistant Geologist	Brian Hobbs	Senior Health & Safety Manager
Tally Sodre	OHSM	Joe Gentile	Corporate Health & Safety Manager

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☒ HEARING PROTECTION (as needed) ☒ SAFETY SHOES: Steel Toe or composite toe	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest of high-visibility clothing; long sleeve shirt; long pants	☒ GLOVES: Leather, nitrile, and cut resistant (as needed) ☐ OTHER

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Required Equipment: None

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs

EXCLUSION ZONE (EZ): A 10-foot exclusion zone will be maintained around equipment in use..

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Mobilize/demobilize and establish work area	**1a. FALL:** Slip/trips/falls from obstructions, uneven terrain, weather conditions, heavy loads, and/or poor housekeeping.	1a. Use 3 points-of-contact/ensure secure footing when entering and exiting vehicle. 1a. Inspect walking path for uneven terrain, steep hills, obstructions, and/or weather-related hazards (i.e., ice, snow, and puddles) prior to mobilizing equipment. Use established pathways. Walk on stable/secure ground. 1a. Do not climb over stored materials/equipment; walk around. Practice good housekeeping; organize and store equipment neatly in one area at its lowest potential energy. 1a. Wear boots with adequate treads. 1a. Delineate unsafe areas with 42” cones, caution tape and/or flagging.
	1b. CONTACT: Personal injury and/or property damage caused by being struck by Site traffic or equipment used in Site activities.	1b. Observe and maintain the posted speed limits. 1b. When first arriving onsite, park vehicles in designated parking space and/or out of the way locations. Use parking brake on all vehicles and tire chocks on work trucks and trailers. 1b. Check in with Site Manager/Supervisor to ensure coordination with other Site activities and to discuss any special hazards. Ensure that short-service employees (SSE) are identified. 1b. Identify potential traffic sources. 1b. Wear PPE including high visibility clothing or reflective vest. 1b. Use a spotter while moving work vehicles; plan ahead to avoid backing whenever possible. 1b. Maintain a minimum 10’ exclusion zone when vehicles are in motion. When backing up truck rig with an attached trailer use a second spotter if there is tight clearance simultaneously on multiple sides of the equipment or if turning angles limit driver-to-spotter visibility. 1b. Delineate work area with 42” cones, flags, caution tape, and/or other barriers. 1b. Position “Work Area” signs at Site entrances, if possible, or at either side of work area.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
		1b. Position largest vehicle to protect against oncoming traffic. 1b. Face traffic, maintain eye contact with oncoming vehicles, use a spotter, and establish a safe exit route. 1b. Observe potential overhead and ground surface features that may interfere with moving equipment. Clear the path of physical hazards prior to initiating mobilization.
	1c. CAUGHT: Personal injury from pinch points and being in line-of-fire of vehicle and/or equipment.	1c. Make sure driver has engaged parking brake and placed wheel chocks in a position to prevent movement. Be sure that vehicle is parked in front/down gradient (positioned to best block oncoming traffic) of work area. 1c. Wear leather gloves when handling any tools or equipment. Wear cut-resistant gloves (Kevlar or similar) when handling sharp objects/cutting tools/glass. 1c. Keep body parts away from line-of-fire of equipment. 1c. Always carry tools by the handles and/or designated carrier. Ensure sharp-edged tools are sheathed/secure. 1c. Remove any loose jewelry. Avoid wearing loose clothing and/or ensure loose clothing is secure. 1c. Secure all items on the equipment, tighten up any items or features that have potential to shift or break during mobilization.
	1d. OVEREXERTION: Muscle strains while lifting/carrying equipment.	1d. Use body positioning and lifting techniques that avoid muscle strain; keep back straight, lift with legs, turn with whole body, keep load close to body, and never reach with a load. 1d. Ensure that loads are balanced. Use assistance (mechanical or additional person) to carry equipment that is either unwieldy or over 50 lbs.
	1e. EXPOSURE: Personal injury from exposure to biological and environmental hazards.	1e. Inspect area to avoid contact with biological hazards (i.e. poisonous plants, stinging insects, ticks, etc.). 1e. Wear long sleeved clothes treated with Permethrin, apply insect repellant containing DEET to exposed skin, and inspect clothes and skin for ticks during and after work. 1e. Apply sunscreen (SPF 15+) if exposure to sun for 30 minutes or more is expected.
	1f. EXPOSURE: Weather related injuries.	1f. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, nausea, rapid and shallow breathing). Take breaks in cool places and hydrate as needed. 1f. Watch for cold stress symptoms (severe shivering, slowing of body movement, weakness, stumbling or inability to walk, collapse). Take breaks in warm areas as needed. 1f. Wear clothing appropriate for weather and temperature conditions (e.g., rain jackets, snow pants, multiple layers). 1f. If lightning is observed, wait 30 minutes in a sheltered location (car is acceptable) before resuming work.
	1g. EXPOSURE: Personal injury from noise hazards.	1g. Wear hearing protection if sound levels exceed 85 dBA (if you must raise your voice for normal conversation).

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JOB SAFETY ANALYSIS	Ctrl. No. GEN-017	DATE 1/4/2018	☐NEW ☒REVISED	PAGE 1 of 2

JSA TYPE CATEGORY:	WORK TYPE:	WORK ACTIVITY (Description):	
GENERIC	**Drilling**	**Monitoring and Recovery Well Development**	
DEVELOPMENT TEAM	**POSITION / TITLE**	**REVIEWED BY:**	**POSITION / TITLE**
Amy Hoffman	Staff Geologist	Brian Hobbs	Senior Health & Safety Manager
Ron Lombino	Staff Geologist	Joe Gentile	Corporate Health & Safety Manager
Courtney Lind	Staff Engineer		

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☒ GLOVES: Leather or cut-resistant and Nitrile
☒ HARD HAT	☐ FACE SHIELD	☐ SUPPLIED RESPIRATOR	☒ OTHER: Insect repellant, sunscreen (as needed)
☐ LIFELINE / BODY HARNESS	☒ HEARING PROTECTION (as needed)	☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	
☒ SAFETY GLASSES	☒ SAFETY SHOES: Composite-toe or steel toe boots		

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Required Equipment as needed: Truck Rig or support truck, Trailer, 42-inch Safety cones and flags, Caution Tape, Interface Probe, Power Source, Submersible Pump, Surge Block/Plunger, 20 lb. Type ABC Fire Extinguisher, Holding Tanks and/or Buckets, Absorbent Pads, 5-gas meter, Tools as needed: Socket and Pipe Wrench, Screw Driver, Pry Bar, Ratchet, Vault Key.

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs

EXCLUSION ZONE (EZ): Maintain a 20 Foot EZ During Development Activities

"SHOW ME YOUR HANDS"
Driller and helper should show that hands are clear from controls and moving parts

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Mobilization / Demobilization (**Review Mobilization and Demobilization JSA**)	**1a. CONTACT:** Equipment/property damage.	1a. The truck rig's tower/derrick will be lowered and secured prior to mobilization. 1a. Set-up the work area / position equipment in a manner that eliminates or reduces the need for backing of trucks and trailers. 1a. All non-essential personnel should **maintain an exclusion zone of 20 feet**. 1a. Beep horn twice before backing up. 1a. When backing up with an attached trailer use a spotter Level or avoid if needed. 1b Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment. 1b. Do not climb over stored materials/equipment; walk around. Store equipment at lowest potential energy.
	1b. FALL: Slip/trip/fall hazards.	
2. Open/close well.	**2a. EXERTION:** Muscle strain (some wells have large vault covers).	2a. Keep back straight, lift with legs, keep load close to body, and never reach with a load. Ensure that loads are balanced to reduce the potential for muscle strain. Two people are required when lifting objects over 50 lbs or when the shape makes the object difficult to lift.
	2b. CAUGHT: Pinch points associated with removing/replacing manholes and working with hand tools.	2b. Wear cut-resistant/leather gloves when working with well vault/cover and hand tools. Do not put fingers under well vault/cover. 2b. Use ratchet and pry bar for well cover and inspect before use.
	2c. EXPOSURE: Potentially hazardous vapors.	2c. No open flames/heat sources. 2c. Allow well to vent after opening it and before starting development activities to minimize exposure to vapors. Air monitoring must be performed prior to set up and during the well development activities. Work on upwind side of well.
	2d. CONTACT: Traffic.	2d. Wear required PPE including high visibility clothing or reflective vest. 2d. Delineate work area with 42" safety cones and/or other barriers. Position vehicle to protect against oncoming traffic. 2d. Face traffic, maintain eye contact with oncoming vehicles, and establish a safe exit route.

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Develop well (mechanical surging).	**3a. CAUGHT:** Cut hazards and finger pinch points.	3a See 2b. 3a. Use required PPE including leather/cut-resistant gloves when handling development equipment. Identify finger/hand pinch points. Keep hands away from active surge equipment. 3a. All non-essential personnel should **maintain an exclusion zone of 20 feet**.
	3b. CONTACT/EXPOSURE: Contamination (e.g., SPH, contaminated groundwater, vapors).	3b. See 2c. 3b. Wear Nitrile gloves and safety glasses. Insert and remove surge block/plunger and line/cable slowly to avoid splashing at the surface. 3b. Use an absorbent pad to clean any spills.
	3c. EXERTION: Muscle strain from lifting equipment.	3c. See 2a. 3c. Use mechanical device to insert and remove surge block/plunger if greater than 50lb.
	3d. CONTACT: Injury while handling wench line/cable, or with active surging equipment.	3d. If using a drill rig, inspect all wench lines/cables for any kinks or if frayed prior to use. Replace any damaged lines/cables. Review **Drill Rig checklist prior to development activities**. 3d. See 3a.
4. Purging well (pumping water to holding tanks/drums/buckets).	**4a. CAUGHT:** Pinch points associated with connecting hose to tank. Pinch points associated with handling pump and hoses.	4a. See 3a. 4a. Ensure that fingers are not placed near coupling when attaching and securing hose(s). Do not place fingers under pump/hoses. Wear leather or cut-resistant gloves when handling pump/hose(s). 4a. Keep hands clear from any line of fire.
	4b. FALL: Using side mounted ladder when attaching hose to tank. Slip, trip, fall from lines/hoses	4b. Inspect ladder steps to make sure steps are not bent/damaged and free of debris/fluid. 4b. Use three points of contact always when using ladder. 4b. Use hoist or other mechanical means to secure and move hose. 4b. Utilize anti-whip cords on all compressed hoses. Keep hoses and lines coiled and organized out of designated walking paths around the work zone.
	4c. CONTACT: Contamination (e.g., SPH, contaminated groundwater).	4c. Secure water hose. 4c. Do not overfill tanks, and purge/transfer liquids in such a manner that they do not splash. (See 3b). 4c. Dispose of used materials/PPE in the designated impacted PPE container.
	4d. EXERTION: Muscle strain from lifting/carrying equipment.	4d. See 2a.
	4e. FALL: Spilled purge water.	4e. Clean up any spills using absorbent pads or spill kits.
5. Decontaminate equipment	**5a. CONTACT/EXPOSURE:** Contamination (e.g., SPH, contaminated groundwater, vapors).	5a. See 3b.
	5b. EXPOSURE/CONTACT: Chemicals in cleaning solution	5b. Decontaminate equipment in well-ventilated area. Wear nitrile gloves to avoid skin contact with cleaning solutions.

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

JOB SAFETYANALYSIS Ctrl. No. GEN-020	DATE: 1/4/2018	☐NEW ☒REVISED	PAGE 1 of 2

JSA TYPE CATEGORY: **GENERIC**	WORK TYPE: **Gauging & Sampling**	WORK ACTIVITY (Description): **Soil Sampling**	
DEVELOPMENT TEAM	**POSITION / TITLE**	**REVIEWED BY:**	**POSITION / TITLE**
MaryBeth Lyons	Project Scientist	Brian Hobbs	Senior Health & Safety Manager
		Joe Gentile	Corporate Health and Safety Manager

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES ☒ FLAME RESISTANT CLOTHING (as needed)	☐ GOGGLES ☐ FACE SHIELD: ☒ HEARING PROTECTION: (as needed) ☒ SAFETY SHOES: Composite-toe or steel toe boots	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	☒ GLOVES: Leather, Nitrile and cut resistant ☒ OTHER: Insect repellant, sunscreen (as needed)

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Recommended Equipment: 42" traffic cones, caution tape, trowel

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs.

EXCLUSION ZONE (EZ): A 10-foot exclusion zone will be maintained around moving equipment, if present.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Secure location	**1a. CONTACT:** Personnel and vehicular traffic may enter the work area.	1a. If in an area with foot or vehicle traffic, delineate the work area with 42" traffic cones and/or caution tape to prevent exposure to traffic and inform others of work activity. 1a. Wear reflective vest and/or high visibility clothing. 1a. Face the direction of any vehicular traffic. Position vehicle to protect worker from traffic. 1a. Communicate work activity with adjacent work areas.
	1b. FALL: Tripping/falling due to uneven terrain or entry/exit from excavations.	1b. Inspect pathways and work area for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions. 1b. Use established pathways and walk on stable, secure ground. 1b. Stage equipment and tools in a convenient, stable, and orderly manner. Store equipment at lowest potential energy. 1b. Roux employees should stay 5 feet from in-progress excavations and trenches. Should entry to an excavation be required (when stabilization is complete), ladders must be employed for steep embankments, excavations, pits, and trenches.
	1c. EXPOSURE: Exposure to sun and excessive heat, possibly causing sunburn, heat exhaustion or heat stroke. Exposure to cold temperatures possibly causing cold stress. Skin burn as a result of fire, if applicable. Exposure to explosive vapors due to tank farm operations. Exposure to airborne dust due to high wind speeds. Biological hazards - ticks, bees/wasps, poison ivy, thorns, insects, etc.	1c. Wear sunscreen with an SPF 15 or greater whenever 30 minutes or more of exposure is expected. 1c. Use a tent to shade the work area from direct sunlight particularly when warm temperatures are expected. 1c. Be aware of the location of all Site personnel. 1c. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, rapid and shallow breathing). 1c. Watch for cold stress symptoms (severe shivering, slowing of body movement, weakness, stumbling or inability to walk, collapse). 1c. Take breaks for rest and water as necessary. Move to an area that is well shaded or a climate controlled area (i.e., car, site trailer, etc.). 1c. No open flames/heat sources. 1c. Flame retardant clothing must be worn when specified by Site policy. 1c. Cell phones should be disabled when specified by Site policy. 1c. Pre-treat field clothing with Permethrin prior to site visit to kill ticks and insects. 1c. Wear long sleeved shirts and tuck in (or tape) pant legs into socks or boots to prevent ticks from reaching skin. 1c. Spray insect repellant containing DEET on exposed skin when working in overgrown areas of the Site. 1c. Inspect area to avoid contact with biological hazards. 1c. Wear cut-resistant gloves when handling branches, shrubs, etc. that may lie within the walking path. 1c. Wear spoggles if the average wind speeds are above 15 mph. 1c. Personnel shall examine themselves and co-worker's outer clothing for ticks periodically when onsite. 1c. If skin comes in contact with poison ivy, wash skin thoroughly with soap and water. If rash persists after washing, immediately notify your supervisor, the OM and OHSM for possible consultation with a physician at an approved Occupational Health Clinic.

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
2. Collect Soil Sample	**2a. CONTACT:** Personal injury from pinch points, cuts, and abrasions from sampling equipment tools, and material within soil sample. Personal injury from contact with moving equipment while sampling. Personal injury from contact with glass sample jars.	2a. Wear cut-resistant (i.e., Kevlar) gloves under chemical-resistant (nitrile) disposable gloves when handling soil samples and sampling jars. 2a. Where possible, use trowel or equivalent tool to avoid contact with soil. 2a. If sampling from bucket of heavy equipment, ensure all equipment is off and operator utilizes the “show me your hands” policy. 2a. See 1a.
	2b. EXPOSURE: Exposure to contamination (impacted soil) and/or lab preservatives.	2b. Wear chemical-resistant (nitrile) disposable gloves over cut resistant gloves to protect hands when handling samples; use containment material or plastic sheeting to protect surrounding areas. 2b. Wear safety glasses to protect eyes from dust or air-borne contaminants that may results from disturbing the soil. 2b. Where possible, remain upgradient from sample location if collecting soil sample from stockpile, drill rig, etc. to avoid breathing contaminant vapors, if they are present. 2b. When collecting soil sample from hand auger, put large zip lock bag over entire auger to prevent spillage of soil on to the ground. 2b. Open sample jars slowly and fill carefully to avoid contact with preservatives.
	2c. EXERTION: Exertion due to repetitive motion and ergonomics.	2c. Utilize a table or raised surface for soil sampling if multiple soil samples are going to be taken to minimize repetitive bending motion.
3. Decontaminate equipment	**3a. EXPOSURE/CONTACT:** Contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated vapors and/or soil). **3b. EXPOSURE:** Chemicals in cleaning solution including ammonia.	3a. Wear chemical-resistant (nitrile) disposable gloves and safety glasses. 3a. Use an absorbent pad to clean spills. 3a. Properly dispose of used materials/PPE in provided drums in designated drum storage area. 3a. Remain upwind of sample and avoid breathing contaminant vapors, if they are present. 3b. Wear chemical-resistant (nitrile) disposable gloves and safety glasses. 3b. Work on the upwind side of decontamination area. 3b. Use an absorbent pad to clean spills. 3b. Properly dispose of used materials/PPE in provided drums in designated drum storage area. Ensure that all drums are properly labeled and secured.

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JOB SAFETY ANALYSIS	Ctrl. No. GEN-021	DATE: 1/4/2018	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY:	WORK TYPE	WORK ACTIVITY (Description)
GENERIC	**Gauging and Sampling**	**Soil Vapor Sampling (Permanent Monitoring Points)**

DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE
Jeff Wills	Project Hydrogeologist	Brian Hobbs	Senior Health & Safety Manager
Julie Moriarity	Project Scientist	Joe Gentile	Corporate Health and Safety Manager

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☒ GLOVES: Cut-resistant & Nitriles
☒ HARD HAT	☐ FACE SHIELD	☐ SUPPLIED RESPIRATOR	
☐ LIFELINE / BODY HARNESS	☐ HEARING PROTECTION	☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	☒ OTHER: Bug Spray, Sun Screen, Knee Pads or kneeling pad
☒ SAFETY GLASSES	☒ SAFETY SHOES: Steel-toe boots		

REQUIRED AND / OR RECOMMENDED EQUIPMENT

9/16" Socket and Wrench, Non-Toxic Clay, Teflon-Lined Tubing, Masterflex Tubing, Air Pump with Low Flow, Dry Cal, Enclosure (Bucket with 2 holes), Helium Gas Canister, Summa Canisters and Flow Controllers, MultiRae Photo Ionization Detector (PID), Helium Detector, Tubing Cutter, 42-inch Safety Cones, Caution Tape or Retractable Cone Bars

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs.

EXCLUSION ZONE (EZ): A 5-foot exclusion zone will be maintained for non-essential personnel.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Define and secure work area.	**1a. FALL:** Potential tripping hazards.	1a. Ensure work area is secure and inform others (third party) of work activity. 1a. Remove tripping hazards and inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment.
	1b. CONTACT: Potential contact with moving vehicles or pedestrians.	1b. If working alongside roads, look both ways before entering roadways, face traffic, and utilize work vehicle to protect employees. 1b. Delineate work area (including vehicles) with traffic safety cones and caution tape or retractable cone bars. 1b. Maintain a 5-foot exclusion zone. 1b. Wear high visibility clothing or reflective safety vest.
	1c. EXERTION: Muscle strain while lifting and carrying equipment.	1c. When carrying equipment to/from work area, keep back straight, lift with legs, keep load close to body, never reach with a load. Ensure that loads are balanced. Use mechanical assistance/make multiple trips to carry equipment.
2. Remove well cover / close well cover.	**2a. CONTACT/CAUGHT:** Pinch points and scrapes associated with hand tools and well covers.	2a. Keep hands away from pinch points. 2a. Use hand tools with extensions to remove and replace well covers. 2a. Wear cut-resistant gloves. 2a. Use knee pads or kneeling pad when repetitive kneeling on rough ground is anticipated.
	2b. FALL: Potential tripping hazards associated with installing bolts.	2b. Place security bolts in secure location so not to create tripping hazards. Replace security bolts so that they fit flush with monitoring well covers.
	2c. EXERTION: Physical exertion to remove bolts that were over torqued or stripped.	2c. Replace any security bolts that show signs of stripping. Do not over tighten. 2c. Use body positioning and bending techniques that minimize muscle strain; keep back straight, bend at the knees. 2c. See 2a.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Screen vapor point with PID.	**3a. FALL:** Potential tripping hazards associated with equipment. **3b. EXPOSURE:** Inhalation of soil vapor	3a. Place equipment in one area close to the sampling location. 3b. Identify area where equipment is to be stored within the work area (away from main walking path). 3a. Don't leave equipment on the ground. Return equipment to storage area between uses. 3b. Replace brass caps immediately upon completion to avoid soil vapors migrating to the surface through sample tubing. 3b. Stand upwind of sample point during screening activities.
4. Remove / replace brass caps at the end of the sam`ple tubing.	**4a. CONTACT:** Pinch points associated with hand tools and brass caps. **4b. EXPOSURE:** Potential pathway for vapors to migrate to land surface.	4a. Use wrench to remove and replace brass caps. 4a. Wear cut-resistant gloves to protect against pinch points and scrapes. 4b. See 3b. 4b. Stand up wind of sample point location.
5. Set up soil vapor sampling equipment and calibration of meters.	**5a. FALL:** Potential tripping hazards associated with equipment and tubing.5b. **5b. CONTACT:** Pinch points associated with handling equipment. **5c. EXPOSURE:** Inhalation of calibration gas and helium.	5a. See 3a. 5a. Keep tubing slack to a minimum and locate the summa canister as close to the sampling location as possible. 5a. Avoid stepping over equipment and tubing. 5b. Do not place fingers/hands under sampling equipment. 5b. Make multiple trips when unloading equipment in work area. 5b. Wear cut-resistant gloves to protect against pinch points while handling sampling equipment. 5c. Review SDS for each type of calibration gas used before calibrating. 5c. Calibrate meters in a well-ventilated area and keep air flow regulator away from face. 5c. Close valve on canisters after use to avoid inhalation of excess helium or calibration gas. 5c. Stand up wind of bucket during helium tracer gas test.
6. Cleaning Work Area.	**6a. FALL:** Potential tripping hazards associated with equipment and tubing. **6b. CONTACT:** Storing and transport of equipment in car.	6a. See 3a. 6a. See 3b. 6b. Ensure that equipment is placed securely in the vehicle. Do not stack equipment on top of each other. Secure equipment so that it will not slide while being transported. 6b. Wear cut-resistant gloves while handling/loading equipment.

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APPENDIX B

Site-Specific Emergency Response Plan and
Routes to Urgent Care and Emergency Medical Facilities

DIRECTIONS TO HOSPITAL

1. HEAD SOUTHEAST ON EAST 112TH STREET (144 FEET)
2. TURN RIGHT ONTO PARK AVENUE (0.3 MILES)
3. TURN RIGHT ONTO EAST 106TH STREET (0.2 MILES)
4. TURN LEFT ONTO 5TH AVENUE (0.3 MILES)
5. MOUNT SINAI HOSPITAL WILL BE ON THE LEFT

DIRECTIONS TO CITYMD

1. HEAD SOUTHEAST ON EAST 112TH STREET (0.1 MILES)
2. TURN RIGHT ONTO LEXINGTON AVENUE (0.8 MILES)
3. CITYMD WILL BE ON THE RIGHT

250 0 250 500
Feet

Title:

EMERGENCY ROUTE MAP

SENDERO VERDE REDEVELOPMENT
PROJECT – PARCEL B

Prepared For:

SV–B OWNERS LLC

ROUX

Compiled by: J.M.	Date: 20NOV18	FIGURE
Prepared by: M.S.R.	Scale: AS SHOWN	5
Project Mgr: J.M.	Project: 2984.0001Y000	
File: 2984.0001Y102.5.mxd		

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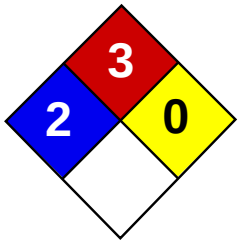
APPENDIX C

SDSs for Chemicals Used



Material Safety Data Sheet
Benzene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Benzene

Catalog Codes: SLB1564, SLB3055, SLB2881

CAS#: 71-43-2

RTECS: CY1400000

TSCA: TSCA 8(b) inventory: Benzene

CI#: Not available.

Synonym: Benzol; Benzine

Chemical Name: Benzene

Chemical Formula: C6-H6

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Benzene	71-43-2	100

Toxicological Data on Ingredients: Benzene: ORAL (LD50): Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse]. DERMAL (LD50): Acute: >9400 mg/kg [Rabbit]. VAPOR (LC50): Acute: 10000 ppm 7 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of eye contact (irritant), of inhalation. Hazardous in case of skin contact (irritant, permeator), of ingestion. Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC. MUTAGENIC EFFECTS: Classified POSSIBLE for human. Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female [POSSIBLE]. The substance is toxic to blood, bone marrow, central nervous system (CNS). The substance may be toxic to liver, Urinary System. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 497.78°C (928°F)

Flash Points: CLOSED CUP: -11.1°C (12°F). (Setaflash)

Flammable Limits: LOWER: 1.2% UPPER: 7.8%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat. Slightly flammable to flammable in presence of oxidizing materials. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Explosive in presence of oxidizing materials, of acids.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards:
Extremely flammable liquid and vapor. Vapor may cause flash fire. Reacts on contact with iodine heptafluoride gas. Dioxygenyl tetrafluoroborate is as very powferful oxidant. The addition of a small particle to small samples of benzene, at ambient temperature, causes ignition. Contact with sodium peroxide with benzene causes ignition. Benzene ignites in contact with powdered chromic anhydride. Virgorous or incandescent reaction with hydrogen + Raney nickel (above 210 C) and bromine trifluoride.

Special Remarks on Explosion Hazards:
Benzene vapors + chlorine and light causes explosion. Reacts explosively with bromine pentafluoride, chlorine, chlorine trifluoride, diborane, nitric acid, nitryl perchlorate, liquid oxygen, ozone, silver perchlorate. Benzene + pentafluoride and methoxide (from arsenic pentafluoride and potassium methoxide) in trichlorotrifluoroethane causes explosion. Interaction

of nitryl perchlorate with benzene gave a slight explosion and flash. The solution of permanganic acid (or its explosive anhydride, dimaganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene. Peroxodisulfuric acid is a very powferful oxidant. Uncontrolled contact with benzene may cause explosion. Mixtures of peroxomonsulfuric acid with benzene explodes.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) [United States] TWA: 1.6 STEL: 8 (mg/m3) from ACGIH (TLV) [United States] TWA: 0.1 STEL: 1 from NIOSH TWA: 1 STEL: 5 (ppm) from OSHA (PEL) [United States] TWA: 10 (ppm) from OSHA (PEL) [United States] TWA: 3 (ppm) [United Kingdom (UK)] TWA: 1.6 (mg/m3) [United Kingdom (UK)] TWA: 1 (ppm) [Canada] TWA: 3.2 (mg/m3) [Canada] TWA: 0.5 (ppm) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor:
Aromatic. Gasoline-like, rather pleasant. (Strong.)

Taste: Not available.

Molecular Weight: 78.11 g/mole

Color: Clear Colorless. Colorless to light yellow.

pH (1% soln/water): Not available.

Boiling Point: 80.1 (176.2°F)

Melting Point: 5.5°C (41.9°F)

Critical Temperature: 288.9°C (552°F)

Specific Gravity: 0.8787 @ 15 C (Water = 1)

Vapor Pressure: 10 kPa (@ 20°C)

Vapor Density: 2.8 (Air = 1)

Volatility: Not available.

Odor Threshold: 4.68 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 2.1

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:
Miscible in alcohol, chloroform, carbon disulfide oils, carbon tetrachloride, glacial acetic acid, diethyl ether, acetone. Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources, incompatibles.

Incompatibility with various substances: Highly reactive with oxidizing agents, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Benzene vapors + chlorine and light causes explosion. Reacts explosively with bromine pentafluoride, chlorine, chlorine trifluoride, diborane, nitric acid, nitryl perchlorate, liquid oxygen, ozone, silver perchlorate. Benzene + pentafluoride and methoxide (from arsenic pentafluoride and potassium methoxide) in trichlorotrifluoroethane causes explosion. Interaction of nitryl perchlorate with benzene gave a slight explosion and flash. The solution of permanganic acid (or its explosive anhydride, dimaganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene. Peroxodisulfuric acid is a very powferful oxidant. Uncontrolled contact with benzene may cause explosion. Mixtures of peroxomonsulfuric acid with benzene explodes.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 930 mg/kg [Rat]. Acute dermal toxicity (LD50): >9400 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 10000 7 hours [Rat].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC. MUTAGENIC EFFECTS: Classified POSSIBLE for human. Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female [POSSIBLE]. Causes damage to the following organs: blood, bone marrow, central nervous system (CNS). May cause damage to the following organs: liver, Urinary System.

Other Toxic Effects on Humans:
Very hazardous in case of inhalation. Hazardous in case of skin contact (irritant, permeator), of ingestion.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects (female fertility, Embryotoxic and/or foetotoxic in animal) and birth defects. May affect genetic material (mutagenic). May cause cancer (tumorigenic, leukemia)) Human: passes the placental barrier, detected in maternal milk.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Causes skin irritation. It can be absorbed through intact skin and affect the liver, blood, metabolism,and urinary system. Eyes: Causes eye irritation. Inhalation: Causes respiratory tract and mucous membrane irritation. Can be absorbed through the lungs. May affect behavior/Central and Peripheral nervous systems (somnolence, muscle weakness, general anesthetic, and other symptoms similar to ingestion), gastrointestinal tract (nausea), blood metabolism, urinary system. Ingestion: May be harmful if swallowed. May cause gastrointestinal tract irritation including vomiting. May affect behavior/Central and Peripheral nervous systems (convulsions, seizures, tremor, irritability, initial CNS stimulation followed by depression, loss of coordination, dizziness, headache, weakness, pallor, flushing), respiration (breathlessness and chest constriction), cardiovascular system, (shallow/rapid pulse), and blood.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Benzene UNNA: 1114 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Benzene California prop. 65 (no significant risk level): Benzene: 0.007 mg/day (value) California prop. 65: This product contains the following ingredients

for which the State of California has found to cause cancer which would require a warning under the statute: Benzene Connecticut carcinogen reporting list.: Benzene Connecticut hazardous material survey.: Benzene Illinois toxic substances disclosure to employee act: Benzene Illinois chemical safety act: Benzene New York release reporting list: Benzene Rhode Island RTK hazardous substances: Benzene Pennsylvania RTK: Benzene Minnesota: Benzene Michigan critical material: Benzene Massachusetts RTK: Benzene Massachusetts spill list: Benzene New Jersey: Benzene New Jersey spill list: Benzene Louisiana spill reporting: Benzene California Director's list of Hazardous Substances: Benzene TSCA 8(b) inventory: Benzene SARA 313 toxic chemical notification and release reporting: Benzene CERCLA: Hazardous substances.: Benzene: 10 lbs. (4.536 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R11- Highly flammable. R22- Harmful if swallowed. R38- Irritating to skin. R41- Risk of serious damage to eyes. R45- May cause cancer. R62- Possible risk of impaired fertility. S2- Keep out of the reach of children. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S39- Wear eye/face protection. S46- If swallowed, seek medical advice immediately and show this container or label. S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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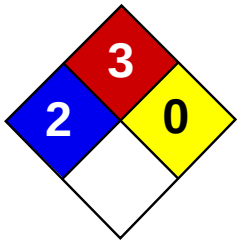

Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Toluene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Toluene

Catalog Codes: SLT2857, SLT3277

CAS#: 108-88-3

RTECS: XS5250000

TSCA: TSCA 8(b) inventory: Toluene

CI#: Not available.

Synonym: Toluol, Tolu-Sol; Methylbenzene; Methacide; Phenylmethane; Methylbenzol

Chemical Name: Toluene

Chemical Formula: C6-H5-CH3 or C7-H8

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Toluene	108-88-3	100

Toxicological Data on Ingredients: Toluene: ORAL (LD50): Acute: 636 mg/kg [Rat]. DERMAL (LD50): Acute: 14100 mg/kg [Rabbit]. VAPOR (LC50): Acute: 49000 mg/m 4 hours [Rat]. 440 ppm 24 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to blood, kidneys, the nervous system, liver, brain, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 480°C (896°F)

Flash Points: CLOSED CUP: 4.4444°C (40°F). (Setaflash) OPEN CUP: 16°C (60.8°F).

Flammable Limits: LOWER: 1.1% UPPER: 7.1%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable liquid, insoluble in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards:
Toluene forms explosive reaction with 1,3-dichloro-5,5-dimethyl-2,4-imidazolididione; dinitrogen tetraoxide; concentrated nitric acid, sulfuric acid + nitric acid; N2O4; AgClO4; BrF3; Uranium hexafluoride; sulfur dichloride. Also forms an explosive mixture with tetranitromethane.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Toxic flammable liquid, insoluble or very slightly soluble in water. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 200 STEL: 500 CEIL: 300 (ppm) from OSHA (PEL) [United States] TWA: 50 (ppm) from ACGIH (TLV) [United States] SKIN TWA: 100 STEL: 150 from NIOSH [United States] TWA: 375 STEL: 560 (mg/m3) from NIOSH [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweet, pungent, Benzene-like.

Taste: Not available.

Molecular Weight: 92.14 g/mole

Color: Colorless.

pH (1% soln/water): Not applicable.

Boiling Point: 110.6°C (231.1°F)

Melting Point: -95°C (-139°F)

Critical Temperature: 318.6°C (605.5°F)

Specific Gravity: 0.8636 (Water = 1)

Vapor Pressure: 3.8 kPa (@ 25°C)

Vapor Density: 3.1 (Air = 1)

Volatility: Not available.

Odor Threshold: 1.6 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 2.7

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:
Soluble in diethyl ether, acetone. Practically insoluble in cold water. Soluble in ethanol, benzene, chloroform, glacial acetic acid, carbon disulfide. Solubility in water: 0.561 g/l @ 25 deg. C.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources (flames, sparks, static), incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Incompatible with strong oxidizers, silver perchlorate, sodium difluoride, Tetranitromethane, Uranium Hexafluoride. Frozen Bromine Trifluoride reacts violently with Toluene at -80 deg. C. Reacts chemically with nitrogen oxides, or halogens to form nitrotoluene, nitrobenzene, and nitrophenol and halogenated products, respectively.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 636 mg/kg [Rat]. Acute dermal toxicity (LD50): 14100 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 440 24 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC. May cause damage to the following organs: blood, kidneys, the nervous system, liver, brain, central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose: LDL [Human] - Route: Oral; Dose: 50 mg/kg LCL [Rabbit] - Route: Inhalation; Dose: 55000 ppm/40min

Special Remarks on Chronic Effects on Humans:
Detected in maternal milk in human. Passes through the placental barrier in human. Embryotoxic and/or foetotoxic in animal. May cause adverse reproductive effects and birth defects (teratogenic). May affect genetic material (mutagenic)

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Causes mild to moderate skin irritation. It can be absorbed to some extent through the skin. Eyes: Cauess mild to moderate eye irritation with a burning sensation. Splash contact with eyes also causes conjunctivitis, blepharospasm, corneal edema, corneal abraisons. This usually resolves in 2 days. Inhalation: Inhalation of vapor may cause respiratory tract irritation causing coughing and wheezing, and nasal discharge. Inhalation of high concentrations may affect behavior and cause central nervous system effects characterized by nausea, headache, dizziness, tremors, restlessness, lightheadedness, exhilaration, memory loss, insomnia, impaired reaction time, drowsiness, ataxia, hallucinations, somnolence, muscle contraction or spasticity, unconsciousness and coma. Inhalation of high concentration of vapor may also affect the cardiovascular system (rapid heart beat, heart palpitations, increased or decreased blood pressure, dysrhythmia,), respiration (acute pulmonary edema, respiratory depression, apnea, asphyxia), cause vision disturbances and dilated pupils, and cause loss of appetite. Ingestion: Aspiration hazard. Aspiration of Toluene into the lungs may cause chemical pneumonitis. May cause irritation of the digestive tract with nausea, vomiting, pain. May have effects similar to that of acute inhalation. Chronic Potential Health Effects: Inhalation and Ingestion: Prolonged or repeated exposure via inhalation may cause central nervous system and cardiovascular symptoms similar to that of acute inhalation and ingestion as well liver damage/failure, kidney damage/failure (with hematuria, proteinuria, oliguria, renal tubular acidosis), brain damage, weight loss, blood (pigmented or nucleated red blood cells, changes in white blood cell count), bone marrow changes, electrolyte imbalances (Hypokalemia, Hypophostatemia), severe, muscle weakness and Rhabdomyolysis. Skin: Repeated or prolonged skin contact may cause defatting dermatitis.

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 313 mg/l 48 hours [Daphnia (daphnia)]. 17 mg/l 24 hours [Fish (Blue Gill)]. 13 mg/l 96 hours [Fish (Blue Gill)]. 56 mg/l 24 hours [Fish (Fathead minnow)]. 34 mg/l 96 hours [Fish (Fathead minnow)]. 56.8 ppm any hours [Fish (Goldfish)].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Toluene UNNA: 1294 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Toluene California prop. 65 (no significant risk level): Toluene: 7 mg/day (value) California prop. 65 (acceptable daily intake level): Toluene: 7 mg/day (value) California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Toluene Connecticut hazardous material survey.: Toluene Illinois

toxic substances disclosure to employee act: Toluene Illinois chemical safety act: Toluene New York release reporting list: Toluene Rhode Island RTK hazardous substances: Toluene Pennsylvania RTK: Toluene Florida: Toluene Minnesota: Toluene Michigan critical material: Toluene Massachusetts RTK: Toluene Massachusetts spill list: Toluene New Jersey: Toluene New Jersey spill list: Toluene Louisiana spill reporting: Toluene California Director's List of Hazardous Substances.: Toluene TSCA 8(b) inventory: Toluene TSCA 8(d) H and S data reporting: Toluene: Effective date: 10/04/82; Sunset Date: 10/0/92 SARA 313 toxic chemical notification and release reporting: Toluene CERCLA: Hazardous substances.: Toluene: 1000 lbs. (453.6 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R11- Highly flammable. R20- Harmful by inhalation. S16- Keep away from sources of ignition - No smoking. S25- Avoid contact with eyes. S29- Do not empty into drains. S33- Take precautionary measures against static discharges.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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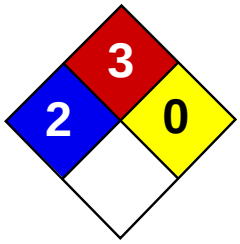
Last Updated: 11/06/2008 12:00 PM



Material Safety Data Sheet
Ethylbenzene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Ethylbenzene

Catalog Codes: SLE2044

CAS#: 100-41-4

RTECS: DA0700000

TSCA: TSCA 8(b) inventory: Ethylbenzene

CI#: Not available.

Synonym: Ethyl Benzene; Ethylbenzol; Phenylethane

Chemical Name: Ethylbenzene

Chemical Formula: C8H10

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Ethylbenzene	100-41-4	100

Toxicological Data on Ingredients: Ethylbenzene: ORAL (LD50): Acute: 3500 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, permeator).

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (irritant, sensitizer). CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 432°C (809.6°F)

Flash Points:
CLOSED CUP: 15°C (59°F). (Tagliabue.) OPEN CUP: 26.667°C (80°F) (Cleveland) (CHRIS, 2001) CLOSED CUP: 12.8 C (55 F) (Bingham et al, 2001; NIOSH, 2001) CLOSED CUP: 21 C (70 F) (NFPA)

Flammable Limits: LOWER: 0.8% - 1.6%UPPER: 6.7% - 7%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Slightly explosive in presence of heat.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards:
Vapor may travel considerable distance to source of ignition and flash back. Vapors may form explosive mixtures with air. When heated to decomposition it emits acrid smoke and irritating fumes.

Special Remarks on Explosion Hazards: Vapors may form explosive mixtures in air.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with eyes. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Sensitive to light. Store in light-resistant containers.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 100 STEL: 125 (ppm) from OSHA (PEL) [United States] TWA: 435 STEL: 545 from OSHA (PEL) [United States] TWA: 435 STEL: 545 (mg/m3) from NIOSH [United States] TWA: 100 STEL: 125 (ppm) from NIOSH [United States] TWA: 100 STEL: 125 (ppm) from ACGIH (TLV) [United States] TWA: 100 STEL: 125 (ppm) [United Kingdom (UK)] TWA: 100 STEL: 125 (ppm) [Belgium] TWA: 100 STEL: 125 (ppm) [Finland] TWA: 50 (ppm) [Norway] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweetish. Gasoline-like. Aromatic.

Taste: Not available.

Molecular Weight: 106.16 g/mole

Color: Colorless.

pH (1% soln/water): Not available.

Boiling Point: 136°C (276.8°F)

Melting Point: -94.9 (-138.8°F)

Critical Temperature: 617.15°C (1142.9°F)

Specific Gravity: 0.867 (Water = 1)

Vapor Pressure: 0.9 kPa (@ 20°C)

Vapor Density: 3.66 (Air = 1)

Volatility: 100% (v/v).

Odor Threshold: 140 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.1

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility:
Easily soluble in diethyl ether. Very slightly soluble in cold water or practically insoluble in water. Soluble in all proportions in Ethyl alcohol. Soluble in Carbon tetrachloride, Benzene. Insoluble in Ammonia. Slightly soluble in Chloroform. Solubility in Water: 169 mg/l @ 25 deg. C.; 0.014 g/100 ml @ 15 deg. C.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ingnition sources (flames, sparks, static), incompatible materials, light

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Not considered to be corrosive for metals and glass.

Special Remarks on Reactivity:
Can react vigorously with oxidizing materials. Sensitive to light.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation.

Toxicity to Animals: Acute oral toxicity (LD50): 3500 mg/kg [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. May cause damage to the following organs: central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, permeator).

Special Remarks on Toxicity to Animals:
Lethal Dose/Conc 50% Kill: LD50 [Rabbit] - Route: Skin; Dose: 17800 ul/kg Lowest Published Lethal Dose/Conc: LDL[Rat] - Route: Inhalation (vapor); Dose: 4000 ppm/4 H

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects and birth defects (teratogenic) based on animal test data. May cause cancer based on animals data. IARC evidence for carcinogenicity in animals is sufficient. IARC evidence of carcinogenicity in humans inadequate. May affect genetic material (mutagenic).

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Can cause mild skin irritation. It can be absorbed through intact skin. Eyes: Contact with vapor or liquid can cause severe eye irritation depending on concentration. It may also cause conjunctivitis. At a vapor exposure level of 85 - 200 ppm , it is mildly and transiently irritating to the eyes; 1000 ppm causes further irritation and tearing; 2000 ppm results in immediate and severe irritation and tearing; 5,000 ppm is intolerable (ACGIH, 1991; Clayton and Clayton, 1994). Standard draize test for eye irritation using 500 mg resulted in severe irritation (RTECS) Inhalation: Exposure to high concentrations can cause nasal, mucous membrane and respiratory tract irritation and can also result in chest constriction and, trouble breathing, respiratory failure, and even death. It can also affect behavior/Central Nervous System. The effective dose for CNS depression in experimental animals was 10,000 ppm (ACGIH, 1991). Symptoms of CNS depression include

headache, nausea, weakness, dizziness, vertigo, irritability, fatigue, lightheadedness, sleepiness, tremor, loss of coordination, judgement and conciousness, coma, and death. It can also cause pulmonary edema. Inhalation of 85 ppm can produce fatigue, insomnia, headache, and mild irritation of the respiratory tract (Haley & Berndt, 1987). Ingestion: Do not drink, pipet or siphon by mouth. May cause gastroinestinal/digestive tract irritation with Abdominal pain, nausea, vomiting. Ethylbenzene is a pulmonary aspiration hazard. Pulmonary aspiration of even small amounts of the liquid may cause fatal pneumonitis. It may also affect behavior/central nervous system with

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 14 mg/l 96 hours [Fish (Trout)] (static). 12.1 mg/l 96 hours [Fish (Fathead Minnow)] (flow-through)]. 150 mg/l 96 hours [Fish (Blue Gill/Sunfish)] (static). 275 mg/l 96 hours [Fish (Sheepshead Minnow)]. 42.3 mg/l 96 hours [Fish (Fathead Minnow)](soft water). 87.6mg/l 96 hours [Shrimp].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Ethylbenzene UNNA: 1175 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Ethylbenzene Illinois toxic substances disclosure to employee act: Ethylbenzene Illinois chemical safety act: Ethylbenzene New York release reporting list: Ethylbenzene Rhode Island RTK hazardous substances: Ethylbenzene Pennsylvania RTK: Ethylbenzene Minnesota: Ethylbenzene Massachusetts RTK: Ethylbenzene Massachusetts spill list: Ethylbenzene New Jersey: Ethylbenzene New Jersey spill list: Ethylbenzene Louisiana spill reporting: Ethylbenzene California Director's List of Hazardous Substances: Ethylbenzene TSCA 8(b) inventory: Ethylbenzene TSCA 4(a) proposed test rules: Ethylbenzene TSCA 8(d) H and S data reporting: Ethylbenzene: Effective Date: 6/19/87; Sunset Date: 6/19/97 SARA 313 toxic chemical notification and release reporting: Ethylbenzene

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASSE D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R11- Highly flammable. R20- Harmful by inhalation. S16- Keep away from sources of ignition - No smoking. S24/25- Avoid contact with skin and eyes. S29- Do not empty into drains.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References:
-Manufacturer's Material Safety Data Sheet. -Fire Protection Guide to Hazardous Materials, 13th ed., National Fire Protection Association (NFPA) -Registry of Toxic Effects of Chemical Substances (RTECS) -Chemical Hazard Response Information System (CHRIS) -Hazardous Substance Data Bank (HSDB) -New Jersey Hazardous Substance Fact Sheet -Ariel Global View -Reprotext System

Other Special Considerations: Not available.

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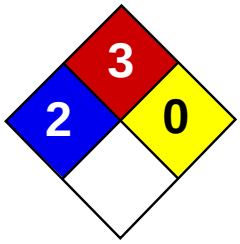
Last Updated: 11/06/2008 12:00 PM



Material Safety Data Sheet
Xylenes MSDS

Section 1: Chemical Product and Company Identification

Product Name: Xylenes

Catalog Codes: SLX1075, SLX1129, SLX1042, SLX1096

CAS#: 1330-20-7

RTECS: ZE2100000

TSCA: TSCA 8(b) inventory: Xylenes

CI#: Not available.

Synonym: Xylenes; Dimethylbenzene; xylol; methyltoluene

Chemical Name: Xylenes (o-, m-, p- isomers)

Chemical Formula: C6H4(CH3)2

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Xylenes	1330-20-7	100

Toxicological Data on Ingredients: Xylenes: ORAL (LD50): Acute: 4300 mg/kg [Rat]. 2119 mg/kg [Mouse]. DERMAL (LD50): Acute: >1700 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: 3 (Not classifiable for human.) by IARC. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to blood, kidneys, liver, mucous membranes, bone marrow, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 464°C (867.2°F)

Flash Points: CLOSED CUP: 24°C (75.2°F). (Tagliabue.) OPEN CUP: 37.8°C (100°F).

Flammable Limits: LOWER: 1% UPPER: 7%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Slightly explosive in presence of open flames and sparks, of heat.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Vapors may travel to source of ignition and flash back.

Special Remarks on Explosion Hazards:
Vapors may form explosive mixtures with air. Containers may explode when heated. May polymerize explosively when heated. An attempt to chlorinate xylene with 1,3-Dichloro-5,5-dimethyl-2,4-imidazolidindione (dichlorohydrantoin) caused a violent explosion

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined

areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 100 (ppm) [Canada] TWA: 435 (mg/m3) [Canada] TWA: 434 STEL: 651 (mg/m3) from ACGIH (TLV) [United States] TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweetish.

Taste: Not available.

Molecular Weight: 106.17 g/mole

Color: Colorless. Clear

pH (1% soln/water): Not available.

Boiling Point: 138.5°C (281.3°F)

Melting Point: -47.4°C (-53.3°F)

Critical Temperature: Not available.

Specific Gravity: 0.864 (Water = 1)

Vapor Pressure: 0.9 kPa (@ 20°C)

Vapor Density: 3.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 1 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.1

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Insoluble in cold water, hot water. Miscible with absolute alcohol, ether, and many other organic liquids.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources, incompatibles

Incompatibility with various substances: Reactive with oxidizing agents, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Store away from acetic acid, nitric acid, chlorine, bromine, and fluorine.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 2119 mg/kg [Mouse]. Acute dermal toxicity (LD50): >1700 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 5000 4 hours [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: 3 (Not classifiable for human.) by IARC. May cause damage to the following organs: blood, kidneys, liver, mucous membranes, bone marrow, central nervous system (CNS).

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals:
Lowest Lethal Dose: LDL [Human] - Route: Oral; Dose: 50 mg/kg LCL [Man] - Route: Oral; Dose: 10000 ppm/6H

Special Remarks on Chronic Effects on Humans:
Detected in maternal milk in human. Passes through the placental barrier in animal. Embryotoxic and/or foetotoxic in animal. May cause adverse reproductive effects (male and femael fertility (spontaneous abortion and fetotoxicity)) and birth defects based animal data.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Causes skin irritation. Can be absorbed through skin. Eyes: Causes eye irritation. Inhalation: Vapor causes respiratory tract and mucous membrane irritation. May affect central nervous system and behavior (General anesthetic/CNS depressant with effects including headache, weakness, memory loss, irritability, dizziness, giddiness, loss of coordination and judgement, respiratory depression/arrest or difficulty breathing, loss of appetite, nausea, vomiting, shivering, and possible coma and death). May also affects blood, sense organs, liver, and peripheral nerves. Ingestion: May cause gastrointestinal irritation including abdominal pain, vomiting, and nausea. May also affect liver and urinary system/ kidneys. May cause effects similar to those of acute inhalation. Chronic Potential Health Effects: Chronic inhalation may affect the urinary system (kidneys) blood (anemia), bone marrow (hyperplasia of bone marrow) brain/behavior/Central Nervous system. Chronic inhalation may alsocause mucosal bleeding. Chronic ingestion may affect the liver and metabolism (loss of appetite) and may affect urinary system (kidney damage)

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Xylenes UNNA: 1307 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Xylenes Illinois chemical safety act: Xylenes New York acutely hazardous substances: Xylenes Rhode Island RTK hazardous substances: Xylenes Pennsylvania RTK: Xylenes Minnesota: Xylenes Michigan critical material: Xylenes Massachusetts RTK: Xylenes Massachusetts spill list: Xylenes New Jersey: Xylenes New Jersey spill list: Xylenes Louisiana spill reporting: Xylenes California Director's List of Hazardous Substances: Xylenes TSCA 8(b) inventory: Xylenes SARA 302/304/311/312 hazardous chemicals: Xylenes SARA 313 toxic chemical notification and release reporting: Xylenes CERCLA: Hazardous substances.: Xylenes: 100 lbs. (45.36 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R10- Flammable. R21- Harmful in contact with skin. R36/38- Irritating to eyes and skin. S2- Keep out of the reach of children. S36/37- Wear suitable protective clothing and gloves. S46- If swallowed, seek medical advice immediately and show this container or label.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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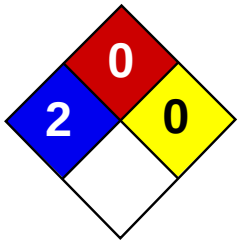

Health	2
Fire	0
Reactivity	0
Personal Protection	G

Material Safety Data Sheet
Tetrachloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Tetrachloroethylene

Catalog Codes: SLT3220

CAS#: 127-18-4

RTECS: KX3850000

TSCA: TSCA 8(b) inventory: Tetrachloroethylene

CI#: Not available.

Synonym: Perchloroethylene; 1,1,2,2-Tetrachloroethylene; Carbon bichloride; Carbon dichloride; Ankilostin; Didakene; Dilatin PT; Ethene, tetrachloro-; Ethylene tetrachloride; Perawin; Perchlor; Perclene; Perclene D; Percosolvel; Tetrachloroethene; Tetraleno; Tetralex; Tetravec; Tetroguer; Tetropil

Chemical Name: Ethylene, tetrachloro-

Chemical Formula: C2-Cl4

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Tetrachloroethylene	127-18-4	100

Toxicological Data on Ingredients: Tetrachloroethylene: ORAL (LD50): Acute: 2629 mg/kg [Rat]. DERMAL (LD): Acute: >3228 mg/kg [Rabbit]. MIST(LC50): Acute: 34200 mg/m 8 hours [Rat]. VAPOR (LC50): Acute: 5200 ppm 4 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (anticipated carcinogen) by NTP. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, peripheral nervous system, respiratory tract, skin, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with skin. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, metals, acids, alkalis.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Personal Protection:
Safety glasses. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 25 (ppm) from OSHA (PEL) [United States] TWA: 25 STEL: 100 (ppm) from ACGIH (TLV) [United States] TWA: 170 (mg/m3) from OSHA (PEL) [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Ethereal.

Taste: Not available.

Molecular Weight: 165.83 g/mole

Color: Clear Colorless.

pH (1% soln/water): Not available.

Boiling Point: 121.3°C (250.3°F)

Melting Point: -22.3°C (-8.1°F)

Critical Temperature: 347.1°C (656.8°F)

Specific Gravity: 1.6227 (Water = 1)

Vapor Pressure: 1.7 kPa (@ 20°C)

Vapor Density: 5.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 5 - 50 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.4

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Miscible with alcohol, ether, chloroform, benzene, hexane. It dissolves in most of the fixed and volatile oils. Solubility in water: 0.015 g/100 ml @ 25 deg. C It slowly decomposes in water to yield Trichloroacetic and Hydrochloric acids.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, metals, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Oxidized by strong oxidizing agents. Incompatible with sodium hydroxide, finely divided or powdered metals such as zinc, aluminum, magnesium, potassium, chemically active metals such as lithium, beryllium , barium. Protect from light.

Special Remarks on Corrosivity: Slowly corrodes aluminum, iron, and zinc.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 2629 mg/kg [Rat]. Acute dermal toxicity (LD50): >3228 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 5200 4 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (Some evidence.) by NTP. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. May cause damage to the following organs: kidneys, liver, peripheral nervous system, upper respiratory tract, skin, central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of ingestion.

Special Remarks on Toxicity to Animals:
Lowest Publishe Lethal Dose/Conc: LDL [Rabbit] - Route: Oral; Dose: 5000 mg/kg LDL [Dog] - Route: Oral; Dose: 4000 mg/kg LDL [Cat] - Route: Oral; Dose: 4000 mg/kg

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects and birth defects(teratogenic). May affect genetic material (mutagenic). May cause cancer.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Causes skin irritation with possible dermal blistering or burns. Symtoms may include redness, itching, pain, and possible dermal blistering or burns. It may be absorbed through the skin with possible systemic effects. A single prolonged skin exposure is not likely to result in the material being absorbed in harmful amounts. Eyes: Contact causes transient eye irritation, lacrimation. Vapors cause eye/conjunctival irritation. Symptoms may include redness and pain. Inhalation: The main route to occupational exposure is by inhalation since it is readily absorbed through the lungs. It causes respiratory tract irritation, . It can affect behavior/central nervous system (CNS depressant and anesthesia ranging from slight inebriation to death, vertigo, somnolence, anxiety, headache, excitement, hallucinations, muscle incoordination, dizziness, lightheadness, disorentiation, seizures, enotional instability, stupor, coma). It may cause pulmonary edema Ingestion: It can cause nausea, vomiting, anorexia, diarrhea, bloody stool. It may affect the liver, urinary system (proteinuria, hematuria, renal failure, renal tubular disorder), heart (arrhythmias). It may affect behavior/central nervous system with symptoms similar to that of inhalation. Chronic Potential Health Effects: Skin: Prolonged or repeated skin contact may result in excessive drying of the skin, and irritation. Ingestion/Inhalation: Chronic exposure can affect the liver(hepatitis,fatty liver degeneration), kidneys, spleen, and heart (irregular heartbeat/arrhythmias, cardiomyopathy, abnormal EEG), brain, behavior/ central nervous system/peripheral nervous system (impaired memory, numbness of extremeties, peripheral neuropathy and other

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 18.4 mg/l 96 hours [Fish (Fatthead Minnow)]. 18 mg/l 48 hours [Daphnia (daphnia)]. 5 mg/l 96 hours [Fish (Rainbow Trout)]. 13 mg/l 96 hours [Fish (Bluegill sunfish)].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Tetrachloroethylene UNNA: 1897 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Tetrachloroethylene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Tetrachloroethylene Connecticut hazardous material survey.: Tetrachloroethylene Illinois toxic substances disclosure to employee act: Tetrachloroethylene Illinois chemical safety act: Tetrachloroethylene New York release reporting list: Tetrachloroethylene Rhode Island RTK hazardous substances: Tetrachloroethylene Pennsylvania RTK: Tetrachloroethylene Minnesota: Tetrachloroethylene Michigan critical material: Tetrachloroethylene Massachusetts RTK: Tetrachloroethylene Massachusetts spill list: Tetrachloroethylene New Jersey: Tetrachloroethylene New Jersey spill list: Tetrachloroethylene Louisiana spill reporting: Tetrachloroethylene California Director's List of Hazardous Substances: Tetrachloroethylene TSCA 8(b) inventory: Tetrachloroethylene TSCA 8(d) H and S data reporting: Tetrachloroethylene: Effective date: 6/1/87; Sunset date: 6/1/97 SARA 313 toxic chemical notification and release reporting: Tetrachloroethylene CERCLA: Hazardous substances.: Tetrachloroethylene: 100 lbs. (45.36 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R40- Possible risks of irreversible effects. R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. S23- Do not breathe gas/fumes/vapour/spray S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S37- Wear suitable gloves. S61- Avoid release to the environment. Refer to special instructions/Safety data sheets.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: g

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:29 PM

Last Updated: 05/21/2013 12:00 PM

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APPENDIX D

Incident Investigation and Reporting Program

INCIDENT INVESTIGATION AND REPORTING MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER	:	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	:	**07/18**
REVISION NUMBER	:	**4**

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APPENDICES

Appendix A – Accident Report and Investigation Form

Appendix B – Lessons Learned Form

Appendix C – Injury Illness Reporting Flow Chart

1. PURPOSE

Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C, and Remedial Engineering (collectively, "Roux") has instituted the following management program for reporting Environmental Health and Safety (EHS) incidents and near losses, investigation and correcting the causes of incidents, tracking incidents and corrective actions taken, and sharing the cause and corrective actions with Roux personnel. These practices and procedures establish a method to track progress and improvements to the company EHS performance.

2. SCOPE AND APPLICABILITY

These procedures apply to all Roux employees. Employees are required to follow these procedures for all incidents involving Roux personnel, or other personnel (e.g., subcontractors) working for Roux, regardless of the specific work activity or work location.

This program is intended, in part, to fulfill the Occupational Safety and Health Administration (OSHA) occupational injury and illness reporting and recording requirements cited in the Code of Federal Regulations (CFR) at 29 CFR 1904.

3. RESPONSIBILITIES

It shall be the responsibility of all Roux employees to report all incidents as soon as possible to the PM (or Administrative Manager for office-related incidents), SHSO, OHSM and OM, regardless of severity. Additionally, the following positions have specific responsibilities for implementing this specific SOP.

3.1 Corporate Health and Safety Manager (CHSM)

- The CHSM has the responsibility of ensuring that a system is in place for reporting, investigation, correction, and communicating of EHS incidents and near losses.
- The CHSM has the overall responsibility of implementing and communicating the contents of this program to Office Health and Safety Managers (OHSMs).
- The CHSM will review all incidents and corrective actions taken. The CHSM will provide a summary of serious incidents to the Board of Directors.
- The CHSM will communicate learnings from incidents and corrective actions taken to all personnel, through quarterly communications.
- The CHSM will periodically review and evaluate the effectiveness of this procedure.

3.2 Office Manager (OM)

- The OM will designate the individual to serve as the OHSM responsibility for ensuring that requirements in this procedure are met.
- The OM will ensure that sufficient resources are allocated to fulfill the requirements of this procedure.
- The OM will conduct final review of all incident reports prepared under this procedure.

3.3 Office Health and Safety Manager (OHSM)

- It is the responsibility of the OHSM to review draft incident reports and assist the OM in finalizing reports of all accidents, illnesses and incidents related to work activity, and to assist the SHSO when necessary.

- The OHSM may not approve a site-specific HASP unless the HASP includes incident reporting procedures and forms.
- The OHSM will suggest and implement corrective actions to prevent the same type of incident from re-occurring.
- The OHSM will keep all incident reports, corrective action taken, and follow-up forms on file. The OHSM will provide copies of all final reports and forms to the CHSM within one week of the incident. If a serious incident occurs, the CHSM will be notified as soon as possible.
- The occurrence of a serious incident will trigger an EHS audit by the OHSM.

3.4 Project Manager (PM)

- It shall be the PM's responsibility to promptly correct any deficiencies that were determined to cause or contribute to the incident investigated.
- If a site-specific HASP is not utilized, the PM must ensure that field personnel have copies of the Roux Accident Reporting and Investigation Forms.
- The PM has the responsibility of ensuring that the SHSO and other field personnel understand the need for timely incident reporting.
- In the event of an incident, the PM will determine the root cause of the incident with the assistance of the SHSO and/or OHSM. The PM should provide input as to corrective preventative measures.

3.5 Site Health and Safety Officer (SHSO)

- The SHSO shall provide the details of the incident to the OHSM, PM and OM. The OM or his delegate will provide additional notifications, such as, in the event of a work-related motor vehicle accident, to include Roux Legal.
- It is the SHSO's responsibility to immediately notify the OHSM and the PM when any incident occurs. Such notification should take place immediately following the completion of any emergency actions required by the HASP.
- The SHSO should provide input as to corrective preventative measures.
- The SHSO must ensure that corrective actions proposed by the OHSM or OM are carried out.

3.6 All Personnel

- All personnel are responsible for reporting and describing the details of any incident in which they are involved to the SHSO and PM. Such notification should take place immediately following the completion of any emergency actions required by the HASP and after the loss and before the scene is disturbed or vehicles moved.

4. PROCEDURE

4.1 Incident Investigation

On receiving a report of incident (or "near-loss") occurrence from a Roux employee, the SHSO or OHSM shall immediately investigate the circumstances and shall make appropriate recommendations to prevent recurrence. The Incident Report form can be found in **Appendix A**, and "near loss" Roux Lessons Learned form can be found in **Appendix B**. The OHSM may participate in the investigation of more serious accidents and incidents that occur on-site. The Corporate Health and Safety Manager (CHSM) shall also be immediately notified by telephone on occurrence of a serious accident or incident. At the CHSM's discretion, he may also participate in the investigation.

4.2 Incident Report

Details of the incident shall be documented using the Accident Report and Investigation Forms (Appendix A) within twenty-four (24) hours of the incident and shall be distributed to the SHSO, the OHSM, PM, OM and the CHSM. The CHSM will update OSHA Forms 301 and the 300 log when necessary.

Appendix A – Accident Report and Investigation Form

☐ Roux Environmental Engineering and Geology, D.P.C.
☐ Roux Associates, Inc. ☐ Remedial Engineering, P.C.

ACCIDENT REPORT

Brian Hobbs, Corporate Health and Safety Manager
Cell: (631) 807-0193; Office: (631) 630-2416

PART 1: ADMINISTRATIVE INFORMATION

Project #: _____
Project Name: _____
Project Location (street address/city/state)**:**
_____
_____
Client Corporate Name / Contact / Address / Phone #:
_____
_____
_____
_____
_____

Immediate Verbal Notifications Given To:

Corporate Health & Safety	☐Yes	☐No
Office Health & Safety	☐Yes	☐No
Office Manager	☐Yes	☐No
Project Principal	☐Yes	☐No
Project Manager	☐Yes	☐No
Client Contact	☐Yes	☐No

REPORT STATUS (time due):
☐ Initial (24 hr) Date: _____
☐ Final (5-10 days) Date: _____

Accident Report Delivered To:

Corporate Health & Safety	☐Yes	☐No
Office Health & Safety	☐Yes	☐No
Office Manager	☐Yes	☐No
Project Principal	☐Yes	☐No
Project Manager	☐Yes	☐No

REPORT TYPE: ☐ Loss ☐ Near Loss Estimated Costs: $ _____

OSHA CASE # Assigned by Corporate Health & Safety if Applicable:

Corporate Health & Safety Confirmed Final Accident Report
☐Yes ☐No

DATE OF INCIDENT: _____

TIME INCIDENT OCCURRED: _____ ☐AM ☐PM

INCIDENT LOCATION – City, State, and Country (If outside U.S.A.)
_____

INCIDENT TYPES: (Select most appropriate if Loss occurred.)
From lists below, please select the option that best categories the incident. When selecting an injury or illness, also indicate the severity level.

☐**INJURY** ☐**ILLNESS**

----------**Severity Level**----------

☐Fatality ☐First Aid ☐Medical
☐Restricted Work ☐Lost Time ☐Treatment

OTHER INCIDENT TYPES

☐Spill / Release
Material involved:_____
Quantity (U.S. Gallons): _____
☐Misdirected Waste ☐Consent Order ☐NOV
☐Property Damage ☐Exceedance
☐Motor Vehicle ☐Fine / Penalty

ACTIVITY TYPE (Check most appropriate one.)

☐Decommissioning	☐Geoprobe	☐Sampling
☐Demolition	☐Motor Vehicle	☐System Start-up
☐Dewatering	☐Operations/ Maintenance	☐Trenching
☐Drilling		☐AST/UST Removal
☐Excavation	☐Pump/Pilot Test	☐Other_____
☐Gauging	☐Rigging/Lifting	

INJURY TYPE (Check all applicable.)

☐Abrasion	☐Occupational Illness
☐Amputation	☐Puncture
☐Burn	☐Rash
☐Cold/Heat Stress	☐Repetitive Motion
☐Inflammation	☐Sprain/Strain
☐Laceration	☐Other_____

BODY PART AFFECTED (Check all applicable.)

☐Respiratory	☐Shoulder	☐Face
☐Neck	☐Arm	☐Leg
☐Chest	☐Wrist	☐Knee
☐Abdomen	☐Hand/Fingers	☐Ankle
☐Groin	☐Eye	☐Foot/Toes
☐Back	☐Head	☐Other_____

I. PERSON(S) DIRECTLY / INDIRECTLY INVOLVED IN INCIDENT (Attach additional information as necessary/applicable.)

Name/Phone # of Each Person Directly/Indirectly Involved in Incident:	Designate: Roux/Remedial Employee Roux/Remedial Subcontractor Client Employee Client Contractor Third Party	As applicable, Current Occupation; Yrs in Current Occupation; Current Position; and Yrs in Current Position:	As applicable, Employer Name; Address; and Phone #:	As applicable, Supervisor Name; and Phone #:
1)				
2)				

II. PERSONS INJURED IN INCIDENT (Attach additional information as necessary/applicable.)

Name/Phone # of Each Person Injured in Incident:	Designate: Roux/Remedial Employee; Roux/Remedial Subcontractor; Client Employee; Client Contractor; Third Party	As applicable, Current Occupation; Yrs in Current Occupation; Current Position; and Yrs in Current Position:	As applicable, Employer Name; Address; and Phone #:	As applicable, Supervisor Name; and Phone #:	Description of Injury:
1)					
2)					

III. PROPERTY DAMAGED IN INCIDENT (Attach additional information as necessary/applicable.)

Property Damaged:	Property Location:	Owner Name, Address & Phone #:	Description of Damage:	Estimated Cost:
1)				
2)				$

IV. WITNESSES TO INCIDENT (Attach additional information as necessary/applicable.)

Witness Name:	Address:	Phone #:
1)		
2)		

PART 2: WHAT HAPPENED AND INCIDENT DETAILS

PROVIDE FACTUAL DESCRIPTION OF INCIDENT (e.g., describe loss/near loss, injury, response / treatment).

I. AUTHORITIES/GOVERNMENTAL AGENCIES NOTIFIED (Attach additional information as necessary/applicable.)

Authority/Agency Notified:	Name/Phone #/Fax # of Person Notified:	Address of Person Notified:	Date & Time of Notification:	Exact Information Reported/Provided:

II. PUBLIC RESPONSES TO INCIDENT (if applicable)

Response/Inquiry By: (check one)	Entity Name:	Name/Phone # of Respondent/ Inquirer:	Address of Entity/Person:	Date & Time of Response/Inquiry:
☐Newspaper ☐Television ☐Community Group ☐Neighbors ☐Other _____				

Describe Response/Inquiry:

Roux/Remedial Response:

(Check all that apply.) (Attach photos, drawings, etc. to help illustrate the incident.)
ATTACHED INFORMATION: ☐Photo ☐Sketches ☐Vehicle Acord Form ☐Police Report ☐Other

Name(s) of person(s) who prepared Initial and Final Report:	**Title(s):**	**Phone number(s):**

PART 3: INVESTIGATION TEAM ANALYSIS

CONCLUSION: WHY IT HAPPENED (LIST CAUSAL FACTORS AND CORRESPONDING ROOT CAUSES)

(Root Causes: Lack of knowledge or skill, Doing the task according to procedures or acceptable practices takes more time or effort, Short-cuts or not following acceptable practices is reinforced or tolerated, Not following procedures or acceptable practices did not result in an accident, Lack of or inadequate procedures, Inadequate communications of expectations regarding procedures or acceptable practices, Inadequate tools or equipment, External Factors)

ROOT CAUSE(S) AND SOLUTION(S): HOW TO PREVENT INCIDENT FROM RECURRING

PERSONAL FACTORS:

A. LACK OF SKILL OR KNOWLEDGE

B. DOING THE JOB ACCORDING TO PROCEDURES OR ACCEPTABLE PRACTICES TAKES MORE TIME OR EFFORT

C. SHORT-CUTTING PROCEDURES OR ACCEPTABLE PRACTICES IS POSITIVELY REINFORCED OR TOLERATED

D. IN PAST, DID NOT FOLLOW PROCEDURES OR ACCEPTABLE PRACTICES AND NO INCIDENT OCCURRED

JOB FACTORS:

E. LACK OF OR INADEQUATE PROCEDURES

F. INADEQUATE COMMUNICATION OF EXPECTATIONS REGARDING PROCEDURES OR ACCEPTABLE STANDARDS

G. INADEQUATE TOOLS OR EQUIPMENT (available, maintained, etc.)

CAUSAL FACTOR / BEHAVIOR / CONDITION	ROOT CAUSE	SOLUTION(S) [Must Match Root Cause(s)]		PERSON RESPONSIBLE	AGREED DUE DATE	ACTUAL COMPLETION DATE
		#	Solution(s)			

INVESTIGATION TEAM:

PRINT NAME	JOB POSITION	DATE	SIGNATURE

QUALITY REVIEW Correct root cause(s) identified? Do root cause(s) and solution(s) match? Are solution(s) feasible / maintainable?

Name: **Job Title:**

PART 4: Date Solutions were Implemented & Validated (Were Solutions Effective?)			
Date	**Solution**	**Verifier / Validator Name and Job Title**	**Details** (of I & V performed)

Appendix B - Lessons Learned Form

HEALTH & SAFETY LESSONS LEARNED
ROUX REPORT FORM

☐ **Roux Environmental Engineering and Geology, D.P.C.**
☐ **Roux Associates, Inc.** ☐ **Remedial Engineering, P.C.**

(Check applicable company name)

PART 1: ADMINISTRATIVE INFORMATION	
Office: ☐ New York ☐ Massachusetts ☐ New Jersey ☐ Illinois ☐ CA - Los Angeles ☐ CA - Oakland	
Project Manager:	**Project Principal:**
Project Name:	**Project Location:**

PART 2: LESSONS LEARNED INCIDENT DETAILS			
Date\Time Occurred (MM/DD/YYYY HH:MM)**:**		**Date\Time Submitted** (MM/DD/YYYY HH:MM)**:**	
LESSONS LEARNED INCIDENT TYPE - What could have happened? - Select all that apply (1-7)			
1. ☐ Fire / Explosion 2. ☐ Injury / Illness	3. ☐ Security (e.g, theft, trespassing, vandalism)	4. ☐ Environmental (spill, permit exceedance, etc.) 5. ☐ Transportation of personnel (vehicle accident)	6. ☐ Property/Equipment Damage 7. ☐ Business Interruption
Event Leading to Potential Injury/Illness:			
Job Task*:		**Equipment Involved*:**	

WHAT HAPPENED? Do not include individuals' names. Ensure photos, sketches, etc. are not personally identifiable unless written consent has been obtained.

Summary (1-2 sentences. Provide brief description of the incident. Provide facts only, no speculation or opinion)**:**

Incident Details (Brief factual details of what, where, when; include photos, sketches, etc. as attachments)**:**

Immediate Corrective Actions Taken:

SERIOUS INJURY OR FATALITY (SIF): **IF AN ACTUAL SIF, USE EXISTING ROUX ACCIDENT REPORTING FORM**
Could this have resulted in a SIF? ☐ **Yes** ☐ **No**
A potential SIF is defined as likely to have caused an injury resulting in significant physical body damage with probable long term and/or life altering complications.

INCIDENT INVOLVED:			
Roux Employee: ☐ **Yes** ☐ **No** **Subcontractor Company Name:**			
INVESTIGATION TEAM			
NAME	**JOB TITLE**	**NAME**	**JOB TITLE**

PART 3: INCIDENT INVESTIGATION FINDINGS AND REPORT QUALITY REVIEW
Date Investigation Team Assigned (mm/dd/yyyy):
INVESTIGATION SUMMARY: Determine from list below what behaviors and/or conditions may have contributed to the H&S Lessons Learned Incident. Then, use the "Multiple-Why Technique" for each of these behaviors/conditions; provide a narrative for each that explains how the associated Root Cause(s) was determined. Do not include individuals' names.

ROOT CAUSES: HOW TO REDUCE POSSIBILITY OF INCIDENT RECURRING
Selection of RCs and solutions reflects the analysis of investigation team. It is not meant as a legally binding conclusion as to causal factors and/or solutions.

PERSONAL FACTORS:

A. LACK OF SKILL OR KNOWLEDGE

B. DOING THE JOB ACCORDING TO PROCEDURES OR ACCEPTABLE PRACTICES TAKES MORE TIME OR EFFORT

C. SHORT-CUTTING PROCEDURES OR ACCEPTABLE PRACTICES IS POSITIVELY REINFORCED OR TOLERATED

D. IN PAST, DID NOT FOLLOW PROCEDURES OR ACCEPTABLE PRACTICES AND NO INCIDENT OCCURRED

JOB FACTORS:

E. LACK OF OR INADEQUATE PROCEDURES

F. INADEQUATE COMMUNICATION OF EXPECTATIONS REGARDING PROCEDURES OR ACCEPTABLE STANDARDS

G. INADEQUATE TOOLS OR EQUIPMENT (available, maintained, etc.)

Behavior / Condition	Root Cause	Solution(s) (Must Match Root Cause)	Person Responsible for Completion	Completion Target Date	Completion Actual Date

QUALITY REVIEW Correct root cause(s) identified? Do root cause(s) and solution(s) match? Are solution(s) feasible / maintainable?

Name: **Job Title:**

PART 4: Date Solutions were Implemented & Validated (Were Solutions Effective?)			
Date	**Solution**	**Verifier / Validator Name and Job Title**	**Details** (of I & V performed)

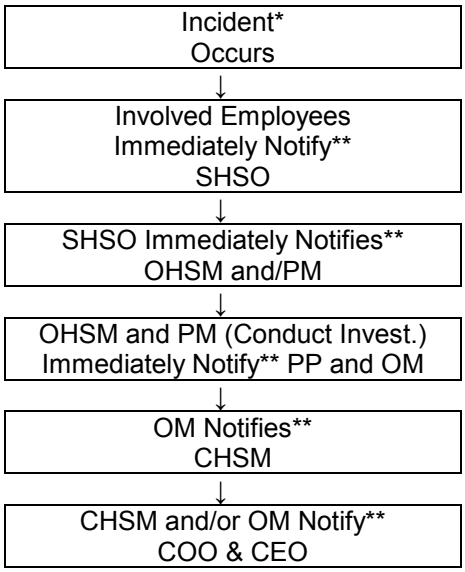
JOB TASK - Select the most appropriate one (primary job associated with incident-related work activity, avoid "Other" if possible)			
1. Carbon Change	7. Gauging	12. Pavement Cutting	18. System Startup
2. Construction	8. Geoprobe / Direct Push	13. Pump Test	19. UST Removal exposure and
3. Demolition	9. Mobil Remediation (includes vacuum event and chemical injection)	14. Sampling	20. Waste Management
4. Dewatering	10. NAPL Recovery	15. Site Visit / Survey	21. Well Abandonment
5. Drilling (well install)	11. O&M (remediation system)	16. Subsurface	22. Other:
6. Excavation /		17. System Install	

EQUIPMENT INVOLVED THAT CONTRIBUTED TO H&S LESSONS LEARNED - Select all that apply

1. Air Stripper
2. API Separator
3. Automobile
4. Boom Material
5. Bulldozer
6. Cable
7. Carbon Drum / Vessel
8. Chain Block
9. Compressor, Air
10. Control Panel (local)
11. Crane (mobile)
12. Drill Rig
13. Drilling Equipment, Vacuum
14. Drum, Vertical
15. Dump Truck
16. Electric Heater
17. Electrical Power Supply
18. Engine, Combustion
19. Equipment Safety Grounding
20. Excavator / Power Shovel
21. Exclusion Zone Equipment
22 Fan / Blower
23 Fencing
24 Filter
25. Fire Extinguisher
26. Forklift
27. Front End Loader
28. Grader
29. Hammer
30. Knife
31. Non-Powered Equipment
32. Powered Equipment
33. Drill
34. Grinder
35. Hydraulic Torque Wrench
36. Powered Saw
37. Impact Wrench
38. Saw
39. Screwdriver
40. Shears
41. Shovel
42. Snip
43. Wrench
44. Hoist
45, Hook/Clamp/Buckle, etc.
46. Jack
47. Ladder, Extension
48. Ladder, Platform
49. Ladder, Step
50. Lock Out / Tag Out
51. Maintenance Tool, General
52. Manifold
53, Manlift/Basket/Cherry Picker
54. Motor, Electric
55. Oxidizer
56. Pallet
57. Piping
58. Piping, Hose
59. Piping, Injection/Mixing Point
60. Hydrojet
61. Centrifugal Pump
62. Diaphragm Pump
63. Reciprocating Pump
64. Regenerative Pump
65. Rotary Pump
66. Transfer Pump
67. Submersible Pump
68. Face Shield
69. Fall Protection
70. Gloves
71. Hard Hat / Helmet
72. Hearing Protection
73. Respiratory PPE (Chemical)
74. Respiratory PPE (Particulate)
75. Safety Glasses
76. Safety Goggles
77. Safety Shoes / Boots
78. Safety Vest / Clothing
79. Rope
80. Bailer
81. Geoprobe
82. Hand Auger
83. PID
84. Multi-Gas Meter
85. Sample Container
86. Split-Spoon Sampler
87. Sling
88. Snow Blower
89. Snow Plow
90. Space Heater
91. Air Sparging System
92. Carbon Treatment Sys
93. Chemical Oxidation Sy
94. Dual Phase Product Recovery System
95. Groundwater Pump and Treat System
96. POET System
97. Shed or Trailer
98. Vapor Extraction Syst
99. Vapor-Phase Treatme System
100. Other System, Type
101. Surge Tank
102. Underground Tank
103. Telemetry System
104. Testing Devices
105. Tractor Trailer
106. Truck, Flatbed
107. Truck, Pickup
108. Truck, Tank Truck
109. Truck, Vacuum
110. Safety Valve
111. Block Valve
112. Extraction Well
113. Monitoring Well
114. Recovery Well
115. Winch
116. Wire Rope
117. No Equipment Involv
118. MPT – Traffic Contr Devices
118. Not in List (describe)

Appendix C – Injury Illness Reporting Flow Chart

Health & Safety Near/Loss – Loss (Incident)*
Notification Flow Chart



* Incident – any work or site-related occurrence that resulted in, or could potentially have resulted in, the need for medical care or in property damage (i.e., all injuries or illnesses, exposure to toxic materials or any other significant occurrence resulting in property damage or in a "near loss")

** Verbal Notification

Initial Incident Report (written) to SHSO, OHSM, OM and CHSM within 24 hours
Follow-up Report within one week.

APPENDIX E

Heavy Equipment Exclusion Zone Policy

HEAVY EQUIPMENT EXCLUSION ZONE MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER	:	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	:	**07/18**
REVISION NUMBER	:	**1**

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1. PURPOSE

The purpose of the Exclusion Zone Management Program is to establish the minimum clearance distance that must be maintained between workers and heavy equipment while equipment is in operation (i.e., engaged or moving). The intent is to have no personnel or equipment entering the Exclusion Zone while the equipment is in operation or moving to ensure that Roux and Subcontractor employees are not unnecessarily exposed to the hazards of the equipment.

2. SCOPE AND APPLICABILITY

This Management Program applies to all Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C, and Remedial Engineering (collectively, "Roux") employees and their subcontractors who are performing field work and are potentially exposed to heavy equipment. For the purpose of this program, heavy equipment includes, but is not necessarily limited to: excavation equipment, drill rigs, vacuum trucks, forklifts, lull telehandlers, man lifts, bobcats, delivery trucks, etc.

3. PROCEDURES

As specified in the following sections of this Program, an Exclusion Zones must be established and maintained during activities involving the movement/operation of heavy equipment. The Exclusion Zone requirements apply to all personnel on the site but are primarily focused on those personnel who are required to be working in the vicinity of the equipment. The exclusion zone is in effect when heavy equipment is moving or engaged (ex. movement of an arm or bucket of an excavator, rotation of an auger, lifting of a load with a forklift, raising/lowering of a man lift, etc.).

1. The Exclusion Zone must meet the following minimum requirements:
   - A minimum distance of 10 feet from all heavy equipment and loads being moved by the equipment;
   - Greater than the swing/reach radius of any moving part on the heavy equipment (i.e., for large equipment this may mean an exclusion zone distance larger than 20 feet);
   - Greater than the tip-over distance of the heavy equipment; and
   - Greater than the radius of blind spots.

   The size of the Exclusion Zone will need to be determined on a task-specific basis considering the size of the heavy equipment in use and the task being performed. Prior to all heavy equipment operations, the Exclusion Zone(s) distance must be specifically identified in the Job Safety Analysis (JSA).
2. The spotter (or another individual) should be assigned responsibility for enforcing the Exclusion Zone. The spotter should be positioned immediately outside of the Exclusion Zone within a clear line of sight of the equipment operator. The spotter must signal the operator to stop work if anyone or anything has the potential to enter or compromise the Exclusion Zone. The operator should stop work if the spotter is not within his/her line of sight. If multiple pieces of equipment are being used, each piece of equipment must have its own Exclusion Zone and spotter. For large excavation and demolition projects the spotter should be in constant radio contact (not cell phone) with the machine driver.
3. If an individual must enter the Exclusion Zone, the designated Spotter must signal the Equipment Operator to stop the equipment. Once the equipment is no longer moving (ex. movement of an arm of an excavator is STOPPED, lifting of a load with a forklift STOPPED, raising/lowering of a man lift is

STOPPED, etc.), the operator must DISENGAGE THE CONTROLS and STOP and SIGNAL BY "SHOWING HIS HANDS". This signal will indicate that it is safe for the personnel to enter the limits of the Exclusion Zone to perform the required activity. The equipment must remain completely stopped/disengaged until all personnel have exited the limits of the Exclusion Zone and the designated Spotter has signaled by "SHOWING HIS HANDS" to the Equipment Operator that it is safe to resume operations.

4. When entering the limits of the Exclusion Zone, personnel must at a minimum:
   - Establish eye contact with the operator and approach the heavy equipment in a manner that is in direct line of sight to the Equipment Operator;
   - Never walk under any suspended loads or raised booms/arms of the heavy equipment; and
   - Identify a travel path that is free of Slip/Trip/Fall hazards.
5. The Exclusion Zone should be delineated using cones with orange snow fence or solid poles between the cones, barrels, tape or other measures. For work in rights-of-way rigid barriers, such as Jersey barriers or temporary chain link fence should be used. For certain types of wide-spread or moving/mobile equipment operations, such delineation may not be practicable around pieces of equipment or individual work areas. In such instances, it is expected that the entire operation will be within a larger secure work area or that additional means will be utilized to ensure security of the work zone.

All subcontractors who provide heavy equipment operations to field projects must implement a program that meets or exceeds the expectations described above as well as any additional requirements that may be required on a client or site-specific basis.

3.1 Exceptions

It is recognized that certain heavy equipment activities may require personnel to work within the limits of the Exclusion Zone as specified in this program. Such activities may include certain excavation clearance tasks, drill crew activities or construction tasks. However, any such activity must be pre-planned with emphasis on limiting the amount and potential exposure of any activity required within the zone. The critical safety steps to mitigate the hazards associated with working within the Exclusion Zone must be defined in the JSA and potentially other project-specific plans (i.e., critical lift plans, etc.), and approved by the Roux Project Principal and client representative, if required, prior to implementation.

4. TRAINING

Many Roux projects have different requirements that are client-specific or site-specific in nature. It is the responsibility of the Project Principal (or Project Manager if delegated this responsibility by the Project Principal) to ensure that the workers assigned to his/her projects are provided orientation and training with respect to these client and/or site-specific requirements.

APPENDIX F

Subsurface Utility Clearance Management Program

SUBSURFACE UTILITY CLEARANCE MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER	:	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	:	**07/18**
REVISION NUMBER	:	**1**

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APPENDICES

1. PURPOSE

Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C, and Remedial Engineering (collectively, "Roux") has instituted the following program for completing proper utility mark-outs and for conducting subsurface clearance activities. This establishes a method to ensure, to the greatest extent possible, that utilities have been identified and contact and/or damage to underground utilities and other subsurface structures will be avoided.

2. SCOPE AND APPLICABILITY

The Subsurface Utility Clearance Management Program applies to all Roux employees, its contractors and subcontractors. Employees are expected to follow this program for all intrusive work involving Roux or other personnel (e.g., contractors/subcontractors) working for Roux unless the client's requirements are more stringent. Deviation from the program regardless of the specific work activity or work location must be pre-approved based on client's site knowledge, site experience and client's willingness for the use of this program. Any and all exceptions shall be documented and pre-approved by the Project Principal and the Office Manager.

3. PROCEDURES

3.1 Before Intrusive Activities

During the project kick-off meeting for intrusive activities the PM will review the Roux Subsurface Utility Clearance Checklist and Utility Verification (Appendix C) / Site Walkthrough Record (Appendix D) and the below bullet points with the project field team:

(Please note that these are intended as general reminders only and should not be solely relied upon.)

- Ensure the Mark-out / Stake-out Request Information Sheet (or one-call report) is complete and accurate for the site including address and cross streets and review for missing utilities. (Note: utility mark-out organizations do not have contracts with all utilities and it is often necessary to contact certain utilities separately such as the local water and sewer authorities).
- Have written confirmation prior to mobilizing to the site that the firm or Roux personnel performing the intrusive activity has correctly completed the mark-out notification process including requesting mark-outs, waiting for mark-outs to be applied to ground surfaces at the site, and receiving written confirmation of findings (via fax or email) from utility operators for all known or suspected utilities in the proposed area of intrusive activity, and provided utility owner written confirmation to Roux personnel for review and project files documentation.
- Do not begin any intrusive activity until all utilities mark-out has been completed (i.e., did all utilities mark-out the site?) and any unresolved mark-out issues are finalized. Perform a site walk to review the existing utilities and determine if said utilities have been located by the utility locators.

  (Note: The Tolerance Zone is defined as two feet plus half of the diameter or half of the greatest dimension (for elliptical sewers, duct banks and other non-cylindrical utilities) of a utility and two feet from the outside edge of any subsurface structure.)
- Install Pre-Clearance exploratory test holes (e.g., hand-dug test holes or other soft digging techniques) for the first 5-ft below land surface (BLS) at each location prior to conducting mechanized intrusive activities. The size of the pre-clearance exploratory test hole should be at a minimum twice the diameter of any downhole tool or boring device. (Note: Pre-Clearance exploratory test holes should be defined in the SOW/proposal provided to the client to prevent project delays and to allow adequate time for PM and PP to evaluate alternative approaches for the project. Alternative approaches will need to be pre-approved by the OM.

- For excavations, all utilities need to be marked and then exposed by hand following the protocols in this program. Pre-clearing for excavations may be performed by the "moat" technique (i.e., soft digging around the perimeter). In these cases, dig in small lifts (<12" for first 5 feet) using a dedicated spotter.) For Tolerance Zone work, unless otherwise agreed upon with the Utility Operator, work within the tolerance zone requires verification by means of hand-dug test holes performed to expose the utility. Once structures have been verified a minimum clearance of two feet must be maintained between the utility and any powered equipment.
- In addition, the following activities should be conducted:
  - Review the work scope to be performed with the site owner/tenant to determine if it may impact any utilities;
  - Attempt to procure any utility maps or historic drawings of subsurface conditions of the site;
  - **Determine the need for utility owner companies to be contacted or to have their representatives on site**;
  - Where mark-outs terminate at the property boundary, consider the use of private utility locating / GPR / geophysical-type services which may be helpful in locating utilities. Use of private utility locating firms, however, does not eliminate the legal requirement for the Excavator firm to submit a request for Public Utility Mark-outs. Also, the information provided by the service may be inaccurate and unable to locate subsurface utilities and structures in urban areas, landfills, urban fill areas and below reinforced slabs, etc. They should not be relied upon as the only means of performing utility clearance;
  - Documented description of the dig site which is included in the projects Health and Safety Plan (HASP) and one call report will be maintained in the field and distributed amongst Roux personnel its contractors and subcontractors; and
  - Documentation of the actual placement of mark outs in the field shall be collected using dated pictures, videos and/or sketches with distance from markings to fixed objects. All documentation shall be maintained within the project file.

3.2 During Intrusive Activities

The PM, field team lead or personnel performing oversight is to:

- Ensure the mark-out remains valid. (In certain states there are limits regarding the duration of time after the mark-out was applied to the ground surface work can be started or interrupted.) Additionally, the mark-outs must be maintained, documented, and in many cases refreshed periodically to be considered valid, this will be accomplished through calls to the one call center.
- Ensure intrusive activities are only performed within the safe boundaries of the mark-out as detailed in the One-Call Report.
- Halt all work if intrusive activities have resulted in discovery of an unmarked utility. Roux personnel shall notify the facility owner/operator and the one call center. All incidents such as this will be reported as per Roux Incident Investigation and Reporting Management Program.
- Halt all work if intrusive activities must take place outside of the safe boundaries of a mark-out and only proceed after new mark-outs are performed.
- Halt the intrusive activities and immediately consult with the PP if an unmarked utility is encountered.
- Completing any subsurface utility clearance incident reports that are necessary.

- If a utility cannot be found as marked Roux personnel shall notify the facility owner/operator directly or through the one call center. Following notification, the excavation may continue, unless otherwise specified in state law.
- Contractors/subcontractors must contact the one-call center to refresh the ticket when the excavation continues past the life of the ticket. Ticket life shall be dictated by state law however at a maximum ticket life shall not exceed 20 working days.

3.3 Stop Work Authority

Each Roux employee has Stop Work Authority which he or she will execute upon determination of any imminent safety hazard, emergency situation, or other potentially dangerous situation, such as hazardous weather conditions. This Stop Work Authority includes subsurface clearance issues such as the adequacy of a mark-out or identification during intrusive operations of an unexpected underground utility. Authorization to proceed with work will be issued by the PM/PP after such action is reviewed and resolved. The PM will initiate and execute all management notifications and contact with emergency facilities and personnel when this action is appropriate.

Appendix A - Definitions

Intrusive Work Activities	All activities such as digging or scraping the surface, including but not limited to, excavation, test pitting or trenching, soil vapor sampling or the installation of soil borings, soil vapor monitoring points and wells, or monitoring wells, and drilling within the basement slab of a recently demolished building.
Mark-out / Stake Out	The process of contracting with a competent and qualified company to confirm the presence or absence of underground utilities and structures. This process will clearly mark-out and delineate utilities that are identified so that intrusive work activities can be performed without causing disturbance or damage to the subsurface utilities and structures. After utility mark-outs are completed the soft digging will be completed prior to intrusive work.
Tolerance Zone	Defined as two feet on either side of the designated centerline of an identified utility, plus half of the diameter or half of the greatest dimension (for elliptical sewers, duct backs and other non-cylindrical utilities) of that utility and two feet from the outside edge of any subsurface structure.
Structure	For the purpose of this program a structure is defined as any underground feature that may a present potential source(s) of energy such as, but not limited to, utility vaults, bunkers, piping, electrical boxes, wires, conduits, culverts, utility lines, underground tanks and ducts.
Soft Digging	The safest way to remove material from unknown obstructions or services is by using tools such as a vactor or air knife, non-mechanical tools, or hand tools. The methods are clean and non-evasive and used for uncovering and exposing buried services, excavating and for providing a quick method of soil removal from sensitive areas.
Verification	Exploratory test-hole dug with hand tools within the Tolerance Zone to expose and verify the location, type, size, direction-of-run and depth of a utility or subsurface structure. Vacuum excavation (soft dig) methods can further facilitate exposure of a subsurface utility and accurately provide its location and identification prior to intrusive work approaching the Tolerance Zone.

Appendix B - Example of Completed One Call Report

Example Completed One-Call Report

New York 811

Send To: C_EMAIL Seq No: 744

Ticket No: 133451007 ROUTINE

Start Date: 12/16/13 Time: 7:00 AM Lead Time: 20

State: NY County: QUEENS Place: QUEENS
Dig Street: 46TH AVE Address:
Nearest Intersecting Street: VERNON BLVD
Second Intersecting Street: 11TH ST

Type of Work: SOIL BORINGS
Type of Equipment: GEOPROBE
Work Being Done For: ROUX

In Street: X On Sidewalk: X Private Property: Other:
On Property Location if Private: Front: Rear: Side:

Location of Work: MARK THE ENTIRE NORTH SIDE OF THE STREET AND SIDEWALK OF: 46TH AVE BETWEEN VERNON BLVD AND 11TH STREET

Remarks:

Nad: Lat: Lon: Zone:
ExCoord NW Lat: 40.7475399 Lon: -73.9534811 SE Lat: 40.7457406 Lon: -73.9493680

Company : ZEBRA ENVIROMENTAL Best Time: 6AM-5PM
Contact Name: DAVID VINES Phone: (516)596-6300
Field Contact: DAVID VINES Phone: (516)596-6300
Caller Address: 30 N PROSPECT AVE Fax Phone: (516)596-4422
LYNBROOK, NY 11563
Email Address: david@zebraenv.com

Additional Operators Notified:
ATTNY01 AT&T CORPORATION (903)753-3145
CEQ CONSOLIDATED EDISON CO. OF N.Y (800)778-9140
MCINY01 MCI (800)289-3427
PANYNJ01 PORT AUTHORITY OF NY & NJ (201)595-4841
VZQ VERIZON COMMUNICATIONS (516)297-1602

Link to Map for C_EMAIL: http://ny.itic.occinc.com/XGMZ-DF2-L23-YAY

Original Call Date: 12/11/13 Time: 1:15 PM Op: webusr
IMPORTANT NOTE: YOU MUST CONTACT ANY OTHER UTILITIES DIRECTLY

Appendix C - Roux Subsurface Utility Clearance Checklist

Roux Subsurface Utility Clearance Checklist ***Date of Revision – 12/3/14***

Work site set-up and work execution

ACTIVITY	Yes	No	N/A	COMMENTS INCLUDING JUSTIFICATION IF RESPONSE IS NO OR NOT APPLICABLE
Daily site safety meeting conducted, SPSAs performed, JSAs reviewed, appropriate work permits obtained.				
HASP is available and reviewed by site workers / visitors.				
Subsurface Utility Clearance Procedure has been reviewed with all site workers.				
Work area secured; traffic control established as needed. Emergency shut-off switch located. Fire extinguishers / other safety equipment available as needed.				
Utility mark-outs (public / private) clear and visible. Provide Excavator's Stake-Out Reference Number / Request Date / Time.				
Tolerance zone work identified.				
Work execution plan reviewed and adhered to (ground disturbance methods, clearance depths, any special utility protection requirements, or any other execution requirements; especially for Tolerance Zone work).				
Verbal endorsement received from Roux PM for any required field deviations to work execution plan.				

<u>Key reminders for execution</u>:

The Subsurface Utility Clearance Protocol should be referenced to determine all requirements while executing subsurface work. The bullet points below are intended as general reminders only and should not be solely relied upon.

- Tolerance zone is defined as two feet plus half of the diameter or half of the greatest dimension (for elliptical sewers, duct banks and other non-cylindrical utilities) of a utility and two feet from the outside of any subsurface structure.
- Install Pre-Clearance exploratory test holes (e.g., hand-dug test holes or vacuum excavation) must be performed for the first five feet below land surface (BLS) at each location prior to conducting mechanized intrusive activities. The size of the pre-clearance exploratory test hole should be at a minimum twice the diameter of any downhole tool or boring device. (Note: Pre-clearance exploratory test holes should be defined in the SOW/proposal provided to the client to prevent project delays and to allow adequate time for PM and PP to evaluate alternative approaches for the project. Alternate approaches will need to be pre-approved by the OM.
- For excavations, all utilities need to be marked and then exposed by hand following the protocols in this program. Pre-clearing for excavations may be performed by the "moat" technique (i.e., soft

digging around the perimeter). In these cases, dig in small lifts (<12" for first five feet) using a dedicated spotter.) For Tolerance Zone work, unless otherwise agreed upon with the Utility Operator, work within the tolerance zone requires verification by means of hand-dug test holes to expose the utility. Once structures have been verified a minimum clearance of two feet must be maintained between the utility and any powered equipment.

Appendix D - Utility Verification/Site Walkthrough Record

Employee Name: _____

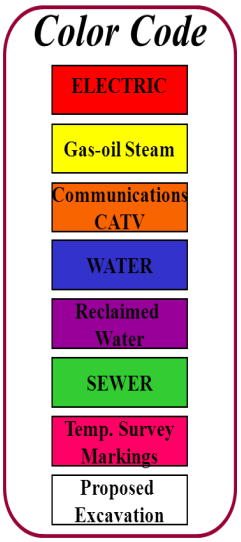
Date: _____

Instructions: For each utility suspected at the job site, indicate location on the job site, approximate burial depth, and means of detecting the utility. Leave blank if that utility is not believed to be present.

Utility	Description of Utility Location Identified Onsite	Approx. Depth (bls)	Method / Instrumentation used to determine Utility Location	Utility Owner Response (Date/Time)	Mark Out Indicates (Clear / Conflict)
Electrical Lines					
Gas Lines					
Pipelines					
Steam Lines					
Water Lines					
Sanitary and Stormwater Sewer lines					
Pressured Air-Lines					
Tank Vent Lines					
Fiber Optic Lines					
Underground Storage Tanks					
Phone Lines/ Other					

* bls - below land surface

Site Sketch Showing Utilities:



Other Comments / Findings:

Completed by: _____

Signature: _____ Date: _____

APPENDIX G

Personal Protective Equipment Management Program

PERSONAL PROTECTIVE EQUIPMENT MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER	**:**	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	**:**	**07/18**
REVISION NUMBER	**:**	**3**

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1. PURPOSE

Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C, and Remedial Engineering (collectively, "Roux") has instituted the following program to establish guidelines for the selection of personal protective equipment (PPE) for use by Roux personnel performing field activities in hazardous environments. PPE is not meant to be a substitute for engineering, work practice, and/or administrative controls, but PPE should be used in conjunction with these controls to protect the employees in the work place. Clothing, body coverings, and other accessories designed to prevent worker exposure to workplace hazards are all types of PPE. To ensure adequate PPE employee-owned PPE is evaluated on a case-by-case basis to insure its adequacy, maintenance and sanitation.

2. SCOPE AND APPLICABILITY

These guidelines apply to all PPE selection decisions to be made in implementing the Roux program. The foundations for this program are the numerous Occupational Health and Safety Administration (OSHA) standards related to PPE cited in 29 CFR 1910 Subpart I, 29 CFR 1926 Subpart E, and the hazardous environment work employee protection requirements under the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standard at 29 CFR 1910.120 and 1926.65. To ensure hazard assessments are documented the levels of protection, types of protection and tasks requiring protection are covered in site-specific Health and Safety Plans (HASPs) and Job Safety Analyses (JSAs).

3. PROCEDURES

Due to the varied nature of site activities and the different potential hazards associated with different sites, several aspects must be considered when selecting PPE. The following text describes PPE selection logic and provides guidelines and requirements for the appropriate selection and use of PPE.

3.1 Introduction

To harm the body, chemicals must first gain entrance. The intact skin and the respiratory tract are usually the first body tissues attacked by chemical contaminants. These tissues provide barriers to some chemicals but in many cases, are damaged themselves or are highly permeable by certain chemical compounds. Personal protective equipment therefore is used to minimize or eliminate chemical compounds coming into contact with these first barrier tissues.

The proper selection of equipment is important in preventing exposures. The PM making the selection will have to take several factors into consideration. The level of protection, type and kind of equipment selected depends on the hazardous conditions and in some cases cost, availability, compatibility with other equipment, and performance. An accurate assessment of all these factors must be made before work can be safely carried out.

3.2 Types of PPE

The type and selection of PPE must meet certain general criteria and requirements as required under OSHA 29 CFR 1910.132 and 1926.95. In addition to these general requirements, specific requirements and specifications exist for some types of PPE that form the basis of the protective clothing scheme. Following is a list of the common types of specific PPE and the specific requirements for the PPE type, where applicable:

1. Hard Hats - Regulated by 29 CFR 1910.135 and 1926.100; and, specified in ANSI Z89.1.

2. Face Shields and Safety Glasses - Regulated by 29 CFR 1910.133 and 1926.102; and, specified in ANSI Z87.1.
3. Respiratory Protection - Regulated by 29 CFR 1910.134 and 1926.103.
4. Hand Protection - Not specifically regulated.
5. Foot Protection - Regulated by 29 CFR 1910.136 and 1926.96; and, specified in ANSI Z41.1.
6. Protective Clothing (e.g., fully encapsulated suits, aprons) - Not specifically regulated.

3.3 Protective Clothing Selection Criteria

3.3.1 Chemicals Present

The most important factor in selecting PPE is the determination of what chemicals the employee may be exposed to. On field investigations, the number of chemicals may range from a few to several hundred. The exact chemicals or group of chemicals present at the site (certain groups tend to require similar protection) can be determined by collecting and analyzing samples of the air, soil, water, or other site media. When data are lacking, research into the materials used or stored at the site can be used to infer chemicals possibly on the site.

Once the known or suspected chemicals have been identified, and taking into consideration the type of work to be performed, the most appropriate clothing shall be selected.

Protective garments are made of several different substances for protection against specific chemicals. There is no universal protective material. All will decompose, be permeated by, or otherwise fail to protect under given circumstances. Fortunately, most manufacturers make guides to the use of their products (i.e., Dupont's Tyvek™ Permeation Guide). These guides are usually for gloves and coveralls and typically provide information regarding chemical degradation rates (failure of the material to maintain structural integrity when in contact with the chemical), and may provide information on the permeation rate (whether or not the material allows the chemical to pass through). When permeation tables are available, they shall be used in conjunction with degradation tables to determine the most appropriate protective material.

During most site work, chemicals are usually in mixed combinations and the protective materials are not in continuous contact with pure chemicals for long periods of time; therefore, the selected material may be adequate for the particular chemical and type of work being performed, yet not the "best" protecting material for all site chemicals and activities. Selection shall depend upon the most hazardous chemicals based on their hazards and concentrations. Sometimes layering, using several different layers of protective materials, affords the best protection.

3.3.2 Concentration of the Chemical(s)

One of the major criteria for selecting protective material is the concentration of the chemical(s) in air, liquid, and/or solid state. Airborne and liquid chemical concentrations should be compared to the OSHA standards and/or American Conference of Governmental Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH) guidelines to determine the level of skin or other absorptive surface (e.g., eyes) protection needed. While these standards are not designed specifically for skin exposed directly to the liquid, they may provide skin designations indicative of chemicals known to have significant skin or dermal absorption effects. For example, airborne levels of PCB on-site may be

low because it is not very volatile, so the inhalation hazard may be minimal; however, PCB-containing liquid coming in direct contact with the skin may cause overexposure. Thus, PCB has been assigned a skin designation in both the OSHA and ACGIH exposure limit tables.

3.3.3 Physical State

The characteristics of a chemical may range from nontoxic to extremely toxic depending on its physical state. Inorganic lead in soil would not be considered toxic to site personnel, unless it became airborne, since it is generally not absorbed through the intact skin. Organic lead in a liquid could be readily absorbed. Soil is frequently contaminated with hazardous materials. Concentrations will vary from a few parts per million to nearly one hundred percent. The degree of hazard is dependent on the type of soil and concentration of the chemical. Generally speaking, "dry" soils do not cause a hazard to site personnel if they take minimal precautions such as wearing some type of lightweight gloves.

3.3.4 Length of Exposure

The length of time a material is exposed to a chemical increases the probability of breakthrough. Determinations of actual breakthrough times for short-term exposures indicate that several different materials can be used which would be considered inadequate under long-term exposures. It should be kept in mind that during testing, a pure (100% composition) liquid is usually placed in direct contact with the material producing a worst-case situation.

3.3.5 Abrasion

When selecting protective clothing, the job the employee is engaged in must be taken into consideration. Persons moving drums or performing other manual tasks may require added protection for their hands, lower chest and thighs. The use of leather gloves and a heavy apron over the other normal protective clothing will help prevent damage to the normal PPE and thus reduce worker exposures.

3.3.6 Dexterity

Although protection from skin and inhalation hazards is the primary concern when selecting PPE, the ability to perform the assigned task must be maintained. For example, personnel cannot be expected to perform work that requires fine dexterity if they must wear a thick glove. Therefore, the PPE selection process must consider the task being performed and provide PPE alternatives or techniques that allow dexterity to be maintained while still protecting the worker (e.g., wearing tight latex gloves over more bulky hand protection to increase dexterity).

3.3.7 Ability to Decontaminate

If disposable clothing cannot be used, the ability to decontaminate the materials selected must be taken into consideration. Once a chemical contacts the material, it must be cleaned before it can be reused. If the chemical has completely permeated the material, it is unlikely that the clothing can be adequately decontaminated and the material should be discarded.

3.3.8 Climactic Conditions

The human body works best with few restraints from clothing. Protective clothing adds a burden by adding weight and restricting movement as well as preventing the natural cooling process. In severe situations, a modified work program must be used.

Some materials act differently when they are very hot and very cold. For example, PVC becomes almost brittle in very cold temperatures. If there are any questions about the stability of the protective materials under different conditions, the manufacturer should be contacted.

3.3.9 Work Load

Like climactic conditions, the type of work activity may affect work duration and the ability or personnel to perform certain tasks. Similarly, the amount of protective materials a person wears will affect their ability to perform certain tasks. For example, a person in a total encapsulating suit, even at 72 ^{o}F, cannot work for more than a short period of time without requiring a break.

The work schedule should be adjusted to maintain the health of the employees. Special consideration should be given to the selection of clothing that both protects and adds the least burden when personnel are required to perform strenuous tasks. Excessive bodily stress frequently represents the most significant hazard encountered during field work.

3.4 Types of Protective Materials

1. Cellulose or Paper
2. Natural and Synthetic Fibers
    a. Tyvek™
    b. Nomex™
3. Elastomers
    a. Polyethylene
    b. Saran
    c. Polyvinyl Chloride (PVC)
    d. Neoprene
    e. Butyl Rubber
    f. Viton

3.5 Protection Levels

3.5.1 Level A Protection

Level A protection (a fully encapsulated suit) is used when skin hazards exist or when there is no known data that positively rule out skin and other absorption hazards. Since Level A protection is extremely physiologically and psychologically stressful, the decision to use this protection must be carefully considered. At no time will Level A work be performed without the consent of the OM. The following conditions suggest a need for Level A protection:

- confined facilities where probability of skin contact is high;
- sites containing known skin hazards;
- sites with no established history to rule out skin and other absorption hazards;
- atmosphere immediately dangerous to life and health (IDLH) through the skin absorption route;
- site exhibiting signs of acute mammalian toxicity (e.g., dead animals, illnesses associated with past entry into site by humans);

- sites at which sealed drums of unknown materials must be opened;
- total atmospheric readings on the Photoionization Detector (PID), Flame Ionization Detector (FID), and similar instruments indicate 500 to 1,000 ppm of unidentified substances; and
- extremely hazardous substances (e.g., cyanide compounds, concentrated pesticides, Department of Transportation Poison "A" materials, suspected carcinogens and infectious substances) are known or suspected to be present and skin contact is possible.

The following items constitute Level A protection:

- open circuit, pressure-demand self-contained breathing apparatus (SCBA);
- totally encapsulated suit;
- gloves, inner (surgical type);
- gloves, outer;
- chemical protective;
- boots, chemical protective, steel toe and shank;
- radiation detector (if applicable); and
- communications.

3.5.2 Level B Protection

Level B protection is utilized when the highest level of respiratory protection is needed but hazardous material exposure to the few unprotected areas of the body is unlikely.

The following conditions suggest a need for Level B protection:

- the type and atmospheric concentration of toxic substances have been identified and they require the highest level of respiratory protection;
- IDLH atmospheres where the substance or concentration in the air does not present a severe skin hazard;
- the type and concentrations of toxic substances do not meet the selection criteria permitting the use of air purifying respirators; and
- it is highly unlikely that the work being done will generate high concentrations of vapors, gases or particulates, or splashes of materials that will affect the skin of personnel.

Personal protective equipment for Level B includes:

- open circuit, pressure-demand SCBA;
- chemical protective clothing:
- overalls and long-sleeve jacket; or
- coveralls;
- gloves, inner (surgical type); gloves, outer, chemical protective;
- boots, chemical protective, steel toe and shank; and
- communications optional.

3.5.3 Level C Protection

Level C protection is utilized when both skin and respiratory hazards are well defined and the criteria for the use of negative pressure respirators have been fulfilled (i.e., known contaminants and contaminant concentrations, acceptable oxygen levels, approved filter/cartridge available, known cartridge service life, etc.). Level C protection may require carrying an emergency escape respirator during certain initial entry and site reconnaissance situations, or when applicable thereafter.

Personal protective equipment for Level C typically includes:

- full facepiece air-purifying respirator;
- emergency escape respirator (optional);
- chemical protective clothing:
  - overalls and long-sleeved jacket; or
  - coveralls;
- gloves, inner (surgical type);
- gloves, outer, chemical protective; and
- boots, chemical protective, steel toe and shank.

3.5.4 Level D Protection

Level D is the basic work uniform. Personal protective equipment for Level D includes:

- coveralls;
- safety boots/shoes;
- eye protection;
- hand protection;
- reflective traffic safety vest (mandatory for traffic areas or railyard);
- hard hat (with face shield is optional); and
- emergency escape respirator is optional.

3.5.5 Level E Protection

Level E protection is used when radioactivity above 10 mr/hr is detected at the site. Personal protective equipment for Level E includes:

- coveralls;
- air purifying respirator;
- time limits on exposure;
- appropriate dermal protection for the type of radiation present; and
- radiation dosage monitoring.

3.5.6 Additional Considerations

Field work will contain a variety of situations due to chemicals in various concentrations and combinations. These situations may be partially ameliorated by following the work practices listed below:

1. Some sort of foot protection is needed on a site. If the ground to be worked on is contaminated with liquid and it is necessary to walk in the chemicals, some sort of protective "booties" can be worn over the boots. This cuts down on decontamination requirements. They are designed with soles to help prevent them from slipping around. If non-liquids are to be encountered, a Tyvek™ bootie could be used. If the ground contains any sharp objects, the advantage of booties is questionable. Boots should be worn with either cotton or wool socks to help absorb the perspiration.
2. If the site situation requires the use of hard hats, chin straps should be used if a person will be stooping over where his/her hat may fall off. Respirator straps should not be placed over the hard hats. This will affect the fit of the respirator.

   Some types of protective materials conduct heat and cold readily. In cold conditions, natural material clothing should be worn under the protective clothing. Protective clothing should be removed prior to allowing a person "to get warm". Applying heat, such as a space heater, to the outside of the protective clothing may drive the contaminants through. In hot weather, under clothing will absorb sweat. It is recommended that workers use all cotton undergarments.
3. Body protection should be worn and taped to prevent anything from running into the top of the boot. Gloves should be worn and taped to prevent substances from entering the top of the glove. Duct tape is preferred, but masking tape can be used. When aprons are used, they should be taped across the back for added protection. However, this should be done in such a way that the person has mobility.
4. Atmospheric conditions such as precipitation, temperature, wind direction, wind velocity, and pressure determine the behavior of contaminants in air or the potential for volatile material getting into the air. These parameters should be considered in determining the need for and the level of protection.
5. A program must be established for periodic monitoring of the air during site operations. Without an air monitoring program, any changes would go undetected and might jeopardize response personnel. Monitoring can be done with various types of air pumps and filtering devices followed by analysis of the filtration media; personnel dosimeters; and periodic walk-throughs by personnel carrying real-time survey instruments.
6. For operations in the exclusion zone, different levels of protection may be selected, and various types of chemical-resistant clothing may be worn. This selection should be based on the job function, reason for being in the area, and the potential for skin contact with, or inhalation of, the chemicals present.
7. Escape masks must be readily available when levels of respiratory protection do not include a SCBA and the possibility of an IDLH atmosphere exists. Their use can be made on a case-by-case basis. Escape masks could be strategically located at the site in areas that have higher possibilities of vapors, gases or particulates.

APPENDIX H

Community Air Monitoring Plan

Community Air Monitoring Plan

Sendero Verde Redevelopment Project – Parcel B
Tax Block 1617 of Tax Lot 20
New York, New York

June 14, 2019

Prepared for:

SV-B Owners LLC

Prepared by:

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Appendix

1. Introduction

Roux Environmental Engineering and Geology, D.P.C. (Roux) on behalf of Sendero Verde Redevelopment Project – Parcel B, (the "Volunteer"), have developed a project specific Community Air Monitoring Plan (CAMP) to implement real time monitoring at the Site, which occupies Tax Lots 20, 125, and 140 of Tax Block 1617, during remedial construction activities.

The monitoring program will be implemented at all times during which earth disturbance activities are occurring. The CAMP is designed to provide a measure of protection for the downwind community and onsite workers not directly involved with the subject work activities from potential airborne contaminant releases as a direct result of remedial and construction activities. This plan is consistent with the New York State Department of Health's (NYSDOH) Generic Community Air Monitoring Plan guidance document.

The specifics of the CAMP are presented in the following four (4) sections:

- 1.1 VOC Monitoring Approach
- 1.2 Particulate Monitoring Approach
- 1.3 Meteorological Monitoring Approach
- 1.4 Available Suppression Techniques

1.1 VOC Monitoring Approach

Total VOC concentrations in air will be monitored continuously at a location downwind of the excavation activities during all ground intrusive activities. An upwind monitoring station will be set up adjacent to where the excavation is occurring. The VOC monitoring equipment will be located at temporary monitoring stations that will be established daily based on Site logistics and weather conditions. The monitoring work will be conducted using MiniRAE 3000 (or equivalent) portable VOC monitors, or similar type monitors, for all VOC monitoring. The equipment will be calibrated at least once daily using isobutylene as the calibration gas. One (1) upwind and one (1) downwind monitor will be deployed each day. Each monitoring unit is equipped with an audible alarm to indicate exceedance of the action levels (as defined below and summarized in Table 1).

The equipment is capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total VOCs at the downwind perimeter of the Site exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.
- If the ambient air concentration of total VOCs at the downwind perimeter of the Site persists at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of VOCs identified, suppression techniques employed to abate emissions, and monitoring continued. After these steps, work activities can resume if the total organic vapor level at the Site perimeter is below 5 ppm over the background concentration for the 15-minute average. If levels are in excess of 25 ppm above background, identified contributing ground-intrusive activities will be halted and vapor suppression techniques will be evaluated and modified until monitoring indicates VOC levels at the Site perimeter are below 5 ppm over background. Once VOC levels are below 5 ppm at the Site perimeter, work will resume with continued monitoring.

- All 15-minute readings will be recorded and be available for State Regulator (NYSDEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes will be recorded. If an exceedance of the action level occurs, an Action Limit Report (ALR) will be completed, identifying the monitoring device location, the measured VOC level, the activity causing the exceedance, meteorological conditions, and the corrective actions taken, as provided in Appendix A. Additionally, the NYSDEC and NYSDOH will be notified within 24 hours of the VOC ALR generation. Daily monitoring equipment locations and meteorological conditions will also be documented on the daily CAMP Monitoring Location Plan. All documentation will be kept on file at the Site.

1.2 Particulate Monitoring, Response Levels and Actions

Particulate concentrations will be monitored continuously at temporary particulate monitoring stations set up at the sidewalk at upwind and downwind locations. The particulate monitoring will be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action levels (as defined below and summarized in Table 1). Monitoring equipment will be MIE Data Ram monitors or equivalent. A minimum of one (1) upwind and one (1) downwind monitor will be deployed each day, equipped with an omni-directional sampling inlet and a PM-10 sample head. The data logging averaging period will be set to 15-minutes with time and date stamp recording. Alarm averaging will be set at 90 micrograms per cubic meter ($\mu g/m^3$) per 15-minute period. This setting will allow proactive evaluation of Site conditions prior to reaching Action Levels of 100 $\mu g/m^3$ above background. The equipment will be outfitted with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration will be visually assessed during all work activities. The monitoring will be used to compare values to the following:

- If the downwind PM-10 particulate level is 100 $\mu g/m^3$ greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the Site, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 $\mu g/m^3$ above the upwind level and provided that no visible dust is migrating from the Site.
- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 $\mu g/m^3$ above the upwind level, work must be stopped, a re-evaluation of activities initiated, and dust suppression techniques modified. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 $\mu g/m^3$ of the upwind level and in preventing visible dust migration.

All 15-minute readings will be recorded and be available for State Regulator (NYSDEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes will be recorded. If an exceedance of the action level occurs, an ALR will be completed, identifying the monitoring device location, the measured particulate concentration, the activity causing the exceedance, meteorological conditions, and the corrective actions taken, as provided in Appendix A. Daily monitoring equipment locations will also be documented on the daily CAMP Monitoring Location Plan. All documentation will be kept on file at the Site.

1.3 Meteorological Monitoring

Wind speed (estimated) and wind direction, will be approximated based on field observations of onsite personnel. Meteorological data consisting of temperature, barometric pressure, and relative humidity will be recorded in the field book based upon publically available information from local weather stations.

1.4 Available Suppression Techniques

Odor Control

Due to the nature of the project, with excavation occurring, the potential for generation of nuisance odors and the need for odor control may be necessary. If nuisance odors are identified, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of all other complaints about the project.

All necessary means will be employed to prevent on- and off-Site nuisances. At a minimum, procedures will include: (a) limiting the area of open excavations; (b) shrouding open excavations with tarps and other covers; and (c) using foams to cover exposed odorous soils. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) use of chemical odorants in spray or misting systems; and, (e) use of staff to monitor odors in surrounding neighborhoods.

Dust Control

Due to the nature of the project, the potential for generation of nuisance dust and the need for dust control may be necessary. Dust suppression will be achieved through the use of water for wetting excavation areas, if required. Water will be available on-site at suitable supply and pressure for use in dust control.

1.5 Reporting

All recorded monitoring data will be downloaded, and field logged periodically, including action limit reports (if any) and daily CAMP monitoring location plans. All records will be maintained on-Site and available for NYSDEC/NYSDOH review. A summary of CAMP findings, including excursions, will be provided in the Daily and Monthly Reports. All CAMP monitoring records will be included in the overall Final Engineering Report that will be submitted to the NYSDEC and NYSDOH and will include all of the CAMP data collected, daily monitoring station location maps, and copies of the ALRs (if any). If an ALR is generated due to VOC exceedances, the NYSDEC and NYSDOH will be notified within 24 hours of the exceedance.

TABLE

Action Limit Summary for VOCs and Particulates

Table 1. Action Limit Summary for VOCs and Particulates, Sendero Verde Redevelopment Project - Parcel B, New York, NY

Contaminant	Downwind Action Levels*	Action/Response
Volatile Organic Compounds (VOCs) (Monitoring Via Photoionization Detector and Odor Observation)	< 5 ppm	1. Resume work with continuing monitoring.
	5 ppm < level < 25 ppm	1. Work activities must be temporarily halted, source vapors must be identified, suppression techniques employed to abate emissions and monitoring continued. 2. After these steps, if VOC levels (200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or structure, whichever is less) is below 5 ppm over background, resume work.
	> 25 ppm	1. Identified contributing ground intrusive activities must be halted and vapor suppression techniques must be evaluated and modified until monitoring indicates VOC levels below the action level. 2. After these steps, if VOC levels (half the distance to the nearest potential receptor or structure) are below 5 ppm over background, resume work.
Particulates (Monitoring Via Particulate Meter and Observation)	< 100 ug/m^3	1. If dust is observed leaving the work area, then dust control techniques must be implemented or additional controls used.
	100 ug/m3 < level < 150 ug/m^3	1. Employ dust suppression techniques. 2. Work may continue with dust suppression techniques provided that downwind PM-10 particulate concentration do not exceed 150 ug/m^3 above the upwind level and provided that no visible dust is migrating from the work area.
	> 150 ug/m^3	1. STOP work 2. Re-evaluate activities, modify dust suppression techniques. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 ug/m^3 of the upwind level and in preventing visible dust migration.

* Instantaneous readings above background. Particulate readings are based on the respirable (PM-10) fraction. Background readings are taken at upwind locations relative to Work Areas or Exclusion Zones.

APPENDIX A

Action Limit Report

ACTION LIMIT REPORT

Sendero Verde Redevelopment Project - Parcel B

Project Location:

Date: _____ Time: _____

Name: _____

Contaminant: PM-10: _____ VOC: _____

Wind Speed: _____ Wind Direction: _____

Temperature: _____ Barometric Pressure: _____

DOWNWIND DATA

Monitor ID #: _____ Location: _____ Level Reported: _____

Monitor ID#: _____ Location: _____ Level Reported: _____

UPWIND DATA

Monitor ID #: _____ Location: _____ Level Reported: _____

Monitor ID#: _____ Location: _____ Level Reported: _____

BACKGROUND CORRECTED LEVELS

Monitor ID #: _____ Location: _____ Level Reported: _____

Monitor ID#: _____ Location: _____ Level Reported: _____

ACTIVITY DESCRIPTION

CORRECTIVE ACTION TAKEN